Race, Evolution, and Behavior:

A Life History Perspective

Third Edition

J. Philippe Rushton

Commentary on J. Philippe Rushton's
Race, Evolution, and Behavior

"(An) incendiary thesis....that separate races of human beings evolved different reproductive strategies to cope with different environments and that these strategies led to physical differences in brain size and hence in intelligence. Human beings who evolved in the warm but highly unpredictable environment of Africa adopted a strategy of high reproduction, while human beings who migrated to the hostile cold of Europe and northern Asia took to producing fewer children but nurturing them more carefully."

---Malcolm W. Browne, *New York Times Book Review*

"Rushton is a serious scholar who has assembled serious data. Consider just one example: brain size. The empirical reality, verified by numerous modern studies, including several based on magnetic resonance imaging, is that a significant and substantial relationship does exist between brain size and measured intelligence after body size is taken into account and that the races do have different distributions of brain size."

---Charles Murray, Afterword to *The Bell Curve*

"Describes hundreds of studies worldwide that show a consistent pattern of human racial differences in such characteristics as intelligence, brain size, genital size, strength of sex drive, reproductive potency, industriousness, sociability, and rule following. On each of these variables, the groups are aligned in the order: Orientals, Caucasians, Blacks."

---Mark Snyderman, *National Review*

"Rushton's *Race, Evolution, and Behavior*, which is about race differences in IQ and cranial capacity, is an attempt to understand these differences in terms of life-history evolution....Perhaps there ultimately will be some serious contribution from the traditional smoke-and-mirrors social science treatment of IQ, but for now Rushton's framework is essentially the only game in town."

--- Henry Harpending, *Evolutionary Anthropology*

"The remarkable resistance to racial science in our times has led to comparisons with the inquisition of Rome, active during the Renaissance.... Astronomy and the physical sciences had their Copernicus, Kepler, and Galileo a few centuries ago; society and the welfare of humanity is the better for it today. In a directly analogous fashion, psychology and the social sciences today have their Darwin, Galton, and Rushton."

---Glayde Whitney, *Contemporary Psychology*

"This brilliant book is the most impressive theory-based study...of the psychological and behavioral differences between the major racial groups that I have encountered in the world literature on this subject. Rushton has assembled evidence that henceforth should make it impossible to avoid considering evolutionary principles and biological variables in the study of racial differences in behavioral traits. To shun this essential message of his work is to reject scientific coherence."

---Arthur R. Jensen, University of California, Berkeley

"Professor Rushton is widely known and respected for the unusual combination of rigour and originality in his work....Few concerned with understanding the problems associated with race can afford to disregard this storehouse of well-integrated information which gives rise to a remarkable synthesis."

---Hans J. Eysenck, University of London

"The only acceptable explanation of race differences in behavior allowed in public discourse is an entirely environmental one...Professor Rushton deserves our gratitude for having the courage to declare that 'this emperor has no clothes,' and that a more satisfactory explanation must be sought...Rushton has pulled another pillar out from under its superstructure. Whether his particular theory will survive the onslaught of empirical tests remains to be seen. It is, in Popper's terms, a bold hypothesis and provides considerable food for thought."

---Thomas J. Bouchard, Jr., University of Minnesota

"In *Race, Evolution, and Behavior* Rushton offers a brilliant synthesis of a vast collection of biological, behavioral, and social data in terms of human evolutionary development. Rushton is fully alive to contemporary sensitivities in this field and he advances the myriad details of his thesis with great tact and care. Should his argument prove successful Rushton will have produced a major scientific advance in understanding the development of our human species."

---Barry R. Gross, York College, CUNY

"In my view this theory has the simplicity and explanatory power that indicate truth. It is all to the good that this book will interest many people solely for its documentation of the race differences themselves, quite apart from their explanation. In a society in which all race differences in attainment are explained by 'racism,' it is vitally important to be aware of alternative possibilities. Rushton writes as a scientist, describing the way things are without prescribing how they should be, but without data like Rushton's intelligent prescriptions are impossible."

---Michael Levin, City College, CUNY

"The data are startling to the uninitiated....*Race, Evolution, and Behavior* confronts us as few books have with the dilemmas wrought in a democratic society by individual and group differences in key human traits."
---Linda Gottfredson, *Politics and the Life Sciences*

"Should, if there is any justice, receive a Nobel Prize."
---Richard Lynn, *Spectator*

"Undoubtedly, *Race, Evolution, and Behavior* is the best wide-ranging read in differential psychology since Jensen's (1981) *Straight Talk About Mental Tests.*"
--- Christopher Brand, *Personality and Individual Differences*

"Both Lynn (1997) and Rushton (1997) insist that racial differences in the mean measured sizes of skulls and brains (with East Asians having the largest, followed by Whites and then Blacks) support their genetic hypothesis. They rely on the averaged results of the many anthropometric studies reviewed by Rushton (1995) in his book *Race, Evolution, and Behavior*....there is indeed a small overall trend in the direction they describe."
--- Ulric Neisser, Chairman of the American Psychological Association Task Force on Intelligence, *American Psychologist*

"A frank attempt to rehabilitate the concept of race as a primary descriptive category."
-- - Steve Blinkhorn, *Nature*

"Race is in the public eye again, and once more biological anthropologists must address problems with racial taxonomy and related misapplications of evolutionary theory. Rushton's book focuses on racial variation from an evolutionary perspective. His basic thesis is that race differences in behavior are explainable from the viewpoint of life history analysis, particularly the differences between *r*- and *K*-selected evolutionary strategies."
--- John H. Relethford, *American Journal of Physical Anthropology*

General impressions are never to be trusted. Unfortunately when they are of long standing they become fixed rules of life, and assume a prescriptive right not to be questioned. Consequently, those who are not accustomed to original inquiry entertain a hatred and a horror of statistics. They cannot endure the idea of submitting their sacred impressions to cold-blooded verification. But it is the triumph of scientific men to rise superior to such superstitions, to devise tests by which the value of beliefs may be ascertained, and to feel sufficiently masters of themselves to discard contemptuously whatever may be found untrue.

---Sir Francis Galton

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Preface to the Third Edition

This 3rd edition of *Race, Evolution, and Behavior* is published by the Charles Darwin Research Institute (www.charlesdarwinresearch.org). In this Preface I update the main scientific findings that have taken place since the 2nd edition (1997) which had a new Afterword by me updating the science since the 1st edition (1995). The Preface is followed by the exact text as it appeared in the 1st edition and then by the Afterword as it appeared in the 2nd edition so as to maintain precisely the earlier page numbering and citations for reference purposes.

Transaction Publishers brought out the 1st and 2nd editions of *Race, Evolution, and Behavior.* The 1st edition was deemed sufficiently important that Takuya Kura, an ethologist at the University of Kyoto, and his brother Kenya Kura, an economist at the University of San Diego, translated it into Japanese. It was published in 1996 by Hakuhin-sha of Tokyo.

Transaction relinquished the copyright after a firestorm of controversy engulfed their 1999 publication of a Special Abridged Edition of this same book. The Special Abridged Edition presented the same research in a condensed and popularly written style, similar to that used for articles in *Discover Magazine, Reader's Digest, and Scientific American.* But when it was mailed out to thousands of academics, the Progressive Sociologists, a self-proclaimed radical group within the American Sociological Association, and some other self-styled "anti-racist" groups, objected to its distribution and threatened Transaction with loss of a booth at annual meetings, advertising space in journals, and access to mailing lists if they continued to send it out.

Transaction caved in to this pressure, withdrew from publishing the book, and even apologized for having distributed it. They claimed that their copyright should never have appeared on the Special Abridged Edition and that it had "all been a mistake." Transaction's letter of apology appeared on the inside front cover of their flagship journal *Society* (January/February, 2000). Accounts of the affair appeared in the *Chronicle of Higher Education* (January 14, 2000), Canada's *National Post* (January 31, 2000), *National Report* (February 28, 2000), and elsewhere.

Why then this attempt to trash or suppress this book? Because there is no stronger taboo today than talking about race. In many cases, just being accused of "racism" can get you fired. Some vocal groups in academia and the media simply forbid an open discussion of race. It is difficult to disagree with Charles Murray's (1996, p. 575) conclusion in his analysis of the aftermath to *The Bell Curve* controversy, that in regard to heritable variation and race, science has "become self-censored and riddled with taboos -- in a word, corrupt."

The goal of all editions of *Race, Evolution, and Behavior* has been purely scientific — to describe and explain the world around us as it really is. As Charles Darwin, the father of evolution, said: "Science consists in grouping facts so that general laws or conclusions may be drawn from them." I have no suggestions or programs to offer, but I do believe decision makers would benefit from knowing the facts about race. Both science and justice depend on truth. Both should reject error and falsehood, however well meant.

Is Race Really Only Skin Deep?

For the past twenty years I have studied the three major races of *Orientals* (East Asians, Mongoloids), *Whites* (Europeans, Caucasoids), and *Blacks* (Africans, Negroids). An "Oriental" is anyone most of whose ancestors were born in East Asia. A "White" is anyone most of whose ancestors were born in Europe. And a "Black" is anyone most of whose ancestors were born in sub-Saharan Africa. In the main I have not addressed other groups and subgroups.

What I've found is that in brain size, intelligence, sexual behavior, fertility, personality, maturation, life span, crime and family stability, Orientals fall at one end of the spectrum, Blacks fall at the other end, and Whites fall in between. On average, Orientals are slower to mature, less fertile, and less sexually active, have larger brains and higher IQ scores. Blacks are at the opposite end in each of these areas. Whites fall in the middle, often close to Orientals. I've shown that this three-way pattern is true over time and across nations, which means that we cannot ignore it. Only a theory that looks at both genes and environment in terms of Darwin's theory of evolution can explain why the races differ so consistently throughout the world and over the course of time.

The patterns make up what is called a "life-history," a genetically organized suite of traits that evolved together to meet the trials of life — survival, growth, and reproduction (see Chapter 10). Following E. O. Wilson's (1975) *Sociobiology*, evolutionary biologists scale these life-histories along an *r-K* continuum. At one end are *r*-strategies that rely on high reproductive rates. At the other end are *K*-strategies that rely on high levels of parental care. This scale is generally used to compare the life histories of different species of animals. I have used it to explain the smaller but real differences between the human races.

On this scale, Orientals are more *K*-selected than Whites, while Whites are more *K*-selected than Blacks. Highly *K*-selected women produce fewer eggs (and have bigger brains) than *r*-selected women. Highly *K*-selected men invest time and energy in their children rather than the pursuit of sexual thrills. They are "dads" rather than "cads."

The race differences in reproductive strategies make sense in terms of human evolution. Modern humans evolved in Africa about 200,000 years ago. Africans and non-Africans then split about 100,000 years ago. Orientals and Whites split about 40,000 years ago (Chapter 11). The further north the people went "Out of Africa," the harder it was to get food, gain shelter, make clothes, and raise children. So the groups that evolved into today's Whites and Orientals needed larger brains, more family stability, and a longer life. But building a bigger brain takes time and energy during a person's development. So, these changes were balanced by slower rates of growth, lower levels of sex hormones, less aggression, and less sexual activity.

Why? Because Africa, Europe, and Asia had very different climates and geographies that called for different skills, resource usage, and lifestyles. Blacks evolved in a tropical climate which contrasted with the cooler one of Europe in which Whites evolved and even more so with the cold Arctic lands where Orientals evolved.

Because intelligence increased the chances of survival in harsh winter environments, the groups that left Africa had to evolve greater intelligence and family stability. This called for larger brains, slower growth rates, lower hormone levels, less sexual potency, less aggression, and less impulsivity. Advanced planning, self-control, rule-following, and longevity all increased in the non-Africans.

Of course, these three-way racial differences are *averages*. The full range of behaviors, good and bad, is found in every race. No group has a monopoly on virtue or vice, wisdom or folly. Moreover, many readers may be asking themselves, "Isn't race just a social construction, not a biological reality?" Or repeating, "Even if race has some biological basis, there are no important differences between races."

Let's consider athletic ability. Jon Entine's new book, *Taboo: Why Black Athletes Dominate Sports and Why We Are Afraid to Talk About It* provides new evidence for the reality of race. Addressing the old cliché that "White Men Can't Jump" (and the new one that Asian men jump even less well), Entine shows that Black men — and women — have a genetic edge.

The physical facts that Entine reviews are quite well known. Compared to Whites, Blacks have narrower hips which gives them a more efficient stride. They have longer legs which makes for a longer stride. They have a shorter sitting height which provides a higher center of gravity and a better balance. They have wider shoulders, less body fat, and more muscle. Their muscles include more fast twitch muscles which produce power.

Blacks have from 3 to 19% more of the sex hormone testosterone than Whites or East Asians (see Chapter 8 in this book). These testosterone differences translate into more explosive energy, which gives Blacks the edge in sports like boxing, basketball, football, and sprinting. However, some of these race differences, like heavier bone mass and smaller chest cavities, pose a problem for Black swimmers.

Race differences show up early in life. Black babies are born a week earlier than White babies, yet they are more mature as measured by bone development (see Chapter 7). By age five or six, Black children excel in the dash, the long jump, and the high jump, all of which require a short burst of power. By the teenage years, Blacks have faster reflexes, as in the famous knee-jerk response.

East Asians run even less well than Whites. These same narrow hips, longer legs, more muscle, and more testosterone that give Blacks an advantage over Whites, give Whites an advantage over East Asians. But acknowledging the existence of genetic race differences in sports leads to the greater taboo area — considering the possibility of race differences in brain size and crime.

The reason why Whites and East Asians have wider hips than Blacks, and so make poorer runners, is because they give birth to larger brained babies (see Chapter 6). During evolution, increasing cranial size led to women who had a wider pelvis (see Chapters 10 & 11). Further, the hormones that give Blacks an edge at sports makes them more masculine in general — physically active in school, and more likely to get into trouble (see Chapter 7). That is why it is taboo to even say that Blacks are better at many sports.

Brain Size

Four different methods have been used to measure brain size: Magnetic Resonance Imaging (MRI), weighing the brain at autopsy, measuring the volume of an empty skull, and measuring the outside of the head. All four methods produce roughly the same results. The race differences in average brain size remain even after you adjust for body size (see Chapter 6).

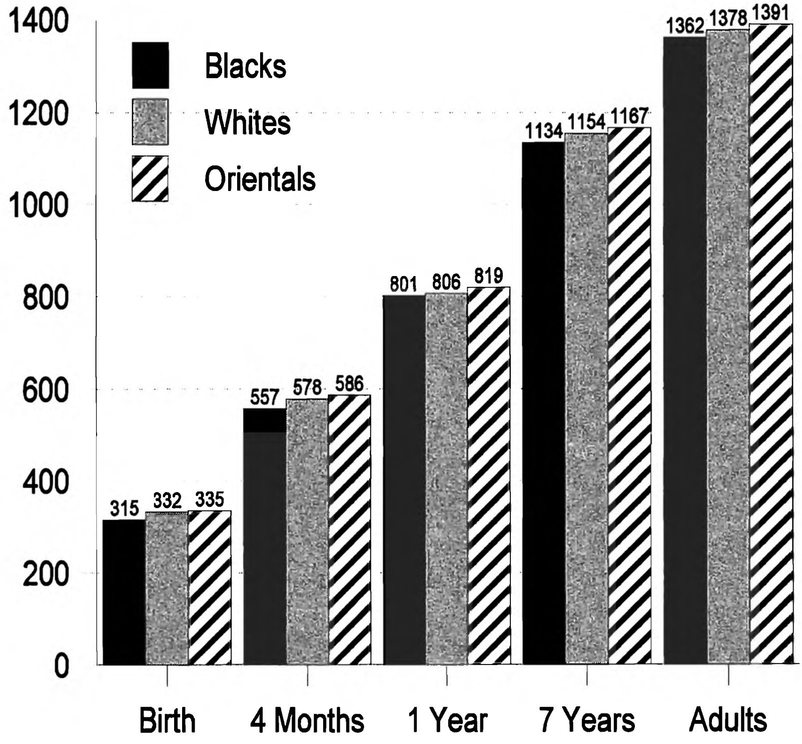
Race differences in brain size show up early in life. One of the studies, the Collaborative Perinatal Project, followed 17,000 European American and 19,000 African American children from birth to seven years. Head circumference was measured using a tape. The White children consistently averaged larger head circumferences than did the Black children.

I wondered what the data would show if Asian American children had been included. So in October, 1996, I visited the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS) in Bethesda, Maryland. I identified 100 Asian American children who also had IQ scores available at age 7 from the Collaborative Perinatal Project's data set which are stored on microfiche. For each subject I recorded data separately on the race/nationality of the mother and father, the sex of child, the child's IQ at age 7, and the child's height, weight, and head circumference at birth, 4 months, 1 year, and 7 years. The sample in this study consisted of 53 girls and 47 boys. Most of the Asians were Chinese, Korean, and Japanese.

My results were published in the 1997 issue of *Intelligence* (Rushton, 1997a).

The children's head circumferences were transformed into cranial capacities so as to make the results comparable with those on adults. Cranial capacity at birth correlated 0.46 with cranial capacity at age 7 and, as shown in Chart P-1, at birth, 4 months, 1 year, and 7 years, the Asian Americans averaged a larger cranial capacity than did the European or African Americans (despite being smaller in stature and lighter in weight). The data on adults in Chart P-1 come from a sample of 6,325 U.S. Army personnel (Rushton, 1992).

CHART P-1
Average Head Size for Blacks, Whites, and Orientals in the U.S. at 5 Ages (After Rushton, 1997a)



Intelligence and Brain Size

The Asian sub-sample in the above study averaged a higher IQ (110) at age 7 than did the White (102) or the Black sub-samples (90). Moreover, their head circumferences at age 7 correlated 0.21 with their IQ test scores at age 7. As such these data corroborated the results of my review article with C. D. Ankney "Brain Size and Cognitive Ability" in the 1996 issue of *Psychonomic Bulletin and Review* in which we surveyed all the published research on this topic. It included studies that used the state-of-the-art technique known as Magnetic Resonance Imaging (MRI) which gives a very good image of the human brain in a living person. We reviewed eight such studies with a total sample size of 381 adults. The overall correlation between IQ and brain size measured by MRI was 0.44. This more accurate measure of brain size is much higher than the 0.20 correlation found in earlier research using simple head size measures (though 0.20 is still significant) and suggests that brain size underlies intelligence.

The correlations of about 0.30 between cognitive ability and head size/brain size are as replicable a set of results as one will find in the behavioral sciences. I reviewed several additional corroborating studies at the annual meeting of the American Association of Physical Anthropologists in Columbus, Ohio (Rushton, 1999a). Two of the studies examined the relation using head circumference measures (Furlow, Armijo-Prewitt, Gangestad & Thornhill, 1997; Rushton, 1997a) and six examined the relation using Magnetic Resonance Imaging. For these six studies there was a total sample size of 422, with a mean correlation of $r = 0.31$ (when weighted by sample size, $r = 0.36$; Flashman et al., 1998; Reiss et al., 1996; Schoenemann, 1997; Tan et al., 1999; Tramo et al., 1998; Wickett et al., in press). Subsequently, Gur et al. (1999) found an overall correlation between MRI measured brain volume and IQ of 0.41.

In his encyclopedic book on mental ability, *The g Factor*, Arthur Jensen (1998) cited my reviews of the literature on race differences in brain size (see Chapter 6 of this book) finding that East Asians and their descendants average about 17 cm^3 (1 in^3) larger brain volumes than do Europeans and their descendants, whose brains average about 80 cm^3 (5 in^3) larger than do those of Africans and their descendants. Jensen (pp. 442-443) then extended my results by calculating an "ecological" correlation (used in epidemiological studies) of +0.998 between median IQ and mean cranial capacity across the three populations of "Mongoloids," "Caucasoids," and "Negroids."

Is The Mean African IQ = 70?

Chapter 6 of this book also reviews the data on race and intelligence. Hundreds of studies on millions of people show a three-way pattern. IQ tests are often made to have an average score of 100, with a "normal" range from 85 to

115. Whites average from 100 to 103. Orientals in Asia and the U.S. tend to have slightly higher scores, about 106, even though IQ tests were made for use in a European American culture. Blacks in the U.S., the Caribbean, Britain, Canada, and in Africa average lower IQs -- about 85. The lowest average IQs are found for sub-Saharan Africans -- from 70 to 75.

The IQ of 70 for Blacks living in Africa is the lowest group mean ever recorded and it caused consternation when brought to public attention in the debates over *The Bell Curve* and *Race, Evolution, and Behavior*. However, there have been several replications of the mean African IQ being in the 70s. For example, Mervyn Skuy and his colleagues (2000) found South African secondary students (in South Africa) had IQ equivalents in the 70s range on several tests, including the Wechsler Intelligence Scale for Children-Revised (WISC-R), the Rey Auditory Verbal Learning Test, the Stroop Color Word Test, the Wisconsin Card Sorting Test, the Bender Gestalt Visual Motor Integration Test, the Rey Osterreith Complex Figure Test, the Trail Making Test, the Spatial Memory Task, and various Drawing Tasks.

The implied conclusion that in abstract reasoning ability, 50% of Black Africa is "mentally retarded" by European standards, was considered not only an injustice but an absurdity by many reviewers. Some therefore dismissed *The Bell Curve* and *Race, Evolution, and Behavior* as nonsensical for even reporting such data for serious consideration. But of course the facts are the facts and must be presented. Alternative explanations can then be offered for them.

One argument has been that an IQ of 70 in abstract reasoning ability manifests itself differently in Blacks than in Whites. Jensen (1972, pp. 5-6) pointed out that Black children with IQs of 70 appear much brighter socially than do White children with IQs of 70, who don't play normally and appear to be more mentally retarded all round, not just in their performance in scholastic subjects and on IQ tests. Black children of IQ 70 routinely learn to speak, to play games, learn names, and act friendly with playmates and teachers. They appear quite normal, whereas White children with similar IQs "look" abnormal. This race difference may be consistent with a genetic interpretation of the mean African IQ of 70 in that it implies that a very low IQ is "normal" in the African population.

In October 1998 I traveled to Johannesburg in South Africa to collect data that might help to resolve this debate. I decided to find a high-IQ population of Africans such as university students who were likely to be at least one standard deviation above the African mean and familiar with paper-and-pencil tests. I teamed up with Mervyn Skuy, Chairman of the Division of Specialized Education at the University of the Witwatersrand.

To ensure they were motivated, we paid over three hundred first year psychology students $10 each to take an untimed Raven's Progressive Matrices test. We gave the students an hour-and-a-half to do the test, although the great majority had done it in 30 minutes. Our final sample consisted of 173 African and 136 White 17- to 23-year-olds. The Africans solved an average of 44 of the 60 problems, and the Whites solved an average of 54. By U.S. standards, this translated into the African university students being at the 14th percentile, equivalent to American 14-year-old high school students. The African students had an IQ equivalent of 84 (Rushton & Skuy, in press).

Assuming that Black university students in South Africa are 1 SD above the average of the general population of that country (as university students typically are), then my finding of an IQ of 84 in that select sample implies that the general population of that country has an average IQ of 70. As such, this study confirms the earlier reviews of the literature (see Lynn, 1997, for an updated review).

In a second study carried out with university students in South Africa, we (Skuy, Gewer, & Rushton, 2000) again found an IQ equivalent of 84. This was an intervention study that looked for ways to boost IQ scores. We therefore gave the study participants several hour-long training sessions in the type of abstract reasoning methods required to solve Raven's Matrices. At pre-test, we found once again that Black Africans averaged an IQ equivalent of 84. The training sessions managed to raise the test group mean to an IQ equivalent of 91.

The full explanation for the low African IQ has yet to be discovered. Perhaps the cultural contribution to IQ scores is greater in Africa than it is in North America and so has a greater suppressant effect. South African Blacks have far higher unemployment rates and poorer schools, libraries, and study facilities than do Whites. Thus, Africans may have had less exposure to or stimulation on the constructs measured by IQ tests. They also live in overcrowded homes, often with no running water or electricity, and have poorer nutrition. Therefore their poor performance is partly the result of these cultural disadvantages.

The *g* Factor

As discussed throughout this book (pp. 33-36, 54-55, 138-139, 186-188, 280-281), the more a test measures the general factor of mental ability (technically, the higher its *g*-loading), the more heritable it is, the more predictive of intelligent behavior it is, and the more it differentiates between the races. In his new book, *The g Factor*, Jensen describes the results from 17 independent data sets on a total of nearly 45,000 Blacks and 245,000 Whites derived from 171 psychometric tests. The *g* loadings for the various tests consistently predict the magnitude of the Black-White difference ($r = 0.63$) on the same tests. This was borne out even among three-year-olds administered eight subtests of the Stanford-Binet. The rank correlation between the *g*-loadings and the Black-White differences was 0.71 ($p < 0.05$).

In Rushton and Skuy's (in press) South African study, cited above, we carried out several internal psychometric analyzes which showed that the items "behaved" the same way in all groups. For example, those items the White students found difficult, the African students did as well. It was just that the thresholds were different for passing the items. The African-White differences were also found to be greater on those items of the Raven's with the highest item-total correlations, indicating a higher *g*-loading.

The jewel in the crown of Jensen's legacy is his development of the method of correlated vectors. A "vector" of scores is a set that possesses both direction and quantity. Jensen has applied his method of correlated vectors to many variables in addition to the Black-White difference scores. He has shown that the vector of a test's *g* loadings is the best predictor not just of that test's correlation with scholastic and work-place performance, but with brain size, brain pH, brain glucose metabolic rate, average evoked potential, reaction time, and other physiological factors, hence establishing the biological (as opposed to the mere statistical) reality of *g*.

Consider, for example, the correlation between IQ and brain size. Numerous modern studies confirm that the correlation between IQ and head circumference measured by tape is about 0.20 and that between IQ and brain volume measured by Magnetic Resonance Imaging is about 0.40. Using the method of correlated vectors shows the correlation of those two measures with *g* to be between 0.60 and 0.70! Jensen's method has distilled the essence of intelligence.

In a recent special issue of the journal *Intelligence* honoring Jensen's accomplishments, I proposed that when a significant correlation occurs between the two vectors, the result be called a *Jensen Effect* because otherwise there is no name for it, only a long explanation of how the effect was achieved (Rushton, 1998). The Jensen Effect can be seen whenever there is a significant correlation between the vector of the sub-tests' *g* loadings and the vector of the same sub-tests' loadings on variable X (where X is some other, usually non-psychometric, variable).

The Flynn Effect is Not a Jensen Effect

Jensen Effects are not omnipresent and their absence can be as informative as the converse. An important absence of the Jensen Effect is that shown for the secular increase in test scores, which has become known as the "Flynn Effect" after Flynn's massive documentation of the phenomenon. Simply stated, the one study done to date shows that the "Flynn Effect" is not a "Jensen Effect."

Flynn (1999a, 1999c) has long championed the view that the "massive IQ gains over time" in the industrialized world show that the average Black-White IQ difference is environmental in origin. Because the populations of several countries have increased in average IQ by about 3 points a decade for 5 decades, Flynn hypothesized that the Black-White differences are caused by the same processes that produce these secular gains (such as improvements in schooling and test taking skills).

On the surface, Flynn's hypothesis seems very reasonable. Yet so far the data do not bear it out. In a principal components analysis, I (Rushton, 1999d) found the secular increase is *unrelated* to *g* and other heritable measures, while the magnitude of the Black-White difference *is* related to heritable *g* and inbreeding depression (see Chart P-2).

CHART P-2

Principal Components Analysis and Varimax Rotation for Pearson Correlations of Inbreeding Depression Scores, Black-White Differences, *g*-loadings, and Gains Over Time on the Wechsler Intelligence Scales for Children After Reliability Has Been partialled Out (After Rushton, 1999d)

Variable	Principal Components			
	Unrotated Loadings		Varimax Rotated	
	I	II	1	2
Inbreeding depression scores	0.31	0.61	0.26	**0.63**
U.S. Black-White differences	0.29	0.70	0.23	**0.72**
WISC-R *g* loadings from U.S.	-0.33	0.90	-0.40	**0.87**
WISC-III *g* loadings from U.S.	-0.61	0.64	-0.66	**0.59**
U.S. gains 1	0.73	-0.20	**0.75**	-0.13
U.S. gains 2	0.81	0.40	**0.77**	0.47
German gains	0.91	0.03	**0.91**	0.11
Austria gains	0.87	0.00	**0.86**	0.07
Scotland gains	0.97	0.08	**0.96**	0.17
Percent of total variance	48.60	25.49	48.44	25.65

Chart P-2 shows the way several variables group together, including the Black-White IQ difference scores from the U.S., secular gains in IQ from the U.S., Germany, Austria, and Scotland, inbreeding depression scores from cousin marriages in Japan, and *g*-loadings from the WISC-R and the WISC-III standardization samples. While the IQ gains on the WISC-R and WISC-III formed a cluster, showing that the secular trend is a reliable phenomenon, this cluster was *independent* of the cluster formed by Black-White differences, inbreeding depression scores (a purely genetic effect), and *g*-factor loadings (a largely genetic effect). This analysis shows that the secular increase in IQ and the mean Black-White IQ difference behave in entirely different ways (see Flynn,1999a, 1999b, in press; Rushton, 1999d, in press).

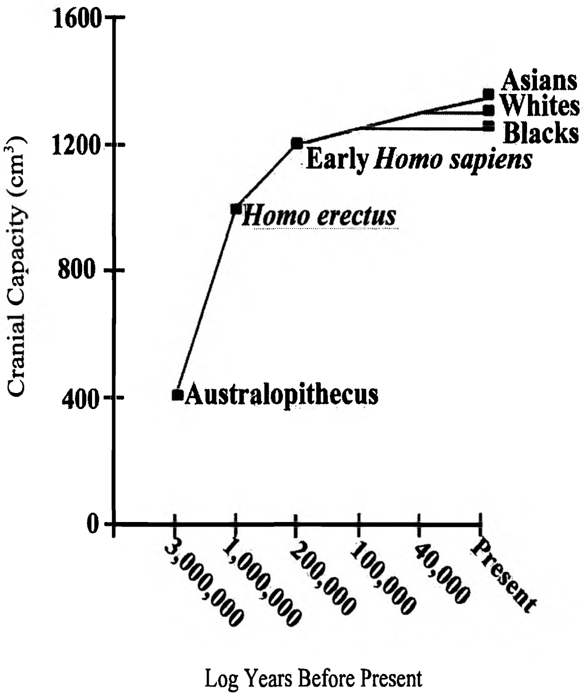
Head Shape and Progressive Evolution

In a critique of my work on race differences in brain size and IQ, Kamin and Omari (1998) argued that because the races differed in head shape, it was misleading to compare them for overall cranial capacity using the same measurement procedures. In reply, Rushton and Ankney (in press) carried out several additional analyzes and confirmed that Blacks average heads proportionately longer, narrower (especially in the front), and flatter than those of Whites and Asians, and that Asians in turn have more spherically-shaped heads than Whites. Importantly, we also found that, over evolutionary time, the increasingly spherically-shaped head going from Africans to Europeans to East Asians was a natural consequence of increasing encephalization, leading directly to increased head width and head height.

The race differences in brain size and head shape all fell into place. In the Afterword to the 2nd edition I had raised the question of whether there was "progress in evolution" as evidenced by directional trends in increasing encephalization. Consequently, Rushton and Ankney (in press) aligned the evidence in Chart P-3 with the Out of Africa model of human origins, and found support for such trends (see Chart P-3).

Three million years ago, Australopithecines averaged a cranial capacity of less than 500 cm^3 (about the size of a chimpanzee brain); two million years ago, *Homo erectus* averaged a capacity of about 1,000 cm^3; and 0.25 million years ago, *Homo sapiens* averaged a capacity of about 1,200 cm^3. Modern humans emerged in Africa some 200,000 years ago, with an African/non-African split about 100,000 years ago, and with an European/East Asian split about 40,000 years ago (Stringer & McKie, 1996). The further north the populations migrated, out of Africa, the more they encountered the cognitively demanding problems of gathering and storing food, acquiring shelter, making clothes, and raising children successfully during prolonged winters. As the populations that migrated from Africa evolved into present-day Caucasoids (current mean cranial capacity, 1,347 cm³) and Mongoloids (1,364 cm³), they did so in the direction of larger and more spherical brains, whereas cranial capacity and head shape of populations that remained in Africa changed very little (1,276 cm³).

Chart P-3
Increasing Brain Size Over Times
(After Rushton & Ankney, in press)



The evolutionary trends in brain size led to concomitant changes in skull morphology and in the musculo-skeletal system. For example, australopithecenes had greater post-orbital constriction (indentation of the skull behind the eye socket) and larger temporal fossae (the opening through which muscles pass from head to jaw) than did *H. erectus*, which had greater post-orbital constriction and larger temporal fossae than did *H. sapiens* (Fleagle, 1999). Within *H. sapiens*, Blacks have greater post-orbital constriction and larger temporal fossae than do Whites, who have greater post-orbital constriction and larger temporal fossae than do Asians (Brues, 1990). This is because as brain tissue expanded in the temporal and parietal lobes, it did so at the expense of the temporalis muscles, which run through the temporal fossa in each zygomatic arch, and serve to close the jaw. Since smaller temporalis muscles cannot close as large a jaw, jaw size was reduced. Consequently, there is less room for teeth, resulting in smaller teeth, shorter roots, and fewer teeth. (Asians and Europeans have smaller jaws, fewer and smaller teeth, and shorter roots than do Africans; Brues, 1990; Stringer & McKie, 1996).

The decrease in jaw size (orthognathism replacing prognathism) in turn led to decreased size of neck muscles and the bony protuberances where they attach (nuchal crests, cervical spinous process), which are no longer required for supporting heavy prognathic faces. (Asians and Europeans have reduced neck muscles and smaller spinous processes and less prognathic faces than do Africans; Binkley, 1989). As brain tissue in the frontal lobes expanded, it took up the space previously occupied by bony super-orbital rims, thereby causing a decrease in glabellas. (Asians and Europeans have less pronounced glabellas than do Africans; Krogman & Ýþcan, 1986). Further down the postcranial skeleton, increased encephalization required a wider pelvic opening, formed by the pubic and ischial bones, rather than just by the iliac bone, in order to allow birth of larger-brained infants. (Asians and Europeans have wider pelvises than do Africans; Krogman & Ýþcan, 1986). There is no explanation for these changes in the musculo-skeletal system other than for accommodating increased brain size.

Finally, because larger brains require more time to develop, trends in maturation rate can also be seen. Gestational age approximates 33 weeks in chimpanzees and 38 weeks in modern humans. Puberty is reached around eight years in chimpanzees and 13 years in humans. Life span averages 30 years in chimpanzees and 45 to 75 years in modern humans (see Chapter 10). These trends are also found across human groups. Asians and Europeans give birth at later gestational ages than do Africans, and their children reach puberty later and live longer (Chapter 7). Thus, changes in brain size have cascading effects on other traits which requires a general (both within and cross-species) "life-history" theory to explain their co-evolution, such as the one proposed in this book.

Sexual Behavior

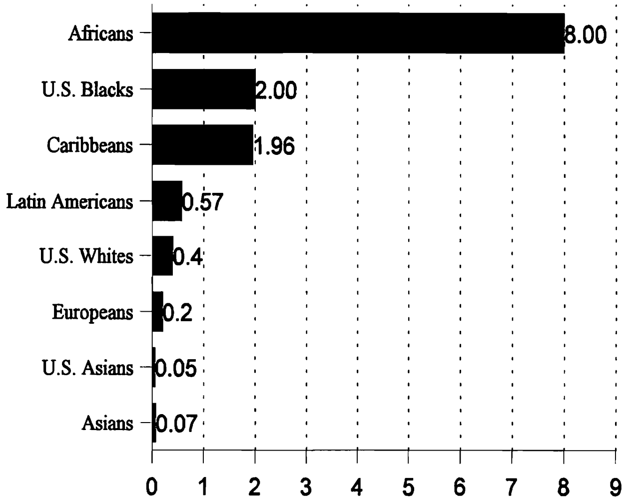
One of the more contentious topics addressed in *Race, Evolution, and Behavior* is reproductive behavior (see Chapter 8). Race differences in sexual behavior have tragic results in real life. For example, they affect the incidence of sexually transmitted diseases (e.g., syphilis, gonorrhea, herpes and chlamydia). Unpleasant though it is to examine these STDs, the rates provide another test of the evolutionary theory of race differences. These differences are hard to explain from a culture-only theory.

Reports from the U.S. Centers for Disease Control and Prevention, the UNAIDS, and the World Health Organization, corroborate over and over again the three-way racial pattern, both within and between countries. Low levels of sexually transmitted diseases are reported in China and Japan and high levels in Africa. European countries are in the middle. The racial pattern of these diseases is also true in the U.S. The 1997 syphilis rate among Blacks was 24 times the White rate. A recent report found up to 25% of inner city girls (mainly Black) have chlamydia.

Racial differences clearly show in the current AIDS crisis. Over 30 million people around the world are living with HIV or AIDS. Many Blacks in the U.S. do get AIDS through drug use, but more get it through sex. At the other extreme, more AIDS sufferers in China and Japan are hemophiliacs. European countries have intermediate HIV infection rates (mostly among homosexual men).

Chart P-4 shows the estimates of the HIV infection rate for 1999 in various parts of the world from the United Nations. The epidemic started in Black Africa in the late 1970s. Today 23 million adults there are living with HIV/AIDS. Over fifty percent of these are female which shows that transmission is mainly heterosexual. Currently, 8 out of every 100 Africans are infected with the AIDS virus and the epidemic is considered out of control. In some areas the AIDS rate reaches 70%. In South Africa one in 10 adults is living with HIV.

CHART P-4
HIV/AIDS Rates (%) for 15- to 49-year-olds by Region in 1999 (After UNAIDS, 1999)



The HIV infection rate is also high in the Black Caribbean; about 2%. Thirty-three percent of the AIDS cases there are women. This high figure among women shows that the spread tends to be from heterosexual intercourse. The high rate of HIV in the 2,000 mile band of Caribbean countries extends from Bermuda to Guyana, and is highest in Haiti, with a rate close to 6%. The Caribbean has the highest rates outside of Black Africa. Data published by the U.S. Centers for Disease Control and Prevention show that African Americans have HIV rates similar to those found in the Black Caribbean and parts of Black Africa. Three percent of Black men and 1% of Black women in the U.S. are living with HIV (Chart P-4). The rate for White Americans is less than 0.1%, while the rate for Asian Americans is less than 0.05%. Rates for Europe and the Pacific Rim are also low. Of course AIDS is a serious public health problem for all racial groups, but it is especially so for Africans and people of African descent.

Crime

Chapter 7 of this book examines crime statistics. Those from the United States show Orientals are a "model minority." They have fewer divorces, fewer out-of-wedlock births, and fewer reports of child abuse than Whites. More Orientals graduate from college and fewer go to prison. On the other hand Blacks are 12% of the American population but make up 50% of the prison population. One out of every three Black men in the U.S. is either in jail, on probation, or awaiting trial. That is much more than the number who graduate from college.

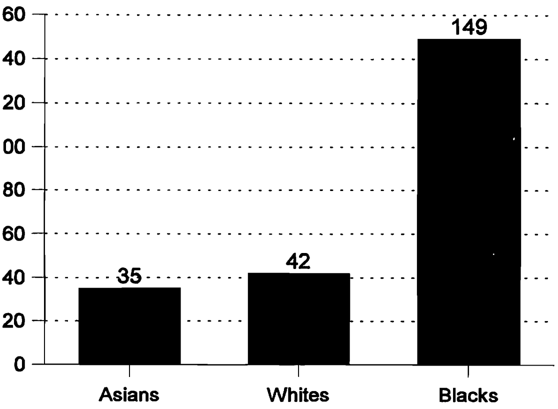
New analyzes by Jared Taylor and Glayde Whitney (1999) have found that throughout the 1990s, Blacks in the U.S. committed five times more violent crimes than did Whites, while Asians committed only about half as many. Taylor and Whitney also corroborated the stark asymmetry of interracial crime in the U.S. Blacks were 50 times more likely to commit a crime of violence (assault, robbery, rape) against Whites than Whites were against Blacks. They also examined "hate crimes,"for which the FBI have been collecting national statistics since passage of the Hate Crime Statistics Act of 1990. Defined as criminal acts "motivated, in whole or in part, by bias," Taylor and Whitney found that Blacks were more than twice as likely to commit hate crimes as Whites.

The analysis by Taylor and Whitney (1999) also compared race differences in crime against sex differences in crime. They found that Blacks were as disproportionately more likely to commit an act of criminal violence than Whites as were men more likely than women. Data from around the world and over the course of history show that males commit more crimes, especially violent crimes, than do females. And just about all scientists agree this difference has some biological basis. Taylor and Whitney concluded that Blacks are as much more prone to violence than Whites as men are than women.

The same racial pattern for violent crime in the U.S. is found worldwide. As discussed in this book (pp. 158-160, 242, 287) INTERPOL Yearbooks throughout the 1980s showed the rate of violent crime (murder, rape, and serious assault) was much higher in African and Caribbean countries than in East Asian countries. European countries were intermediate. The 1990 INTERPOL Yearbook showed the violent crime rate per 100,000 population was 32 for Asians, 75 for Europeans, and 240 for Africans.

In an article in *Criminology*, however, Neapolitan (1998) argued that my INTERPOL crime data were unreliable (i.e., a 'fluke') and therefore not generalizable. However, Whitney and Rushton (2000) have refuted Neapolitan's conjecture with a replication and extension of the INTERPOL results using the most recent issues of the Yearbooks (1993-1996). We categorized each country's racial makeup as primarily East Asian (n = 7), White (n = 47), or Black (n = 22), tabulated each country's rate of homicide, rape, and serious assault per 100,000 population, and then averaged by race over countries. The median rate per 100,000 population for East Asian, White, and Black countries were, respectively, for murder, 1.6, 4.2, and 7.9; for rape, 2.8, 4.5, and 5.5; and for serious assault, 31.0, 33.7, and 135.6. Rough-hewn though these measures may be, the median number of violent crimes per 100,000 population was 35 for Asians, 42 for Whites, and 149 for Blacks (see Chart P-5).

CHART P-5
International Crime Rates for the Three Races (Murder, Rape, and Serious Assault) per 100,000 Population (After Whitney & Rushton, 2000)



Darwin's *Really* Dangerous Idea — the Primacy of Variation

Darwin's *really* dangerous idea was to stress how much genetic variation there is between individuals and between groups, and how natural selection cannot operate without it. When it comes to the study of race, Darwin's idea is the final taboo.

Darwin scientifically explained the diversity of life in terms of variation and selection. Ignoring or minimizing the role of heritable variation goes against the two cornerstones of Darwinian theory: (1) genetic variation exists within species and (2) differential reproductive success favors some varieties over others. In both *Origin* (1859) and *Descent* (1871), Darwin left no doubt about the importance he ascribed to both individual and racial variation. For example:

> Hence I look at individual differences, though of small interest to the systematist, as of high importance for us, as being the first step towards such slight varieties as are barely thought worth recording in works on natural history. And I look at varieties which are in any degree more distinct and permanent, as a step leading to more strongly marked and more permanent varieties; and at these latter, as leading to sub-species, and to species . . . Hence I believe a well marked variety may be justly called an incipient species (1859: 107).

Sir Francis Galton (1865, 1869) immediately recognized what his cousin Darwin's theory meant about the importance of variation in humans. He collated evidence for the existence and heritable nature of variation, thus anticipating the concept of heritability and other later work in behavioral genetics. Galton carried out surveys and found, for example, that good and bad temper and cognitive ability ran in families. He discovered the law of regression-to-the-mean and argued that it showed family characteristics were heritable.

Galton also compared the taciturn American Indians with the talkative impulsivity of Africans (Chapter 7). He noted that these temperaments were true regardless of climate (from the frozen north through the equator), religion, language, or political system (whether self-ruled or governed by the Spanish, Portuguese, English, or French). Anticipating later work on transracial adoption (Chapter 9), Galton pointed out that the majority of individuals adhered to their racial type, even if they were raised by white settlers. He also wrote that the average mental ability of Africans was low, whether in Africa or in the Americas. In *Descent*, Darwin acknowledged Galton's work and also agreed with the brain-size differences between Africans and Europeans found by Paul Broca and other nineteenth-century scientists.

Although Darwinians emerged victorious in their nineteenth-century battles against biblical theology, they subsequently lost this ground to liberal egalitarians, Marxists, cultural-relativists, and literary deconstructionists. From Herbert Spencer (1851) to the world depressions of the late 1920s and 1930s, the political right gained the ascendancy in using evolutionary theory to support their arguments, while the political left came to believe that "survival of the fittest" was incompatible with social equality. Darwinism has been marginalized ever since the mid-1920s when the Boasian school of anthropology succeeded in decoupling the biological from the social sciences (Degler, 1991).

The data on race differences reviewed in this book and the evolutionary models proposed to explain them conflict with what has become known as "political correctness," a mind set that subordinates knowledge and inquiry to ideological discipline about social equality. Presenting misinformation, and the deliberate withholding of evidence, have become all too characteristic of even evolutionary scientists when they write about race. Three well known scientists exemplify this trend: Stephen J. Gould, author of the revised and expanded edition of *The Mismeasure of Man* (1996), Jared Diamond, author of *Guns, Germs, and Steel* (1997), and Christopher Stringer, co-author with Robin McKie of *African Exodus* (1996). I have reviewed the first two books in detail (see Rushton, 1997b, 1999c).

In his 1981 edition of *Mismeasure*, Stephen J. Gould charged nineteenth-century scientists with "juggling" and "finagling" brain size data in order to place Northern Europeans at the apex of civilization. Implausibly, he argued that Paul Broca, Francis Galton, and Samuel George Morton all "finagled" in the *same* direction and by *similar* magnitudes using *different* methods. Gould asks readers to believe that Broca "leaned" on his autopsy scales when measuring wet brains by just enough to produce the same differences that Morton caused by "overpacking" empty skulls and that Galton caused with his "extra loose" grip on calipers while measuring heads!

Yet even before *Mismeasure*'s first edition (1981), new research was confirming the work of these nineteenth-century pioneers. Gould neglected to mention Van Valen's (1974) review which established a positive correlation between brain size and intelligence. As reviewed earlier in this Preface (and especially Chapter 6), the single most devastating development for Gould is the latest research on brain size. How could his revised and expanded edition have missed all that research in the 1990s -- called, with good reason, "The Decade of the Brain"?

Jared Diamond, another well-known evolutionary biologist also joined the debate over racial differences in IQ. In a few *ex cathedra* pronouncements, Diamond branded the genetic argument "racist" (pp. 19-22), declared Herrnstein and Murray's (1994) *The Bell Curve* "notorious" (p. 431), and claimed that: "The objection to such racist explanations is not just that they are loathsome but also that they are wrong" (p. 19). He summarized his views in one creedal sentence: "History followed different courses for different peoples because of differences among people's environments, not because of biological differences among peoples themselves" (p. 25).

Diamond's thesis is that the peoples of the Eurasian continent were environmentally, rather than biologically, advantaged. They had the good fortune to have lived in centrally located homelands that were oriented along an east-west axis, thereby allowing ready diffusion of their abundant supply of domesticable animals, plants, and cultural innovations. The north-south axis of Africa and of the Americas inhibited diffusion due to severe changes in climate. Thus, the agriculturally wealthy Eurasians had a long head start in developing a surplus population with a division of labor that enabled civilization to arise. Yet, as an evolutionary biologist, Diamond should have informed his readers that different environments cause, via natural selection, biological differences among populations in brain size, just as they do in skin coloring and external morphology.

Paleontologist Christopher Stringer of the British Museum of Natural History, and author (with journalist Robin McKie) of *African Exodus,* provides a final example of an important scholar who probably knew better. The parts of the book that review human origins are excellent. Unfortunately, major errors appear in the book when it engages in the obligatory trashing of both *The Bell Curve* and my own work. Perhaps the desire to be politically correct compelled the authors to write: "In any case, the story of our African Exodus makes it unlikely that there are significant structural or functional differences between the brains of the world's various peoples" (p. 181).

The logic here is especially odd given that other parts of the book present a fascinating discussion of how populations vary in jaw size and in number of teeth. For example, page 215 states that compared to Africans, up to 15 percent of Europeans have "at least two wisdom teeth missing...while in east Asia, the figure can be as much as 30 percent in some areas." While Stringer and McKie describe how noses and skin color have been shaped in different regions, and how Europeans and Asians have fewer teeth than Africans, they deny that there are any brain size differences and they withhold from readers the modern literature on brain size and IQ.

In fact, in a subsequent scientific paper, Stringer, Dean and Humphreys (1999) cited racial differences in various mandibular traits (jaws and teeth) including the bichondylar breadth of the mandible (i.e., the distance between the two surfaces at the back of the jaw that attach to the base of the cranium) as evidence to support the Out-of-Africa theory. In Asians bichondylar breadth is wide, in Africans it is narrow, and Europeans are in between. The widening bichondylar breadths occurred as a result of the widening brain cases!

These attempts to deny race differences amount to a new form of creationism (Levin, 1997; Rushton, 1999b; Sarich, 1995). The scientific data fit the Darwinian-Galtonian viewpoint; not the egalitarian one. The

Darwinian-Galtonian viewpoint has been abandoned for political reasons, not because scientific research proved it wrong. In a search of the Medline database for articles published in the last decade that referenced the keywords -- *evolution, genetics, behavior,* and *human* -- and the combination of those words, Bailey (1997, p. 82) found that although each word alone was referenced by several thousand articles, only one article referenced all four. Ruling out evolution and genetics in explaining human behavior violates the consilient approach by which E. O. Wilson predicts all knowledge can be unified in a grand synthesis (Wilson, 1998). It leaves the social sciences closer to medieval theology or Renaissance humanitarianism than to modern science.

The life-history theory proposed in this book unites the evolutionary tradition begun by Darwin with the behavior genetic tradition begun by Galton. Only by studying race, evolution, and behavior, not studiously avoiding them, can we truly stand on the shoulders of these giants who have come before us.

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Preface to the First Edition

Over the last several years I have reviewed the international literature on race differences, gathered novel data and found a distinct pattern. On more than 60 variables, people of east Asian ancestry (Mongoloids, Orientals) and people of African ancestry (Negroids, blacks) define opposite ends of the spectrum, with people of European ancestry (Caucasoids, whites) falling intermediately, and with much variability within each broad grouping (see Glossary regarding terminology). This racial matrix emerges with measures of brain size, intelligence, reproductive behavior, sex hormones, twinning rate, speed of physical maturation, personality, family stability, law-abidingness, and social organization.

To account for the pattern, I proposed a gene-based evolutionary theory familiar to biologists as the *r-K* scale of reproductive strategy. At one end of this scale are *r*-strategies, which emphasize high reproductive rates, and, at the other, *K*-strategies, which emphasize high levels of parental investment. This scale is generally used to compare the life histories of widely disparate species but I used it to describe the immensely smaller variations within the human species. To emphasize that all human beings are *K*-selected relative to other animals this proposal was referred to as "differential *K* theory" (Rushton, 1984, 1985a). I hypothesized that Mongoloid people are more *K*-selected than Caucasoids, who in turn are more *K*-selected than Negroids.

I also mapped the *r-K* scale onto human evolution. Molecular genetic evidence indicates that modern humans evolved in Africa sometime after 200,000 years ago, with an African/non-African split occurring about 110,000 years ago and a Mongoloid/Caucasoid split about 41,000 years ago. Evolutionary selection pressures are far different in the hot African savanna where Negroids evolved, than in the cold Arctic environment, where Mongoloids evolved. Hence, it was predictable that these geographic races would show genetic differences in numerous traits. African populations, the earliest to emerge, are least *K*-selected, and Mongoloids, emerging latest, are most *K*-selected, with Caucasoids falling intermediately. Such an ordering explains how and why the variables clustered.

It is provocative, to say the least, to treat each of these vast races as a separate human subspecies whose multifarious patterns of behavior are reduced to an average position on a gene-based scale of reproductive strategy. But the question I asked myself repeatedly was: Did the facts fit the theory? Unfortunately not many others wanted to look very closely. My thesis, touching as it did on delicate issues, was denounced as "monstrous." I had engendered one of the most disreputable theories of human evolution in the last 60 years.

I did not always believe that race differences existed in deep structure. Fifteen years ago, as an established social learning theorist, I would have said that any differences that existed would have been primarily environmental in origin (Rushton, 1980). However, I have been persuaded, by data, and findings from numerous sources, that the races do differ, genetically, in the mechanisms underlying their behavior.

A major controversy occurred in Canada after my views became publicly known. Following a 1989 presentation of the theory at the American Association for the Advancement of Science, there was a call for my dismissal by the premier of Ontario, a criminal investigation by the Ontario Provincial Police, a media campaign of opposition, disruptions at the university, and an as yet unresolved investigation by the Ontario Human Rights Commission.

The fire storm of outrage led to countless challenges and rejoinders, so much so that at times the affair took over my life. Work on other topics seemed shallow by comparison. I learned to appreciate the cornerstone implications generated by the issue of race. By its impact on diverse areas of behavioral science, it was possible to imagine research on the topic completing the Darwinian revolution.

The prevailing social science paradigms are fast giving way to gene-culture coevolutionary perspectives. Although genetic, developmental, and psychobiological data are being amassed at an ever-increasing rate, there are few encompassing theories. The gene-based evolutionary models put forward here to explain ethnocentrism and racial group differences may provide a catalyst for understanding individual differences and human nature.

It is a truism in differential psychology that variations within groups are larger than those between them and there is enormous overlap in the racial distributions. This can be illustrated with some unpublished data of mine on the age that young men report having their first sexual intercourse. Relative to whites, Orientals report a disproportionately later date and blacks a disproportionately earlier date. Clearly, this does not mean that all Orientals have a later age of first sexual intercourse than all blacks.

Age of First Sexual Intercourse
(in %)

Race	Under 17	Over 17
Orientals	24	76
Whites	37	63
Blacks	64	36

On any single dimension to be discussed the racial differences are not large. Typically they range from 4 to 34 percentile points. Although often modest, the mean differences do exist, and they do so in a stubborn and consistent pattern. Obviously, however, it is problematic to generalize from a proportionate difference or group average to any particular individual. At the level of the individual, it must be recognized that almost all will have a mixture of *r* and *K* characteristics.

It is also necessary to emphasize the indisputable fact that much more research is needed. Objective hypothesis testing about racial differences in behavior has been much neglected over the past 60 years and knowledge is not as advanced as it ought to be. Many of the data sets and theoretical accounts provided here need much improvement. Rough-hewn though some of the evidence may be, it is clear that substantial racial differences do exist and that their pattern cannot be explained adequately except from an evolutionary perspective.

Although the thesis of this book is that genetic variation contributes importantly to the differences between human groups, it is obvious that environmental factors do so too. I would hold, on the currently available evidence, that the genetic and environmental contributions are about equal. Note that genetic effects, like environmental effects, are necessarily mediated by neuroendocrine and psychosocial mechanisms. These offer numerous ways for intervention and the alleviation of suffering.

Acknowledgments

This work belongs in the "London School" tradition founded by Sir Francis Galton. It has had a long gestation. Although I was educated at the University of London, earning a B.Sc. (1970) in psychology from Birkbeck College and a Ph.D. (1973) in social psychology from the London School of Economics and Political Science, I was not aware at the time how much my thinking was influenced by this unique amalgam of evolutionary biology, behavioral genetics, psychometrics, and neuroscience. Until 1980 I pursued my primary research trajectory in social learning theory. However, the discussion about the genetics of intelligence and the biological basis of behavior that occurred there stimulated vital thoughts that might not have happened elsewhere.

The work's specific origin was a book chapter written during an academic term (1981) as the guest of Paul Mussen at the Institute of Human Development of the University of California at Berkeley. In this chapter I broadened my social learning paradigm to encompass sociobiology (Rushton, 1984). Effort continued during a sabbatical (1982-1983) with Hans Eysenck at the University of London's Institute of Psychiatry.

The awarding of a Faculty of Social Science Research Professorship from the University of Western Ontario allowed me a year's relief from teaching duties (1987-1988). So did a fellowship in the John Simon Guggenheim Memorial Foundation (1988-1989), and then another sabbatical from the University of Western Ontario (1989-1990).

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Two colleagues at Western provided magnificent help over many years. Douglas Jackson in psychology expanded my knowledge of psychometrics and Davison Ankney in zoology enlightened my thinking on evolution. Their wisdom, however, extends greatly beyond these central areas of expertise.

Excellent long-distance encouragement was provided by Arthur Jensen at the University of California at Berkeley and Richard Lynn at the University of Ulster. Both brought a stream of important items to my attention and regularly consulted on difficult issues. Their research discoveries form important parts of this book.

I am much beholden to those who provided specific advice on earlier drafts of the book: Davison Ankney, Hans Eysenck, Desmond ffolliett, Jeffrey Gray, Barry Gross, Richard Herrnstein, Douglas Jackson, Arthur Jensen, Sandi Johnson, Michael Levin, Richard Lynn, Edward Miller, Travis Osborne, and Harry Weyher. Others prefer to remain anonymous. Because my advisers and benefactors may not approve of all that I have written, they cannot be held accountable for any of the book's failings. I alone am responsible for these.

Finally, I am more indebted to my family than I can possibly express. Without their encouragement, the book might never have been completed.

1

Revamping Social Science

Favoritism for one's own ethnic group may have arisen as an extension of enhancing family and social cohesiveness (chap. 4). Because people give preferential treatment to those who genetically resemble themselves in order to help propagate their genes more effectively, xenophobia may represent a dark side of human altruism.

The propensity to defend one's own group, to see it as special, and not to be susceptible to the laws of evolutionary biology makes the scientific study of ethnicity and race differences problematic. Theories and facts generated in race research may be used by ethnic nationalists to propagate political positions. Antiracists may also engage in rhetoric to deny differences and suppress discoveries. Findings based on the study of race can be threatening. Ideological mine fields abound in ways that do not pertain to other areas of inquiry.

For scientific progress to be made it is necessary to rise above both "racist" and "antiracist" ideology. Suppose that a team of extraterrestrial scientists arrived on earth to study humans. Obviously they would quickly observe that, like many other species, humans showed considerable geographical variation in morphology. Three major geographical populations or "races" would be identified immediately and investigation mounted into how many others existed. Questions about the origin of the body types would be asked and also whether they covaried with life history variables including reproductive tactics in particular. If these scientists had a solid understanding of evolutionary biology, they would also investigate if these populations differed behaviorally, for example with respect to parental investment and social organization, and, if they did, how the differences might have evolved. Such an approach has proved very fruitful for population biologists studying other animals, particularly since E. O. Wilson's (1975) synthesis of sociobiology. If we are as interested in gaining knowledge as would be these "extraterrestrials", then we should apply similar procedures to our study of *Homo sapiens.*

For some, it would have been better if Mother Nature had made people, genetically, all the same. Cooperation would be easier and we could design just one type of society that would fit everybody. However, we are not all the same. Even children within the same family substantially differ from each other both genetically and behaviorally (Plomin & Daniels, 1987). If we examine how wide the differences can be between brothers and sisters who share the same food, watch the same TV, go to the same schools, and have the same parents, how much more different from each other must we expect other humans to be, especially those living in regions far apart that are normally classified as "races"?

The Nature-Nurture Debate

One of the great worldviews of social science has been that economic and other environmental forces are preeminent in the causation of individual behavior. Modern social scientists have also been egalitarian, promoting the idea that all babies are born with essentially equal endowments. It follows that subsequent inequalities in wealth and poverty, success and failure, happiness and misery, and sickness and health are the product of social forces.

John B. Watson (1878-1958), the founder of behaviorism articulated what was to become the social science orthodoxy (1924: 104):

> Give me a dozen healthy infants, well formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant-chief and, yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors. I am going beyond my facts and I admit it, but so have the advocates of the contrary and they have been doing it for many thousands of years. Please note that when this experiment is made I am to be allowed to specify the way the children are to be brought up and the type of world they have to live in.

Benevolent environmentalism generated a plethora of strategies for intervention in the home, the workplace, the mass media, and the criminal justice system. Psychotherapies and self-help systems flourished as people attempted to rectify blemishes and achieve self-fulfillment. Social workers battled the harmful effects of poverty, unemployment, and other factors.

Environmentalism dovetailed with political philosophies striving to generate sweeping changes in human affairs. From capitalist democracies to totalitarian collectivities, social engineering began in earnest. Marxists took the argument furthest, preaching that public ownership of the economic base of society was a necessary precondition for social harmony.

Especially following World War II (1939-1945) and the revulsion to Hitler's racial policies, egalitarianism led to the virtual elimination of Darwinian thinking among Western social scientists (Degler, 1991). The doctrine of biological equality was taken to an extreme among Communists in the Soviet Union and elsewhere (Clark, 1984). Throughout the world, leftists took up the cry "Not in Our Genes" and vociferously asserted that social inequalities were due entirely to repressive environments (Lewontin, Rose, & Kamin, 1984; Lewontin, 1991).

The nature-nurture debate is fought between those who, in effect, advocate an extreme 100 percent environmentalist position and those who advocate a moderate, even 50-50, position. No behavioral geneticist believes in a 100 percent genetic determinism because it is obvious that physical growth and mental development require good nutrition, fresh air, and exercise and that children and neophytes learn best with access to experienced role models. Genetic influence (not determinism) is the key phrase, for genetic effects are necessarily mediated by neuroendocrine and psychosocial systems that have independent influence on phenotypic behavior.

The burning question is how substantial is the genetic contribution to human nature and the differences therein? While lip service has been paid to the view that people are a product of both genes and culture, until recently, many social scientists and philosophers acted as though the human mind was a blank slate and each person exclusively a product of his or her history and economic arrangement.

During the 1980s there was an increased acceptance of behavioral genetics and evolutionary theorizing. Even the most rigid opponents acquiesced as scientific breakthroughs made headlines. Major reviews of the twin and adoption literature appeared in *Science* and other prestigious journals, leading to the widely accepted conclusion that "genetic factors exert a pronounced and pervasive influence on behavioral variability" (Bouchard, Lykken, McGue, Segal, & Tellegen, 1990: 223).

Discoveries in medical genetics heralded what was to come with gene therapy a possibility for a variety of classic psychological disorders including anxiety, depression, and schizophrenia. The project to sequence the entire human genome got underway, a multibillion dollar international undertaking. Although hard-core naysayers such as *Science for the People* remained implacably opposed to developments (Lewontin, 1991), clearly, the climate was changing.

A renewal of interest in human racial origins also characterized the 1980s with Africa identified as the Garden of Eden. In the 1970s dramatic fossil discoveries in East Africa of *Homo habilis* and *Homo erectus,* along with the 3.7 million-year-old footprints and bones of "Lucy" and her fellow australopithecenes captured the public imagination. By the 1980s, through genetic analyses of existing human populations, "Eve" was thought to be a long-armed, thick-boned, well-muscled, dark-skinned woman who lived some 200,000 years ago on the East African savanna. She appeared on the front cover of *Newsweek* (January 11, 1988) and helped center a debate on the evolution of human origins.

Race differences in behavior, although a necessary concomitant of these revisionist viewpoints, were not included in these studies, and constituted an embarrassment for scholars who omitted them. On the topic of race, a righteous conformity had come to prevail. A sign of the times was Sandra Scarr's presidential address to the Behavior Genetics Association in 1986. She observed, in a talk entitled "Three Cheers for Behavioral Genetics," that "the war is largely over.... The mainstream of psychology has joined our tributary, and we are in danger of being swallowed up in a flood of acceptance" (Scarr, 1987: 228). While accepting that genetics underlay social class differences in IQ, she rejected a genetic explanation for racial differences because racial barriers were less permeable. Scarr (1987) interpreted her own work as showing an environmental causation for racial variation.

In this book, new truths about racial group differences are advanced. The stepwise function of racial characteristics made explicit in Table 1.1 is the starting point for discussion. Mongoloids and Caucasoids have the largest brains, whether indexed by weight at autopsy, external head size, or intracranial volume, but have the slowest rate of dental development, indexed by onset of permanent molar teeth, and produce the fewest gametes, indexed by frequency of twin birthing and size of the testes. For example, blacks produce more than 16 two-egg twins per 1,000 live births whereas the figure for whites is 8 and for Orientals it is less than 4.

Most psychological work on race has focused on differentials between blacks and whites in the United States where whites achieve disproportionately higher than blacks. Ever since Arthur Jensen's (1969) classic monograph, a controversy has raged over whether the causes of this disparity involved genetic as well as environmental factors (Eysenck & Kamin, 1981; Loehlin, Lindzey, & Spuhler, 1975). Extensive surveys now show that a plurality of experts believe that Jensen was correct in attributing a portion of the racial variance to genetic differences (Snyderman & Rothman, 1987, 1988).

The intelligence debate was broadened by Richard Lynn (1982, 1991c) who gathered global data showing that Orientals had higher test scores than whites. Others described physiological, maturational, and other behavioral differences among the races (Eysenck, 1971; Jensen, 1973; R. Lynn, 1987). The scientific discussion was also expanded with data on activity level and temperament (Freedman, 1979), crime (J.Q. Wilson & Herrnstein, 1985), personality (P.E. Vernon, 1982), family structure (Moynihan, 1965), and health and longevity (Polednak, 1989).

The present book explores these and other variables in detail. It includes extensive evidence from (a) Mongoloid samples (one-third of the world's population), (b) Negroid samples from other than the United States (most black people live in postcolonial Africa), and (c) multifarious characteristics in addition to mental ability. I conclude that the racial group differences in intelligence are observed worldwide, in Africa and Asia, as well as in Europe and North America, and that they are paralleled by differences in brain size, speed of dental maturation, reproductive physiology, and numerous other variables.

The central theoretical question is: Why should Caucasian populations average so consistently *between* Negroid and Mongoloid populations on so many

TABLE 1.1
Relative Ranking of Races on Diverse Variables

Variable	Orientals	Whites	Blacks
Brain size			
Autopsy data (cm^3 equivalents)	1,351	1,356	1,223
Endocranial volume (cm^3)	1,415	1,362	1,268
External head measures (cm^3)	1,356	1,329	1,294
Cortical neurons (billions)	13.767	13.665	13.185
Intelligence			
IQ test scores	106	100	85
Decision times	Faster	Intermediate	Slower
Cultural achievements	Higher	Higher	Lower
Maturation rate			
Gestation time	?	Intermediate	Earlier
Skeletal development	Later	Intermediate	Earlier
Motor development	Later	Intermediate	Earlier
Dental development	Later	Intermediate	Earlier
Age of first intercourse	Later	Intermediate	Earlier
Age of first pregnancy	Later	Intermediate	Earlier
Life span	Longer	Intermediate	Shorter
Personality			
Activity level	Lower	Intermediate	Higher
Aggressiveness	Lower	Intermediate	Higher
Cautiousness	Higher	Intermediate	Lower
Dominance	Lower	Intermediate	Higher
Impulsivity	Lower	Intermediate	Higher
Self-concept	Lower	Intermediate	Higher
Sociability	Lower	Intermediate	Higher
Social organization			
Marital stability	Higher	Intermediate	Lower
Law abidingness	Higher	Intermediate	Lower
Mental health	Higher	Intermediate	Lower
Administrative capacity	Higher	Higher	Lower
Reproductive effort			
Two-egg twinning (per 1,000 births)	4	8	16
Hormone levels	Lower	Intermediate	Higher
Size of genitalia	Smaller	Intermediate	Larger
Secondary sex characteristics	Smaller	Intermediate	Larger
Intercourse frequencies	Lower	Intermediate	Higher
Permissive attitudes	Lower	Intermediate	Higher
Sexually transmitted diseases	Lower	Intermediate	Higher

traits? It is not simply IQ scores that require explanation. A network of evidence such as that shown in Table 1.1 allows more chance of finding powerful theories than do single dimensions drawn from the set. No environmental factor is known to produce the inverse relation between brain size, maturational speed, and reproductive potency nor to cause so many diverse variables to correlate in so comprehensive a fashion. There is, however, a genetic factor: evolution.

The explanation proposed for the racial pattern originates in life-history theory. A life history is a genetically organized suite of characters that have evolved so as to allocate energy to survival, growth, and reproduction. For example, across 21 primate species, age of eruption of first molar correlates 0.89, 0.85, 0.93, 0.82, 0.86, and 0.85 with body weight, length of gestation, age of weaning, birth interval, sexual maturity, and life span. The highest correlation is 0.98 with brain size (B. H. Smith, 1989).

Theories concerning large brains and long life in primates take on particular importance because humans are the most encephalized and the longest lived of primates. Humans can be viewed as the most extreme on an evolutionary scale trading parental care and social organization for egg production and reproductive potency. This tradeoff may be conceptualized along a continuum of *r*-*K* reproductive strategies (E. O. Wilson, 1975).

At one extreme the great apes exemplify the *K*-strategy, producing one infant every five or six years and providing much parental care. At the other extreme, oysters exemplify the *r*-strategy, producing 500 million eggs a year but providing no parental care. A female mouse lemur, an *r*-strategist among primates, produces her first offspring at 9 months of age and has a life expectancy of 15 years. A mouse lemur may mature, have offspring, and die before a *K*-strategist gorilla has her first offspring.

This cross-species scale may be applied to the immensely smaller variation among human groups. Although all human beings are at the *K*-selected end of the continuum, some may be more so than others, a proposal introduced as "differential *K* theory" (Rushton, 1984, 1985a, 1988b). Black women, compared to white women, average a shorter period of ovulation and produce more eggs per ovulation in addition to all the other characteristics in Table 1.1. As mentioned, the rate of dizygotic twinning, a direct index of egg production, is less than 4 per 1,000 births among Mongoloids, 8 per 1,000 among Caucasoids, and 16 or greater per 1,000 among Negroids. Conversely, Mongoloid populations average the largest brains, the highest IQ scores, and the most complex social organizations.

Archaic versions of the three major races appear to differ in antiquity, with Mongoloids being the most recently evolved and Negroids the earliest. As I mentioned in the Preface, Africans emerged from the ancestral *Homo* line about 200,000 years ago, with an African/non-African split occurring about 110,000 years ago, and a Caucasoid/Mongoloid split about 41,000 years ago

(Stringer & Andrews, 1988). Because Bonner (1980) had shown that, in general, animals that emerged later in earth history had larger brains and greater culture than those that had emerged earlier, I extrapolated to the human succession (Rushton, 1992b). Because groups migrating out of Africa into the colder climate of Eurasia encountered more challenging environments, including the last ice age, which ended just 12,000 years ago, they were more stringently selected for intelligence, forward planning, sexual and personal restraint, and a *K*-parenting strategy. The Siberian cold experienced by Oriental populations was the most severe and exerted the greatest selection.

Few social scientists, however, were willing to examine the evidence or to engage in scientific debate. Charles Leslie, an advisory editor of *Social Science and Medicine* exemplified the opposition. Outraged that the journal had published my work on how racial variation in sexuality contributed to the global epidemiology of AIDS, Leslie (1990: 896) used his opening address at the Eleventh International Conference on the Social Sciences and Medicine to condemn the editorial decision to publish me. The justification for his denouncement is illuminating of the state of much social science research.

> [M]ost of the influential work in the social sciences is ideological, and most of our criticisms of each other are ideologically grounded. Non social scientists generally recognize the fact that the social sciences are mostly ideological, and that they have produced in this century a very small amount of scientific knowledge compared to the great bulk of their publications. Our claim to being scientific is one of the main intellectual scandals of the academic world, though most of us live comfortably with our shame.... By and large, we believe in, and our social science is meant to promote, pluralism and democracy.

This view of social science was also exemplified by Caporael and Brewer (1991:1) who edited a special volume of the *Journal of Social Issues,* a publication of the American Psychological Association, to "recapture" evolutionary theory from people like me for those more "socially responsible." Asserted the editors, "Biological explanations of human social behavior tend to be ideologically and politically reactive". One contributor (Fairchild, 1991: 112) went further:

> If ideology is inextricably tied to the generation of knowledge, then all social science writings—including this one—involve certain ideological biases or political agendas.... These biases are typically unstated. The author's ideological biases are as follows: (a) The idea of inherited "racial" differences is false; instead, "race" is a proxy for a host of longstanding historical and environmental variables. (b) Social science has the mandate of applying its theories and methods to alleviate human suffering and inequality.

The evolutionary psychology of race differences has become the most politically incorrect topic in the world today. On no other issue are the outmoded paradigms and obsolete models of the social science orthodoxy so clearly revealed. And on no other topic does the intellectual battle fuse with the political and so much distort basic scientific values. Although nobody denies that some ethnic groups are disproportionately represented in wealth, education, health, and crime, alternative explanations for the differences constitute ideological warfare. Ultimately, the battle is over nothing less than how to conceptualize human nature.

The Revolution Ahead

In the next 10 years, scientists worldwide will devote billions of dollars to the Human Genome Project. In the process, they will decipher all 100,000 human genes, cure certain inherited diseases, (like cystic fibrosis in northern Europeans, Tay Sachs in European Jews, beta thalassemia in eastern Mediterraneans, and sickle-cell in those of West African descent), and inform us more about ourselves than many of us are prepared to know. This knowledge will include why ethnic and racial groups are disproportionately represented in various spheres of activity.

Just as women doctors have advocated that to conceptualize women as being the same as men leads to a neglect of women's problems and their treatment (e.g., premenstrual symptoms and menopause and hormone replacement therapy), so black doctors have become concerned that treating blacks the same as whites is to neglect black problems. For example, 30 percent of the people who have kidney failure and undergo dialysis are black, but estimates are that fewer than 10 percent of organ donors are black. Blacks fare better with organs donated from blacks.

Another example is that genetics contributes to black hypertension. Black men experience a faster heart rate when performing moderate exercise, although the pulse rates of the black and white men while resting showed no significant differences. Black men have higher rates of cancer of the prostate than white men who in turn have higher rates than Oriental men, one determinant of which is testosterone (Polednak, 1989).

Racial differences exist in risk for AIDS with blacks being most at risk and Asians least so (chap. 8). In the United States, blacks, who make up 12 percent of the population, represent 30 percent of those with AIDS. Among women, 53 percent of those with AIDS are black. Fifty-five percent of children with AIDS are black.

Race is also a critical factor in the success of many medicines. For example, Asians are more sensitive to the drugs used to treat anxiety, depression, and schizophrenia, requiring lower dosages; they are also more likely to have side effects with lower dosages (Levy, 1993). Another widely cited example is that Asians are more sensitive to the adverse effects of alcohol, especially to marked facial flushing, palpitation, and tachycardia. Levy (1993: 143) argues that ethnicity should be taken into account in formulary selection and prescribing decisions for individual patients.

Ethnically related disparities exist in every field of endeavor. Continuing with Asians and blacks in the United States, the clear and publicly acknowledged fact is that one has a disproportionately high number who qualify for college educations and the other has a disproportionately high number who qualify for successful careers in professional athletics. In numerous other important outcomes, such as economic standing, crime, illiteracy, poverty, and unemployment, one group or another is disproportionately represented. These disproportionate representations are stubborn, and in America, Britain, and Canada they have resisted strenuous efforts to eliminate them.

With respect to IQ differences in the United States, their possible causes were the subject of a survey of 661 scientists in relevant disciplines (Snyderman & Rothman, 1987, 1988). Of the respondents, 94 percent regarded differences within the white population to have a significant genetic component, the average estimate of the amount being 60 percent. A majority (52 percent) of those responding to the question believed that part of the black-white difference was genetic, compared to only 17 percent of those answering the question who believed it was entirely environmental. The case for genetic determination is even more strongly felt for socioeconomic status differences.

The origin of modern humans is one of the largest unsolved problems in evolution. Explaining race differences may give clues to what happened during early human evolutionary history. It may also provide a universal model of human action. Groups are but aggregates of individuals and ultimately it is at the level of the individual that an account must be sought. Gene-based reproductive strategies provide a better explanation of behavior than sociological forces alone.

It is the thesis of this book that the principles of evolution and sociobiology should be applied to the study of racial group differences among *Homo sapiens*. Lumsden and Wilson (1983: 171) set the stage:

> A guiding principle has nevertheless reemerged from the combined efforts that once inspired Comte, Spencer, and other nineteenth-century visionaries before dying from premature birth and Social Darwinism: that all of the natural science and social sciences form a seamless whole, so that chemistry can be unified with physics, biology with chemistry, psychology with biology, and sociology with psychology—all the way across the domain of inquiry by means of an unbroken web of theory and verification. In the early years the dream was bright.... The bridge between biology and psychology is still something of an article of faith, in the process of being redeemed by neurobiology and the brain sciences. Connections beyond, to the social sciences, are being resisted as resolutely as ever. The newest villain of the piece, the embattled spearhead of the natural-science advance, is sociobiology.

Sir Francis Galton

The work to be presented in this book is part of a historical tradition sometimes known as the "Galton School" and sometimes as the "London School" of Psychology. Started by Sir Francis Galton (1822–1911), the cousin of Charles

Darwin (1809-1882), the tradition has been continued by Karl Pearson, Charles Spearman, Cyril Burt, Hans Eysenck, Richard Lynn, and Arthur Jensen, among others. This historical tradition is too often unacknowledged in contemporary research.

Galton is the originator of scientific research on individual differences. His 1865 article "Hereditary Talents and Character" was published 14 years before Wundt "founded" psychology, at a time when Freud was only 9 years old. A forerunner to *Hereditary Genius* (1869), the article was concerned with the heritability, distribution, and measurement of individual differences in "zeal and industry," as well as intelligence, and appeared 6 years after *The Origin of Species* (Darwin, 1859), and 6 years before *The Descent of Man* (Darwin, 1871). Providing early evidence that individual differences in intelligence were heritable, this article was the first to advocate using twins for proof.

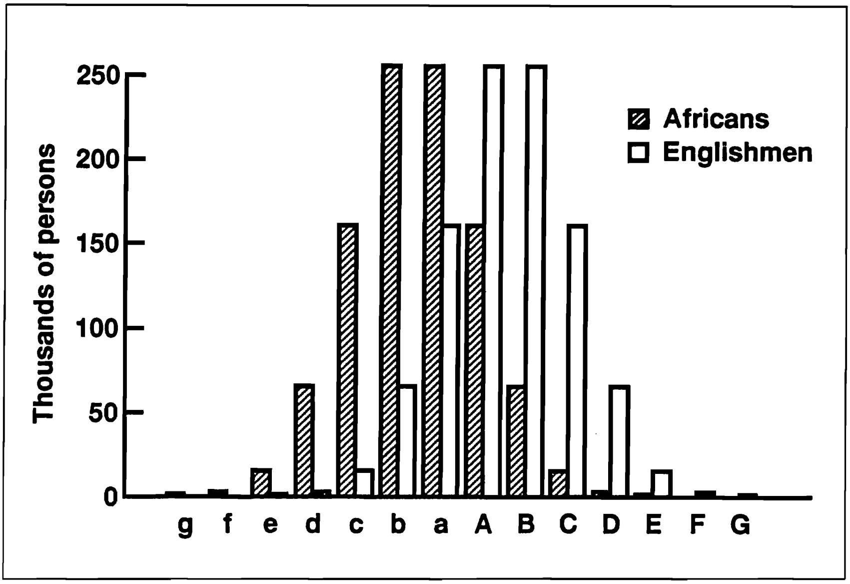
It was Galton who made the first attempt to place the racial question into psychological and statistical terms. Galton's (1853) anthropological work, exploring the tribes of southwest Africa, had stimulated his interest in human differences. To Galton, mathematics did not exist among the Africans, with fingers being used to help count (chap. 5). Galton said it would "sorely puzzle" the Ovaherero to realize that if one sheep cost two sticks of tobacco, two sheep would cost four. Galton (1869: 337) also contrasted an easily stirred impulsive temperament in Africans with a complacency in Chinese. Following the publication of Darwin's (1859) *Origin of Species,* Galton applied Quetelet's (1796-1874) statistical advances regarding deviations from an average and the normal distribution to explain natural selection.

It occurred to Galton (1869) that intellectual ability might be normally distributed. He examined marks from various examinations and found that middle scores were consistently more frequent than very high or very low scores. He applied fourteen grades to human intellect, seven on each side of the mean, using capital and lowercase letters (Figure 1.1). He concluded that 1 person in about 79,000 would fall in the highest grade, *G,* and necessarily the same number in the lower grade of imbeciles, *g;* 1 in 4,300 in grade *F* and in *f,* but 1 in only 4 in each of the average grades, *A* and *a.* To allow for a few persons of such outstanding intellect that they were too few for statistical treatment he designated a grade as *X,* and to its opposite, *x.*

Galton postulated that the distribution of intellect would be the same in all ethnic taxa, but that the mean would differ. Figure 1.1 shows that in his opinion Africans averaged lower than Europeans, but with a large overlap. Galton's estimates turn out to be remarkably similar to those obtained from normative samples of black and white Americans 100 years later (Jensen, 1973: 212-13; see also Figures 2.5 and 6.3).

Galton also judged the range of intellect available in other populations, including dogs and other intelligent animals, and postulated overlap. Thus,

Figure 1.1: Galton's (1869) Classification of English and African Mental Ability



The letters below the baseline are Galton's grades of intelligence from *A* and *a*, above and below average, to *G* and *g*, eminent and imbecile. The left-hand columns represent the number of Africans, while those to the right represent the number of Englishmen. Based on estimates given by Galton (1869, p. 30, 327-328).

the class of *G* of such animals in respect to memory and powers of reason is viewed as superior to the *g* of humankind. Galton was struck by the number of eminent people in the Greek population of Attica in the century beginning 530 B.C. (Pericles, Thucydides, Socrates, Xenophon, Plato, and Euripides among others). He believed the proportion of persons in the highest grades was much greater than in the England of his time.

Galton was not only the first to advocate the use of twins to help disentangle the effects of heredity and environment, he also carried out breeding experiments with plants and animals, anticipating later work in behavioral genetics. Galton (1883, 1889) also studied temperament, as in his article "Good and Bad Temper in English Families" and he pioneered work on assortative mating among spouses, and the interrelationships of intelligence, temperament, and physique. He suggested that socially desirable traits went together because of mate preferences (chap. 4).

Galton was not exclusively hereditarian. He carried out surveys to assess other influences making for eminence, and reported that devoted, high-minded mothers and first-born ordinal position were important predictors (Galton, 1874). Less well known is that Galton (1879, 1883) was interested in mental imagery and invented the word association test, creating stimulus words and gathering statistical information on their unconscious associations. These were published in *Brain* (1879), and Freud can almost certainly be included among the readers of this issue, although he never referred to Galton's paper nor credited Galton with priority in suggesting the existence of unconscious mental processes (Forrest, 1974).

The longest-standing contributions of Galton are statistical. He was among the first to apply the normal distribution, deviation scores, and percentiles to psychological characteristics (1869). He invented the concepts of regression and correlation (1888a, 1889). He was influential in founding the journal *Biometrika* (1901), which, by promulgating statistical techniques for the study of biological variation, including psychological characteristics, helped begin the psychometric tradition. In his anthropometric laboratory, Galton (1883, 1889) pioneered many measurement techniques including those of head size. During the 1880s and 1890s more than 17,000 individuals of all ages from diverse walks of life were tested. For a small fee visitors could have various measurements taken and recorded.

Galton (1888b) was the first to report a quantitative relationship between cranial capacity and mental ability in humans. Galton's subjects were 1,095 Cambridge undergraduates divided into those who had achieved first class honors degrees and those who had not. Galton computed head volume by multiplying head length by breadth by height and plotting the results against age (19 to 25 years) and class of degree (A, B, C). He reported that (1) cranial capacity continued to grow after the age of 19, and (2) men who obtained high honors degrees had a brain size from 2 to 5 percent greater than those who did not.

Years later, when Galton's data were reworked using correlation coefficients, the relation between head size and college grades was found to lie between 0.06 and 0.11 (Pearson, 1906). Pearson (1924: 94) reported Galton's response: "He was very unhappy about the low correlations I found between intelligence and head size, and would cite against me those 'front benches' [the people on the front benches at Royal Society meetings who Galton perceived as having large heads]; it was one of the few instances I noticed when impressions seemed to have more weight with him than measurements." As reviewed in chapter 2, volumetric measures of brain size from magnetic resonance imaging give the substantially higher correlations Galton had predicted.

When Galton died in 1911, his will endowed Karl Pearson with a Chair of Eugenics (later Genetics) at the University of London. Pearson, later Galton's biographer (1914–1930), invented the product-moment correlation and the chi-square goodness-of-fit statistic, and helped inaugurate the great biometric trajectory that included R. A. Fisher (inventor of the analysis of variance) and Sewall Wright (inventor of path analysis), both of whom are best known, along with J. B. S. Haldane, for the "Modern Synthesis" of Darwinian evolution with Mendelian genetics. Few social scientists are aware that the statistics they use were originated for the purpose of estimating the transmission of genetic variance.

A rival to Pearson's Department of Eugenics was the University of London's Psychology Department headed by another Galtonian, Charles Spearman. Spearman invented rank order correlations, factor analysis, discovered the *g* factor in tests of intelligence, and investigated the interaction of personality and intelligence, finding, like Galton before him, that socially desirable traits such as honesty and intelligence often went together (Spearman, 1927). Spearman's successor was Sir Cyril Burt, and two of Burt's most famous students, Raymond Cattell (1982) and Hans Eysenck (1981) have promulgated this unique amalgam of evolutionary biology, behavioral genetics, psychometrics, and neuroscience to the present day.

Arthur Jensen (1969) also wears the Galton mantle. It is not well known that Jensen's early research was concerned with personality factors in educational attainment. After receiving his doctoral degree at Columbia University, he moved to London to carry out postdoctoral research with Eysenck, learned about the *g* factor in tests of intelligence, and subsequently pursued the implications. So many psychologists have been influenced by the evolutionary thinking arising out of sociobiology that the Galtonian identity may be lost in what is hopefully an emerging paradigm (Buss, 1984; Rushton, 1984).

Counterrevolution

It may be important to consider why the Galtonian tradition is not better appreciated. Many of the earliest psychologists including Freud, Dewey, James, McDougall, and Thorndike embraced Darwinism with enthusiasm, as did other social thinkers including Karl Marx and Herbert Spencer. At this time, the eugenics movement too was widely supported, as much by socialist reformers as by right-wing traditionalists (Clark, 1984; Kevles, 1985). The mix of political ideology with human biology, however, eventually led to Galton's unpopularity.

By the mid-1930s the political right had gained the ascendancy in claiming evolutionary theory to support their arguments while the political left had come to believe that the concept of "survival of the fittest" was incompatible with the notion of equality. Powerful ideologues, such as the anthropologist Franz Boas (1912, 1940) and his student Margaret Mead, fought against the idea of biological universals. Boas (1912) reported that the head shapes of thousands of immigrants to New York City changed with the amount of time spent in the United States. In *Coming of Age in Samoa* (Mead, 1928) purported to discover a "negative instance" of adolescence being a time of emotional stresses, and its conclusion added significantly to the increasingly antibiological orthodoxy (Caton, 1990; Degler, 1991; Freeman, 1984).

Opposition to the Nazis played a significant role in blunting Galton's impact. From the 1930s onward, scarcely anyone outside Germany and its Axis allies dared to suggest that groups of individuals might be in any genetic respect different to any other lest it should appear that the author was supporting or excusing the Nazi cause. Those who believed in the biological equality of people were free to write what they liked, without fear of contradiction. They made full use of their opportunity in the decades that followed. Politically fueled also by European decolonization and by the U.S. civil rights movement, the idea of a genetically based core of human nature on which individuals and social groups might differ was consistently derogated.

Among the refugees who fled Nazi persecution and entered Britain and the United States in the 1930s and 1940s there were many who exerted a powerful influence on the Zeitgeist of the social sciences, helping to create an orthodoxy of egalitarianism and environmentalism (Degler, 1991). As Degler reminds us, however, from the longer historical perspective it is the decoupling of biology and human behavior that requires explanation. Evolutionary studies of human nature are inherently mainstream. Radical environmentalism and cultural determinism are the anomalous conditions in need of justification.

The Distal-Proximal Continuum

In 1975, E. O. Wilson published *Sociobiology: The New Synthesis.* This was a monumental founding document, an epic treatment of animal behavior and evolutionary theory. In it, Wilson defined the new science as "the systematic study of the biological basis of all social behavior" (p. 4) and named altruism the "central theoretical problem of sociobiology" (p. 3). How could altruism, which by definition reduced personal fitness, possibly evolve by natural selection?

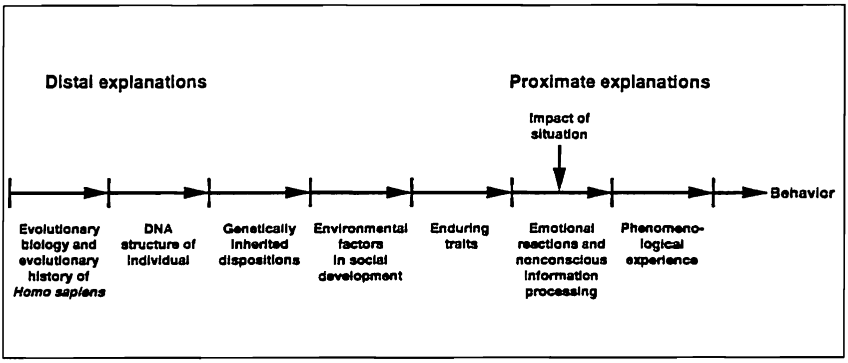
At the roots of the new synthesis was a modernization of Samuel Butler's famous aphorism that a chicken is only an egg's way of making another egg, that is, "the organism is only DNA's way of making more DNA" (E. O. Wilson, 1975: 3). This represented a conceptual advance over Darwin's idea of the survival of the "fittest" individual, for it is now DNA, not the individual, that is "fit." According to this view, an individual organism is only a vehicle, part of an elaborate device that ensures the survival and reproduction of genes with the least possible biochemical alteration. Thus, an appropriate unit of analysis for understanding natural selection and a variety of behavior patterns is the gene. Any means by which a pool of genes, in a group of individuals, can be transmitted more effectively to the next generation will be adopted (Hamilton, 1964). Here, it is suggested, are the origins of maternal behavior, sterility in castes of worker ants, aggression, cooperation, and self-sacrificial altruism. All these phenomena are strategies by which genes can be more readily transmitted. Richard Dawkins (1976) captured this idea perfectly in the title of his book: *The Selfish Gene.*

Although several issues are involved in the controversy over sociobiology, many are the result of a confusion between ultimate and proximate levels of explanation. The diagram shown in Figure 1.2 may be informative. Disagreement and uncertainty occur when explanations move from proximal to more distal levels. Thus, some phenomenologists, situationists, and cognitivists, who focus attention on processes just prior to the behavior, mistrust the view that these processes themselves are partly determined by previous learning. Learning theorists, in turn, often do not readily accept the view that a person's previous learning history is partly a function of inherited traits. Often even behavioral geneticists ignore the broader context of the evolutionary history of the animal from which they are attempting to breed selected traits.

Controversy is less likely to ensue when explanations move from distal to proximal. Evolutionary biologists typically do not find the heritability of traits problematic, and most trait theorists accept that behavioral dispositions are modified by later learning. In addition, learning theorists believe that the products of early experience interact with subsequent situations to produce emotional arousal and cognitive processing, which in turn give rise to the person's phenomenology just prior to his or her behavior.

Proximal wariness of distal explanation may be due in part to concern about extreme reductionism, for example, that phenomenology is entirely reducible to learning, or that learning is only secondary to genetics. Unfortunately, an-

Figure 1.2: The Distal-Proximal Dimension and Levels of Explanation in Social Behavior



When explanations move from distal to proximal, controversy does not ensue, whereas the converse is not always true. Adapted from Rushton (1984, p. 3, Figure 1). Copyright 1984 by Plenum Press. Reprinted with permission.

other reason for dispute arises from lack of knowledge. Most researchers seem devoted to an exclusive orientation. It is rare for cognitive social learning theorists to know much about evolution or genetics; or for humanistic phenomenologists to understand psychometrics, or for trait theorists to pursue behaviorism. The psychoanalytic and radical behaviorist schisms even create their own journals and professional schools.

2

Character Traits

The belief in a core of human nature around which individuals and groups consistently differed was widely derogated during the 1960s and 1970s. Three main explanations have been advanced for why this occurred. First, the predictive power of trait theories was judged to be weak. Second, the interventionist power of social learning theory was affirmed to be strong. Third, the socially committed emphasized malleability to change an unjust society.

The main empirical reason given for rejecting the trait concept is that different indices of the same trait only correlate, on the average, 0.20 to 0.30, too low a figure to make the trait concept very useful. Major reviews of the literature by trait psychologist Philip E. Vernon (1964) and by social learning theorist Walter Mischel (1968) concluded that 0.30 was the representative correlation of consistency across situations. As Eysenck (1970) and many others have shown, this conclusion is incorrect.

The Altruistic Personality

The most important and largest study of the problem of generality versus specificity in behavior concerned altruism. This is the classic "Character Education Enquiry" carried out by Hartshorne and May in the 1920s and published in three books (Hartshorne & May, 1928; Hartshorne, May, & Maller, 1929; Hartshorne, May, & Shuttleworth, 1930). These investigators gave 11,000 elementary and high school students some 33 different behavioral tests of altruism (referred to as the "service" tests), self-control, and honesty in home, classroom, church, play, and athletic contexts. Concurrently, ratings of the children's reputations with teachers and classmates were obtained. Altogether, more than 170,000 observations were collected. Scores on the various tests were correlated to discover whether behavior is specific to situations or consistent across them.

This study is still regarded as a landmark that has not been surpassed by later work. It will be discussed in some detail because it is the largest examination of the question ever undertaken, it raises most of the major points of interest, and it has been seriously misinterpreted by many investigators. The various tests administered to the children are summarized in Table 2.1.

TABLE 2.1
Some of the Measures Used in the "Studies in the Nature of Character" Investigation

Tests	Nature and scoring of the task
Service tests	
Self-or-class test	Whether the student chose to enter a competition to benefit himself or herself or the class.
Money voting test	Whether the student voted to spend class money on himself or herself or charity.
Learning exercises	Whether the student learned material when performance increments led to money going to the Red Cross.
School-kit test	Number of items donated to charity from a pencil case given to a child.
Envelopes test	Number of jokes, pictures, etc., collected for sick children in an envelope provided.
Honesty tests	
Copying technique	Whether student cheated on a test by copying answers from the person next to him or her.
Duplicating technique	Whether student cheated on a test by altering answers after his or her paper had been duplicated without his or her knowledge.
Improbable achievement	Whether student cheated as indicated by an improbably high level of performance on a task.
Double testing technique	Whether students' scores on an unsupervised test (e.g., number of push-ups) decreased when a retest was supervised.
Stealing	Whether students stole money from a puzzle box.
Lying	Whether students admitted to having cheated on any of the tasks.
Self-control tests	
Story resistance tests	Time students persisted in trying to read the climax of an exciting story when words ran into each other.
Puzzle memory tests	Time spent persisting at difficult puzzles.
Candy test	The number of pieces of candy not eaten in a "resisting temptation" paradigm.
Tickle test	The ability to keep a "wooden face" while being tickled by a feather.
Bad odor test	The ability to keep a "wooden face" while having a bad odor placed under the nose.
Bad taste test	The ability to keep a "wooden face" while testing unrefined cod liver oil.
Knowledge of moral rules	
Cause-effect test	Agreement with items such as "Good marks are chiefly a matter of luck."
Recognition test	Agreement with items such as "Copying composition out of a book but changing some of the words" constituted cheating.
Social-ethical vocabulary	Picking the best definition of words denoting moral virtue (e.g., bravery, malice).
Foresight test	Students wrote out consequences for transgressions such as "John accidentally broke a street lamp with a snowball".
Probability test	Students ranked the probability of various outcomes for such behaviors as "John started across the street without looking both ways."
Reputational ratings	
Recording of helpful acts	For 6 months, teachers recorded helpful acts performed by students.
The "guess who" test	Children wrote names of classmates who fitted very short descriptions (e.g., Here is someone who is kind to younger children . . .).
Check list	Teachers rated each child on adjectives such as kind, considerate, and stingy.

Note. From Rushton, Brainerd & Pressley (1983, p. 22, Table 1). Copyright 1983 by the American Psychological Association. Reprinted with permission.

First, the results based on the measures of altruism showed that any one behavioral test of altruism correlated, on the average, only 0.20 with any other test. But when the five behavioral measures were aggregated into a battery, they correlated a much higher 0.61 with the measures of the child's altruistic reputation among his or her teachers and classmates. Furthermore, the teachers' and peers' perceptions of the students' altruism were in close agreement (r = 0.80). These latter results indicate a considerable degree of consistency in altruistic behavior. In this regard, Hartshorne et al. (1929:107) wrote:

> The correlation between the total service score and the total reputation scores is .61... Although this seems low, it should be borne in mind that the correlations between test scores and ratings for intelligence seldom run higher than .50.

Similar results were obtained for the measures of honesty and self-control. Any one behavioral test correlated, on average, only 0.20 with any other test. If, however, the measures were aggregated into batteries, then much higher relationships were found either with other combined behavioral measures, with teachers' ratings of the children, or with the children's moral knowledge scores. Often, these correlations were on the order of 0.50 to 0.60. For example, the battery of tests measuring cheating by copying correlated 0.52 with another battery of tests measuring other types of classroom cheating. Thus, depending on whether the focus is on the relationship between individual measures or on the relationship between averaged groups of behaviors, the notions of situational specificity and situational consistency are both supported. Which of these two conclusions is more accurate?

Hartshorne and colleagues focused on the small correlations of 0.20 and 0.30. Consequently, they argued (1928: 411) for a doctrine of specificity:

> Neither deceit nor its opposite, "honesty" are unified character traits, but rather specific functions of life situations. Most children will deceive in certain situations and not in others. Lying, cheating, and stealing as measured by the test situations used in these studies are only very loosely related.

Their conclusions and data have often been cited in the subsequent literature as supporting situational specificity. For example, Mischel's (1968) influential review argued for specificity on the ground that contexts are important and that people have different methods of dealing with different situations.

Unfortunately Hartshorne and May (1928-30), P. E. Vernon (1964), Mischel (1968), and many others, including me (Rushton, 1976), had seriously overinterpreted the results as implying that there was not enough cross-situational consistency to make the concept of traits very useful. This, however, turned out to be wrong. By focusing on correlations of 0.20 and 0.30 between any two measures, a misleading impression is created. A more accurate picture is obtained by examining the predictability achieved from a number of measures. This is because the randomness in any one measure (error and specificity variance) is averaged out over several measures, leaving a clearer view of what a person's true behavior is like. Correlations of 0.50 and 0.60 based on aggregated measures support the view that there is cross-situational consistency in altruistic and honest behavior.

Further evidence for this conclusion is found in Hartshorne and May's data. Examination of the relationships between the battery of altruism tests and batteries concerned with honesty, self-control, persistence, and moral knowledge suggested a factor of general moral character (see, e.g., Hartshorne et al., 1930: 230, Table 32). Maller (1934) was one of the first to note this. Using Spearman's tetrad difference technique, Maller isolated a common factor in the intercorrelations of the character tests of honesty, altruism, self-control, and persistence. Subsequently, Burton (1963) reanalyzed the Hartshorne and May data and found a general factor that accounted for 35-40 percent of common variance.

As Eysenck (1970), among others, has repeatedly pointed out, failures to take account of the necessity to average across a number of exemplars in order to see consistency led to the widespread and erroneous view that moral behavior is almost completely situation specific. This, in turn, led students of moral development to neglect research aimed at discovering the origins of general moral "traits". The fact that, judging from the aggregated correlational data, moral traits do exist, and, moreover, appear to develop early in life, poses a considerable challenge to developmental research.

The Principle of Aggregation

The argument presented for the existence of moral traits applies, of course, to other personality traits and the ways of assessing them. Focusing on correlations between just two items or situations can lead to major errors of interpretation. The more accurate assessment is to use a *principle of aggregation* and average across a number of measures. As mentioned, this is because the randomness in any one measure (error and specificity variance) is averaged out over several measures, leaving a clearer view of underlying relationships.

Perhaps the most familiar illustration of the effect of aggregation is the rule in educational and personality testing that the reliability of an instrument increases as the number of items increases. For example, single items on the Stanford-Binet IQ test only correlate about 0.15; subtests based on four or five items correlate around 0.30 or 0.40, but the aggregated battery of items that make up the performance subscale correlates around 0.80 with the battery of items that make up the verbal subscale.

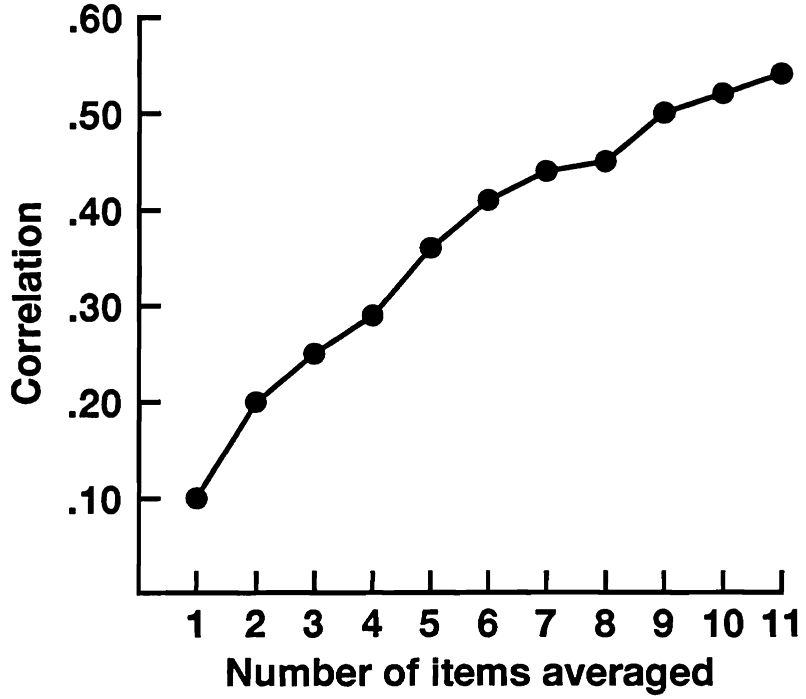
One of the earliest illustrations of the principle of aggregation is the so-called "personal equation" in astronomy. In 1795, Maskelyne, the head of the Greenwich observatory, discharged an otherwise capable assistant because he recorded transits of stars across a vertical hairline in the telescope about half a second "too late." Maskelyne estimated the error of his assistant's measurements by comparing them to his own observations, which he naturally assumed to be correct. An account of these facts in a Greenwich observatory report was noted by a German astronomer, Bessel, some decades later, and led him to test astronomers against each other, with the result that no two agreed precisely on the time of a transit. Clearly, the only sensible estimate of a star's transit across the hairline was some average of many observations, not one.

Researchers in the psychometric tradition had long made the argument for aggregation. An early paper by Spearman (1910:273-74) on the proper use of correlation coefficients contains the following observations:

> It is the superposed accident (measurement error) that the present paper attempts to eliminate, herein following the custom of all sciences, one that appears to be an indispensable preliminary to getting at nature's laws. This elimination of the accidents is quite analogous to, and serves just the same purpose as, the ordinary process of "taking means" or "smoothing curves."
>
> The method is as follows. Let each individual be measured several times with regard to any characteristic to be compared with another.

The principle of aggregation is applied in Figure 2.1 to an aggression questionnaire where correlations of stability increase as a function of the number

Figure 2.1: Relation Between Number of Aggressive Items and Predictability of Other Aggressive Occasions



As the number of items being correlated increases from 1 to 7 to 11, the corresponding predictabilities increase from 0.10 to 0.44 to 0.54. From Rushton & Erdle (1987, p. 88, Figure 1). Copyright 1987 by the British Psychological Society. Reprinted with permission.

of items involved. Clearly, if the goal is to predict aggressiveness, aggregated estimates provide increased utility. Similar results occur with group differences. The percentage of variance accounted for by sex differences in the aggression data increase from 1 to 3 to 8 percent as the number of questionnaire items increase from 1 to 5 to 23. Parallel results occur when age and socioeconomic status differences are examined. When age, sex, and SES are combined, the Multiple R increases from an average of 0.18 for single items to 0.39 for the 23 items.

Behavioral Consistency

Unfortunately, Spearman's advice has rarely been taken in some areas of psychology. Psychologists interested in behavioral development have often assessed constructs using only a single measure. It is not surprising, therefore, that relationships involving these constructs have been weak. When multiple measures of each construct are used, relationships become more substantial.

In a series of studies that helped return personality research from a social learning to a trait perspective, Epstein (1977, 1979, 1980) had students complete daily check lists of their feelings and the situations they found themselves in. He found that across several kinds of data the stability coefficients increased from an average of 0.27 for day to day consistency to an average of 0.73 for week to week consistency. Figure 2.2 shows how the stability coefficients increase over time in the aggregated categories.

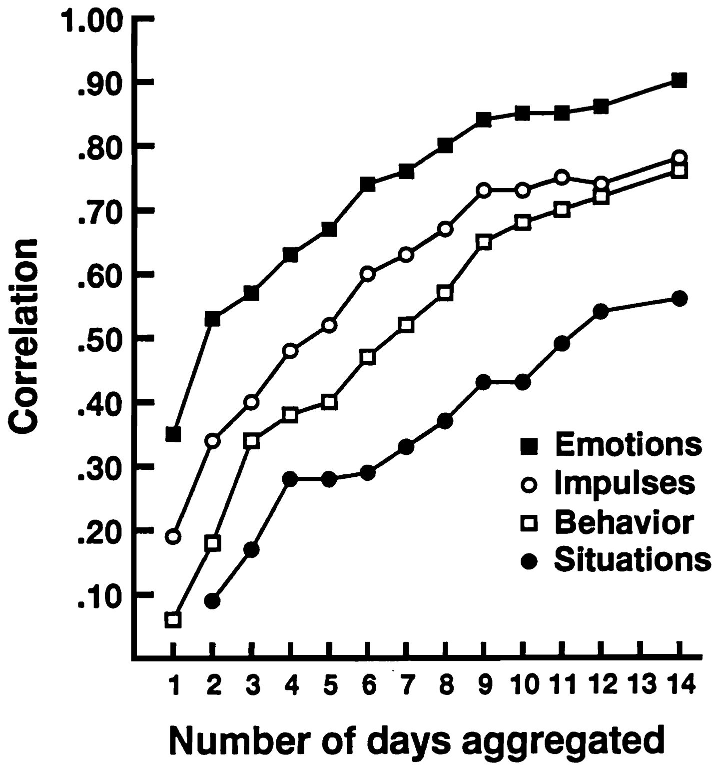
Thus, daily fluctuations of happy or unhappy moods cohered into typical mood dispositions when measured over longer time periods. Similarly for social contacts, recorded heart rates, and reported somatic and psychosomatic symptoms, the aggregated correlations were over 0.90 for a 14-day aggregate. Also, the increased stability of "situations" with time suggests that the circumstances people find themselves in reflect the choices they have made as a function of their personality.

The decades-long debate over the consistency of personality and the existence of character traits has now been settled. Perhaps the debate should never have occurred. But hindsight is nearly always perfect and many notable researchers had been sufficiently misled by the low correlations across single items of behavior to doubt the value of the trait construct (Rushton, Brainerd, & Pressley, 1983; Epstein & O'Brien, 1985).

Judges' Ratings

One traditionally important source of data has been the judgments and ratings of people made by their teachers and peers. In recent years, judges' ratings have been much maligned on the ground that they are little more than "erroneous constructions of the perceiver." This pervasive view had led to a disenchantment with the use of ratings. The main empirical reason that is cited

Figure 2.2: Stability of Individual Differences as a Function of Number of Days of Measurement



As more measurement days are aggregated people become more predictable. Adapted from Epstein (1977, p. 88, Figure 1).

for rejecting rating methods is that judges' ratings only correlate, on the average, 0.20 to 0.30. However, it is questionable that correlations between two judges' ratings are stable and representative. The validity of judgments increases as the number of judges becomes larger.

Galton (1908) provided an early demonstration from a cattle exhibition where 800 visitors judged the weight of an ox. He found that the individual estimates were distributed in such a way that 50 percent fell between plus or minus three percent of the middlemost value that was itself within one percent of the real value. Galton likened the results to the votes given in a democracy where, with the reservation that the voters be versed in the issues, the *vox populi* was correct. Shortly thereafter, K. Gordon (1924) had subjects order a series of objects by weight. When the number of subjects making the judgment increased from 1 to 5 to 50, the corresponding validities increased from 0.41 to 0.68 to 0.94.

In everyday life, similar averaging techniques are used in subjective decision-making situations. For example, the reliability of decisions about to whom prizes should be awarded for cooking, handicrafts, wine making, physical beauty, and so on is enhanced by averaging the decisions of several judges. This procedure is also routine in forms of athletic competition where performance criteria are partially subjective (e.g., diving, gymnastics). When gradation in qualities to be discriminated are fine, the only fair procedure is to obtain many judgments.

Longitudinal Stability

The question of cross-situational consistency becomes a question about longitudinal consistency when the time dimension is introduced. To what extent, over both time and situation, do a person's behaviors stem from enduring traits of character? When studies measure individual differences by aggregating over many different assessments, longitudinal stability is usually found. But when single measurements or other less reliable techniques are used, longitudinal stability is less marked.

Intelligence is the trait with the strongest stability over time. The ordering of an individual relative to his or her age cohort over the teenage and adult years shows typical correlations of 0.62 to 0.94 over 7 to 40 years (Brody, 1992). The trend is for the correlations to decline as the period of time between administrations of the test increases. But the correlations can be increased by further aggregation. For example, the combined score from tests administered at ages 10, 11, and 12 correlate 0.96 with a combined score from tests administered at ages 17 and 18 (Pinneau, 1961). This latter finding suggests that there was initially no change at all in an individual's score relative to his or her cohorts over the high school years.

Intelligence in infancy, however, is either slightly less stable or somewhat less easy to measure. The correlations between a composite of tests taken from 12 to 24 months predicts the composite at ages 17 and 18 around 0.50 (Pinneau, 1961). Newer techniques based on infant habituation and recognition memory (the infant's response to a novel or familiar stimulus) made in the first year of life predict later IQ assessed between 1 and 8 years of age with a weighted (for sample size) average of between 0.36 and 0.45 (McCall & Carriger, 1993).

The stability of personality has been demonstrated over several 30-year longitudinal studies. To summarize these, Costa and McCrae (1994:21) quote William James (1890/1981), saying that once adulthood has been reached, personality is "set like plaster." At younger ages, personality stability was demonstrated by Jack Block (1971, 1981) in work where the principle of aggregation was strictly adhered to. For about 170 individuals data were first obtained in the 1930s when the subjects were in their early teens. Further data were gathered when the subjects were in their late teens, in their mid-30s, and in their mid-40s. The archival data so generated were enormously wide-ranging and often not in a form permitting of direct quantification. Block systematized the data by employing clinical psychologists to study individual dossiers and to rate the subject's personality using the Q-sort procedure—a set of descriptive statements such as "is anxious," which can be sorted into piles that indicate how representative the statement is of the subject. To ensure independence, the materials for each subject were carefully segregated by age level, and no psychologist rated the materials for the same subject at more than one time period. The assessments by the different raters (usually three for each dossier) were found to agree with one another to a significant degree, and they were averaged to form an overall description of the subject at that age.

Block (1971, 1981) found personality stability across the ages tested. Even the simple correlations between Q-sort items over the 30 years between adolescence and the mid-40s provided evidence for stability. Correlations indicating stability were, for example, for the male sample: "genuinely values intellectual and cognitive matters," 0.58; "is self-defeating," 0.46; and "has fluctuating moods," 0.40; for the female sample, "is an interesting, arresting person," 0.44; "aesthetically reactive," 0.41; and "is cheerful," 0.36. When the whole range of variables for each individual was correlated over 30 years, the mean correlation was 0.31. When typologies were created, the relationships became even more substantial.

Using self-reports instead of judgments made by others, Conley (1984) analyzed test-retest data from 10 to 40 years for major dimensions of personality such as extraversion, neuroticism, and impulsivity. The correlations in different studies ranged from 0.26 to 0.84 for periods extending from 10 to 40 years, with an average of about 0.45 for the 40-year period. Overall the personality traits were only slightly less consistent over time than were measures of intelligence (0.67, in this study).

Longitudinal stability has been cross-validated using different procedures. Thus, one method is used to assess personality at Time 1 (e.g., ratings made by others) and a quite different method at Time 2 (e.g., behavioral observations). Olweus (1979), for example, reported correlations of 0.81 over a 1-year time period between teacher ratings of the aggressive behavior of children and frequency count observations of the actual aggressive behavior. Conley

(1985) reported correlations of about 0.35 between ratings made by a person's acquaintances as they were about to get married and self-reports made some 20 years later.

In a 22-year study of the development of aggression, Eron (1987) found that children rated as aggressive by their peers when they were 8 years old were rated as aggressive by a different set of peers 10 years later and were 3 times more likely to have been entered on police record by the time they were 19 than those not so rated. By age 30, these children were more likely to have engaged in a syndrome of antisocial behavior including criminal convictions, traffic violations, child and spouse abuse, and physical aggressiveness outside the family. Moreover, the stability of aggression was found to exist across three generations, from grandparents to children to grandchildren. The 22-year stability of aggressive behavior is 0.50 for men and 0.35 for women.

Also in the 22-year data, early ratings of prosocial behavior were positively related to later prosocial behavior and negatively related to later antisocial behavior. Children rated as concerned about interpersonal relations at age 8 had higher occupational and educational attainment as well as low aggression, social success, and good mental health, whereas aggression at age 8 predicted social failure, psychopathology, aggression, and low educational and occupational success. In all of these analyses, social class was held constant. Eron's (1987) data suggested that aggression and prosocial behavior are at two ends of a continuum (see Figure 2.3).

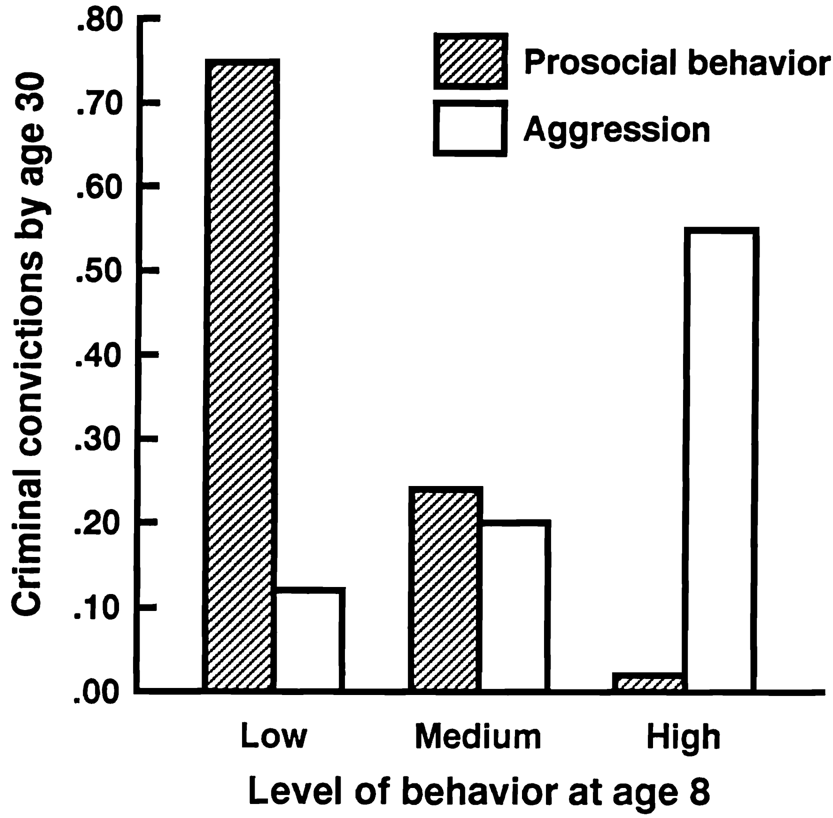
The general conclusion is that once people reach the age of 30 there is little change in the major dimensions of personality. McCrae and Costa (1990; Costa & McCrae, 1992) reviewed six longitudinal studies published between 1978 and 1992, including two of their own. The six had quite different samples and rationales but came to the same conclusions. Basic tendencies typically stabilized somewhere between 21 and 30. Retest measures for both self-reports and ratings made by others are typically about 0.70. Moreover, anything these dimensions affect stabilizes as well, such as self-concept, skills, interests, and coping strategies.

Predicting Behavior

Although a great deal of effort has gone into refining paper and pencil and other techniques for measuring attitudes, personality, and intelligence, relatively little attention has been given to the adequacy of measurements on the behavioral end of the relationship. Whereas the person end of the person-behavior relationship has often been measured by multi-item scales, the behavior to be predicted has often comprised a single act.

Fishbein and Ajzen (1974) proposed that multiple-act criteria be used on the behavioral side. Using a variety of attitude scales to measure religious attitudes and a multiple-item religious behavior scale, they found that atti-

Figure 2.3: Mean Number of Criminal Convictions by Age 30 as a Function of Aggressive and Altruistic Behavior at Age 8



Both boys and girls rated as aggressive by their peers at 8 years old are three times more likely to have a police record by age 30 than those not so rated. Alternatively, those rated as high in prosocial behavior at age 8 grow up to be less criminal than those rated as low in prosocial behavior. From Eron (1987, p. 440, Figure 2). Copyright 1987 by the American Psychological Association. Reprinted with permission.

tudes were related to multiple-act criteria but had no consistent relationship to single-act criteria. Whereas the various attitude scales had a mean correlation with single behaviors ranging from 0.14 to 0.19, their correlations with aggregated behavioral measures ranged from 0.70 to 0.90.

In a similar paper to Fishbein and Ajzen's, Jaccard (1974) carried out an investigation to determine whether the dominance scales of the California Psychological Inventory and the Personality Research Form would predict self-reported dominance behaviors better in the aggregate than they would at the single-item level. The results were in accord with the aggregation expectations. Whereas both personality scales had a mean correlation of 0.20 with individual behaviors, the aggregated correlations were 0.58 and 0.64.

Comparable observations were made by Eaton (1983) who assessed activity level in three- and four-year olds using single versus multiple actometers attached to the children's wrists as the criterion and teachers' and parents' ratings of the children's activity level as the predictors. The ratings predicted activity scores from single actometers relatively weakly (0.33) while predicting those aggregated across multiple actometers comparatively well (0.69).

One Problem with Experimental Studies

Failures to aggregate dependent variables in experimental situations may produce conclusions about the relative modifiability of behavior that may be incorrect. For example, with respect to social development, it is considered well established that observational learning from demonstrators has powerful effects on social behavior (Bandura, 1969, 1986). These findings have prompted governmental concern about possible inadvertent learning from television. Concerning intellectual development, it is equally well known that intervention programs designed to boost children's intelligence, some of them employing observational learning, have achieved only modest success (Brody, 1992; Locurto, 1991).

The apparent difference in the relative malleability of social and intellectual development has been explained in various ways. One leading interpretation is that intellectual development is controlled by variables that are "structural" and, therefore, minimally susceptible to learning, whereas social development is controlled by variables that are "motivational" and, therefore, more susceptible to learning. An analysis of the dependent variables used in the two types of studies, however, suggests an interpretation based on the aggregation principle.

In observational learning studies, a single dependent variable is typically used to measure the behavior; for example, the number of punches delivered to a Bo-Bo doll in the case of aggression (Bandura, 1969) or the number of tokens donated to a charity in the case of altruism (Rushton, 1980). In intellectual training studies, however, multiple-item dependent variables such as standardized intelligence tests are typically used. Throughout this discussion it has been stressed that the low reliability of nonaggregated measures can mask strong underlying relationships between variables. In the case of learning studies, it can have essentially the opposite effect. It is always easier to produce a change in some trait as a consequence of learning when a single, less stable measure of the trait is taken than when more stable, multiple measures are taken. This fact may explain why social learning studies of altruism have generally been more successful than training studies of intellectual development.

Mental Ability Tests

Intelligence has been the most researched individual difference variable since Galton (1869). In 1879, in Leipzig, Wilhelm Wundt (1832–1920) established the first psychology laboratory. He used many of the same measures as Galton although he was interested in the structure of the mind common to everybody. James McKeen Cattell (1860–1944), an American studying with Wundt, wanted to examine individual differences but was unable to interest Wundt. So, after receiving his doctorate, Cattell moved to London for a postdoctoral period with Galton and went on to become the world's first professor of psychology (at the University of Pennsylvania) and then head of the psychology department at Columbia University. He was one of the founders of the American Psychological Association and it was he who, in 1890, coined the term *mental test* to describe the series of sensory and reaction-time tasks that were burgeoning during this time.

The main outcome of the Galton-Cattell effort was negative. A study by one of Cattell's own graduate students reported that the various mental tests failed to correlate either with each other or with academic grades (Wissler, 1901). Even though several flaws can be noted about this study, including a failure to aggregate (Jensen, 1980a), it signaled the end of the Galtonian approach for several decades. Instead, the measurement of intelligence went off in a very different direction.

In 1904 the French Ministry of Education wanted to identify slow learners who needed help so they commissioned Alfred Binet (1857–1911) and Théophile Simon (1873–1961) to construct a test that would screen low-achieving students. They reasoned that a good test should include increasingly difficult items that older children could answer more easily than younger children. The test should tap higher mental functions, such as comprehension and imagination.

In 1908, Binet produced a second version of his scale with an increased number of test items. It was found that, on average, a three-year-old child can point to nose, eyes, or mouth; can repeat sentences of six syllables; and can give his family name. At the age of four he knows his sex, he can name certain objects shown to him, such as a key, knife, or penny, and can indicate which of two lines, 5 cm and 6 cm in length respectively, is the longer. At the age of five, the child can indicate the heavier of two cubes, one weighing 3 g and the other 12 g; he can copy a square, using pen and ink; and he can count four pennies. At the age of six he knows right from left as shown by indicating right hand and left ear; he can repeat sentences of 16 syllables; and he knows morning from afternoon. At the age of seven he knows the number of fingers on each hand, or both hands, without counting them; he can copy a diamond, using pen and ink; and he can describe pictures as seen.

The test worked. It identified the retarded and correlated with expected indicators of intelligence such as school marks, teacher and peer evaluations, and ease of trainability; the test was soon introduced to America. In 1910, Henry H. Goddard found the scales had predictive accuracy at his Vineland, New Jersey school for feeble-minded children. In 1916, Louis Terman and his associates at Stanford University adapted the test for American schoolchildren and established norms for average performance. The original Binet-Simon test thus became the Stanford-Binet test. The 1916 version was modified in 1937, 1960, 1972, and 1986, and the norms for average performance were updated. It became a standard by which all later intelligence tests have been judged.

In 1917, the United States entered the First World War and Robert Yerkes of Harvard, then president of the American Psychological Association, organized psychologists to help the war effort. America's leading psychometricians, including Henry Goddard and Louis Terman, began to develop group-administered tests to help select recruits. Two group tests were devised, Alpha and Beta. The Alpha was a verbal test designed for literate people, containing questions in such areas as arithmetical reasoning, number series completion, and analogies—categories similar to those found in the Stanford-Binet and many present-day intelligence tests. The Beta, intended for use with illiterate recruits, contained similar questions, but in purely pictorial form. Altogether nearly 2 million army recruits took one or the other of these tests.

Comparisons based on these data were published as an official report amounting to 890 pages (Yerkes, 1921) as well as a book (Yoakum & Yerkes, 1920). For the comparison of blacks and whites, the former included all who showed any physical evidence of Negroid ancestry, that is, all hybrids. Also, all were born in the United States, with English their native language. Of those scoring sufficiently high to be allowed into the army, a disproportionate number of blacks scored C- to D-, low average to inferior, whereas a disproportionate number of whites scored C+ to A+, average to superior.

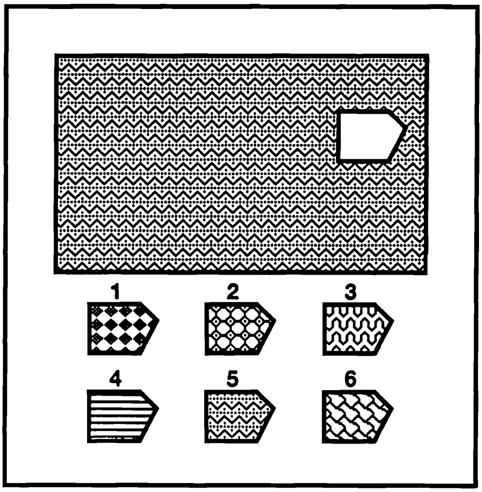
Marked differences occurred between different states, with the largely urbanized northern states producing higher scores than the more rural south, a difference attributed to the better educational facilities in the north. Like whites, blacks also did better in the north. A special comparison was made of the races in five northern states versus four southern states. Although the northern blacks still did not score as high as the whites, their scores were distributed in a more similar pattern.

The results of this undertaking set off the first public controversy about intelligence testing. Overall, the average mental age of all army recruits was 13, meaning that the average 13-year-old could pass the tests, but not the average 12-year-old. The data also revealed that immigrant groups, on the average, scored lower than native-born Americans, and that immigrants from southern and eastern Europe scored lower than those from northern and western Europe. These data were made much of by Carl Brigham (1923), a professor of psychology at Princeton who, in his book *A Study of American Intelligence,* advocated immigration controls to keep the American gene pool from deteriorating. Yerkes wrote the foreword to Brigham's book.

The controversy over the test results began the modern version of the nature-nurture debate. Clearly test scores were not 100 percent determined by innate ability; the question became whether environmental factors alone could account for the pattern of distributions. On the environmental side, biases and problems inherent in the tests began to be identified. For example, some items

Figure 2.4: Typical Intelligence Test Items

1.	*Digit span forward.*	Repeat a series of three to nine digits, after hearing them spoken at the rate of one digit per second.
2.	*Digit span backward.*	Repeat three to nine digits backward, that is, in reverse order of presentation.
3.	*Picture arrangement.*	Arrange a haphazard order of cartoon pictures in a row to make a logical story.
4.	*Verbal analogies.*	Complete the analogy. Cat is to kitten as dog is to: beast bark puppy chase
5.	*Logical reasoning.*	In a race the dog runs faster than the horse, which is slower than the cow, and the pig runs faster than the dog. Which one finishes last?
6.	*Number series.*	Write the number that most logically continues the series. 35, 28, 21, 14, ____
7.	*Figure matrices.*	Indicate which alternative most logically fills the blank space.



depended on highly specific cultural knowledge, a flaw that was particularly disadvantageous to recent immigrants, and those outside the educational mainstream. Moreover, testing conditions had not been standardized; for some, the tests were administered in cramped and noisy conditions. On the genetic side, adoption and twin studies for systematically examining the relative roles of heredity and environment in intelligence were begun.

Dozens of publishing firms sprang up to service industrial and clinical needs as well as educational ones. Measures of specific aptitudes and personality as well as general intelligence were produced. In 1926 the Scholastic Aptitude Test (SAT) came into being for college admissions. In 1939 David Wechsler published what was to become the Wechsler Adult Intelligence Scale (WAIS), the most widely used individually administered intelligence test for adults, and in 1949 he published the Wechsler Intelligence Scale for Children (WISC). The professionalized testing industry generated sophisticated new techniques for examining the reliability and validity of tests. The introduction of machine-scoring techniques greatly facilitated research and development.

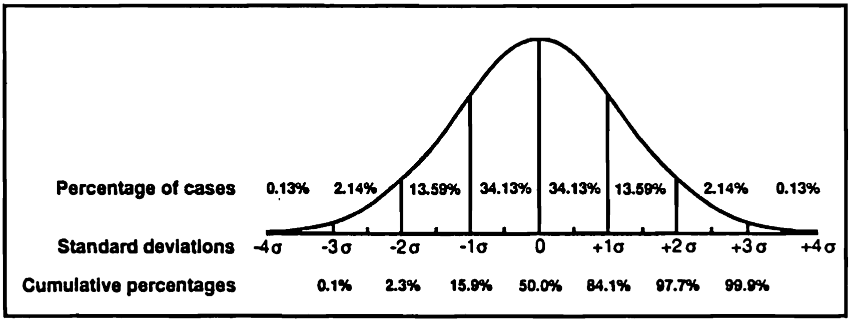
Diverse items have become available and a large technical literature has grown on the characteristics of good items (Jensen, 1980a). They can be administered individually or given to many people simultaneously. On group tests, to make scoring easier, the subject is asked to select the correct answer from the several alternatives provided. Figure 2.4 illustrates typical item types from both individually and group administered tests (see Jensen, 1980a, for a full range). Ideally, items should not take too long to solve as there is only a limited time for testing and many must be given. Also, items must be so devised as to have a single correct answer. Preferably, items should not involve specific knowledge such as "How far is it between San Francisco and Los Angeles?" so much as problem solving where all the elements are equally known or equally unknown to the subjects. One exception is vocabulary where the subject may be asked to explain the meaning of words going from very easy and familiar words like *summer* and *strange* to more rare and difficult words like *adumbrate* and *cacophony*.

One reason for thinking that items such as those in Figure 2.4 tap intelligence is the observation that children grow more intelligent in an absolute sense as they grow older. The average ten-year-old is brighter than the average four-year-old, and can pass more test items. Thus, mental age is an index of mental ability, and in relation to chronological age gives some indication of the degree to which a child is advanced or retarded. This was the original concept on which mental testing was based. Indeed the equation for IQ, or the intelligence quotient is:

$$\text{IQ} = \frac{\text{MA}}{\text{CA}} \times 100$$

where MA stands for mental age and CA stands for chronological age and the 100 is introduced to get rid of the decimal point.

Figure 2.5: The Normal Distribution



Areas (in percentages) under the normal curve and the baseline of the curve are scaled to standard deviations and cumulative percentages

The equation for IQ is no longer used. Because test scores for large numbers of representative people are more or less normally distributed (Figure 2.5) scores from almost any system can be converted into a standard score. For convenience the average IQ is set at 100 with a standard deviation of of 15.

Spearman's *g*

Spearman (1927) discovered that a general factor of mental ability (symbolized *g*) exists in any and every large collection of diverse tests of cognitive performance, regardless of its specific information content, sensory modality, or form of response. He posited that the *g* factor reflects whatever it is that causes individual differences in performance.

The degree to which various tests are correlated with *g*, or are "*g*-loaded," can be determined by factor analysis, a statistical procedure for grouping items. Differences in *g* loading, however, are not predictable from superficial features of the item. Other than performing a factor analysis, the best clue to an item's *g* loading is the degree of its cognitive demand. For example, backward digit span (Item 2, Figure 2.3) has a higher *g* loading than forward digit span (Item 1). Other highly *g*-loaded tests are verbal analogies (Item 4), series completions (Item 6), and figure matrices (Item 7). Several of these last items (#7), involving two-dimensional perceptual analogies with both horizontal and vertical transformations, were combined into a *g*-saturated test, the Raven's Progressive Matrices by Lionel Penrose, the British geneticist, and John Raven, a British psychologist, and student of Spearman (Penrose & Raven, 1936). It has become the best known and most researched of all "culture-reduced" tests (Raven & Court, 1989).

Most conventional tests of mental ability are highly *g*-loaded although they usually measure some admixture of other factors in addition to *g*, such as verbal, spatial, and memory abilities, as well as acquired information of a scholastic nature (Brody, 1992). Test scores with the *g* factor statistically removed have virtually no predictive power for scholastic performance. Hence, it is the *g* factor that is the "active ingredient." The predictive validity of *g* applies also to performance in nearly all types of jobs. Occupations differ in their complexity and *g* demands as much as do mental tests, so as the complexity of a job increases, the better cognitive ability predicts performance on it (e.g., managers and professions 0.42 to 0.87, sales clerks and vehicle operators 0.27 to 0.37; see Hunter, 1986, Table 1; Hunter & Hunter, 1984).

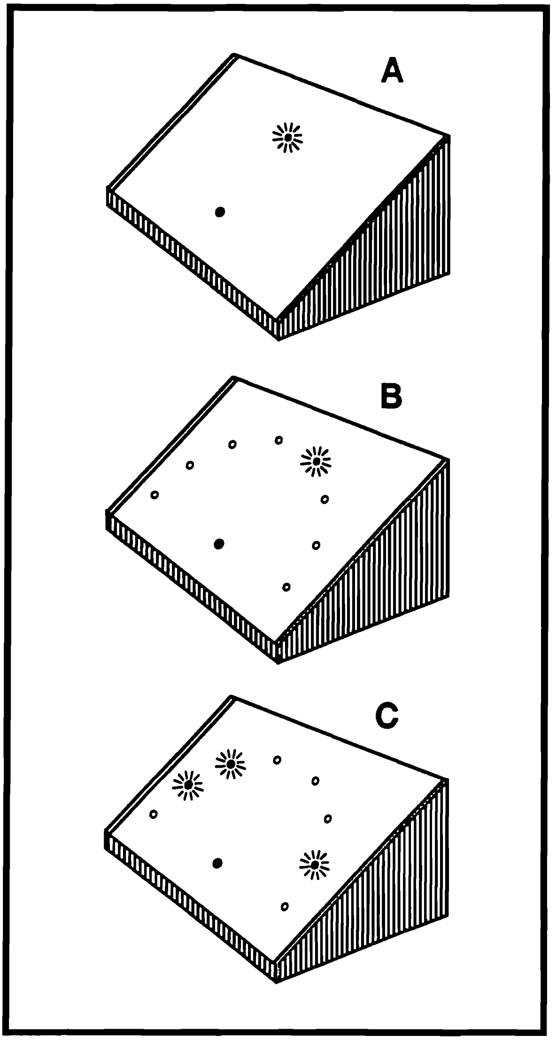
Gottfredson (1986, 1987) summarized meta-analyses of decades of personnel selection research and showed the following: (a) intelligence tests predict performance in training and on the job in all kinds of work; (b) job performance is more correlated with test performance in higher-level, more complex jobs than in lower-level ones; (c) the relation of tested intelligence to job performance is linear, meaning that there is no threshold above which higher levels of intelligence are not associated with higher mean levels of job performance; (d) it is almost entirely the *g* factor in psychometric tests that accounts for their validity for predicting job performance; (e) the predictive validity of intelligence tests remains largely the same but that of experience fades among workers with higher mean levels of experience; (f) intelligence tests predict job performance even after controlling for differences in job knowledge; and (g) intelligence tests predict job performance equally well for blacks and whites, whether performance is measured objectively or subjectively.

Decision-Making Speed

Convincing proof for the pervasiveness of *g* comes from recent work on brain efficiency in decision making. The Galton-Cattell type of tasks found lacking at the beginning of the century are again in the forefront. The tasks are simple, calling on very elementary cognitive processes in which there is little or no intellectual content. All subjects can easily perform the tasks, the only source of reliable individual differences being the speed (measured in milliseconds) with which the subject responds. These have been shown to be highly correlated with intelligence as measured by traditional IQ tests (Brody 1992).

One type of reaction time apparatus, described by Jensen (1993), is shown in Figure 2.6. Covers are placed on the console, exposing either one, two, four, or eight of the light button combinations. In the "simple reaction time" task (shown in A), a single light is exposed and when it comes on the subject moves his hand to switch it off. This response normally takes around half a second. In the more complicated "choice reaction time" task (shown in B), all the light buttons are exposed and when one of them comes on, the subject has

Figure 2.6: Subject's Response Console for Decision Time Studies



Console A is for simple reaction time, B is for choice reaction time, and C is for odd-man-out reaction time. The black dot in the lower center of each panel is the home button. The open circles, 15 cm from the home button, are green under-lighted push buttons. In conditions A and B, only one green push button lights up on each trial; in C, three push buttons light up simultaneously on each trial, with unequal distances between them, the remotest one from the other two being the odd-man-out, which the subject must touch. From Jensen (1993, p. 53, Figure 1). Copyright 1993 by Ablex Publishing Corporation. Reprinted with permission.

to "choose" which one to turn off, and the reaction time takes a little longer. In the "oddman out" task (shown in C), a still more complex version, three lights come on of which two are close together and one stands apart. The subject has to judge which is the light that stands apart and switch it off. It is more difficult than the simpler reaction time tasks and typically takes about twice as long, but still averages less than a second. Reaction time is the time taken to get off the home button after one of the lights goes on.

Another speed of information processing task that is correlated with *g* is known as "inspection time." It is the time that a visual or auditory stimulus must be displayed before a person is able to make a simple discrimination, such as which of two lines is the longer, when one line is double the length of the other. Inspection time is typically less than one-tenth of a second. Nonetheless it correlates with the *g* factor extracted from ability tests between 0.30 and 0.50, for a very wide range of ages, from childhood to old age, with longer intervals being required by people with lower levels of ability (Kranzler & Jensen, 1989).

It is interesting to ask why these reaction time and elementary cognitive tasks correlate with measures of intelligence when the earlier Galton-Cattell measures did not? One answer includes the principle of aggregation. In the reaction time task shown in Figure 2.6, 15 trials are given at each level of 1, 2, 4, or 8 light buttons of complexity. Moreover the multi-trial information-processing tasks are themselves often combined in aggregations, thus increasing still further the correlations with multi-item IQ tests. In Wissler's (1901) negative review, simple reaction times had been correlated with academic grades (not IQ tests) and then in a restricted range of subjects.

Intelligence and Brain Size

A threefold increase in the relative size of the hominid brain has occurred in the last 4 million years. It is reasonable to hypothesize that bigger brains evolved to increase intelligence. Passingham (1982) reported evidence in favor of this hypothesis using a visual discrimination learning task to measure the speed with which children and other mammals abstracted such rules as "pick the same object each time to get food." More intelligent children, assessed by standardized IQ tests, learn faster than those less intelligent, and mammals with larger brains learn faster than those with smaller brains (i.e. chimp > rhesus monkey > spider monkey > squirrel monkey > marmoset > cat > gerbil > rat = squirrel).

Georges Cuvier (1769–1832) may have been the first to formally consider that brain size proportional to body size was the determinant of intelligence across species. Galton (1888b) was the first to quantify the relationship among humans. He reported that students at Cambridge University who earned top grades averaged a 2 1/2 to 5 percent larger head volume (length x width x height of head) than others. Soon after, K. Pearson (1906) re-examined the relationship, using the newly developed correlation coefficient, and found a small positive correlation. This has remained the general observation with correlations typically ranging from 0.10 to 0.30 (Jensen & Sinha, 1993; Wickett, Vernon & Lee, 1994; Van Valen, 1974).

Table 2.2 summarizes the results from 32 studies of the relation between head size and mental ability in normal samples. Clinical samples have been excluded. The most representative or average correlation has been reported from those studies providing multiple correlations (e.g. by age and sex or by adjusting for body size). Corrections for body size have typically not been included because many studies did not report this statistic although occasionally they have been used to control for age effects. Double entries have been eliminated, particularly those emanating from the Collaborative Perinatal Project (Broman, Nichols, Shaughnessy, & Kennedy, 1987). Also not included in Table 2.2 are typological studies showing that mentally defective children have smaller heads than children of normal intelligence (Broman et al., 1987), while gifted and superior children have larger ones (Fisch, Bilek, Horrobin, & Chang, 1976; Terman, 1926/1959: 152).

The 32 studies are categorized into 3 sections. Section A sets out the results of 13 studies that took external head measurements from a total of 43,166 children and adolescents and correlated these with mental ability estimated by ratings, school grades, and standardized tests. The correlations ranged from 0.11 to 0.35 with an unweighted mean of 0.23 (when weighted by sample size, 0.21). The relationship was found in boys and girls, in whites from Australia, Europe, and the United States, in blacks from the United States, and in Amerindians from Guatemala.

Section B sets out the results from 15 studies using external head measurements from a total of 6,437 adults with intelligence estimated by ratings, university grades, and standardized tests. The correlations ranged from 0.03 to 0.39 with an unweighted mean of 0.15 (when weighted by sample size, also 0.15). The samples included both sexes, whites from Europe, Canada, and the United States, and Amerindians and Orientals from North America.

The correlations in Section A and B are low. This is partly because measuring head size by tape and ignoring skull thickness is not a perfect measure of brain size and also because intelligence tests are not perfect measures of mental ability. It is possible to correct the correlations for some of these unreliabilities. In his review Van Valen (1974) estimated that the true correlation between head size and intelligence is about 0.30. This was confirmed by R. Lynn (1990a) in three studies of 9- and 10-year-olds in schools in Northern Ireland and England measuring head perimeter by tape and intelligence by standardized tests. Before correction for attenuation due to measurement error, R. Lynn's correlations were between 0.18 and 0.26; after correction they ranged from 0.21 to 0.30.

TABLE 2.2
Intelligence and Brain Size

Source	Sample	Head measurement	Test	r
A. Children and adolescents by external head measurements				
Pearson (1906)	4,386 British children (2,198 boys, 2,188 girls) aged 3 to 20; standardized to age 12	Length	Teachers' estimate	.11
Murdock & Sullivan (1923)	595 American children aged 6 to 17; standardized by age and sex	Perimeter	IQ tests	.22
Estabrooks (1928)	251 American children of North European ancestry (102 boys, 149 girls) aged 6 years	Capacity	Binet	.19
Porteus (1937)	200 white Australian children	Perimeter	Porteus Maze	.20
Klein et al. (1972)	170 Guatemalan Indian children aged 3 to 6	Perimeter	Knowledge tests standardized with age-sex groups	.28
W. A. Weinberg et al. (1974)	334 white American boys aged 8 to 9 years	Perimeter	WISC	.35
Broman et al. (1987)	18, 907 black American boys and girls aged 7 years	Perimeter	WISC	.19
Broman et al. (1987)	17, 241 white American boys and girls aged 7 years	Perimeter	WISC	.24
R. Lynn (1990a)	310 Irish boys and girls aged 9 to 10	Perimeter	PMAT	.18
R. Lynn (1990a)	205 Irish children aged 9 years	Perimeter	Matrices	.26
R. Lynn (1990a)	91 English children aged 9 years	Perimeter	Matrices	.26
Osborne (1992)	224 white American children (106 boys, 118 girls) aged 13 to 17; controls for height and weight	Capacity	Basic	.29
Osborne (1992)	252 black American children (84 boys, 168 girls) aged 13 to 17; controls for height and weight	Capacity	Basic	.28
Summary of A	*Number of Studies:* *Range of r:* *Mean r:*	*13* *.11 - .35* *.23*		
B. Adults by external head measurements				
Pearson (1906)	1,011 British male university students	Length	Grades	.11
Pearl (1906)	935 Bavarian male soldiers	Perimeter	Officers' ratings	.14
Reid & Mulligan (1923)	449 Scottish male medical students	Capacity	Grades	.08
Sommerville (1924)	105 white American male university students	Capacity	Thorndike	.08
Wrzosek (1931; cited in Henneberg et al., 1985)	160 Polish male medical students	Capacity	Baley's Polish language IQ test	.14
Schreider (1968)	80 Otomi Indians from Mexico of unspecified sex	Perimeter	Form Board	.39
Schreider (1968)	158 French peasants of unspecified sex	Perimeter	Matrices	.23
Passingham (1979)	415 English villagers (212 men, 203 women) aged 18 to 75	Capacity	WAIS	.13
Susanne (1979)	2,071 Belgian male conscripts	Perimeter	Matrices	.19
Henneberg et al. (1985)	302 Polish medical students (151 men, 151 women) aged 18 to 30 years.	Capacity	Baley's Polish language IQ test	.14

Table 2.2 (cont.)

Source	Sample	Head measurement	Test	r
Bogaert & Rushton (1989)	216 Canadian men and women university students, adjusted for sex	Perimeter	MAB	.14
Rushton (1992c)	73 Oriental Canadian men and women university students	Perimeter	MAB	.14
Rushton (1992c)	211 white Canadian men and women university students	Perimeter	MAB	.21
Reed & Jensen (1993)	211 white American men college students	Capacity	Various	.03
Wickett et al. (1994)	40 white Canadian women university students	Perimeter	MAB	.11
Summary of B	*Number of Studies:*	*15*		
	Range of r:	*.03 - .39*		
	Mean r:	*.15*		
C. Adults by magnetic resonance imaging				
Willerman et al. (1991)	40 white American university students (20 men, 20 women); corrected for sex, body size and the extended IQ range	MRI	WAIS	.35
Andreasen et al. (1993)	67 white American adults (37 men, 30 women) with a mean age of 38	MRI	WAIS	.38
Raz et al. (1993)	29 white American adults (17 men, 12 women) aged 18 to 78	MRI	CFIT	.43
Wickett et al. (1994)	39 white Canadian women aged 20 to 30 years	MRI	MAB	.40
Summary of C	*Number of Studies:*	*4*		
	Range of r:	*.35 - .43*		
	Mean r:	*.39*		

Note. CFIT = Culture Free Intelligence Test; MAB = Multidimensional Aptitude Battery; MRI = Magnetic Resonance Imaging; PMAT = Primary Mental Abilities Test; WAIS = Wechsler Adult Intelligence Scale; WISC = Weschsler Intelligence Scale for Children.

The head size-IQ correlations reported in Table 2.2 have been reported separately for each of the three races. In a Canadian study, I found a correlation of r = 0.14 in a sample of 73 Oriental first-year university students and r = 0.21 in a sample of 211 non-Orientals, both samples taken from introductory psychology classes (Rushton, 1992c). For both black and white U.S. teenagers, Osborne (1992) found correlations of 0.28 and 0.29. In the Collaborative Perinatal Project, Broman et al. (1987) found a correlation of 0.24 for 17,000 white 7-year-olds and 0.19 for 19,000 black 7-year-olds. In a follow-up analysis of these data, Jensen and Johnson (in press) showed that the 0.20 head size-IQ correlation existed *within* families. The sibling with the larger head perimeter tended to be the more intelligent sibling, in both the black and the white samples.

Section C sets out the results of 4 studies on 175 adults with brain size estimated by magnetic resonance imaging (MRI) to create, in effect, a 3-dimensional model of the brain in *vivo*. Each of these studies used standardized tests to measure IQ. The correlations ranged from 0.35 to 0.43 with an unweighted mean of 0.39 (when weighted by sample size, also 0.39). These new-technology confirmations of Galton's (1888b) observations make it indisputable that brain size is related to intelligence.

TABLE 2.3
Correlations Between Head Circumference at Different Ages with IQ at 7 Years

	Whites				Blacks			
Age	Sample size	Circumference (cm)	SD	r	Sample size	Circumference (cm)	SD	r
Birth	16,877	34.0	1.5	.13*	18,883	33.4	1.7	.12*
4 months[a]	15,905	40.9	1.4	.19*	17,793	40.4	1.6	.16*
1 year	14,724	45.8	1.5	.20*	16,786	45.6	1.5	.15*
4 years	12,454	50.1	1.5	.21*	14,630	49.9	1.6	.16*
7 years	16,949	51.5	1.5	.24*	18,644	51.2	1.6	.18*

Note. Data have been calculated from Broman, Nichols, Shaughnessy & Kennedy (1987; p. 104, Table 6-10; p. 220, Table 9-28; p. 226, Table 9-34; p. 223, Table 9-41; p. 247, Table 9-54).

[a] Contains up to 2 percent of children with damage to central nervous system.

* p<.00001.

The U.S. national Collaborative Perinatal Project (Broman et al., 1987) is worth considering in more detail. Children were followed from conception to the age of 7 years with head circumference measured at birth, 4 months, 1 year, 4 years, and 7 years, and the Bayley Mental and Motor Scales given at 8 months, the Stanford-Binet at 4 years, and the Wechsler at 7 years. For white children, head circumference at birth correlated 0.47 with head circumference at 7 years, and for black children the correlation was 0.39. For both races combined, Bayley scores at 8 months correlated about 0.25 with Wechsler scores at 7 years and the Binet IQ at age 4 correlated 0.62 with the Wechsler at age 7.

Table 2.3. summarizes data I have abstracted from several tables in Broman et al. (1987) after excluding the 2 percent with major neurological disorders, except where reported. For both the black and the white children, the correlations among the head circumference measures at all ages predicted the mental ability scores. As can be seen, the head circumference of white children is greater than that of black children in each of the age categories by a mean of 0.36 cm or approximately 0.2 SD. The greater head size of white children is

not a function of greater body size because black children are taller than white children at both 4 and 7 years of age (Broman et al., 1987, Tables 7-8, 8-19). Although not shown in Table 2.3, the three tests of mental ability all favored the white children while the measure of motor ability favored the black children. These topics will be taken up in chapters 6 and 7.

Finally, the relation between brain size and intelligence is supported by the parallels with age. Both brain size and IQ increase during childhood and adolescence and then slowly and finally more quickly decrease. Table 2.3. shows the age trends with head circumference for both black and white children. At autopsy, from birth through childhood, head circumference is related to brain weight between 0.80 and 0.98 (Brandt, 1978; Bray et al., 1969; Cooke, Lucas, Yudkin, & Pryse-Davies, 1977).

In summation, the mean for the 29 head size-IQ correlations (Sections A and B in Table 2.2) is 0.20 (weighted $r = 0.18$). Although this correlation is not large, accounting for 4 percent of the variance, it is pervasive across numerous samples. Correcting for height and weight in some studies decreased the relationship whereas in others it increased the correlation (Wickett et al., 1994). Correcting for unreliability raises the correlation to about 0.30. Taking the four studies of magnetic resonance imaging, the correlation with intelligence is $r = .40$. This is the currently best estimate of the relationship between brain size and mental ability.

3

Behavioral Genetics

From an evolutionary point of view, individual differences are the alternative genetic combinations and adaptations that compete through the mechanism of natural selection. A mountain of data has now accumulated showing that genes bias the development of complex social behavior in one direction over alternatives, even of political attitudes and choice of marriage and other social partners. As Turkheimer and Gottesman (1991) proposed, it is time to enshrine $H^2 \neq 0$ as the "first law of behavior genetics" and to argue that $H^2 = 0$ is no longer an interesting null hypothesis.

Methods

The basic assumption of behavior genetic studies is that phenotypic variance in measurements can be partitioned into environmental (E) and genetic (G) components, which combine in an additive manner. A nonadditive interaction term (G x E) allows for combinations of genetic and environmental effects. Symbolically:

Phenotypic variance = G + E + (G x E)

The percentage of phenotypic variance attributable to genetic influences is often referred to as the heritability coefficient and can be represented as H^2. All procedures for estimating genetic influence involve measuring family groups and unrelated people and comparing the resultant correlations with those expected from a genetic hypothesis. Adoption studies and the comparison of twins are the most widely used procedures. In twin studies, monozygotic (MZ) or identical twins are assumed to share 100 percent of their genes and dizygotic (DZ) or fraternal twins are assumed to share, on average, 50 percent of their genes. If the correlation between scores on a trait is higher for the monozygotic than for the dizygotic twins, the difference can be attributed to genetic effects if it is assumed that the environments of each type of twin are roughly equal.

While critics have argued that the twin method is invalid for estimating heritability, detailed empirical work demonstrates the critiques to be of limited importance. For example, in cases where parents and twins misclassify zygosity, the degree of twin similarity on many traits is better predicted by true zygosity (defined by blood and fingerprint analysis) than by social definition. Moreover, when measures of the differences that do exist in the treatment of twins are correlated with personality and other scores, there is no evidence that differences in treatment have any effect (Plomin, DeFries, & McClearn, 1990).

One of the less appreciated aspects of twin studies is the information they also provide about environmental effects. If the raw data are the between-pair and within-pair sibling variances and covariances, then between-sibling mean squares reflect both sibling resemblances and sibling differences, while the within-pairs mean squares reflect only sibling differences. The genetic models are fitted to these mean squares. The total phenotypic variance can be partitioned into the following three sources: V(G), additive genetic effects; V(CE), common environmental influences that affect both siblings equally; and V(SE), specific environmental influences that affect each sibling individually. This last one is a residual term that is comprised of many sources, including measurement error and certain kinds of interaction between genotypes and environments. Thus, the total phenotypic variance is partitioned as V(G) + V(CE) + V(SE).

In many studies, the statistics used are correlations, including regressions and a special form of the correlation, the intraclass (R) correlation (Plomin et al., 1990). Heritabilities can be estimated by comparing these correlations, as in doubling the difference between monozygotic and dizygotic twin similarities, that is, $H^2 = 2(RMZ - RDZ)$. Doubling the similarity correlation among siblings presents another evaluation (or multiplying by four the correlation among half-siblings). Another estimate of heritability is obtained by taking the correlation between the "midparent" value (mean of two parents) and "midchild" value (mean of all children). These methods, however, have to assume there is no nongenetic cause of resemblance between offspring and parents; to the degree to which there are, the heritabilities may be overestimated.

Environmental influences can also be estimated from within families. In twin studies, the effects of common environment (CE) can be estimated by subtracting the monozygotic twin correlation from double the dizygotic twin correlation, that is, CE = 2RDZ - RMZ. Any specific environmental (SE), or nonshared environmental influences, including error of measurement, can be estimated from subtraction, that is, $SE = 1 - H^2 - CE$, which should agree with 1 - RMZ if certain basic assumptions of the twin method are met. Because monozygotic twins are genetically identical, RMZ in itself constitutes an upper-bound estimate of H^2 (if CE = 0), and 1 - RMZ constitutes an estimate of environmentality, that is, the proportion of individual differences in a population unexplained by genetic factors.

Adoption studies provide the human equivalent of the "cross-fostering" designs used in animal experiments and allow estimates of genetic and environmental influences under a different but overlapping set of assumptions as compared to those of the twin method. For example, assumptions are made that there is random selection but, of course, children who are placed up for adoption may not be a random sample of the population and the homes into which they are adopted are typically better than average. Nonetheless, the logic of adoption studies is straightforward. Any resemblance between birth parents and their adopted-away children will be due to genetic influences for there are no environmental factors in common; any resemblance between adopted children and their adoptive families will be due to environmental influences, for there are no genetic influences in common.

Particularly dramatic are those studies that combine the twin and adoption methods, as in the famous Minnesota Study of Twins Reared Apart (Bouchard et al., 1990). Here monozygotic and dizygotic twins are separated in infancy and reared apart (MZA and DZA), a technique that becomes even more powerful when combined with a matched group of MZ and DZ twins reared together (MZT, DZT). In addition to the Minnesota study there is the Swedish Adoption/Twin Study of Aging examining 351 pairs of middle-aged twins reared apart with 407 matched control pairs (Pedersen et al., 1991), and a Finnish investigation of 165 pairs of twins reared apart (Langinvainio, Koskenvuo, Kaprio & Sistonen, 1984).

Emergenic Traits

In the case of identical twins reared apart, their correlation directly represents heritability; differences represent environmentality and measurement error. Table 3.1 presents a contrast of data from the monozygotic twins reared apart (MZA) in the Minnesota study with a group of monozygotic twins reared together (MZT) for anthropometric, psychophysiologic, intellectual, personality, and social interest variables (from Bouchard et al., 1990). Convergent results show substantial genetic effects on all the traits in question, and weak or nonexistent effects for the common environment.

The findings in Table 3.1 demonstrate remarkable similarity between MZA twins. They are often nearly equal to those for MZT twins and, as such, imply that common rearing enhances familial resemblance during adulthood only slightly. The MZ twin correlations constitute a substantial portion of the reliable variance of each trait confirming the high heritabilities involved. The MZA twin correlations were not related to how much contact the twins had as adults (Bouchard et al., 1990).

Remarkable similarities of idiosyncratic life-style and personal preference have been noted among monozygotic pairs, although not among dizygotic pairs. For example, the lives of the "Jim twins," adopted as infants into sepa-

TABLE 3.1
Similarity Correlations for Monozygotic Twins Reared Apart and Together

	Reared apart		Reared together	
Variables	*r*	Number of pairs	*r*	Number of pairs
Anthropometric				
Fingerprint ridge count	.97	54	.96	274
Height	.86	56	.93	274
Weight	.73	56	.83	274
Psychophysiological				
Brain wave alpha	.80	35	.81	42
Systolic blood pressure	.64	56	.70	34
Heart rate	.49	49	.54	160
Intelligence				
WAIS IQ-full scale	.69	48	.88	40
WAIS IQ-verbal	.64	48	.88	40
WAIS IQ-performance	.71	48	.79	40
Raven, Mill-Hill composite	.78	42	.76	37
Reaction time speed	.56	40	.73	50
g factor	.78	43	-	-
Mean of 15 Hawaii-battery scales	.45	45	-	-
Mean of 13 CAB scales	.48	41	-	-
Personality				
Mean of 11 MPQ scales	.50	44	.49	217
Mean of 18 CPI scales	.48	38	.49	99
Social attitude				
Mean of 23 SCII scales	.39	52	.48	116
Mean of 34 JVIS scales	.43	45	-	-
Mean of 17 MOII scales	.40	40	.49	376
Mean of 2 religiosity scales	.49	31	.51	458
Mean of 14 nonreligious social attitude items	.34	42	.28	421
MPQ Traditionalism scale	.53	44	.50	217

Note: Adapted from Bouchard, Lykken, McGue, Segal & Tellegen (1990, p. 226, Table 4). Copyright 1990 by the American Association for the Advancement of Science. Reprinted with permission. CAB = Comprehensive Ability Battery; CPI = California Personality Inventory; JVIS = Jackson Vocational Interest Survey; MOII = Minnesota Occupational Interest Inventory; MPQ = Multidimensional Personality Questionnaire; SCII = Strong Campbell Interest Inventory; WAIS = Wechsler Adult Intelligence Scale.

rate working-class Ohio families, have been marked by a trail of similar names. Both had childhood pets named Toy. Both married and divorced women named Linda and had second marriages with women named Betty. They named their sons James Allen and James Alan.

Lykken, McGue, Tellegen, and Bouchard (1992) describe other examples from the Minnesota study. One pair resolutely refused to express any opinions on controversial issues, since long before they discovered each other's existence this had been their habit. Another pair were helpless gigglers, although each described their adoptive parents as undemonstrative and serious in manner, and neither had known anyone who laughed as freely as she did until finally she met her twin. There were two who handled dogs; one showed them, and the other who taught obedience classes.

Lykken et al. (1992: 1565–66) continued:

> There were two gunsmith hobbyists among the group of twins; two women who habitually wore seven rings; two men who offered a (correct) diagnosis of a faulty wheel bearing on Bouchard's car; two who obsessively counted things; two who had been married five times; two captains of volunteer fire departments; two fashion designers; two who left little love notes around the house for their wives,... in each case, an MZA pair.

Lykken et al. (1992) suggest that these personal idiosyncrasies are "emergenic" traits due to chance genetic configurations and so may not run in families. Because monozygotic twins share all their genes and thus all gene configurations, they can be surprisingly concordant for unusual qualities despite being separated in infancy and reared apart. These emergent traits may explain statistical rarities such as great leadership and genius, or even just atypical selling ability, parenting success, interpersonal attractiveness, entrepreneurial ability, psychotherapeutic effectiveness and other important individual differences.

The standard assumption of behavior genetics is that traits run in families and that pairs of relatives are similar in proportion to their genetic resemblance. Yet there is evidence of traits for which the MZ correlation is high, indicating a genetic basis, when the DZ correlation and other first degree relatives are insignificant. When MZ twins are substantially more than twice as similar as DZ twins and other first-degree relatives, a nonadditive or configural genetic determination is suggested.

The Heritability of Behavior

It may come as something of a surprise to learn the range of traits that studies have shown to be genetically influenced. In the next sections, therefore, the heritability of individual differences are reviewed on several dimensions.

Anthropometric and Physiological Traits

Height, weight, and other physical attributes provide a point of comparison to behavioral data. Not surprisingly, they are usually highly heritable accounting for 50 to 90 percent of the variance. These results are found from studies of both twins and adoptees (e.g., Table 3.1). The genes also account for large portions of the variance in physiological processes such as rate of breathing, blood pressure, perspiration, pulse rate, and EEG-measured brain activity.

Obesity was studied in a sample of 540 42-year-old Danish adoptees selected so that the age and sex distribution was the same in each of four weight categories: thin, medium, overweight, and obese (Stunkard et al., 1986). Biological and adoptive parents were contacted and their current weight assessed. The weight of the adoptees was predicted from that of their biologic parents but not at all from that of the adoptive parents with whom they had been raised. The relation between biologic parents and adoptees was present across the whole range of body fatness—from very thin to very fat. Thus, genetic influences play an important role in determining human fatness, whereas the family environment alone has no apparent effect. This latter result, of course, is one that varies from popular views. Subsequent evidence shows significant genetic transmission of obesity in black as well as in white families (Ness, Laskarzewski, & Price, 1991).

Testosterone is a hormone mediating many bio-behavioral variables in both men and women. Its heritability was examined in 75 pairs of MZ twins and 88 pairs of DZ twins by Meikle, Bishop, Stringham, & West (1987). They found that genes regulated 25 to 76 percent of plasma content for testosterone, estradiol, estrone, 3 alpha-audiostanediol glucuronide, free testosterone, lutinizing hormone, follicle stimulating hormone, and other factors affecting testosterone metabolism.

Activity Level

Several investigators have found activity level to be heritable from infancy onward (Matheny, 1983). In one study, activity in 54 identical and 39 fraternal twins aged 3 to 12 years was assessed with behaviors like "gets up and down" while "watching television" and "during meals" (Willerman, 1973). The correlation for identical twins was 0.88 and for fraternal twins was 0.59, yielding a heritability of 58 percent. An investigation of 181 identical and 84 fraternal twins from 1 to 5 years of age using parent ratings found correlations for a factor of zestfulness of 0.78 for identical and 0.54 for fraternal twins, yielding a heritability of 48 percent (Cohen, Dibble, & Grawe, 1977). Data from a Swedish sample aged 59 years and including 424 twins reared together and 315 twins reared apart showed the heritability for activity level in this older sample to be 25 percent (Plomin, Pedersen, McClearn, Nesselroade, & Bergeman, 1988).

Altruism and Aggression

Several twin studies have been conducted on altruism and aggression. Loehlin and Nichols (1976) carried out cluster analyses of self-ratings made by 850 adolescent pairs on various traits. Clusters labeled kind, argumentative, and family quarrel showed the monozygotic twins to be about twice as much alike as the dizygotic twins, with heritabilities from 20 to 42 percent. Matthews, Batson, Horn, and Rosenman (1981) analyzed adult twin responses to a self-report measure of empathy and estimated a heritability of 72 percent. In the Minnesota adoption study of twins raised apart, summarized in Table 3.1, the correlations for 44 pairs of identical twins reared apart are 0.46 for aggression and 0.53 for traditionalism, a measure of following rules and authority (Tellegen et al., 1988).

In a study of 573 pairs of identical and fraternal adult twin pairs reared together, all of the twins completed separate questionnaires measuring altruistic and aggressive tendencies. The questionnaires included a 20-item self-report altruism scale, a 33-item empathy scale, a 16-item nurturance scale, and many items measuring aggressive dispositions. As shown in Table 3.2, 50 percent of the variance on each scale was associated with genetic effects, virtually 0 percent with the twin's common environment, and the remaining 50 percent with each twin's specific environment. When the estimates were corrected for unreliability of measurement, the genetic contribution increased to 60 percent (Rushton, Fulker, Neale, Nias, & Eysenck, 1986).

TABLE 3.2
Genetic and Environmental Contributions to Altruism and Aggression Questionnaires in 573 Adult Twin Pairs

Trait	Additive genetic variance		Common environmental variance		Specific environmental variance	
Altruism	51%	(60%)	2%	(2%)	47%	(38%)
Empathy	51%	(65%)	0%	(0%)	49%	(35%)
Nurturance	43%	(60%)	1%	(1%)	56%	(39%)
Aggressiveness	39%	(54%)	0%	(0%)	61%	(46%)
Assertiveness	53%	(69%)	0%	(0%)	47%	(31%)

Note. Adapted from Rushton, Fulker, Neale, Nias & Eysenck (1986, p. 1195, Table 4). Copyright 1986 by the American Psychological Association. Reprinted with permission. Estimates in parentheses are corrected for unreliability of measurement.

At 14 months of age, empathy was assessed in 200 pairs of twins by the child's response to feigned injury by experimenter and mother (Emde et al., 1992). Ratings were based on the strength of concern expressed in the child's face, the level of emotional arousal expressed in the child's body as well as prosocial intervention by the child (e.g., comforting by patting the victim or bringing the victim a toy). About 36 percent of the variance was estimated to be genetic.

Attitudes

Although social, political and religious attitudes are often thought to be environmentally determined, a twin study by Eaves and Eysenck (1974) found that radicalism-conservatism had a heritability of 54 percent, tough-mindedness had a heritability of 54 percent, and the tendency to voice extreme views had a heritability of 37 percent. In a review of this and two other British studies of conservatism, Eaves and Young (1981) found for 894 pairs of identical twins an average correlation of 0.67 and for 523 fraternal twins an average correlation of 0.52, yielding an average heritability of 30 percent.

In a cross-national study, 3,810 Australian twin pairs reared together reported their response to 50 items of conservatism such as death penalty, divorce, and jazz (Martin et al., 1986). The heritabilities ranged from 8 percent to 51 percent (see Table 4.4, next chapter). Overall correlations of 0.63 and 0.46 were found for identical and fraternal twins, respectively, yielding a heritability of 34 percent. Correcting for the high assortative mating that occurs on political attitudes raised the overall heritability to about 50 percent. Martin et al. (1986) also replicated the analyses by Eaves and Eysenck (1974) on the heritability of radicalism and tough-mindedness.

Religious attitudes also show genetic influence. Although Loehlin and Nichols (1976) found no genetic influences on belief in God or involvement in organized religious activities in their study of 850 high school twins, when religiosity items were aggregated with other items, such as present religious preference, then a genetic contribution of about 20 percent became observable (Loehlin & Nichols, 1976, Table 4-3, Cluster 15). Using a more complete assessment battery, including five well-established scales of religious attitudes, interests and values, and estimates of heritability from twins reared apart as well as together, the Minnesota study estimated the genetic contribution to the variance in their instruments to be about 50 percent (Table 3.1; also Waller, Kojetin, Bouchard, Lykken, & Tellegen, 1990).

Criminality

The earliest twin study of criminality was published in 1929 in Germany by Johannes Lange. Translated into English in 1931, *Crime as Destiny* reported on the careers of a number of criminal twins, some of them identical, others fraternal, shortly after the distinction between the two kinds had become generally accepted. Lange compared the concordance rates for 13 monozygotic and 17 dizygotic pairs of twins in which at least 1 had been convicted of a criminal offense. Ten of the 13 monozygotic pairs (77 percent) were concordant, whereas only 2 of the 17 dizygotic pairs (12 percent) were concordant. A summary of Lange's (1931) study and of the literature up to the 1960s was provided by Eysenck and Gudjonsson (1989). For 135 monozygotic twins the concordance rate was 67 percent and for 135 dizygotic twins, 30 percent.

Among subsequent studies is an investigation of the total population of 3,586 male twin pairs born on the Danish Islands from 1881 to 1910, recording serious offenses only. For this nonselected sample, identical and fraternal twin concordances are 42 percent versus 21 percent for crimes against persons and 40 percent versus 16 percent for crimes against property (Christiansen, 1977). Three small studies carried out in Japan showed similar concordance rates to those in the West (see Eysenck & Gudjonsson, 1989: 97–99).

Replicating the concordance ratios based on official statistics are those from studies based on self-reports. Sending questionnaires by mail to 265 adolescent twin pairs, Rowe (1986) sampled the eighth through twelfth grades in almost all the school districts of Ohio. The results showed that identical twins were roughly twice as much alike in their criminal behavior as fraternal twins, the heritability being about 50 percent.

Converging with the twin work are the results from several American, Danish, and Swedish adoption studies. Children who were adopted in infancy were at greater risk for criminal convictions if their biological parents had been so convicted than if their adoptive parents had been. For example, in the Danish study, based on 14,427 adoptees, for 2,492 adopted sons who had neither adoptive nor biological criminal parents, 14 percent had at least one criminal conviction. For 204 adopted sons whose adoptive (but not biological) parents were criminals, 15 percent had at least one conviction. If biological (but not adoptive) parents were criminal, 20 percent (of 1,226) adopted sons had criminal records; if both biological and adoptive parents were criminal, 25 percent (of 143) adopted sons were criminals. In addition, it was found that siblings raised apart showed 20 percent concordance and that half-siblings showed 13 percent concordance while pairs of unrelated children reared together in the same adoptive families showed 9 percent concordance (Mednick, Gabrielli, & Hutchings, 1984).

Dominance

Using a variety of assessment techniques, several studies have found individual differences in interpersonal dominance to be largely inherited (e.g., Gottesman, 1963, 1966; Loehlin & Nichols, 1976). In a longitudinal study of 42 twin pairs, Dworkin, Burke, Maher, and Gottesman (1976) found that individual differences in dominance, as assessed on the California Psychological Inventory, remained stable over a 12-year time period, as did the heritability estimate. Carey, Goldsmith, Tellegen, and Gottesman (1978), in a review of the literature, reported that, of all traits, dominance is one of those most reliably found to be heritable, with a weighted mean heritability coefficient, over several samples, of 56 percent. In the Minnesota study (Table 3.1) this is also the correlation for 44 pairs of identical twins reared apart for the trait of social potency (a leader who likes to be the center of attention).

Emotionality

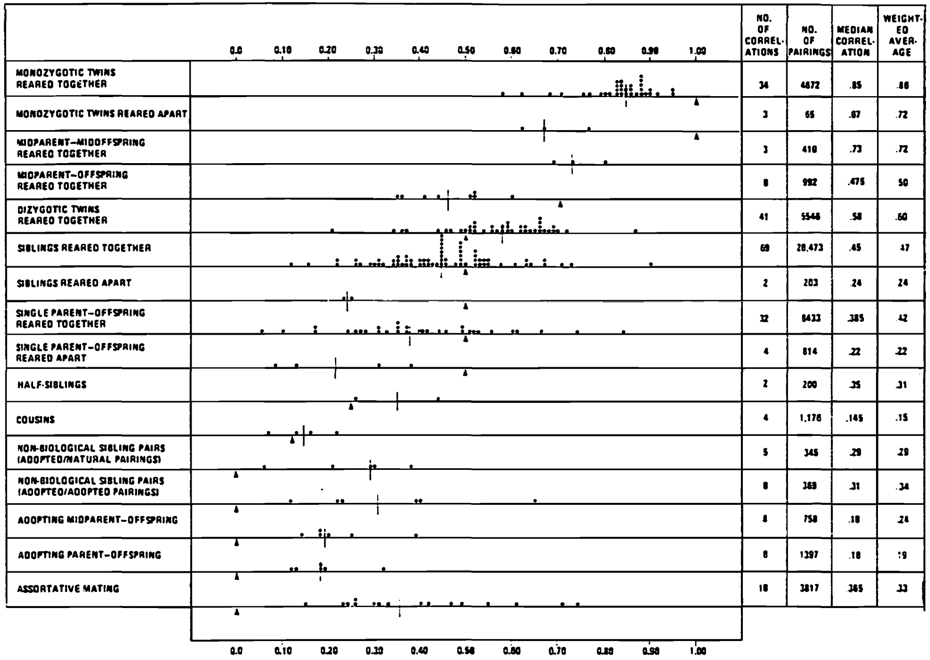
The largest heritability study of emotional reactivity, or the speed of arousal to fear and anger, was carried out by Floderus-Myrhed, Pedersen, and Rasmuson (1980). They administered the Eysenck Personality Inventory to 12,898 adolescent twin pairs of the Swedish Twin Registry. The heritability for neuroticism was 50 percent for men and 58 percent for women. Another large twin study, carried out in Australia, involving 2,903 twin pairs, found identical and fraternal twin correlations of 0.50 and 0.23 for neuroticism (Martin & Jardine, 1986). The opposite side of the neuroticism continuum, emotional stability, as measured by the California Psychological Inventory's Sense of Well-Being scale, is also found to have a significant heritability, both in adolescence and 12 years later (Dworkin et al., 1976).

The studies of twins raised apart substantiate the genetic contribution to a neuroticism "superfactor." In the Minnesota study (Table 3.1), the correlation for the 44 MZA twins is 0.61 for the trait of stress reaction, 0.48 for alienation, and 0.49 for harm avoidance (Tellegen et al., 1988). In a Swedish study of 59-year-olds the correlation for emotionality in 90 pairs of identical twins reared apart is 0.30 (Plomin et al., 1988). Other adoption studies also confirm that the familial resemblance for neuroticism is genetically based. In a review of three adoption studies, the average correlation for nonadoptive relatives was about 0.15 and the average correlation for adoptive relatives was nearly zero, suggesting a heritability estimate of about 0.30 (Henderson, 1982).

Intelligence

Ever since Galton (1869), more genetic studies of intelligence have been carried out than for any other trait. The early data were reviewed by Erlenmeyer-Kimling and Jarvik (1963) and were compatible with a heritability as high as 80 percent. Newer data and reviews have confirmed the high heritability of intelligence, showing that it is 50 percent or greater. The most extensive review is that by Bouchard and McGue (1981) based on 111 studies identified

Figure 3.1: Familial Correlations for IQ



	NO. OF CORREL-ATIONS	NO. OF PAIRINGS	MEDIAN CORREL-ATION	WEIGHT-ED AVER-AGE
MONOZYGOTIC TWINS REARED TOGETHER	34	4672	.85	.86
MONOZYGOTIC TWINS REARED APART	3	65	.67	.72
MIDPARENT–MIDOFFSPRING REARED TOGETHER	3	410	.73	.72
MIDPARENT–OFFSPRING REARED TOGETHER	8	992	.475	50
DIZYGOTIC TWINS REARED TOGETHER	41	5546	.58	.60
SIBLINGS REARED TOGETHER	69	26,473	.45	.47
SIBLINGS REARED APART	2	203	.24	.24
SINGLE PARENT–OFFSPRING REARED TOGETHER	32	8433	.385	.42
SINGLE PARENT–OFFSPRING REARED APART	4	814	.22	.22
HALF-SIBLINGS	2	200	.35	.31
COUSINS	4	1,176	.145	.15
NON-BIOLOGICAL SIBLING PAIRS (ADOPTED/NATURAL PAIRINGS)	5	345	.29	.29
NON-BIOLOGICAL SIBLING PAIRS (ADOPTED/ADOPTED PAIRINGS)	6	369	.31	.34
ADOPTING MIDPARENT–OFFSPRING	6	758	.19	.24
ADOPTING PARENT–OFFSPRING	6	1397	.18	.19
ASSORTATIVE MATING	16	3817	.365	.33

The horizontal lines show the median correlation coefficients; the arrows show the correlations expected if IQ were entirely due to additive genetic variance; and the vertical bar in each distribution indicates the median observed correlation. From Bouchard & McGue (1981, p. 1056, Figure 1). Copyright 1981 by the American Association for the Advancement of Science. Reprinted with permission.

in a survey of the world literature. Altogether there were 652 familial correlations, including 113,942 pairings. Figure 3.1 displays the correlations between relatives, biological and adoptive, in the 111 studies.

Several heritability estimates can be calculated from Bouchard and McGue's (1981) review. Doubling the difference between the correlations for identical and fraternal twins reared together produces a heritability estimate of 52 percent. Doubling the correlation for parents and offspring adopted apart yields an estimate of 44 percent. Doubling the correlation for siblings adopted apart provides an estimate of 48 percent. Doubling the difference between the correlation for biological parents and offspring living together (0.42) and the correlation for adoptive parents and their adopted children (0.19) leads to a heritability estimate of 46 percent. Doubling the difference between the correlation for biological siblings reared together (0.47) and the correlation for adoptive siblings (0.32) provides an estimate of 30 percent. The sample of identical twins reared apart yields the highest estimate, 72 percent. As shown in Table 3.1, the ongoing study of reared-apart identical twins at the University of Minnesota also yields estimates of substantial heritability (Bouchard et al., 1990).

The Swedish Adoption/Twin Study of Aging provided corroborative data for high heritability. There were 46 pairs of identical twins reared apart, 67 pairs of identical twins reared together, 100 pairs of fraternal twins reared apart, and 89 pairs of fraternal twins reared together. Their average age was 65 years. The heritabilities for general intelligence was about 80 percent and for 13 specific abilities somewhat less. Thus, average heritabilities for verbal, spatial, perceptual speed, and memory tests were, respectively, 58 percent, 46 percent, 58 percent, and 38 percent (Pedersen, Plomin, Nesselroade, & McClearn, 1992).

It is the *g* factor that is the most heritable component of intelligence tests. In Bouchard et al.'s study (Table 3.1) the *g* factor, the first principal component extracted from several mental ability tests, had the highest heritability (78 percent). Similarly in Pedersen et al.'s (1992) study, the first principal component had a heritability of 80 percent whereas the specific abilities averaged around 50 percent.

Remarkably, the strength of the heritability varies directly as a result of a test's *g* loading. Jensen (1983) found a correlation of 0.81 between the *g* loadings of the 11 subtests of the Wechsler Intelligence Scale for Children and heritability strength assessed by genetic dominance based on inbreeding depression scores from cousin marriages in Japan. Inbreeding depression is defined as a lowered mean of the trait relative to the mean in a non-inbred population and is especially interesting because it indicates genetic dominance, which arises when a trait confers evolutionary fitness.

Jensen took the figures on inbreeding depression from a study by Schull and Neel (1965) who calculated them from 1,854 7- to 10-year-old Japanese children. Since about 50 percent of the sample involved cousin marriages, it was possible to assess the inbreeding depression on each subtest, expressed as the percentage decrement in the score per 10 percent increase in degree of inbreeding. These were calculated after statistically controlling for child's age, birth rank, month of examination, and eight different parental variables, mostly pertaining to SES. The complement of inbreeding depression was found by Nagoshi and Johnson (1986) who observed "hybrid vigor" in offspring of Caucasoid-Mongoloid matings in Hawaii.

Subsequently, Jensen (1987a) reported rank order correlations of 0.55 and 0.62 between estimates of genetic influence from two twin studies and the *g* loadings of the Wechsler Adult Intelligence Scale subtests, and P. A. Vernon (1989) found a correlation of 0.60 between the heritabilities of a variety of speed of decision time tasks and their relationship with the *g* loadings from a psychometric test of general intelligence. More detailed analyses showed that the relationship among the speed and IQ measures are mediated entirely by hereditary factors. Thus, there are common biological mechanisms underlying the association between reaction time and information-processing speed and mental ability (Baker, Vernon, & Ho, 1991).

Heritabilities for mental ability have been examined within black and Oriental populations. A study by Scarr-Salapatek (1971) suggested the heritability might be lower for black children than for white children. Subsequently, Osborne (1978, 1980) reported heritabilities of greater than 50 percent both for 123 black and for 304 white adolescent twin pairs. Japanese data for 543 monozygotic and 134 dizygotic twins tested for intelligence at the age of 12 gave correlations of 0.78 and 0.49 respectively, indicating a heritability of 58 percent (R. Lynn & Hattori, 1990).

Related to intelligence at greater than 0.50 are years of education, occupational status, and other indices of socioeconomic status (Jensen, 1980a). All of these have also been shown to be heritable. For example, a study of 1,900 pairs of 50-year-old male twins yielded MZ and DZ twin correlations of 0.42 and 0.21, respectively for occupational status, and 0.54 and 0.30 for income (Fulker & Eysenck, 1979; Taubman, 1976). An adoption study of occupational status yielded a correlation of 0.20 between biological fathers and their adult adopted-away sons (2,467 pairs; Teasdale, 1979). A study of 99 pairs of adopted-apart siblings yielded a correlation of 0.22 (Teasdale & Owen, 1981). All of these are consistent with a heritability of about 40 percent for occupational status. Years of schooling also shows substantial genetic influence; for example, MZ and DZ twin correlations are typically about 0.75 and 0.50 respectively, suggesting that heritability is about 50 percent (e.g., Taubman, 1976).

Locus of Control

The Internal-External Locus of Control Scale was developed as a continuous measure of the attitude with which individuals relate their own behavior to its contingent reward or punishment. That one's own actions are largely affected by luck or chance or some more powerful force was labeled a belief in external control. The converse attitude, that outcomes are contingent on one's own behavior, was termed internal control. A study by Miller and Rose (1982) reported a family twin study in variation of locus of control. In this study, the heritability estimates based on the comparison of MZ and DZ twins were corroborated by also estimating the heritability through the regression of offspring on parent and the correlation between non-twin siblings. The combination of results revealed heritability estimates greater than 50 percent.

Longevity and Health

Work on the genetics of longevity and senescence was pioneered by Kallman and Sander (1948, 1949). These authors carried out a survey in New York of over 1,000 pairs of twins aged 60 years or older and found that intra-pair differences for longevity, disease, and general adjustment to the aging process were consistently smaller for identical twins than for fraternal twins. For example, the average intra-pair difference in life span was 37 months for identical twins and 78 months for fraternal twins. In an adoption study of all 1,003 nonfamilial adoptions formally granted in Denmark between 1924 and 1947, age of death in the adult adoptees was predicted better by knowledge of the age of death in the biological parent than by knowledge of the age of death in the adopting parent (Sorensen, Nielsen, Andersen, & Teasdale, 1988).

Many individual difference variables associated with health are heritable. Genetic influences have been found for blood pressure, obesity, resting metabolic rate, behavior patterns such as smoking, alcohol use, and physical exercise, as well as susceptibility to infectious diseases. There is also a genetic component of from 30 to 50 percent for hospitalized illnesses in the pediatric age group including pediatric deaths (Scriver, 1984).

Psychopathology

Numerous studies have shown substantial genetic influences on reading disabilities, mental retardation, schizophrenia, affective disorders, alcoholism, and anxiety disorders. In a now classic early study, adopted-away offspring of hospitalized chronic schizophrenic women were interviewed at the average age of 36 and compared to matched adoptees whose birth parents had no known psychopathology (Heston, 1966). Of 47 adoptees whose biological parents were schizophrenic, 5 had been hospitalized for schizophrenia. None of the adoptees in the control group was schizophrenic. Studies in Denmark confirmed this finding and also found evidence for genetic influence when researchers started with schizophrenic adoptees and then searched for their adoptive and biological relatives (Rosenthal, 1972; Kety, Rosenthal, Wender,

& Schulsinger, 1976). A major review of the genetics of schizophrenia has been presented by Gottesman (1991).

Alcoholism also runs in families such that about 25 percent of the male relatives of alcoholics are themselves alcoholics, as compared with less than 5 percent of the males in the general population. In a Swedish study of middle-aged twins who had been reared apart, twin correlations for total alcohol consumed per month were 0.71 for 120 pairs of identical twins reared apart and 0.31 for 290 pairs of fraternal twins reared apart (Pedersen, Friberg, Floderus-Myrhed, McClearn, & Plomin, 1984). A Swedish adoption study of males found that 22 percent of the adopted-away sons of biological fathers who abused alcohol were alcoholic (Cloninger, Bohman, & Sigvardsson, 1981).

Sexuality

A questionnaire study of twins found genetic influence on strength of sex drive in turn predictive of age of first sexual intercourse, frequency of intercourse, number of sexual partners, and type of position preferred (Eysenck, 1976; Martin, Eaves, & Eysenck, 1977). Divorce, or the factors leading to it at least, is also heritable. Based on a survey of more than 1,500 twin pairs, their parents, and their spouses' parents, McGue and Lykken (1992) calculated a 52 percent heritability. They suggested the propensity was mediated through other heritable traits relating to sexual behavior, personality, and personal values.

Perhaps the most frequently cited study of the genetics of sexual orientation is that of Kallman (1952), in which he reported a concordance rate of 100 percent among homosexual MZ twins. Bailey and Pillard (1991) estimated the genetic component to male homosexuality to be about 50 percent. They recruited subjects through ads in gay publications and received usable questionnaire responses from 170 twin or adoptive brothers. Fifty-two percent of the identical twins, 22 percent of the fraternal twins, and 11 percent of the adoptive brothers were found to be homosexual. The distribution of sexual orientation among identical co-twins of homosexuals was bimodal, implying that homosexuality is taxonomically distinct from heterosexuality.

Subsequently, Bailey, Pillard, Neale, and Agyei (1993) carried out a twin study of lesbians and found that here, too, genes accounted for about half the variance in sexual preferences. Of the relatives whose sexual orientation could be confidently rated, 34 (48 percent) of 71 monozygotic co-twins, 6 (16 percent) of 37 dizygotic cotwins, and 2 (6 percent) of 35 adoptive sisters were homosexual.

Sociability

In one large study, Floderus-Myrhed et al. (1980) gave the Eysenck Personality Inventory to 12,898 adolescent twin pairs of the Swedish Twin Registry. The heritability for extraversion, highly related to sociability, was 54 percent for men and 66 percent for women. Another large study of extraversion involving 2,903 Australian twin pairs, found identical and fraternal twin correlations of 0.52 and 0.17 with a resultant heritability of 70 percent (Martin & Jardine, 1986). In a Swedish adoption study of middle-aged people, the correlation for sociability in 90 pairs of identical twins reared apart was 0.20 (Plomin et al., 1988).

Sociability and the related construct of shyness show up at an early age. In a study of 200 pairs of twins, Emde et al. (1992) found both sociability and shyness to be heritable at 14 months. Ratings of videotapes made of reactions to arrival at the home and the laboratory and other novel situations, such as being offered a toy, along with ratings made by both parents showed heritabilities ranging from 27 to 56 percent.

Values and Vocational Interests

Loehlin and Nichols's (1976) study of 850 twin pairs raised together provided evidence for the heritability of both values and vocational interests. Values such as the desire to be well-adjusted, popular, and kind, or having scientific, artistic, and leadership goals were found to be genetically influenced. So were a range of career preferences including those for sales, blue-collar management, teaching, banking, literature, military, social service, and sports.

As shown in Table 3.1, Bouchard et al. (1990) reported that, on measures of vocational interest, the correlations for their 40 identical twins raised apart are about 0.40. Additional analyses from the Minnesota Study of Twins Reared Apart suggest the genetic contribution to work values is pervasive. One comparison of reared-apart twins found a 40 percent heritability for preference for job outcomes such as achievement, comfort, status, safety, and autonomy (Keller, Bouchard, Arvey, Segal, & Dawis, 1992). Another study of MZAs indicated a 30 percent heritability for job satisfaction (Arvey, Bouchard, Segal, & Abraham, 1989).

Threshold Model

The genetic model typically proposed to explain the experimental results is the polygenic threshold model, which assumes that a large number of genes contribute equally and additively to the trait, and that there is a threshold point beyond which the phenotype is expressed. In addition to the genetic effects, environmental factors can act to shift the distribution, thus influencing the position of a given genotype with respect to the threshold (Falconer, 1989). This interaction of polygenic threshold inheritance with environmental influences is termed the multifactorial model.

Thus, genetic "influence," not genetic "determinism" is the appropriate catchphrase when it comes to social behavior. Although genes affect a person's threshold for activation, for some only a small stimulus is needed to activate behavior, while for others a greater stimulus is required. An analogy drawn from medicine is of someone with a genetic disposition for flu who may never succumb in a benevolent environment although even a person relatively resistant may suffer if the environment is sufficiently hostile. Often the environment may override genetic differences. About 50 percent of the variance in human social behavior seems to be of genetic origin, with the remaining 50 percent environmental.

Figure 3.2 illustrates Kimble's (1990) threshold model showing the interactions that bring expression to a variety of potentials. The underlying predisposition (x-axis) is largely genetic in origin but may have been strengthened or weakened during development. The y-axis is the strength of the environmental effect. The threshold function within these axes divides the figure into two parts: reaction and no reaction.

The threshold model has great generality, offering a unifying principle to wide areas of psychology (Kimble, 1990). Its generality is achieved by treating numerous behaviors in terms of the occurrence or nonoccurrence of responses and its incorporation of human differences that enter the model as differences in predisposition and reaction thresholds. Kimble (1990) provides several examples: (1) from sensory perception, the rule is that the greater the sensitivity of an observer, the lower the stimulus intensity required to make a signal detectable; (2) in stress models of mental disorder, the greater an individual's vulnerability, the lower the stress required to produce a pathological reaction; (3) in psychopharmacology, the greater the susceptibility of a person to a drug, the smaller the dose required to produce a specific effect; (4) in education, the greater the readiness of a child to learn, the less instruction needed to impart a given skill or bit of knowledge; and (5) with social attitudes, the more racial bias a person has, the less evidence it takes to elicit a prejudicial statement.

Whether a predisposition is activated depends upon the net effect of other tendencies that are activated with it and that encourage or discourage the expression of that potential. For example, students pass or fail their courses for reasons that depend on their abilities, but also on their willingness to work hard enough to meet the standards of a course. The ease with which new learning occurs depends on previous learning, response biases and innate stimulus preferences.

The strength of environmental effects may combine in unique ways. Additive effects may be found with stress. As stress accumulates, it takes the organism upward on the y-axis of Figure 3.2 and above the thresholds for a succession of cumulative responses—alarm, resistance, and exhaustion. Interactive complexities may also occur. A new stressor, delivered during the

Figure 3.2: Threshold Model of the Interaction of Instigation and Disposition

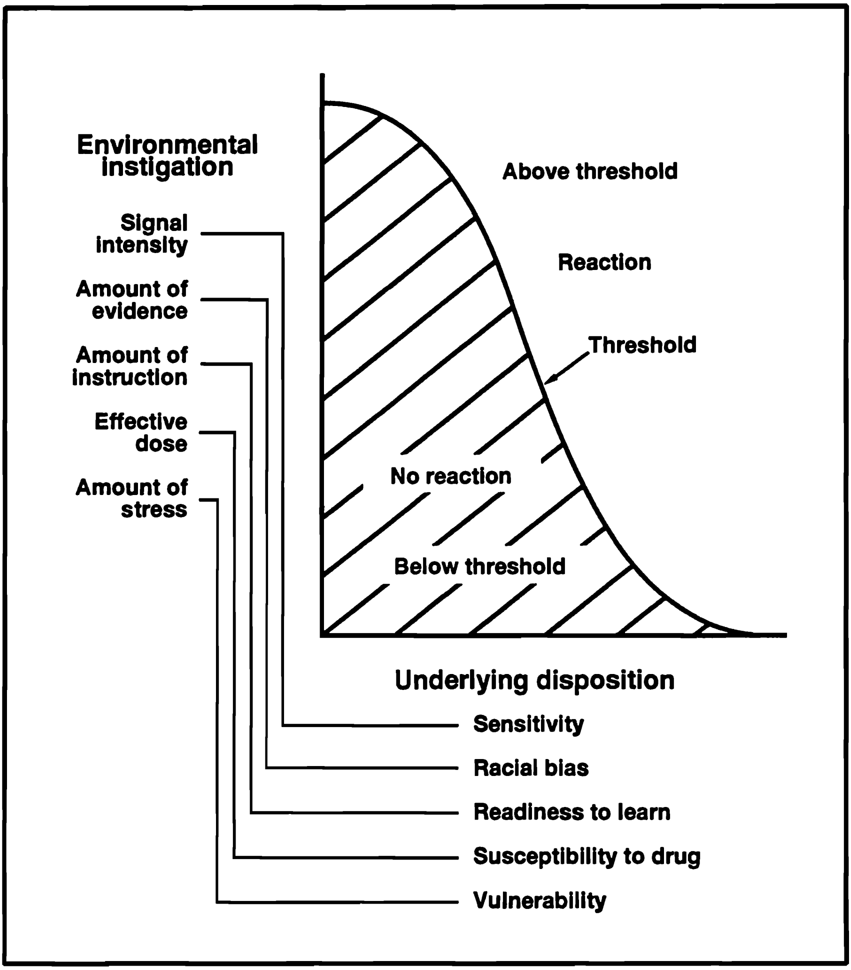


Figure 3.2 can be read as though it were a correlational scatter plot. Combinations of environmental instigation (vertical y-axis) and underlying disposition (horizontal x-axis) above the threshold produce a reaction; those below the threshold do not. Figure 3.2 tells us that, in general, the greater the underlying disposition, the less the stimulus required to evoke the response. Adapted from Kimble (1990, pp. 37, Figure 1). Copyright 1990 by the American Psychological Society. Reprinted with permission

stage of resistance when individuals are coping effectively, may bring them prematurely to the stage of exhaustion. According to the inverted-U hypothesis, up to a point increasing arousal benefits performance; beyond that point it interferes.

In cases such as this it is useful to think of the entire *behavioral scale*, not isolated points on it, as the genetically based trait that has been fixed by natural selection (E. O. Wilson, 1975: 20-21). Events may slide individual responses up or down a scale of stress (or aggression), but each of the various degrees may be adaptive at the appropriate level of instigation—short of the rarely recurring pathological level.

Genetic dispositions are simply one set of causes contributing to behavior. Alcoholism provides a good example of the qualification that must often be made to how genes and environment combine to influence behavior. No matter how strong the hereditary propensity toward alcoholism might be, no one will become alcoholic unless large quantities of alcohol are consumed over long periods of time.

Epigenesis in Development

Genes do not cause behavior directly. They code for enzymes, which, under the influence of the environment, lay down tracts in the brains and nervous systems of individuals, thus differentially affecting people's minds and the choices they make about behavioral alternatives. In regard to aggression, for example, some people may inherit temperaments that dispose them to irritability, impulsivity, or a lack of conditionability. There are many plausible routes from genes to behavior, and collectively, these routes may be referred to as epigenetic rules.

Epigenetic rules are genetically based recipes by which individual development is guided in one direction over alternatives. Their operation is probably most apparent in embryology in which the construction of anatomical and physiological features occurs (Waddington, 1957). To take a familiar example, the physical development from fertilized egg to neonate follows a preordained course in which development starts in the head region and works its way down the body. By the end of the first month, a brain and spinal cord become evident, and a heart has formed and begun to beat. By the end of the eighth week, the developing fetus has a face, arms, legs, basic trunk, and internal organs. By the sixth or seventh month, all major systems have been elaborated and the fetus may survive if born prematurely. However, development continues, and the last months of pregnancy are important for the buildup of body fat, tissue, and antibodies and for the refinement of other systems.

Average newborns weigh about 7 1/2 pounds, but they can double their birth weight by 6 months and triple it by their first birthday. After age 2 and until puberty, children grow 2 to 3 inches in height and gain 6 to 7 pounds in weight each year. The sequence of growth during infancy is rapid and uniform. Most babies in North America can sit in a highchair by 6 months, crawl by 10 months, and walk alone by 15 months.

The reason for spelling out what may seem obvious is that it so powerfully illustrates that development involves coordinated pathways of timed gene-action systems that switch off and on according to a predetermined plan. Behavioral development thus gives expression to the dynamics of preprogrammed change; and in this perspective, behavioral discontinuities (walking, adolescence) may be as strongly rooted in the epigenetic ground plan as the continuities are.

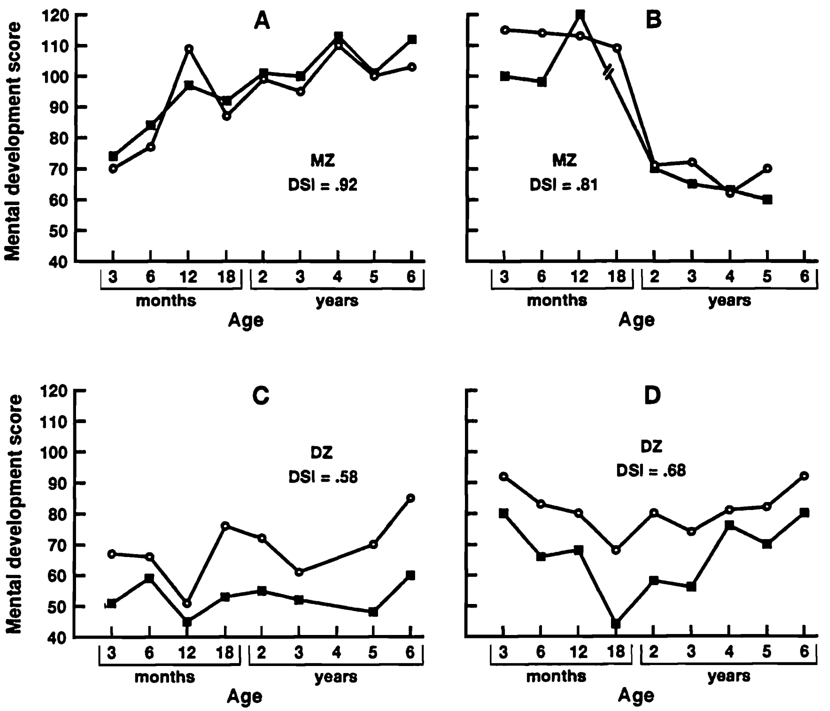
The genetics of behavioral development is illustrated in R. S. Wilson's (1978, 1983, 1984) longitudinal Louisville Twin Study, which tested some 500 pairs at 3, 6, 9, 12, 18, 24, and 30 months, then yearly from 3 through 9 years, with a final follow-up at 15 years. Measures were made of both height and mental development. Each test yielded age-adjusted standardized scores with a mean of 100. Thus, an infant of average height or IQ at every age would have scores of 100, with no variability. But if there were episodes of acceleration or lag in growth, the standardized scores would change across ages, reflecting the relative upward or downward shift of the child's height or IQ in relation to age mates. Consider the results for mental ability shown in Figure 3.3.

The results for mental development aggregated across 500 pairs of twins (Figure 3.4) show that the differentiation between the 2 zygosity groups is not very pronounced in the early years. After 3 years, however, the DZ twin correlations drop steadily to 0.59 at 6 years, while the MZ correlations remain in the upper 0.80s, thus showing a consonance proportionate with shared genes. In fact, by 6 years of age, the DZ correlations for height and intelligence are virtually the same (R = 0.57 and 0.59, respectively). Also shown in Figure 3.4 are the correlations between DZ twins and their siblings computed by pairing the sibling first with Twin A, then with Twin B, and averaging the results. The siblings were tested on a schedule that yielded age-matched tests for each twin-sibling set (R. S. Wilson, 1983).

Further strengthening these results are the correlations for non-twin sibling pairs (not shown in Figure 3.4). By 8 and 9 years these non-twin siblings had virtually the same concordance value as DZ twins at that age. In short, any two-zygote pair from the same family—whether DZ twins, a twin matched with a sibling, or two singleton siblings—showed a progressive trend to converge to a degree of similarity in cognitive performance expectable from the number of genes they shared in common.

The differentiation of monozygotic from dizygotic twin pairs is given additional perspective with data for height where the correlations can be extended back to birth. The results are presented graphically in the right hand box in Figure 3.5. They show that MZ twins are less concordant for height at birth than DZ twins, but there is a sharp rise in concordance at 3 months.

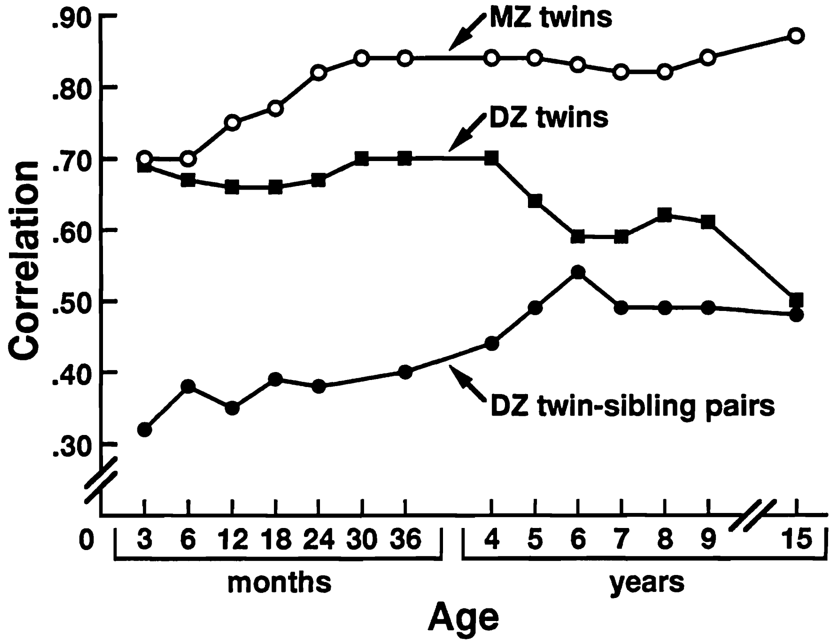
Figure 3.3: Correlated Pathways of Development



The two sets of MZ twins shown in panels A and B display quite different trends in mental development, but there is a high degree of congruence within each pair. Note especially the upward trend for the twins in panel A and how it contrasts with the downward trend in panel B. It appears that the inner programming can dictate trends in either direction, and the degree of advancement or lag in the early months has little bearing on the ultimate level reached by school age. The two sets of dizygotic twins shown in panel C and D display a greater divergence in trend during childhood, although the main directional shifts are somewhat the same. This is in accord with what would be expected from individuals who share half their genes in common. The developmental synchronies index (DSI) reflects the goodness of fit between the two curves and can be used to quantify the relative similarity of the two groups. Synchronies between lags and spurts in mental development are found to average about 0.90 for identical twins and about 0.50 for fraternal twins. From R.S. Wilson (1978, p. 942, Figure 1). Copyright 1978 by the American Association for the Advancement of Science. Reprinted with permission.

Subsequently, the MZ concordance for height moved incrementally upward while that for DZ progressively dropped. The comparative data for mental ability starting at 3 months (left box) is less pronounced, but still clear. Inci-

Figure 3.4: Correlations Proportionate with Shared Genes for Mental Development

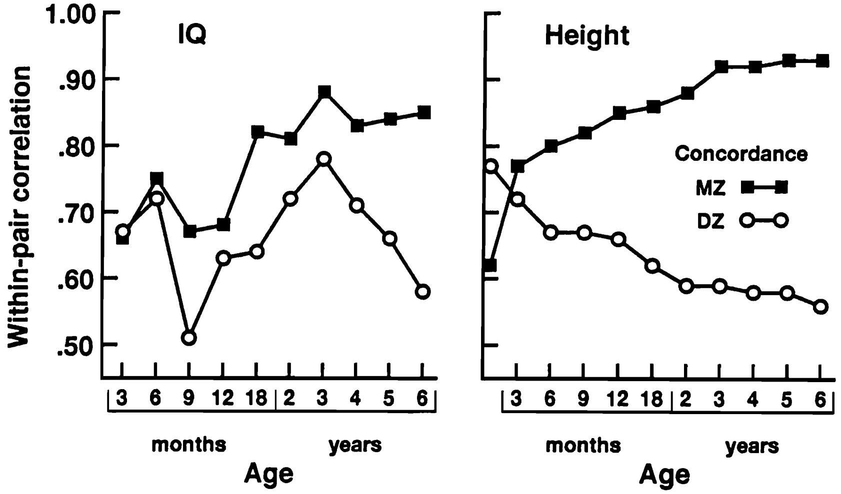


Due to common and specific environmental influences, during the first months of life the differentiation between the two zygosity groups is not very pronounced whereas that between DZ twin-sibling sets is over pronounced. Genetic influences are continually at work and by 6 years of age, while the MZ twin correlations remained in the upper 0.80s, the DZ twin correlations had dropped and the DZ twin-sibling correlations had risen and were not significantly different from each other. Adapted from R.S. Wilson (1983, p. 311, Figure 4). Copyright 1983 by the Society for Research in Child Development. Reprinted with permission.

dentally, these and similar data also suggest that, after 18 months of age, the growth gradients for height and mental development are independent of one another (R. S. Wilson, 1984).

R. S. Wilson's (1983) data are considered a benchmark for quality in human behavior genetics. They are also pivotal for the ideas presented in this book. The data show that genes are like blueprints or recipes, providing a template for propelling development forward to some targeted end point. The mechanism could be simple: If a gene produces an enzyme, then all that is required is that a switch mechanism operates to turn on when feedback informs that insufficient enzyme exists in the system and to turn off when feedback informs that the deficit has been corrected. Homeostatic mechanisms

Figure 3.5: Steady March Toward Twin Concordance



At birth the MZ twins are less concordant for height (right panel) than are DZ twins, perhaps due to monochorionicity and competition effects during gestation. By 3 months, however, the MZ concordance for height has moved sharply upward and thereafter moves incrementally upward until reaching R - 0.94 at 6 years. By contrast, the DZ pairs dropped from an initially high value of R = 0.78 at birth until they reached an intermediate value of R - 0.57 at 6 years. The comparative data for mental ability starting at 3 months (left panel) is less pronounced, but still clear. Adapted from R. S. Wilson (1984, p. 155, Figure 4).

are well established in the physiology and psychology of motivation (Toates, 1986).

"Catch-up growth" following deficits caused by malnutrition or illness also demonstrates that development requires constant self-corrections until some targeted end state is reached. Deprived children subsequently develop very rapidly to regain the growth trajectory they would have been on if the diversion had not occurred, following which growth slows down and development proceeds at the normal rate (Tanner, 1978). Developmental processes are constantly involved in a match-to-model process with an inherent growth equation.

Other genetic timing mechanisms include the age at peak height velocity, age at menarche, age of development of secondary sex characteristics, age of first sexual intercourse, and age of menopause. In all of these, identical twins, whether reared apart or together show greater concordance than dizygotic twins raised apart or together.

Gene-Culture Correlation

In *Genes, Mind and Culture,* Lumsden and Wilson (1981) outline the coevolutionary process between genes and culture and how epigenetic rules guide psychological development from sensory filtering through perception to feature evaluation and decision making. In *Genes, Culture and Personality,* Eaves, Eysenck, and Martin (1989) describe some of the individual difference variables that play themselves out in social behavior.

The concept of geneotype-environment correlation, originally proposed by Plomin, DeFries, and Loehlin (1977), has been developed by Sandra Scarr (Scarr & McCartney, 1983; Scarr, 1992). When there is a correlation between genetic and environmental effects it means that people are exposed to environments on the basis of their genetic propensities. For example, if intelligence is heritable, then gifted children will have, on average, intellectually gifted parents who provide them with an intellectual environment as well as genes for intelligence. Alternatively, the individual might be picked out as gifted and given special opportunities. Even if no one does anything about the individual's talent, the individual might gravitate toward intellectual environments. These three scenarios represent three types of gene-environment correlation: passive, reactive, and active, respectively.

An example of how genotypes drive experience, or of active genotype-environment correlation, was provided in an analysis of television effects by Rowe and Herstand (1986). Although same-sex siblings were found to resemble one another in their exposure to violent programs, it was the most aggressive sibling who (1) identified most with aggressive characters, and (2) viewed the consequences of the aggression as positive. Within-family studies of delinquents find that both IQ and temperament distinguishes delinquent siblings from those who are nondelinquent (Hirschi & Hindelang, 1977; Rowe, 1986). It is not difficult to imagine how intellectually and temperamentally different siblings acquire alternate patterns of social responsibility. Nor to see how children with higher IQs may accumulate better language skills and greater knowledge of more diverse areas than their lower IQ peers, and how some personality types gravitate to one rather than an alternative work environment.

Genetic canalization provides an explanation for the important finding, mentioned earlier, that common family environment has little impact on longer-term intellectual and personality development. Such factors as social class, family religion, parental values, and child-rearing styles are not found to have a common effect on siblings (Plomin & Daniels, 1987). Within the same upbringing environment, the more belligerent sibling observationally learns the items from the parents' aggressive repertoire, whereas the more nurturant sibling selects from the parents' altruistic responses. As Scarr (1992) highlights, the unit of environmental transmission is not so much the family as the microenvironment within the family, and this is largely the construction of individuals in the ways "they evoke responses from others, actively select or ignore opportunities, and construct their own experiences" (p. 14).

That genes guide experience is shown in studies examining variables more often considered as environmental causes than as genetic outcomes (reviewed by Plomin & Bergeman, 1991). Thus, genes influence not only the amount of television watched but also the nurturance of parents, the nature of the peer group, the sense of well-being experienced and a host of life history events. For genetic reasons parents initiate more similar actions to MZ twins than they do to DZ twins while MZ twins reared apart retrospectively recall the warmth of their unlike environments more similarly than do their DZ counterparts. The heritability of family environment measures is about 25 percent.

Both twin and adoption studies show genetic influence on sibling gravitations to college-oriented, delinquent, or popular peer groups (Daniels & Plomin, 1985; Rowe & Osgood, 1984). Although television viewing has been used as an environmental measure in thousands of studies, the correlation for the amount of television viewing for biological siblings is 0.48, whereas the correlation for adoptive siblings is 0.26, suggesting substantial genetic influence (Waller, Kojetin, Bouchard, Lykken, & Tellegen, 1990). The Swedish Adoption Twin Study of Aging showed that life events are heritable. For reared apart monozygotic twins (MZA) the correlation for controllable life events (e.g., serious conflict) is 0.54 and for uncontrollable life events (e.g., serious illness) it is 0.22. The typical heritability for life events is 40 percent (Plomin, Lichtenstein, Pedersen, McClearn, & Nesselroade, 1990).

Dramatic evidence of how genes influence exposure to trauma comes from ongoing studies of combat experience in twin pairs who served in the U.S. military during the Vietnam era (1965-1975). The Vietnam Era Twin Registry consists of 4,042 male-male twin pairs who were born between 1939 and 1957 and served on active duty in the U.S. armed forces. A 35 percent heritability was found on the probability of serving in Vietnam, a 47 percent heritability for exposure to combat, and a 54 percent heritability for receiving a combat decoration (Lyons et al., 1993). Subsequent liability for experiencing symptoms associated with posttraumatic stress disorder had a heritability of about 30 percent (True et al., 1993).

The potential effects of epigenetic rules on behavior and society may go well beyond ontogeny. Through cognitive phenotypes and group action, altruistic inclinations may find their expression in charities and hospitals, creative and instructional dispositions in academies of learning, martial tendencies in institutes of war, and delinquent tendencies in social disorder. Thus, genes may have extended effects beyond the body in which they reside, biasing individuals toward the production of particular cultural systems (Rushton, Littlefield, & Lumsden, 1986).

That genotypes seek out maximally conducive environments is well illustrated by findings that aggressive and altruistic individuals select similar others with whom to associate, not only as friends but also as marriage partners (Huesmann, Eron, Lefkowitz, & Walder, 1984; Rowe & Osgood, 1984). As discussed in the next chapter, the epigenetic rules that bias people to choose each other on the basis of similarity may be particularly fine-tuned, inclining individuals to assort most according to the more genetically influenced of sets of attributes.

4

Genetic Similarity Theory

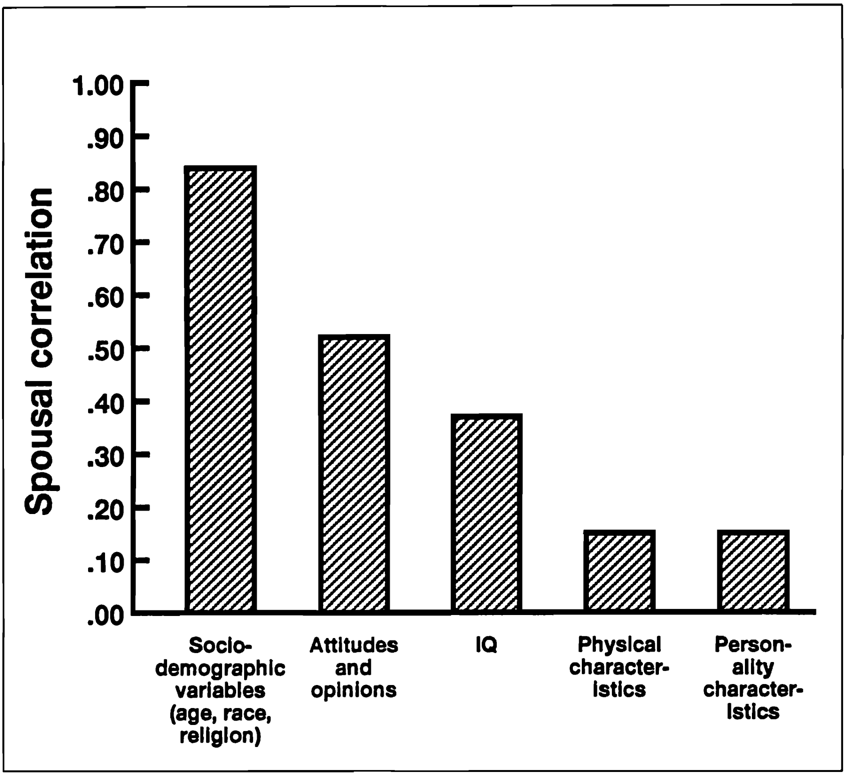
Choosing mates and other social partners are among the most important decisions individuals make affecting their social environment. The tendency is to choose similarity. For example, spouses tend to resemble each other in such characteristics as age, ethnic background, socioeconomic status, physical attractiveness, religion, social attitudes, level of education, family size and structure, intelligence, and personality.

As can be seen in Figure 4.1, the median assortative mating coefficient for standardized IQ measures averaged over 16 studies involving 3,817 pairings is 0.37 (Bouchard & McGue, 1981). Correlations tend to be higher for opinions, attitudes, and values (0.40 to 0.70) and lower for personality traits and personal habits (0.02 to 0.30 with a mean of about 0.15). Spouses also resemble each other in a variety of physical features. Rushton, Russell, and Wells (1985) combined anthropometric data from a wide range of studies and found low but positive correlations for more than 60 different measures, including height (0.21), weight (0.25), hair color (0.28), eye color (0.21), chest breadth (0.20), and interpupillary breadth (0.20)—even curious outliers like 0.40 for ear lobe length, 0.55 for wrist circumference, and 0.61 for length of middle finger.

Most explanations of the role of similarity in human relationships focus on immediate, environmental effects, for example, their reinforcement value (Byrne, 1971). Recent analyses, however, suggest that genetic influences may also be involved. According to "genetic similarity theory" (Rushton, Russell, and Wells, 1984; Rushton, 1989c), genetic likeness exerts subtle effects on a variety of relationships and has implications for the study of social behavior in small groups and even in large ones, both national and international.

In this chapter, genetic similarity theory is introduced in connection with altruism. It is proposed that genetically similar people tend to seek one another out and to provide mutually supportive environments such as marriage, friendship, and social groups. This may represent a biological factor underlying ethnocentrism and group selection.

Figure 4.1: Spousal Resemblance on a Variety of Characteristics



Spouses are most similar for sociodemographic variables such as age, race, and religion, next most for a variety of social attitudes and opinions, then for IQ, and finally for physical and personality characteristics. On all dimensions, spouses are more similar than is expected by chance.

The Paradox of Altruism

Altruism has long posed a serious dilemma for theories of human nature. Defined as behavior carried out to benefit others, in extreme form altruism involves self-sacrifice. In humans altruistic behavior ranges from everyday kindness, through sharing scarce resources, to giving up one's life to save others. In nonhuman animals, altruism includes parental care, warning calls, cooperative defense, rescue behavior, and food sharing; it may also involve self-sacrifice. The poisonous sting of a honeybee is an adaptation against hive robbers. The recurved barbs facing backward from the sharp tip cause the whole sting to be wrenched out of the bee's body, along with some of the bee's vital internal organs. These barbs have been described as instruments of altruistic self-sacrifice.

As recognized by Darwin (1871), however, a genetic basis for altruism would represent a paradox for theories of evolution: How could altruism evolve through "survival of the fittest" when, on the face of it, altruistic behavior diminishes personal fitness? If the most altruistic members of a group sacrifice themselves for others, they run the risk of leaving fewer offspring to pass on the very genes that govern the altruistic behavior. Hence, altruism would be selected against, and selfishness would be selected for.

The resolution of the paradox of altruism is one of the triumphs that led to the new synthesis called sociobiology. By a process known as kin selection, individuals can maximize their inclusive fitness rather than only their individual fitness by increasing the production of successful offspring by both themselves and their genetic relatives (Hamilton, 1964). According to this view, the unit of analysis for evolutionary selection is not the individual organism but its genes. Genes are what survive and are passed on, and some of the same genes will be found not only in direct offspring but in siblings, cousins, nephews/nieces, and grandchildren. If an animal sacrifices its life for its siblings' offspring, it ensures the survival of common genes because, by common descent, it shares 50 percent of its genes with each sibling and 25 percent with each sibling's offspring.

Thus, the percentage of shared genes helps determine the amount of altruism displayed. Social ants are particularly altruistic because of a special feature of their reproductive system that gives them 75 percent of their genes in common with their sisters. Ground squirrels emit more warning calls when placed near relatives than when placed near nonrelatives; "helpers" at the nest tend to be related to one member of the breeding pair; and when social groups of monkeys split, close relatives remain together. When the sting of the honey bee is torn from its body, the individual dies, but the bee's genes, shared in the colony of relatives, survive.

Thus, from an evolutionary perspective, altruism is a means of helping genes to propagate. By being most altruistic to those with whom we share genes we help copies of our own genes to replicate. This makes "altruism" ultimately "selfish" in purpose. Promulgated in the context of animal behavior this idea became known as "kin-selection" and provided a conceptual breakthrough by redefining the unit of analysis away from the individual organism to his or her genes, for it is these that survive and are passed on.

Another way sociobiologists have suggested that altruism could evolve is through reciprocity. Here there is no need for genetic relatedness; performing an altruistic act need only lead to an altruistic act in return. For example, two male baboons in coalition are able to supplant a single male consorting with a female; on any particular occasion, one of the two males copulates while the other, the "altruist," does not. On a later occasion when another female is in estrus, the same two males are likely to get together again, but this time their roles are reversed, the former beneficiary now assuming the role of the altruist.

Detecting Genetic Similarity

In order to pursue a strategy of directing altruism toward kin, the organism must be able to recognize degrees of relatedness. There is clearly no such thing as "genetic extra-sensory perception." For individuals to direct altruism selectively to genetically similar individuals, they must respond to phenotypic cues. This is typically accomplished by detecting similarities between self and others in physical and behavioral cues. Four processes have been suggested by which animals recognize relatives: (a) innate feature detectors, (b) matching on appearance, (c) familiarity, and (d) location. They are not mutually exclusive. If there are evolutionary advantages to be gained from the ability to detect genetic similarity, all the mechanisms may be operative.

Innate Feature Detectors

Individuals may have "recognition alleles" that control the development of innate mechanisms allowing them to detect genetic similarity in strangers. Dawkins (1976) suggested a thought experiment to illustrate how this could come about, known as the "green beard effect." In this theory, a gene has two effects: It causes individuals who have it to (1) grow a green beard, and (2) behave altruistically toward green-bearded individuals. The green beard serves as a recognition cue for the altruism gene. Altruism could therefore occur without the need for individuals to be directly related.

Matching on Appearance

The individual may be genetically guided to learn its own phenotype, or those of its close kin, and then to match new, unfamiliar individuals to the template it has learned—for example, Dawkins's (1982) "armpit effect." Individuals that smell (or look or behave) like oneself or one's close kin could be distinguished from those that smell (or look or behave) differently. This mechanism would depend on the existence of a strong correlation between genotype and phenotype.

Familiarity or Association

Preferences may also depend on learning through social interaction. This may be the most common means of kin recognition in nature. Individuals that are reared together are more likely to be kin than non-kin. This may also involve a more general mechanism of short-term preference formation. Zajonc (1980) has shown experimentally that the more one is exposed to a stimulus, the more one prefers it. Based on studies of Japanese quail and of humans, respectively, Bateson (1983) and van den Berghe (1983) have suggested that sexual preferences may be established early in life through an imprinting-like process.

Location

The fourth kin recognition mechanism depends on a high correlation between an individual's location and kinship. The rule states: "If it's in your nest, it's yours." Where an individual is and whom the individual encounters can also be based on similar genes—for example, if parents exert discriminatory influence on where and with whom their offspring interact.

Kin Recognition in Animals

There is dramatic experimental evidence that many animal species recognize genetic similarity. Greenberg (1979) showed that the sweat bee, *Lasioglossum zephyrum,* can discriminate between unfamiliar conspecifics of varying degrees of relatedness. Guard bees of this species block the nest to prevent intruders from entering. In this study, bees were first bred for 14 different degrees of genealogical relationship with each other. They were then introduced near nests that contained sisters, aunts, nieces, first cousins, or more distantly related bees. In each case the guard was expected to make a binary decision—either permitting the bee that was introduced to pass or actively preventing it from doing so. There was a strong linear relationship ($r = 0.93$) between the ability to pass the guard bee and the degree of genetic relatedness. The greater the degree of genetic similarity, the greater the proportion of bees that were allowed to enter the hive. The guard bees appear to be able to detect the degree of genetic similarity between themselves and the intruder. Subsequent kin recognition studies have shown that the honeybee, *Apis mellifera,* is able to discriminate between full and half sisters raised in neighboring cells.

There is also evidence that the ability to detect genetic similarity exists in various species of plants, tadpoles, birds, rodents, and rhesus monkeys. In studies of the frog *Rana cascadae,* by Blaustein and O'Hara (1982), tadpoles were separated before hatching and reared in isolation. The individual tadpoles were then placed in a rectangular tank with two end compartments created by plastic mesh. Siblings were placed in one compartment and nonsiblings in the other. The separated tadpoles spent more time at the siblings' end of the tank. Because the tadpoles were separated as embryos and raised in complete isolation, an ability to detect genetic similarity is implicated.

Mammals are also able to detect degrees of genetic relatedness (Fletcher & Michener, 1987). For example, Belding's ground squirrels produce litters that contain both sisters and half sisters. Despite the fact that they shared the same womb and inhabit the same nest, full sisters fight less often than half sisters, come to each other's aid more, and are less prone to chase one another out of their home territory. Similar findings have been noted among captive multimale, multifemale groups of rhesus monkeys growing up outdoors in large social troops. Adults of both sexes are promiscuous, but mothers appear to chase paternal half siblings away from their infants less often than they do unrelated juveniles, and males (despite promiscuity) appear to "recognize" their own offspring, for they treat them better (Suomi, 1982). In the preceding examples, the degree of genetic relatedness was established by blood tests. Walters (1987) has reviewed well-replicated data from several primate species indicating that grooming, alliance formation, cooperative defense, and food sharing occur more readily in kinship groups.

Kin Recognition in Humans

Building on the work of Hamilton (1964), Dawkins (1976), Thiessen and Gregg (1980), and others, the kin-selection theory of altruism was extended to the human case. Rushton et al. (1984) proposed that, if a gene can better ensure its own survival by acting so as to bring about the reproduction of family members with whom it shares copies, then it can also do so by benefiting any organism in which copies of itself are to be found. This would be an alternative way for genes to propagate themselves. Rather than merely protecting kin at the expense of strangers, if organisms could identify genetically similar organisms, they could exhibit altruism toward these "strangers" as well as toward kin. Kin recognition would be just one form of genetic similarity detection.

The implication of genetic similarity theory is that the more genes are shared by organisms, the more readily reciprocal altruism and cooperation should develop because this eliminates the need for strict reciprocity. In order to pursue a strategy of directing altruism toward similar genes, the organism must be able to detect genetic similarity in others. As described in the previous section, four such mechanisms by which this could occur have been considered in the literature.

Humans are capable of learning to distinguish kin from non-kin at an early age. Infants can distinguish their mothers from other women by voice alone at 24 hours of age, know the smell of their mother's breast before they are six days of age, and recognize a photograph of their mother when they are 2 weeks old. Mothers are also able to identify their infants by smell alone after a single exposure at 6 hours of age, and to recognize their infant's cry within 48 hours of birth (see Wells, 1987, for review).

Human kin preferences also follow lines of genetic similarity. For example, among the Ye'Kwana Indians of South America, the words "brother" and "sister" cover four different categories ranging from individuals who share 50 percent of their genes (identical by descent) to individuals who share only 12.5 percent of their genes. Hames (1979) has shown that the amount of time the Ye'Kwana spend interacting with their biological relatives increases with their degree of relatedness, even though their kinship terminology does not reflect this correspondence.

Anthropological data also show that in societies where certainty of paternity is relatively low, males direct material resources to their sisters' offspring (to whom their relatedness is certain) rather than to their wives' offspring (Kurland, 1979). An analysis of the contents of 1,000 probated wills reveals that after husbands and wives, kin received about 55 percent of the total amount bequeathed whereas non-kin received only about 7 percent; offspring received more than nephews and nieces (Smith, Kish, & Crawford, 1987).

Paternity uncertainty also exerts predictable influence. Grandparents spend 35 to 42 percent more time with their daughters' children than with their sons' children (Smith, 1981). Following a bereavement they grieve more for their daughters' children than for their sons' children (Littlefield & Rushton, 1986). Family members feel only 87 percent as close to the fathers' side of the family as they do to the mothers' side (Russell & Wells, 1987). Finally, mothers of newborn children and her relatives spend more time commenting on resemblances between the baby and the putative father than they do about the resemblance between the baby and the mother (Daly & Wilson, 1982).

When the level of genetic similarity within a family is low, the consequences can be serious. Children who are unrelated to a parent are at risk; a disproportionate number of battered babies are stepchildren (Lightcap, Kurland, & Burgess, 1982). Children of preschool age are 40 times more likely to be assaulted if they are stepchildren than if they are biological children (Daly & Wilson, 1988). Also, unrelated people living together are more likely to kill each other than are related people living together. Converging evidence shows that adoptions are more likely to be successful when the parents perceive the child as similar to them (Jaffee & Fanshel, 1970).

Spouse Selection

A well-known phenomenon that is readily explained by genetic similarity theory is positive assortative mating, that is, the tendency of spouses to be nonrandomly paired in the direction of resembling each other in one or more traits more than would be expected by chance. Although the data shown in Figure 4.1 are widely accepted, it is less well known that spouses also resemble each other in socially undesirable characteristics, including aggressiveness, criminality, alcoholism, and psychiatric disorders such as schizophrenia and the affective disorders. Although alternative reasons can be proposed for this finding, such as losing the competition for the most attractive and healthiest mates (Burley, 1983), it does suggest that the tendency to seek a similar partner may override considerations such as mate quality and individual fitness.

A study of cross-racial marriages in Hawaii found more similarity in personality test scores among males and females who married across ethnic groups than among those marrying within them (Ahern, Cole, Johnson, & Wong, 1981). The researchers posit that, given the general tendency toward homogamy, couples marrying heterogamously with respect to ethnicity tend to "make up" for this dissimilarity by choosing spouses more similar to themselves in other respects than do persons marrying within their own ethnic group.

It could be argued that human assortative mating has nothing to do with questions about genetic similarity, that it results only from common environmental influences. This view cannot easily account for the incidence of assortative mating in other animals ranging from insects to birds to primates, in laboratory as well as in natural settings (Fletcher & Michener, 1987; Thiessen & Gregg, 1980). Assortative mating also occurs in many species of plants (Willson & Burley, 1983). To have evolved independently in such a wide variety of circumstances, assortative mating must confer substantial advantage. In humans these may include (1) increased marital stability, (2) increased relatedness to offspring, (3) increased within-family altruism, and (4) greater fecundity.

The upper limit on the fitness-enhancing effect of assortative mating for similarity occurs with incest. Too much genetic similarity between mates increases the chances that harmful recessive genes may combine. The negative effects of "inbreeding depression" have been demonstrated in many species, including humans (Jensen, 1983; Thiessen & Gregg, 1980). As a result, many have hypothesized that the "incest taboo" has an evolutionary basis, possibly mediated through negative imprinting on intimate associates at an early age (van den Berghe, 1983). Optimal fitness, then, may consist in selecting a mate who is genetically similar but not actually a relative. Van den Berghe (1983) speculates that the ideal percentage of relatedness is 12.5 percent identical by descent, or the same as that between first cousins. Other animal species also avoid inbreeding. For example, several experiments have been carried out with Japanese quail, birds that, although promiscuous, proved particularly sophisticated. They preferred first cousins to third cousins, and both of these relatives to either unrelated birds or siblings, thus avoiding the dangers of too much or too little inbreeding (Bateson, 1983).

Blood Tests of Sexually Interacting Couples

To directly test the hypothesis that human mating follows lines of genetic similarity, Rushton (1988a) examined blood antigen analyses from nearly 1,000 cases of disputed paternity. Seven polymorphic marker systems—ABO, Rhesus (Rh), MNSs, Kell, Duffy (Fy), Kidd (Jk), and HLA—at 10 loci across 6 chromosomes were examined in a sample limited to people of North European appearance (judged by photographs kept for legal identification). Such blood group differences provide a biological criterion sufficient to identify more than 95 percent of true relatedness in situations of paternal dispute (Bryant, 1980), and to reliably distinguish between fraternal twins raised together (Pakstis, Scarr-Salapatek, Elston, & Siervogel, 1972). They provide a less precise but still useful estimate of genetic distance among unrelated individuals.

Sexually interacting couples were found to share about 50 percent of measured genetic markers, partway between mothers and their offspring, who shared 73 percent, and randomly paired individuals from the same sample, who shared 43 percent (all comparisons were significantly different, $p < 0.001$). In the cases of disputed paternity, genetic similarity predicted whether the male was the true father of the child. Males not excluded from paternity were 52 percent similar to their partners whereas those excluded were only 44 percent similar ($p < 0.001$).

TABLE 4.1
Percentage of Genetic Similarity in 4 Types of Human Relationships, Based on 10 Blood Loci

Relationship	Number of pairs	Mean	Standard deviation	Range
Mother-offspring	100	73	9	50-88
Sexually interacting adults (male not excluded from paternity)	799	52	12	17-90
Sexually interacting adults (male excluded from paternity)	187	44	12	15-74
Randomly paired male-female dyads	200	43	14	11-81

Note. From Rushton (1988a, p. 331, Table 1). Copyright by Elsevier Science Publishing. Reprinted with permission.

Heritability Predicts Spousal Similarity

If people choose each other on the basis of shared genes, it should be possible to demonstrate that interpersonal relationships are influenced more by genetic similarity than by similarity attributable to a similar environment. A strong test of the theory is to observe that positive assortative mating is greater on the more heritable of a set of homogeneous items. This prediction follows because more heritable items better reflect the underlying genotype.

Stronger estimates of genetic influence have been found to predict the degree of matching that marriage partners have engaged in on anthropometric, attitudinal, cognitive, and personality variables. Thus, Rushton and Nicholson (1988) examined studies using 15 subtests from the Hawaii Family Study of Cognition and 11 subtests from the Wechsler Adult Intelligence Scale. With the Hawaii battery, genetic estimates from Koreans in Korea correlated positively with those from Americans of Japanese and European ancestry (mean $r = 0.54, p < 0.01$). With the Wechsler scale, estimates of genetic influence correlated across three samples with a mean $r = 0.82$.

Consider the data in Table 4.2 showing heritabilities predicting the similarity of marriage partners. Note, though, that many of the estimates of genetic influence in this table are based on calculations of midparent-offspring regressions using data from intact families, thereby combining genetic and shared-family environmental effects. The latter source of variance, however, is surprisingly small (Plomin & Daniels, 1987) and has not been found to add systematic bias. Nonetheless, it should be borne in mind that many of the estimates of genetic influence shown in Table 4.2 were calculated in this way.

Reported in Table 4.2 is a study by Russell, Wells, and Rushton (1985) who used a within-subjects design to examine data from three studies reporting independent estimates of genetic influence and assortative mating. Positive correlations were found between the two sets of measures ($r = 0.36, p < 0.05$, for 36 anthropometric variables; $r = 0.73, p < 0.10$, for 5 perceptual judgment variables; and $r = 0.44, p < 0.01$, for 11 personality variables). In the case of the personality measures, test-retest reliabilities over a three-year period were available and were not found to influence the results.

Another test of the hypothesis reported in Table 4.2 was made by Rushton and Russell (1985) using two separate estimates of the heritabilities for 54 personality traits. Independently and when combined into an aggregate, they predicted similarity between spouses ($rs = 0.44$ and $0.55, ps < 0.001$). Rushton and Russell (1985) reviewed other reports of similar correlations, including Kamin's (1978) calculation of $r = 0.79$ ($p < 0.001$) for 15 cognitive tests and DeFries et al.'s (1978) calculation of $r = 0.62$ ($p < 0.001$) for 13 anthropometric variables. Cattell (1982) too had noted that between-spouse correlations tended to be lower for the less heritable, more specific cognitive abilities (tests of vocabulary and arithmetic) than for the more heritable general abilities (*g*, from Progressive Matrices).

TABLE 4.2
Summary of Studies on Relation Between Heritability of Traits and Assortive Marriage

Study	Sample	Test type	Heritability	Correlation with assortment
Kamin (1978)	739 European-American families in Hawaii	15 subtests from HFSC	Midparent-midchild regression	.79***
DeFries et al. (1978)	73 European-American families in Hawaii	13 anthropometric variables from HFSC	Midparent-midchild regression	.62***
Cattell (1982)	Numerous twin and family studies	Cognitive abilities, specific and general	Multiple abstract variance analysis	Higher on the more heritable traits; magnitudes not reported
Russell et al. (1985)	Asians and North Africans	5 perceptual judgments	Parent-offspring correlation corrected for assortative mating	.73***
	Belgians	36 anthropometric variables	Parent-offspring correlation corrected for assortative mating	.36*
	European-Americans	11 scales from MMPI	Midparent-offspring correlation	.71**
Rushton & Russell (1985)	100-669 families in Hawaii (ethnicity not specified)	54 personality scales	Parent-offspring regression	.44***
			Doubled sibling-sibling correlation	.46***
			Composite of both above	.55***
Rushton & Nicholson (1988)	871 European-American families in Hawaii	15 subtests from HFSC	Midparent-offspring regression	Intragroup .71**
				Intergroup .43+
	311 Japanese-American families in Hawaii	15 subtests from HFSC	Midparent-offspring regression	Intragroup .13
				Intergroup .47*
	209 families in Republic of Korea	14 subtests from HFSC	Midparent-offspring regression	Intragroup .53*
				Intergroup .18
	55 Canadians	11 subtests from WAIS	Midparent-offspring regression	Intragroup .23
				Intergroup .60*
	240 adolescent twins in Kentucky	11 subtests from WAIS	Holsinger's H formula	Intragroup –
				Intergroup .68*
	120 Minnesota families	4 subtests from WAIS plus total score	Parent-offspring correlation corrected for assortative mating	Intragroup .68
				Intergroup .64

Note. From Rushton (1989c, p. 509, Table 3). Copyright 1989 by Cambridge University Press. Reprinted with permission.
HFSC = Hawaii Family Study of Cognition; MMPI = Minnesota Multiphasic Personality Inventory; WAIS = Weschler Adult Intelligence Scale
*** $p < .001$; ** $p < .01$; * $p < .05$; $^{+}p < .10$.

Also shown in Table 4.2 are analyses carried out using a between-subjects design. Rushton and Nicholson (1988) analyzed data from studies using 15 subtests from the Hawaii Family Study of Cognition (HFSC) and 11 subtests from the Wechsler Adult Intelligence Scale (WAIS); positive correlations were calculated within and between samples. For example, in the HFSC, parent-offspring regressions (corrected for reliability) using data from Americans of European ancestry in Hawaii, Americans of Japanese ancestry in Hawaii, and Koreans in Korea correlated positively with between-spouse similarity scores taken from the same samples and with those taken from two other samples: Americans of mixed ancestry in California and a group in Colorado. The overall mean *r* was 0.38 for the 15 tests. Aggregating across the numerous estimates to form the most reliable composite gave a substantially better prediction of mate similarity from the estimate of genetic influence ($r = 0.74$, $p < 0.001$). Similar results were found with the WAIS. Three estimates of genetic influence correlated positively with similarities between spouses based on different samples, and in the aggregate they predicted the composite of spouse similarity scores with $r = 0.52$ ($p < 0.05$).

Parenthetically, it is worth noting that statistically controlling for the effects of *g* in both the HFSC and the WAIS analyses led to substantially lower correlations between estimates of genetic influence and assortative mating, thus offering support for the view that marital assortment in intelligence occurs primarily with the *g* factor. The *g* factor tends to be the most heritable component of cognitive performance measures (chap. 3).

Intrafamilial Relationships

One consequence of genetic similarity between spouses is a concomitant increase of within-family altruism. Several studies have shown that not only the occurrence of relationships but also their degree of happiness and stability can be predicted by the degree of matching on personal attributes (Bentler & Newcombe, 1978; Cattell & Nesselroade, 1967; Eysenck & Wakefield, 1981; Hill, Rubin & Peplau, 1976; Meyer & Pepper, 1977; Terman & Buttenwieser, 1935a, 1935b). Because many of the traits on the basis of which spouses choose each other are about 50 percent heritable, it follows that the matching results in genetic similarity. Whereas each trait may add only a tiny amount to the total genetic variance shared by spouses, the cumulative effects could be considerable.

The quality of marriage of 94 couples was examined in a study by Russell and Wells (1991). The couples were also given the Eysenck Personality Questionnaire. On average, couples showed a significant tendency to assort on Eysenck Personality Questionnaire items. Likewise, on average, similarity between spouses at the item level was predictive of a good marriage. The degree to which similarity on an item predicted a good marriage correlated weakly but significantly ($p < 0.05$) with the heritability of the item, as estimated independently by Neale, Rushton, & Fulker (1986). Thus, some support was found for the hypothesis that quality of marriage depends on genetic similarity.

A related prediction can be made about parental care of offspring that differ in similarity. Sibling differences within families have often been overlooked as a topic of research. Positive assortative mating for genetically based traits may make some children genetically more similar to one parent or sibling than to another. For example, if a father gives his child 50 percent of his genes, 10 percent of them shared with the mother, and the mother gives the child 50 percent of her genes, 20 percent shared with the father, then the child will be 60 percent similar to the mother and 70 percent similar to the father. Genetic similarity theory predicts that parents and siblings will favor those who are most similar.

Littlefield and Rushton (1986) tested this hypothesis in a study of bereavement following the death of a child. It was predicted that the more similar the parent perceived the child to be, the greater would be that parent's grief experience. (Perceived similarity with offspring is correlated with genetic similarity measured by blood tests [Pakstis et al., 1972].) Respondents picked which side of the family the child "took after" more, their own or their spouse's. Spouses agreed 74 percent on this question. Both mothers and fathers grieved more intensely for children perceived as resembling their side of the family.

Other evidence of within-family preferences comes from a review by Segal (1993) of feelings of closeness, cooperation, and altruism in twin pairs. Compared with fraternal twins, identical twins worked harder for their co-twins on tasks, maintained greater physical proximity, expressed more affection, and suffered greater loss following bereavement.

A Genetic Basis for Friendship

Friendships also appear to be formed on the basis of similarity. This assumption holds for similarity as perceived by the friends, and for a variety of objectively measured characteristics, including activities, attitudes, needs, personality, and, also, anthropometric variables. Moreover, in the experimental literature on who likes whom, and why, one of the most influential variables is perceived similarity. Apparent similarity of personality, attitudes, or any of a wide range of beliefs has been found to generate liking in subjects of varying ages and from many different cultures.

According to genetic similarity theory, there is a genetic basis to friendship and friendship is one of the mechanisms that leads to altruism. Many social psychological studies show that altruism increases with the benefactor's actual or perceived similarity to the beneficiary. For example, Stotland (1969) had subjects observe a person who appeared to be receiving electric shocks.

When Stotland manipulated the subjects' beliefs about their similarity to that person, perceived similarity was correlated with reported empathy as well as with physiological skin conductance measures of emotional responsiveness. Krebs (1975) has found that apparent similarity not only increases physiological correlates of emotion such as skin conductance, vasoconstriction, and heart rate, but also the willingness to reward the victim. In young children, the frequency of social interactions between friends corresponds closely to the frequency of acts of altruism between them (Strayer, Wareing, & Rushton, 1979).

Data show that the tendency to choose similar individuals as friends is genetically influenced. In a study of delinquency among 530 adolescent twins by Rowe and Osgood (1984), path analysis revealed not only that antisocial behavior was about 50 percent heritable, but that the correlation of 0.56 between the delinquency of an individual and the delinquency of his friends was mediated genetically, that is, that adolescents genetically disposed to delinquency were also genetically inclined to seek each other out for friendship. In a study of 396 adolescent and young adult siblings from both adoptive and nonadoptive homes, Daniels and Plomin (1985) found that genetic influences were implicated in choice of friends: Biological siblings were more similar to each other in the types of friends they had than were adoptive siblings.

Blood Tests among Friends

I (Rushton, 1989d) used blood tests to determine whether friends are more similar to each other using methods parallel to those used in the study of heterosexual partners. Seventy-six long-term, nonrelated, nonhomosexual male Caucasian friendship pairs ranging in age from 18 to 57 years were recruited by advertisements from the general community. A control group was formed by randomly pairing individuals from the sample. At the testing session, a 12- to 14-milliliter blood sample was drawn from each person.

The best friends were 54 percent similar to each other using 10 loci from 7 polymorphic blood systems—ABO, Rhesus (Rh), MNSs, P, Duffy (Fy), Kidd (Jk), and HLA. An equal number of randomly chosen pairs were only 48 percent similar ($t[150] = 3.13$, $p < 0.05$). Stratification effects were unlikely because within-pair differences in age, education, and occupation did not correlate with the blood similarity scores (mean $r = -0.05$).

Heritability and Friendship Similarity

I also examined similarity on several questionnaire items chosen because estimates had been calculated of the degree of genetic influence on the various components. For example, 36 heritabilities were available with respect to 50 social attitude items (see Table 4.3) from data on 3,810 Australian twin pairs (Martin et al., 1986). For 90 items from the Eysenck Personality Questionnaire, two independent sets of heritability estimates were available for a

TABLE 4.3
Heritability Estimates and Similarity Between Friends on Conservatism Items (N = 76)

Item	Heritability estimate	Friendship similarity score	Test-retest reliability	Similarity score corected for unreliability	Similarity score corrected for age, education, and occupation
1. Death penalty	.51	.28	.87	.30	.38
2. Evolution theory	–	.08	.95	.08	.20
3. School uniforms	–	.20	.99	.20	.42
4. Striptease shows	–	.13	.97	.13	.24
5. Sabbath observance	.35	.08	.91	.08	.09
6. Hippies	.27	.03	.97	.03	.15
7. Patriotism	–	.10	.89	.11	.13
8. Modern art	–	.02	.93	.02	.09
9. Self-denial	.28	.08	.79	.09	.12
10. Working mothers	.36	.07	.83	.08	.13
11. Horoscopes	–	.23	.92	.24	.20
12. Birth control	–	.04	-.01	.00	.19
13. Military drill	.40	.10	.96	.10	.22
14. Coeducation	.07	-.05	.74	-.06	-.05
15. Divine law	.22	.25	.82	.28	.20
16. Socialism	.26	.08	.83	.09	.14
17. White superiority	.40	.22	.68	.27	.11
18. Cousin marriage	.35	.04	.89	.04	.24
19. Moral training	.29	.07	.77	.08	.16
20. Suicide	–	.08	.86	.09	.08
21. Chaperones	–	.00	.94	.00	.11
22. Legalized abortion	.32	.13	.96	.13	.29
23. Empire building	–	.02	.85	.02	.05
24. Student pranks	.30	-.02	.88	-.02	.07
25. Licensing law	–	-.20	.85	-.22	-.13
26. Computer music	.26	.02	.91	.02	.16
27. Chastity	–	.00	.76	.00	.13
28. Fluoridation	.34	.08	.86	.09	.04
29. Royalty	.44	.15	.92	.16	.16
30. Women judges	.27	.03	1.00	.03	.08
31. Conventional clothes	.35	.31	.83	.34	.29
32. Teenage drivers	.26	.02	.78	.02	.20
33. Apartheid	.43	.14	.69	.17	.10
34. Nudist camps	.28	.08	.85	.09	-.09
35. Church authority	.29	.08	.86	.09	.21
36. Disarmament	.38	.07	.96	.07	.19
37. Censorship	.41	.03	.81	.03	.10
38. White lies	.35	.06	.76	.07	-.01
39. Caning	.21	.14	.83	.15	.11
40. Mixed marriage	.33	.25	.79	.28	.29
41. Strict rules	.31	.25	.81	.28	.19
42. Jazz	.45	.42	.77	.48	.40
43. Straitjackets	.09	.00	.85	.00	.00
44. Casual living	.29	.18	.63	.23	.55
45. Learning Latin	.26	.03	.97	.03	.10
46. Divorce	.40	.03	.92	.03	.09
47. Inborn conscience	–	.20	.70	.24	-.11
48. Colored immigration	–	.06	.88	.06	.10
49. Bible truth	.25	.30	.95	.31	.47
50. Pajama parties	.08	.08	.91	.08	.24

Note. From Rushton (1989d, p. 365, Table 1). Copyright 1989 by Elsevier Science Publishing. Reprinted with permission.

total of 81 of the items, one set from 3,810 Australian twin pairs (Jardine, 1985), and the other set from 627 British twin pairs (Neale et al., 1986). These intercorrelated with $r = 0.44$ ($p < 0.001$) and were aggregated to form a more reliable composite. For 13 anthropometric measures, estimates of genetic influence were available based on midparent-offspring regressions from data on 125 families in Belgium (Susanne, 1977).

Examples of varying heritabilities include: 51 percent for attitude to the death penalty versus 25 percent for attitude to the truth of the Bible (see Table 4.3), 41 percent for having a preference for reading versus 20 percent for having a preference for many different hobbies (Neale et al., 1986), and 80 percent for mid-finger length versus 50 percent for upper arm circumference (Susanne, 1977). When evaluating these results, it should be kept in mind that the friendship heritabilities were generalized from one sample (e.g., Australian twins) to another (Canadian friends). This result is a conservative test of the genetic similarity hypothesis because the predicted effect has to be sufficiently generalizable to overcome these differences.

Across the measures, close friends were found to be significantly more similar to each other than to randomly paired individuals from the same sample. Pearson product-moment correlations showed that compared with random pairs, friendship dyads are more similar in age (0.64 vs. -0.10, $p < 0.05$), education (0.42 vs. 0.11, $p < 0.05$), occupational status (0.39 vs. -0.02, $p < 0.05$), conservatism (0.36 vs. -0.02, $p < 0.05$), mutual feelings of altruism and intimacy (0.32 vs. -0.04 and 0.18 vs. -0.08, $ps < 0.05$), 13 anthropometric variables (mean = 0.12 vs. -0.03, ns), 26 personality scale scores (mean = 0.09 vs. 0.00, ns), and 20 personality self-rating scores (mean = 0.08 vs. 0.00, ns). Although these similarities are very small, significantly more are positive than could be expected by chance (13/13 of the anthropometric variables, 18/26 of the personality scale scores, and 15/20 of the personality self-rating scores, all $p < 0.05$, binomial sign test). It should be noted that these relative magnitudes parallel the between-spouse similarities (Figure 4.1).

Similarity between friends was strongest on the most heritable characteristics. For the 36 conservatism items (Table 4.3), the heritabilities correlated $r = 0.40$ ($p < 0.01$) with the degree of similarity between friends, a relationship not altered when corrected for test-retest reliability or age, education, and occupational status. For the 81 personality items, the heritabilities correlated 0.20 ($p < 0.05$) with friendship similarities, a relationship also not changed by a correction for test-retest reliability or socioeconomic similarity. For the 13 anthropometric variables, however, the correlation between heritabilities and similarities was not significant ($r = 0.15$).

Independent corroboration that attitudes with high heritability are stronger than those with low heritability has come from a series of studies by Tesser (1993). Each subject responded "agree" or "disagree" to attitudes with known heritabilities, including some of those in Table 4.3. Attitudes higher in heritability were accessed more readily as measured by response time, changed less readily when attempts were made at social influence, and predicted better in the attitude-similarity attraction relationship. Thus, Tesser (1993) found that the more heritable attitudes correlated most with attraction to a stranger imagined as a potential friend, a romantic partner, and as a spouse.

Ethnocentrism

The implications of the finding that people moderate their behavior as a function of genetic similarity are far-reaching. They suggest a biological basis for ethnocentrism. Despite enormous variance within populations, it can be expected that two individuals within an ethnic group will, on average, be more similar to each other genetically than two individuals from different ethnic groups. According to genetic similarity theory, people can be expected to favor their own group over others.

Ethnic conflict and rivalry, of course, is one of the great themes of historical and contemporary society (Horowitz, 1985; Shaw & Wong, 1989; van den Berghe, 1981). Local ethnic favoritism is also displayed by group members who prefer to congregate in the same area and to associate with each other in clubs and organizations. Understanding modern Africa, for example, is impossible without understanding tribalism there (Lamb, 1987). Many studies have found that people are more likely to help members of their own race or country than they are to help members of other races or foreigners, and that antagonism between classes and nations may be greater when a racial element is involved.

Traditionally, political scientists and historians have seldom considered intergroup conflict from an evolutionary standpoint. That fear and mistrust of strangers may have biological origins, however, is supported by evidence that animals show fear of and hostility toward strangers, even when no injury has ever been received. Direct analogies have been drawn between the way monkeys and apes resent and repel intruding strangers of the same species and the way children attack another child who is perceived as being an outsider (Gruter & Masters, 1986; Hebb & Thompson, 1968). Many influential social psychologists have pondered whether the transmission of xenophobia could be partly genetic. W. J. McGuire (1969:265) wrote:

> [I]t appears possible for specific attitudes of hostility to be transmitted genetically in such a way that hostility is directed towards strangers of one's own species to a greater extent than towards familiars of one's own species or towards members of other species. It would not be impossible for xenophobia to be a partially innate attitude in the human.

Theorists from Darwin and Spencer to Allport and Freud and now Alexander, Campbell, Eibl-Eibesfeldt, and E. O. Wilson have considered in-group/outgroup discrimination to have roots deep in evolutionary biology. (For a historical review, see van der Dennen, 1987.) Recent developmental psychological studies have found that even very young children show clear and often quite rigid disdain for children whose ethnic and racial heritages differ from their own, even in the apparent absence of experiential and socialization effects (Aboud, 1988).

Many of those who have considered nationalist and patriotic sentiment from a sociobiological perspective, however, have emphasized its apparent irrationality. Johnson (1986) formulated a theory of patriotism in which socialization and conditioning engage kin-recognition systems so that people behave altruistically toward in-group members as though they were genetically more similar than they actually are. In Johnson's analysis, for example, patriotism may often be an ideology propagated by the ruling class to induce the ruled to behave contrary to their own genetic interests, while increasing the fitness of the elite. He noted that patriotism is built by referring to the homeland as the "motherland" or "fatherland," and that bonds between people are strengthened by referring to them as "brothers" and "sisters."

According to genetic similarity theory, patriotism is more than just "manipulated" altruism working to the individual's genetic detriment. It is an epigenetically guided strategy by which genes replicate copies of themselves more effectively. The developmental processes that Johnson (1986) and others have outlined undoubtedly occur, as do other forms of manipulated altruism. However, if these were sufficient to explain the human propensity to feel strong moral obligation toward society, patriotism would remain an anomaly for evolutionary biology. From the standpoint of optimization, one might ask whether evolutionarily stable ethical systems would survive very long if they consistently led to reductions in the inclusive fitness of those believing in them.

If epigenetic rules do incline people toward constructing and learning those ideologies that generally increase their fitness, then patriotic nationalism, religious zealotry, class conflict, and other forms of ideological commitment can be seen as genetically influenced cultural choices that individuals make that, in turn, influence the replication of their genes. Religious, political, and other ideological battles may become as heated as they do partly because of implications for fitness; some genotypes may thrive more in one ideological culture than another. In this view, Karl Marx did not take the argument far enough: Ideology serves more than economic interest; it also serves genetic purpose.

Two sets of falsifiable propositions follow from this interpretation. First, individual differences in ideological preference are partly heritable. Second, ideological belief increases genetic fitness. There is evidence to support both propositions. With respect to the heritability of differences in ideological preference, it has generally been assumed that political attitudes are mostly determined by the environment; however, as discussed in chapter 3, both twin and adoption studies reveal significant heritabilities for social and political attitudes as well as for stylistic tendencies (see also Table 4.3).

Examples of ideologies that increase genetic fitness are religious beliefs that regulate dietary habits, sexual practices, marital custom, infant care, and child rearing (Lumsden & Wilson, 1981; Reynolds & Tanner, 1983). Amerindian tribes that cooked maize with alkali had higher population densities and more complex social organizations than tribes that did not, partly because cooking with alkali releases the most nutritious parts of the cereal, enabling more people to grow to reproductive maturity (Katz, Hodiger, & Valleroy, 1974). The Amerindians did not know the biochemical reasons for the benefits of alkali cooking, but their cultural beliefs had evolved for good reason, enabling them to replicate their genes more effectively than would otherwise have been the case.

By way of objection, it could be argued that although some religious ideologies confer direct benefits on the extended family, ideologies like patriotism decrease fitness (hence, most analyses of patriotism would ultimately rest entirely on social manipulation). Genetic similarity theory may provide a firmer basis for an evolutionary understanding of patriotism, for benefited genes do not have to be only those residing in kin. Members of ethnic groups, for example, often share the same ideologies, and many political differences are genetic in origin. One possible test of genetic similarity theory in this context is to calculate degrees of genetic similarity among ideologues in order to examine whether ideological "conservatives" are more homogeneous than the same ideology's "liberals." Preserving the "purity" of an ideology might be an attempt to preserve the "purity" of the gene pool.

Because ethnic conflict has defied explanation by the standard social science disciplines, genetic similarity theory may represent an advance in understanding the causes of these conflicts, as well as of ethnocentric attitudes in general. Eibl-Eibesfeldt (1989) agreed that if attraction toward similarity has a genetic component then it provides the basis for xenophobia as an innate trait in human beings, a phenomenon manifested in all cultures so far studied.

Van den Berghe (1989) also endorsed the genetic similarity perspective on ethnocentrism, stating that ethnicity has a "primordial dimension." In his 1981 book, *The Ethnic Phenomenon,* he had suggested that ethnocentrism and racism were explainable as cases of extended nepotism. He had shown that even relatively open and assimilative ethnic groups police their ethnic boundaries against invasion by strangers and he showed how they used badges as markers of group membership. These were likely to be cultural rather than physical, he argued, such as linguistic accent or even clothing style. Subsequently, it seemed to him, the ability to recognize others who shared traits of high heritability provided a better means for identifying fellow ethnics. Genetic markers would be more reliable than flexible cultural ones, although these other membership badges could also be used.

Adopting a gene-based evolutionary perspective for ethnic conflict may prove illuminating, especially in the light of the conspicuous failures of environmentalist theories. With the breakup of the Soviet Bloc, many Western analysts have been surprised at the outbreak of the fierce ethnic antagonisms long thought over. Richard Lynn (1989: 534) put it directly:

> Racial and ethnic conflict is occurring throughout the world—between Blacks and Whites in the United States, South Africa, and Britain; Basques and Spaniards in Spain; and Irish and British in Northern Ireland. These conflicts have defied explanations by the disciplines of sociology, psychology, and economics.... genetic similarity theory represents a major advance in the understanding of these conflicts.

R. Lynn (1989) raised the question of why people remain as irrationally attached as they do to languages, even almost dead ones such as Gaelic and Welsh. One function of language barriers, he suggested, was to promote inbreeding among fellow ethnics. The close mapping recently found to occur between linguistic and genetic trees supports Lynn's hypothesis. Cavalli-Sforza, Piazza, Menozzi, and Mountain (1988) grouped gene frequencies from 42 populations into a phylogenetic tree based on genetic distances and related it to a taxonomy of 17 linguistic phyla (chap. 11). Despite the apparent volatility of language and its capacity to be imposed by conquerors at will, considerable parallelism between genetic and linguistic evolution was found.

Selection of Groups

Humans have obviously been selected to live in groups, and the line of argument presented so far may have implications for determining whether group selection occurs among humans. Although the idea of group selection, defined as "selection that operates on two or more members of a lineage group as a unit" (E. O. Wilson, 1975: 585), and as "the differential reproduction of groups, often imagined to favor traits that are individually disadvantageous but evolve because they benefit the larger group" (Trivers, 1985: 456), was popular with Darwin, Spencer, and others, it is not currently thought to play a major role in evolution. Hamilton's (1964) theory of inclusive fitness, for example, is regarded as an extension of individual selection, not group selection (Dawkins, 1976, 1982). Indeed, in recent times group selection has "rivaled Lamarkianism as the most thoroughly repudiated idea in evolutionary theory," as D. S. Wilson put it (1983: 159). Mathematical models (reviewed in D. S. Wilson, 1983) show that group selection could override individual selection only under extreme conditions such as small intergroup migration rate, small group size, and large differences in fitness among groups.

In the recent past it was Wynne-Edwards (1962) who brought the altruism issue to theoretical center stage. He suggested that whole groups of animals collectively refrain from overbreeding when the density of population becomes too great—even to the point of directly killing their offspring if necessary. Such self-restraint, he argued, protects the animals' resource base and gives them an advantage over groups that do not practice restraint and become extinct as a result of their profligacy. This extreme form of the group selection claim was immediately disputed. A great deal of argument and data was subsequently marshaled against the idea (Williams, 1966). There did not seem to exist a mechanism (other than favoring kin) by which altruistic individuals could leave more genes than selfish individuals who cheated.

A compromise was offered by E. O. Wilson (1975), who suggested that although genes are the units of replication, their selection could take place through competition at both the individual and the group levels; for some purposes these can be viewed as opposite ends of a continuum of nested, ever-enlarging sets of socially interacting individuals. Kin selection is thus seen as intermediate between individual and group selection. Genetic similarity theory, according to which genes maximize their replication by benefiting any organism in which their copies are to be found, may provide a mechanism by which group selection can be enhanced.

Among humans, the possibility of conferring benefits on genetically similar individuals has been greatly increased by culture. Through language, law, religious imagery, and patriotic nationalism, all replete with kin terminology, ideological commitment enormously extends altruistic behavior. Groups made up of people who are genetically predisposed toward such moral behaviors as honesty, trust, temperence, willingness to share, loyalty, and self-sacrifice will have a distinct genetic advantage over groups that do not. In addition, if strong socialization pressure, including "mutual monitoring" and "moralistic aggression," is used to shape behavior and values within the group, a mechanism is provided for controlling, and even removing, the genes of cheaters.

Moreover, as reviewed earlier, social learning is biased by individualized epigenetic rules. Social psychological studies of cultural transmission show that people pick up trends more readily from role models who are similar (Bandura, 1986). Taken together it is likely that different ethnic groups learn from different trendsetters and the variance among groups is increased, thereby increasing the efficacy of group selection. Those groups adopting an optimum degree of ethnocentric ideology may have replicated their genes more successfully than those that did not. Evolution under bioculturally driven group selection, including migration, war, and genocide, may account for a substantial amount of change in human gene frequencies (Alexander, 1987; Ammerman & Cavalli-Sforza, 1984; Chagnon, 1988; D. S. Wilson, 1983). E. O. Wilson (1975: 573–74) put it forcefully:

> If any social predatory mammal attains a certain level of intelligence, as the early hominids, being large primates, were especially predisposed to do, one band would have the capacity to consciously ponder the significance of adjacent social groups and to deal with them in an intelligent organized fashion. A band might then dis-

> pose of a neighboring band, appropriate its territory, and increase its own genetic representation in the metapopulation, retaining the tribal memory of this successful episode, repeating it, increasing the geographic range of its occurrence, and quickly spreading its influence still further in the metapopulation. Such primitive cultural capacity would be permitted by the possession of certain genes.... The only combination of genes able to confer superior fitness in contention with genocidal aggressors would be those that produce either a more effective technique of aggression or else the capacity to preempt genocide by some form of pacific manoeuvering. Either probably entails mental and cultural advance. In addition to being autocatalytic, such evolution has the interesting property of requiring a selection episode only very occasionally in order to proceed as swiftly as individual-level selection. By current theory, genocide or genosorption strongly favoring the aggressor need take place only once every few generations to direct evolution. This alone could push truly altruistic genes to a high frequency within the bands.

5

Race and Racism in History

For millennia, racism was not a word, it was a way of life. Ethnic nepotism and prohibitions against hybridization are a matter of historical record. Downgrading the importance of race not only conflicts with people's evolved tendency to classify and build histories according to putative descent, but ignores the work of biologists studying other species (Mayr, 1970). In his 1758 work, Linnaeus classified four subspecies of *Homo sapiens: europaeus, afer, asiatic,* and *americanus.* Most subsequent classifications recognize at least the three major subdivisions considered in this book: Negroid, Caucasoid, and Mongoloid (see Glossary for terminology).

Racism

The most fundamental relationship recognized by tribal man is that of blood, or descent; in many cases anyone not made a relative becomes an enemy. Primitive society often seems to be organized on two major principles: that the only effective bond is a bond of blood, and that the purpose of society is to unite for wars of offense and defense. Sometimes tribes take the name "men," meaning *we alone are men,* whereas outsiders are something else, often not defined at all.

Like groups of baboons, macaques, and chimpanzees, aboriginal tribes of people occupy territory as a closed group system. After a critical population density is reached, within-group antagonisms often lead to splits along kinship lines. Among the Yanomamo of South America, when the population reaches about 300, tensions within the village increase, arguments are more frequent, and, typically following a fight, a fission occurs (Chagnon, 1988).

Identification of racial variation in man based on differences in morphology and pigmentation is as old as recorded history. As referenced by Loehlin et al. (1975), in 1200 B.C. the Egyptians of the Nineteenth Dynasty painted polychromatic human figures on the walls of their royal tombs depicting peoples of different skin color and hair form: red (Egyptians), yellow (Asiatic and Semitic), black (sub-Saharan African), and white (western and northern European, also shown with blue eyes and blond beards).

In the Bible, from a single ancestor, the three sons of Noah are mythically divided into the descendents of Shem (Semites), Ham (non-Semitic Mediterraneans, sometimes said to include Negroids), and Japheth (northern peoples, sometimes said to mean Indo-Europeans, or Aryans). The Jews were descended from Shem and were warned by Jehovah to preserve themselves as "a special people unto himself, above all the people that are upon the face of the earth" (Deut. 7: 6). The patriarch Noah condemned Canaan, one of Ham's sons and his descendents to be "a servant of servants...unto his brethren" (Gen. 9: 25–27). This verse was used by the Israelites to sanction their subjugation of the Canaanites when they conquered the Promised Land and later by both Christians and Muslims to justify their slavery of blacks.

Other groups generated their own religious justifications for separateness. The Aryan or Indo-European people who invaded India 2,500 years ago built up a complex caste system to preserve their original physical type. They began to compose the *Rig-Veda,* a distillation of their religious beliefs. Eventually these were combined in the *Upanishads* (composed c. 800 B.C., first written c. 1300 A.D.) which, among other things, placed strong social barriers against free hybridization. The caste system may have been the most elaborate and effective barrier against the mixing of contiguous ethnic groups that the world has ever known. It continues to this day despite the attempts of governments to dismantle it. Nonetheless, the once fair complexions of the Brahmans have darkened considerably.

At the Battle of Blood River in Zululand, South Africa, on Sunday, December 16, 1838, the White Boer Voortrekkers entered into a covenant with God. If he would deliver them from the overwhelming numbers of Zulu warriors that surrounded them, they would observe the day as an anniversary every year and conduct their lives in accord with the spirit of the covenant. In the battle, 4,000 Zulu soldiers armed with assegai and shields were killed while one member of the small force of Boer soldiers, armed with rifles and a cannon, suffered a cut hand. The Boer nation had become a theocracy (Michener, 1980).

Caucasoids, of course, are not the only ethnocentrics. It is impossible to understand modern Africa without comprehending the nature of tribal rivalry (Lamb, 1987). For example, *The Times Higher Education Supplement* (August 30, 1985: 8) reported that the Kenyan government had warned lecturers and administrators at the University of Nairobi to stop awarding higher marks to students of their own tribe.

The character *yi,* "barbarian," has been the normal Chinese word applied to all non-Chinese peoples for over 2,000 years (Cameron, 1989: 13). The Chinese had always felt superior to the rest of the world, long before women of the Roman Empire craved the alluring effects of Chinese silk to the point of alarming the Roman Senate about the drain on its treasury. The European traders, priests, and soldiers who came later gave the Chinese no reason to doubt their judgment about themselves. The very name that the Chinese called their country, *Chung Kuo,* the centrally located "Middle Kingdom," from whence culture radiated outward, was ethnocentric. Today China is convinced that her communism is the only right and true communism, and that her way out of communism is the only right and true way forward.

By the late eighteenth and early nineteenth centuries, most of mankind had been categorized by white scientists according to race. Along with the classifications came value judgments. Since white people had now conquered or settled much of the earth they proposed for themselves an innately superior bloodline.

A theory of North European racial supremacy was assisted and expanded by the discovery of a surprising linguistic relationship between the Aryans, Persians, Hittites, Greeks, and Romans of the ancient world, and the peoples of modern Europe. The Indo-European languages gave rise to the hypothesis of a common race, in which a blond, light complexioned people with rare creative gifts continuously refertilizes dying and decadent civilizations.

Among the chief advocates of this "Aryan" hypothesis was Arthur de Gobineau (1816-1882), a French count who wrote the first racial interpretation of history. The Comte de Gobineau's (1853-1855) *Essays on the Inequality of Human Races* portrayed the Aryans as an ancient race of European peasants, fishermen, hunters, and shepherds who gave flower to the genius of the Greek and Roman civilizations, among many others. Gobineau felt the virtues of the European aristocracy—love of freedom, honor, and spirituality was racially ordained and from there downward went a hierarchy of capacity based partly on linguistic ability.

The bourgeoisie, for example, corrupted the nobility. The "yellow race" was bourgeois, preoccupied with a steady uncreative drive toward material prosperity. Blacks had little intelligence but had crude, overdeveloped senses. Gobineau's ideas were later incorporated with those of other theorists to provide a means of racial identification, particularly the idea that a common language rooted Europeans together. Many of these ideas were taken over by the Nazis to justify their attacks on "alien" Jews (Mosse, 1978).

Mostly anthropologists ignored Jewish people, regarding them as part of the Caucasian race and capable of assimilation into European life. Gobineau, himself, thought of the Jews as a race that had succeeded in everything it did, a free, strong, intelligent people that had produced as many men of learning as merchants. Moreover, for Gobineau, the ancient Jews demonstrated that the value of race was independent of the material conditions of the environment. Great races could flourish anywhere, and did so.

Others who supported the doctrine of Nordic superiority included: Houston Stewart Chamberlain (1855-1927), an Englishman who detected Aryan genes in almost all the great men of the past, including Jesus Christ; Madison Grant (1865-1937), American lawyer and naturalist whose book *The Passing* *of the Great Race* (1916) treated the decline of the Nordic people and whose arguments helped pass the restrictive U.S. immigration laws in the early 1920s; and Lothrop Stoddard (1883-1950), also active in the immigration issue, who warned in *The Rising Tide of Color* (1920) that white people would eventually be overwhelmed by the fecundity of the nonwhite, colored races.

As late as the 1950s, the word "race" was still widely used to designate peoples and national groups that today would be called ethnic groups. In Britain the word was applied to the English, Welsh, Scottish, and Irish components of the country. Winston Churchill, in his *History of the English Speaking Peoples,* habitually used the term for ethnic or "tribal" differences, as between Angles, Saxons, Danes, Jutes, and Normans. Few words in the Western world have undergone such significant changes, primarily as a result of the aftermath of World War II. For example, a survey showed that among the writers of physical anthropology textbooks in the United States, whereas 65 percent between 1932 and 1969 accepted that races of man exist, only 32 percent of those that appeared between 1970 and 1979 did so (Littlefield, Lieberman, & Reynolds, 1982).

Race as Breeding Group

Classifying animals into types is the special concern of the science of taxonomy, or systematics. To impart order to the biological world, a classificatory scheme was originated by Carolus Linnaeus (1707-1778), a Swedish naturalist at the University of Uppsala. The system that is currently in use is known as the Linnaean Hierarchy and dates in its (near) present form to 1758 and the tenth edition of Linnaeus's *Systema Naturae.* It is based on the proposition that animals with similar body construction may be regarded as members of the same classification group. Moreover, an evolutionary inference is made: the more closely two animals resemble each other, the more closely they are likely to be related. Thus, taxonomy directly correlates the structural organization of animals and indirectly their evolutionary histories.

Within a given classification group, it is often possible to distinguish several subgroups, each containing animals characterized by even greater similarity of body structure and, by inference, evolutionary history. Each such subgroup may then be further subclassified, and a whole hierarchy of classification groups can be established. In this hierarchy, from highest (most inclusive) to lowest (least inclusive) the seven main ranks are: kingdom, phylum, class, order, family, genus, and species. Intermediate ranks may also be assigned by the prefixes sub- or super- (e.g., superorder, suborder, and so on). The specific animal groups encompassed by a given category are often referred to as taxa. For example, mammals are a taxon at the class rank.

In the hierarchy as a whole, progressively lower ranks consist of progressively more but smaller groups. Thus, animals make up one kingdom, some 2 dozen phyla, and about 2 million species. Also, the groups at successively lower ranks exhibit an increasing resemblance of body forms and an increasingly similar evolutionary history. For example, the members of a class resemble each other to a great extent, but the members within one of the orders of that class resemble each other to an even greater extent. A similar correlation holds for evolutionary histories.

According to Linnaean tradition and the International Code of Zoological Nomenclature, all species (and only species) should be identified by two names, their genus name and their species name. These are in Latin or latinized form and used universally. For example, the species to which we belong is *Homo sapiens*. Such species names are always underlined or printed in italics, and the first name is capitalized. Thus, the human species belongs to the genus *Homo*. *Homo sapiens* happens to be the only presently living species within the genus *Homo*. The genus name is always a noun, and the specific name is usually an adjective.

TABLE 5.1
A Partial Taxonomic Classification of Man

Rank	Name	Characteristics
Phylum	Chordata	With notochord, dorsal hollow nerve cord, and gills in pharynx at some stage of life cycle
Class	Mammalia	Young nourished by milk glands, skin with hair; body cavity divided by diaphragm; aortic arch only on left; red corpuscles without nuclei; constant body temperature; 3 middle-ear bones; brain with well-developed cerebrum
Order	Primates	Basically tree-dwelling; usually with fingers, flat nails; sense of smell reduced
Family	Hominidae	Upright, bipedal locomotion; living on ground; hands and feet differently specialized; family and tribal social organization
Genus	Homo	Large brain; speech; life span extended, with long youth
Species	Homo sapiens	Prominent chin, high forehead, thin skull bones; spine double-curved; body hair sparse

A complete classification of an animal tells a great deal about the nature of that animal. For example, if we knew nothing else about men except their taxonomic classification, then we would know that their design characteristics are as outlined in Table 5.1. Such data already represent a substantial detailing of the body structure. We would also know by implication that the evolutionary history of men traces back to a common chordate ancestry.

There are times when a species is divided into subspecies, in which case a trinomial nomenclature is employed. Taxa lower than subspecies are sometimes employed when four words are used in the scientific name, the last one standing for *variety.* Thus, the race is a minor taxon in relation to the species.

Despite the central importance of the species concept in biology, biologists do not agree on a definition that applies to all cases. Before Darwin's time, the species was considered a primeval pattern, or archetype, divinely created. Gradually taxonomists began to think of species as groups of interbreeding natural populations that are reproductively isolated from other such groups, in which every individual is unique and may change to a greater or lesser extent when placed in a different environment.

The theoretical importance of variation within populations was discussed by Mayr (1970). For decades, it had been debated whether geographic variation was genetic in nature. Mendelian evolutionists denied it was so because their interpretation of speciation depended upon spectacular mutations, not selection operating on graded characters. Today all biologists accept the genetic uniqueness of local populations. Because no two individuals are genetically identical, no two groups of individuals will be identical. Moreover, every local population is under continuous selection pressure for maximal fitness in the particular area where it occurs. Consequently subspecies may come to differ behaviorally, as well as biometrically.

In sum, race is a biological concept. Races are recognized by a combination of geographic, ecological, and morphological factors and gene frequencies of biochemical components. However, races merge with each other through intermediate forms, while members of one race can and do interbreed with members of other races.

Most modern classifications recognize three major subdivisions, Negroid, Caucasoid, and Mongoloid. Some investigators have designated additional races, such as the Amerindians and Australoids. Within each race, several varieties or minor races have been proposed, although there is no agreed upon number. Mostly for political reasons, a majority of investigators avoid the use of the term *race* as much as possible and use, for the major human races, the word "population" and for the minor races, the phrase "ethnic group."

Islamic Ethnology

Hostility and hybridization both characterized ethnic relations among those ancient Middle Eastern groups who affected history—the Egyptians, the

Sumerians, the Akkadians, the Israelites, the Hittites, the Persians, and later, the Greeks and the Romans. The nobility and leadership of the varying factions often urged against hybridization. The Bible provides many examples of the Hebrews being enjoined to avoid it. Tribes and nations thought it natural and legitimate to despise, conquer, enslave, and displace each other. Slavery is attested from the very earliest written records among the Sumerians, the Babylonians, and the Egyptians, as well as the Greeks and the Romans. The wall paintings of ancient Egypt, for example, typically depict the gods and pharaohs as larger than life while Negroes and other outlanders were posed as servants and slaves.

In the seventh century A.D. Islam arose among the Arabs. Under them, and later under the Ottoman Turks, a universal civilization was created from the Atlantic Ocean to China, and from Europe to West Africa. The creation through conquest of far-flung empires into which different races and ethnic groups were pulled, especially through the institution of slavery, led to a considerable body of writing, extending over almost a thousand years, about the characteristics of the various groups. Written in Arabic, Persian, and Turkish, discussion focused on the suitability of various races for different tasks and occupations.

Among Arabs, where intense tribal loyalties spilled over into feuding and warfare, there existed the usual ethnocentrism. In his book *Race and Slavery in the Middle East,* Lewis (1990) examined the common stereotypes that emerged for various national groups. In early Arabic poetry, many nuances of human coloration are described. The Arabs saw their own olive coloring as generally preferable to either the redder color of the Persians, Greeks, and Europeans or to the black and brown peoples of the Horn of Africa and beyond. As Ibn al-Fagih al-Hamadani, an Iraqi Arab author put it around A.D. 902: "The Iraqis are neither half-baked dough nor burned crust but between the two" (cited in Lewis, 1990: 46). One exception was the preference for blondes as concubines; these typically brought the highest prices.

Sa'id al-Andalusi (d. 1070), writing from the then Muslim city of Toledo in Spain, classified ten nations as having achieved distinction in cultivating civilization: the Indians, Persians, Chaldees, Greeks, Romans, Egyptians, Arabs, Jews, Chinese, and Turks. But the northern as well as the southern barbarians were seen as more like beasts than men. It was thought that the Slavs and Bulgars, because of their distance from the sun, had a frigid temperament and dull intelligence. In the South Sa'id thought that the blacks, because of the hot thin air, lacked "self control and steadiness of mind and are overcome by fickleness, foolishness, and ignorance" (cited in Lewis, 1990: 47–48).

Lewis (1990) examined Arabic relations with blacks with whom the Muslims had dealt as slave traders for over 1,000 years. Although the Koran stated there were no superior and inferior races and therefore no bar to racial intermarriage, in practice this pious doctrine was disregarded. Arabs did not want their daughters to marry even hybridized blacks. The Ethiopians were the most respected, the "Zanj" (Bantu and other Negroid tribes from East and West Africa south of the Sahara) the least respected, with the Nubians occupying an intermediate position.

The negative views of black people are traced by Lewis (p. 52) to Mas'udi (d. 956) who quoted the Greek physician Galen (A.D. c. 130-c. 200) attributing to the black man "a long penis and great merriment. Galen says that merriment dominates the Black man because of his defective brain, whence also the weakness of his intelligence." This description is later repeated, with variations.

Most Arab geographers speak of the nudity, paganism, cannibalism, and primitive life of the Africans, particularly of the Bantu-speakers of East Africa alongside Zanzibar, which the Arabs had colonized in 925 A.D. Maqdisi depicted blacks as having the nature "of wild animals...most of them go naked...the child does not know his father, and they eat people" (cited in Lewis, 1990: 52). A thirteenth-century Persian writer, Nasir al-Din Tusi, remarks that Negroes differ from animals only in that "their two hands are lifted above the ground...the ape is more teachable and more intelligent" (cited in Lewis, 1990: 53). In the fourteenth century, Ibn Butlan held a musical rhythm stereotype, suggesting that if an African "were to fall from heaven to earth he would beat time as he goes down" (cited in Lewis, p. 94); another stereotype held that black people may be particularly pious because of their simplicity.

Throughout Islamic literature there is also the image of unbridled, sexual potency in blacks, as related, for example, in stories and illustrations from *The Thousand and One Nights.* Black females, as well as males, are portrayed with greatly endowed genitalia. One Persian manuscript from 1530 A.D. (Lewis, 1990: 97, and color plate no. 23) contains a pictorial illustration accompanying a poem in which a white woman watches while her black maidservant is able to accommodate to copulation with an ass; when the white woman tries do so, there are disastrous consequences.

In the main, black people are considered destined for menial occupations. Whereas slaves and their offspring from other parts of the empire were able to, and did, rise to the highest levels of office, black slaves did so rarely. Black slaves were seen as unintelligent, a view not held of non-African slaves, nor of those on the empires' borders, including the European Christians, the Indian Hindus, and the Chinese.

Racial characteristics were often attributed to the environment. Ibn Khaldun (1332-1406) whom Lewis describes as the greatest historian and social thinker of the Middle Ages, devoted a chapter to climatic effects. Even the merriment attributed to black people was considered climatic rather than genetic in origin (Lewis, p. 47). One writer, Jahiz of Basra (ca. 776-869) attributed the widely perceived low intelligence of black people to their existing socioeconomic position and asked his readers whether they would have anticipated the existence of the achievements in Indian science, philosophy, and art from their experience of Indian slaves. Since the reply was likely to be no, then the same argument might apply to black lands (cited in Lewis, p. 31).

Christian Explorers

Europeans had always known of the great glories and riches of the East. Chinese silk production from looms had long been a desired commodity and silk routes from China into central Asia and the Mediterranean had been established by 126 B.C., although sometimes forgotten, then rediscovered. The brilliance of the Chinese as inventors and artists was known to the Islamic Arabs and Persians (Lewis, 1990).

In 1275, Marco Polo (1254–1324) traveled to China from Venice with a view to opening up trade with the Mongol Empire. He came away impressed with the efficient administration of roads, bridges, cities interconnected by canals, a postal system, census, markets, standardized weights and measures, coin and paper money. The brilliance and tolerance of the Oriental court, as portrayed by Marco Polo, enthralled the Western world. Polo wrote, "Surely there is no more intelligent race on earth than the Chinese."

Christian contact with Africa began in earnest in 1441 when for the first time, slaves and gold were directly imported from West Africa into Portugal. The discovery of gold provided a great stimulus to further exploration. Later in the fifteenth Century the Portugese had rounded the Cape of Good Hope and established contact with the Arab-controlled East African areas of Mozambique and Mombassa, before continuing historic voyages that opened direct commerce between Europe and India. It was chiefly to protect their trade with India and the East that first the Portugese, and later the other European powers, established colonies on the African coast. Trade in ivory, and later, slaves for the American colonies, provided additional impetus for investigation. Through centuries of trade with Greco-Roman, Islamic, and now Christian cultures, large parts of the periphery of North, East, and West Africa had been influenced by foreigners. Other parts, however, especially the central interior regions and southern tracts, remained unexplored and unknown to outsiders.

The written impressions of seven major explorers of black Africa, including of areas uninfluenced by Arab or European cultures was collated by J. R. Baker (1974). These explorers were chosen because of their reputation for accuracy and reliability in reporting. Baker believed it improbable that a very different picture would have emerged if another set of explorers had been substituted, or a fuller number included. The explorers, with the dates of their major works and of their explorations, are:

H. F. Fynn (1950)	1824–34
D. Livingstone (1857)	1840–56

F. Galton (1853)	1850-51
B. P. Du Chaillu (1861)	1856-59
J. H. Speke (1863)	1860-63
S. W. Baker (1866)	1862-65
G. Schweinfurth (1873)	1869-71

As J. R. Baker (1974) describes it, the impression gained is of a poor level of civilization, including naked or near naked appearance, sometimes broken by an amulet or ornament rather than a covering of the genital area; self-mutilation as in filing down the teeth and piercing the ears and lips to admit large ornaments; poorly developed toilet and sanitary habits; one-story dwellings of simple construction; villages rarely reaching 6 or 7 thousand inhabitants or being interconnected with roadways; simple canoes excavated from large trees with no joining parts; no invention of the wheel for pottery or grinding corn or vehicular transport; little domestication of animals or using them for labor or transport; no written script or recording of historical events; no use of money; no invention of a numbering system, nor of a calendar.

Some explorers were struck by the absence of administration and code of law. Examples were told of chiefs despotically killing at will for minor breaches of etiquette or even for pleasure. When the explorer Speke gave Mutesa, the king of Buganda, a rifle, the king tried it out on a woman prisoner. When witchcraft was suspected, hundreds might be slaughtered often with grotesque forms of execution. When slavery was practiced, slave owners were at liberty to kill their slaves. In some places cannibalism was practiced. Nowhere did there appear to exist any formal religion with sanctified traditions, beliefs about the origin of the world, or ethical codes with sentiments of mercy.

The explorers found Africans to be of low intelligence with few words to express abstract thoughts and little interest in intellectual matters. Speke wrote that the Negro thinks only for the moment and prefers to spend the day as lazily as possible. Livingstone wrote that the tribes lacked foresight, thinking it futile of the explorer to plant date seeds in full knowledge that he would never see the fruit. S. W. Baker (1866: 396-397) thought that young black children were "in advance, in intellectual quickness, of the white child of similar age" but that "the mind does not expand—it promises fruit, but does not ripen."

Whenever a bright individual did arise, as in one story told to Livingstone about a man who built an irrigation system to his garden to help cultivate potatoes, the idea typically died with its creator. Occasional stories were told about individuals attempting to invent written scripts. The explorers tended to see the hybrid groups as being more intelligent and the darker more Negroid groups as less intelligent. Thus, Livingstone remarked that the tribes of Angola were "by no means equal to the Cape Caffires in any respect whatever" (S. W. Baker, 1866: 397). However, some tribes were notably accomplished in pottery, iron forging, wood art, and musical instrumentation.

As also reported by the Islamic writers, Africans were perceived to have great musical virtuosity in precision of timing and accuracy of pitch, whether of voice or tuning of instruments. The native dances that the explorers witnessed tended to be voluptuous, with obscene motions made to other dancers. This was not true of ceremonial war dances, particularly those given by the Zulus, where great discipline, order, sedateness, and regularity were to be observed. The Zulus had been one of the greatest warrior tribes ever known in Africa, creating a military empire from Zululand through Tanzania to the Congo for much of the nineteenth century, until being defeated finally by the British in 1879.

The Enlightenment

Europe's scientific revolution, begun with Galileo (1564-1642) and Newton (1642-1727), produced profound and far-reaching changes. Science altered in meaning from simply "knowledge" to "systematically formulated knowledge, based on observation and experiment." It became, as never before, necessary to "prove" the rules. The Enlightenment of the eighteenth century was characterized by belief in the power of human reason to comprehend the natural world. The study of human nature and human differences was brought within its ambit.

In the seventeenth century, as explorers discovered more and more about varieties of ape and human, there was much confusion about the degree of overlap. Some humans lived very simple lives as food gatherers, without knowledge of agriculture. Some apes were able to be trained to eat dinner at a table. It was possible to conjecture that apes were a lower form of man that refused to speak in order to avoid being made into slaves, while pygmies, for example because of their flat noses and short statures, were a higher form of ape. In 1699, the English physician Edward Tyson was the first to make a careful study of the anatomy of a chimpanzee, showing it to be structurally more similar to humans than to monkeys. He hypothesized that African pygmies were intermediate to apes and humans (Baker, 1974: 31-32).

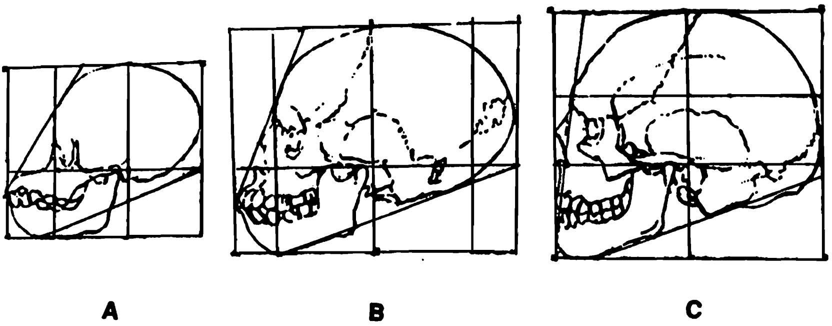
Carl Linnaeus supposed that anthropoid apes were structurally not very distinguishable from humans. By 1758, in the tenth edition of his *System Naturae,* he assigned two species to the genus *Homo, H. sapiens* (man) and *H. troglodytes* (anthropoid apes). As mentioned at the beginning of this chapter, Linnaeus also classified *Homo sapiens* into four subspecies: *europaeus, afer, asiaticus,* and *americanus.* He used mental as well as physical qualities to distinguish them. Thus, *europaeus* was described as "active, very acute, a discoverer... ruled by custom" and *afer* (African blacks) were judged as "crafty, lazy, careless...ruled by caprice."

Later, Leclerc de Buffon (1707-1788), a French naturalist, and Petrus Camper (1722-1789), a Dutch anatomist, demonstrated that apes were more clearly distinguishable from man. Thus, in 1779, a study by Camper of the orangutan's vocal organs revealed that it was incapable of speech, and in later studies, he showed its inability to walk upright on two feet, a point that biologists agreed separated man from apes at a higher taxonomic level than Linnaeus had suggested.

Camper also made studies of the human races. He introduced the concept of a "facial line" to quantitatively compare the races of man with one another and with animals, thus beginning modern craniology (see Figure 5.1). Camper made it clear that the Negro was no man-ape hybrid. By a criterion established by Buffon, all human races were members of the same species because they were able to breed with each other, but not with representatives of other groups. Yet to many, it seemed inescapable that the Negro was the most apelike variety of man.

Two views of racial differences predominated before Darwin's theory of evolution: *monogenism*, the belief that despite racial differences, man was a single species with a unique origin; and *polygenism*, the view that the human races had separate origins. Although the races could clearly interbreed, the polygenist view was that hybrids from such a union possessed weak constitutions, confirming just how far the races had diverged. The crucial question was how far in the past the various branches of human evolution had begun to

Figure 5.1: Camper's (1791) Drawings of Skulls to Illustrate Facial Angle



The skulls are of A, a young orangutan, B, a young Negro, and C, a typical European. Camper first made a drawing of the left side of a skull set up in a horizontal position and then drew a line grazing the front surface of the first incisor tooth and forehead, neglecting any nasal bone en route. The angle formed by the facial line with the horizontal plane became the "facial angle." If either the jaw projects or the forehead slopes backward, the facial angle will be small. Camper found the following facial angles: for a monkey, 42°; orangutan, 58°; a Negro, 70°; a European, 80°; and the most perfect human features, as represented in classical Greek statues, almost 90°. From Camper (1791, cited in Baker, 1974).

diverge. If the divergence had occurred very far back, the varieties may have become distinct enough to be considered as species.

Many of those supporting the inequalities of race were political liberals, opposed to the religious monarchists of their day. Jean Jacques Rousseau (1712-1778), the French political philosopher, posited in his 1775 *Discourse on the Origins of Inequality*, that whereas primitive man was solitary and therefore knew nothing of his inequality, great civilizations necessarily threw unequal people together thereby causing misery. Rousseau argued that it was only by accepting the great diversity that existed in society that one could construct a legitimate social order in which the citizenry would be willing to renounce their natural liberty for sake of a superior freedom. The power of law and democracy, Rousseau argued, would make men independent of one another by making them all equally dependent on the law of the republic.

Voltaire (1694-1778), too, stressed the immutable physical differences between the races, for example, emphasizing the size of the labia and external genitalia in the female Hottentot (see J. R. Baker, 1974: 313-317 for engravings and details). By the seventeenth century it was recognized that skin color was not solely due to the action of the sun's rays during the life of the individual. White babies born in the tropics and black babies born in Europe were seen to resemble their parents and to keep their color throughout life. Voltaire argued that such diversity inclined against the religious belief that all human races were descended in recent time from a single Adam and Eve ancestor.

David Hume (1711-1776), Scottish philosopher and historian, wrote that the races had originated independently and those that lived beyond the polar circles or between the tropics were inferior to those of the temperate zone. The people of Africa were less intelligent and accomplished than the rest of mankind, he claimed, and that although many had been freed, none had made a major contribution to art or science. Hume held many political posts, including head of the British Colonial Office in 1766. He argued that the character of the different races was partly inborn, for he noted the uniform nature of the Chinese despite their distribution over a huge area varying in climate.

Immanuel Kant (1724-1804) wrote much about national character but only little about differences between the major races, agreeing in the main with Hume's assessment. Kant was particularly impressed by the African belief in fetishes, the teeth of leopards and the skin of snakes worn for their magical powers. Fetishistic beliefs implied intellectual inferiority, sinking "as deep in foolishness as seems to be possible for human nature" and far away from the sense of innate moral duty he called "Categorical Imperative," wherein maxims of conduct served as universal laws.

George Wilhelm Friedrich Hegel (1770-1831) also scorned the use of fetishes to control the forces of nature, believing that Africans were incapable of acquiring complicated religious belief systems and that they stood outside his theory of historical development. For Hegel, Africa was "no historical part of the world; it has no movement or development to exhibit." Although Karl Marx (1818-1883) did not make it public knowledge, he was later to share Hegel's view of African people when he transformed Hegel's theory of history to fit his own political philosophy (Weyl, 1977).

Johann Friedrich Blumenbach (1752-1840), a German professor of medicine, researched the physiology and comparative anatomy of the different races and confirmed they were all members of the same species. Although he did not know about evolution, he was aware that plants and animals became modified as a result of climatic changes and domestication, a process he referred to as *degeneration* from the God-given original. Assuming the truth of the Bible, he contended that Caucasoids were the closest to Adam and Eve and that the other varieties arose by a process of degeneration through exposure to climatic extremes. Although Blumenbach thought the European forms the most beautiful, he insisted that many racial differences had been greatly exaggerated in the telling, including the size of the external genitalia of the female Hottentot, emphasized by Voltaire.

Samuel Thomas Soemmering (1755-1830), a German anatomist still known today for his work on the sympathetic nervous system, wrote on the comparative anatomy of the Negro and European. He dissected the various body parts to systematically examine the claim that, anatomically, the Negro approximated more closely to the apes than did the European. He concluded that Negroes were strikingly human, clearly distinguishable from apes and other animals, although there were many primitive features. For example, the lower jaw of the Negro is more robust than the European, and the part to which the masseter muscle is attached is very broad; also, the upper and lower incisor teeth project forward so as to meet at an angle.

It was Soemmering in 1785 (cited by Todd, 1923) who first published an estimate of cranial capacity. His method was the simple one of filling the skull with water. He reasonably assumed that the cavity of the human skull reflected the size of the brain it once contained. He reported that the cranium of a European is more capacious than that of a Negro. Saumarez (cited by Todd, 1923), also using the water method, confirmed Soemmering's statement. Vicey, too, in 1817 (cited by Todd, 1923), also using the water method, found the relationship.

Not all biologists of the time believed that Africans differed from Europeans. Franz Joseph Gall (1758-1828), the German physician most responsible for establishing that the brain was the organ of the mind, specifically rejected the view that the Negroid skull contained less brain than that of the European. On the other hand, Gall had rejected classification schemes altogether, holding that each skull was unique. He invented phrenology, a theory in which a person's talents and qualities were traced from the configurations of the skull to particular areas of the brain.

Friedrich Tiedemann (1781-1861), a German comparative anatomist and physiologist, pointed out that Camper's facial angle did not give a measure of brain size, as certain authors had supposed. Measuring endocranial volume he found no differences between Africans and Europeans. Using autopsies, however, he found African brains to be slightly smaller than those of Europeans, especially in their frontal parts. Structurally he also found the brains to be similar, except that the African brain seemed less convoluted. In facial features Tiedemann reiterated that Africans showed more similarities to the ape than did Europeans. Relative to Europeans, he found Africans had larger facial and flatter nasal bones, a more strongly projecting jaw and incisor teeth, and a less anterior foramen magnum, the position where the backbone meets the skull.

Louis Agassiz (1807-1873), the Swiss naturalist famous for studying fossil fishes, traveled to America in 1846 and was persuaded to stay on as professor of zoology at Harvard, where he founded and directed the Museum of Comparative Zoology. He theorized that the creation of species occurred in discrete geographical centers with minimum variation, a view he later applied to the human situation. Agassiz believed that God had created the races as separate species; the biblical tale of Adam referred only to the origin of Caucasians. For him, mummified remains from Egypt implied that Negroes and Caucasians were as distinct 3,000 years earlier as they were in his day, and since the biblical story of Noah's Ark had been dated only 1,000 years before that, there would not have been time for all the sons of Noah to have developed their distinct attributes. For Agassiz, these included intellectual and moral qualities, with Europeans ranking higher than Amerindians and Orientals, and Africans ranking the lowest. Agassiz lived to become America's leading opponent of the Darwinian revolution.

Samuel George Morton (1799-1851), America's great physical anthropologist, collected more than 1,000 human skulls. In his illustrated *Crania Americana,* published in 1839, Morton reported that Amerindian and Mongoloid skulls were intermediate in size to those of Caucasoids and Negroids; for 144 Amerindian skulls the mean cranial capacity was 82 in^3 as compared to the mean of 87 in^3 for whites and 78 in^3 for blacks. For a second study, the *Crania Aegyptiaca* of 1844, Morton categorized by race more than 100 skulls he had been sent from the tombs of ancient Egypt. His two Negroid groups averaged 73 and 79 in^3 and his Caucasian groups averaged from 80 to 88 in^3. By 1849, in Morton's final tabulation of 623 skulls the size ranking remained Caucasoid > Mongoloid > Negroid; among Caucasoids, North Europeans typically came out on top.

Although problematic by today's standards, Morton's work is still debated (chap. 6). One problem was that Morton often randomly combined male with female skulls. Another was his tendency to average his subsamples using a weighted rather than an unweighted procedure, thus allowing an overrepresentation of extreme groups. Among Indians for example, the small-sized Incas were overrepresented relative to the large-sized Iroquois, thus lowering the Amerindian average. In its time, however, Morton's was a major achievement.

Paul Broca (1824–1880), the great French neurologist who also founded the Anthropological Society of Paris in 1859, was a world leader in the field of brain-behavior relationships. He used a comparative approach, examining brains either damaged by strokes or compared across races. Today, "Broca's area" refers to that part of the left cerebral hemisphere that controls the production of speech, and the difficulty in speaking after damage to this area is called "Broca's aphasia."

Broca weighed brains at autopsy and refined the techniques for estimating endocranial volume by filling skulls with lead shot. He concluded that variation in brain size was related to intellectual achievement: skilled workers had larger brains than unskilled workers, mature adults had larger brains than either children or the very elderly, eminent individuals had larger brains than those who were less eminent, and Europeans had larger brains than Africans.

Broca was struck by the variation in the size of brains. Those of eminent men donated after their deaths ranged from about 1,000 grams for Gall, the founder of phrenology, and Walt Whitman, the American poet, through 1,492 grams for the great German mathematician Gauss, to nearly 2,000 grams for Georges Cuvier, the French naturalist. Broca's own brain was later found to weigh 1,424 grams. It began to be realized that brain size varied with several nonintellectual factors, including age, body size, health, cause of death, time after death before weighing the brain, and so on. The only way to examine the true relationship between brain size and eminence was to take an average of many brains and to try to statistically control for extraneous variables.

Broca provided additional distinctions among the brains of the races. These included the ratio of the anterior part of the brain to the posterior (Negroids had a lower ratio, with less in the front), the relative number of convolutions (Negroids had fewer), the speed and order with which sutures between the skull bones closed (Negroids closed faster), and the relative position of the foramen magnum (Negroids further back). Broca noted that in some samples of Mongoloid populations the cranial capacities surpassed those of Europeans. Also with respect to the Negro skull, Broca (1858; cited by J. R. Baker, 1974) remarked:

> In him, the bones of the cranium are conspicuously thicker than ours, and have at the same time much greater density; they scarcely contain any diploë, and their resistance is such that they can sustain truly extraordinary blows without breaking.

After Darwin

In 1859, in the first edition of *The Origin of Species,* Charles Darwin (1809-1882) was very guarded on the subject of human evolution. He merely remarked tentatively that as a result of future investigations, "Psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation." These words were slightly strengthened in later editions, and by 1871, in *The Descent of Man,* Darwin made explicit the application of evolution to human faculties. Evolutionary thinking destroyed the creationist debate between monogenists and polygenists; it affirmed human unity but left the question open as to how far back in prehistoric time a common ancestor had been shared, and by what routes the various races had taken to their present adaptions.

Human fossil evidence had begun to enter the picture in the seventeenth century when Isaac de la Payrère, from France, discovered stone tools used by primitive men who, he claimed, lived in the time before Adam. In 1655 his findings and theory were greatly disapproved of and his books publicly burned by Church authorities. Shortly thereafter, human bones began to turn up along with those of extinct animals throughout western Europe. In 1796 Georges Cuvier, the French naturalist, found the remains of ancient mammoths and gigantic reptiles, and soon paleoanthropology was established as a scientific discipline.

In 1856, three years before Darwin propounded his theory of evolution, Neanderthal Man was discovered in Germany's Neander Valley near Dusseldorf. The skeleton possessed a number of peculiar traits that defined them as very ancient, including a low, narrow, sloping forehead, heavy eyebrow ridges, and a deep depression at the root of the nose. This began the long tradition of a club-wielding, uncouth, "caveman" ancestor and the search for a still more primitive "missing link" between man and ape.

The German biologist Ernst Haeckel (1834-1919) predicted that the sought-after link would be found in a warmer climate such as Africa or southern Asia where the living would be easier than in glaciated Europe. Toward the end of the nineteenth century, a member of the Dutch colonial army, Eugene Dubois, ventured out to Sumatra and Java in the hopes of discovering such a manlike ape. Between 1890 and 1892, Dubois found pieces of "Java Man," now dated to about 800,000 years B.P., that everyone agreed was more apelike than the Neanderthal. This meant that early humans, later named *Homo erectus,* had been in Asia before Europe. The importance of *H. erectus* was vastly increased from 1927 to 1937 as more than 40 similar fossils were found in limestone caves at Zhoukoudian, outside of Beijing. Also found were thousands of stone tools and evidence that *H. erectus* used fire. "Beijing Man" was somewhat like the Java *erectus* and has been dated at 200,000 to 500,000 years.

Homo erectus and Neanderthals were more manlike than apelike. Then, in South Africa, in 1924, Raymond Dart discovered a real apelike missing link. It was followed by the discovery of similar apelike creatures in Africa, with a brain only slightly bigger than a chimpanzee's. The nose was flat. The jaw dominated the face and the mouth thrusted forward. But the teeth were humanlike and it had a bit of a forehead. Most importantly, it walked upright! Its spinal cord entered the brain not at the back of the head, like a gorilla's, but at the bottom of the skull, suggesting bipedalism. Although that didn't make it human, it allowed it to fall into the broader category of "hominid." Later termed *Australopithecus,* these apelike creatures existed 3 million or so years before Java Man.

In all of the fossil finds, however, in the progression from the apelike *Australopithecus* to the manlike *erectus* and then Neanderthal man, there was no evidence of where and when anatomically modern humankind first arose. Although it seemed fairly certain that *Australopithecus* had turned into *erectus,* and that *erectus,* after originating in Africa, had then spread around the Old World, the question was: How had erectus turned into *Homo sapiens*?

There were two rival theories: multi-regional continuity versus single-origin. The first of these was propounded by the German anthropologist Franz von Weidenreich (1873-1948), who meticulously described fossils from around the world including those from Java and China. The theory was elaborated by his follower, the American anthropologist, Carleton S. Coon (1904-1982), of Harvard University, the Peabody Museum, and the University of Pennsylvania. Their theory postulated a separate but parallel evolution for several different groups of *Homo erectus* occurring simultaneously in various regions of the world, beginning about 1 million years ago. Half a million years ago, *Homo erectus,* already divided into geographic races, gradually evolved into the different races of *Homo sapiens.*

Living in their own territory, Coon (1962) postulated that each race could be at different points along the evolutionary path and could pass the critical threshold from primitive to *sapient* state at different times. To account for observed differences in cranial capacity and cultural attainment, Coon (1962) suggested that African populations lagged behind the other races and that living Australian aborigines still retained primitive *erectus* characteristics. Although these "racist" elements were later discarded as an embarrassment, the multiregional hypothesis has remained viable to contemporary times (see chap. 11).

Predictable consequences followed from the theory. Because each race had its own distinct rootstock, remnants of the original people should be detectable in modern populations, despite admixture and migration. Thus, the 800,000-year-old *erectus* Java Man, and his descendants, the Australian aborigines, were considered to share ridges in their skull tops and enormously thick brows above their eyes. In China, the 200,000- to 500,000-year-old *erectus,* Beijing Man, was said to share, with modern Mongoloids, a flat face and a distinct shovel-shaped incisor.

At the other extreme of the forum were those who claimed that all currently living races are but local varieties of the expansion of a single population of *Homo sapiens* that colonized the entire world. Much debate centered on the origin of this single population, many suggesting Asia as a likely contender because of its large, centrally located population. At the time, much of Europe would have been under ice. Intermediate theories suggested separate parallel evolutions from distinct Neanderthal populations, with local differences continuously modified by intermittent migration and admixture. This compromise multiregional theory was probably the most accepted view until modern genetic theories entered the debate with their "Out of Africa" hypothesis suggesting that "Eve" was a black African woman who lived only 200,000 years ago (chap. 11).

Meanwhile, in nineteenth-century Europe, the science of craniometry flourished (Topinard, 1878). Cesare Lombroso (1836-1909), an Italian physician and anthropologist who founded the discipline of criminology believed that Darwin's theory of evolution provided a biological basis for why some people were more likely to develop criminal tendencies than others, and why physical indicators may exist to allow prediction. He carried out several anthropometric surveys of the heads and bodies of criminals and noncriminals, including a sample of 383 crania from dead convicts. He claimed that, as a group, criminals averaged many primitive features including smaller brains, greater skull thickness, simplicity of cranial sutures, large jaws, preeminence of the face over the cranium, a low and narrow forehead, long arms, and large ears. He also studied African tribes in the Upper Nile region and thought they displayed so many primitive traits that criminality would be considered normal behavior among them.

Maria Montessori (1870-1952), the well-known Italian educational reformist, not only devised a system of self-education for young children, but also lectured on anthropology at the University of Rome. She accepted evolutionary-based differences in criminality and intelligence from the work of Broca and Lombroso. She also measured the circumference of children's heads in her schools and concluded that faster learning was made by children with bigger brains.

Todd (1923) gives some of the history of attempts to measure skull capacity using linear formulations and packing material. Sand was used in 1831, millet in 1837, white pepper or mustard seed in 1839, and shot in 1849. These were poured inside of a sealed skull and then emptied into a graduated cylinder to read the skull's volume in cubic centimeters. Head circumferences, lengths, breadths, and heights were measured across races to predict internal capacity. At the Western Reserve University in Cleveland, Todd (1923) found that the sex-combined cranial capacity for 198 whites was 1,312 cm^3 and for 104 blacks it was 1,286 cm^3.

The collection of wet brains and dry skulls for comparing blacks and whites was reviewed by Pearl (1934). This included the study by Samuel Morton already described and an autopsy study of soldiers who had died of pneumonia during the American Civil War (1861-1865). Pearl calculated that the brains of black soldiers weighed 1,342 grams and white soldiers 1,471 grams. Pearl also cited a study just then published by Vint (1934) of 389 adult male Kenyans with an average brain weight of 1,276 grams. Altogether, Pearl concluded, the Negro brain averaged about 100 grams, or about 8 to 10 percent lighter than the white brain.

With notable exceptions, for example, American anthropologist Franz Boas and his school, this view was dominant until World War II. Even during the war, Simmons (1942) reported a study of 2,241 skulls from the permanent collection at Western Reserve University, Cleveland, Ohio. Using a new technique of filling skulls with plastic material rather than seed or water, she found that 1,179 white men averaged 1,452 cm^3 in contrast to 661 black men who averaged 1,389 cm^3, and 182 white women averaged 1,275 cm^3 as against 219 black women who averaged 1,238 cm^3 (white and black means = 1,364 and 1,314 cm^3). Simmons was also able to show that the race differences in cranial capacity were not due to racial differences in body size because black men and women were taller than white men and women.

Bean (1906) reported that structurally, the anterior part of the Negro brain was smaller and less complexly convoluted than the Caucasian brain. He also reported that the weight of the Negro brain at autopsy varied with the amount of Caucasian admixture, from 0 admixture = 1,157 grams, 1/16 = 1,191, 1/8 = 1,335, 1/4 = 1,340, and 1/2 = 1,347. Later reports of brain complexity differences and size covariations with white admixture came from Vint (1934) and Pearl (1934). Debates were generated. Mall (1909), for example, disputed Bean's (1906) claim that whites had relatively larger frontal lobes than blacks, although he accepted that there was an overall size difference of about 100 grams.

Mongoloid populations were not as intensely studied, at least not by Europeans. Morton's (1849) craniometric data on Amerindians had suggested a capacity intermediate to whites and blacks. Analyses and reviews of 15 autopsy studies on hundreds of Japanese and Koreans by Spitzka (1903) and Shibata (1936), however, suggested that Asians and Europeans were more or less comparable in brain weight. Brains from Asia were larger than those from Africa although Asians were often smaller in height and lighter in weight than were Africans.

Regardless, during World War II (1939-1945), ethnic nepotism led to unparalleled degrees of discrimination and killing. After the Holocaust, the association with Nazism discredited even the mildest attempts to produce genetic explanations of human affairs. Craniometry became associated with extreme forms of racial prejudice. For many years, research on race differences in brain size (and intelligence) virtually ceased, and the literature underwent vigorous critiques, notably from Philip V. Tobias (1970), Leon Kamin (1974), and Stephen Jay Gould (1981). As we shall see in the next chapter, their conclusions in favor of the null hypothesis do not hold.

6

Race, Brain Size, and Intelligence

From weighing wet brains at autopsy and calculating cranial capacity from skulls and external head measurements, it will be seen from modern as well as historical studies that Mongoloids and Caucasoids average larger brains than Negroids. The Mongoloid > Negroid finding is especially striking. When adjustments are made for body size, Mongoloids have even larger and heavier brains than do Caucasoids. Although sampling and methodological difficulties may be identified in particular studies, results obtained from multimethod comparisons allow a triangulation on probable truth.

The racial differences in brain size show up early in life. Analyses of the U.S. Collaborative Perinatal Project discussed in chapter 2 showed that 17,000 white infants and 7-year-olds had significantly larger head perimeters than their 19,000 black counterparts, even though, by 7 years, black children were taller and heavier (Broman et al., 1987). In all groups, head perimeter at birth and at age 7 correlated with IQ at age 7 from 0.10 to 0.20.

Small differences in brain volume translates into greater brain efficiency and millions of excess neurons and helps to explain the global distribution of intelligence test scores. It will be seen that Caucasoids from North America, Europe, and Australasia generally obtain mean IQs of around 100. Mongoloids from both North America and Pacific Rim countries typically obtain higher means in the range of 101-111. Negroids from south of the Sahara, the Caribbean, or the United States obtain means of from 70-90. Studies of mental decision times, measured in milliseconds, which correlate with conventional IQ tests (chap. 2), show that Mongoloids have the fastest reaction times, followed by Caucasoids, and then by Negroids.

Brain Weight at Autopsy

In a review highly critical of the literature on wet brain weight measured at autopsy, Tobias (1970) claimed that all interracial comparisons were "invalid," "misleading," and "meaningless" because 14 crucial variables had been left uncontrolled. These included "sex, body size, age of death, nutritional state in early life, source of the sample, occupational group, cause of death, lapse of time after death, temperature after death, anatomical level of severance [of brain from spinal cord], presence or absence of cerebrospinal fluid, of meninges, and of blood vessels" (pp. 3 and 16). Tobias pointed out that each of these variables alone could increase or decrease brain size by 10 to 20 percent, an amount equivalent or greater than any purported race difference. He equally opposed conclusions of race differences in structural variables such as cortical thickness, size of frontal lobe, or complexity of the brain's convolutions.

Because I was curious to know what the data would show, despite methodological weaknesses, and because I believed that the principle of aggregation (chap. 2) often cancels measurement error, I calculated the mid-points of the range of scores provided by Tobias (1970: 6, Table 2) and found that Mongoloids averaged 1,368 grams, Caucasoids 1,378 grams, and Negroids 1,316 grams (Rushton, 1988b). I also averaged a related measure, the "millions of excess nerve cells" estimated by Tobias for 8 subgroups and nationalities (1970: 9, Table 3). These were the number of neurons available for general adaptive purposes over and above that necessary for maintaining bodily functioning and were derivable from equations based on brain/body weight ratios (Jerison, 1963, 1973). Tobias was skeptical of the value of this "exercise" and provided few details. Nonetheless, I found that in millions of excess neurons, Mongoloids = 8,990, Caucasoids = 8,650, and Negroids = 8,550 (Rushton, 1988c).

Subsequent to Tobias's (1970) review, a major autopsy study was carried out by Ho et al. (1980a, 1980b) who provided original brain weight data for 1,261 adult subjects aged 25 to 80 from Cleveland, Ohio. Ho et al. excluded those brains obviously damaged and avoided most of the problems cited by Tobias. Sex-combined differences were found between 811 American whites (1,323 g; *SD* = 146) and 450 American blacks (1,223 g; *SD* = 144), a difference that, according to Ho et al., remained significant after controlling for age, stature, body weight, and total body surface area.

In the introduction to their article, Ho et al. (1980a) briefly reviewed additional literature from which I calculated that Mongoloids averaged 1,334 grams, Caucasoids 1,307 grams, and Negroids 1,289 grams. Averaging the three sets of estimates (Tobias's review, Ho et al.'s review, and Ho et al.'s data), I found a sex-combined brain weight for Mongoloids of 1,351 grams, Caucasoids 1,336 grams, and Negroids 1,286 grams (Rushton, 1988b). Further, Ho et al.'s review suggested that, whereas the Caucasoid brain weight began to decline at age 25, the Mongoloid brain weight may not do so until age 35.

Endocranial Volume

Many more studies have estimated brain size from cranial capacity, for, as J. R. Baker (1974: 429) remarked, "Skulls are many, freshly removed brains are few." This literature too has undergone serious critiques, for example, by Gould, first published in *Science* (1978), and then his book, *The Mismeasure* *of Man* (1981). In particular, Gould re-analyzed Morton's (1849) work, mentioned in the last chapter, and alleged that the figures had been biased by "unconscious...finagling" and "juggling" (1978: 503).

Gould (1981: 65) suggested how biases could be introduced into such data:

> Plausible scenarios are easy to construct. Morton, measuring by seed, picks up a threateningly large black skull, fills it lightly and gives it a few desultory shakes. Next, he takes a distressingly small Caucasian skull, shakes hard, and pushes mightily at the foramen magnum with his thumb. It is easily done, without conscious motivation; expectation is a powerful guide to action.

TABLE 6.1
S. J. Gould's "Corrected" Final Tabulation of Morton's Assessment of Racial Differences in Cranial Capacity

	Cubic inches	
Population	**1978 version**	**1981 version**
Native Americans	86	86
Mongolians	85	87
Modern Caucasians	85	87
Malays	85	85
Ancient Caucasians	84	84
Africans	83	83

Note. From Rushton (1989a, p. 14. Table 2). Copyright 1989 by Academic Press. Reprinted with permission.

Table 6.1 represents Gould's summary of Morton's data after correcting Morton's alleged errors. The first column reports Gould's 1978 summary and the second column his 1981 summary following an admission of his own bias in calculating the 1978 figures for modern Caucasians. In both his 1978 and 1981 writings, Gould dismissed the differences between groups as "trivial."

I have averaged Gould's 1978 and 1981 figures on cranial capacity and found, on both occasions, that Mongoloids (Native Americans + Mongoloids) > Caucasoids (Modern Caucasians + Ancient Caucasians) > Negroids (Africans). After excluding "Malays" due to uncertainty as to their racial category, the figures from column 1 are 85.5, 84.5, and 83 cubic inches (1,401; 1,385; and 1,360 cm^3) and from column 2 they are 86.5, 85.5, and 83 cubic inches, respectively (1,418; 1,401; 1,360 cm^3). The figures did not change appreciably if Malays were included as either Mongoloids or Caucasoids. Clearly, despite Gould's conclusions, Mongoloids and modern Caucasians had an advantage of 4 cubic inches (64 cm^3) over Africans in these "corrected" data (Rushton, 1988b, 1989b). Differences of even 1 cubic inch (16 cm^3) should probably not be dismissed as "trivial."

In any case, Gould's charge that Morton "unconsciously" doctored his results to show Caucasian racial superiority has been refuted. A random sample of the Morton collection was remeasured by Michael (1988) who found that very few errors had been made and that these were not in the direction that Gould had asserted. Instead, errors were found in Gould's own work. Michael (1988: 353) concluded that Morton's research "was conducted with integrity...(while)...Gould is mistaken."

I also averaged other data on endocranial volume and found support for my ranking based on Gould's analyses. For example, Coon (1982) had calculated capacities for 17 populations from detailed measurements made by Howells (1973) of 2,000 skulls recorded on a tour of the world's museums. Coon had concluded that "Asiatic Mongols, Eskimoes, and Polynesians have the largest brains, European Caucasoids the next largest, Africans and Australoids still smaller, and the small or dwarfed peoples the smallest" (1982: 18). Coon's book began with a preface from Howells warning readers not to be too easily dismissive. Combining the sexes, I found that Mongoloids = 1,401 cm^3, Caucasoids = 1,381 cm^3, and Negroids = 1,321 cm^3. I also averaged capacities from a table provided by Molnar (1983: 65) based on data from Montagu (1960) and found that Mongoloids = 1,494 cm^3, Caucasoids = 1,435 cm^3, and Negroids = 1,346 cm^3. I then averaged across Coon's and Molnar's figures to find Mongoloids = 1,448 cm^3, Caucasoids = 1,408 cm^3, and Negroids = 1,334 cm^3 (Rushton, 1988b).

An international database of up to 20,000 endocranial specimens from 122 ethnic groups has been computerized and classified in terms of climate and geography by Beals et al. (1984). It showed that endocranial volume varied according to climate in various regions of the world, including the Americas.

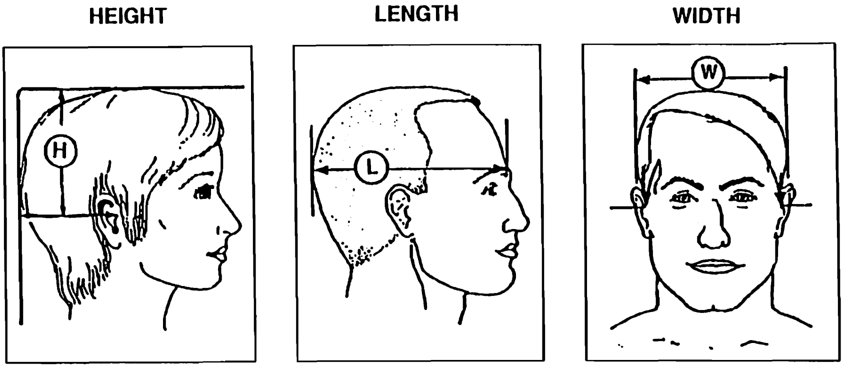
Overall there was a 2.5 cm^3 increase in brain volume with each degree of latitude. Regional differences emerged. Table 2 (p. 306) in Beals et al. shows that sex-combined brain cases from 26 populations in Asia averaged 1,380 cm^3 (*SD* = 83), 10 from Europe averaged 1,362 cm^3 (*SD* = 35), and 10 from Africa averaged 1,276 cm^3 (*SD* = 84).

The continental areas represented heterogenous ethnic groups. For example, "Asia" included Arabs, Hindus, Tamils and Veddas, while "Africa" included Egyptians (K. Beals, personal communication, May 9, 1993). When the aforementioned groups are eliminated to reduce racial heterogeneity by identifying continental areas in relation to the presence or absence of winter frost (Beals et al., 1984: 307, Table 5), the regional differences become more pronounced (19 Asian groups = 1,415 cm^3, *SD* = 51; 10 European groups = 1,362 cm^3, *SD* = 35; 9 African groups = 1,268 cm^3, *SD* = 85).

External Head Measurements

A third way of estimating cranial capacity is from external head measurements (Figure 6.1). For example, the length, width, and height of the head are placed in regression equations to predict cranial capacity. Lee and Pearson (1901) may have been the first to do this. They chose skulls in series of 50 to 100 from widely different races to permit generalizing the results. Capacities had been determined independently by competent observers. Altogether, skull

Figure 6.1: Cranial Capacity Estimated from External Head Measurements



H = height, L = length, and W = width. Using formulae devised by Lee and Pearson (1901), cranial capacity (cm^3) for men = .000337 (L = 11 mm) (W = 11 mm) (H - 11 mm) + 406.01 and for women = .0004 (L - 11 mm) (W - 11 mm) (H - 11 mm) + 206.6, where 11 mm is subtracted for fat and skin around the skull.

dimensions based on the greatest length, the greatest breadth, and the height measured from the auricular line were examined for 941 men and 516 women including representatives of the Asian, European, and African continents (p. 246, Table XX).

Lee and Pearson (1901) showed that their equations, including a "panracial" equation (p. 252, Number 14; p. 260), provided cranial capacity estimates more accurate for the individual skull than the direct method of using sand, seed, or shot. Their equations predicted both male and female capacities with errors of less than 1 percent, or about 2 to 5 cm^3 on crania of 1,300 to 1,500 cm^3 (p. 244, Table XVIII), considerably less than the 30 cm^3 difference typically found between two observers measuring the same series of skulls using an internal "packing" procedure.

Lee and Pearson's (1901) panracial equations were:

for men,

$$CC\ (\text{cm}^3) = 0.000337\ (L\text{-}11\text{mm})(B\text{-}11\text{mm})(H\text{-}11\text{mm}) + 406.01\ (1)$$

for women,

$$CC\ (\text{cm}^3) = 0.0004\ (L\text{-}11\text{mm})(B\text{-}11\text{mm})(H\text{-}11\text{mm}) + 206.6\ (2),$$

where CC is cranial capacity and L, B, and H are length, breadth, and height in millimeters and 11mm is subtracted for fat and skin around the skull. When data for height of head are missing, cranial capacity can be estimated from another equation given by Lee and Pearson (1901: 235, Table VII, Number 5; as used by Passingham (1979) and amended by Rushton (1993) to subtract 11mm for fat and skin around the skull):

for men,

$$CC\ (\text{cm}^3) = 6.752\ (L\text{-}11\text{mm}) + 11.421\ (B\text{-}11\text{mm}) - 1434.06\ (3)$$

for women,

$$CC\ (\text{cm}^3) = 7.884\ (L\text{-}11\text{mm}) + 10.842\ (B\text{-}11\text{mm}) - 1593.96\ (4).$$

I have applied these equations to four different anthropometric data sets. One set, compiled by Melville Herskovits (1930), a student of Franz Boas, has often been cited as showing an absence of racial differences because of the amount of overlap in the distributions. As can be seen in Table 6.2, a sample of 961 American Negroes had larger head measurements than a sample of Swedes. However, Herskovits's monograph actually contained information on head length and width for 26 internatioanl samples (N = 54,454; males only).

TABLE 6.2
Cranial Capacities Calculated from Head Lengths and Widths Provided by Herskovits (1930) for Various Male Samples and Classified by Race or Geographical Region

Race/region and group	Sample size	Length (mm)	Width (mm)	Cranial capacity (cm^3)
Mongoloids/Asian				
Pure Sioux	540	194.90	155.10	1,453
Half-blood Sioux	77	194.40	154.30	1,441
Montagnais-Naskapi	50	194.00	157.10	1,470
Marquesans	83	193.20	153.20	1,420
Hawaiians	86	191.25	158.93	1,472
	Mean	*193.55*	*155.73*	*1,451*
Caucasoids/European				
Old Americans	727	197.28	153.76	1,454
Foreign-born Scotch	263	196.70	153.80	1,451
Oxford students	959	196.05	152.84	1,435
Aberdeen students	493	194.80	153.40	1,433
Swedes	46,975	193.84	150.40	1,393
Cambridge students	1,000	193.51	153.96	1,431
Cairo natives	802	190.52	144.45	1,302
Foreign-born Bohemians	450	189.80	159.10	1,465
American-born Bohemians	60	188.00	156.50	1,423
	Mean	*193.39*	*153.13*	*1,421*
Negroids/African				
American Negroes	961	196.52	151.38	1,422
Masai	91	194.67	142.49	1,308
Lotuko	34	192.90	141.30	1,283
Kajiji	55	192.31	144.56	1,316
Somali	27	191.81	143.19	1,297
Ekoi	19	191.05	143.16	1,291
Vai	40	188.85	142.45	1,268
Akikuyu	384	188.72	143.25	1,276
Kagoro	72	188.19	142.43	1,263
Akamba	128	187.80	143.63	1,275
Ashanti	48	187.33	145.01	1,287
Acholi	30	187.30	141.80	1,250
	Mean	*190.62*	*143.72*	*1,295*

Note. From Rushton (1993, p. 230, Table 1). Copyright 1993 by Pergamon Press. Reprinted with permission. Cranial capacity (cm^3) = [6.752 x (L - 11mm)] + [11.421 x (W - 11mm)] - 1434.06. Formula is from Lee and Pearson (1901).

Using equation 3, I calculated cranial capacities for each sample and then took averages. I found that 5 "Mongoloid" samples (in this case, mostly North American Indians) averaged 1,451 cm^3 (*SD* = 22), 9 Caucasoid samples averaged 1,421 cm^3 (*SD* = 49), and 12 Negroid samples averaged 1,295 cm^3 (*SD* = 44). Treating each sample mean as an independent entry, a one-way ANOVA revealed that the races differed significantly in brain size with a highly significant trend in the predicted direction (Rushton, 1990c, as amended, 1993). No information was available on body size.

Herskovits's (1930) data were gathered by different investigators from different parts of the world using different techniques. Although not too much reliance should be placed on my reanalysis of this one study, nonetheless, because Herskovits's monograph has so often been referred to by those critical of race differences, the aggregation is noteworthy. It obviously confirms the re-aggregations of the "corrected" data sets by Tobias (1970) and Gould (1978, 1981).

To examine how generalizable were the results from the reanalyses of the data sets purporting to show "no difference," I sought out additional sets. The military services turned out to be a good source because of their need to measure the body proportions of their personnel so as to provide them with uniforms, including helmets. The U.S. National Aeronautics and Space Administration (1978) made a compilation from which I abstracted the body size and head size data for 24 international male military samples totaling 57,378 individuals (Rushton, 1991b). These are shown in Table 6.3. For each sample I calculated cranial capacities using equation 3 and then the mean differences. The unadjusted cranial capacity for the 4 Mongoloid samples was 1,343 cm^3 (*SD* = 47) and for 20 Caucasoid samples, 1,467 cm^3 (*SD* = 58). The stature, weight, and total body surface area of the Mongoloid samples averaged significantly lower than those of the Caucasoid samples. After adjusting for the body size variables, the least-square mean for Mongoloids was 1,460 cm^3, and for Caucasoids, 1,446 cm^3.

Probably the best single data set is the stratified random sample of 6,325 U.S. Army personnel measured in 1988 (Rushton, 1992a). Individual and head measurements were available separately for men and women, officers and enlisted personnel, and those who had defined themselves to the U.S. Army as black, Asian or white. Because head measurements were available for length, width, and height, cranial capacities were calculated from equations (1) and (2). The means and standard errors for all the variables are shown in Table 6.4.

For the entire sample, the unadjusted size of the cranium was 1,375 cm^3. The range was from 981 cm^3, a black woman, to 1,795 cm^3, a white man. Because the measurements had been gathered on individuals, specific adjustments could be made to the raw data for the effects of age, stature, and weight, and then sex, rank, or race.

The races differed significantly in both the unadjusted (raw) and adjusted cranial capacities. Analysis of variance of unadjusted cranial capacity showed that 543 Asian-Americans averaged 1,391 cm^3 (*SD* = 104), 2,871 European-Americans, 1,378 cm^3 (*SD* = 92) and 2,676 African-Americans, 1,362 cm^3 (*SD* = 95). After adjusting for the effects of stature, weight, sex, and military rank, the differences became larger with Asian-Americans averaging 1,416

TABLE 6.3
Anthropometric Variables for Male Military Samples from NASA (1978)

Race / NASA identification number, and group	Sample size	Head length (mm)	Head breadth (mm)	Head height (mm)	Stature (cm)	Weight (gms)	Surface area (m^2)	Cranial capacity (cm^3)	Encephalization quotient
Orientals									
84. Thai military, 1963	2,950	179.0	152.0	128.0	163.40	56,300	1.60	1,340	7.33
85. Vietnam military, 1964	2,129	181.9	149.0	123.3	160.43	51,100	1.52	1,299	7.58
86. South Korean Air Force, 1961	264	184.1	154.9	130.4	168.66	62,840	1.72	1,408	7.16
87. South Korean military, 1965	3,747	179.0	153.0	125.0	165.20	59,400	1.65	1,323	6.98
Mean		*181.0*	*152.2*	*126.7*	*164.42*	*57,410*	*1.62*	*1,343*	*7.26*
SD		*2.5*	*2.5*	*3.2*	*3.38*	*4,983*	*.08*	*47*	*.26*
Caucasoids									
18. U.S. Air Force fliers, 1950	4,063	197.0	154.1	129.7	175.56	74,100	1.90	1,471	6.69
19. U.S. Air Force, 1965	3,827	196.2	153.1	131.8	175.28	70,980	1.86	1,477	6.92
24. U.S. Navy fliers, 1965	1,549	198.3	155.6	131.1	177.64	77,760	1.95	1,502	6.62
25. U.S. Air Force, 1967	2,420	198.7	156.0	134.5	177.34	78,740	1.96	1,539	6.72
30. U.S. Army, 1966	6,682	194.7	152.7	132.3	174.52	72,160	1.87	1,470	6.81
31. U.S. Navy, 1966	4,095	194.2	152.3	135.4	175.33	71,560	1.87	1,491	6.95
32. U.S. Navy divers, 1972	100	197.5	154.0	142.6	176.22	81,520	1.98	1,589	6.78
33. U.S. Marines, 1966	2,008	194.3	152.8	133.8	174.56	72,650	1.87	1,482	6.83
34. U.S. Army aviators, 1959	500	197.3	155.4	126.7	176.52	71,100	1.87	1,455	6.81
36. U.S. Army aviators, 1970	1,482	197.0	152.6	132.9	174.56	77,630	1.93	1,488	6.56
48. NATO military, 1961	3,356	189.7	155.5	131.8	170.22	67,660	1.79	1,457	7.05
59. German Air Force, 1975	1,465	191.6	156.8	129.2	176.66	74,730	1.91	1,455	6.58
65. British soldiers, 1972	500	197.8	155.1	127.3	174.05	73,190	1.88	1,461	6.70
66. British Air Force, 1971	2,000	199.0	157.8	130.3	177.44	75,040	1.92	1,516	6.84
68. Canadian Air Force, 1961	314	193.5	152.9	131.5	177.44	76,410	1.94	1,458	6.50
69. Canadian Air Force, 1961	290	193.8	152.9	129.7	176.68	75,550	1.92	1,444	6.49
70. New Zealand Air Force, 1973	238	197.1	152.1	132.5	176.95	75,280	1.92	1,481	6.67
75. Latin American Forces, 1972	1,985	186.0	152.0	122.0	167.00	65,900	1.74	1,329	6.54
77. French young men, 1967	2,000	195.0	154.5	125.1	171.99	63,850	1.75	1,421	7.14
90. Iranian military, 1969	9,414	187.4	148.6	127.1	166.85	61,630	1.69	1,356	6.98
Mean		*195.3*	*153.9*	*130.9*	*174.66*	*72,872*	*1.88*	*1,470*	*6.76*
SD		*3.7*	*2.1*	*4.4*	*3.21*	*5,114*	*.09*	*58*	*.20*

Note. From Rushton (1991b, pp. 356-357, Table 1). Copyright 1991 by Ablex Publishing Corporation. Reprinted with permission.
Surface area (m^2) = [wt $(kgms)^{0.425}$ x ht $(cm)^{0.725}$ x 0.007184].
Cranial capacity (cm^3) = 0.000337 (Head length - 11 mm) (Head Breadth - 11 mm) + 406.01.
Encephalization quotient = Observed cranial capacity (cm^3)/Expected cranial capacity, i.e., (0.12) (Body weight in gms)$^{0.67}$.

TABLE 6.4
Cranial Capacity, Height, and Weight by Sex, Rank, and Race for 6,325 U.S. Military Personnel

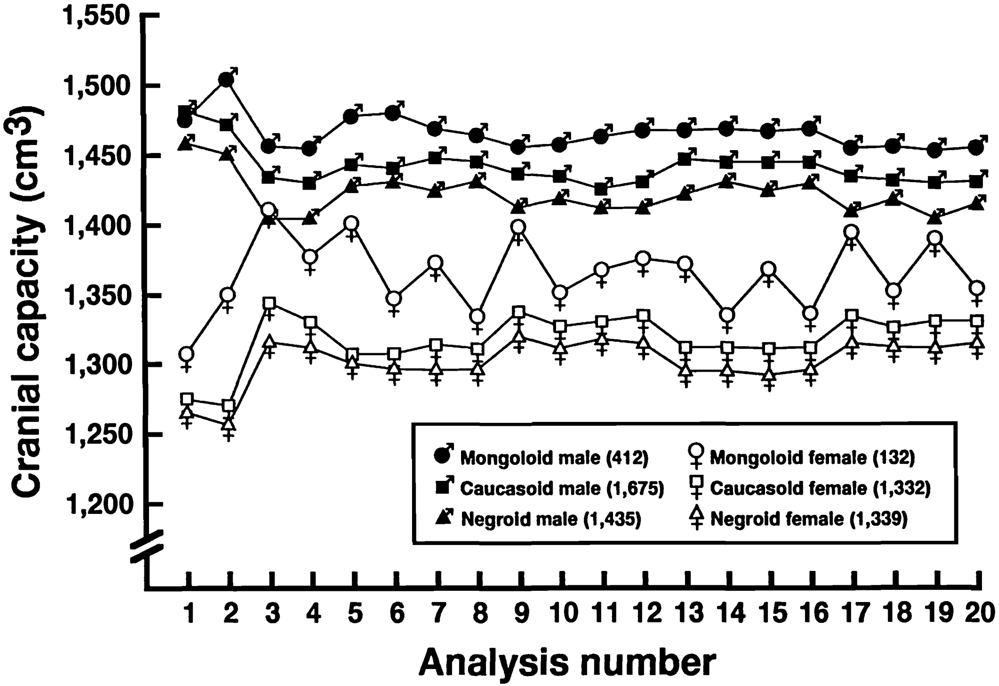
		Cranial capacity (cm^3)		Height (cm)		Weight (kg)	
Sex, rank / race	Sample size	Mean	SE	Mean	SE	Mean	SE
Female, enlisted							
Negroid	1,206	1,260	2.73	163.0	.18	62.2	.23
Caucasoid	1,011	1,264	2.84	162.9	.20	61.6	.25
Mongoloid	116	1,297	9.38	158.1	.61	58.6	.91
Female, officer							
Negroid	89	1,270	10.05	164.0	.66	64.4	.85
Caucasoid	270	1,284	5.49	164.7	.37	62.3	.55
Mongoloid	16	1,319	34.20	157.1	1.44	56.2	2.20
Male, enlisted							
Negroid	1,336	1,449	2.64	175.5	.18	78.4	.31
Caucasoid	1,302	1,468	2.52	176.0	.18	77.9	.30
Mongoloid	388	1,464	4.74	168.9	.32	73.2	.60
Male, officer							
Negroid	45	1,467	14.17	176.5	1.10	80.3	1.29
Caucasoid	288	1,494	5.48	177.6	.39	80.5	.57
Mongoloid	23	1,485	17.60	169.4	1.64	71.4	2.05

Note. From Rushton (1992a, p. 405, Table 1). Copyright 1992 by Ablex Publishing Corporation. Reprinted with permission.

cm^3, European-Americans 1,380 cm^3, and African-Americans 1,359 cm^3. Attempts to diminish the differences in cranial capacity by numerous corrections for body size were unsuccessful (Figure 6.2).

A fourth study was made possible by a 1990 review of ergonomically important body measurements compiled by the International Labour Office in Geneva (Jurgens, Aune, & Pieper, 1990). Head and body size measurements had been gathered over a 30-year period for tens of thousands of men and women aged 25 to 45 years. Some 300 references had been examined from 7 sources: handicraft workers such as tailors and shoemakers, anthropology studies, medical records, sports participation, growth surveys, forensic and legal investigations, and ergonomic studies. Notably lacking were the studies of

Figure 6.2: Cranial Capacity for a Stratified Random Sample of 6,325 U.S. Army Personnel



The data, grouped into six sex by race categories, are collapsed across military rank. They show, across 20 different analyses controlling for body size, men averaging larger cranial capacities than women and Asian-Americans averaging larger than European-Americans or African-Americans. Analysis 1 presents the data, unadjusted for body size. From Rushton (1992a, p. 408, Figure 1). Copyright 1992 by Ablex Publishing Corporation. Reprinted with permission.

TABLE 6.5
Cranial Capacities of World Populations of 25 to 45-Year-Olds

	Men				Women			
Region, number of references, and source countries	Stature (mm)	Head length (mm)	Head breadth (mm)	Cranial capacity (cm^3)	Stature (mm)	Head length (mm)	Head breadth (mm)	Cranial capacity (cm^3)
1. North America (34 refs. from Canada and U.S.A.)	1,790	195	155	1,453	1,650	180	145	1,191
2. Latin America (20 refs. from Indian populations in Bolivia, Peru, etc.)	1,620	185	150	1,328	1,480	175	145	1,152
3. Latin America (15 refs. from European-Negroid populations in Chile, the Caribbean Island States, etc.)	1,750	190	155	1,419	1,620	175	150	1,206
4. Northern Europe (28 refs. from Denmark, Sweden, etc.)	1,810	195	155	1,453	1,690	180	150	1,246
5. Central Europe (42 refs. from Austria, Switzerland, etc.)	1,770	190	155	1,419	1,660	180	145	1,191
6. Eastern Europe (14 refs. from Poland and Soviet Union)	1,750	190	155	1,419	1,630	180	150	1,246
7. South-eastern Europe (40 refs. from Bulgaria, Romania, etc.)	1,730	190	155	1,419	1,620	175	150	1,206
8. France (20 refs.)	1,770	195	155	1,453	1,630	180	140	1,137
9. Iberian Peninsula (6 refs. from Spain and Portugal)	1,710	185	155	1,385	1,600	180	150	1,246
10. North Africa (10 refs. from Algeria, Ethiopia, Sudan, etc.)	1,690	190	145	1,305	1,610	185	140	1,177
11. West Africa (10 refs. from Congo, Ghana, Nigeria, etc.)	1,670	195	145	1,339	1,530	180	135	1,083
12. South-eastern Africa (16 refs. from Angola, Kenya, etc.)	1,680	195	145	1,339	1,570	180	135	1,083
13. Near East (5 refs. from Iraq, Lebanon, Turkey, etc.)	1,710	190	150	1,362	1,610	180	140	1,137
14. North India (23 refs. from Bangladesh, Nepal, etc.)	1,670	190	145	1,305	1,540	180	135	1,083
15. South India (3 refs. from India and Sri Lanka)	1,620	180	145	1,237	1,500	175	130	989
16. North Asia (5 refs. from China, Mongolia, etc.)	1,690	190	150	1,362	1,590	180	145	1,191
17. South China (9 refs. from Macao, Taiwan, etc.)	1,660	190	150	1,362	1,520	180	145	1,191
18. South-East Asia (11 refs. from Brunei, Indonesia, Malaysia, Philippines, etc.)	1,630	185	145	1,271	1,530	175	135	1,043
19. Australia (6 refs. from European population in Australia and New Zealand)	1,770	192	155	1,433	1,670	180	145	1,191
20. Japan (26 refs. from Japan and Korea)	1,720	190	155	1,419	1,590	180	145	1,191

Note. From Rushton (1994, Table 1).

Cranial capacity for men (cm^3) = [6.752 x (Head length - 11 mm) + 11.421 x (Head breadth - 11 mm)] - 1434.06.

Cranial capacity for women (cm^3) = [7.884 x (Head length - 11 mm) + 10.842 x (Head breadth - 11 mm) - 1593.96. Formulas are from Lee and Pearson (1901).

military personnel examined above, thus making these new data independent of previous sets.

Jurgens et al. (1990) grouped their data into 20 world regions. Summarized in Table 6.5 are the 50th percentile measures of stature, head length, and head breadth, separately for men and women as well as the number of references cited to arrive at the summarized figures. From these I derived cranial capacities using equations (4) and (5) above (Rushton, 1994).

Because the regions were fully described in the research report with respect to the included countries (see Table 6.5), it was possible to eliminate ambiguous categories, thereby facilitating racial comparisons. Excluded from statistical analysis were 6 regions: No. 2 (Amerindians), Nos. 3 and 10 (combining Caucasoid and Negroid populations), Nos. 14 and 15 (North and South India), and No. 18 (combining Caucasoid and Mongoloid populations).

If each of the male/female sample means is treated as an independent entry for analysis, there are 6 clear Mongoloid samples (Regions 16, 17, and 20), 18 predominately Caucasoid samples (Regions 1, 4, 5, 6, 7, 8, 9, 13, and 19), and 4 clear African samples (Regions 11 and 12). Analysis of variance carried out on the unadjusted (raw) means showed that the east Asians (M = 1,286 cm^3, SD = 117) and Caucasoids (M = 1,311 cm^3, SD = 103) averaged larger absolute cranial capacities than Africans (M = 1,211 cm^3, SD = 144). After adjusting for the effects of stature, the differences became more pronounced with east Asians averaging 1,308 cm^3, Caucasians 1,297 cm^3, and Africans 1,241 cm^3. Subsidiary analyses weighted by the number of references or some other combination of countries did not alter the overall pattern of the results (Rushton, 1994).

Brain Size from Infancy to Adolescence

Race differences in brain size are evident in infants and young children. Ho, Roessmann, Hause, and Monroe (1981) collated brain weights at autopsy from 782 newborns. In absolute terms (unadjusted for other variables), white babies averaged heavier brains than black babies: 272 grams versus 196 grams. Many of these babies were premature (49 percent of the white sample and 78 percent of the black sample). When the criteria of a gestational age of 38 weeks and a body weight at birth of 2,500 grams was employed to define "full term" in both groups, the racial differences disappeared. Black babies, however, have a biologically based shorter gestation than white babies (chap. 7) and so the appropriateness of imposing these criteria for racial comparisons can be questioned.

The U.S. Collaborative Perinatal Project discussed in chapter 2 examined and followed up approximately 17,000 white children and 19,000 black children from conception to the age of 7 years in the United States (Broman et al., 1987). In both blacks and whites, head perimeter at birth, 4 months, 1 year, 4 years, and 7 years predicted IQ scores at age 7 from 0.12 to 0.24 (Table 2.3). I have calculated from the appropriate tables in Broman et al. (1987) that the white children are born with larger heads and larger bodies (a 16 percentile point advantage in each). However, I have also calculated that catch-up growth favors black children in height but not in head perimeter. By age 4 black children are 11 percentile points taller than white children, and by age 7 they are 16 percentile points taller, but at age 7 their head perimeter remains 8 percentile points smaller. With IQ measured at 4 and at 7 years of age, white children show a 34 percentile point advantage (1 standard deviation).

Adolescents have also been examined. R. Lynn (1993) used Lee and Pearson's (1901) equations (1) and (2) to calculate cranial capacities from external head measurements on 36 samples of 7- to 15-year-olds gathered by the Philadelphia Growth Center (Krogman, 1970). The core sample consisted of 169 white males, 224 black males, 135 white females, and 220 black females. The boys and girls had all been screened for serious illnesses or dental problems and were middle-class from "a solid, stable responsible cross section of the population" (Krogman, 1970: 4). After adjusting for the effects of age, stature, and sex, white children averaged 1,250 cm^3 and black children averaged 1,236 cm^3.

Summary of Brain Size Data

Table 6.6 summarizes the results from 44 studies of race differences in adult brain size from the 3 different methods discussed: wet brain weights from autopsies (grams), endocranial volume (cm^3), and external head measurements (cm^3). The brain size in grams can be converted to cranial capacity in cubic centimeters and vice versa. J. R. Baker (1974: 429) provided an equation for changing cm^3 to grams:

$$\text{Brain weight [g]} = 1.065\ \text{cm}^3 - 195 \qquad (5)$$

To convert brain weight into cranial capacity, a specific gravity of 1.036 has often been assumed. Thus:

$$\text{Cranial capacity (cm}^3\text{)} = 1.036\ \text{g} \qquad (6)$$

These equations do not result in the same product. Equation (6) has been used in modern studies (e.g., Hofman, 1991) and will be used here to convert the autopsy data in Table 6.6 from grams to cm^3.

There are four sets of data itemized and then averaged in Table 6.6. Section A sets out the results of autopsy studies. There were 38 of these, including 16 reports of data from Korea and Japan, 18 from Caucasoids in Europe and the United States, and 8 from Negroids in Africa and the United States. The results are shown for men and women separately where possible. For some studies, key reviews were used because the originals were unpublished, in a foreign language, or otherwise difficult to obtain. In the studies cited by Dekaban and Sadowsky (1978) I calculated the mean as the midpoint of a range. Double entries have been eliminated whenever found. After the 38th autopsy study, summary statistics are provided for each racial group showing the number of studies, the range, the mean, and the median. The sex-combined averages are calculated by adding the mean and median figures for men and women and dividing by two. Following this, the mean is transformed into cm^3 using equation (6).

TABLE 6.6
Summary of Race Differences in Brain Size: Multimethod Comparisons

		Mongoloids			Caucasoids			Negroids		
Data type / source	**Samples and procedures**	**Men**	**Women**	**Both**	**Men**	**Women**	**Both**	**Men**	**Women**	**Both**
A. Autopsy data (grams)										
1. Peacock (1865, cited and averaged by Pearl, 1934)	5 Negro men	–	–	–	–	–	–	1,257	–	–
2. Russell (1869, analyzed by Pearl, 1934)	379 black soldiers and 24 white soldiers most of whom died of pneumonia during U.S. Civil War	–	–	–	1,471	–	–	1,342	–	–
3. Doenitz (1874, cited in Spitzka, 1903)	10 Japanese men executed by decapitation	1,337	–	–	–	–	–	–	–	–
4. Bischoff (1880, cited in Pakkenberg & Voigt, 1964)	906 Europeans measured at pathology institute	–	–	–	1,362	1,219	(1,291)	–	–	–
5. Taguchi (1881, cited in Spitzka, 1903)	100 Japanese men executed by decapitation	1,356	–	–	–	–	–	–	–	–
6. Topinard (1885, cited in Pearl, 1934)	29 unspecified Negro men, collected from the literature	–	–	–	–	–	–	1,234	–	–
7. Suzuki (1892, cited in Shibata, 1936)	27 Japanese (24 men, 3 women) aged 35 to 73	1,348	1,120	(1,234)	–	–	–	–	–	–
8. Taguchi (1892, cited in Shibata, 1936)	524 Japanese (374 men, 150 women) aged 21 to 95	1,367	1,214	(1,291)	–	–	–	–	–	–
9. Marshall (1892)	2,012 British (972 men, 1,040 women) aged 20 to 90 years; reanalysis of 1861 data published with breakdowns for age, height, weight, sane/insane	–	–	–	1,329	1,194	(1,262)	–	–	–
10. Waldeyer (1894, cited in Pearl, 1934)	12 African men aged 15+	–	–	–	–	–	–	1,148	–	–
11. Retzius (1900, cited in Pakkenberg & Voigt, 1964)	700 Swedes at a pathological institute	–	–	–	1,399	1,248	(1,324)	–	–	–
12. Matiegka (1902, cited in Pakkenberg & Voigt, 1964)	416 Europeans at a pathological institute	–	–	–	1,347	1,204	(1,276)	–	–	–
13. Matiegka (1902, cited in Pakkenberg & Voigt, 1964)	581 Europeans at the Institute of Forensic Medicine in Prague	–	–	–	1,450	1,306	(1,378)	–	–	–
14. Marchand (1902, cited in Pakkenberg & Voigt, 1964)	1,169 Europeans aged 18 to 50 at a pathological institute in Marburg	–	–	–	1,400	1,275	(1,338)	–	–	–
15. Spitzka (1903)	597 Japanese (421 men, 176 women) aged 21 to 95 from hospitals around Tokyo; ten years of records including data on age, stature, weight	1,367	1,214	(1,291)	–	–	–	–	–	–
16. Bean (1906)	Review of records for 22 Negro men and 10 Negro women	–	–	–	–	–	–	1,256	980	(1,118)
17. Bean (1906)	125 Americans from an anatomical laboratory in Baltimore (37 white men, 9 white women, 51 black men, 28 black women)	–	–	–	1,341	1,103	(1,222)	1,292	1,108	(1,200)
18. Chernyshev (1911, cited in Dekaban & Sadowsky, 1978)	Unspecified number of men and women (probably Russian) aged 20 to 80 years	–	–	–	1,346	1,210	(1,278)	–	–	–

TABLE 6.6 (cont.)

		Mongoloids			Caucasoids			Negroids		
Data type / source	**Samples and procedures**	**Men**	**Women**	**Both**	**Men**	**Women**	**Both**	**Men**	**Women**	**Both**
19. Nagayo (1919, 1925, cited in Shibata, 1936)	485 Japanese (329 men, 156 women) aged 16 to 60	1,362	1,242	(1,302)	–	–	–	–	–	–
20. Kurokawa (1920, cited in Shibata, 1936).	440 Japanese (240 men, 200 women) aged 15 to 50	1,402	1,256	(1,329)	–	–	–	–	–	–
21. Kubo (1922, cited in Shibata, 1936)	60 Koreans (56 men, 4 women) aged 21 to 74	1,353	1,206	(1,280)	–	–	–	–	–	–
22. Kimura (1925, cited in Shibata, 1936)	405 Japanese (243 men, 162 women) aged 15 to 50	1,402	1,249	(1,326)	–	–	–	–	–	–
23. Muhlmann (1927, cited in Dekaban & Sadowsky, 1978)	Unspecified number of men and women (probably German) aged 20 to 80 years	–	–	–	1,346	1,205	(1,276)	–	–	–
24. Yoshizawa (1929, 1930, cited in Shibata, 1936)	315 Japanese (211 men, 104 women) aged 16 to 80	1,361	1,231	(1,296)	–	–	–	–	–	–
25. Hoshi (1930, cited in Shibata, 1936)	954 Japanese (551 men, 403 women) aged 16+	1,396	1,255	(1,326)	–	–	–	–	–	–
26. Hoshi (1930, cited in Shibata, 1936)	Unknown number of Japanese of both sexes aged 15 to 50	1,406	1,261	(1,334)	–	–	–	–	–	–
27. Amano-Hayashi (1933, cited in Shibata, 1936)	1,817 Japanese (1,074 men, 743 women) aged 16+	1,375	1,244	(1,310)	–	–	–	–	–	–
28. Kusumoto (1934, cited in Shibata, 1936)	522 Japanese (342 men, 180 women) of unknown age	1,360	1,241	(1,301)	–	–	–	–	–	–
29. Vint (1934)	389 adult Kenyans of Bantu and Nilotic stock autopsied by author from native hospitals in Nairobi; only brains judged normal used; weights validated against cranial capacity using water technique and compared to data published on Europeans	–	–	–	1,428	–	–	1,276	–	–
30. Shibata (1936)	153 Koreans (136 men, 17 women) aged 17 to 78; those who died of diseases known to influence brain weight were excluded	1,370	1,277	(1,324)	–	–	–	–	–	–
31. Roessle & Roulet (1938, cited in Pakkenberg & Voigt, 1964)	456 German soldiers	–	–	–	1,405	–	–	–	–	–
32. Appel & Appel (1942)	2,080 white U.S. men aged 12 to 96 at a mental hospital in Washington, DC; weights recorded from hospital records; brains with lesions and abnormalities excluded	–	–	–	1,305	–	–	–	–	–
33. Takahashi & Suzuki (1961)	470 Japanese (301 men, 169 women) aged 30 to 69	1,397	1,229	(1,313)	–	–	–	–	–	–
34. Pakkenberg & Voigt (1964)	1,026 Danes (724 men, 302 women) aged 19 to 95 at the Forensic Institute in Copenhagen between 1959 and 1962; age, height, weight, and cause of death examined	–	–	–	1,440	1,282	(1,361)	–	–	–

TABLE 6.6 (cont.)

		Mongoloids			Caucasoids			Negroids		
Data type / source	**Samples and procedures**	**Men**	**Women**	**Both**	**Men**	**Women**	**Both**	**Men**	**Women**	**Both**
35. Spann & Dustmann (1965, cited in Dekaban & Sadowsky, 1978)	Unspecified number of German men and women aged 15 to 94	–	–	–	1,403	1,268	(1,336)	–	–	–
36. Chrzanowska & Beben (1973, cited in Dekaban & Sadowsky, 1978)	1,670 Poles (896 men, 774 women) aged 20 to 89	–	–	–	1,413	1,266	(1,340)	–	–	–
37. Dekaban & Sadowsky (1978)	4,736 U.S. whites (2,733 males, 1,963 females) from hospitals around Washington, D.C., aged birth to 86+; figures calculated for 16 to 86 years (2,036 men, 1,411 women)	–	–	–	1,392	1,254	(1,323)	–	–	–
38. Ho et al. (1980a, 1980b)	1,261 white and black Americans aged 25 to 80 (416 white men, 228 black men, 395 white women, 222 black women); weights taken from 5 years of records at Case Western Reserve University	–	–	–	1,392	1,252	(1,322)	1,286	1,158	(1,222)
Summary of A	*Number of studies*	*16*	*14*	*14*	*18*	*14*	*14*	*8*	*3*	*3*
	Range	*1,337-1,406*	*1,120-1,277*	*1,234-1,334*	*1,305-1,471*	*1,103-1,306*	*1,222-1,378*	*1,148-1,342*	*980-1,158*	*1,118-1,222*
	Mean in grams	*1,372*	*1,231*	*1,304*	*1,387*	*1,235*	*1,309*	*1,261*	*1,082*	*1,180*
	Median in grams	*1,367*	*1,242*	*1,306*	*1,396*	*1,250*	*1,323*	*1,267*	*1,108*	*1,200*
	Mean in cm³	*1,421*	*1,275*	*1,351*	*1,437*	*1,280*	*1,356*	*1,306*	*1,121*	*1,223*
B. Endocranial volume (cm³)										
39. Beals et al. (1984)	Sex-combined endocranial volume from 122 populations based on up to 20,000 specimens from around the world and their geographic and climatic coordinates; packing was made with mustard seed; a standard 6% reduction made for studies reporting results based on lead shot	1,491	1,340	(1,415)	1,441	1,283	(1,362)	1,338	1,191	(1,268)
C. Cranium size from external head measurements (cm³)										
40. Rushton (1990c, amended 1993)	26 male populations (5 "Mongoloid" – mostly Amerindian, 9 European and European-American and 12 African and African-American; 54,454 individuals); measurements compiled by Herskovits (1930)	1,451	–	–	1,421	–	–	1,295	–	–
41. Rushton (1991b)	24 international male military samples (4 Mongoloid, 20 Caucasoid; 57,378 individuals); measurements compiled by NASA (United States, 1978)	1,343 1,460*	– –	– –	1,467 1,446*	– –	– –	– –	– –	– –

TABLE 6.6 (cont.)

Data type / source	Samples and procedures	Mongoloids			Caucasoids			Negroids		
		Men	Women	Both	Men	Women	Both	Men	Women	Both
42. Rushton (1992a)	6,325 U.S. military personnel from a stratified random sample including officers and enlisted personnel (411 Asian men, 132 Asian women, 1,590 white men, 1,281 white women, 1,381 black men, 1,295 black women); measurements gathered by Army	1,465 1,486*	1,300 1,319*	(1,383) (1,403)*	1,473 1,462*	1,268 1,259*	(1,371) (1,361)*	1,450 1,441*	1,261 1,250*	(1,356) (1,346)*
43. Rushton (1994)	28 world samples (3 of Asian men, 3 of Asian women, 9 of Caucasian men, 9 of Caucasian women, 2 of African men, 2 of African women; tens of thousands of individuals); measurements compiled by the International Labour Office in Geneva	1,381 1,371*	1,191 1,244*	(1,286) (1,308)*	1,422 1,378*	1,199 1,215*	(1,311) (1,297)*	1,339 1,337*	1,083 1,144*	(1,211) (1,241)*
Summary of C	*Number of studies (uncorrected)*	*4*	*2*	*2*	*4*	*2*	*2*	*3*	*2*	*2*
	Range	*1,343- 1,465*	*1,191- 1,300*	*1,286- 1,383*	*1,421- 1,473*	*1,199- 1,268*	*1,311- 1,371*	*1,295- 1,450*	*1,083- 1,261*	*1,211- 1,356*
	Mean in cm^3	*1,410*	*1,246*	*1,335*	*1,446*	*1,234*	*1,341*	*1,361*	*1,172*	*1,284*
	Median in cm^3	*1,416*	*1,246*	*1,335*	*1,445*	*1,234*	*1,341*	*1,339*	*1,172*	*1,284*
	Number of studies (corrected)	*3*	*2*	*2*	*3*	*2*	*2*	*2*	*2*	*2*
	Range	*1,371- 1,486*	*1,244- 1,319*	*1,308- 1,403*	*1,378- 1,462*	*1,215- 1,259*	*1,297- 1,361*	*1,337- 1,441*	*1,144- 1,250*	*1,241- 1,346*
	Mean in cm^3	*1,439*	*1,282*	*1,356*	*1,425*	*1,237*	*1,329*	*1,389*	*1,197*	*1,294*
	Median in cm^3	*1,460*	*1,282*	*1,356*	*1,446*	*1,237*	*1,329*	*1,389*	*1,197*	*1,294*
D. Grand summary: Mean of means (cm^3)										
	Autopsies	1,421	1,275	1,351	1,437	1,280	1,356	1,306	1,121	1,223
	Endocranial volume	1,491	1,340	1,415	1,446	1,283	1,362	1,338	1,191	1,268
	External head measures	1,410	1,246	1,335	1,446	1,234	1,341	1,361	1,172	1,284
	Corrected external head measures	1,439	1,282	1,356	1,425	1,237	1,329	1,389	1,197	1,294
	GRAND MEAN in cm^3	*1,440*	*1,286*	*1,364*	*1,437*	*1,259*	*1,347*	*1,349*	*1,170*	*1,267*

Note. *Adjustments made for body size.

The results in section A show that the sex-combined mean brain weight of Mongoloids is almost as heavy (1,304 g) as that of Caucasoids (1,309 g) and that both of these are higher than those of Negroids (1,180 g). The statistical significance of these differences can be gauged from the fact that in no case is the brain weight of a Negroid sample of men or women above the mean or median of those of Mongoloids or Caucasoids ($p < .001$). Translating the grams into cm^3 the Mongoloids, Caucasoids, and Negroids average, respectively 1,351; 1,356; and 1,223 cm^3.

Section B sets out the endocranial data. Here the global review by Beals et al. (1984) based on up to 20,000 endocranial specimens from 122 ethnic groups is relied on. The sex-combined mean for Mongoloids is 1,415 cm^3, for Caucasoids 1,362 cm^3, and for Negroids 1,268 cm^3 (Figures from Table 5 of Beals et al., 1984; sex differences from K. Beals, personal communication, May 9, 1993). Several endocranial studies carried out within the United States, described at the end of chapter 5 (e.g. Todd, 1923, Simmons, 1942), have not been included, nor has the subsequent confirmation of the Beals et al. figures for Negroid crania in the independent review by Ricklan and Tobias (1986). Ricklan and Tobias (1986), for example, found that 917 males averaged 1,342 cm^3 and 320 females averaged 1,280 cm^3 for a sex-combined Negroid mean of 1,280 cm^3. Because of the degree of overlap in some series, I took Beals et al. (1984) to be sufficient.

Section C sets out four studies estimating cranial capacity from external head measurements. The non-asterisked figures are uncorrected for body size while the asterisked figures have been corrected. As in Section A, the number of studies, the range, the mean, and the median are provided. The uncorrected sex-combined mean cranial capacity of Mongoloids (1,335 cm^3) is virtually the same as for Caucasoids (1,341 cm^3), both of which average larger than Negroids (1,284 cm^3). Using the body size corrected figures in Section C shows Mongoloids average 1,356 cm^3, Caucasoids 1,329 cm^3, and Negroids 1,294 cm^3. These differences are highly significant within studies.

Noteworthy is the consistency of the results shown across the different methods. In cm^3 the data from (a) autopsies, (b) endocranial volume, (c) head measurements, and (d) head measurements corrected for body size show: Mongoloids = 1,351; 1,415; 1,335; 1,356 (mean = 1,364); Caucasoids = 1,356; 1,362; 1,341; 1,329 (mean = 1,347); and Negroids = 1,223; 1,268; 1,284; 1,294 (mean = 1,267). From these a world average brain size can be calculated of 1,326 cm^3, comparable to one of 1,349 cm^3 computed by Beals et al. (1984).

The primary conclusion to be made is that whereas the Mongoloid-Caucasoid difference in brain size is quite small, amounting to an average of 17 cm^3 favoring Mongoloids overall (14 cm^3 on uncorrected measures and 27 cm^3 on measures corrected for body size), those between Mongoloids and Negroids average an overall 97 cm^3. The Mongoloid-Negroid difference based on autopsy data is 128 cm^3, on endocranial volume 147 cm^3, on uncorrected external head measurements 51 cm^3, and on head measurements corrected for body size 62 cm^3. The mean difference between Caucasoids and Negroids is 80 cm^3.

No exact solution is possible, of course, to the problem of how large the difference in cranium size is among the races. The magnitudes depend on which samples are included, whether the craniums are adjusted for body size, and which methods are used for computing the average. For example, one might hold that brain size should be weighted by sample size because larger samples provide more stable estimates than do smaller samples, at least when the samples are homogeneous with respect to methods employed. With approximate solutions the only way is to use as many estimates as possible and see if they triangulate. Many of the figures can be recalculated using sample weighted means, mid-points of ranges, medians, and other procedures. These make no difference to the rank orderings, especially of Mongoloid and Caucasoid greater than Negroid. Whether Mongoloids average higher than Caucasoids, however, sometimes depends on correction for body size.

The pervasive sex difference in brain size so clearly observed throughout Table 6.6 has been known since Paul Broca in the nineteenth century. As with race differences, however, critics have suggested the differences "disappear" when variables such as age and body size are controlled for (Gould, 1981:105–6). A decisive reanalysis of Ho et al.'s (1980) autopsy data by Ankney (1992) now makes clear that even after controlling for body size and other variables, a 100 gram difference remains between men and women. My own research using external head measurements confirmed Ankney's results, including in the stratified sample of 6,325 U.S. Army personnel. Ankney (1992) proposed that the sex difference in brain size is related to those intellectual qualities at which men excel, that is, in spatial and mathematical reasoning.

Differences due to method of estimation within a race are smaller than the differences between Mongoloids and Negroids. Based on the sex-combined averages, discrepancies due to methods within race average 31 cm^3. Within Mongoloids the discrepancies range from 5 to 80 cm^3, with a mean of 41 cm^3; within Caucasoids they range from 6 to 33 cm^3, with a mean of 19 cm^3; and within Negroids they range from 10 to 71 cm^3, with a mean of 38 cm^3.

Problems of sampling and lack of control over extraneous variables can be cited for many of the individual studies (Tobias, 1970). These difficulties, of course, apply to data from all three racial groups and there is no special reason to believe they are systematically in favor of one race over another. Body size differences cannot be the cause of the racial differences because Mongoloids have a greater cranial capacity than Negroids although they are often shorter in height and lighter in weight (Eveleth & Tanner, 1990). The racial ordering remains constant even in samples where Negroids are taller than Caucasoids, as in the study by Simmons (1942) cited at the end of the last chapter, or when the races are statistically equated by adjusting for body size.

Within humans, Haug (1987: 135) has reported a correlation of $r = .479$ ($n = 81, p < .001$) between the number of neurons in the human cerebral cortex and brain volume in cm^3, including both men and women in the sample. The regression equating the two is given as: (# of cortical neurons [in billions] = 5.583 + 0.006 [cm^3 brain volume]). This means that on this estimate, Mongoloids, who average 1,364 cm^3 have 13.767 billion cortical neurons (13.767 x 10^9). Caucasoids who average 1,347 cm^3 have 13.665 billion such neurons, 102 million less than Mongoloids. Negroids who average 1,267 cm^3, have 13.185 billion cerebral neurons, 582 million less than Mongoloids and 480 million less than Caucasoids.

Overall the human brain has been estimated to contain up to 100 billion (10^{11}) nerve cells classifiable into about 10,000 different types (Kandel, 1991). There may be 100,000 billion synapses. Even storing information at the low average rate of one bit per synapse, which would require two levels of synaptic activity (high and low), the structure as a whole would generate 10^{14} bits. Contemporary supercomputers, by comparison, command a memory of about 10^9 bits of information.

Most neural tissue goes to maintain bodily functions. Over and above this are "excess neurons" available for general adaptive purposes (Jerison, 1973). However crude the current estimates, hundreds of millions of cerebral cortex neurons differentiate Mongoloids from Negroids (582 x 10^6 based on those just calculated; 440 x 10^6 based on those averaged from Tobias as described on page 114). These are probably sufficient to underlie the proportionate achievements in intelligence and social organization. The half-billion neuron difference between Mongoloids and Negroids are probably all "excess neurons" because, as mentioned, Mongoloids are often shorter in height and lighter in weight than Negroids. The Mongoloid-Negroid difference in brain size across so many estimation procedures is striking.

Intelligence Test Scores

Since the time of World War I, when widespread testing began, African-descended people have scored lower than whites on assessments of intelligence and educational attainment (Loehlin et al., 1975). Fewer people are aware that Orientals often score higher than whites on the same tests whether assessed in Canada and the United States, or in their home countries (P. E. Vernon, 1982). In an overview of mathematics education, for example, Steen (1987) showed that within the United States, the proportion of Oriental-American students who achieve high mathematics scores (above 650) on the Scholastic Aptitude Test is twice the national average while the proportion of black students who do so is much less than one-fourth the national average.

A review of the global distribution of intelligence test scores has been provided by Richard Lynn (1991c). The mean IQs for whites in the United States, Britain, Continental Europe, Australia, and New Zealand were presented relative to an American IQ set at 100, with a standard deviation of 15. Caucasoids in the United States and Britain obtained virtually identical mean IQs. This was first demonstrated in a 1932 Scottish survey of 11-year-olds who obtained a mean IQ of 99 on the American Stanford-Binet. Subsequent studies in Scotland and Britain confirmed this result.

The earlier standardization of tests in the United States were generally based on normative samples of Caucasoids only, such as the early Stanford-Binet and Wechsler tests, but the later standardizations such as the WISC-R included blacks. For this reason R. Lynn adjusted the American means for later tests, because when the mean of the American total population is set at 100, the mean of American whites is 102.25, as derived from the standardization sample of the WISC-R (Jensen & Reynolds, 1982).

The mean IQs from all the Caucasoid populations reviewed lay in the range of 85 to 107. R. Lynn discussed some of the reasons for the variation between and within countries, such as sampling accuracy and procedures as well as differences in education and living standards. For example, in the case of children, those in private schools may or may not be included in the samples. The IQs of Indians from the Indian subcontinent and Britain ranged from 85 to 96. A mean of 86 in India was derived from a review by Sinha (1968) of 17 studies of children aged between 9 and 15 years and totaling in excess of 5,000. The ethnic Indians in Britain obtained a mean of 96.

The Mongoloid mean IQs are set out in Table 6.7. It will be seen that for general intelligence the Mongoloid peoples tend in the majority of studies to obtain somewhat higher means than Caucasoids. This is the case in the United States, Canada, Europe, Japan, Hong Kong, Taiwan, Singapore, and the People's Republic of China. The range is from 97 to 116, with a mean of around 105.

A striking feature of the result for Mongoloids is that their verbal IQs are consistently lower than their visuospatial IQs. In most studies the differences are substantial, amounting to between 10 to 15 IQ points. This pattern is present in Japan, Hong Kong, the United States, and Canada. This difference also shows up in the United States on the Scholastic Aptitude Test, in which Mongoloids invariably do better than Caucasoids on the mathematics test (largely a measure of general intelligence and visuospatial ability) but also less well than Caucasoids on the verbal test (Wainer, 1988).

Research on the academic accomplishments of Mongoloids in the United States continues to grow. Caplan, Choy, and Whitmore (1992) gathered survey and test score data on 536 school-age children of Indochinese refugees in five urban areas around the United States. Unlike some of the previously studied populations of "boat people," these refugees had had limited exposure to Western culture, knew virtually no English when they arrived, and often had a history of physical and emotional trauma. Often they came with nothing more

TABLE 6.7
Mean IQ Scores for Various Mongoloid Samples

Sample	Age	Sample size	Test	Intelligence			Source
				General	Verbal	Visuo-spatial	
Japan	5-16	1,070	WISC	–	–	103	Lynn, 1977b
Japan	6	240	Vocabulary-spatial	97	89	105	Stevenson et al., 1985
Japan	11	240	Vocabulary-spatial	102	98	107	Stevenson et al., 1985
Japan	4-6	600	WPPSI	103	98	108	Lynn & Hampson, 1986a
Japan	2-8	550	McCarthy	100	92	108	Lynn & Hampson, 1986b
Japan	6-16	1,100	WISC-R	103	101	107	Lynn & Hampson, 1986c
Japan	13-15	178	Differential Aptitude	104	–	114	Lynn, Hampson & Iwawaki, 1987
Japan	13-14	216	Kyoto NX	101	100	103	Lynn, Hampson & Bingham, 1987
Japan	3-9	347	CMMS	110	–	–	Misawa et al., 1984
Japan	9	444	Progressive Matrices	110	–	–	Shigehisa & Lynn, 1991
Hong Kong	6-15	4,500	Progressive Matrices	110	–	–	Lynn, Pagliari & Chan, 1988
Hong Kong	10	197	PM, Space Relations	108	92	114	Lynn, Pagliari & Chan, 1988
Hong Kong	9	376	Cattell Culture Fair	113	–	–	Lynn, Hampson & Lee, 1988
Hong Kong	6	4,858	Coloured PM	116	–	–	Chan & Lynn, 1989
China	6-16	5,108	Progressive Matrices	101	–	–	Lynn, 1991b
Taiwan	16	1,290	Culture Fair	105	–	–	Rodd, 1959
Singapore	13	147	Progressive Matrices	110	–	–	Lynn, 1977a
Belgium	6-14	19	WISC	110	102	115	Frydman & Lynn, 1989
United States	6-17	4,994	Various	100	97	–	Coleman et al., 1966; Flynn, 1991
United States	6-11	478	Various	101	–	–	Jensen & Inouye, 1980
United States	6-10	2,000	Figure copying	–	–	105	Jensen, 1973
United States	6	80	Hunter Aptitude	106	97	106	Lesser, Fifer & Clark, 1965
United States	6-14	112	Various	107	–	–	Winick et al., 1975
Canada	15	122	Differential Aptitude	105	97	108	P. E. Vernon, 1982
Canada	6-8	38	WISC	100	94	107	Kline & Lee, 1972

Note. From R. Lynn (1991c, pp. 264-265, Table 2). Copyright 1991 by The Institute for the Study of Man. Reprinted with permission. CMMS = Columbia Mental Maturity Scale; WISC = Wechsler Intelligence Scale for Children; WPPSI = Wechsler Preschool and Primary Scale of Intelligence.

than the clothes they wore. All the children attended schools in low-income metropolitan areas. The results showed that whether measured by school grades or nationally normed standardized tests, the children were above average overall, "spectacularly" so in mathematics.

The mean IQs of Negroids are invariably found to be lower than those of Caucasoids. Three hundred and sixty-two investigations done in the United States were presented by Shuey (1966) who reported the overall mean IQ of Afro-Americans to be approximately 85. Subsequent studies in the United States such as those by Coleman et al. (1966), Broman et al. (1987), and others have confirmed this figure. Many of these studies are shown in Table 6.8. For the United States, seven major post-Shuey (1966) studies were chosen because of their special interest by virtue of the large number of subjects, because they yield IQs for the verbal and visuospatial abilities, or because they are derived from young children. These show that the Negroid mean IQ of approximately 85 is present among children as young as 2 to 6 years old. In Britain, three studies of Afro-Caribbeans obtained mean IQs of 86, 94, and 87, broadly similar to those in the United States. Figures are available for two of the Caribbean islands, namely Barbados (mean IQ = 82) and Jamaica (mean IQ = 66–75).

As a result of these studies, carried out across different intelligence tests and cohorts, it is sometimes assumed that the mean IQ of all Negroids is approximately 85. R. Lynn noted, however, that most African-Americans are Negroid-Caucasoid hybrids with about 25 percent Caucasian admixture (Chakraborty, Kamboh, Nwankwo, & Ferrell, 1992) and he believed a similar proportion was probably true of blacks in the West Indies and Britain. It is possible, therefore, that the mean IQs of non-mixed Africans will be lower than that of the hybrids. R. Lynn tested this hypothesis by examining the literature from Africa (see Table 6.9).

TABLE 6.8
Mean IQ Scores for Various Negroid-Caucasold Mixed-Race Samples

				Intelligence			
Sample	Age	Sample size	Test	General	Verbal	Visuo-spatial	Source
United States	-	-	362 Studies	85	-	-	Shuey, 1966
United States	7	19,000	Wechsler	90	89	93	Broman et al., 1987
United States	2	46	Stanford-Binet	86	-	-	Montie & Fagan, 1988
United States	6-18	4,995	Verbal and non-verbal	84	89	-	Coleman et al., 1966
United States	6	111	WISC	81	86	80	Miele, 1979
United States	6-16	305	WISC-Revised	84	87	88	Jensen & Reynolds, 1982
United States	7-14	642	PMA	77	77	83	Baughman & Dahlstrom, 1968
United States	6-11	2,518	Various	84	-	-	Jensen & Inouye, 1980
S. Africa colored	10-14	4,721	Army Beta	84	-	-	Fick, 1929
Barbados	9-15	108	WISC-Revised	82	84	84	Galler et al., 1986
Britain	11	113	NFER	86	87	-	Mackintosh & Mascie-Taylor,1985
Britain	10	125	British Ability Scales	94	92	-	Mackintosh & Mascie-Taylor,1985
Britain	8-12	205	NFER	87	-	-	Scarr et al., 1983
Jamaica	10-11	50	Various	75	82	90	P. E. Vernon, 1969
Jamaica	11	1,730	Moray House	72	72	-	Manley, 1963; P. E. Vernon, 1969
Jamaica	5-12	71	WISC	66	74	64	Hertzig et al., 1972

Note. From R. Lynn (1991c, p. 269, Table 4). Copyright 1991 by The Institute for the Study of Man. Reprinted with permission. NFER = National Federation of Educational Research; PMA = Primary Mental Abilities; WISC = Wechsler Intelligence Scale for Children.

TABLE 6.9
Mean IQ Scores for Various Negroid Samples

				Intelligence			
Sample	Age	Sample size	Test	General	Verbal	Visuo-spatial	Source
Congo	adults	320	Progressive Matrices	65	-	-	Ombredane et al., 1952
Ghana	adults	225	Culture Fair	80	-	-	Buj, 1981
Nigeria	6-13	87	Colored Matrices, PMA	75	-	81	Fahrmeier, 1975
Nigeria	adults	-	Progressive Matrices	86	-	-	Wober, 1969
South Africa	8-16	1,220	Progressive Matrices	81	-	-	Notcutt, 1950
South Africa	adults	703	Progressive Matrices	75	-	-	Notcutt, 1950
South Africa	10-14	293	Army Beta	65	-	-	Fick, 1929
South Africa	9	350	Progressive Matrices	67	-	-	Lynn & Holmshaw, 1990
South Africa	16	1.093	Junior Aptitude	69	60	69	Owen, 1989
Uganda	12	50	Various	80	-	-	P. E. Vernon, 1969
Zambia	adults	1.011	Progressive Matrices	75	-	-	Pons, 1974; Crawford Nutt, 1976

Note. From R. Lynn (1991c, pp. 267, Table 3). Copyright 1991 by The Institute for the Study of Man. Reprinted with permission. PMA = Primary Mental Abilities.

An early study of the intelligence of "pure" African Negroids was carried out in South Africa by Fick (1929). He administered the American Army Beta Test, a nonverbal test designed for those who could not speak English, to 10- to 14-year-old white, black African, and mixed-race (mainly Negroid-Caucasoid hybrid) schoolchildren. In relation to the white mean of 100, based on more than 10,000 children, largely urban black African children obtained a mean IQ of 65, while urban mixed-race children obtained a mean IQ of 84. Thus South African mixed races obtained a mean IQ virtually identical to that of African-Americans.

The other studies of the IQs of black Africans summarized in Table 6.9 show means in the range of 65 to 86, with a mean of about 75. R. Lynn cited the work of Owen (1989) as the best single study. Owen presented results for 1,093 16-year-olds in the eighth grade who had been in school for around eight years and should have been knowledgable about paper and pencil tests. The test used was the South African Junior Aptitude, which provides measures of verbal and nonverbal reasoning, spatial ability, verbal comprehension, perceptual speed, and memory. The mean IQ of the sample in comparison with white South African norms is 69, which is also around the median of the studies listed in Table 6.6. R. Lynn rounded this figure to 70 and took it as the approximate mean for pure Negroids.

Since R. Lynn's review, Owen (1992) has published another South African study. He gave Raven's Standard Progressive Matrices to four groups of high school students. The results showed clear racial mean differences with 1,065 whites = 45.27 (*SD* = 6.34); 1,063 East Indians = 41.99 (*SD* = 8.24); 778 mixed races = 36.69 (*SD* = 8.89); and 1,093 pure Negroids = 27.65 (*SD* = 10.72). Thus, Negroids are from 1.5 to 2.7 standard deviations below the two Caucasoid populations and about 1 standard deviation lower than the mixed races. The four groups showed little difference in test reliabilities, the rank order of item difficulties, item discrimination values, and the loadings of items on the first principal component. Owen (1992: 149) concluded: "Consequently, from a psychometric point of view, the [test] is not culturally biased."

R. Lynn also summarized the results of studies of the intelligence of Amerindians. The mean IQs have invariably been found to be somewhat below that of Caucasoids. The largest study is that of Coleman et al. (1966), which obtained a mean of 94, but a number of studies have reported means in the 70 to 90 range. The median of the 15 studies listed is 89, which Lynn took as a reasonable approximation, indicating that the Amerindian mean IQ falls somewhere between that of Caucasoids and Negroid-Caucasoid hybrids. The same intermediate position is occupied by Amerindians in performance on the Scholastic Aptitude Test (Wainer, 1988).

In addition, all the studies of Amerindians have found that they have higher visuospatial than verbal IQs. The studies listed are those where the Amerindians speak English as their first language, so this pattern of results is unlikely to be solely due to the difficulty of taking the verbal tests in an unfamiliar language. The verbal-visuospatial disparity is also picked up in the Scholastic Aptitude Test, where Amerindians invariably score higher on the mathematical test than on the verbal (Wainer, 1988).

Finally, R. Lynn examined the published IQ scores for several Southeast Asian peoples, including Polynesians, Micronesians, Melanesians, Maoris, and Australian aborigines. Apart from the low mean of 67 for a small sample of Australian aborigine children, all the mean IQs lie in the range of 80–95. The one study to include measures of general, verbal, and visuospatial abilities for New Zealand Maoris shows that this population does not share the strong visuospatial-weak verbal ability profile of Mongoloids and Amerindians. Although the intelligence of this group of peoples has not been extensively researched, R. Lynn suggested there are sufficient studies to suggest a mean IQ of about 90.

Spearman's *g*

Although the black and white populations in the United States differ, on average, by about 15 IQ points, they differ by various amounts on different tests. These relative differences are directly related to the *g* loadings of the particular tests, *g* being the general factor common to all complex tests of mental ability (chap. 2). Jensen (1985) termed this important discovery about black-white differences *Spearman's hypothesis,* because it was first suggested by Charles Spearman (1927: 379), the English psychologist who invented factor analysis and discovered *g*. In a series of studies, Jensen investigated and found support for Spearman's hypothesis.

Thus, Jensen (1985) examined 11 large-scale studies, each comprising anywhere from 6 to 13 diverse tests administered to large black and white samples aged 6 to 16 1/2, with a total sample size of 40,000, and showed that a significant and substantial correlation was found in each between the test's *g* loadings and the mean black-white difference on the same tests. In a follow up, Jensen (1987b; Naglieri & Jensen, 1987) matched 86 black and 86 white 10- to 11-year-olds for age, school, sex, and socioeconomic status and tested them with the Wechsler Intelligence Scale for Children-Revised and the Kaufman Assessment Battery for Children for a total of 24 subtests. The results showed that the black-white differences on the various tests correlated $r = 0.78$ with the test's *g* loading.

Hence, Jensen concluded, in accord with Spearman's hypothesis, the average black-white difference on diverse mental tests may be interpreted as chiefly a difference in *g*, rather than as a difference in the more specific sources of test score variance associated with any particular informational content, scholastic knowledge, acquired skill, or type of test.

Decision Times

As described in chapter 2, speed of information processing in decision time or on elementary cognitive tasks rests on the neurological efficiency of the brain in analysis and decision making. Early studies of black-white differences in speed of reaction time were reviewed by Jensen (1980a) who concluded that the more complex the task, the more it loaded on Spearman's *g*, the more it tapped neurological efficiency, and the faster whites performed relative to blacks.

To further examine the racial difference in reaction times and their relationship to *g*, P. A. Vernon and Jensen (1984) gave a battery of eight tasks to 50 black and 50 white college students who were also tested on the Armed Services Vocational Aptitude Battery (ASVAB). Despite markedly different content, the reaction time measures correlated significantly at about 0.50 with the ASVAB in both the black and the white samples. Blacks had significantly slower reaction time scores than whites, as well as lower scores on the ASVAB. The greater the complexity of the reaction time task, measured in milliseconds, the stronger its relationship to the *g* factor extracted from the ASVAB, and the greater the magnitude of the black-white difference.

In his global review, R. Lynn (1991c) summarized several of his own cross-cultural investigations of reaction times with 9-year-old children from five countries (R. Lynn, Chan, & Eysenck, 1991; R. Lynn & Holmshaw, 1990; R. Lynn & Shigehisa, 1991). There were Mongoloids from Hong Kong (N = 118) and Japan (N = 444), Caucasoids from Britain (N = 239) and Ireland (N = 317), and Negroids from South Africa (N = 350). All the children were drawn from typical primary schools in their respective countries, except the Irish children who came from rural areas. All 1,468 children were administered the Raven Progressive Matrices intelligence test.

Three reaction time tasks were used for different degrees of difficulty from "simple" through "complex" to "odd-man-out," all taking under a second to perform (chap. 2). The results are shown in Table 6.10. It will be seen that the Mongoloid children are consistently faster in decision times than the Caucasoid, who in turn are consistently faster than the Negroid. All the differences are statistically significant. The figures given are the times in milliseconds, so that the Mongoloids have the shortest times and the Negroids the longest. The table also gives the IQ scores on the Progressive Matrices. R. Lynn concluded

TABLE 6.10
IQ Scores and Decision Times for 9-Year-Old Children from Five Countries

Racial type / country	Sample size	Progressive matrices IQ score	Decision time (msecs)		
			Simple	Complex	Odd-man-out
Mongoloid					
Hong Kong	118	113	361	423	787
Japan	444	110	348	433	818
Caucasoid					
Britain	239	100	371	480	898
Ireland	317	89	388	485	902
Negroid					
South Africa	350	67	398[a]	489[a]	924[a]
		SD	*64*	*67*	*187*

Note. From R. Lynn (1991c, pp. 275, Table 7). Copyright 1991 by The Institute for the Study of Man. Reprinted with permission.

[a] Errata, *The Mankind Quarterly,* Vol. 31, No. 3, Spring 1991, p. 192.

that the racial differences lie at the neurological level, reflecting the efficiency of the brain in analysis and decision making.

Meanwhile, Jensen (1993; Jensen & Whang, 1993) used similar decision time tasks as R. Lynn to extend his test of Spearman's hypothesis. Thus, Jensen (1993) gave 585 white and 235 black 9- to 11-year-old children from middle-class suburban schools in California a battery of 12 reaction time tasks based on the simple, choice, and oddman procedures. The response time loadings on psychometric *g* were estimated by their correlations with scores on Raven's Progressive Matrices. In another procedure, the chronometric tasks assessed speed of retrieval of easy number facts such as addition, subtraction, or multiplication of single digit numbers. These have typically been learned before the children are 9 years old, and all children in the study were able to perform them correctly.

In both studies, Spearman's hypothesis was borne out as strongly as in the previous studies using conventional psychometric tests. Blacks scored lower than whites on the Raven's Matrices and were slower than whites in decision time. In addition, the size of the black-white difference on the decision time variables was directly related to the variables' loadings on psychometric *g*. Moreover, when the response time was separated into a cognitive decision component and a physical movement component, blacks were found to be slower than whites on the cognitive part and faster than whites on the physical part.

Using the same procedures as in the study just described, Jensen and Whang (1993), also in California, compared 167 9- to 11-year-old Chinese American children with the 585 white children. On Raven's Matrices there was a 0.32 standard deviation advantage to the Oriental children (about 5 IQ points), although they were lower in socioeconomic status. Also, compared to the white American children, the Chinese American children were faster in the cognitive aspects of information processing (decision time) but slower in the motor aspects of response execution (movement time).

Cultural Achievement

The third focus of R. Lynn's (1991c) review of intelligence around the world was on discoveries and inventions. Here R. Lynn followed Galton and other early psychologists who proposed that civilization results from the presence in a population of very talented people. Because there will be more of these in a population where the average level of intelligence is high, the intelligence levels of populations can be inferred from their intellectual achievements.

Twenty-one criteria by which a civilization could be judged were set up by J. R. Baker (1974), some of whose work was described in chapter 5. J. R. Baker suggested that in civilized societies, the majority of people complied with most of the requirements set out in Table 6.11. He then proceeded to analyze the historical record to ascertain which races have originated civilizations. His conclusion was that the Caucasoid peoples developed all 21 components of civilization in four independent locations, the Sumerian in the valley of the Tigris and the Euphrates, the Cretan, the Indus Valley, and the ancient Egyptian. The Mongoloids also developed a full civilization in the Sinic civilization in China. The Amerindians achieved about half of the 21 components in the Maya society of Guatemala, a little less in the Inca and Aztec societies, but these peoples never invented a written script, the wheel (except possibly in children's toys), the principle of the arch in their architecture, metal working, or money for the exchange of goods. The Negroids and the Australian aborigines achieved virtually none of the criteria of civilization.

While J. R. Baker confined his analysis to the achievements of the races in originating civilizations, parallel racial differences occur in later cultural development. During the last 3,000 years the many discoveries required for developed civilizations have been made primarily by Caucasoid and Mongoloid

TABLE 6.11
Criteria for Civilization

1. In the ordinary circumstances of life in public places, they cover the greater part of the trunk with clothes.
2. They keep the body clean and take care to dispose of its waste products.
3. They do not practice severe mutilation or deformation of the body, except for medical reasons.
4. They have knowledge of building in brick or stone, if the necessary materials are available in their territory.
5. Many of them live in towns or cities, which are linked by roads.
6. They cultivate food plants.
7. They domesticate animals and use some of the larger ones for transport (or have in the past so used them), if suitable species are available.
8. They have knowledge of the use of metals, if these are available.
9. They use wheels.
10. They exchange property by the use of money.
11. They order their society by a system of laws, which are enforced in such a way that they ordinarily go about their various concerns in times of peace without danger of attack or arbitrary arrest.
12. They permit accused persons to defend themselves and to bring witnesses for their defense.
13. They do not use torture to extract information or for punishment.
14. They do not practice cannibalism.
15. Their religious systems include ethical elements and are not purely or grossly superstitious.
16. They use a script (not simply a succession of pictures) to communicate ideas.
17. There is some facility in the abstract use of numbers, without consideration of actual objects (or, in other words, at least a start has been made in mathematics).
18. A calendar is in use, accurate to within a few days in the year.
19. Arrangements are made for the instruction of the young in intellectual subjects.
20. There is some appreciation of the fine arts.
21. Knowledge and understanding are valued as ends in themselves.

Note. Adapted from J. R. Baker (1974, pp. 507-508). Copyright 1974 by J. R. Baker.

peoples. As mentioned in chapter 5, during much of this period the Mongoloid civilization in China was equal to or in advance of the Caucasoid civilizations in Europe.

As early as 360 B.C., the Chinese had invented the cross bow and transformed the nature of warfare. The key to its effectiveness is the pressure sensitive trigger that releases the string of the bow mounted crosswise on a wooden stock. Cities became transformed for the manufacture and trade in weaponry.

Around 200-100 B.C. the Han period saw the introduction of written examinations for candidates for the Mandarin civil service, an idea that was considered an advance when it was introduced into Britain some 2,000 years later (Klitgaard, 1986; Bowman, 1989). Printing was invented in China by about 800, some 600 years before it was developed in Germany. Paper money was used in China in 1300 but not in Europe until the nineteenth and twentieth centuries. By 1050 A.D. Chinese knowledge of chemistry allowed them to invent gunpowder, along with hand grenades, fire arrows, and rockets of oil and poison gas. By 1100 A.D. there were industrially organized complexes involving upward of 40,000 workers making rockets in factories. Flame throwers, guns, and cannons were used by the thirteenth century, meaning that the Chinese had the cannon at least a century before Europe did.

The Chinese were the first to invent the principle of the magnetic compass. In 1422 the Chinese reached the east coast of Africa with a great fleet of sixty or more ships provisioned for ocean cruising, carrying 27,000 men, and their horses, and a year's supply of grain, herds of pigs, and jars of fermenting wine. There was nothing comparable in Europe, and certainly not in Africa. With gunpowder weapons, great navigational and organizational skills, the latest charts and magnetic compasses, the Chinese could have gone around the Cape of Good Hope and "discovered" Europe! The Chinese may have had the compass as early as 100 A.D.; it is not mentioned in European writing until 1190.

For centuries China was the richest and most powerful nation on earth. The Chinese technology for the manufacture of high quality porcelain was ahead of Europe until the late eighteenth century. However, the Chinese were an inward-looking people. The earlier sailing expedition had been for bringing back giraffes, lions, and rhinoceroses to the emperor. After the voyage, Confucian civil servants destroyed many records of the travels including the building plans of the vessels. In place of foreign voyages, they began the task of rebuilding the Great Wall, constructed from rammed earth some 1700 years earlier. When completed it was planned to wind across northern China for 1400 miles, 25 feet high, faced with brick, and with a 12-foot wide cobbled road running along the top between guard houses—one of the greatest man-made structures ever built. The goal was to keep foreigners out.

During the last five centuries the Caucasoids have pulled ahead of the Mongoloids in science and technology. Nevertheless, although the Europeans have generally been ahead of the Mongoloids during the last five centuries, since 1950 the Japanese have provided a major challenge and have surpassed the West in the production of high quality technological goods. Other Pacific Rim countries are similarly rising to prominence relative to the United States and Europe, let alone to the Third World and Africa (McCord, 1991).

Another source noted by R. Lynn (1991c) for evaluating racial contributions to science and technology, is Isaac Asimov's (1989) *Chronology of Science and Discovery.* This lists approximately 1,500 of the most important scientific and technological discoveries and inventions that have ever been made. Virtually every one was made by the Caucasian or Mongoloid peoples, thus confirming the historical record.

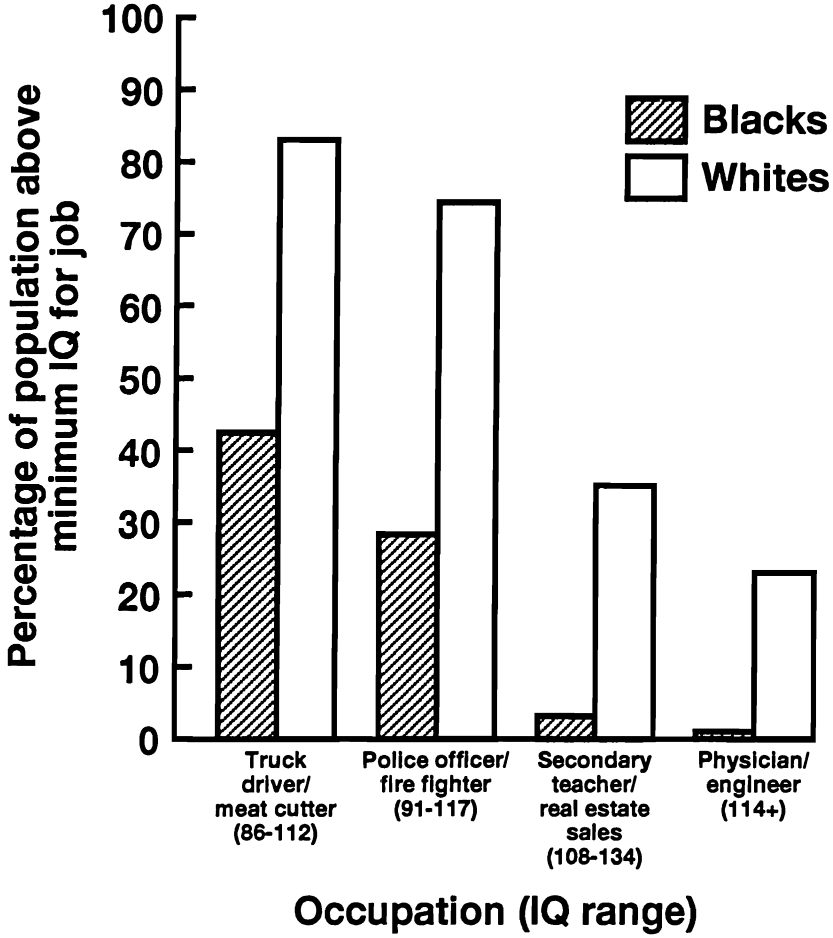
Finer grain analysis within the United States suggests that the differences in cultural achievement may be far-reaching. The relatively strong visuospatial and weak verbal abilities of Oriental Americans may result in a tendency to do well in professions like science, architecture, and engineering, which call for strong visuospatial abilities, and less well in law, which calls for strong verbal abilities. This is the pattern of occupational achievement documented by Weyl (1989) in studies of American ethnic populations.

Weyl's method involves the analysis of the frequencies of ethnic names among those who have achieved occupational distinction calculated in relation to their frequencies in the general population. Thus, he finds that typical Chinese names like Chang and Yee are greatly overrepresented in *American Men and Women of Science* as compared with their frequency in the general population, but they are underrepresented in *Who's Who in American Law.* On the basis of this method Weyl constructs a performance coefficient for which average achievement is 100. A coefficient of 200 means that an ethnic group appears twice as frequently in reference works of occupational distinction as would be expected from its numbers in the total population, while a coefficient of 50 means that it appears half as often. In the 1980s, ethnic Chinese obtained performance coefficients of over 600 for science, while for law their performance coefficient was only 24. (African-American representation was negligible on all rosters.)

Gottfredson (1986, 1987) suggested that occupations be viewed as analogous to differentially *g*-loaded mental tests. Large-scale studies from World War I through the 1980s have shown that occupations differ considerably in the mean intelligence levels of their incumbents. The mean level of intelligence of the occupation, in turn, correlates highly with the prestige level of the occupation. Gottfredson reasoned that the overall intellectual complexity of the work should effect the percentage of workers who are black. Figure 6.3 provides data relevant to this conjecture.

Gottfredson first determined the IQ ranges from which workers have most often been recruited to different occupations. Then, she used nationally representative mental test data to determine the proportions of blacks and whites

Figure 6.3: Percentage of Blacks and Whites in the United States Above Minimum IQ Required for Various Occupations



The lower average distribution of IQ among blacks leads to a disproportionate underrepresentation in occupations selected on the basis of high IQ. Drawn from data in Gottfredson (1986, 1987).

falling within each of those IQ recruitment ranges. Third, she computed the ratio of blacks to whites who would be eligible for each occupation on the basis of intelligence alone. Black-white parity in employment is represented by a ratio of 1.00. She found that the ratios ranged from 0.72 for truck drivers to 0.05 for physicians, proportional to the actually observed black/white ratios of 0.98 to 0.30. Note that observed black-white differences in employment are smaller than those expected on the basis of intelligence alone, a finding consistent with data showing that mean IQs are lower for blacks than for whites in the same occupational category and for black versus white applicants for the same jobs.

Gottfredson (1987) noted that different assumptions about the distribution of intelligence in the black and white populations and about the intelligence requirements of occupations would produce somewhat different estimated black-white ratios for individual occupations, but the overall pattern of ratios would probably be the same under any set of reasonable assumptions. For example, even when recruitment standards are set half a standard deviation (7.5 IQ points) lower for blacks, the ratios are only 1 to 5 for physicians and engineers and 1 to 3 for secondary school teachers and real estate salespersons. She concluded that "racially blind worker selection can be expected to produce especially striking deviations from black-white parity in higher level jobs" (p. 512).

7

Speed of Maturation, Personality, and Social Organization

In this chapter there are fewer stratified random samples than in the previous chapter and more errors in collecting information on small groups. Some studies, often with poorly standardized methodologies, fail to show a racial difference. When differences are found, however, they support the Mongoloid-Caucasoid-Negroid gradient. The racial pattern is discernible in speed of development, mortality rates, personality, family functioning, mental durability, law abidingness, social organization, and other variables.

Speed of Maturation

Table 7.1 summarizes the racial differences on several measures of life span development. In the United States, black babies have a shorter gestation period than white babies. By week 39, 51 percent of black children have been born while the figure for white children is 33 percent; by week 40, the figures are 70 and 55 percent respectively (Niswander & Gordon, 1972). Similar results have been obtained in Paris. Collating data over several years, Papiernik, Cohen, Richard, de Oca, and Feingold (1986) found that French women of European ancestry had longer pregnancies than those of mixed black-white ancestry from the French Antilles, or black African women with no European admixture. These differences persisted after adjustments for socioeconomic status.

Other observations, made within equivalent gestational age groups established by ultrasonography, find that black babies are physiologically more mature than white babies as measured by pulmonary function, amniotic fluid, fetal birth weight between 24 and 36 weeks of gestation, and weight-specific neonatal mortality (reviewed in Papiernik et al., 1986). I am unaware of data on gestation time for Mongoloids.

Black precocity continues throughout life. Revised forms of Bayley's Scales of Mental and Motor Development administered in 12 metropolitan areas of the United States to 1,409 representative infants aged 1-15 months showed black babies scored consistently above whites on the Motor Scale (Bayley, 1965). This difference was not limited to any one class of behavior, but in-

TABLE 7.1
Relative Ranking of Races on Speed of Maturation

Speed of maturation variable	Orientals	Whites	Blacks
Gestation period	?	Intermediate	Earlier
Fetal maturity	?	Intermediate	Earlier
Skeletal development at birth	?	Intermediate	Earlier
Head lifting at 24 hours	?	Intermediate	Earlier
Muscular development	Later	Intermediate	Earlier
Reaching and eye-hand coordination at 2 months	Later	Intermediate	Earlier
Turning self over at 3 to 5 months	Later	Intermediate	Earlier
Age to crawl	Later	Intermediate	Earlier
Age to walk	Later	Intermediate	Earlier
Ability to remove clothing at 15-20 months	Later	Intermediate	Earlier
Dental maturity	Later	Intermediate	Earlier
Age of puberty and first sexual intercourse	Later	Intermediate	Earlier
Age at first pregnancy	Later	Intermediate	Earlier
Age at death	Later	Intermediate	Earlier

Note. Adapted from Rushton (1992b, p. 814, Table 3). Copyright 1992 by Psychological Reports. Reprinted with permission.

cluded: coordination (arm and hand); muscular strength and tonus (holds head steady, balances head when carried, sits alone steadily, and stands alone); and locomotion (turns from side to back, raises self to sitting, makes stepping movements, walks with help, and walks alone).

Similar results have been found for children up to about age 3 elsewhere in the United States, in Jamaica, and in sub-Saharan Africa (Curti, Marshall, Steggerda, & Henderson, 1935; Knobloch & Pasamanik, 1953; Williams & Scott, 1953; Walters, 1967). In a review critical of the literature Warren (1972) nonetheless reported evidence for African motor precocity in 10 out of 12 studies. For example, Geber (1958: 186) had examined 308 children in Uganda and reported an "all-round advance of development over European standards which was greater the younger the child." Freedman (1974, 1979) found similar results in studies of newborns in Nigeria using the Cambridge Neonatal Scales (Brazelton & Freedman, 1971).

Mongoloid children are motorically delayed relative to Caucasoids. In a series of studies carried out on second- through fifth-generation Chinese-Americans in San Francisco, on third- and fourth-generation Japanese-Americans in Hawaii, and on Navajo Amerindians in New Mexico and Arizona, consistent differences were found between these groups and second- to fourth-generation European-Americans using the Cambridge Neonatal Scales (Freedman, 1974, 1979; Freedman & Freedman, 1969). One measure involved pressing the baby's nose with a cloth, forcing it to breathe with its mouth. Whereas the average Chinese baby fails to exhibit a coordinated "defense reaction," most Caucasian babies turn away or swipe at the cloth with the hands, a response reported in Western pediatric textbooks as the normal one.

On other measures including "automatic walk," "head turning," and "walking alone," Mongoloid children are more delayed than Caucasoid children. Mongoloid samples, including the Navajo Amerindians, typically do not walk until 13 months, compared to the Caucasian 12 months and Negro 11 months (Freedman, 1979). In a standardization of the Denver Developmental Screening Test in Japan, Ueda (1978) found slower rates of motoric maturation in Japanese as compared with Caucasoid norms derived from the United States, with tests made from birth to 2 months in coordination and head lifting, from 3 to 5 months in muscular strength and rolling over, at 6 to 13 months in locomotion, and at 15 to 20 months in removing garments.

Eveleth and Tanner (1990) discuss race differences in terms of skeletal maturity, dental maturity, and pubertal maturity. Problems include poorly standardized methods, inadequate sampling, and many age/race/method interactions. Nonetheless, when many null and idiosyncratic findings are averaged out the data suggest that African-descended people have a faster tempo than others.

With skeletal maturity, the clearest evidence comes from the genetically timed age at which bone centers first become visible. Africans and African-Americans, even those with low incomes, mature faster up to 7 years. Mongoloids are reported to be more delayed at early ages than Caucasoids but later catch up, although there is some contradictory data. Subsequent skeletal growth varies widely and is best predicted by nutrition and socioeconomic status.

With dental development, the clearest pattern comes from examining the first phase of permanent tooth eruption. For beginning the first phase, a composite of first molar and first and second incisors in both upper and lower jaws showed an average for 8 sex-combined African series of 5.8 years compared to 6.1 years each for 20 European and 8 east Asian series (Eveleth & Tanner, 1990, Appendix 80, after excluding east Indians and Amerindian samples from the category "Asiatics"). For completion of the first phase, Africans averaged 7.6, Europeans 7.7, and east Asians 7.8 years. (The significance of this pattern will be discussed in chapter 10, where the predictive value of age of first molar for traits like brain size has been shown in other primate species.) No clear racial pattern emerged with the onset of deciduous teeth nor with the second phase of permanent tooth eruption.

In speed of sexual maturation, the older literature and ethnographic record suggested that Africans were the fastest to mature and Orientals slowest with Caucasian people intermediate (e.g., French Army Surgeon, 1898/1972). Despite some complexities this remains the general finding. For example, in the United States, blacks are more precocious than whites as indexed by age at menarche, first sexual experience, and first pregnancy (Malina, 1979). A national probability sample of American youth found that by age 12, 19 percent of black girls had reached the highest stages of breast and pubic hair development, compared to 5 percent of white girls (Harlan, Harlan, & Grillo, 1980). The same survey, however, found white and black boys to be similar (Harlan, Grillo, Coroni-Huntley, & Leaverton, 1979).

Subsequently, Westney, Jenkins, Butts, and Williams (1984) found that 60 percent of 11-year-old black boys had reached the stage of accelerated penis growth in contrast to the white norm of 50 percent of 12.5-year-olds. This genital stage significantly predicted onset of sexual interest, with over 2 percent of black boys experiencing intercourse by age 11. While some surveys find that Oriental girls enter puberty as early as whites (Eveleth & Tanner, 1990), others suggest that in both physical development and onset of interest in sex, the Japanese, on the average, lag one to two years behind their American counterparts (Asayama, 1975).

Mortality Rates

Death rates between blacks and other populations in the United States are substantial (National Center for Health Statistics, 1991). For example, the 1980 annual age-adjusted death rate per 1,000 resident population was 3.5 for Chinese Americans in contrast to 5.6 for white Americans, and more for black Americans (Yu, 1986). In numerous specific studies these statistics are borne out. For example, in a study of 2,687 deaths among U.S. Navy personnel between 1974 and 1979, blacks had higher mortality rates than whites for numerous types of accidental and violent occurrences, improper use of medication, toxic effects, accidental drownings, and shootings (Palinkas, 1984). The gap in the death rate between blacks and whites has widened over the last 26 years (Angel, 1993; Pappas, Queen, Hadden, & Fisher, 1993).

Black babies in the United States show a greater mortality rate than white babies. In 1950, a black infant was 1.6 times as likely to die as a white infant. By 1988, the relative risk had increased to 2.1. Controlling for some maternal risk factors associated with infant mortality or premature birth, such as age, parity, marital status, and education, does not eliminate the gap between blacks and whites within those risk groups. For instance, in the general population, black infants with normal birth weights have almost twice the mortality of their white counterparts.

One recent study examined infants whose parents were both college graduates in a belief that such a study would eliminate obvious inequalities in access to medical care. The researchers compared 865,128 white and 42,230 black children but they found that the mortality rate among black infants was 10.2 per 1,000 live births as against 5.4 per 1,000 among white infants (Schoendorf, Carol, Hogue, Kleinman, & Rowley, 1992).

The reason for the disparity appears to be that the black women give birth to greater numbers of low birth weight babies. When statistics are adjusted to compensate for the birth weight of the babies, the death rates for the two groups become virtually identical. Newborns who are not underweight, born to black and white college-educated parents, had an equal chance of surviving the first year. Thus, in contrast to black infants in the general population, black infants born to college-educated parents have higher mortality rates than similar white infants only because of their higher rates of low birth weight.

The racial differences in mortality persist into adulthood. Polednak (1989) examined mortality rates for black and white adults in the United States from various National Health Surveys. For most causes of death, including cancers, hypertensive and ischemic heart disease, cerebrovascular diseases, pneumonia, tuberculosis, and chronic liver diseases, at most ages (15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84), blacks had higher mortality rates than whites. For all causes of death combined and across all age groups, using an age-standardized procedure, Polednak (1989) calculated that in 1980 the death rate per 100,000 for whites was 1,018 and for blacks was 1,344.

The summary statistics obviously obscure particular patterns, such as the death rate for black adults being highest in young adults (ages 25-54) and lower at age 75 years and older than among whites when death rates are typically the highest. Also the death rate differentials were highest of all for blacks at all ages from 15 to 85 and older for homicide with a reversal at all ages for suicide. With motor vehicle accidents, more whites died than blacks at very young and very old ages with a reversal in the middle age range. This latter statistic has been replicated with infant deaths and may be due to lower access by blacks to motor vehicles and a greater reliance on public transport (Schoendorf et al., 1992).

Polednak (1989) also examined the international data by compiling mortality rates from various sourcebooks. The total annual death rates were consistently higher for African countries (18 per 1,000) than for other least developed countries (17.1 per 1,000) and the rest of the world (11.3 per 1,000). For 52 reporting countries from the World Health Organization's *World Health Statistics* Annual of 1987, Polednak (1989) calculated age-standardized mortality rates per 100,000 for selected causes of death (infectious and parasitic diseases, cancers, circulatory diseases, ischemic heart disease, stroke, etc.).

I have aggregated Polednak's data on "all causes" of death and found that 8 Carribbean countries (mostly black) averaged an age-standardized mortality rate of about 713 per 100,000, 34 European and North American countries (mostly white) averaged about 615 per 100,000, and Japan and Singapore averaged about 550 per 100,000. Interestingly, the racial pattern showed a reversal for suicide with Caribbean countries lowest (about 4 per 100,000), Pacific countries highest (about 15 per 100,000), and European countries intermediate (about 12 per 100,000).

TABLE 7.2
Relative Ranking of Races on Personality and Temperament Traits

Trait	Orientals	Whites	Blacks
Activity level	Low	Medium	High
Aggressiveness	Low	Medium	High
Cautiousness	High	Medium	Low
Dominance	Low	Medium	High
Excitability	Low	Medium	High
Impulsivity	Low	Medium	High
Self-concept	Low	Medium	High
Sociability	Low	Medium	High

Note. Adapted from Rushton (1992b, p. 815, Table 5). Copyright 1992 by Psychological Reports. Reprinted with permission.

Personality

Across ages (24-hour-old infants, children, high school students, university students, and adults), across traits (activity level, aggressiveness, cautiousness, dominance, excitability, impulsiveness, and sociability), and across methods (archival statistics, naturalistic observation, ratings, and self-reports), data show that, in terms of behavioral restraint, Mongoloids average higher than do Caucasoids who, in turn, average higher than Negroids (Table 7.2). With infants and young children, observer ratings are the main method employed, whereas with adults the use of standardized tests are more frequent.

Freedman and Freedman (1969) compared Chinese-American newborns with European-American newborns on 25 items of behavior. Analysis indicated that the main differences came from items tapping excitability/imperturbability. Thus, the European-American infants had a greater tendency to be changeable, moving back and forth between states of contentment and upset, as well as reaching the peak of excitement sooner, while the Chinese-American infants were calmer and more consolable when upset.

In a study of Amerindian infants, Brazelton, Robey, and Collier (1969) reported that Amerindian neonates exhibited almost none of the normally occurring spasmodic movements common in Caucasian newborns, and maintained smoother gross motor movements throughout the first year. By 3 and 4 years of age, Caucasoid children engage in more approach and interaction behavior, whereas Mongoloid children spend more time on individual projects and generally demonstrate low noise levels, quiet serenity, and few aggressive or disruptive behaviors (Freedman, 1974, 1979). Eskimos (Inuit), also of Mongoloid origin, are perceived by Europeans as behaviorally restrained (LeVine, 1975: 19) while to Eskimos, Euro-Americans appear "emotionally volatile" (LeVine, 1975: 19), as they do also to Chinese Americans (Freedman, 1979: 156).

With preschoolers, a study carried out in Quebec, Canada, suggests that the racial pattern in temperament is generalizable. A sample of 825 4- to 6-year-old children from 66 different countries speaking 30 different languages were assessed by 50 teachers. All the children were in preschool French language immersion classes for immigrant children in Montreal to enable better integration into the school system. Only 20 percent of the children were born in Canada, with the black children typically coming from French language countries like Haiti, the white children from Spanish-speaking countries like Chile, and the Oriental children from what used to be French Indochina (Vietnam, Kampuchea). Teachers reported better social adjustment and less hostility-aggression from Mongoloid than from Caucasoid children; and Caucasoid children were better adjusted and less hostile than Negroid children (Tremblay & Baillargeon, 1984).

Using continuous observation for four separate 2 1/2 hour time periods, Orlick, Zhou, & Partington (1990) compared three groups of Chinese 5-year-olds in Beijing (N = 77) with three groups of their white Canadian counterparts in Ottawa (N = 89). Whereas 85 percent of peer interactions documented in China were cooperative in nature, 78 percent of those in Canada involved conflict. With 10-year-olds, Ekblad and Olweus (1986) gave the Olweus' Aggression Inventory to 290 10-year-old children in the People's Republic of China and found that the Chinese were less aggressive and higher in prosocial behavior than the Swedish children.

Studies of adults show parallel differences. Researchers have investigated the personality of the Chinese and Japanese, both in their homelands and in North America, giving university students standardized tests such as Cattell's Sixteen Personality Factor Questionnaire, the Eysenck Personality Questionnaire, the Edwards Personal Preference Schedule, and the Minnesota Multiphasic Personality Inventory (P. E. Vernon, 1982). The evidence consistently favored the hypothesis that, on average, Orientals were more introverted and more anxious than Euro-Americans and less dominant and less aggressive. While fewer systematic studies have been carried out on Africans and black Americans, many imply greater aggressiveness, dominance, impulsivity, and displays of masculinity compared to whites (Dreger & Miller, 1960; J. Q. Wilson & Herrnstein, 1985).

I (Rushton, 1985b) indexed behavioral restraint by low extraversion (sociability) and high neuroticism (anxiety) scores from the Eysenck Personality Questionnaire. Data collected from 25 countries around the world were summarized by Barrett and Eysenck (1984). Averaging across these I found that eight Mongoloid samples (N = 4,044) were less extraverted and more neurotic than 38 Caucasian samples (N = 19,807), who were less extraverted and more neurotic than four African samples (N = 1,906).

Self-Concept

African American youth have higher general self-esteem than whites or Orientals. In one study, a sample of 637 (299 African Americans and 338 white Americans) 11- to 16-year-olds were examined in two small southern towns (Tashakkori, 1993). Respondents read along on each question while the teacher was reading it aloud. Items measuring self-esteem were from the Rosenberg Self-Esteem Scale and included: "I take a positive attitude toward myself"; "I feel I am a person of worth, on an equal basis with others"; "At times I think I am no good at all"; "On the whole, I am satisfied with myself"; "I feel I do not have much to be proud of"; and "I am able to do things as well as most people."

Several other general competence and specific self-beliefs were assessed. Thus, general competence beliefs were assessed by items such as "I am intelligent" and "I can learn almost anything if I set my mind on it." More specific beliefs tapped attractive appearance, physical ability, and academic self-perceptions like reading and mathematics and personal control over events.

Tashakkori (1993) found the general self-esteem scores on the Rosenberg Scale as well as other indices of self-attitudes showed African Americans scored from one-half to two-thirds of a standard deviation higher than white Americans. This finding joined those from older adolescents in national studies (Tashakkori & Thompson, 1991). African American groups have consistently more positive scores on the majority of specific self-belief indices, particularly regarding appearance and attractiveness but also including competence in reading, science, and social studies (but not mathematics), despite their lower self-reported (and actual) academic achievement. The only beliefs in which the blacks scored lower than the whites were those that reflected self-efficacy and control of events that happened to self.

Many results now confirm Hare's (1985:41) conclusion that "African American adolescents can be theorized to be feeling relatively better, but doing relatively worse, lending importance to study of the *sources* as well as the *levels* of self-esteem" (his italics). Nyborg (1994) proposes that self-esteem is partly a function of steroid action and that African-Americans have more testosterone than whites (chapters 8 and 13).

Family Functioning

Marital stability can be assessed by rate of divorce, out-of-wedlock birthing, child abuse, and delinquency. On each of these measures, the rank ordering of marital stability within American populations is Oriental > white > black (Jaynes & Williams, 1989). For example, it has been noted that while there are approximately 1.5 million individuals of Northeast Asian descent living in the United States, they tend not to be an object of family research, partly because they are not perceived as a "problem," having significantly fewer divorces, out-of-wedlock births, or incidences of child abuse than whites, even when controlling for social class, on which they are higher (Garbarino and Ebata, 1983). Black family structure, on the other hand, has been studied intensively.

Much research has emphasized the instability of black marriages and family ties, the matriarchal family structure, and the lack of authority of fathers (DuBois, 1908; Frazier, 1948). Subsequently, Moynihan (1965) wrote the report that is the most frequently cited discussion of black families in the United States. Moynihan observed high rates of marital dissolution, frequent heading of families by women, and numerous illegitimate births in black families, in contrast to white families. Some 25 years later the figures cited as evidence for the instability of the black family have doubled and tripled (Jaynes & Williams, 1989). While one out of two white marriages will end in divorce, two out of three black marriages will eventually dissolve. Out-of-wedlock births have increased among whites from 2 percent in 1960 to 8 percent in 1982, whereas among blacks it increased from 22 percent in 1960 to 52 percent in 1982. About 75 percent of births to black teenagers are out of wedlock compared with 25 percent of births to white teenagers, an age group constituting over 50 percent of new mothers (Jaynes & Williams, 1989).

A family pattern similar to that of black Americans is found in Africa, south of the Sahara. Draper (1989) described the unique pattern of African marriage, mating, and family organization that predates the colonial period and differentiates the Negro racial majority from elsewhere in the world. For example, biological parents do not expect to be the major providers for their children.

The African pattern typically contains some or all of the following distinctions: (1) the early onset of sexual activity; (2) loose emotional ties between spouses; (3) the expectation of sexual union with many partners, and children by them; (4) lowered maternal nurturing with long-term "fostering" of children, sometimes for several years, to nonprimary caretakers, with the stated reason sometimes being to remain sexually attractive to future sexual partners; (5) increased male-male competitiveness for females and lowered paternal involvement in child rearing or maintenance of single pair bonds; and (6) higher fertility, despite education and urbanization, that in other regions lead to a decline in fertility. Among the Herero of South West Africa among whom Draper lived, men typically do not marry until 35 or 40 years of age. However, nearly all will have sired several children by unmarried women. Children from such unions suffer no social stigmata.

Africa is characterized by the continued high prevalence of polygyny, a status not only the preserve of elite men, but one to which men of moderate means aspire at some point in their lives. Women are the mainstays of the rural economy and they and their children tend to be self-supporting. Africa is primarily a continent of female farming. African men do not have a tradition of working for the family; when they work, separate bookkeeping by husband and wife is the norm. Women rarely receive, and do not expect to receive full support from husbands, even in cities. Men expect to have substantial leisure and the general male pattern of low parental investment is as true in the pastoral and mixed pastoral/horticultural economies of East Africa as it is in the agricultural areas of Central and West Africa: "Male reproductive effort was not channeled into parenting...but into mating" (Draper, 1989: 154).

The use of surrogate caretakers relieves both men and women from full responsibility for their offspring, thus opening the way for greater emphasis on mating effort and increased fertility. Relative to others in the developing world, African women terminate intensive care of the child early in the child's life. Once a child is a year or so old, the mother enlists the help of various surrogate caretakers for her children. Young children and grandparents do much of the normal upbringing. Children learn to look to older children for satisfaction of basic needs during the day, and pre-teen and teenage peer groups exist relatively independently of the family unit. With reduction of weaning, ovulation is restored and the mother is capable of conceiving again. Large numbers of births per women at relatively short birth intervals results.

The persistence of adult mating and parenting strategies in the face of countervailing environmental cues is to be found in the literature on West African couples living in London, England. As summarized by Draper (1989), young couples who migrate to England for postsecondary education often foster their children to European families in the larger metropolitan region. The foster parents interpret the infrequent visiting of their wards by the parents as signs of parental neglect; the African parents consider that they have made safe and responsible arrangements for the care of their children.

Mental Durability

Indices of social breakdown are also to be gained from figures of those confined to mental institutions or who are otherwise behaviorally unstable. Most of the data to be reviewed come from the United States. In 1970, 240 blacks per 100,000 population were confined to mental institutions, compared with 162 whites per 100,000 population (Staples, 1985). Blacks also use community mental health centers at a rate almost twice their proportion in the general population. The rate of drug and alcohol abuse is much greater among the black population, based on their overrepresentation among patients receiving treatment services. Moreover, it is estimated that over one-third of young black males in the inner city have serious drug problems (Jaynes & Williams, 1989).

Kessler and Neighbors (1986) have demonstrated, using cross-validation on eight different surveys encompassing more than 20,000 respondents, that the effect of race on psychological disorders is independent of class. They observed an interaction between race and class such that the true effect of race was suppressed and the true effect of social class was magnified in models that failed to take the interaction into consideration. Again, in contrast, Orientals are underrepresented in the incidence of mental health problems (P. E. Vernon, 1982).

Law Abidingness

With respect to crime, J. Q. Wilson and Herrnstein (1985) review much of the relevant literature. Afro-Americans currently account for about half of all arrests for assault and murder and two-thirds of all arrests for robbery in the United States, even though they constitute less than one-eighth of the population. Since about the same proportion of victims say their assailant was black, the arrest statistics cannot be attributed to police prejudice. Blacks are also overrepresented among persons arrested for most white-collar offenses. For example, in 1980 blacks made up about one-third of those arrested for fraud, forgery, counterfeiting, and receiving stolen property, and about one-fourth of those arrested for embezzlement. Blacks are underrepresented only among those white-collar offenses that ordinarily require, for their commission, access to high status occupations (tax fraud, securities violations).

A similar racial pattern is to be found in other industrialized Western countries. In London, England, for example, while comprising 13 percent of the population, African-descended people account for 50 percent of the crime (*Daily Telegraph,* March 24, 1983). The dark-skinned Caucasoids from Pakistan, India, and Bangladesh, however, who are also recent immigrants, do not appear to be higher in crime than white populations. In Toronto, Canada, unofficial figures suggest that recent Afro-Caribbean immigrants, while making up 2 to 5 percent of the population, are responsible for between 32 and 40 percent of the crime (*The Globe and Mail,* February 8, 1989). Immigrants from the Pacific Rim, however, are underrepresented in crime.

In the 1920s the underrepresentation of the Chinese in the U.S. crime figures led American criminologists to consider the ghetto as a place that *protected* members from the disruptive tendencies of the outside society (J. Q. Wilson & Herrnstein, 1985: 473). Among blacks the ghetto is said to foster crime. Detailed analyses made in the United States show that currently one in four black males between the ages of 20 and 29 is either in jail, on probation, or on parole and that this is not due to bias in the criminal justice system (Klein, Petersilia, & Turner, 1990).

I have found that, internationally, African and Caribbean countries report twice the amount of violent crime (murder, rape, and serious assault) as do European countries and three times more than do countries from the Pacific Rim (Rushton, 1990b). Summing crime data from the International Police Organization (INTERPOL) and averaging across years gives figures per 100,000 population, respectively, of 142, 74, and 43. These proportionate racial differences are similar to those found using statistics from within the United States. It is worth considering these data in more detail.

I consulted the published statistics provided by INTERPOL (Rushton, 1990b). INTERPOL's crime statistics for 1983-1984 and 1985-1986 provided data on nearly 100 countries in 14 crime categories. Because the figures for some crimes are highly dependent on a country's laws (e.g., sex offenses) or on availability (e.g., theft of motor cars), I focused on the three most serious crimes, which were relatively well defined: murder, rape, and serious assault.

I collated the figures per 100,000 population for 1984 and 1986 (or the next nearest year) and aggregated across the three categories (see Table 7.3). Countries for which data could not be found in all three categories were dropped. Countries were then grouped by primary racial composition with only Fiji and Papua, New Guinea being eliminated due to uncertainty as to

TABLE 7.3
International Crime Rates per 100,000 Population for Countries Categorized by Predominant Racial Type

		Homicide		Rape		Serious assault		Total	
Year / racial type	Number of countries	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1984									
Mongoloid	9	8.0	14.1	3.7	2.6	37.1	46.8	48.8	50.3
Caucasoid	40	4.4	4.3	6.3	6.5	61.6	66.9	72.4	72.5
Negroid	22	8.7	11.8	12.8	15.3	110.8	124.6	132.3	139.3
F(2,69)		*1.92*		*3.99**		*3.16**		*3.59**	
1986									
Mongoloid	12	5.8	10.9	3.2	2.7	29.4	40.2	38.4	42.7
Caucasoid	48	4.5	4.6	6.2	6.3	65.7	91.2	76.4	95.4
Negroid	28	9.4	10.6	14.4	15.9	129.6	212.4	153.3	223.8
F(2,86)		*3.04*		*7.54**		*2.87*		*3.55**	

Note. From Rushton (1990b, p. 320, Table 2). Copyright 1990 by the Canadian Criminal Justice Association. Reprinted with permission.
* $p < 0.05$

their racial status. For 1984, complete data were available for 71 countries: 9 Mongoloid (including Indonesia, Malaysia, and the Philippines), 40 Caucasoid (including Arabic North Africa, the Middle East, and Latin America), and 22 Negroid (sub-Saharan Africa including Sudan and the Caribbean); for 1986, complete data were available for 88 countries (12 Mongoloid, 48 Caucasoid, and 28 Negroid).

Obviously the groupings shown in Table 7.3 do not represent in any sense "pure types" and there is enormous racial and ethnic variation within almost every country; moreover, each country undoubtedly differs in the procedures used to collect and disseminate the crime figures. Certainly within each racial grouping are to be found countries reporting both high and low crime rates. The Philippines, for example, a country grouped as Mongoloid, reported one of the highest homicide rates in the world, 43 per 100,000 in 1984; Togo, a country grouped as Negroid, had the lowest reported crime rate in the world, a "rounded down" 0 per 100,000 in all 3 crime categories in 1984.

The means and standard deviations for the three racial groups broken down by type of crime are shown in Table 7.3. If each country is treated as an independent entry, the results of one-way ANOVAS reveal that the races differ significantly in crime production. Using the aggregates, significant linear trends show Mongoloids < Caucasoids < Negroids for both 1984 [F (1, 69) = 5.20, $p < 0.05$] and 1986 [F (1, 86) = 4.99, $p < 0.05$]. A nonparametric analysis of these ratio figures shows that the exact probability of getting this particular ranking twice in a row is 1/6 x 1/6 = 0.027.

Social Organization

A similar racial pattern is found when assessing administrative cohesion and political organization, either contemporaneously or historically. Twenty-five hundred years ago, China governed 50 million people via an imperial bureaucracy with universally administered entrance exams leading to the Inner Cabinet, an achievement that surpassed those of equivalent European civilizations, including that of the Roman Empire. In Africa, however, written languages were not invented and the degree of bureaucratic organization therefore necessarily limited.

One way of assessing a government's administrative ability is its capacity for conducting an accurate census. The United States conducts one of these every ten years and there is, of course, a margin of error. The amount of error in the U.S. census is considered small relative to African and Caribbean countries whose population statistics are notoriously poor, but large compared to a census conducted over ten days beginning July 1, 1990 in the People's Republic of China. There were over 1 million census takers organized for the population of 1 billion people.

The disorganization of African and African-American societies relative to those elsewhere in the world is increasingly the focus of concerned commentary. In the United States, the optimism generated by the Civil Rights movement of the 1950s, culminating in the Civil Rights Act of 1964 has almost completely dissipated. The abysmal social and financial conditions of poverty and unemployment, drugs and crime, teenage parenthood, and wretched educational achievement in black urban centers provide problems of gigantic proportion for the future (Jaynes & Williams, 1989).

Some see the city of Detroit as a harbinger of what is to come. In the early 1960s Detroit seemed like a model American city. Industry was booming as both blacks and whites found steady work in the automobile industry. But in 1967 the worst race riot in American history erupted. Overnight, Detroit was violently jerked from being a prosperous, integrated industrial center to that of a chaotic, seething ghetto. The anarchic conditions and political rhetoric surrounding black city-states like Detroit have been recorded by the Israeli writer, Ze'ev Chafets (1990) in *Devil's Night and Other True Tales of Detroit,* an account of, among other events, how local citizens burn down houses, abandoned buildings, and unused factories each Halloween night. Chafets refers to Detroit as "America's first Third World City."

In Africa, as the imperial powers of Europe began decolonization after World War II there were high hopes and intensive, forward-looking interest in the countries of sub-Saharan Africa. Hundreds of billions of dollars of foreign aid and private investment poured in. However, unlike South Asia, a region generally considered to be in a somewhat similar situation thirty-five years ago, Africa's economy has substantially declined in size and dereliction and decay are everywhere. The crumbling infrastructure often forces companies to provide their own generators for electricity, their own water for drinking and their own radio transmitters for communication. In an age of computers and fax machines, it is difficult to raise a dial tone in many African cities (Duncan, 1990; Lamb, 1987). Studies by the World Bank and others show that by every indicator conditions will only worsen in the 1990s and that the relentless peripheralization of Africa from the world economy will continue.

One ominous feature is Africa's inability to control its population growth, currently at 3.2 percent a year, the highest rate in Africa's known history or in the world (Caldwell & Caldwell, 1990). South Asia and Latin America, whose rates stand at 2.1 percent and 2.5 percent respectively, have reduced population growth since 1960. In the United States the average woman will be a source of 14 children, grandchildren, and great-grandchildren; the comparable figure for an African woman is 258. As a result, the African continent, which accounted for 9 percent of the world's population in 1950, accounts for 12 percent today.

If these trends continue, Africans will constitute more than a quarter of the human race by late in the next century and for a long time thereafter (Caldwell & Caldwell, 1990). In spite of a staggering death toll from AIDS of about 20 million people, the United Nations world population projections say that Africa's population will double by the year 2015 (Briefings, *Science,* September 18, 1992, vol. 257, p. 1627).

Racial Rankings

Table 1.1 summarized the results for some 6 categories of variables reported in the empirical literature. I have found that general rankings made by Orientals, as well as by whites reflect these racial orderings (Rushton, 1992c). As shown in Table 7.4, whites and Orientals rank whites intermediate to Orientals and blacks on measures of industriousness, activity, sociability, rule following, strength of the sex drive, genital size, intelligence, and brain size.

TABLE 7.4
Ranking of Races on Various Dimensions Made by Orientals and Whites

	Oriental ranking of			White ranking of		
	Blacks	Whites	Orientals	Blacks	Whites	Orientals
Intelligence	3^c	2^b	1^a	3^c	2^b	1^a
Brain size	3^c	2^b	1^a	3^b	1^a	2^a
Industriousness	3^b	2^b	1^a	3^c	2^b	1^a
Activity	1^a	2^b	3^c	1^a	2^b	3^c
Anxiety	3^b	2^b	1^a	3	2	1
Sociability	3^b	1^a	3^c	2^b	1^a	3^c
Aggressiveness	2	1	3	1^a	2^b	3^c
Rule-following	3^c	2^b	1^a	3^c	2^b	1^a
Strength of sex drive	2^a	1^a	3^b	1^a	2^b	3^c
Size of genitalia	1^a	2^b	3^c	1^a	2^b	3^c

Note. From Rushton (1992c, p. 441, Table 2). Copyright 1992 by Pergamon Press. Reprinted with permission. Different superscripts indicate significant differences ($p < .05$).

Other Variables

Many other variables distinguish the races, some anecdotal, but surely worthy of study. African rhythm from Burkino Faso to South Africa enables Africans to sing in unison while they work. A visitor will often note that when a group is working in the fields, one person sits off to the side and beats a drum so all can sing and work in unison. African American rhythm music has conquered the adolescent population from Toronto to Tokyo. Is there a racial gradient on this dimension from Africans to Asians? If so, what is the neurohormonal mediator?

There are racial differences in the production of odor produced by the apocrine glands (J. R. Baker, 1974). These glands are associated with underarm and genital hair and become active when people are frightened or aroused. Blacks have more and larger apocrine glands than Caucasians and Caucasians more than Orientals. The Sino-Japanese are very sensitive to smell and doctors specialize in treatment for body odors. In Japan, a strong odor used to be sufficient in the early part of this century to warrant the sufferer being exempt from military service (J. R. Baker, 1974: 173).

Blacks have deeper voices than whites. In one study, Hudson and Holbrook (1982) gave a reading task to 100 black men and 100 black women volunteers ranging in age from 18 to 29 years. The fundamental vocal frequencies were measured and compared to white norms. The frequency for black men was 110 Hz, lower than the 117 Hz for white men, and the frequency for black women was 193 Hz, lower than the frequency of 217 Hz for white women.

Differences in bone density between blacks and whites have been noted at a variety of ages and skeletal sites and remain even after adjusting for body mass (Pollitzer & Anderson, 1989). Racial differences in bone begin even before birth. Divergence in the length and weight of the bones of the black and white fetus is followed by greater weight of the skeleton of black infants compared with white infants. Blacks have not only greater skeletal calcium content, but also greater total body potassium and muscle mass. These findings are important for osteoporosis and fractures, especially in elderly people.

Body structure differences likely account for the differential success of blacks at sporting events. Blacks are disproportionately successful in sports involving running and jumping but not at all successful at sports such as swimming. For example in the 1992 Olympic Games in Barcelona, blacks won every men's running race. On the other hand, no black swimmer has ever qualified for the U.S. Olympic swim team. The bone density differences mentioned above may be a handicap for swimming.

The physique and physiology of blacks may give them a genetic advantage in running and jumping, as discussed in *Runner's World* by long time editor Amby Burfoot (1992). For example, blacks have less body fat, narrower hips, thicker thighs, longer legs, and lighter calves. From a biomechanical perspective, this is a useful package. Narrow hips allow for efficient, straight-ahead running. Strong quadricep muscles provide horsepower, and light calves reduce resistance.

With respect to physiology, West Africans are found to have significantly more fast-twitch fibers and anaerobic enzymes than whites. Fast-twitch muscle fibers are thought to confer an advantage in explosive, short duration power events such as sprinting. East and South African blacks, by contrast, have muscles that provide great endurance by producing little lactic acid and other products of muscle fatigue.

A number of direct performance studies have shown a distinct black superiority in simple physical tasks such as running and jumping. Often, the subjects in these studies were very young children who had no special training. Blacks also have a significantly faster patellar tendon reflex time (the familiar knee-jerk response) than white students. Reflex time is obviously an important variable for sports that require lightning reflexes. It would be interesting to know if the measures on which blacks performed best were the ones on which Orientals performed poorest, and vice versa. Do reflex times and percentage of fast-twitch muscle show a racial gradient, and is it one opposite to that of cognitive decision time? Is this ultimately a physiological tradeoff?

8

Sexual Potency, Hormones, and AIDS

An inverse relation is found between the racial pattern reported on brain size and intelligence and that reported in this chapter on gamete production and sexual behavior. Mongoloid populations, who average highest in brain size and intelligence, are lowest in egg production and reproductive effort. Caucasoids average intermediately. The racial gradient is found on numerous physiological, anatomical, and behavioral measures, including AIDS. Sex hormones may mediate this pattern.

Reproductive Potency

The average woman produces one egg every 28 days in the middle of the menstrual cycle. Some women, however, have shorter cycles than others and some produce two eggs in a cycle. Both events translate into greater fecundity because of the greater opportunities they provide for a conception. Occasionally double ovulation results in the birth of dizygotic (two-egg) twins.

The races differ in the rate at which they double ovulate. Among Mongoloids, the frequency of dizygotic twins per 1,000 births is less than 4, among Caucasoids the rate is 8 per 1,000, and among Negroids the figure is greater than 16 per 1,000, with some African populations having twin frequencies of more than 57 per 1,000 (Bulmer, 1970). Recent reviews of twinning rates in the United States (Allen, 1988) and Japan (Imaizumi, 1992) confirm the racial differences. Note that the frequency of monozygotic twinning is nearly constant at about 4 per 1,000 in all groups. Monozygotic twinning is the result of a single fertilized egg splitting into two identical parts.

The frequency of three-egg triplets and four-egg quadruplets shows a comparable racial ordering. For triplets, the rate per million births among Mongoloids is 10, among Caucasoids 100, and among Negroids 1,700; and for quadruplets, per million births, among Mongoloids 0, among Caucasoids 1, and among Negroids, 60 (Allen, 1987; Nylander, 1975). Data from racially mixed matings show that multiple births are largely determined by the race of the mother, independently of the race of the father, as found in Mongoloid-Caucasoid crosses in Hawaii, and Caucasoid-Negroid crosses in Brazil (Bulmer, 1970).

TABLE 8.1
Relative Ranking of Races in Reproductive Potency

Reproductive potency variable	Orientals	Whites	Blacks
Gamete production and multiple birthing	3	2	1
Speed of menstrual cycle	?	2	1
Speed of sexual maturation	?	2	1
Age of first sexual intercourse	3	2	1
Number of premarital partners	3	2	1
Frequency of premarital intercourse	3	2	1
Frequency of sexual fantasies	3	2	1
Frequency of marital intercourse	3	2	1
Number of extramarital partners	3	2	1
Permissive attitudes, low guilt	3	2	1
Primary sexual characteristics (size of penis, testis, vulva, vagina, clitoris, ovaries)	3	2	1
Secondary sexual characteristics (salient voice, breasts, buttocks, muscles)	3	2	1
Biologic control of sexual behavior (periodicity of sexual response; predictability of sexual life history from age of onset of puberty)	3	2	1
Androgen levels	3	2	1
Sexually transmitted diseases	3	2	1

Note. From Rushton (1992b, p. 814, Table 3). Copyright 1992 by Psychological Reports. Reprinted with permission.

Sexual Anatomy

Anatomical differences have often been referred to in the ethnographic record (chap. 5; see also French Army Surgeon, 1898/1972; J. R. Baker, 1974; Lewis, 1990). Reference has been made to the placement of female genitals

(Orientals highest, blacks lowest); the angle and texture of erection (Orientals parallel to body and stiff, blacks at right angles to the body and flexible); the size of genitalia (Orientals smallest, blacks largest); and the salience of muscularity, buttocks, and breasts (Orientals least, blacks most).

Rushton and Bogaert (1987) averaged the ethnographic data on erect penis size and estimated them to approximate: Orientals, 4 to 5.5 inches in length (10-14 cm) and 1.25 inches in diameter (3.2 cm); Caucasians, 5.5 to 6 inches in length (14-15.3 cm) and 1.3 to 1.6 inches in diameter (3.3-4.1 cm); blacks, 6.25 to 8 inches in length (15.9-20.3 cm) and 2 inches in diameter (5.1 cm). Women were proportionate to men, with Orientals having smaller vaginas and blacks larger ones, relative to Caucasians. Variations were noted: in the French West Indies, the size of the penis and vagina covaried with amount of black admixture.

New focus on penis size has come in the wake of the AIDS crisis. It has become increasingly obvious that one size of condom does not fit all. Because condom use is considered an essential element of AIDS prevention, and because condom size is a critical determinant in user satisfaction, both the World Health Organization's *Specifications and Guidelines for Condom Procurement* and the United Nations' International Organization for Standardization have recommended a 49-mm flat width condom for Asia, a 52-mm flat width for North America and Europe, and a 53-mm size for Africa (e.g., World Health Organization, 1991). China is reported to be manufacturing its own condoms—49 mm, plus or minus 2 mm.

In Thailand, where several ergonomic studies have been conducted, female prostitutes say that size 52 mm condoms bunch up during intercourse causing irritation and adolescent male users report that even 49 mm slip off during intercourse. Other indications are that size 52 mm condoms may be too small for some Caucasian and African men. As a result of such information, studies are currently underway to establish typical penis size and shape in various parts of the world (e.g., Program for Appropriate Technology in Health, 1992).

The research currently available suggests that at least three sizes are needed to cover the 10th to 90th percentile, based on Kinsey Institute (see 8.6 below) and Thailand data (Table 8.2). These sizes would be: (1) 45 mm flat width, (2) 52 mm flat width, and (3) 57 mm flat width. It seems evident, based on penile size data collected in Thailand, that the current "Asian" size of 49 mm flat width is too large for approximately 15 percent of the male population. It also seems possible, assuming the Kinsey data for African American males are relevant, that the 52 mm nominal flat width condom is too small for at least 25 percent of the African population, and that flat widths of 55-56 mm would be more suitable for that region (Program for Appropriate Technology in Health, 1991).

Another aspect of size—length—poses less of a problem for universal fit. Condoms that rely on general elasticity to prevent slip-off can be unrolled to

TABLE 8.2
Racial Differences in Erect Penis Size

	Percentage of sample		
Penis size	**Thailand**[a]	**White/U.S.**[b]	**Black/U.S.**[b]
Length (mm)			
75-100	3	0	0
100-125	27	3	0
126-150	51	27	15
151-175	17	53	59
176-200	2	15	20
> 200	0	2	5
Circumference (mm)			
< 75	0	2	2
76-100	16	3	2
101-112	37	13	9
113-127	30	53	53
128-137	14	10	11
138-150	3	15	15
>150	0	5	9

Note. From World Health Organization Global Programme on AIDS Specifications and Guidelines for Condom Procurement (1991, p. 33, Table 5). Data are in the public domain.

[a] Measured at point of maximum circumference; [b] Measured at base

any of a variety of lengths, provided that the condom is sufficiently long to accommodate at least the 95th percentile. Based on Kinsey Institute data for African American and white males in the United States and additional data from Thailand, the optimum lengths might be 180 mm for the Asian populations, 190 mm for the Caucasian populations, and 200 mm for the African populations (Program for Appropriate Technology in Health, 1991).

Data provided by the Kinsey Institute have confirmed the black-white difference in penis size (Table 8.2, and items 70–72 of Table 8.4). Alfred Kinsey and his colleagues instructed their respondents on how to measure their penis along the top surface, from belly to tip. The respondents were given cards to fill out and return in preaddressed stamped envelopes. Nobile (1982) published the first averages of these data finding the length and circumferences of the penis for the white samples was smaller than for the black sample. (Flaccid length = 3.86 inches [9.80 cm] vs. 4.34 inches [11.02 cm]; erect length = 6.15 inches [15.62 cm] vs. 6.44 inches [16.36 cm]; erect circumference = 4.83 inches [12.27 cm] vs. 4.96 inches [12.60 cm] respectively.)

Measures of the size of the testes, either taken from living subjects or from those at autopsy, show that this is twofold lower in Asian men than Europeans (9 vs. 21 g). These differences are too large to be accounted for in terms of body size (Harvey & May, 1989; Short, 1979, 1984). According to Harvey and May (1989) this size differential means that individual Caucasians produce about twice the number of spermatozoa per day than do Chinese (185–253 x 10^6 compared with 84 x 10^6). Larger scrotal circumferences have sometimes been reported in Africans than in Europeans (Short, 1979; Ajmani, Jain, & Saxena, 1985).

Sex Hormones

In an early study by W. Freeman (1934), racial-group differences in the weight of the hypophysis (pituitary) were suggested, with blacks having the heaviest (800 mg), whites being intermediate (700 mg), and Orientals having the lightest (600 mg). The pituitary is directly involved with the release of gonadotropins, which stimulate the testicles and ovaries in their functions (the release of testosterone, estradiol, and progesterone on the one hand, and sperm and eggs on the other). This would order the population differences in rate of multiple birthing, for gonadotropin levels differentiate the races in the predicted direction (Soma, Takayama, Kiyokawa, Akaeda, & Tokoro, 1975), as well as distinguish mothers of dizygotic twins from mothers with no dizygotic twins (Martin, Olsen, Thiele, Beaini, Handelsman, & Bhatnager, 1984).

The proposition of a Negroid-Caucasoid-Mongoloid gradient for maternal gonadotropin was supported by R. Lynn (1990b) in a review of the medical literature. He provided indirect evidence from racial differences in the sex ratio, that is, the proportion of male to female infants. It is known that the sex ratio is low in black populations, moderate in Caucasoids, and high in Mongoloids, and there is also evidence that high levels of gonadotropin lowers the sex ratio, suggesting that high gonadotropin levels in black women are partially responsible for the low sex ratio (James, 1986). The maternal hormonal gradient may also be the explanation for the same racial pattern that exists for premenstrual syndrome (Janiger, Riffenburgh, & Kersh, 1972).

R. Lynn (1990b) suggested that paralleling the gonadotropin gradient in women is a testosterone gradient in men. One study of matched groups of 50 black and 50 white male college students in California found that testosterone levels were 19 percent higher in blacks than in whites (Ross, Bernstein, Judd, Hanisch, Pike, & Henderson, 1986). A 3 percent difference favoring blacks has been found among an older group of 3, 654 white and 525 black U.S. male Vietnam era military veterans (Ellis & Nyborg, 1992).

The incidence of cancer of the prostate provides indirect evidence. Numerous medical surveys show that Oriental populations experience less than half the U.S. incidence whereas U.S. blacks have a much higher lifetime risk than U.S. whites (Hixson, 1992; Polednak, 1989). By turning over cells in the prostate, the conversion of testosterone to dihydrostestosterone by the enzyme 5-alpha reductase is most widely considered to be one major source of the mutations leading to cancer. Measurements of two metabolites of dihydrostestosterone show markedly lower levels in the serum of Japanese natives and 10 to 15 percent higher concentrations in American blacks (Hixson, 1992).

There is also evidence that biological factors differentially influence sexual behavior across the races, the direction being blacks > whites > Orientals. Inspection of Figures 1 vs. 2 and 3 in Udry and Morris (1968), for example, shows a higher periodicity, or greater frequency of intercourse at midcycle, the time that is most likely to result in pregnancy, among black women than among white women. In a recent comparison of Oriental and white students at a Canadian university, Oriental women reported less periodicity of sexual response than white women (Rushton, 1992c).

Biological factors similarly predict the onset of sexual interest, dating, first intercourse, and first pregnancy better for blacks than for whites or for Orientals (Presser, 1978; Goodman, Grove, & Gilbert, 1980; Westney et al., 1984). The converse may also be true. Social factors such as religious beliefs and sex-role attitudes predict the sexual behavior of white women better than that of black women (Tanfer & Cubbins, 1992).

Intercourse Frequency and Attitudes

Racial differences exist in frequency of sexual intercourse. Examining Hofmann's (1984) review of the extent of premarital coitus among young

TABLE 8.3
World Health Surveys Showing Proportion of Population Aged 11–21 Experiencing Premarital Coitus

Population	% sexually experienced Men	Women	Both
Asians	12	5	9
Europeans	46	35	40
Africans	74	53	64

Note. From Rushton & Bogaert (1987, p. 535, Table 2). Copyright 1987 by Academic Press. Reprinted with permission. The table summarizes a review by Hofmann (1984).

people around the world, Rushton and Bogaert (1987) categorized the 27 countries by primary racial composition and averaged the figures. The results showed that African adolescents are more sexually active than Europeans, who are more sexually active than Asians (see Table 8.3). While some variation occurs from country to country, consistency is found within groups. As is typical of such surveys, young men report a greater degree of sexual experiences than young women (Symons, 1979). It is clear from Table 8.3, however, that the population differences are replicable across sex, with the men of the more restrained group having less experience than the women of the less restrained.

A confirmatory study was carried out in Los Angeles which held the setting constant and fully sampled the ethnic mix. Of 594 adolescent and young adults, 20 percent were classified as Oriental, 33 percent as white, 21 percent as Hispanic, and 19 percent as black. The average age at first intercourse was 16.4 for Orientals and 14.4 for blacks, with whites and Hispanics intermediate, and the percentage sexually active was 32 percent for Orientals and 81 percent for blacks, with whites and Hispanics intermediate (Moore & Erickson, 1985).

A Youth Risk Behavior Survey with a reading level for 12-year-olds was developed by the Centers for Disease Control in the United States to examine health-risk behaviors including sexual behaviors. In 1990, a representative sample of 11,631 students in grades 9-12 (ages 14 to 17) from across the United States anonymously completed the questionnaire during a 40-minute class period. Students were asked whether they had ever had sexual intercourse, with how many people they had had sexual intercourse, and with how many people they had had sexual intercourse during the past 3 months. They were also asked about their use of condoms and other methods of preventing pregnancy (Centers for Disease Control, 1992a).

Of all students in grades 9-12, 54 percent reported ever having had sexual intercourse and 39 percent reported having had sexual intercourse during the 3 months preceding the survey. Male students were significantly more likely than female students to ever have had sexual intercourse (61 percent and 48 percent, respectively) and to have had sexual intercourse during the 3 months preceding the survey (43 percent and 36 percent, respectively). Black students were significantly more likely than white students to ever have had sexual intercourse (72 percent and 52 percent, respectively), to have had sexual intercourse during the 3 months preceding the survey (54 percent and 38 percent, respectively), and to have had four or more sex partners in their lifetime (38 percent and 16 percent, respectively). Four percent of all students reported having had a sexually transmitted disease. Black students (8 percent vs. 3 percent) were significantly more likely to report having had a sexually transmitted disease than white students (Centers for Disease Control, 1992a, 1992b).

The rate of premarital intercourse is matched by that following marriage. Rushton and Bogaert (1987) inspected a section on cross-cultural intercourse frequency in a review by Ford and Beach (1951) and categorized the tribal peoples listed into three main groups. The Oceanic and Amerindian people tended to have a lower rate of sexual intercourse per week average (1-4) than U.S. whites (2-4) and Africans (3-10). Subsequent surveys tend to support the same conclusion. For married couples in their twenties, the average frequency of intercourse per week for the Japanese approximates 2 (Asayama, 1975), for American whites 4, and for American blacks 5 (Fisher, 1980).

Sex surveys are also beginning in the People's Republic of China where, according to *Time Magazine* (May 14, 1990), a new era of relative permissiveness is beginning. According to the *Time* account, in one survey, 500 volunteer social workers have interviewed 23,000 people in 15 provinces using a 240-question survey. Results from a smaller survey, of about 2,000 men and women from urban centers throughout China have now been published (Bo & Wenxiu, 1992). The results show much restraint relative to that in the West. For example, over 50 percent of the men and women reported never having discussed sex with others and over 20 percent of spouses had never talked about sex with each other. This compared to less than 5 percent of respondents in England (Eysenck, 1976).

Over 50 percent thought that masturbation (and even loss of semen) was debilitating. Only 19 percent of males who admitted masturbating had engaged in the practice before the age of 17 years, and no female masturbators reported that they had done it before that age, while over 90 percent of the women stated that they had commenced after the age of 20. One reason for the older average age of masturbation is a later puberty. Of the males, about 50 percent reported that they had experienced their first seminal emission above the age of 17.

The frequency of reported intercourse may also be slightly lower in urban China than in the urban West. For married couples aged 20–30 the average is about 12 times a month or 3 times a week (Bo & Wenxiu, 1992, Table 7). Only 5 percent of the males and 3 percent of the females reported frequencies of one or more sexual outlets a day. The incidence of reported extramarital intercourse is also lower in China. About 29 percent of the males and 23 percent of the females admitted that they had been or were engaged in it. In the United States, one set of figures indicate 45 percent and 34 percent, respectively (*Playboy Magazine,* 1983).

Not all surveys find racial differences in the predicted direction. Tanfer and Cubbins (1992) found that 20- to 29-year-old single black women cohabiting with a sexual partner reported only 4.3 occasions of intercourse in the previous four weeks as compared with 6.9 among cohabiting white women ($p <$ .05). The authors suggested that these black women's partners had other sexual partners as well and were less available than the white women's partners. Another possible reason was that more of the black sample were pregnant (Tanfer & Cubbins, 1992, Table 3).

Concomitant racial differences are found in sexual attitudes. In Ford and Beach's (1951) survey, the Asian groups were the most likely to endorse beliefs concerning the weakening effects of intercourse. A review by P. E. Vernon (1982) led him to conclude that both the Chinese and the Japanese were not only less experienced in premarital sex, but were also less permissive, and less concerned with sexual display than Caucasians. Thus, Connor (1975, 1976) had found that three generations of Japanese Americans, as well as Japanese students in Japan, reported less interest in sex than Caucasian samples. Abramson and Imari-Marquez (1982) observed that each of three generations of Japanese Americans showed more sex guilt than matched Caucasian Americans. In studies carried out in Britain and Japan using a sex fantasy questionnaire, Iwawaki and Wilson (1983) found that British men reported twice as many fantasies as Japanese men, and British women admitted to four times as much sex fantasy as Japanese women.

In contrast, African-descended people are more permissive than Caucasians. Reiss (1967) observed this with several hundred black and white university students in the United States on scales measuring premarital sexual attitudes (e.g., approving of or feeling guilt about petting and intercourse in casual and romantic relationships); results replicated with other samples and measuring instruments (Heltsley & Broderick, 1969; Sutker & Gilliard, 1970). Johnson (1978) also compared black and white premarital sexual attitudes and behavior and included a Swedish sample who were expected to be (and were) more permissive than American whites. The black sample (particularly males) was found to have had intercourse earlier and with a greater number of casual partners, and with less feelings of distaste, than either white sample.

The Kinsey Data

To explore racial differences in behavior, Rushton and Bogaert (1987, 1988) examined the Kinsey data. As is generally known, Kinsey, Pomeroy, Martin, and Gebhard created the Institute for Sex Research at Indiana University in 1947. In 1948 they published *Sexual Behavior in the Human Male* and in 1953 *Sexual Behavior in the Human Female.* In these books they did not address the issue of group differences but did leave a promissory note:

> The present volume is confined to a record on American and Canadian whites, but we have begun accumulating material which will make it possible to include the American and Canadian Negro groups in later publications. Several hundred histories from still other race cultural groups begin to show the fundamental differences which exist between American and other patterns of sexual behavior, but the material is not yet sufficient for publication. (1948: 76)

Early impressions based on some of these data suggested that if blacks were found to be sexually precocious compared to whites on some measures (Gebhard, Pomeroy, Martin, & Christenson, 1958), the differences would probably be small and overstated (Bell, 1978). Only recently has it become possible to provide tests of significance on a full range of variables.

In 1979, Gebhard and Johnson published a supplementary volume containing novel information, as well as a "cleaning" of the original data (eliminating individuals derived from sources with a known sexual bias such as prostitutes). This volume presented nearly 600 tables of percentages for a range of sexual practices and morphological data by race, socioeconomic status, sexual orientation, etc. From these data, we chose 41 items to compare black-white differences. Because the black sample was a privileged group, consisting of university students from 1938 to 1963, a period of time during which it was more difficult for blacks in the United States to go to a university than it is today, and because they were also of high socioeconomic and religiously devout background (Gebhard & Johnson, 1979: Tables 3-6, 9, 295), it was possible to compare social class differences. The white sample was divided into those who were college-educated and those who were not.

The Kinsey interview method along with some of its strengths and weaknesses has been described by Gebhard and Johnson (1979). Personal interviews were conducted from 1938 to 1963 assessing some 300 items of demographic, physical, and sexual information on over 10,000 white and 400 black respondents. It is not a random sample, as most respondents were college educated and between 20 and 25 years of age when interviewed. They are most representative of the middle classes and the Midwest of the United States at the time (Indiana and Illinois, including Chicago). Because the black sample was a relatively elite group, a restricted test of race differences is made. If more normative samples of black people had been used, it is likely that the differences would be greater.

Rushton and Bogaert examined the 600 tables in Gebhard and Johnson (1979) to choose those that seemed most relevant. As often as possible, a cutoff was chosen at the place where 50 percent of the black respondents had fallen. For example, if 10 percent of the black sample's fathers were under age 20 when the respondent was born, 20 percent were between the ages of 20 and 26, and 35 percent were between the ages of 26 and 30, the 50th percentile would be found in the category of age 26–30. It was then possible to calculate the percentage of the two white samples falling in this category to see if they differed from the black percentage. Where feasible, data was collapsed across males and females, thus providing the most reliable number of data points. The percentages were turned into proportions based on the number who had answered the question and a z test was calculated for the significance of differences between proportions. Analysis in terms of dichotomous proportions rather than means and standard deviations was necessitated by the limitations of the archival data.

It is worth noting that the proportions of females in the black and white groups were not entirely equivalent. For example, considering the item concerning year of birth (Gebhard & Johnson, 1979, Table 2) for which fairly complete data were available, males comprised 52 percent of the 9023 white college students responding, 44 percent of the 399 black college students, and 43 percent of the 1794 noncollege whites. Because females comprised a significantly higher percentage of black than of white students (X^2 = 9.2) the results were biased *against* finding race differences since females typically are more restrained in their sexual behavior than males (Symons, 1979). Although we did not report it in our papers, most of the racial differences were replicated across sex.

Table 8.4 presents the items and the table numbers from Gebhard and Johnson (1979), the proportions for the three samples, along with the tests of significance. The hypothesis that the white college-educated sample was more sexually restrained than the white noncollege-educated sample, which, in turn, was more sexually restrained than the black college-educated was supported on 24 out of 41 occasions (items 19, 31, 70, 72, 74, 90, 91, 100, 135, 199, 218, 227, 228, 239, 268, 297, 301, 322, 323, 326, 329, 348, 351, 367), with the majority being statistically significant. The probability of taking three items at a time and getting this ordering on 24 out of 41 occasions is itself greater than chance on a test of direct probabilities ($p < 0.001$). When the comparisons are made pairwise, the black college-educated sample is found to be more different from college-educated whites than are whites without a college education on 31 out of 41 occasions (items 19, 20, 28, 29, 69, 70, 71, 74, 90, 91, 100, 135, 183, 199, 218, 227, 228, 239, 268, 291, 297, 322, 323, 324, 326, 342, 348, 351, 355, 367, 374).

These results imply that race is more important than social class in determining sexual behavior. Social class did, however, have effects. Comparing the white college-educated sample with the white noncollege-educated sample showed statistically significant differences favoring the college-educated in terms of sexual restraint on 23 out of 41 occasions (items 19, 30, 31, 90, 91, 99,. 100, 135, 183, 199, 218, 227, 228, 239, 268, 297, 301, 308, 322, 323, 326, 329, 367). Results not in accord with expectation were also observed (items 28, 29, 30, 53, 99, 291, 308).

In sum, college-educated whites tended to be the most sexually restrained and college-educated blacks the least sexually restrained, with noncollege-educated whites intermediate. This pattern was observed on measures made of the speed of occurrence of premarital, marital, and extramarital sexual experiences, number of sexual partners, and frequency of intercourse. For women, measures of the speed and incidence of pregnancy, the rapidity of the menstrual cycle, and the number of orgasms per act of coitus also differentiated the groups.

Subsequently, M. S. Weinberg and Williams (1988) confirmed many of Rushton and Bogaert's (1987, 1988) observations with respect to black-white differences in sexuality. They reanalyzed evidence from three independent sources: the Kinsey data, which formed the basis of Rushton and Bogaert's studies, except that they used the original raw data rather than the published marginal totals; a 1970 National Opinion Research Center poll of sexual attitudes; and a study carried out in San Francisco. All three reanalyses showed the racial effects on sexuality while statistically holding education and social class constant.

TABLE 8.4
Analysis of Kinsey Data on Race and Socioeconomic Status Differences in Sexual Behavior

		Sample sizes and proportion		
Number	Item	Black college	White non-college	White college
19	Genetic father's age at respondent's birth: "26-30 and under"	189 / 313 = .60[a]	677 / 1,471 = .46[b]	3,385 / 7,872 = .43[c]
20	Genetic mother's age at respondent's birth: "26-30 and under"	275 / 348 = .79[a]	1,026 / 1,532 = .67[b]	5,415 / 8,082 = .67[b]
28	Respondent's age at genetic father's death: "18 and under"	65 / 123 = .53[a]	243 / 695 = .35[b]	966 / 2,300 = .42[c]
29	Respondent's age at genetic mother's death: "19 and under"	49 / 93 = .53[a]	175 / 472 = .37[b]	663 / 1,441 = .46[a]
30	Age respondent left parental home: "21 years or under"	104 / 186 = .56[a]	639 / 1,048 = .61[a]	1,767 / 3,606 = .49[b]
31	Number of siblings: "2 and under"	215 / 399 = .54[a]	977 / 1,777 = .55[a]	6,423 / 9,047 = .71[b]
53	Age at puberty (aggregate measure): "13 years and under"	292 / 400 = .73[a]	1,238 / 1,794 = .69[a]	6,970 / 9,052 = .77[b]
69	Estimated length of erect penis: "Less than or equal to 6.50 inches"	105 / 161 = .65[a]	403 / 791 = .82[b]	3,059 / 3,777 = .81[b]
70	Measured length of erect penis: "Less than or equal to 6.25 inches"	30 / 59 = .51[a]	86 / 143 = .60[a,b]	1,497 / 2,376 = .63[b]
71	Measured length of flaccid penis: "Less than or equal to 4.50 inches"	40 / 59 = .68[a]	126 / 142 = .89[b]	2,117 / 2,379 = .89[b]
72	Measured circumference of flaccid penis: "Less than or equal to 4.00 inches"	41 / 59 = .70[a]	104 / 137 = .76[a,b]	1,825 / 2,310 = .79[b]
74	Angle of penile erection: "Penis almost vertical or down from vertical as much as... 85°"	102 / 164 = .62[a]	450 / 585 = .77[b]	3,473 / 4,396 = .79[b]
90	Average length of menstrual cycle: "28 days or less"	129 /155 = .83[a]	428 / 595 = .72[b]	1,983 / 2,916 = .68[c]
91	Average length of menstrual flow: "4 days or under"	80 / 148 = .54[a]	230 / 574 = .40[b]	1,044 / 2,983 = .35[c]
99	Periodicity of female sexual response: "No periodicity"	36 / 173 = .21[a,b]	153 / 767 = .20[b]	710 / 2,839 = .25[a]
100	Age hymen broken: "18 years or under"	67 / 126 = .53[a]	175 / 546 = .32[b]	414 / 1,594 = .26[c]
135	Incidence of prepubertal heterosexual techniques: "Coitus"	116 / 400 = .29[a]	215 / 1,789 = .12[b]	814 / 9,045 = .09[c]
183	Reason for worry about masturbation: "Moral (guilt, shame)"	13 / 41 = .32[a,b]	56 / 206 = .27[b]	390 / 1,027 = .38[a]
199	Age of first premarital petting: "15 years and under"	241 / 388 = .62[a]	931 / 1,663 = .56[b]	3,929 / 8,731 = .45[c]
218	Age of first postpubertal coitus: "17 years and under"	171 / 335 = .51[a]	514 / 1,286 = .40[b]	1,186 / 5,651 = .21[c]
227	Intention to have premarital coitus: "No intention"	81 / 368 = .22[a]	654 / 1,487 = .44[b]	3,509 / 7,311 = .48[c]
228	Moral restraint on premarital coitus: "Much"	195 / 397 = .49[a]	993 / 1,655 = .60[b]	5,926 / 8,845 = .67[c]
239	Number of premarital coital companions: "5 partners or fewer"	169 / 307 = .55[a]	550 / 786 = .70[b]	3,068 / 4,202 = .73[c]
268	Incidence and type of nonmarital pregnancy: "Never"	102 / 310 = .68[a]	665 / 864 = .77[b]	3,938 / 4,633 = .85[c]
291	Duration of first marriage: "Under 5 years"	93 / 176 = .53[a]	326 / 1,053 = .31[b]	1,446 / 3,443 = .42[c]
297	Time between first marriage and first marital coitus in first marriage: "One day or less"	53 / 67 = .79[a]	428 / 620 = .69[b]	1,108 / 1,705 = .65[c]

TABLE 8.4 (cont.)

		Sample sizes and proportion					
Number	Item	Black college		White non-college		White college	
301	Time before first birth in first marriage: "9-11 months"	14 / 62	= .23^{a}	86 / 574	= .15^{a}	218 / 1,815	= .12^{b}
308	Clarity of contraceptive data for first marriage: "Clearly none used in this marriage"	25 / 176	= .14^{a}	147 / 1,051	= .14^{a}	172 / 3,432	= .05^{b}
322	Frequency of cunnilingus in foreplay in first marriage: "None"	139 / 174	= .80^{a}	636 / 1,043	= .61^{b}	1,576 / 3,426	= .46^{c}
323	Frequency of fellatio in foreplay in first marriage: "None"	146 / 174	= .84^{a}	679 / 1,044	= .65^{b}	1,710 / 3,420	= .50^{c}
324	Time between intromission and ejaculation in coitus in first marriage: "<6 minutes"	89 /158	= .56^{a}	675 / 951	= .71^{b}	2,057 / 3,164	= .65^{c}
326	Frequency (mean) per week of marital coitus in first marriage: "Age 21-25"		3.83		3.32		3.11
327	Maximum frequency of marital coitus in first marriage: "7 per week or less"	110 / 167	= .66^{a,b}	616 / 934	= .66^{a}	2,043 / 3,349	= .61^{b}
329	Frequency of positions in coitus in first marriage: female above, male supine: "Much"	16 / 172	= .09^{a}	134 / 1,033	= .13^{a}	546 / 3,415	= .16^{b}
340	Average number of wife's orgasms per act of coitus in first marriage: ">1"	23 / 173	= .13^{a}	92 / 1,026	= .09^{a,b}	304 / 3,376	= .09^{b}
342	Incidence of extramarital sexual activity in first marriage: "None"	31 / 175	= .17^{a}	390 / 1,053	= .37^{b}	1,047 / 3,439	= .30^{c}
348	Year of first marriage in which first extra-marital coitus occurred: "Within first 2 years"	40 / 78	= .51^{a}	112 / 448	= .25^{b}	199 / 867	= .23^{b}
351	Number of extramarital companions during first marriage: "Zero"	93 / 173	= .54^{a}	763 / 1,045	= .73^{b}	2,573 / 3,431	= .75^{b}
355	Expectation of future extramarital coitus: "Will not have"	50 /131	= .38^{a}	445 / 695	= .64^{b}	1,751 / 2,779	= .63^{b}
367	Incidence of sexual contact with prostitutes: "Never"	96 / 177	= .54^{a}	506 / 766	= .66^{b}	3,285 / 4,693	= .70^{c}
374	Incidence of fellatio with prostitutes: "Never"	44 / 70	= .63^{a}	116 / 228	= .51^{b}	605 / 1,164	= .52^{b}

Note. From Rushton & Bogaert (1988, pp. 265-268, Table 1). Copyright 1988 by Academic Press. Reprinted with permission. Within each item, those proportions of respondents answering in each category having different superscripts are significantly different ($p < .05$). The table number and item are from the "cleaned" Kinsey data by Gebhard & Johnson (1979).

AIDS

Differences in sexual activity translate into consequences. Teenage fertility rates around the world show Negroids > Caucasoids > Mongoloids (Hofmann, 1984). So does the pattern of sexually transmitted diseases. World Health Organization Technical Reports and other studies examining the worldwide prevalence of syphilis, gonorrhea, herpes, and chlamydia typically find low levels in China and Japan and high levels in Africa, with European countries intermediate. Africa is known to be unusual compared to other areas of the world in having sexually transmitted diseases as the major cause of infertility (Cates, Farley, & Rowe, 1985). The worldwide racial pattern in these diseases is replicated within the United States.

The 100,410 cases of acquired immunodeficiency syndrome (AIDS) reported to the World Health Organization as of July 1, 1988 were examined by Rushton and Bogaert (1989). While the modes of transmission were universally the same—through sex and blood and from mother to fetus—it was clear that the virus had entered and spread disproportionately among the racial groups. Because of political sensitivities, many African and Caribbean countries report only a fraction of their actual number of AIDS cases and strenuously deny that AIDS may have originated in Africa (Norman, 1985; Palca, 1991). Negroid countries, relative to others, have an enormous AIDS problem. In some areas, 25 percent or more of the 20–40-year age group are infected with the human immunodeficiency virus (HIV).

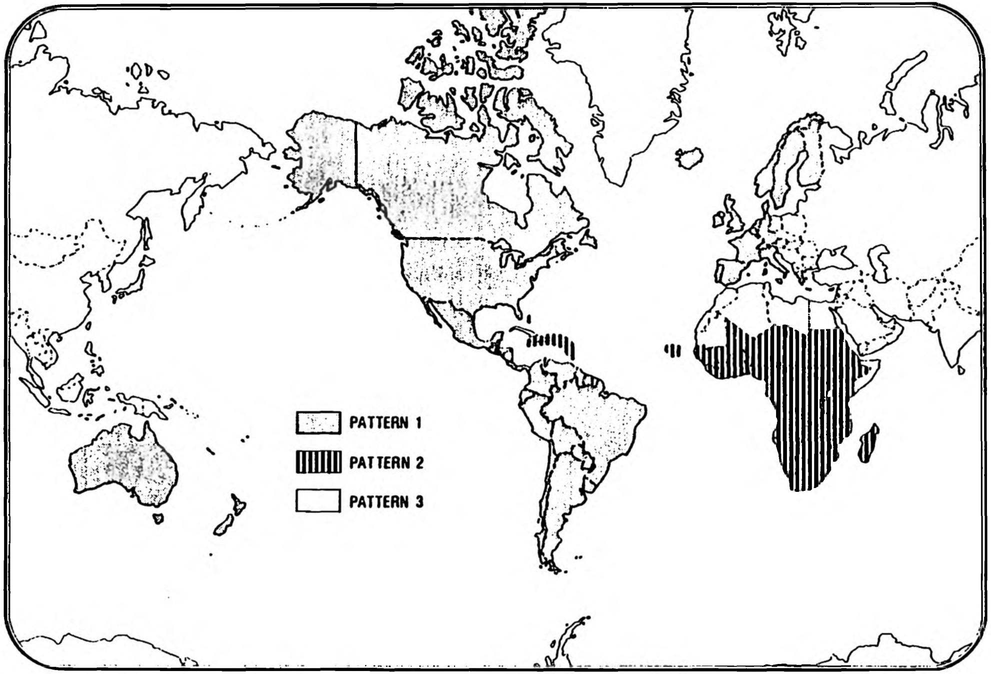
In African and Caribbean countries the AIDS virus is transmitted predominantly through heterosexual intercourse (Figure 8.1). The age and sex distributions of HIV infection rates is similar to that of other sexually transmitted diseases with higher prevalence among younger sexually active women. At the other extreme, it is a characteristic feature of AIDS in China and Japan that most sufferers are hemophiliacs. An intermediate amount of HIV infection is apparent in Europe and the Americas, where it has occurred predominantly among homosexual men.

The pattern of whites intermediate to blacks and Orientals is also well documented within the United States (Figure 8.2). As of July 1, 1988, blacks amounted to 12 percent of the U.S. population and accounted for 26 percent of adult and 53 percent of pediatric cases of AIDS. Whites amounted to 80 percent of the population and accounted for 59 percent of adult and 23 percent of child cases, with Hispanic populations intermediate. Oriental populations did not exist in the figures, which included those from California and Hawaii.

By April 1, 1990, the global figures had grown to 237,110 showing an 18-month doubling time and a crystallization of the racial pattern. I (Rushton 1990a) calculated the figures on a per capita basis to find that blacks in Caribbean countries had developed as large an AIDS problem as had Africans and African-Americans, a point ignored by most commentators. The three most affected countries in the world were Bermuda, the Bahamas, and French Guiana. Moreover, within the United States, blacks had increased their total share of the figures from 26 to 27 percent, whites had decreased, and Orientals remained at less than 1 percent.

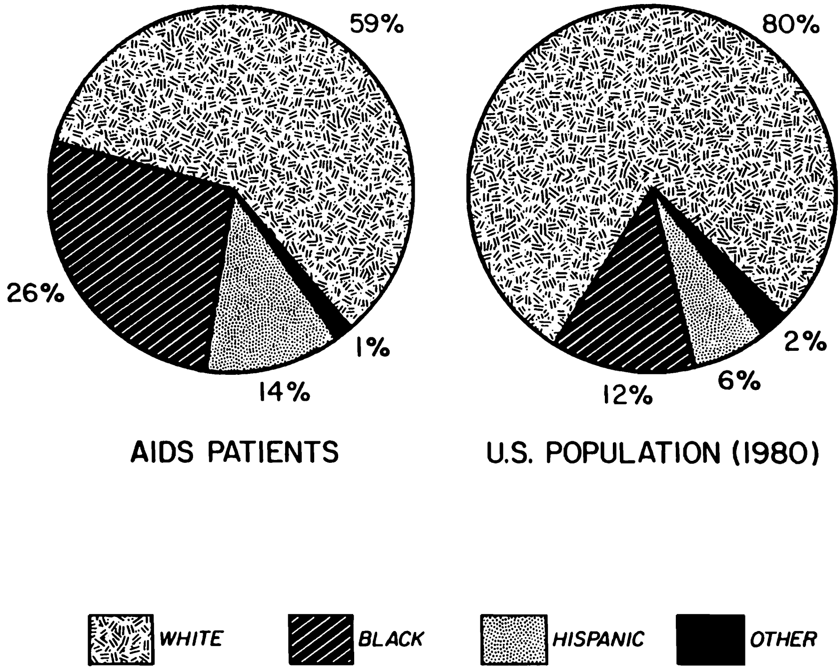
I have collated the most recent data as of January 4, 1994 in Table 8.5 (World Health Organization, 1994). The official statistics show a cumulative global total of 851,628 cases reported from 187 countries. The number of cases per 1,000 population are computed to give an indication of the relative seriousness of the epidemic between countries with different sizes of populations after excluding countries reporting fewer than 200 cases. The population size of the country is taken from estimates standardized for mid-1991 (United Nations, 1992). On this measure Canada has a rate of .320 per 1,000 making it the 33rd most affected country in the world. Of the other leading countries, 17 are in Africa, 10 are in the Caribbean, 4 are in Europe, and the other is the United States.

Figure 8.1: Three Infection Patterns of the AIDS Virus Are Apparent Worldwide



Pattern 1 is found in North and South America, Western Europe, and Australasia where 90% of the cases are homosexual males or users of intravenous drugs. Pattern 2 is found in Africa and the Caribbean where the primary mode of transmission is heterosexual sex and the number of infected females and males is approximately equal. Pattern 3 is typical of the rest of the world where relatively few cases have been reported. Adapted from Piot et al. (1988, Figure 3). Data are in the public domain.

Figure 8.2: Racial and Ethnic Classification of U.S. Adult AIDS cases in 1988



Orientals were underrepresented in cases of AIDS relative to their numbers in the population. Since 1988 the racial differences have grown larger. Adapted from Heyward & Curran (1988, p. 80). Data are in the public domain.

The most recent figures from the United States confirm that blacks are overrepresented in every exposure category (data as of September 30, 1993; Centers for Disease Control and Prevention, 1993). If the population of the United States is divided up racially, the 30 million African-Americans with a cumulative total of 106,585 adult/adolescent cases have a rate of 3.553 per 1,000, equivalent to the black populations of Africa and the Caribbean (Table 8.5). The white and Oriental populations of the United States have rates of .861 and .000 per 1,000, comparable to the white and Oriental populations of Europe and Asia.

One suggestion often made is that blacks in the United States have such a high prevalence of AIDS because of intravenous drug use. Among black men, 36 to 43 percent acquired the disease through drug use, but between 50 and 57

TABLE 8.5

The 33 Countries Most Affected by AIDS Based on Per Capita Cumulative Cases Reported to the World Health Organization as of January 1994

Country	Date of report (y.m.d)	Cumulative number of cases	Population in millions (as of mid-1991)	Cases per thousand
1. Bahamas	93.09.20	1,329	.259	5.131
2. Bermuda	93.06.30	223	.061	3.656
3. Malawi	93.08.20	29,194	8.556	3.412
4. Zambia	93.10.20	29,734	8.780	3.387
5. Zimbabwe	93.09.30	26,332	10.019	2.628
6. French Guiana	93.09.30	232	.101	2.297
7. Congo	92.12.31	5,267	2.346	2.245
8. Uganda	93.09.30	34,611	19.517	1.773
9. Barbados	93.09.30	397	.255	1.557
10. Kenya	93.07.09	38,220	25.905	1.475
11. Tanzania	93.01.07	38,719	28.359	1.365
12. Rwanda	93.12.10	10,138	7.491	1.353
13. U.S.A.	93.09.30	339,250	252.688	1.343
14. Burundi	93.12.10	7,225	5.620	1.286
15. Central African Republic	92.11.30	3,730	3.127	1.193
16. Cote d'Ivoire	93.07.05	14,555	12.464	1.168
17. Trinidad	93.09.30	1,404	1.253	1.121
18. Guadeloupe	93.03.21	353	.345	1.023
19. Botswana	93.11.24	1,151	1.348	.854
20. Martinique	93.09.30	266	.343	.776
21. Ghana	93.04.30	11,044	15.509	.712
22. Togo	93.12.10	2,391	3.643	.656
23. Zaire	93.06.10	21,008	35.672	.589
24. Spain	93.09.30	21,205	39.025	.543
25. Switzerland	93.09.20	3,415	6.792	.503
26. France	93.09.30	26,970	57.049	.473
27. Haiti	90.12.31	3,086	6.625	.466
28. Honduras	93.09.30	2,365	5.265	.449
29. Guyana	93.03.31	359	.800	.449
30. Gabon	93.12.10	472	1.212	.389
31. Guinea-Bissau	93.12.10	380	.984	.386
32. Italy	93.09.30	19,832	57.052	.348
33. Canada	93.09.30	8,640	27.034	.320

percent acquired it through sexual transmission, 8 percent heterosexually (compared to 1 percent of whites). Of all 24,358 adult cases transmitted heterosexually (7 percent of total), 14,143 or 58 percent involve blacks, with another 20 percent being Hispanic. Hispanics, of course, are a linguistic group; racially, a proportion is black or partly black, especially in New York. Blacks are also overrepresented in the "men who have sex with men" exposure category (19 % versus a population expectation of 12 %). Overall, in the last six years, blacks in the United States increased their total share of the AIDS figures from 26 to 31 percent, Hispanics increased from 14 to 17 percent, Asians and American Indians combined stayed at less than 1 percent, and whites decreased from 59 to 51 percent.

The racially distinct mode of AIDS transmission is particularly marked for women and children, with blacks accounting for 53 and 55 percent of all cases and whites 25 and 20 percent respectively. Whereas among white Americans 94 percent of cases are in men, with a sex ratio of 16:1, among black Americans it is 79 percent with a ratio of 4:1. Black Americans approximate the pattern in Africa and the Caribbean and white Americans the pattern in Europe (Figure 8.1).

9

Genes Plus Environment

Could the observed racial differences be entirely due to cultural modes of transmission? Because the Chinese and Japanese are known to come from tightly integrated family backgrounds, strong socialization is deemed to produce conformity, restraint, and respect for traditional values. An opposite pattern of results is then typically expected from blacks who come from less cohesive family systems and who are undersocialized for achievement.

The racial differences in family unity, however, themselves need explanation. What caused Caucasians to average intermediately in this respect to Africans and Orientals? In any case, socialization cannot account for the early onset of the traits, the speed of dental and other maturational variables, the size of the brain, the number of gametes produced, the physiological differences in testosterone, nor the evidence on cross-cultural consistency. All of these strongly implicate the role of genetic and evolutionary influences. Although purely environmental explanations are therefore unparsimonious from the outset, it is useful to consider the heritability of the racial group differences more fully.

Genetic Weights Predict Racial Differences

High heritabilities are stronger predictors across samples and tests than low heritabilities, probably because they better reflect the enduring biological substrate. As described in chapter 4, items higher in heritability are more consequential for assortment between spouses and best friends than are those with low heritabilities (Rushton, 1989c). Attitudes higher in heritability are shown to be responded to more quickly, to be more resistant to change, and to be more predictive in the attitude similarity attraction relationship (Tesser, 1993).

To my knowledge, Jensen (1973, chapter 4) was the first to apply the idea of differential heritability to race differences. Jensen deduced diametrically opposite predictions from genetic and environmental perspectives. He reasoned that if racial differences in cognitive performance are genetically based, then black-white differences should be greatest on those tests with higher heritabilities. But if racial differences are caused by the environment, then black-white differences should be greatest on those tests more environmentally influenced, and so would have lower heritability.

Jensen (1973) tested these predictions by calculating "environmentability" for various tests through the degree to which sibling correlations departed from the pure genetic expectation of 0.50. These showed an inverse relation with the magnitude of the black-white differences. That is, the most environmentally influenced tests were the ones that least differentiated between blacks and whites. Then, Jensen (1973) cited an unpublished study by Nichols (1972) who estimated the heritability of 13 tests from 543 siblings and found that the correlation between these heritabilities and the black-white difference scores on the same tests was 0.67. In other words, the more heritable the test, the more it discriminated between the races.

The genetic hypothesis is indirectly supported by studies using a test's *g* loading rather than its heritability. As described in chapters 2, 3, and 6, the higher a test's *g* loading, the more predictive of intelligent behavior it tends to be, the more heritable it is, and the more it differentiates between the races. Thus, Jensen (1985, 1987b) examined 12 large-scale studies, each comprising anywhere from 6 to 13 tests administered to over 40,000 elementary and high school students and found that the test's *g* loading consistently predicted the magnitude of the black-white difference.

Prompted by Jensen's approaches I showed a direct genetic effect on the black-white differences using inbreeding depression scores, a measure of genetic dominance (Rushton, 1989e). As described by Jensen (1983), inbreeding depression is an effect for which there is no really satisfactory explanation other than a genetic one. It depends on the presence of dominant genes that enhance fitness in the Darwinian sense.

Inbreeding depression scores had been calculated by Schull and Neel (1965) in a study of 1,854 7 to 10-year-old Japanese cousins tested in 1958 and 1960 and shown to be related to the *g* factor scores for 11 subtests of the Wechsler Intelligence Scale for Children by Jensen (1983).

I correlated these inbreeding depression scores with standardized black-white differences on the same subtests from five of the studies used by Jensen. Because the Japanese children had been tested in the 1950s on the original Wechsler Scale, while the American children were tested in the 1970s on the revised version of Wechsler Scale, the predicted effect had to be sufficiently strong to overcome these differences.

Set out in Table 9.1 is a summary of the data used in the studies by Jensen (1985, 1987b) and Rushton (1989e). As mentioned, the *g* factor loadings are indirect estimates of genetic penetrance and the inbreeding depression scores direct estimates. I have calculated a weighted average for the five sets of black-white differences (in σ units, based on raw scores from a total N = 4,848) as well as a weighted average for the 10 sets of *g* loadings. Also in Table 9.1 are the reliabilities of the tests.

TABLE 9.1

Subtests of the Wechsler Intelligence Scale for Children-Revised (WISC-R) Arranged in Ascending Order of Black-White Differences in the United States, with Each Subtest's *g* loading, Inbreeding Depression Score, and Reliability

WISC-R subtest	Black-White difference (N = 4,848)	*g* loading (N = 4,848)	Inbreeding depression (N = 1,854)	Reliability (N = 2,173)
1. Coding	.45	.37	4.45	.72
2. Arithmetic	.61	.61	5.05	.77
3. Picture completion	.70	.53	5.90	.77
4. Mazes	.73	.40	5.35	.72
5. Picture arrangement	.75	.52	9.40	.73
6. Similarities	.77	.65	9.95	.81
7. Comprehension	.79	.62	6.05	.77
8. Object assembly	.79	.53	6.05	.70
9. Vocabulary	.84	.72	11.45	.86
10. Information	.86	.68	8.30	.85
11. Block design	.90	.63	5.35	.85

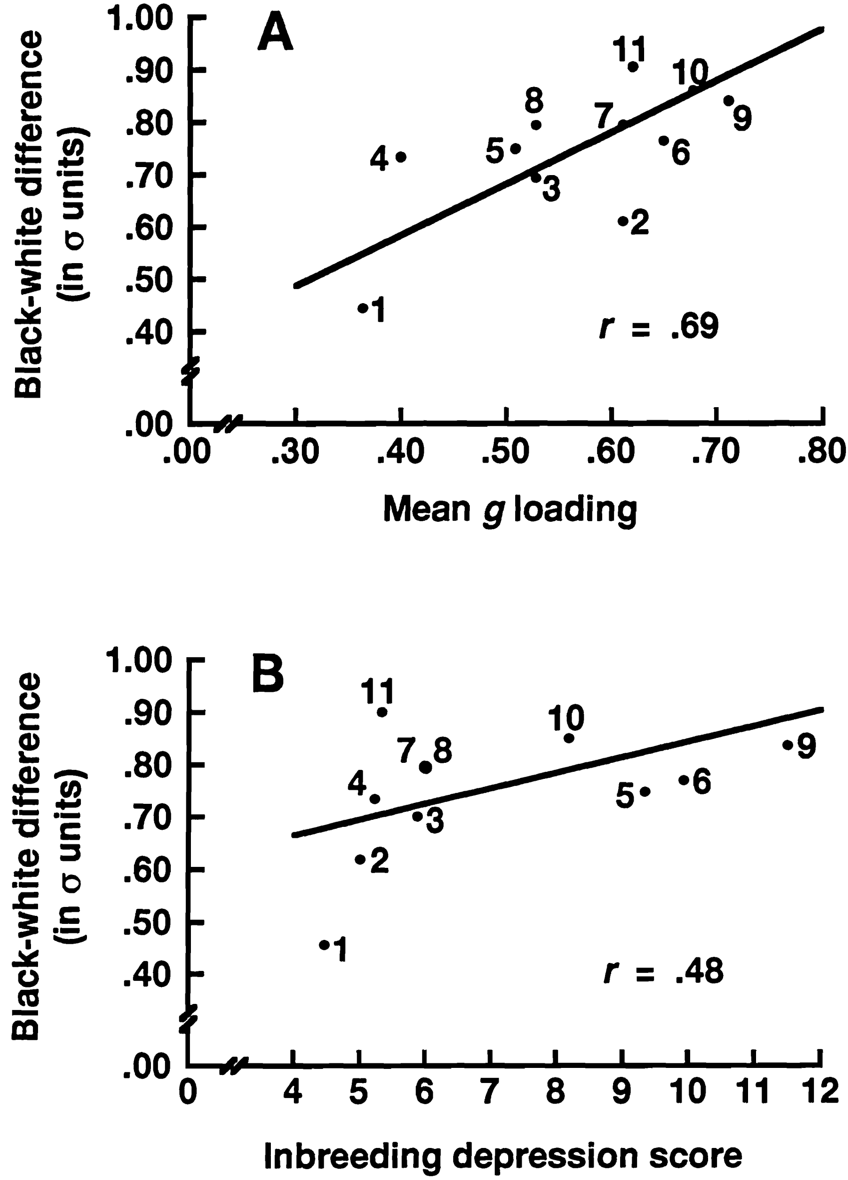
Note. Based on data from Jensen (1983, 1985, 1987; Naglieri & Jensen 1987) and Rushton (1989e).

Figure 9.1 shows the regression of black-white differences on the *g* factor loadings and on the inbreeding depression scores. Clearly, as the *g* loading and inbreeding depression scores increase, so do the magnitudes of the black-white differences. The racial differences are significantly predicted by the genetic penetrance of each of the subtests. The genetic contribution to racial differences in mental ability is robust across populations, languages, time periods, and measurement specifics.

Adoption Studies

A well-known adoption study of 7-year-old black, interracial, and white children by middle-class white families was conducted by Scarr and Weinberg (1976), with a 10-year follow-up by R. A. Weinberg, Scarr, & Waldman (1992).

Figure 9.1: Regression of Black-White Differences on *g* Loadings (Panel A) and on Inbreeding Depression Scores (Panel B) Calculated from a Japanese Sample



The numbers indicate subtests from the Wechsler Intelligence Scale for Children—Revised: 1 Coding, 2 Arithmetic, 3 Picture completion, 4 Mazes, 5 Picture arrangement, 6 Similarities, 7 Comprehension, 8 Object assembly, 9 Vocabulary, 10 Information, 11 Block design. The results show that the magnitude of the black-white difference in IQ increases with the genetic penetrance of the subtest, either measured indirectly by the *g* factor, or directly by inbreeding depression.

Designed specifically to separate genetic factors from rearing conditions as causal influences on the poor cognitive performance of black children, Scarr and Weinberg (1976: 726) noted:

> Transracial adoption is the human analog of the cross-fostering design, commonly used in animal behavior genetics research.... There is no question that adoption constitutes a massive intervention.

Presented in the first column of Table 9.2 are some of the results from the study when the children were aged 7. The 29 adopted children whose biological parents were both black achieved a mean IQ of 97; the 68 adopted children with one black and one white biological parent scored 109; the 25 adopted children whose biological parents were both white scored 112; and the 143 white nonadopted children with whom they were raised scored 117. (A mixed group of 21 Asians, North American Indians and Latin American Indians scored 100.)

Also set out in Table 9.2 are some of the follow-up results when the children were aged 17. The 21 adopted children whose biological parents were both black achieved a mean IQ of 89 and an average school aptitude percentile of 42 across four measures; the 55 adopted children with one black and one white biological parent had an IQ of 99 and a school percentile of 53; the 16 adopted children with two white parents had an IQ of 106 and a school percentile of 59; and the 104 nonadopted white children had an IQ of 109 and

TABLE 9.2
Comparison of Black, Mixed-Race, and White Adopted and Biological Children Raised In White Middle-Class Families

Children's background	Age 7 IQ	Age 17 IQ	Age 17 school achievement		Age 17 school aptitude based on national norms (weighted mean of 4 percentiles)
			Grade point average	Class rank	
Adopted, with 2 black biological parents	97	89	2.1	36	42
Adopted, with 1 white, 1 black biological parent	109	99	2.2	40	53
Adopted, with 2 white biological parents	112	106	2.8	54	59
Nonadopted, with 2 white biological parents	117	109	3.0	64	69

Note. Based on data from R.A. Weinberg, Scarr & Waldman (1992).

a school percentile of 69. (The 12 adopted mixed group of Asian/Amerindian children had an IQ of 96 with no data provided of school achievement.)

Expectancy effects, that adoptive parents' beliefs about the child's racial background could influence the child's intellectual development were ruled out, at least at age 7, by the finding that scores from 12 interracial children believed by their adoptive parents to be black/black scored at virtually the same level as interracial children correctly classified by their adoptive parents (Scarr & Weinberg, 1976).

Scarr and Weinberg (1976) and R. A. Weinberg et al. (1992) did not interpret their results with the genetic-racial hypothesis. The poorer performance of the all-black children was attributed to their experience of later and more difficult placements in the adoption process and to the fact that these children had both natural and adoptive parents with somewhat lower educational levels and abilities (two points lower in adoptive parents' IQ). The authors emphasized the beneficial effects of the rearing environment, pointing out that at both age 7 and 17 all groups of adopted children performed above their expected population means. Their analyses frequently combined the two "socially classified black" groups with "other" black children with one parent of unknown, Asian, Indian, or other racial background.

At age 7 this combined interracial group had an IQ of 106 and a mean school achievement percentile across 3 measures of 56, significantly higher than the regional black mean, although not as high as the nonadopted white children with whom they were raised. At age 17, the combined interracial sample had a mean IQ of 97 and a school performance at the 41st percentile, still higher than the regional black mean, but now lower than the regional white mean.

Although in their age 17 breakdowns, R. A. Weinberg et al. (1992: 132) found that "[b]iological mothers' race remained the best single predictor of adopted child's IQ when other variables were controlled," this was largely attributed to "unmeasured social characteristics." Their overall conclusion (p. 133) was that

> the social environment maintains a dominant role in determining the average IQ level of black and interracial children and that both social and genetic variables contribute to individual variations among them.

A more straightforward interpretation of the results consistent with the other data presented in this book, is that blacks have lower mental ability than whites because of their African ancestry. At both age 7 and 17 the adopted children with one black and one white biological parent had an IQ and aptitude percentile intermediate to the adopted children with two black or two white parents. Because school achievement and school aptitude tests are not affected by the potential biases that may have influenced the individual IQ testing, the convergence of results is striking.

It will be interesting to examine the remaining data from Scarr and Weinberg's 10-year follow-up when it is eventually published. Preliminary analyses suggest that the black 17-year-olds display greater amounts of social deviance and psychopathology than do the white 17-year-olds (Scarr, Weinberg, & Gargiulo, 1987).

Two other adoption studies, however, show mixed results, either with no relative deficiency in the IQs of black or mixed-race children when compared to white children or what appear to be effects for the social environment. In the first of these, Eyferth (1961, cited in Loehlin et al., 1975) compared 83 offspring from German mothers and white occupation troops with 181 offspring whose fathers were U.S. blacks or French North Africans. The results showed no overall difference in average IQ between the two groups when tested at about 10 years of age on a German version of the Wechsler Intelligence Scale for Children. In the second, Moore (1986) reported that 23 black children adopted by white middle-class families had a mean IQ of 117 and 23 black children adopted by black middle-class families had a mean IQ of 104. No difference in IQ existed between children with one or two black parents. In neither study was information available on the biological parents, so selective factors could not be ruled out.

Although the Asian/Amerindian children in Scarr and Weinberg's (1976) study showed little evidence of having IQs above the white mean, four studies of Korean children adopted by white families do support the racial hypothesis. In the first, 25 four-year-olds from Vietnam, Korea, Cambodia and Thailand, all adopted into white American homes prior to 3 years of age, excelled in academic ability with a mean IQ score of 120, as opposed to a U.S. national norm of 100 (Clark & Hanisee, 1982). Prior to placement half the babies had required hospitalization for malnutrition.

In the second, Winick, Meyer, and Harris (1975) found 141 Korean children adopted as infants by American families exceeded American children in both IQ and achievement scores when they reached 10 years of age. Many of these Korean infants were malnourished and the interest of the investigators was on the possible effects of early malnutrition on later intelligence. When tested, those who had been severely malnourished as infants obtained a mean IQ of 102; a moderately well nourished group obtained a mean IQ of 106; and an adequately nourished group obtained a mean IQ of 112.

A study by Frydman and Lynn (1989) examined 19 Korean infants adopted by families in Belgium. At about 10 years of age, their mean IQ was 119, the verbal IQ was 111, and the performance IQ was 124. Because the Belgian norms had been established in 1954 and Flynn's (1984) evidence suggested that mean IQs in all economically developed nations had been increasing over time by about 3 IQ points a decade, Lynn corrected the Belgian norms upward to 109. This still left the Korean children with a statistically significant 10 point advantage over indigenous Belgian children. Neither the social class of the adopting parent nor the number of years the child spent in the adopted family had any effect on the child's IQ.

A study by Brooks (1989) examined a group of Korean children raised by white American families. She compared their activity level and temperament with white infants raised in white families and Oriental infants raised in Oriental families. The adopted children scored partway between the other two groups suggesting that both genetic and environmental factors were operative.

Generalizing Heritabilities

A less direct line of reasoning for the heritability of racial group differences is to show that many of the variables on which the populations differ are substantially heritable. Chapter 3 reviewed the behavioral genetic literature on intelligence, rate of maturation, strength of sex drive, altruism, family structure, and law abidingness. Occasionally heritabilities have been calculated for races other than Caucasoids, although their number is small. Thus, for tests of mental ability, data for 543 monozygotic and 134 dizygotic Japanese 12-year-old twins gave correlations of 0.78 and 0.49 respectively, indicating a heritability of 58 percent (R. Lynn & Hattori, 1990). Similarly the genetic and cultural transmission of obesity in black families is similar to that among white families, which led the authors of the study to conclude that the greater obesity in black people is probably mediated genetically (Ness et al., 1991).

By a process of inductive generalization, it is reasonable to estimate the heritability of the differences between groups to be roughly the same as that within groups, or about 50 percent. A formal relation of within-group to between-group heritability was proposed by DeFries (1972), but, to the best of my knowledge, this has not been developed further. However, as the geneticist Theodosius Dobzhansky (1970: Preface) wrote, "does one need nowadays to convince the reader that...differences between subspecies... are mostly genetic?" He was writing about wild animals and plants, but, as natural scientists, how can we afford not to extrapolate this to humans? Many heritabilities have been found to be generalizable across distinct cultural and racial groups, that is, to correlate with the magnitudes of heritabilities calculated in other groups, as well as to predict behavioral phenomena in those groups (Rushton, 1989b; Figure 9.1 and chap. 4).

A standard objection, however, exists to the effect that one cannot apply observations *within* populations to valid comparisons *between* them until such time as we know conclusively that the two populations being compared have been exposed to exactly the same environmental conditions. This argument was made most explicit in an influential article by Bodmer and Cavalli-Sforza (1970) following the controversy generated by Jensen's (1969) classic monograph. Bodmer and Cavalli-Sforza (1970: 29) concluded:

> [T]he question of a possible genetic basis for the race I.Q. difference will be almost impossible to answer satisfactorily before the environmental differences between U.S. blacks and whites have been substantially reduced...no good case can be made for such studies on either scientific or practical grounds.

Many have reiterated Bodmer and Cavalli-Sforza's (1970) perspective. Thus, Weizmann, Wiener, Wiesenthal, and Ziegler (1990:4) insisted that "[o]ne cannot generalize heritabilities...a point disputed to our knowledge only by Rushton 1989[b]." Weizmann et al. (1990:5) went on to state that "if substantial changes within a population are due to environmental changes, then similar explanations may also apply to differences between groups." However, it is a narrowly conceived argument to expect environmental relationships to generalize and genetic ones not to. As Maynard-Smith (1978: 150) contended, "it is a good common sense principle that if environmental factors can affect some characteristic, it is likely that genes will do so also."

The animal data shows a degree of genetic generalizability. Similar characters tend to have similar heritabilities. Two extensive literature surveys of this question were conducted by Roff and Mousseau (1987) for drosophila and by Mousseau and Roff (1987) for nondrosophila. Both showed, for example, that morphological traits are consistently more heritable than physiological variables. Such findings have led an important caveat to be added to textbook conclusions: "Whenever a value is stated for the heritability of a given character it must be understood to refer to a particular population under particular conditions.... Nevertheless, within the range of sampling errors, estimates tend to be similar in different populations" (Falconer, 1989: 164).

Regression to the Mean

In the 1970s several "indirect" approaches were proposed to test the genetic explanation of race differences (Loehlin et al., 1975; Scarr, 1981). One was to examine parent-child regression effects, which are predicted to differ for black and white samples if they are drawn from genetically different populations. If the population mean for blacks is 15 IQ points lower than for whites, then the offspring of high-IQ black parents should show more regression toward a lower population mean than the offspring of high-IQ white parents. Similarly, the offspring of low-IQ black parents should show less regression than those of low-IQ white parents.

Although not having parent-child comparisons, Jensen (1973, chapter 4) tested the prediction with even better data, from siblings. Sibling comparisons provide a better test than parent-offspring comparisons because siblings share more similar environments than do parents and offspring. Jensen found that black and white children matched for IQ have siblings who regress approximately halfway to their respective population means rather than to the mean of the combined populations.

For example, if black and white children are matched with IQs of 120, the black siblings will average close to 100 and the white siblings close to 110. A reverse effect is found with children matched at the lower end of the IQ scale. If black and white children are matched for IQs of 70, the black siblings will average about 78 and the white siblings about 85. The regression line shows no significant departure from linearity throughout the range of IQ from 50 to 150. As Jensen (1973) pointed out, this amount of regression directly fits a genetic model and not an environmental one. The same effect occurs for height, or number of fingerprint ridges, or any other polygenically inherited characteristic.

Jensen (1974) provided additional results explained by a genetic-regression hypothesis. Black and white parents matched for high socioeconomic status produce children with different levels of IQ. Upper-status black children average two to four IQ points below lower-status white children, despite the environmental advantage and even though it is likely that the upper-status black parents were of higher IQ than the lower-status white parents. The regression-to-the-mean phenomenon could account for the cross-over of the average IQs of the children from the two racial groups.

Between versus Within Family Effects

Other adoption and twin designs show that the environmental variables influencing behavior are primarily those that occur within families rather than between them (Plomin & Daniels, 1987). This is one of the more important discoveries made using behavior genetic procedures; it appears to hold even for variables such as altruism, obesity, and law abidingness, which parents are thought to strongly socialize. One implication of this finding is that because the variables usually proposed to explain racial differences, such as social class, religious beliefs, cultural practices, father absence, and parenting styles account for so little variance *within* a race, they are unlikely to account for the differences *among* races.

Using similar reasoning, Jensen (1980b) described how data from siblings could be used to determine whether relationships between variables are caused by factors "extrinsic" to the family, such as social class. Such factors serve to make family members similar to one another and different from people in other families. Strong social class effects can be presumed operative, therefore, if the covariance structures that emerge from between-family data disappear when using "intrinsic" within-family data. If the covariance structures remain constant regardless of whether they are calculated on the basis of within-family or between-family data, then social class effects must be less operative, and genetic and within-family effects more operative. Research shows that the general factor of intelligence, *g*, is constant across all three major racial groups from both within-family and between-family analyses (Jensen, 1987a; Nagoshi, Phillips, & Johnson, 1987). The implication is that the differences in *g* found between races are primarily due to within-family effects, such as genetics, rather than to between-family effects such as socioeconomic background.

Additional evidence for the within-family, intrinsic nature of *g* comes from data on the head size-IQ correlation (chap. 2). Jensen and Johnson (in press) showed a significant positive correlation between head size and IQ in both black and white, male and female samples of 4- and 7-year-olds. In all cases, the sibling with the larger head perimeter tends to be the more intelligent sibling.

Race versus Social Class

One challenge for purely environmental theories is to explain upward and downward within-family mobility. For example, Weinrich (1977) reviewed data showing that those adolescents moving from one SES level to another showed the sexual patterns of their *to be acquired* class, not the class they were raised in by their parents. More recent research confirms the importance of within-family variation with some siblings more often adopting the syndrome of early sexuality, delinquency, and low educational attainment than others (Rowe, Rodgers, Meseck-Bushey, & St. John, 1989).

Within-family social mobility has been known for some time in the IQ literature. In one study Waller (1971) obtained the IQ scores of 130 fathers and their 172 adult sons, all of whom had been routinely tested during their high school year in Minnesota. The IQs ranged from below 80 to above 130 and were related to social class. Children with lower IQs than their fathers went down in social class as adults, and those with higher IQs went up (r = 0.37 between difference in father-son social class and difference in father-son IQ). Such intergenerational social mobility has subsequently been confirmed (Mascie-Taylor & Gibson, 1978).

Socioeconomic effects often appear to confound those of race because, as will be discussed in chapter 13, lower socioeconomic groups more often engage in *r*-strategies than do higher socioeconomic groups. Dizygotic twinning (the *r*-strategy) is greater among lower than upper socioeconomic women in both European and African samples, as are differences in family size, intelligence, law abidingness, health, longevity, and sexuality. The question then arises as to whether social class or race is more predictive of behavior.

With brain size, in the stratified random sample of 6,325 military personnel (Rushton, 1992a), the 18 cm^3 (1 percent) difference in rank between officers and enlisted personnel was smaller than either the 21 cm^3 (1.5 percent) difference between Caucasoids and Negroids, or the 36 cm^3 (2.6 percent) difference between Mongoloids and Caucasoids. Other data (summarized in Table 6.6) suggests a 4 to 6 percent Negroid-Caucasoid difference and a 1 to 2.8

percent Mongoloid-Caucasoid difference in brain size. Race may be the more important variable.

In the study just referred to on regression effects, Jensen (1974) found that black children from high socioeconomic status homes scored lower on IQ tests than white children from low socioeconomic homes. The study examined virtually all the white (*N* = 1,489) and black (n = 1,123) children enrolled in regular classes of the fourth, fifth, and sixth grades of the Berkeley elementary school district in California. The black children's parents were high-level administrators, supervisors, college teachers, and professionals; the white children's parents were manual and unskilled workers. The racial differences showed up on both the verbal and the nonverbal parts of the nationally standardized Thorndike-Lorge Intelligence Test.

In a similar study of the Scholastic Aptitude Test, the results from 1984 showed that the median scores of black college applicants from families earning over $50,000 were lower than those of whites from families earning less than $6,000. The scores were monotonically related to income within both races (R. A. Gordon, 1987a). Race was more powerful than income in determining test scores.

Although it is well known that test scores are correlated with socioeconomic status within racial groups, this does not, in fact, explain black-white ability differences. The pattern of black-white differences is different in factorial composition from the pattern of social class differences within the black and the white groups (Jensen & Reynolds, 1982). For example, the SES differences tend to be largest on tests of verbal ability rather than on tests of spatial visualization. This is just the opposite of the pattern of black-white differences on verbal and spatial tests.

To examine race versus social class differences in sexual behavior, Rushton and Bogaert (1988) contrasted noncollege-educated whites with college-educated blacks. Table 8.4 shows the results. Noncollege-educated whites were more restrained than college-educated blacks on such measures as speed of occurrence of premarital, marital, and extramarital experiences, number of partners, frequency of intercourse, speed and incidence of pregnancy, and length of the menstrual cycle, although they were not as restrained as the college-educated whites. The black sample, consisting of university students from 1938 to 1963 was atypical in the direction of being religiously devout and of high socioeconomic status.

The race/social class findings of Rushton and Bogaert (1988) depicted in Table 8.4 were independently replicated with additional samples by M. S. Weinberg and Williams (1988). These authors reanalyzed evidence from three independent sources: the original Kinsey data, which formed the basis of Rushton and Bogaert's studies; a 1970 National Opinion Research Center poll of sexual attitudes; and a study carried out in San Francisco. All three reanalyses showed the predicted racial effects on sexuality while holding education and social class constant. Moreover, with dizygotic twinning, while both race and social class are predictive, race is the source of the larger portion of variance (Rushton, 1987b).

In other domains, too, race has been found to have strong effects independent of class. With psychological illness, Kessler and Neighbors (1986) used cross-validation on eight different surveys encompassing more than 20,000 respondents to demonstrate an interaction between race and class such that the true effect of race was suppressed and the true effect of social class was magnified in models that failed to take the interaction into consideration.

With crime, figures show that even at the time when they were lower in socioeconomic status, the Chinese in the United States were more law abiding than the Caucasoids. In the 1920s this led American criminologists to consider the ghetto as a place that protected members from the disruptive tendencies of the outside society (J. Q. Wilson & Herrnstein, 1985).

Gene-Culture Coevolution

Why is there such a strong correlation between poor social and economic conditions, low intelligence, and high social pathologies such as crime? Environmentalists have argued that the Negroid peoples in Africa, the Caribbean, the United States, and Britain all live in socially and economically impoverished backgrounds, as compared with Caucasoids and Mongoloids, and that these conditions are responsible for some or perhaps all of their low intelligence. R. Lynn (1991c) met this argument with the concept of genotype-environment correlation introduced in chapter 3.

Theorists have proposed that, particularly after puberty, an increasingly active organism is capable of shaping its own environment in a direction canalized by its underlying genotype. Scarr and McCartney (1983) call this "niche building," and the two races most successful in building socially and economically developed niches in which to live and rear their children have been the Caucasoids and the Mongoloids.

The argument that poor social and economic conditions are responsible for the lower intelligence of the Negroids places the cart before the horse. It assumes that the impoverished environments are simply the result of external circumstances over which people have no control. Such a claim does not stand up to examination. There are too many cases that it does not explain, such as the achievements of immigrants to the United States from the Pacific Rim and to Britain and South Africa from the Indian subcontinent.

Genetic theories help to explain why some people have succeeded where others, initially more advantageously placed, have failed in the same way that they explain upward and downward mobility effects among siblings within a family. Some have the right genotypes for building socially and economically prosperous environments for themselves and their families. Within the constraints allowed by the total spectrum of cultural alternatives, people create environments maximally compatible with their genotypes (Rushton et al., 1986).

10

Life-History Theory

Explaining the total array of international evidence summarized in Table 1.1 necessitates a more powerful theory than would be required to explain any single dimension from the set. It also requires going beyond the particulars of any one country. Mongoloids and Caucasoids have the largest brains, whether indexed by weight at autopsy, endocranial volume, or externally measured head circumference, but they have the slowest rate of dental development, indexed by onset of permanent molar teeth, and they produce the fewest gametes, indexed by double ovulation and frequency of twin birthing. I proposed that the explanation for the racial pattern lay in primate life-history theory.

Evolutionary biologists assume that each species (or subspecies, such as a race) has evolved a characteristic life history adapted to the particular ecological problems encountered by its ancestors (E. O. Wilson, 1975). A life history is a genetically organized suite of characters that evolved in a coordinated manner so as to allocate energy to survival, growth, and reproduction. These strategies may be organized along a scale.

At one end of this scale are "*r*-strategies" that emphasize gamete production, mating behavior, and high reproductive rates and, at the other, "*K*-strategies" that emphasize high levels of parental care, resource acquisition, kin provisioning, and social complexity. The *K*-strategy requires more complex nervous systems and larger brains. Johanson and Edey (1981: 326) succinctly summarized, quoting Owen Lovejoy: "More brains, fewer eggs, more '*K*'."

The thesis to be advanced in this and the next chapter is that archaic versions of what were to become the modern Caucasoid and Mongoloid peoples dispersed out of Africa about 100,000 years ago and adapted to the problem of survival in predictably cold environments. This evolutionary process required a bioenergetic tradeoff that increased brain size and parenting behavior ("*K*") at the expense of egg production and sexual behavior ("*r*"). In other words, Mongoloids are more *K*-selected than Caucasoids, who in turn are more *K*-selected than Negroids.

Reproductive Strategies

Life cycle traits and their variations began to receive increasing study after a paper by Cole (1954) questioned why some species engaged in the extreme reproductive strategy of semelparity, expending all energy in a burst of reproductive effort and dying shortly thereafter, while other species engaged in iteroparity, reproducing at regular intervals over the life span. Since then much additional information on life histories has been amassed.

The fundamental axiom of sociobiology is that an organism is just a gene's way of making another gene (Dawkins, 1976; E. O. Wilson, 1975). Because certain gene combinations will be reproductively more successful than others in a particular environment, they will increase in relative number in the population. An organism's body and behavior are mechanisms by which genes maintain and replicate themselves more efficiently.

Sometimes it is advantageous for genes to build large bodies in which to live, while at other times small bodies are more effective. Large bodies take longer to build at each developmental stage and the cycle from one generation to the next becomes extended along with increased life span (Figure 10.1). Larger bodies also lead to lowered reproductive capacities due to increased interbirth intervals and lower average litter sizes. With fewer offspring comes increased parental care and social organizational skills and a concomitant increase in brain size. Life-history variables tend to be selected together.

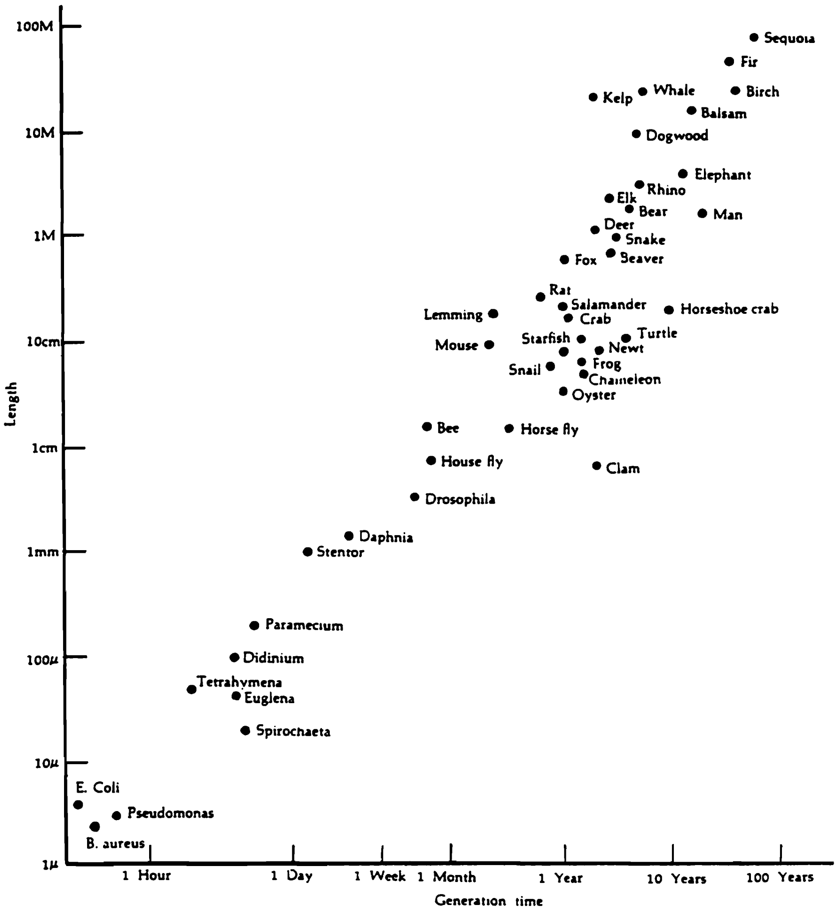
r-K Reproductive Strategies

A whole new canon of theory came into being with MacArthur and Wilson's (1967) *r-K* analysis of how species colonize islands and become equilibriated. Their models emphasized birth rates, death rates, and population size. The symbol *r* stands for the maximum rate of increase in a population and is aided by prolific breeding; *K* is a symbol for the carrying capacity of the environment, or the largest number of organisms of a particular species that can be maintained indefinitely in a given part of the environment.

Thus, there are two alternative strategies by which to produce offspring. At one extreme organisms can produce a very large number of offspring but give little parental care to any of them. This is the *r*-strategy. At the other extreme organisms can produce very few offspring, but lavish intensive parental care and protection on each. This is the *K*-strategy. Thus, the symbols *r* and *K* have been used to designate two ends of a hypothetical continuum involving tradeoffs between offspring production and parental care (Figure 10.2).

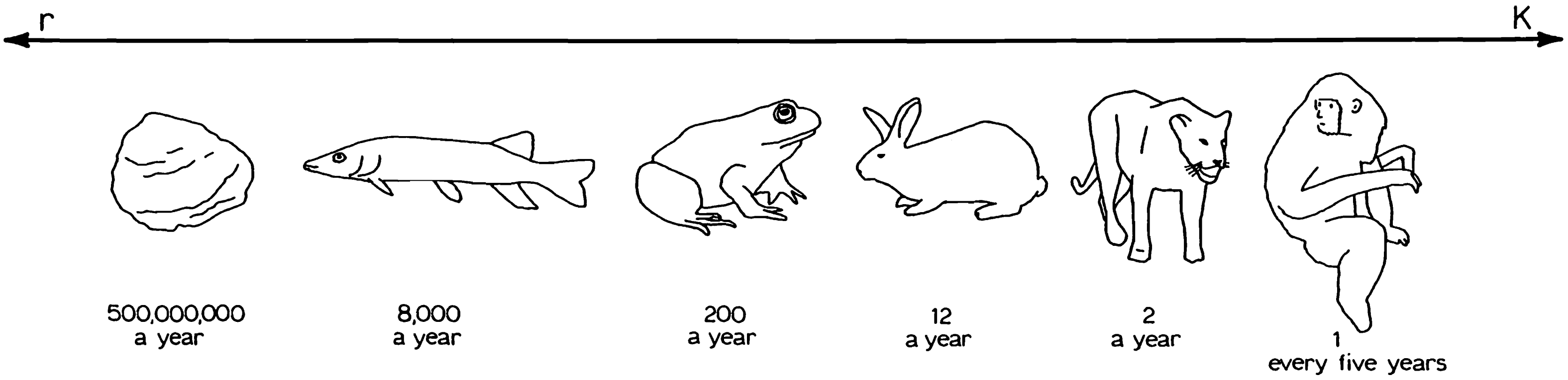
Shortly after MacArthur and Wilson (1967) formulated their *r-K* analysis, Pianka (1970) codified a number of life-cycle traits thought to be selected for, and to covary with, the *r*- and *K*- reproductive strategies. These are summarized in Table 10.1. While each of the traits might independently contribute to

Figure 10.1: Length of an Organism Plotted Logarithmically Against Age of First Reproduction



In general, smaller organisms have a shorter period of development, partly because they are simpler to build. At the other extreme, giant sequoia trees do not reproduce until they are 80 meters tall, which takes 60 years to achieve. Putting energy resources into reproductive structures is something a sapling can ill afford when it is struggling desperately to grow more rapidly than other rival saplings. Only the fastest growers will win in the competition for sun, and any plant that diverts its precious resources toward cones or flowers and seeds may lose. From Bonner (1965, p. 17, Figure 1). Copyright 1965 by Princeton University Press. Reprinted with permission.

Figure 10.2: The *r*-*K* Continuum of Reproductive Strategies Balancing Egg Output with Parent Care



Shown on this macro-scale, oysters producing 500 million eggs a year but providing no care exemplify the *r*-strategy. The great apes, producing one infant every five or six years and providing extensive care, exemplify the *K*-strategy. After Johanson & Edey (1981).

TABLE 10.1

Some Life-History Differences Between *r* and *K* Strategists

r-strategist	*K*-strategist
Family characteristics	
Large litter size	Small litter size
Short birth spacing	Long birth spacing
Many offspring	Few offspring
High infant mortality	Low infant mortality
Little parental care	Much parental care
Individual characteristics	
Rapid maturation	Slow maturation
Early sexual reproduction	Delayed sexual reproduction
Short life	Long life
High reproductive effort	Low reproductive effort
High energy utilization	Efficient energy utilization
Low encephalization	High encephalization
Population characteristics	
Opportunistic exploiters	Consistent exploiters
Dispersing colonizers	Stable occupiers
Variable population size	Stable population size
Lax competition	Keen competition
Social system characteristics	
Low social organization	High social organization
Low altruism	High altruism

Note. Modified from Pianka (1970, p. 593, Table 1), E. O. Wilson (1975, p. 101, Table 4-2), Eisenberg (1981, p. 442, Figure 156), and Barash (1982, p. 307, Table 13.1).

fitness, the important point is that they are expected to correlate with and select for other features of the life history (E. O. Wilson, 1975). These have been codified by a number of workers (see Barash, 1982: 307; Daly & Wilson, 1983: 201; Eisenberg, 1981: 438ff; Pianka, 1970: 593; E. O. Wilson, 1975: 101).

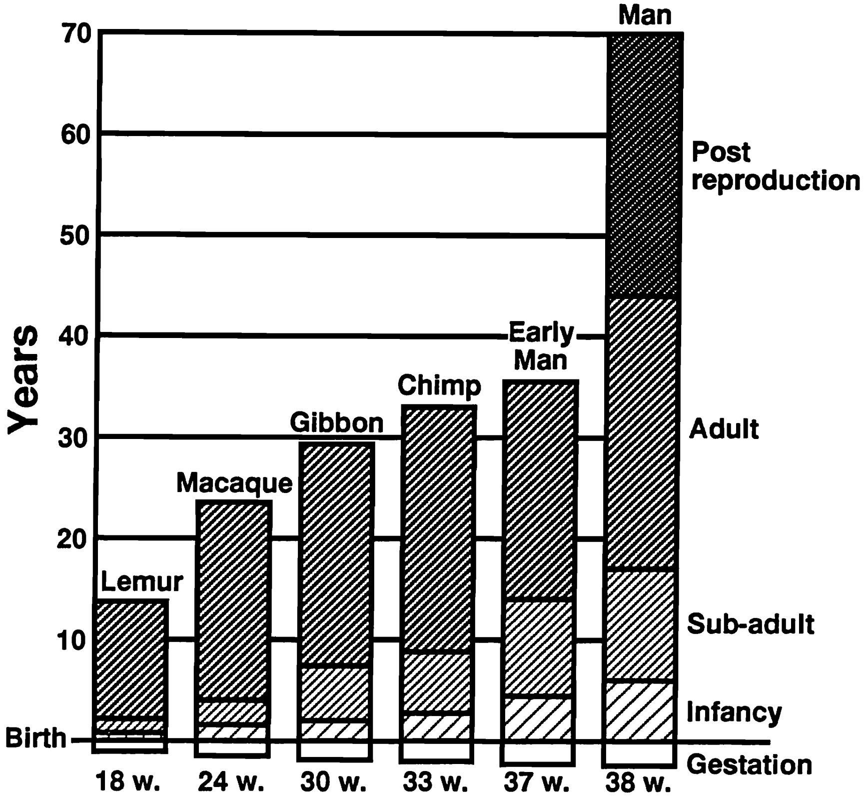
From Table 10.1, it can be seen that, in terms of *family characteristics*, *r*- and *K*-strategists differ in terms of litter size (number of offspring produced at one time), birth spacing, total number of offspring, rate of infant mortality, and degree of parental care. In regard to *individual characteristics*, *r*- and *K*-strategists differ in rate of physical maturation, sexual precocity, life span, body size, reproductive effort, energy use, and brain size. In terms of *population and social system characteristics*, they differ in their treatment of the environment, their tendency to geographically disperse, the stability of their population size, their ability to compete under scarce resources, their degree of social organization, and their altruism.

Species are, of course, only relatively *r* and *K*. Thus, rabbits are *K*-strategists compared to fish but *r*-strategists compared to primates. Primates are all relatively *K*-strategists, and humans may be the most *K* of all. But primates vary enormously. Following Harvey and Clutton-Brock (1985, Table 1) the following figures are provided for nonhuman primate species (with those for *Homo sapiens* in parentheses). Gestation lengths range from 60 to 250 days (267); birth weight from less than 10 to over 2000 g (3300 g); litter size typically is 1, but twinning is very common in some species (1); weaning age from less than 50 to over 1500 days (720); female age at first breeding from less than 1 to over 9 years (>10); adult brain weight from less than 10 to over 500 g (1250); and longevity from less than 10 to over 40 years (70). Most of the life-history measures are positively correlated, although the relationships are not perfect.

The life phases and gestation times of primates display a natural scale of prolongation going from lemur to macaque to gibbon to chimp to early humans to modern humans (see Figure 10.3), with a consistent trend toward *K* (Schultz, 1960; Lovejoy, 1981). For example, a female gorilla will have her first pregnancy at about 10 years of age and can expect to live to the age of 40. A female mouse lemur, at the other end of the primate scale, produces her first offspring at 9 months of age and has a life expectancy of 15 years. A mouse lemur may mature, have offspring, and die before a gorilla has her first offspring.

Note the suggestion in Figure 10.3 (from Schultz, 1960) that earlier human ancestors lived on a shorter time scale than present-day humans. Also note the proportionality of the four indicated phases. The postreproductive phase is restricted to humans. With each step in the natural scale, populations devote a greater proportion of their reproductive energy to subadult care, with increased investment in the survival of offspring. As a species, humans are at the *K* end of the continuum.

Figure 10.3: Progressive Prolongation of Life Phases and Gestation in Primates



Note the proportionality of the indicated phases. With each step in the natural scale, populations devote a greater proportion of their reproductive energy to subadult care, with increased investment in the survival of offspring. The post-reproductive phase is restricted to humans. After Schultz (1960) and Lovejoy (1981).

Even tooth development accurately reflects primate life histories. B. H. Smith (1989) correlated the age of eruption of the first molar with the life-history factors tabulated by Harvey and Clutton-Brock (1985). First molars are the earliest permanent teeth to erupt in primates and in many other mammals and they are stable in many aspects of their growth. Smith found that across 21 primate species, age of eruption of first molar correlated 0.89, 0.85, 0.93, 0.82, 0.86, and 0.85 with the life-history variables of body weight, length of gestation, age of weaning, birth interval, sexual maturity, and life span. The highest correlation was 0.98 with brain size.

Brain size, even more than body size, is the key factor, acting as the biological constant determining many variables. These include the upper limit on the size of the group cohesively maintained through time (Dunbar, 1992). It also includes other variables like speed of physical maturation, degree of infant dependency, and maximum recorded life span (Harvey & Krebs, 1990; Hofman, 1993).

The hominid brain has tripled in size over the last 4 million years. *Australopithecenes* averaged about 500 cm^3, the size of a chimpanzee. *Homo habilis* averaged about 800 cm^3, *Homo erectus* about 1,000 cm^3, and modern *Homo sapiens* about 1,400 cm^3. If the encephalization quotient, the expected brain ratio given a certain body size, is plotted over the same evolutionary time frame, the increase is proportionately less, although still substantial: 3.0 to 6.9 (Jerison, 1973; Passingham, 1982). On the most recent calculations, the figures go from 2.4 to 5.8 (McHenry, 1992).

Metabolically the brain is a very expensive organ. Representing only 2 percent of body mass, the brain uses about 5 percent of the body's basal metabolic rate in cats and dogs, about 10 percent in rhesus monkeys and other primates, and about 20 percent in humans. Across primates large brains are also expensive in life-history trade-offs, requiring a more stable environment, a longer gestation, a slower rate of maturation, a higher offspring survival, a lower reproductive output, and a longer life (Pagel & Harvey, 1988; Harvey & Krebs, 1990). Unless large brains substantially contributed to fitness, therefore, they would not have evolved. Increasing encephalization likely adds fitness by increasing the efficiency with which information is processed.

Bonner (1980, 1988) hierarchically arranged the facts of animal behavior and the evolution of culture according to a continuous increase in brain size or complexity of the nervous system. Bonner (1980) wrote:

> There is a direct inverse correlation with the time of appearance of a group in earth history and the size of its brain. At one end of the spectrum fish have small brains, while at the other end mammals have the largest. This suggests a trend toward increase in the ability to learn, toward an increase in the flexibility of the response.

One influential scheme proposed to account for the evolution of *r*- and *K*-strategies is *r*- and *K*-selection (E. O. Wilson, 1975). The symbols *r* and *K* originate in the mathematics of population biology: *r* refers to the natural *rate of increase* in a population temporarily freed from resource limitations. In *r*-selected species, the population is usually kept at a low density by unpredictable features of the environment such as the weather, or predators. Under such circumstances a selective advantage is hypothesized to accrue to speedy, prolific breeders who maximally replicate their genes before conditions change and their lives are ended. On the other hand, *K* refers to the *carrying capacity* of a particular habitat, or the maximum population a species can maintain under certain fixed conditions. In *K*-selected species, the population is usually at a high density and competitive interactions among individuals are expected to be important. Selection, therefore, is hypothesized to favor large individuals with high competitive ability who produce small numbers of intensely cared for offspring rather than engage in high reproductive output. *K*-strategies are thought to evolve in predictable environments.

Consider the animals and plants depicted on the continuum in Figure 10.1 from the perspective of *r-K* theory. The smallest bacteria are archetypal *r*-strategists, having a maximally intense rate of reproduction and an enormously fluctuating population size as the environment alternates. The largest mammals and trees, on the other hand, because they are so large, prevail over many environmental perturbations and their populations remain steady over time.

Criticisms of and refinements to the MacArthur and Wilson (1967) and Pianka (1970) formulations began immediately. While some claimed that Pianka's extension was an inappropriate overgeneralization (Stearns, 1977; Boyce, 1984), others found it useful, including E. O. Wilson (1975), the co-founder of the *r-K* perspective. Some argued that *r*- and *K*-strategies are not properly organized as bipolar ends of a continuum but, rather, describe orthogonal axes in a multidimensional space where additional strategies also operate (e.g., alpha-strategies, based on extreme competitiveness). "Bet-hedging" theory and other possibilities were also proposed as alternative explanations for patterns in life-history variation (Boyce, 1984; Stearns, 1984).

At the empirical level, deviations occur from the positive correlations expected. A negative correlation between body size and parental care, for example, has been found in a variety of marine taxa. Despite such anomalies, however, the *r-K* continuum usefully organized information on life-history traits. As Dawkins (1982: 293) wrote: "Ecologists enjoy a curious love/hate relationship with the *r-K* concept, often pretending to disapprove of it while finding it indispensible."

r-K Strategies Within Species

Sociobiologists focus primarily on the evolutionary origins of between-species differences. Yet the theory of evolution also requires that there be a genetic basis to within-species differences. Several studies suggest that the *r-K* continuum applies within species.

Gadgil and Solbrig (1972) examined within species differences in plants, specifically in the common weedy dandelion *Taraxacum officinale sensu latu.* They measured an important characteristic of *r* and *K*, the proportion of resources devoted to reproductive tissues. These individual differences were examined under a variety of growth chamber, greenhouse, and experimental field conditions. Among populations of naturally occurring dandelions it was found that those biotypes growing on lawns more frequently walked on, mowed, or otherwise unpredictably disturbed (i.e., subjected to *r*-selection) had, as expected, a higher seed output and a higher proportion of biomass devoted to reproduction than those dandelions growing in less disturbed areas. When the plants were subsequently grown from seed under greenhouse experimental conditions using a variety of temperatures and soils, it was demonstrated that the differences were genetically fixed. Whereas the *r*-selected biotypes allocated more resources to the production of seeds and reached reproductive maturity faster (they bloomed a year earlier), the more *K*-selected biotypes allocated resources to leaf biomass at the expense of seed production, thus gaining a direct competitive advantage in conditions of higher density through their capacity to shade out the *r*-types.

In a five-year examination of the fluctuating population cycles of field mice, demographic changes were demonstrated to be related to genetic markers predictive of *r*- and *K*-behaviors (Krebs, Gaines, Keller, Myers, & Tamarin, 1973). Examining two species of *Microtus* (*M. pennsylvanius* and *M. orchragaster*) through a combination of naturalistic observation, fencing experiments, dispersal studies, and polymorphic serum protein analysis, the authors showed that the genotype most responsible for speedy population growth tended to be the earliest breeders and most dispersing when population density was high (*r*-strategists). The segment of the population that remained behind were individuals selected for competitive spacing behavior under high population density (*K*-strategists).

In a study on fish, five populations of American shad (*Alosa sapidissima*) were observed at different latitudes on the Atlantic coast (Leggett & Carscadden, 1978). Reproductive strategies were found to vary: Northern populations, spawning in environments that are thermally harsh but predictably variable, allocate a greater proportion of their energy reserves to migration, thereby ensuring higher post-spawning survival. This was accomplished by reducing energy allocated to gonads. These *K*-shad were larger, older at maturity, more iteroparus (repeat spawners), and less fecund (producing three to five times fewer eggs), than the semelparous (dying after reproduction) *r*-shad.

In a selective breeding experiment, Taylor and Condra (1980) chose *Drosophila pseudoobscura* (flies) either for rapid development in an uncrowded environment and early oviposition of many eggs (*r*-selection), or for the ability to withstand crowding and intense competition for food (*K*-selection). After 10 months and approximately 17 generations, significant differences were found in chromosome frequencies, egg-adult development rates (*r*-selected lines developed one day faster than *K*-selected ones), survivorship (as preadults, *K*-selected flies were 14 percent to 22 percent more viable than *r*-selected flies), and longevity. Contrary to prediction, however, no differences were observed in body size, overall fecundity, or carrying capacity (population size).

In another breeding experiment, Hegmann and Dingle (1982) examined a set of life-history variables in the milkweed bug, *Oncopeltus fasciatus.* They indexed body size, age at first reproduction, number of eggs per clutch, interclutch interval, and developmental time to adulthood. To estimate the additive genetic variance for each of these characteristics and the additive genetic covariances among them, they employed half-sibling comparisons. The results indicated that each of the individual traits was heritable, and moreover, because significant genetic covariances were found among traits, that selection for any one trait in the set was likely to lead to selection for the others.

In an eleven-year study of differences in the guppy (*Poecilia reticulata*), genetic changes in life histories were shown over 30 to 60 generations (Reznik, Bryga, & Endler, 1990). Earlier maturing fish allocated a greater proportion of the body mass to reproduction (embryo weight/total body weight) and produced more and smaller offspring per brood, while late maturing fish produced a smaller number of larger offspring. Using experimental procedures and the transplanting of populations to a common environment, the differences were shown to be heritable. Other evidence for within-species variation in life histories was found with snow geese by Lessells, Cooke, and Rockwell (1989) and with ground squirrels by Zammuto and Millar (1985), among others.

K and Hominid Life Histories

Two hundred and fifty million years ago, the mammalian grade was reached by descendants of reptiles. Subsequent mammalian evolution was explained from an *r-K* perspective by Eisenberg (1981). Competition over resources selected for longer lives, smaller litters, and trends toward iteroparity, which, if the resource base then varied predictably within years, selected for an increased percentage of life span spent in social learning. The increased need for social learning selected for higher encephalization, a longer gestation, and continuing growth after birth. Larger brains in turn led to delayed sexual maturation and the creation of a complex interdependent social grouping with high degrees of altruism. The first primitive primates emerged 70 million years ago, in the form of shrewlike creatures. Twenty-five million years ago, primates were well established and the higher primates had split into three types: the New World monkeys, the Old World monkeys, and the apes. By 5 billion years ago, the human evolutionary line had diverged from the African apes (chimpanzees and gorillas).

Approximately 4 million years ago, several species of *Australopithecus*, apelike hominids, walked upright in regions of East Africa with small brains not much larger than those of apes (about 500 cm^3) and large canine teeth. There is disagreement on what the life history and family structure of the australopithecenes was like. Strong sexual dimorphism suggests these earliest hominids were more apelike than humanlike in their sexual behavior, with males physically fighting each other for estrous females (Leakey & Lewin, 1992). Some australopithecenes, however, may already have begun to differentiate from apes employing something more akin to humanlike pair-bonding, family structure, and social organization (Johanson & O'Farrell, 1990). In this scenario, by walking erect, males had their hands free to carry food back to their families. This would have enabled the simultaneous raising of more offspring than could be managed by other primates. It required a move toward pair-bonding so that the food the males brought back was being used by their own genetic offspring (Lovejoy, 1981; Johanson & Edey, 1981).

After 2.3 million years ago, the australopithecenes were joined on the East African savanna by *Homo habilis,* a more advanced hominid with a larger brain, a higher and rounder head, and a less protruding face. These were the first representatives of the genus *Homo* and their name, "handy man," follows the opposable thumbs that enabled them to grip and manipulate fine objects and make stone tools. Their hands, more curved than those of modern people, were still adapted for grasping and climbing trees. They probably ate a broad-based diet and lived in a food-sharing social group of some 20 or 30 individuals, males and females, young and sexually mature.

Almost 2 million years ago, *Homo erectus* emerged in Africa, fully adapted to an upright posture and standing taller than their predecessors. The males were about 180 cm (5′9″) and the females about 160 cm (5′3″) (McHenry, 1992). Their hands were capable of precision gripping and many kinds of tool making. Their skulls were also larger, with a brain of about 1,000 cm^3. However, they still had a receding forehead, big front teeth, huge brow ridges over the eyes, and extremely thick neck muscles.

H. erectus probably lived in small bands of perhaps 100 members, most of whom were genetically related. Time was spent hunting and gathering along the banks of streams or on the shores of lakes. Weapons and implements were made from bone and stone. Fire was discovered, enabling movement from open encampments to caves. Able to keep warm, *erectus* started to migrate throughout Eurasia, perhaps as long as 1.8 million years ago. In Europe and Western Asia, Neanderthals evolved. Neanderthals developed clothing, constructed simple winter shelters, stored food, and buried their dead. They had brain volumes comparable to early *H. sapiens* and may have shared a similar stone age technology in regions of the Middle East as recently as 50,000 years ago.

H. erectus was likely a hunter practicing cannibalism and head hunting. Meat from the hunt, however, would have formed only a small part of the diet. Other edible forms of life were snakes, birds and their eggs, and mice and other rodents. Many of these even children might have caught, as with present-day hunters like the Kalahari Bushmen and the Australian aborigines. Vegetable food was a particularly large part of the diet in the form of fleshy leaves, fruits, nuts, and roots.

H. erectus may not have used language as fully as modern humans (Milo & Quiatt, 1993). Neanderthal vocal anatomy seems to have precluded them from generating the full range of human speech sounds (Lieberman, 1991). The less advanced linguistic and cognitive skills of *H. erectus* may eventually have given modern humans an evolutionary advantage in communicating and in competing for food. Neanderthals no longer existed after 32,000 B.P.

Because *H. erectus* used weapons and was a prey-killing animal, some theorists have speculated that they were "killer-apes," engaging in murder and warfare. This view was popularized most by Robert Ardrey (1961: 31) in his book, *African Genesis.* Ardrey wrote:

> Man emerged from the anthropoid background for one reason only: because he was a killer. Long ago, perhaps many millions of years ago, a line of killer apes branched off from the nonaggressive primate background. For reasons of predatory necessity the line advanced. We learned to stand erect in the first place as a necessity of the hunting life. We learned to run in our pursuit of game across the yellowing African savannah...
>
> A rock, a stick, a heavy stone—to our ancestral killer ape it meant the margin of survival. But the use of the weapon meant new and multiplying demands on the nervous system for the coordination of muscle and touch and sight. And so at last came the enlarged brain; so at last came man.
>
> Far from the truth lay the antique assumption that man had fathered the weapon. *The weapon, instead, had fathered man.* (Emphasis added)

If killing, through hunting or battle, did provide some of the impetus for humans' evolution to a bipedal erect gait and larger brain, then the ability and desire to wield clubs certainly was not sufficient. As important was the necessity to learn to cooperate and work as a group. Humans were not only hunters. They also were hunter-*gatherers* with up to two-thirds of their diet being plant foods.

With increasing complexity of social organization would have come the social rules necessary to keep the individual's personal drives and emotions concerning jealousy, fear, sex, and aggression under control. Language developed to enhance cooperation. Thus, humans became religious, loyal, and altruistic to the group, and capable of abstract theorizing about their nature and the society of which they were part. Altruism and society both arose out of evolutionary necessity, as much as did any killer instincts.

Human nature, therefore, even at the level of *Homo erectus,* is far more complex and positive than that suggested by such terms as *killer ape.* Even if killing does turn out to have been one of humans' evolutionary pacemakers, there can be little doubt that cooperation and altruism toward group members was another. A tendency toward hostility to and suspicion of outgroups, and loyalty and identification to ingroups appears to be the fuller story of this earlier development.

Lovejoy (1981) provided a more complete scenario of how *K*-selection led the evolving hominid line to develop the unique reproductive and other characteristics that separated it from apes, including bipedality, reduced anterior dentition, a large neocortex, and material culture. Although the *K*-strategy of adaptation is a general mammalian trait, and well developed among the primates, Lovejoy argued that hominids diverged from pongids through an adaptive strategy that involved the *r*-selected trait of a shorter period between births.

Because *K*-selection normally increases the length of time between births, a species adopting an extreme *K*-strategy may risk extinction. Great apes, for example, produce only one infant every five or six years, a dangerously low reproductive rate for ensuring survival. To produce a greater number of offspring while otherwise increasing a *K*-strategy, Lovejoy (1981) proposed that early hominids made a move to pair-bonding. This set in motion a series of feedback loops. Pair-bonding resulted in females and infants being provided with food by males, which resulted in females not having to be so mobile, which resulted in females being able to raise more children at a time. This required males to carry food back to their families, which required a bipedal gait to free the hands for carrying, which required pair-bonding so that the food the males brought back was used by their own genetic offspring. Pair-bonding may also have resulted in a reduction in male-male competition for mates, thus making cooperation and wider social bonding possible.

Lovejoy's (1981) ideas challenged the consensus of opinion, ever since Darwin, that bipedality and a large neocortex arose out of tool use and hunting. The hominid fossils found in Ethiopia and attributed to *Australopithecus,* together with the 4 million-year-old footprint discovered at Laeotali in Tanzania, made the hunting hypothesis unlikely. Study of the crania and pelvis suggested that bipedality had arisen while the brain size was no larger than a modern chimpanzee, about 2 million years before the widespread use of material culture (Johanson & Edey, 1981).

Because tooth development accurately reflects extant primate life histories, it can be used to give insight into extinct hominids known only through the fossil record. B. H. Smith (1989) generated predictions for age of first molar eruption and life span. She divided the resultant life-history patterns into three grades. The first, a "chimpanzee grade" she applied to australopithecenes. Here the data suggested a little over three years for the first molar eruption, and a life span of about 40. Next, an "*erectus* grade" included *Homo habilis* and early *Homo erectus,* with figures of 4.6 years for first molar and 52 years for life span. Finally, modern humans constituted a third grade along with later *erectus* and Neanderthals in which first molar eruptions took place at 5.9 years and life span was 66 years.

Falk (1992) and Leakey and Lewin (1992), among others, hold that other dental research confirms that the australopithecenes were more apelike than humanlike. This was suggested by the pattern of development. In apes, the canine erupts after the second molar whereas in humans, it precedes it. Apes and humans also differ in the relation between the development of the anterior and posterior teeth. Research using computerized tomography (CAT scans) to produce three-dimensional X-ray pictures of fossil skulls suggested that the australopithecenes were bipedal apes, with apelike life histories and apelike facial and dental developments. Nonetheless some hominid-like features existed, including the lack of a gap between the canine and premolar teeth and the overall shape of the brain.

To reiterate, by a series of adaptations, large brained modern humans have become the most *K* of all the primates. As shown in Figure 10.3, there is a consistent trend toward prolonged life span, prolonged gestation, single births, successively longer periods between pregnancies, and developmental delay. With each step in the natural scale, populations devote a greater proportion of their reproductive energy to subadult care, with increased investment in the survival of fewer offspring.

The possible family life and social organization of *Homo* was further described by R. L. Smith (1984). He suggested that 1 to 2 million years ago, the degree of male bonding and female promiscuity may have been more similar to chimpanzees. In such a situation, where ejaculates from more than one male occur in the vicinity of ova, sperm competition leads to enlarged penises and testes to make deeper and more voluminous ejaculations possible. With increased weaponry and individual male command of food resources, female promiscuity would be supplemented by temporary courtship, which would be adaptive for females in leading to more paternal investment in offspring, and for males in leading to greater paternity confidence. Evolutionary competition among females may have led to continuous female attractiveness, with perennial pendulous breasts, ongoing sexual receptivity, and hidden ovulation. Competition among males may have selected for increased capacity to provide resources and paternal investment. Slowly a move occurred toward pair-bonding.

The further consequences of human pair-bonding were described by Lovejoy (1981). With greater pair-bonding, fewer male-male agonistic interactions need occur in competition for mates. With the decreased emphasis on sexual competitiveness would come a reduction in the need for anterior dentition, heavy musculature, and general robustness, and an increase in the complexity of social organization. This, too, would increment the number of children able to be raised to reproductive maturity. Indeed, Lovejoy (1981) suggested that an evolutionary process was set in motion that led to a lengthening of the juvenile stage of human development, a greater degree of overall parental care, and the creation of the uniquely human life history.

Race Differences in *r-K* Strategies

It is time to consider whether *r-K* theory explains the race differences among modern humans. The pervasiveness of the pattern of traits summarized in Table

1.1 suggests that the underlying mechanisms are powerful. Racial differences in brain size from autopsies, endocranial volume, and externally measured craniums before and after correction for body size were reviewed in chapter 6. These showed that Mongoloids averaged 1,364 cm^3, Caucasoids 1,347 cm^3, and Negroids 1,267 cm^3. Then, in chapter 7, an inverse relation was found between brain size and speed of physical maturation, including the age of first molar eruption. Eveleth and Tanner (1990) had compiled the data on the first phase of permanent tooth eruption from worldwide information. Eight sex-combined African series averaged 5.8 years compared to 6.1 years for 20 European and 8 East Asian series. A parallel racial difference also occurred for age of completion of this first phase: Africans at age 7.6, Europeans at age 7.7, and East Asians at 7.8.

Chapter 8 reviewed the differences among the races in number of two-egg twins per 1,000 births, caused by the production of two eggs in the same menstrual cycle. The rate per 1,000 births among Mongoloids is less than 4, among Caucasoids it is approximately 8, and among Negroids it is greater than 16, with some African populations having rates as high as 57 per 1,000 (Bulmer, 1970). Many subsequent surveys from around the world have confirmed the racial pattern, and have also shown that the incidence of non-monozygotic triplets and quadruplets shows the same rank ordering (Allen, 1987, 1988; Imaizumi, 1992; Nylander, 1975). The pattern occurs because the tendency to double ovulate is inherited largely through the race of the mother, independently of the race of the father, as observed in Mongoloid-Caucasoid crosses in Hawaii and Caucasoid-Negroid crosses in Brazil (Bulmer, 1970).

Populations adopting the lesser *K*-strategy to egg production (i.e., more eggs) are predicted to also allocate a larger percentage of bodily resources to other aspects of reproductive effort. Chapter 8 presented additional data on reproductive effort and sexual investment. Mongoloid and Negroid populations were at opposite extremes with Caucasoids intermediate. This pattern occurred consistently over traits such as:

1. Intercourse frequencies (premarital, marital, extramarital).
2. Developmental precocity (age of first intercourse, age at first pregnancy, number of pregnancies).
3. Primary sexual characteristics (size of penis, vagina, testes, ovaries).
4. Secondary sexual characteristics (salient voice, muscularity, buttocks, breasts).
5. Biological control of behavior (length of menstrual cycle, periodicity of sexual response, predictability of life history from onset of puberty).
6. Sex hormones (testosterone, gonadotropins, follicle stimulating hormone).
7. Attitudes (permissiveness to premarital sex, expectation of extramarital sex).

The racial differences in intelligence, law abidingness, health, and longevity, reviewed in chapters 6, 7, and 8 seem similarly to be ordered by *r*-*K* theory.

This is also the view of Lee Ellis (1987) who carried out an *r-K* analysis of race differences in crime. After drawing a distinction between intentional victimizing acts in which someone is obviously harmed and nonvictimizing acts, such as prostitution and drug taking, Ellis conceptualized victimizing criminal behavior as the opposite of altruism and therefore an *r*-selected trait.

Reviewing the literature, Ellis (1987) looked for universal demographic correlates of criminal behavior and found the following traits suggestive of *r*-selection:

1. Number of siblings. (Victimizers came from families with large numbers of siblings, or half siblings).
2. Intactness of parents' marital bond. (Victimizers came from families in which parents no longer lived together).
3. Shorter gestation periods. (Victimizers had more premature births).
4. Victimizers had more rapid development to sexual functioning.
5. Victimizers had a greater frequency of copulation outside of bonded relationships (or at least had a stated preference for such).
6. Victimizers had less stable bonding.
7. Victimizers had a lower parental investment in offspring (as evidenced by higher rates of child abandonment, neglect, and abuse).
8. Victimizers had a shorter life expectancy.

Ellis (1987) then examined the evidence on race differences in these characteristics and concluded that blacks are more *r*-selected than whites and both are more *r*-selected than Orientals. Because, across societies, blacks had higher victimizing crime rates than whites, and whites, in turn, had higher rates than Orientals, he also concluded that the racial differences in crime rates were likely the result of underlying neurhormonal mechanisms mediating the differences in reproductive strategies.

In a later extrapolation, Ellis (1989: 94) incorporated reproductive strategies and neurohormonal factors into a theory of rape. In this he made explicit (1989: 94) the prediction that "blacks should have higher rape rates than whites, and whites in turn should have higher rates than Orientals." As described in chapter 7 and Table 7.3, African and Caribbean countries report twice the amount of rape as do European countries and four times more than do countries from the Pacific Rim. Summing crime data from INTERPOL and averaging across years gives figures for rape per 100,000 population, respectively, for Negroids, 13; for Caucasoids, 6; and for Mongoloids, 3. These proportionate racial differences are similar to those found within the United States and they confirm Ellis's predictions.

In summary, when the pattern of traits summarized in Table 1.1 are evaluated against the attributes of Table 10.1, they suggest that the Mongoloids are more *K*-selected than Caucasoids, who in turn are more *K*-selected than Negroids. This view of *r-K* theory is precise enough to generate new research and to throw anomalies into relief. For example, from Table 10.1 it would be predicted that Mongoloids would be larger in body size than Caucasoids, who, in turn, would be larger in body size than Negroids, and yet, this pattern does not appear to be true (Eveleth & Tanner, 1990).

A formidable challenge for alternative theories to the *r-K* formulation is the inverse relation to be observed empirically between brain size and gamete production across human racial groups and their association with other bio-behavioral variables. No environmental factor is known to account for the trade-off between brain size, speed of maturation, and reproductive potency nor to cause so many diverse variables to correlate in so comprehensive a fashion. There is, however, a genetic factor: evolution.

11

Out of Africa

Race differences in reproductive strategies map onto modern theories of human evolution in an interesting way. Genetic distance estimates, including those from DNA sequencing, indicate that archaic versions of the three races emerged from the ancestral hominid line in the following order: Africans less than 200,000 years ago, with an African/non-African split about 110,000 years ago, and a Caucasoid/Mongoloid about 41,000 years ago (Stringer & Andrews, 1988). Such an ordering would fit with and explain the way in which the variables were found to cluster: Negroids, the earliest to emerge, were least *K*-selected; Caucasoids, emerging later, were next least *K*-selected; and Mongoloids, emerging latest, were the most *K*-selected.

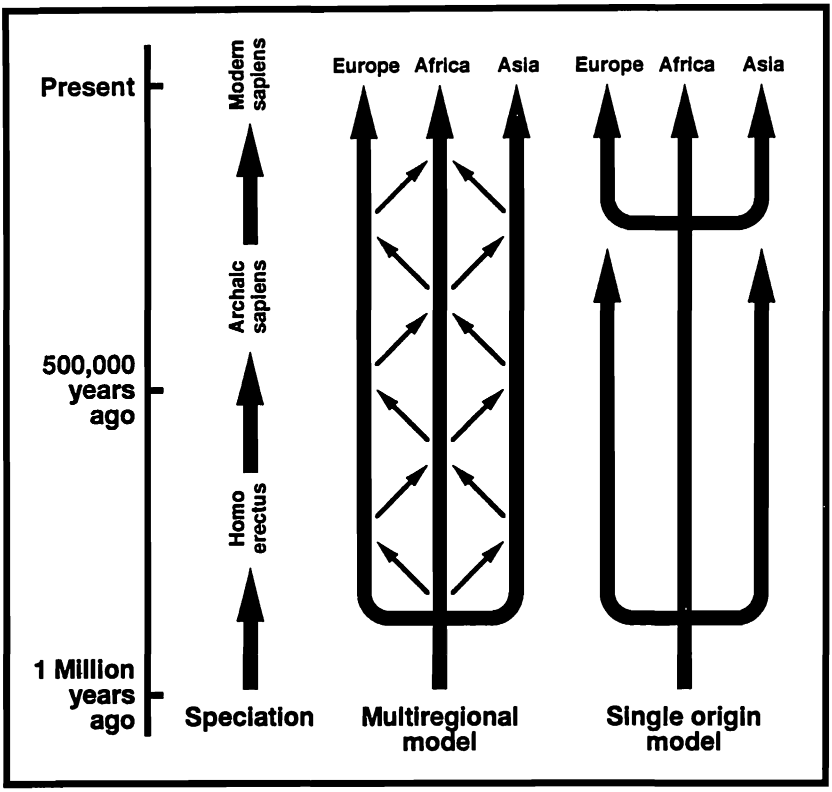
Racial Origins

Australopithecus, Homo habilis, and *Homo erectus* all made their first appearances on the African continent. Thus, Africa, as Charles Darwin correctly surmised, is "the cradle of mankind." However, two very different theories are competing to explain how racial differentiation occurred during the final stages of hominid evolution. At the extremes (Figure 11.1), these are the Multiregional and the Single Origin theories (Sussman, 1993). The Multiregional model requires that many racial characteristics be traceable backward in time over very long periods whereas this is not a requirement of the Single Origin model, which holds that a common female ancestor to all humans, dubbed "Eve," arose only recently in Africa.

Both theories agree that between 1 million and 2 million years ago *Homo erectus* emerged out of Africa to populate Eurasia. They are divided on whether the descendants of these *erectus* populations (the Neanderthals in Europe, Beijing Man in China, and Java Man in Indonesia) gave rise to modern ancestors, or whether the *erectus* groups were evolutionary dead ends supplanted by a wave of anatomically modern people arising in Africa less than 200,000 years ago.

The Multiregional theory holds that over a 1 million-year-period, modern human races evolved in parallel in Africa, Europe, and Asia through intermediate stages from *Homo erectus.* Thus, modern Europeans evolved from Ne-

Figure 11.1: Alternative Models for the Evolution of the Human Races



Both models assume that early man originated in Africa. They differ in how long ago the dispersal into Eurasia occurred. The single origin model (right) holds that modern humans evolved first in Africa, and then migrated to other continents around 100,000 years ago, eventually replacing earlier *Homo erectus* populations. The multiregional model (left) holds that after the migration of *Homo erectus* out of Africa around 1 million years ago, people evolved into modern humans independently in different parts of the world, with some gene flow occurring between the evolving lines to keep them from becoming too far apart (indicated by small arrows).

anderthals, the Chinese people from Beijing Man, and Australian aborigines from Java Man. Unique morphological features are claimed to persist from the archaic populations through to modern ones (Wolpoff, 1989; Thorne & Wolpoff, 1992; Frayer, Wolpoff, Thorne, Smith, & Pope, 1993). These continuing features include the prominent noses of modern Europeans with those of the Neanderthals (200,000 to 35,000 years ago), the flat faces and shovel-shaped incisor teeth of modern Chinese with those of Beijing Man and the Zhoukoudian fossils (500,000 to 200,000 years ago), and the continuous brow ridge of modern Australians with those of Java Man and the Ngandong fossils (700,000 to 100,000 years ago). Necessary to this view, much gene transfer must have occurred among the various groups to keep them evolving in concert.

The Single Origin theory, in contrast, proposes that fully modern humans emerged recently, perhaps only 140,000 years ago, from a primeval African population, and then migrated into all corners of the world. In the process, specific racial features developed while existing Neanderthals and *Homo erectus* populations were replaced (A. C. Wilson & Cann, 1992). A strong version of this theory holds that no genetic mixture took place between the modern and the older populations. An African/non-African split is envisaged as occurring 110,000 years ago following a dispersal event in the Middle East, the pathway out of Africa, with a Caucasoid/Mongoloid split occurring 41,000 years ago (Stringer & Andrews, 1988).

The main debating point between the two theories is whether there is regional continuity in the fossil record. In their review paper supporting the Single Origin model, Stringer and Andrews (1988) maintained that the fossil evidence claimed by the Multiregionalists is so incomplete that no possibility existed of consensus on the fossil record alone, even among paleontologists. Their analysis suggested that the Asian *erectus* populations were evolutionarily separate from those in Africa. These Asian forms then became extinct, and the African species of *Homo,* which should no longer be called *Homo erectus,* was the ancestor of anatomically modern humans.

The consensus of opinion seems increasingly favorable to the Single Origin perspective. Because of its parsimonious alignment with the data set out in Table 1.1, this author preferred Single Origin theory from the outset (Rushton, 1989a, 1992b). However, it is not crucial for the thesis which of the two approaches to racial origins turns out to be correct. Many literate accounts have been provided of the debate and its evidential base (Brown, 1990; Diamond, 1991; Fagan, 1990; Howells, 1993; Leakey & Lewin, 1992; Sussman, 1993). Here the topic will be considered primarily from the Single Origin perspective, based on genetic, paleontological, archaeological, linguistic, and behavioral sources of data.

Genetic Evidence

For many Single Origin theorists, the preferred mode of evidence is at the molecular, genetic level partly because genes and by-products like blood proteins are plentiful. Existing human populations can be compared by measuring similarities and differences and estimating the dates of divergence. Large genetic samples help to smooth minor, often local, variations. A. C. Wilson and Cann (1992: 68) explain the advantage of genes over fossils for evidence:

> [L]iving genes must have ancestors, whereas dead fossils may not have descendants. Molecular biologists know that the genes they are examining must have been passed through lineages that survived to the present; paleontologists cannot be sure that the fossils they examine do not lead down an evolutionary blind alley.

In an early breakthrough using molecular evidence, Sarich and Wilson (1967) had shown that the human lineage had diverged from African apes only 5 to 8 million years ago rather than the 25 million years ago claimed by paleontologists. This meant that the African apes (chimpanzees and gorillas) were genetically more closely related to human beings than they were to Asian apes (orangutans) from whom they separated 10 to 13 million years ago. Further, humans and chimpanzees were each other's closest relatives; chimpanzees and humans were more similar to each other than either were to gorillas. These conclusions on relatedness contradicted both superficial physical similarity and more formal anatomical analysis in which chimpanzees and gorillas appear to be each other's closest relative.

Sarich and Wilson's (1967) molecular clock used blood-group systems and proteins. Subsequent lines of evidence involved DNA hybridization, mitochondrial (mt) DNA sequencing, and nuclear DNA sequencing. All clocks rest on the assumption that if the rate of mutation that occurs is more or less a constant, then by counting the number of differences between two populations it is possible to estimate their time of divergence from a common ancestor.

Only 1 to 5 percent of the DNA genome is expressed as proteins. Between 95 and 99 percent consists of introns, pseudogenes, or "junk" DNA that goes along for the ride, replicating from generation to generation without affecting morphology at all. This superfluous DNA may not be of much use to the organism, but is of great value for researchers. Because it is not impeded by natural selection, mutations accumulate at an even faster rate in this "neutral" DNA than in the coding sequences of DNA, and so provides a "fast clock" for timing evolutionary divergences.

Using DNA hybridization, comparisons can be made of entire genomes (or major portions of them) consisting of billions of base pairs. In the DNA double helix, long strands wind about each other with each base pair attaching to its complementary base in the other strand. A double strand can be "melted" by heat into a single strand and compared with a similarly produced single strand from another species. These "hybrid" strands melt apart at a lower temperature than the originals because of the mismatches in the base pairs, like gaps in a zip. A difference of 1 degree in temperature represents roughly a 1 percent difference in the sequence. Human-chimp DNA comparisons are about 20 percent more stable than human-gorilla or chimp-gorilla comparisons.

Mitochondrial DNA lies outside the nucleus of the cell and contains only about 15,000 base pairs, contrasted with the 3 billion base pairs of the nucleus. Mitochondrial DNA is easier to analyze than nuclear DNA, not only because it has fewer nucleotide sites, but because it has a rate of change 5 to 10 times that of nuclear DNA. Moreover, because it is inherited only through the female line and so is immune to change by sexual recombination, it provides a purer measure of rate of change by mutation alone. It has been "clocked" at a rate of about 2 or 4 percent (or about 330 to 660 mutations) per million years.

Genetic trees, representing the relatedness of modern humans, reflect one fundamental split: sub-Saharan Africans and all other human populations. A classic study by Cann, Stoneking, and Wilson (1987) examined mtDNA gathered from 147 placentas from children whose ancestors lived in five parts of the world: Africa, Asia, Europe, Australia, and New Guinea. Cann et al.'s (1987) evolutionary tree showed that Africans could trace their ancestry to the base of the tree without running into any non-African ancestors. The descendants of the other areas, however, had at least one African ancestor. Moreover, the African-only branch contained more diverse types of mtDNA than the other geographic groups, showing that most evolutionary change had occurred among Africans. Africans had the oldest ancestry because their mtDNA had accumulated the most mutations. Asians, on the other hand, had relatively homogeneous mitochondrial DNA, suggesting they are of more recent ancestry.

Later studies supported and extended the African origin hypothesis, using more refined techniques, broader based populations, and chimpanzee mtDNAs as outgroup anchor points. In one study, mtDNA in single hairs plucked from 15 !Kung hunter-gatherers from the Kalahari Desert in southern Africa were sequenced and compared to 68 other humans, including African pygmies (Vigilant, Pennington, Harpending, Kocher, & Wilson, 1989). The genealogical tree showed the deepest branches occurring amongst the !Kung bushmen.

In a subsequent, confirmatory study, 189 people of diverse geographic origin, including 121 native Africans, produced a tree having many deep branches leading exclusively to African mtDNAs. The deepest branches occurred for pygmies and !Kung bushmen (Vigilant, Stoneking, Harpending, Hawkes, & Wilson, 1991). That the human DNA closest to that of the apes occurs most commonly in Africa implies an African origin for human mtDNA.

These studies give a date for the origin of anatomically modern human mitochondrial DNA to be between 166,000 and 249,000 years ago, or, more simply, about 200,000 years ago. One response of the Multiregionalists has been to question the assumption of the rate of change; they argue that a slower mutation rate is more appropriate and if adopted would place the origin of modern populations at about 850,000 years ago. A slower rate, however, does not seem to fit with the calibrations tested against archaeological data on known human colonization events or known divergence times made with other species such as the chimpanzee (A. C. Wilson & Cann, 1992).

The mitochondrial DNA research does not stand alone in supporting the Single Origin model. The patterns of genetic differences based on the coded sequences of DNA carried in the cell nucleus show similar results to those of mitochondrial DNA as, too, do "classical" data sets based on the proteins that the genes express (Cavalli-Sforza et al., 1993; Nei and Roychoudhury, 1993; Stoneking, 1993). Cavalli-Sforza's support for a recent African origin is a reversal of opinion, for, earlier, on more limited data, he had held that human populations can be divided into two major groups: the Eurafrican (European and African) and the greater Asian. From this observation he had proposed that anatomically modern humans had originated in western Asia (Cavalli-Sforza & Edwards, 1964).

Whereas the work with DNA clocks assumes that mutations accumulate at a constant rate, the work with blood proteins assumes that populations drift apart at a constant rate. These genetic distances show a closer relation between Europeans and Asians than between Europeans and Africans or between Asians and Africans. Thus, Nei and Livshits (1989) examined the three major races using four different sets of genetic loci (84 protein loci, 33 blood group loci, 8 HLA and immunoglobin loci, and 61 DNA markers) to calculate genetic distances. They concluded in favor of the recent African origin based on the assumption that the population that is most distinct has remained in the place of origin and other populations have migrated to other parts of the world.

Subsequently, Nei and Roychoudhury (1993) examined 121 alleles for 26 distinct populations from around the world and statistically allowed the rate of evolution to vary. They confirmed Nei and Livshit's (1989) results indicating an extremely high probability that the first major split of the phylogenetic tree separated Africans from non-Africans and that the genetic distance between Caucasians and Orientals is significantly smaller than either that between Caucasians and Africans or that between Orientals and Africans. Nei and Roychoudhury (1993) noted that to root a tree it is customary to use an outgroup species but that a useful alternative is to put the root to the midpoint of the longest branch between a pair of populations. This was the procedure they used and they went on to support the Out of Africa model and provide a plausible scenario of subsequent migrations and the origins of human populations.

Following the dubbing of mitochondrial Eve as "the mother of us all" some researchers began to search for Adam, "the father of us all." Work with DNA hybridization of the Y chromosome suggested that Adam was also an African. One team suggested that genetic Adam's closest modern counterpart is an Aka pygmy in the Central African Republic (Gibbons, 1991). Polymorphisms on the long arm of the Y chromosome were identified and the most ancestral version found in the pygmies. Other teams have traced the origin of polymorphisms from the Y chromosome to !Kung bushmen, two different groups of pygmies, and Africans in Ethiopia.

The studies described above proceeded independently, using quite different sets of data, yet each strongly implied the Single Origin out of Africa model. Genetic distances calculated from protein systems suggested divergence times of about 110,000 years ago for the African/non-African split and about 41,000 years ago for the Caucasoid/Mongoloid split (Stringer & Andrews, 1988). Nonetheless, detailed critiques of the molecular evidence for the African "Eve" hypothesis continue to appear (Templeton, 1993).

Paleontological Evidence

Proponents of the Multiregional model claim evidence of regional continuity between old and recent forms in anatomical features, particularly in Asia and Australia (Frayer et al., 1993). The Single Origin implies a divide between older and more modern forms (Aiello, 1993). Debate remained especially speculative until new dating procedures became available adding power to the traditional radiocarbon techniques, which cannot reliably date materials older than 30,000 to 40,000 years. Now uranium series techniques are used to date cave sediments such as stalagmites; thermoluminescence procedures are used on sediments or on flints burned by ancient fires; and electron-spin resonance on a variety of materials, particularly animal teeth. In each case a date is assigned to hominid remains by determining the age of the materials with which the remains are associated.

Together the new techniques confirm that all the major steps in human evolution took place in Africa and that *Homo sapiens* lived in Africa between 200,000 and 100,000 years ago, and in the Middle East about 100,000 years ago (Aiello, 1993). In the Middle East there is some evidence that *H. sapiens* and Neanderthals lived in the same region and shared the same Middle Stone Age "tool kit" about 50,000 to 100,000 years ago. The Neanderthals appear to have continued to occupy the area until the moderns took over completely about 40,000 years ago. The persistence of two populations with separate identities over a long period, with no signs of hybridization, suggests that they belonged to separate species. Also, in contrast to the continuity of the fossil record in sub-Saharan Africa, the record in North Africa can be divided into two widely separated groups, non-*Homo sapiens* between 500,000 and 200,000 years ago, and *H. sapiens* after 50,000 years ago.

A review of the physical differences between Neanderthals, who may have arisen in northern Eurasia, and moderns subsequently entering Eurasia from Africa, was provided by Simons (1989). Like earlier *H. erectus,* Neanderthals have dense skeletal bones and thick skulls with projecting brow ridges, and both sexes are extraordinarily muscular. The face juts forward and holds large front teeth. Robust hind limbs and dense bone suggests high levels of endurance and an adaptation to long hours of walking. Early modern humans in Europe have longer distal limb segments than do Neanderthals, which might imply more recent equatorial ancestry. Allen's rule, a principle of zoology, predicts that mammals generally have longer extremities in warm climates. There is ongoing debate about whether, anatomically, in brain localization and vocal tract, Neanderthalers were as capable of speech as moderns (Lieberman, 1991; Milo & Quiatt, 1993).

Craniometric analyses have shown that divergence in face and cranium among modern races is highly limited compared with the distance separating any of them from Neanderthals or *erectus* populations (Howells, 1973, 1989, 1993). Modern European skulls are much more similar to modern Africans and Chinese than they are to fossils of 100,000-year-old Neanderthals. Results such as these provide no evidence of regional continuity. Thus, Howells (1989) concluded that the data supported a recent Single Origin model. Although Howells's analyses often placed Africans (and Australoids) at the polar opposite of East Asians (and American Indians), a result consistent with a recent out of Africa migration, he was unable to show a specific sub-Saharan first source.

Dental research shows that features of the crowns and roots also outline the relationship among prehistoric populations. Dental features are more stable than many evolutionary traits, with a high genetic component that minimizes the effects of environmental differences, sexual dimorphism, and age variations. Among the features found in all modern humans are their number, 32, and their division into quarters: three incisors, one canine, two premolars, and two molars.

Turner (1989) has shown that Mongoloid populations are differentiated from the generalized pattern existing elsewhere in the world in several features, including shovel-shaped incisors, the result of extra ridges in the crown. There is also an important subdivision within the Mongoloid population. Sinodonts, the modern Chinese and Japanese, the Siberians, and the peoples of the Americas have the most shoveling and Sundadonts, southeast Asians, Thais, Malays, Javanese, Polynesians, Jomonese, and Ainu have the least. Sinodonts also display a greater frequency of single-rooted upper first premolars, and triple-rooted first molars. Turner conjectures that these changes were adaptations to life in the dentally demanding colder north.

Turner (1989) used the dental patterns to reconstruct the prehistoric migrations that peopled the Pacific Basin, East Asia, and the New World. The generalized pattern, thought common to all modern humans, entered southeast Asia sometime around 50,000 B.P. Sundadonty evolved from this pattern sometime after 30,000 B.P. and Sinodonty sometime after 20,000 B.P. Turner noted that his type of dental analysis is still in its infancy as a scientific discipline but that future work must link world populations together in a global framework.

Archaeological Evidence

During the 1.5 million years that spanned the emergence of *H. erectus* and *H. sapiens,* the stone implements were crude. Hand axes, choppers, and cleavers were not sufficiently differentiated in shape to imply distinctive function. Wear marks on the tools show they were variously used to cut meat, bone, hides, wood, and nonwoody parts of plants. Moreover, there is no evidence that the tools were ever mounted on other materials for increased leverage and there were no tools made of bone, no ropes to make nets, and no fishhooks. The stone tools remained unchanged for thousands of years. In fact, minimalists have held that there is no good evidence of hunting skills until around 100,000 years ago and even then humans would have been relatively ineffective hunters. Calvin (1990), however, has suggested that some of the stone axes used by *erectus* populations may have been effective throwing instruments aimed at animal herds as they watered.

It is only in the northern Eurasian land mass, particularly the arctic, where little plant food was available, that big-game hunting clearly became the dominant food source. And humans didn't reach the Arctic until around 30,000 years ago. Neanderthal tools found in Europe were similar to earlier human tools found in Africa, being simple hand-held axes not mounted on separate parts such as handles. There were no standardized bone tools and no bows and arrows. Shelters were apparently crude; all that remains of them are postholes and simple stone piles. There is no evidence of art, sewing, boating, or trade, and no variation of tools over time and space suggesting little in the way of innovation.

One hundred thousand years ago, in Africa, at the time when modern-looking Africans had evolved, the stone tool implements suddenly became more specialized. Carefully prepared stone cores enabled numerous thin blades about two inches (five cm) long to be struck off and turned into knives, spear barbs, scrapers, borers, and cutters. This blade technology allowed many more flakes to be struck off than previously and the stone workers relied more heavily on nonlocal rocks, choosing to bring in fine-grained rocks of many types from miles away.

Although the anatomically modern Africans had somewhat superior tools to their predecessors, they are still characterizable as Middle Stone Age in culture. They continued to lack standardized bone tools, bows and arrows, art, and cultural variation. These Africans can barely be considered big-game hunters because their weapons were still spears for thrusting rather than bows and arrows.

Evidence for a more abrupt change doesn't occur until the last Ice Age in Europe (France and Spain) around 35,000 years ago. Anatomically modern people, known as Cro-Magnons, appeared on the scene with dramatically more specialized tools. Standardized bone and antler tools appear for the first time, including needles used for sewing, as do compound tools of several parts tied or glued together, such as spear points set in shafts or ax heads hafted to handles. Rope, used in nets or snares, accounts for the frequent bones of foxes, weasels, and rabbits at Cro-Magnon sites.

Sophisticated weapons for killing dangerous animals at a distance no appear also—weapons such as barbed harpoons, darts, spear throwers, an bows and arrows. European caves are full of bones of bison, elk, reindee horse, and ibex. By this time South African caves also yield bones of buffal and pigs.

Several types of evidence testify to the effectiveness of late Cro-Magno people as big-game hunters. Their sites are more numerous than those of Ne anderthals or Middle Stone Age Africans, implying more success at obtainin food. Moreover, numerous species of big animals that had survived man previous ice ages became extinct toward the end of the last ice age, suggestin that they were exterminated by the human hunters' new skills. Likely victin include Europe's woolly rhino and giant deer, and southern Africa's giant bu falo and giant Cape horse. With watercraft capable of crossing the 60 mile from eastern Indonesia to Australia, and tailored clothing enabling the cros ing of the Bering straits, the giant kangaroos of Australia and the mammotl of North America were exterminated.

The occupation of Northeast Asia about 30,000 years ago depended c many advances: tailored clothing, as evidenced by eyed needles, cave pain ings of parkas, and grave ornaments marking outlines of shirts and trouser warm furs, indicated by fox and wolf skeletons minus the paws (removed i skinning and found in a separate pile); elaborate houses (partially dug into th ground for insulation and marked by postholes, pavements, and walls of mam moth bones) with intricate fireplaces; and stone lamps to hold animal fat an light the long Arctic nights.

Whereas Neanderthals obtained their raw materials within a few miles o home, Cro-Magnons and their contemporaries throughout Eurasia practice long-distance trade, not only for raw material for tools but also for ornaments Tools of obsidian, jasper, and flint have been found hundreds of miles fron where those stones were quarried. Baltic amber reached southeast Europe while Mediterranean shells and the teeth from sharks were carried to inlanc parts of France, Spain, and the Ukraine. Burial displays reflect great variation with skeletons wearing necklaces, bracelets, and head bands of shell beads and bear and lion teeth.

The artwork of anatomically modern humans also shows a clear discontinuity with what went before. Well known are the rock paintings, with polychrome depictions of now extinct animals and the relief carvings and clay sculptures deep within caves in France and Spain that hinted at shamanistic rituals. On the Eurasian plains are "Venus" figurines of women with enormous breasts and buttocks, made from a mixture of clay and bone powder. Ivory carvings of eagles, mammoths, and arctic waterbirds, as well as female figurines have been found in Siberia and dated to 35,000 years ago.

Analysis of amino acids in ostrich eggshells, once used as food and as containers, also bolsters the case that the first modern humans originated in

Africa. Change in amino acids take place in eggshells at a steady rate and, once anchored to radiocarbon dating, enable dating back to 200,000 years ago, and up to 1 million years in colder climates (Gibbons, 1992). The eggshells turn up at camp sites in South Africa between 105,000 and 125,000 years ago, before the earliest dates on other continents. Not long afterward, ostrich shells appear in the Middle East along with anatomically modern human remains.

Linguistic Evidence

Converging with the genetic, paleontological, and archaeological data is that from linguistics. Trees of relatedness constructed from 17 linguistic affinities were found to be related to those based on blood protein affinities in 42 aboriginal peoples who had had little or no mixing with outsiders (Cavalli-Sforza et al., 1988). As with other studies the first split in the genetic tree separated Africans from non-Africans, and the second separated two major clusters, one corresponding to Caucasoids, northeast Asians, Arctic populations, and Amerindians, and the other to southeast Asians, Pacific Islanders, and New Guineans and Australians. Average genetic distances between the most important clusters are proportional to archaeological separation times. Strikingly, the genetic clustering closely matched that of the major language families, indicating considerable parallelism between genetic and linguistic evolution.

Behavioral Evidence

The apparent stepwise sequence of behavioral data summarized in Table 1.1, with Caucasoids averaging consistently between Negroids and Mongoloids, appears to coincide with the dates for the succession of the three races in earth history. The three races emerged from the ancestral hominid line in roughly the following sequence: archaic Africans (later, Negroids) about 200,000 years ago, archaic non-Africans (later, Caucasoids) about 110,000 years ago, and archaic non-Caucasoids (later, Mongoloids) about 41,000 years ago. Such an ordering would fit with and explain the way in which the variables are found to cluster. The clustering thus supports the Single Origin model but is not clearly predictable from the Multiregional Model, based on long periods of separation, in which no consistent pattern of character appearance is expected.

Evidence from behavioral genetics is also relevant. For example, as reviewed in chapter 4, genetic estimates for mental ability subtests are often generalizable across populations, whether calculated on Mongoloid or Caucasoid samples. As was seen in Figure 9.1, inbreeding depression scores on IQ subtests calculated from Japanese families are predictive of the magnitude of black-white differences on the same tests in the United States. These findings support the Single Origin model because they suggest that the underlying genetic substructure of mental ability is the same across the races and thus that substantial genetic relatedness exists.

Racial Differentiation

Given an African origin of less than 200,000 years ago, a dispersal event out of Africa about 100,000 years ago, and a peopling of the rest of the world thereafter, the question arises as to how these events led to the behavioral profiles found among the races. Why would Mongoloids have ended up the most *K*-selected? I agree with those who have proposed that colonizing temperate and cold environments leads to increased cognitive demands to solve the problems of gathering food and gaining shelter and general survival in cold winters (e.g., Calvin, 1990; R. Lynn, 1987, 1991a).

From time to time populations move into new niches which entails increased cognitive demands for survival. When this occurs populations respond by evolving larger brains in relation to body size. Larger brains have the capacity for greater intelligence and enable the populations to deal with the cognitive demands of the new niche. The Caucasoid and Mongoloid peoples who evolved in Eurasia were subjected to pressures for improved intelligence to deal with the problems of survival in the cold northern latitudes. Most of the last 80,000 years has been colder than today. During the main Wurm glaciation of approximately 24-10,000 B.P. winter temperatures in Europe and northeast Asia fell by 5-15°C. The terrain became cold grasslands and tundra with only a few trees in sheltered river valleys; the environment was broadly similar to that of present-day Alaska.

Obtaining food and keeping warm in these conditions posed a problem. Unlike the tropics and subtropics, plant foods were seasonal and not available for many months during the winter and spring. People therefore became wholly reliant on hunting large herbivores such as mammoth, horse, and reindeer to secure their food supply. Even among near-contemporary hunter-gatherers, the proportions of foods obtained by hunting and by gathering varies according to latitude. Peoples in tropical and subtropical latitudes were largely gatherers, while peoples in temperate environments relied more on hunting. Peoples in arctic and subarctic environments relied almost exclusively on hunting, together with fishing, and did so of necessity because plant foods were unavailable for much of the time.

Hunting in the open grasslands of northern Eurasia was also more difficult than hunting in the woodlands of the tropics and subtropics where there is plenty of cover for hunters to hide in. The only way of hunting animals in open grasslands is to make use of natural traps into which the animals could be driven. One of the most common traps was the narrow ravine where some of the beasts would stumble and could be speared by members of the group waiting in ambush. In addition, the herbivores could be surrounded and driven over cliffs, into bogs or into the loops of rivers.

For effective hunting of large herbivores people would have needed to manufacture a variety of tools from stone, wood, and bone for making spearheads and for cutting. When these peoples had killed a large herbivore they would have to skin and butcher it into pieces of a size that could be carried back to the base camp. For this it was necessary to manufacture a variety of sophisticated cutting and skinning tools.

Another set of problems in the northern latitudes would have centered on keeping warm. People had to solve the problems of making fires, clothes, and shelters. It would have been much harder to make fires in Eurasia than in Africa, where spontaneous bush fires would have been frequent. In Eurasia during the glaciations there would have been no spontaneous bush fires. People would have had to make fires by friction or percussion in a terrain where there was little wood. Probably dry grass had to be stored in caves for use as tinder and the main fuel would have been dung, animal fat, and bones. In addition, clothing and shelters were unnecessary in sub-Saharan Africa but were made in Europe during the main Wurm glaciation. Needles were manufactured from bone for sewing together animal skins, and shelters were constructed from large bones and skins. Torrence (1983) has demonstrated an association between latitude and the number and complexity of tools used by contemporary hunter-gatherers.

Thus, the cognitive demands of manufacturing sophisticated tools and making fires, clothing, and shelters (as well as regulating the storage of food; Miller, 1991) would have selected for higher average intelligence levels than in the less cognitively demanding environment in sub-Saharan Africa. Those individuals who could not solve these problems of survival would have died out, leaving those with alleles for higher intelligence as the survivors.

In the data set out in chapter 6, general, verbal, and visuospatial abilities are all higher in Caucasoids compared with Negroids. The magnitude of the Caucasoid advantage was about the same for all three abilities, namely, about 30 IQ points for the comparison with Africans and about 15 IQ points for the comparison with African Americans and African Caribbeans. It is likely that all three abilities came under selection pressure for enhancement in Eurasia to about the same extent.

The intelligence of the Mongoloids are held to have evolved somewhat differently. While the Mongoloid peoples have only slightly higher general intelligence than the Caucasoids, they have markedly higher visuospatial abilities and, indeed, somewhat weaker verbal abilities. R. Lynn (1987, 1991a) attributed the evolution of this pattern of abilities to the even colder winters that Mongoloids experienced relative to Caucasoids. Evolving in Siberia where, in the main Wurm glaciation, the temperatures were some 5–15°C colder than today, the people of northeast Asia would have found themselves between the encroaching ice from the Himalayas in the south and from the Arctic region in the north. In response to this extreme cold, Mongoloids evolved distinctive adaptations to reduce heat loss, including the flattened face and shortened limbs and epicanthic fold and narrow eyes that afford protection against the cold and the glare of the sunlight on the snow. Under these adverse conditions natural selection increased general intelligence and a trade-off in favor of visuospatial abilities over verbal because of the crucial role of strong visuospatial abilities for making sophisticated tools and weapons, and for the planning and execution of group hunting strategies.

R. Lynn (1991a) also provided a scenario for the evolution of intelligence in southeast Asians and Amerindians. Although southeast Asians had some exposure to cold winters before they migrated southward, and so were selected for some enhanced intelligence, this would have been less than that experienced by the northern Caucasoids and Mongoloids. Hence, their intelligence levels were raised above those of Negroids but not to as high a level as the Caucasoids and Mongoloids. With respect to Amerindians, they are descendants of an archaic Mongoloid people that entered the Americas prior to the main Wurm glaciation of approximately 24-10,000 years ago that produced the "classical" Mongoloid features with their highly elevated cognitive abilities. Thus, the first Wurm glaciation at 40,000 B.P. set in place the archaic Mongoloid cognitive profile of relatively strong visuospatial and weak verbal abilities, and then some subsequent selection pressure, such as the main Wurm glaciation, raised the whole profile in the Mongoloids, leaving that of the Amerindians at a lower level.

Once proto-Mongoloids had crossed the Bering Strait and made their way down into the Americas they would have found life easier than their ancestors had been accustomed to in northeast Asia. They would have found a number of herbivorous mammals such as mammoth, horse, antelope, and bison who were quite unused to being hunted by man. With no experience of predation by man they would have been easy game for the skilled hunters who had evolved for many thousands of years in the more difficult environment of northeast Asia. As they moved southward proto-Mongoloids would have found that plant foods were readily available. Thus, survival would have been easier and selection for further increase in cognitive abilities would have relaxed.

K-Selection and Brain Size

R. Lynn is not the first to argue that the benefits of intelligence were greatest for those populations living in cold climates during the ice ages, but he has certainly provided the most detailed modern exposition. Lynn's (1991a) analysis went beyond his earlier (1987) account by also focusing on the racial differences in brain size that I had described (Rushton, 1988b, 1990c). As reviewed in chapter 2, a direct relation exists of about 0.40 between brain size and intelligence. The human brain is a metabolically expensive organ, using 20 percent of the body's supply of energy while representing only 2 percent of its body mass. Unless large brains substantially contribute to fitness, therefore, they would not have evolved. Increasing encephalization likely adds fitness by increasing the efficiency with which information is processed, as measured using conventional tests of intelligence.

The evolution of a larger brain is expected to lead to the selection of other *K*-characteristics. As discussed in chapter 10, with regard to within-species *r*-*K* selection, life-history traits tend to be selected together. Culling for one life-history characteristic typically pulls in related traits. Across species, building a bigger brain demands a longer gestation, higher offspring survival, a delayed maturity, a lower reproductive output, and a longer life (Harvey & Krebs, 1990).

As populations moved north, out of Africa, they encountered not only more cognitively demanding but also more predictable environments. Predictable environments are an ecological precondition for *K*-selection. Although the Arctic climate varies greatly over 1 year, it is highly predictably harsh among years. Temperate zones are also quite predictable but subtropical savannahs, where humans evolved, because of sudden droughts and devastating viral, bacterial, and parasitic diseases, are generally less predictable.

Noncognitive personal qualities were likely selected along with intelligence, either as a necessary concomitant feature or because additional advantages were conferred. In the most *K*-selected populations there would not only be increased brain size and intelligence, but also a reduction in personal and sexual competitiveness including the size of breasts, buttocks, and male genitalia. Decreased emphasis on personal and sexual competitiveness and more emphasis on parenting and personal restraint would allow greater complexity of social organization and increment the number of children successfully raised to reproductive maturity.

K-strategy populations generate centralized social systems with regulated communication networks in which individuals initially compete for position but subsequently gain access to resources dependent on their place in the hierarchy. Less *K*-strategy populations generate relatively less centralized organizations in which the important lines of communication are face-to-face and in which personal dominance matters, because each time resources become available they are competed for anew, in an opportunistic scrambling fashion. Thus may the suite of correlated characteristics shown in Table 1.1 have come into being.

Agriculture and the Modern Era

By 12,000 or so years ago, modern *H. sapiens* dominated the land masses of Africa, Europe, and Asia, and had crossed into the Americas. The semitropical savanna of Africa, the arid tundra of the Eurasian steppes, and the cold glacial landscapes of Siberia had been conquered. Evolutionary challenges continued, however, not least of which was the retreat of the glaciers that began some 10,000 years ago from as far south as London and New York. The global warming threatened a whole way of life developed over thousands of years, destroying many forms of animals and allowing new ones to develop, one of which, largely because of the extension of grasslands, was the horse. In addition, it produced enormous changes in the distribution of plants and animals, especially in the Northern Hemisphere. It was the retreat of the polar ice cap that brought the next, revolutionary, stage of human development—agricultural settlements.

R. Lynn (1991a) suggested that although warm interglacial interludes had occurred previously, the transition to agricultural societies wasn't possible until people became sufficiently intelligent to take advantage of the wild grasses. According to Lynn, it was only after people had been through the last Wurm glaciation that they were cognitively able to do so. Lynn's view provides an explanation for why these advances were never made by Negroids or those southeast Asian populations who escaped the rigors of the last glaciation.

The invention of agriculture, 10,000 years ago, may have speeded up human evolution. It certainly increased cultural innovation. Humans shifted from an essentially mobile, hunting, and gathering existence, to a more sedentary one. Agriculture opened the way to an unprecedented expansion of food supplies and of human populations that, in turn, made cities and civilization possible. Those populations that were most capable of adopting an urban, agricultural way, increased enormously in numbers and social organization, and finally in military power. Smaller bands of hunter-gatherers were swamped by force of numbers and were either absorbed or extinquished.

Agriculture exerted enormous pressure on the human gene pool. Individuals who were members of successful agricultural settlements reproduced themselves at a far greater rate than did those who remained outside such settlements. The stable year-round food supply allowed for large population increases. Agricultural settlements made possible a complex urban society, the development of metallurgy, the invention of writing, and ultimately, civilization.

The earliest archeological sites with evidence of domesticated grain lie in the Middle East, at the north end of the Dead Sea, and date to about 10,000 years ago. Long before that, people in the region had gathered and eaten wild grain. Population growth, possibly combined with climatic change causing summertime food scarcity, might have forced people to plant wild cereals to tide them over. Once begun, the transition from wild to domesticated cereals could have occurred quite quickly.

The domestication of wheat, barley, peas, and beans spread northward into Turkey and eventually into Mesopotamia, moving at about one kilometer a year as the expanding population moved into new territory. The domestication of animals came about 1,000 years after the domestication of plants. Pottery and polished stone implements increased in frequency with the beginning of agriculture and completed the neolithic transition, the final part of the Stone Age.

The slow movement of the spread of agriculture implies demic diffusion, a process in which "it is not the idea of farming that spreads but the farmers themselves" (Ammerman & Cavalli-Sforza, 1984: 61). Integrating information from the archaeological record, radiocarbon dating, and the distribution of genetic polymorphisms from blood-group and other blood-based systems, a southeasterly-northwesterly progression is seen, being as early as 8,000 years ago in Greece and as late as 5,000 years ago in parts of the United Kingdom and Scandinavia. The diffusion is one of people, not cultural knowledge passed passively from static group to group. Population replacement is clearly implied.

Just as hunter-gatherer groups differentially survived, so have cultures and civilizations and the gene pools associated with them. In Western Europe alone, between the years A.D. 275 and A.D. 1025, it has been estimated that there was a war every two years on the average. Some of these wars substantially affected the gene pool, particularly when genocide was practiced. Genocide has probably not been uncommon during human history (Diamond, 1991; E. O. Wilson, 1975). Wars also changed social structures, as when one ideology replaced alternatives. Cultures that put a high premium on trade and exploration, as in Western Europe over the last several hundred years, produced movements of gene pools through migration. Substantial population movements continue, of course, to this day.

12

Challenges and Rejoinders

Holding that the use of racial terminology is poorly justified, opponents of the race concept successfully substituted the phrase "ethnic group" and thereby shifted the emphasis away from a "question begging...biologistic bias" (Montagu, 1960: 697; see also Lewontin et al., 1984: 119–29). The main empirical reason given for denying the importance of race is poor predictive utility. Critics point to enormous variance within races, the blurring of racial distinctions at category edges, and the lack of agreement as to how many races there are (Yee, Fairchild, Weizmann, & Wyatt, 1993).

Is Race a Useful Concept?

The view that race is only a social construct is contradicted by biological evidence. Along with blood protein and DNA data discussed in chapter 11, forensic scientists are able to classify skulls by race. Narrow nasal passages and a short distance between eye sockets mark a Caucasian, distinct cheekbones identify a Mongoloid and nasal openings shaped like an upside down heart typify a Negroid (Ubelaker & Scammell, 1992).

Of course it is simplified to divide all the world's peoples into just three major races. This ignores "Negritoes" and "Australoids," but also subdivisions within the macro races. Within the Mongoloid population distinctions might be drawn between east Asians like the Sino-Japanese and Koreans, and Amerindians and south Asians like the Filipinos and Malays. Similarly, the classification "Negroid" includes Bantu-speaking Africans, pygmies, Khoisan bushmen, and the socially classifiable blacks in the Americas who are hybridized with whites and Amerindians (in the United States by about 25 percent, Chakraborty et al., 1992). Caucasoids include Europeans, Middle Easterners, and members of the Indian subcontinent. It is unclear where still other groups belong. Are Polynesians Caucasian, Mongoloid, or some degree of admixture between them?

The histories of global populations are genetically complex and linked by intervening gradients. Intermediate populations may have come into being due to living in intermediate environments or they may be the result of interbreeding between formerly disparate groups. Future research using genetic information sequences will determine more precisely genetic affiliations and their behavioral correlates.

Constructs in science are only useful if they have explanatory power. The three macro racial categories show much predictive and construct validity. As has been shown, racial categories better organize disparate data than is possible using only ethnicity, religion, or sociopolitical grouping. In each category of Table 1.1, Caucasoids fall *between* Negroids and Mongoloids. The efficient unit of analysis, therefore, is the higher order concept of race, within which cluster the different subdivisions, ethnic groups, and, ultimately, individuals. Ignoring the concept of race not only obscures predictive order of internationally based data, but also neglects the approach of population biologists studying other species (Mayr, 1970: 186-204).

Are the Race Differences as Described?

Many critics have disputed my characterization of the pattern of racial differences. Some have charged that the data presented were misleadingly selected. Weizmann et al. (1991: 49) were among the most explicit:

> Rushton scavenges whatever materials lay at hand, whether ecology, anthropology, psychology or paleontology. His tendentious borrowing of materials, often themselves tainted by racism, is quite unscholarly. Libraries are full of so-called data which can be used to support almost any point of view about the causes of differences among people.

Similarly, Silverman (1990: 1) worried that the studies reviewed led to conclusions that "so precisely parallel racist stereotypes that it is difficult to dismiss the possibility of bias in the theory and/or the data."

A complaint by M. Lynn (1989a: 3) may be nearer the truth:

> [M]any of the race differences reported by Rushton and Bogaert (1987) have not been consistently found. The authors themselves acknowledged that some studies have failed to replicate the reported race differences in testes size, age at onset of puberty, and biologic control of sexual interest. Other failures to replicate the reported race differences were not acknowledged.

My response is that critics have failed to show an opposite to predicted ordering in brain size, intelligence, sexual restraint, law abidingness, and social organizational skills. If the null hypothesis was correct, then racial differences would be randomly distributed around a mean of zero with an equal number of negative as positive instances. Although critics have discussed the reliability of the data sources, the variability within the races, the overlap of the distributions, the size of the samples, the magnitude of the differences, and the change of scores over time, they have not provided contradictory data.

Aggregation versus Deconstruction

The principle of aggregation, a major methodological point discussed at length in chapter 2 must now be reconsidered in the present context. The principle states that the sum of a set of measurements is more stable and unbiased an estimator than any single measurement from the set. One reason is that there is always error associated with measurement. When several measurements are combined, these errors tend to average out. Errors made in one direction are considered to be offset by errors in another. Disregarding "outliers" and intragroup variance is inherent in, and is the purpose of, taking an average.

It is necessary to belabor this obvious principle, made explicit for psychological measurement in the nineteenth century, because it is so easily forgotten when discussing racial differences. What too often occurs is that a subset of the data is identified, deconstructed into particulars, and special explanations given for the scattered fragments. These deconstructed particulars, when re-aggregated, typically show the now familiar pattern of racial differences.

This view of the importance of aggregation has been contested. Zuckerman and Brody (1988: 1032) concluded a critique by saying:

> In sum, we find Rushton's paper flawed in terms of its obscure logic...ignoring of large group differences within the three major races (that are often larger than those between the three racial groupings) and aggregating that which should not be aggregated.

Zuckerman (1991: 985) elaborated this position: "[T]he variability within the three 'races' makes the general comparisons among them meaningless, and aggregation only serves to hide the variability."

Others have made similar points. In the context of U.S. crime statistics, Roberts and Gabor (1990: 299-300) stated: "Any examination of aggregate crime statistics is going to over-estimate the true incidence of crime committed by blacks relative to the amount of crime committed by whites." Yee et al. (1993: 1134) state that I interpret all within group variation as "error" but the next chapter shows how untrue this is. Rather, it represents natural variation, likely genetically based, that is common to all studied animal populations. Finally, Weizmann, Wiener, Wiesenthal, & Ziegler (1991: 46) wrote:

> Rushton's discussion of aggregation reveals his continued misunderstanding of the limited value of averaging multiple items, multiple instances and multiple samples. Aggregation provides a more unbiased estimator of true population values only where they are obscured by random error variance. It is of no use in reducing systematic error.

The principle of aggregation is pivotal. It's implications were discussed at length in chapter 2 for a wide variety of nonracial domains; it is central to other debates. Let us consider some of the examples that have been contested.

Aggregation and Brain Size

Many nineteenth-century scientists including Broca, Darwin, Galton, Lombroso, and Morton concluded that there were racial differences in brain size (chap. 5). With some exceptions, for example, American anthropologists Boas and Mead, this view was probably dominant until World War II (Pearl, 1934). As discussed in chapter 6, following the war, the literature on brain size and race underwent vigorous critiques. Thus, Tobias (1970) cited 14 potentially confounding variables that he argued made the data on black-white differences in brain weight measured at autopsy highly problematic; and Gould (1978) alleged that many of the data on racial differences in endocranial volume were due to "unconscious...finagling" and "juggling" of figures. Together, these authors claimed to have dismantled the "myth" of racial group differences in brain size.

As discussed in chapter 6, however, when the autopsy data debunked by Tobias (1970) were aggregated, racial group differences were found, with Mongoloids and Caucasoids having heavier brains than Negroids (1,368 g, 1,378 g vs. 1,316 g, respectively). When Tobias's number of "excess neurons" were averaged, Negroids had 8.55 billion, Caucasoids had 8.65 billion, and Mongoloids had 8.99 billion. Similarly, re-aggregating Gould's (1978, 1981) "corrected" analyses of nineteenth-century endocranial data showed that about 1 in^3 (16 cm^3) of cranial capacity differentiated the races such that Mongoloids > Caucasoids > Negroids.

These re-assemblages did not convince all the critics. Cain and Vanderwolf (1990) countered that the averaging method I had used for Tobias's data was inappropriate because, for example, the midpoint of a range of means had been used. This procedure, they suggested, could yield misleading results unless the distribution was symmetrical. They did not say why it was reasonable to assume that the distributions were skewed.

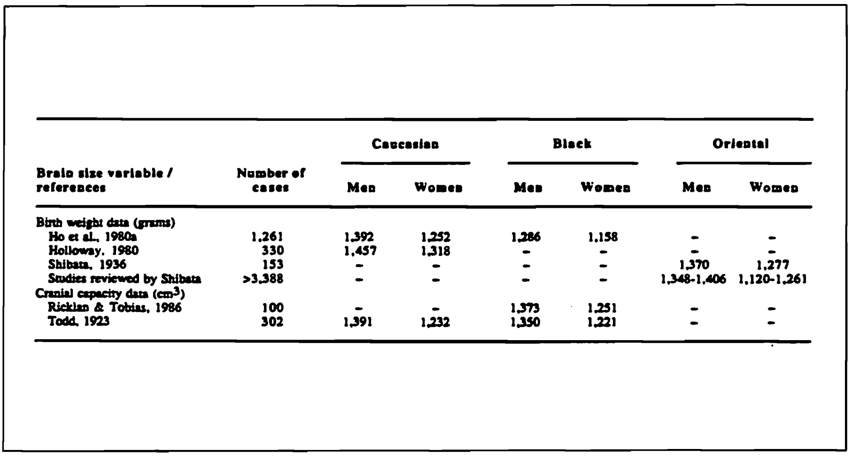
Cain and Vanderwolf (1990) and M. Lynn (1989b) also objected to the inclusion of the data from the ancient Caucasians in the category "Caucasoid" in my aggregation of Gould's data because of their small bodies and dried skulls. But if one accepted this position and excluded the ancient Caucasians from analysis, a 4 in^3 difference in internally measured cranial capacity would be left between Mongoloids and Caucasoids on the one hand and Negroids on the other (see Table 6.1). Even if this magnitude is somewhat overestimated, the residual cannot be ignored. Moreover, if body size is controlled, the rank ordering is indeed Mongoloids > Caucasoids > Negroids because Mongoloids are often smaller in body size than Caucasoids.

Critics also brought "new" data to bear on the debate from a monograph by Herskovits (1930) who had collected external head measurements of American blacks and other populations. From this table, Zuckerman and Brody (1988: 1027) separated out a sample of 46,975 Swedes with a smaller cranial capacity than the American blacks and argued that if this kind of overlap was possible, then it was meaningless to make comparisons across races. This position was subsequently cited by other critics (e.g., Cain & Vanderwolf, 1990; Weizmann et al., 1990).

As discussed in chapter 6, Herskovits (1930) actually collated head size data for 36 male populations made by several investigators (Table 6.2). By choosing among the samples, any racial ranking can be artificially created. It is more appropriate to use the principle of aggregation and combine samples. When Herskovits's (1930) data were aggregated, as we have seen, statistically significant differences in brain size were found, with Mongoloids (in this case North American Indians) and Caucasoids averaging larger than Negroids.

Other tabulations provided by critics to support the null hypothesis turn out on closer examination to support the racial hypothesis. Thus, Cain and Vanderwolf (1990: 782) set out 20 data points including a 1923 series of Caucasoid crania and a 1986 Negroid series (Table 12.1). Their purpose was "to illustrate that by drawing from other studies one can arrive at different conclusions than Rushton did" and to show that Negroid crania are "sometimes" greater than Caucasoid crania. They concluded: "Depending on the studies one chooses to cite, one can arrive at a variety of orderings of brain size or cranial capacity."

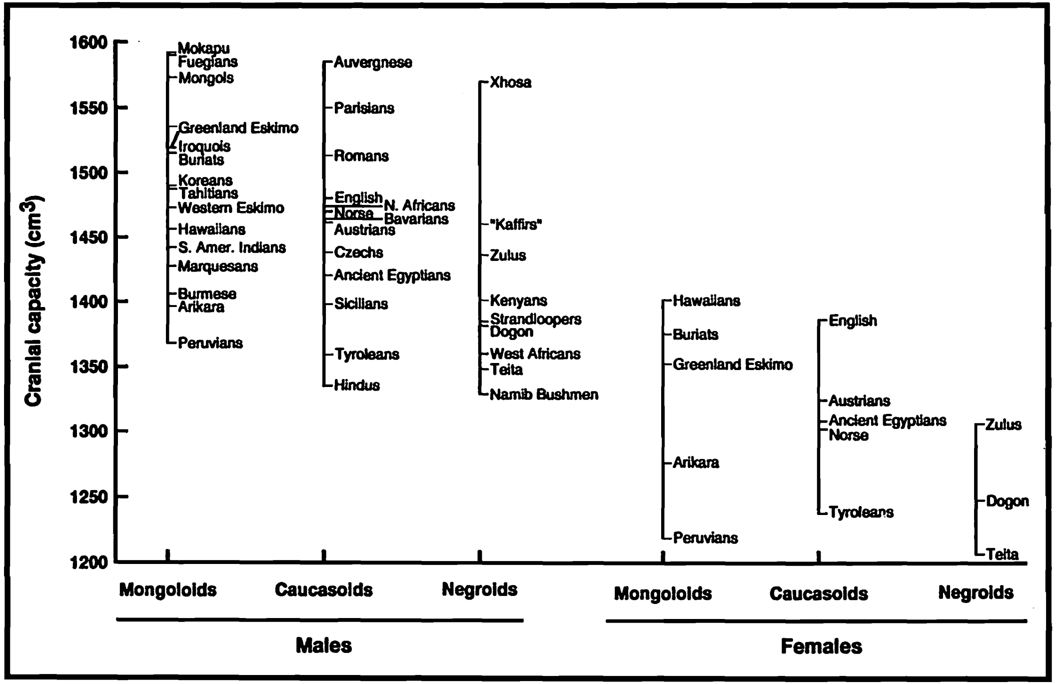
TABLE 12.1
Adult Brain Size Data Assembled by Cain and Vanderwolf (1990)



Brain size variable / references	Number of cases	Caucasian		Black		Oriental	
		Men	Women	Men	Women	Men	Women
Birth weight data (grams)							
Ho et al., 1980a	1,261	1,392	1,252	1,286	1,158	-	-
Holloway, 1980	330	1,457	1,318	-	-	-	-
Shibata, 1936	153	-	-	-	-	1,370	1,277
Studies reviewed by Shibata	>3,388	-	-	-	-	1,348-1,406	1,120-1,261
Cranial capacity data (cm^3)							
Ricklan & Tobias, 1986	100	-	-	1,373	1,251	-	-
Todd, 1923	302	1,391	1,232	1,350	1,221	-	-

Note. From Cain & Vanderwolf (1990, p. 782, Table 1). Copyright 1990 by Pergamon Press. Reprinted with permission.

Figure 12.1: Adult Cranial Capacities Plotted From Data Assembled by Groves (1991)



Adapted with permission of the Australasian Society for Human Biology.

Yet, Cain and Vanderwolf's data show that Negroid adults average the smallest brains. I converted to grams the data in cubic centimeters in Table 12.1 using equation (5) from chapter 6 and aggregated the data across the sexes and measures (Rushton 1990c). Mongoloids averaged 1,297 g, Caucasoids averaged 1,304 g, and Negroids averaged 1,199 g, a difference of 100 g between Negroids and the other two populations. In a reply, Vanderwolf and Cain (1991) acknowledged that "some" of the data are "trustworthy" and in the direction claimed.

A similar sort of table was created by Groves (1991) who entered 21 Mongoloid populations (16 male, 5 females), 18 Caucasoid populations (13 male, 5 female), and 12 Negroid populations (9 male, 3 female). Among those having the largest cranial capacity were the Mokapu, a Mongoloid tribe in Hawaii, and the Xhosa, a tribe from Africa. Groves focused discussion on these outliers and ignored the remainder of his own table. I have plotted the data from his table in Figure 12.1, which, in aggregation, clearly shows the racial pattern. For males, the Mongoloids, Caucasoids, and Negroids average 1,487 cm^3, 1,458 cm^3, and 1,408 cm^3, respectively, and for females they average 1,325 cm^3, 1,312 cm^3, and 1,254 cm^3 respectively. An unweighted sex-combined average of these figures results in 1,406 cm^3, 1,385 cm^3, and 1,331 cm^3, respectively.

Aggregation and Crime

Some claim that crime statistics only reflect police prejudice and biases in the criminal justice system. Some have gone so far as to claim that when the self-reports of adolescents are used, no racial differences in crime exist. Others sidestep crime statistics and focus on those surveys failing to show racial differences in antisocial personality disorder, psychopathy, and psychotic tendency (Zuckerman & Brody, 1988: 1030).

It is true that self-report measures typically show less racial disproportionality than arrest data. This is because they emphasize lesser, even trivial, offenses, that almost all males have engaged in at least once (e.g., "Have you ever been in a fight?") or because they include items of marginal relation to crime (e.g., "Would being in debt worry you?"). It is also because few of the questionnaires assess the frequency of activities.

Self-report measures do, however, show the same general pattern of group differences (age, sex, socioeconomic, and race) as do official statistics. J. Q. Wilson and Herrnstein (1985) review the literature. One study, involving a U.S. national sample of 1,726 youth aged 11 to 17, found clear evidence that African Americans engage in more crime than European-American, and particularly in predatory crimes, with the difference most apparent among high-rate offenders (Elliott & Ageton, 1980). Other studies showed that black males scored higher (that is, were less "normal") than white males on personality tests such as the Minnesota Multiphasic Personality Inventory, particularly on the Psychopathic Deviate (*Pd*) scale, which is predictive of criminal behavior in both racial groups.

Because crime figures vary enormously over type, region, generation, and subpopulation, Roberts and Gabor (1990) proposed they could only be explained using "situational" and "interaction" factors. Thus Roberts and Gabor (1990) pointed out that whereas arrest data from the U.S. Federal Bureau of Investigation indicated that 47 percent of violent crimes were committed by blacks, another set based on the reports of victims, by the U.S. Department of Justice, observed that only 24 percent of such crimes were committed by blacks. The figures were also shown to change with time and geographic area. Thus, the involvement of blacks in crime had increased over the last thirty years and for one year in the state of Delaware, the homicide rate for blacks was 16.7 per 100,000 whereas in Missouri the rate was 65 per 100,000.

Roberts and Gabor (1990) also pointed out that American blacks had a higher homicide rate than their more racially pure counterparts in Africa. They cited rates of 0.01 per 100,000 in Mali and 8 per 100,000 in Tanzania. Moreover, homicide rates in the Far East varied considerably, from 39 per 100,000 residents in the Philippines to 1.3 per 100,000 in Hong Kong.

As discussed in chapter 7, however, I tested the generalizability of racial differences in crime by aggregating the international crime statistics reported to INTERPOL for 1983-1984 and 1985-1986, which provided data on nearly 100 countries in 14 crime categories. For both 1984 and 1986 African and Caribbean countries reported twice the amount of violent crime (rape, murder, and serious assault) as did European countries, and about three times as much as did countries from the Pacific Rim (Table 7.3).

In reply, Gabor and Roberts (1990: 338) argued that the international statistics are "an unstandardized data base which is highly sensitive to the differential legal definitions, reporting, and recording practices of the countries around the world." In many countries, they pointed out, politically motivated killings are included in the homicide data. Rape, they go on to say, is notoriously underreported and highly sensitive to public attitudes, victim services available, the status of women, and the practices of the police and courts prevailing in a given society. Gabor and Roberts (1990) did not say why, despite all the sources of error they had enumerated, so clear a racial pattern could be calculated.

Many critics of the work on crime and race point out that African Americans are typically the victims of crime. For example, Roberts and Gabor (1990) showed that in the United States, black men are 20 times more likely than white men to be shot, cut, or stabbed, and black women are 18 times more likely to be raped than white women. Black people are also more likely than white people to be the victims of burglary, motor vehicle theft, assaults, robbery, and many other offenses.

To this argument two points may be made. First, as J. Q. Wilson and Herrnstein (1985: 463) cogently remarked:

> To believe that blacks do not commit such offenses at greater rates than whites, one would have to believe that the higher rates of victimization are caused by whites entering black neighborhoods in order to break into homes and hold up citizens. While that is possible, it seems unlikely.

Second, there is an asymmetry to interracial crime. The problem of interracial violence is overwhelmingly one of black assaults on whites. While more than 97 percent of white criminals victimize white people, up to 67 percent of black criminals also victimize white people. According to U.S. Department of Justice statistics for 1987, 200 million whites committed 87,029 violent assaults on blacks while nearly 30 million blacks committed 786,660 violent attacks on whites. This averages out to 1 out of every 38 blacks violently assaulting a white in one year, and only 1 out of every 2,298 whites assaulting a black. The black criminal's preference for white victims is at least 60 times that of the white criminal's preference for black victims. Levin (1992) has discussed some of the social implications of racial discrepancies in crime production.

Aggregation and Reproductive Behavior

In a critique, Silverman (1990) made a suggestion that I have adopted (chap. 8) of differentiating the races in terms of "reproductive potency" rather than, as I had previously been doing, in terms of "sexual restraint." Silverman (1990: 6) noted:

> Rushton has performed a novel synthesis in pulling together an array of anatomical, physiological, maturational, and behavioral differences among races, converging on the same pattern, which seems unquestionably rooted in evolutionary processes.

Generally, however, more *ad hominem* attacks have been levelled for the work on sexual behavior than any other. Zuckerman and Brody (1988: 1031) referred to a "strange naivete," an "ethnocentric bias," and a "puritanical esthetic sensibility"; Leslie (1990: 891) labeled it "transparent racist pseudoscience"; and Weizmann et al. (1990: 8) referred to it as "anthroporn." Weizmann et al. ridiculed one reference in particular (French Army Surgeon, 1898/1972) for containing "a recipe for do-it-yourself penis enlargement employing an eggplant and hot peppers!" They alleged this reference was the only source for some of the data, including an item on erect penile angle being parallel to the body in Orientals and at right angles in blacks.

Perhaps it is because data on genital size and sexual potency imply a link with animal reproductive systems that so many reacted with outrage. The interesting question, hardly addressed, is why these differences originated and what purpose they serve. A French Army Surgeon (1898/1972) was only one of several ethnographic sources. He had spent 30 years as a specialist in venereal disease in the French Foreign Legion stationed in Africa, the Middle East, the Caribbean, and French Indochina. Although it was a minor item, the black-white difference in the angle of erection reported by him was confirmed in the Kinsey data (Table 8.4, item 74) as were many other items on penis size and sexual habits (chap. 8).

In a reply to the critique by Weizmann et al. (1990), I pointed to the extensive itemization and re-analysis of the Kinsey data, the reviews of the international surveys carried out by the World Health Organization, and the surveys carried out within the United States since Kinsey, all of which showed that, in reproductive activities, Mongoloids were more restrained than Caucasoids who, in turn, were more restrained than Negroids (Rushton, 1991a). I also discussed the world wide prevalence of AIDS and other sexually transmitted diseases. Unfortunately, the tone of Weizmann et al.'s (1991: 49), counter-response was captured in their labeling of another of the citations as "ethnopornography."

Nevertheless, many legitimate concerns can be raised about the data on sexuality. M. Lynn (1989a, 1989b) and Cunningham and Barbee (1991) questioned the representativeness of Kinsey's samples, the validity of self-report measures, the degree of experimental control over possible confounding variables, and the modifiability of reproductive behavior as indexed by changes from one generation to another. These issues can only be dealt with by the collection of more data and by aggregating over different types of study.

M. Lynn (1989a, 1989b) responded that aggregation cannot overcome any initial selectivity in choosing studies. He emphasized the importance of locating *all* the relevant research on a topic and then cited several studies failing to replicate the race differences. These included reports that sexually experienced blacks had intercourse less often than whites, that on a measure of fertility in Brazil the three races ranked exactly opposite to prediction, and that infertility in the United States was higher for blacks than for whites.

Debate can go back and forth on particulars. Thus, I pointed out that the reason that blacks suffer higher infertility than whites is because of their higher proportion of sexually transmitted diseases, a problem for Negroid populations worldwide (Rushton, 1989a, 1989f). Africa is known to be differentiated from other areas of the world in having these diseases as the major cause of infertility (Cates et al., 1985).

Some critics have suggested that even if all the data were to be included in a gigantic meta-analysis, and the results shown to be as I claim, the outcome would still be a biased one because only those studies consonant with pre-existing stereotypes have been published (Fairchild, 1991; M. Lynn, 1989b;

Weizmann et al., 1991). The best response here is to reiterate that better data must be collected. In collecting these data, however, we must be just as alert to the possibility of bias toward the null hypothesis as toward "pre-existing stereotypes." Cunningham and Barbee (1991), for example, suggested that many of the gender differences that had seemed well established in the 1950s had vanished by the 1980s. However, Cunningham and Barbee (1991) failed to consider the possibility that this was because strong "politically correct" feminist pressure had biased the publication process toward data consistent with the null hypothesis (Levin, 1987).

Aggregation and Other Variables

Similar rejoinders to those made against brain size, sex, and crime have been made to other data sets. With respect to personality, Zuckerman (1990) deconstructed the ordered data from cross-cultural studies into national and even tribal particulars and made the pattern disappear. With respect to developmental status, counter-examples have been provided showing that girls from Hong Kong have an average age of menarche of 12 years and girls from Africa an average age of 15 years (Groves, 1991; M. Lynn, 1989a).

With cognitive performance, Flynn (1984, 1987, 1989, 1991) has discussed how, because IQ in the developed world has been rising for 30 years, it is premature to assume that environmental factors cannot account for racial differences. Flynn (1991) calculated that when generational changes in test scores are taken into account, the Mongoloid-Caucasoid difference disappears. Even the data on black-white differences in IQ contain anomalous studies. Scarr (1987), for example, claimed that black children in Britain are not educationally disadvantaged until age 8, and that in Bermuda at 12 years of age they score two years above U.S. whites on tests of school achievement.

Much disputed also is the contention that the pattern of racial differences in behavior show up historically. Some have suggested that blacks played a significant intellectual role in the civilization of ancient Egypt (Weizmann et al., 1991). Some proponents of Afro-centrism have gone so far as to claim that Aristotle and other geniuses from ancient Greece stole their ideas from black Africa (James, 1992). Flynn (1989) challenged the evidence of history on law abidingness, pointing to the authority-driven criminality of this century in China, Japan, Germany, and Russia. Gabor and Roberts (1990: 343) dismissed the entire effort of examining such data as "idle speculation" with "no place" in the scientific enterprise.

Is the Genetic Evidence Flawed?

Some critics hold to the position that until the genes themselves are mapped, inferences about their effects on behavior are unwarranted. Lovejoy (1990: 909-910) wrote:

> I am particularly interested in Rushton and Bogaert's (presumably) polygenic models for the inheritance of "social organizational complexity," and their projections as to the prospect of identifying which chromosome bears the loci which lead to "decentralized organizations with weak power structures." Perhaps these are pleiotropic characters of a single dominant gene?

If taken seriously, such reasoning would undermine the value of any epidemiological research, a prerequisite for detailed genetic analyses. It would even have denied the strategy of Charles Darwin who, of course, never knew the mechanism by which characters were inherited. Genetic effects were not discovered until years after Darwin's death and the biochemical structure of genes not until decades after. I can only refer such critics to the discussion of distal-proximal explanations in chapter 1.

Some who disapprovingly reviewed the early behavior genetic literature held that the heritability of intelligence should be set at zero (e.g., Kamin, 1974). A 100 percent denial of genetic influence continues to be promoted, most forcefully by Lewontin (1991; Lewontin et al., 1984). One argument is that because development is so complicated and genetic x environment interactions are so ubiquitous it is impossible to disentangle causality and apportion variance separately to genes and environment (Hirsch, 1991; Wahlsten, 1990). These complexities are considered to undermine theorizing on race differences. Lewontin (1992, ix) continues to call for the "dialectical relation" elaborated by Karl Marx in which organism and environment are somehow "fused" as subject and object, a point elaborated on by Lerner (1992) in his account of "developmental contextualism."

In general response to the complexity discussion Bouchard (1984: 182) made a forceful point: If context and interaction effects are so ubiquitous and genetic effects so complicated, how can it be that monozygotic twins reared apart grow to be so similar in so many ways? Siblings raised away from each other grow to be significantly similar to each other, with their degree of similarity being predicted by the number of genes they share. This implies the presence of genetically based stabilizing systems driving development into a common channel (see Table 3.1 and Figures 3.3 to 3.5).

The specific analyses presented for the heritability of race differences have also been debated. M. Lynn (1989a: 30) attributed the findings in Table 9.2, showing that black children raised by white middle-class families regress to their population mean in IQ scores and educational level, to "self-fulfilling prophecies." There is, however, scant (if any) evidence for such effects (Jensen, 1980a).

M. Lynn (1989a: 31) dismissed as "faulty logic" the discussion of how combining within-family and between-family analyses ruled out between-family sources of variance such as social class, thereby leaving in genetic and within-family sources of environmental variance. He similarly dismissed regression to the mean effects and attributed them to environmental effects and called the finding that Japanese inbreeding depression scores predict the magnitude of the black-white difference on the same tests (Figure 9.1) as a "coincidence" (p. 32).

Evidence against the genetic hypothesis was marshaled by Sandra Scarr (1987) who summarized her 20-year program of research on black-white differences in a presidential address to the Behavior Genetics Association. First, using the twin method, she reported lower heritabilities among blacks than among whites, suggesting that among blacks, environmental effects had a more repressive effect. (Willerman, 1979: 440–44, has reviewed other studies showing a lower heritability of IQ in blacks.) Second, using blood groups as genetic markers of African ancestry, Scarr reported that degree of African ancestry did not correlate with IQ test scores. Third, her study of transracial adoption analyzed to that point in time had found that 7-year-old black and mixed-race children reared by upper-middle-class white parents scored above the IQ norm for white children in the same area. Fourth, cross-cultural studies showed that black children in Britain did not become educationally disadvantaged until after age 8, and that black children in Bermuda scored two years above U.S. white children on tests of vocabulary, reading, and mathematics at age 12. Fifth, preschool intervention programs remedied early disparities.

Scarr (1987) concluded that, although for whites, genes strongly influenced individual and social class differences, for blacks, culture imposed limitations on individual mobility and so causal relationships were different. She maintained that racial categories were more rigidly prescribed statuses than social classes. More generally her theory of how people made their own environments was held not to apply to people with few opportunities (Scarr, 1992). Additional evidence against the genetic hypothesis was cited by Zuckerman and Brody (1988) who referred to Eyferth's work showing that the IQs of children fathered by U.S. troops and reared by their white German mothers were the same, irrespective of whether their biological fathers were black or white.

Problems exist in the counter-research too, of course. First, in Scarr's study comparing black and white twins, no tests of zygosity were made (see commentaries in Scarr, 1981). Instead, Scarr inferred monozygotic and dizygotic variances from knowledge of the relationship between opposite-sex pairs who are necessarily dizygotic but who are overrepresented in black samples because of the greater production of female offspring among blacks. Her procedures underestimated heritabilities for all samples, including the whites, among whom the heritabilities ranged from 4 to 44 percent, lower than the 50 to 80 percent more typically estimated. Moreover, Osborne (1978, 1980) subsequently showed heritabilities of greater than 50 percent for a sample of 123 pairs of black adolescent twins, similar to those calculated for a comparison group of 304 pairs of white twins.

Second, with the study of African ancestry, as discussed by Jensen (1981), a positive correlation existed between skin color and blood group ancestry, suggesting that skin color was as good an indicator of African ancestry as were blood groups. But the effects of skin color were statistically controlled for in Scarr's study. If they had not been, African blood groups would have correlated with test scores, as predicted by genetic theory. A significant statistical relation between skin color and IQ among Negroid-Caucasoid hybrids was calculated by Shockley (1973; see also Shuey, 1966). He estimated that for low IQ black populations there is a one-point increase in average "genetic" IQ for each 1 percent of Caucasian ancestry, with diminishing returns as an IQ of 100 is reached.

With the adoption, cross-cultural, and early intervention studies, it is accepted that environments affect IQ and scholastic attainment to a magnitude of 6 to 10 IQ points, even when the heritability is as high as 70 percent (Jensen, 1989). However, the strongest intervention and between-family environments effects are observed among pre-adolescents and not among post-adolescents. The results from the adoption studies cited by Scarr (1987) and Zuckerman and Brody (1988) are based on children who were no older than 13 years of age. The results are thus comparable to those from several American adoption studies showing that the common family environment can affect development up until puberty, after which it is less likely to do so (Plomin & Daniels, 1987).

Post-puberty, causal influences on behavior are increasingly of the genetic and within-family variety. Thus, it would be interesting to know what happened after puberty to the black and white German children in the studies by Eyferth cited by Zuckerman and Brody (1988). The results of the 10-year follow-up to the transracial adoption study conducted by Scarr and her colleagues (Table 9.2), not available to Scarr (1987) at the time of her address to the Behavior Genetics Association, is problematic to the environmentalist perspective because it suggests that the black children regressed to their population mean in IQ.

Is *r-K* Theory Correct?

Several writers have claimed that my theoretical account ignored ecological processes and assumptions that are central to the *r*- and *K*-selection concept (Anderson, 1991; Lerner, 1992; Miller, 1993; Weizmann et al., 1990, 1991). One reason for widespread confusion even among ecologists has centered on the climatic conditions most likely to produce *r*-selection. For example, Barash (1982: 306) wrote, in his textbook *Sociobiology and Behavior*:

> Although the distinction between *r* and *K*-selection was first made explicit by MacArthur and Wilson (1967), it was actually suggested nearly 20 years previously by the great evolutionary geneticist Theodosius Dobzhansky (1950). He noted that, in general, inhabitants of the temperate and arctic zones suffered mortality that was largely independent of their population density, occurring because of large-scale environmental fluctuations, such as drought, storms, sudden influx of large

> numbers of predators. In such conditions, mortality was relatively independent of individual characteristics, so parents ensured their reproductive success by generating a large number of offspring (that is, *r*-selection). By contrast, Dobzhansky emphasized that tropical species competed most intensely with one another rather than with the environment. The relatively benign habitat was virtually filled with organisms, so the difference between success and failure was by producing not a large number of offspring but rather a smaller number of well-endowed descendents (that is, *K*-selection).

Barash, however, is incorrect. *Predictability* is the ecological necessity for *K*-selection. This can occur in either a stable environment or a predictably variable one. What has apparently been misunderstood is that subtropical savannahs, where humans evolved, because of sudden droughts and devastating viral, bacterial, and parasitic diseases, are less predictable for long-lived species than are temperate and especially Arctic environments. Although the Arctic climate varies greatly over one year, it is highly predictable, but harsh, over many years (Rushton & Ankney, 1993).

Many critics have made the classic mistake (many ecologists do also) of confusing variable and unpredictable. Weizmann et al. (1990: 2) claimed that, because of their longer ancestry in stable tropical climates, blacks should be more *K*-selected than other human groups. Miller (1993) also suggested that the converse might be true, that arctic animals with variable winter cycles, would be *r*-selected. But, of course, they are not. Long-lived arctic mammals like polar bears, caribou, muskox, seals, and walruses are highly *K*-selected, as are Arctic people. The reason is that the Arctic environment is not only highly variable, but more importantly, is highly predictable as well. (More generally, data show that plants, lizards, and mammals become more *K*-selected with increasing elevation and latitude [Zammuto & Millar, 1985].)

Annual food shortage in the arctic is predictable, that is, people knew that it would be difficult to find food for 4 to 6 months every year. Thus, this selected for *K*-traits. If an individual had the traits necessary to plan ahead well, the individual's genes survived. Contrast this with tropical savannahs where disease epidemics and prolonged droughts were (and are) unpredictable. Under such conditions an individual that produced many descendants during favorable conditions would be most likely to have some that survived (unpredictable) catastrophes. Alternatively, if an arctic-dwelling person put maximal effort into mating/reproduction he or she likely wouldn't survive for one year; their offspring certainly would not.

Additional criticisms have been made of my (Rushton, 1985a, 1988b) version of *r-K* theory (originally termed "differential *K* theory" to emphasize that all human beings are *K*-selected relative to other animals). Some have insisted that *r-K* theory is applicable only at the level of the species or, at best, to well-defined local populations, but is not applicable to variation within species (Anderson, 1991; Lerner, 1992; Weizmann et al. 1990, 1991). This criticism ignores both the origins of the theory (MacArthur & Wilson, 1967) and the within-species studies of plants, insects, fish, and nonhuman mammals (chap. 10). Other complaints that predictions about altruism, law abidingness, and sexuality are arbitrary and do not derive from *r-K* theory, rest on an incomplete understanding of what the original codifiers of the theory have written (see chap. 10 for references and page numbers).

Are Environmental Explanations Sufficient?

Many environmental theories have been proposed to explain racial differences. Typically the theories are sociological in nature and specify global and diffuse processes such as poverty and systemic white racism. Evidence then often consists of zero-order correlations such as those between race and socioeconomic indicators. Psychological theories have also been proposed. The most detailed and powerful of these I will refer to as "environmental *r-K* theory," to be presented shortly. First, let us consider alternatives.

Freudian Theory

In *Civilization and It's Discontents,* Freud (1930/1962) noted a positive correlation between restrained sexuality and the production of culture. He proposed that repressing aggressive and sexual instincts led them to be sublimated into higher cultural products. Because African children are raised more permissively than are European or American children, their instincts are less subject to being repressed and thus blacks develop uninhibited personalities but lowered economic success.

The toilet training variant of Freud's theory was found in the literature of the early 1950s. This held that African children, not trained to control their bowels until a considerably later age than European children, developed an extraverted culture with values of sensual self-expression and a relaxed heterosexual attitude to sex. At the other end of the scale were Orientals who were toilet trained at a very early age, and thereby became puritanically self-disciplined and oriented toward achievement.

Ice versus Sun People

An evolutionary-based psychological theory of "ice" versus "sun" people by Bradley (1978) was promoted by Leonard Jeffries, Jr., chair of the Black Studies Department at the City College of New York. He held that people of European ancestry, whom he called "ice people," were intrinsically greedy and intent on domination, while people of African descent, or "sun people," were humanistic and communal. Jeffries suggested that abundant skin pigment in African Americans gave them intellectual and physical advantages over whites ("White Professor Wins Court Ruling," *New York Times*, September 5, 1991).

Sex Ratio Theory

Cunningham and Barbee (1991) proposed an ecological analysis based on high infant mortality rates and a scarcity of black males. They hypothesized that a stressful environment led to high black infant mortality rates, particularly *male* infant mortality. The subsequent shortage of adult black males undermined female sexual restrictiveness and encouraged sexual behavior. Males would be reluctant to marry and invest in parenthood and, instead, would mate with a number of women sequentially; single mother births would be common and male attitudes would be misogynistic. Attitudes of sexual permissiveness combined with a high infant mortality rate would encourage high rates of reproduction.

Messner and Sampson (1991) elaborated on this general model to explain the disproportionate amount of crime committed by blacks. It might have been predicted that, because males are more involved in violent crime than females, populations with fewer male births (i.e., blacks) would produce less crime per capita than populations with more male births (i.e., Orientals). But, the opposite occurs. Messner and Sampson (1991) explained the paradox by suggesting that a shortage of men necessarily increases the number of female-headed households, which in turn leads, through poor socialization, to higher levels of underachievement and crime. Crime in turn leads more black men to go to prison, which exacerbates the cycle.

If reproductive patterns are ecologically induced states, rather than genetically maintained traits, then as an ecological setting became more supportive and the infant mortality and unbalanced sex ratio were reduced, the high reproduction rates should also be reduced. Cunningham and Barbee (1991) analyzed the 1960-1985 U.S. fertility data to test this hypothesis. Differences in black/white birth rates were indeed associated with differences in infant mortality rates. As black mortality rates declined, birth rates also declined at rates parallel to that of whites. Thus, it was reasoned, sexual behavior in blacks and whites were equally responsive to their ecologies and there was no necessity to postulate genetic differences.

Further supporting Cunningham and Barbee's (1991) analysis are recent data from the U.S. census on infant mortality. The U.S. National Center for Health Statistics provided breakdowns on infant mortality for 1988. By race, per 1,000 live births, blacks = 18, whites = 9, and Orientals = 5. On the other hand, babies born to college-educated blacks have a higher mortality rate than those born to similarly educated whites, a finding that seems to undermine the idea that poverty and poor medical care are mostly to blame for the difference (Schoendorf et al., 1992).

One reason for the racial disparity in infant mortality is that black women give birth to greater numbers of low-birth weight babies who are considered premature. However the thesis advanced in this book is that the lower birth weight and shorter gestation of blacks is part of a genetically based racial difference in life history (chap. 10). The environmentalist case is that premature births are due to the stress brought on by "complex discriminatory effects" (Wise & Pursley, 1992). On the other hand, predictably, Orientals have a greater number of male births than Caucasoids (James, 1986) and there is at least some evidence that the sex ratio is partly heritable (J. S. Watson, 1992), perhaps mediated hormonally (James, 1986).

Environmental r-K Theory

Prior to my (Rushton, 1984, 1985a) application of *r-K* analyses to human variation, others had explained group differences using an *r-K* approach *without* recourse to genetic factors (Weinrich, 1977; Cunningham, 1981; Draper and Harpending, 1982; Reynolds and Tanner, 1983; Masters, 1984; Weigel and Blurton Jones, 1983). All of these authors postulated that individuals living in unpredictable environments with consequent resource scarcity and uncertainty that offspring would survive to reproductive maturity, would be induced to opportunistically produce as many children as possible while giving less parental care.

Draper and Harpending (1982, 1988) proposed that father absence was a critical determinant of later reproductive strategy. Due to learned perceptions about the predictability of the environment, low-income and father-absent families were said to adopt an opportunistically oriented *r*-strategy of high "mating effort" whereas high-income and father-present families adopted a future-oriented *K*-strategy of "parenting effort." The more predictable an environment is learned to be, the more a *K*-strategy would be adopted. Draper and Harpending reviewed the correlates of the "mating effort" strategy and its culmination in the father-absent child: poor school performance, anti-authoritarianism, aggressiveness, sexual precocity, and criminality. They concluded that "father-present societies are those where most males act like dads and father-absent societies are those where most males act like cads" (1988: 349).

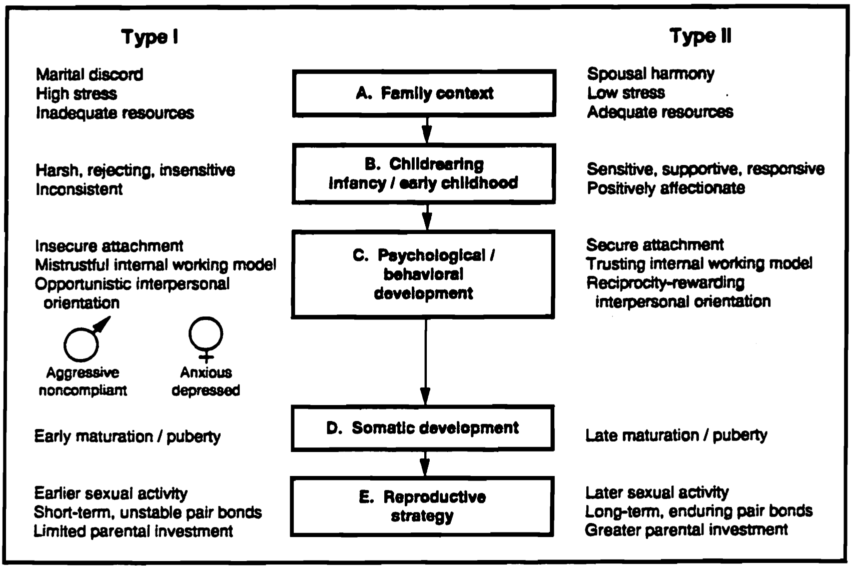
Building on the earlier work by Draper and Harpending, environmental theories of the development of reproductive strategies have been proposed by Belsky, Steinberg, and Draper (1991) and Chisholm (1993). Thus, two diverging pathways (Figure 12.2) were succinctly described by Belsky et al. (1991: 647):

> One is characterized, in childhood, by a stressful rearing environment and the development of insecure attachments to parents and subsequent behavior problems;

in adolescence by early pubertal development and precocious sexuality; and in adulthood, by unstable pair bonds and limited investment in child rearing, whereas the other is characterized by the opposite.

These predictions have been confimed in several longitudinal studies. In one, over 900 16-year-old New Zealand girls were assessed with a diverse battery of psychological, medical, and sociological measures every 2 years from age 3 to age 15 (Moffit, Caspi, Belsky, & Silva, 1992). Family conflict and father absence in childhood predicted an earlier age of menarche, independent of body weight. In longitudinal studies in the United States, Jessor, Donovan, and Costa (1991) predicted onset of sexual intercourse among adolescents from knowledge of whether they had low scores in academic achievement and religiosity, and high scores on measures of deviance and "problem

Figure 12.2: Developmental Pathways of Divergent Reproductive Strategies



In pathway 1, a discordant, stressful, or otherwise unpredictable early environment leads to insecure attachment, an early onset of sexual activity, an opportunistic interpersonal orientation, and limited parental investment. In pathway 2, a harmonious and predictable early environment leads to a delayed onset of sexual activity, a reciprocally rewarding interpersonal orientation and large amounts of parental investment. From Belsky, Steinberg & Draper (1991, p. 651, Figure 1). Copyright 1991 by the Society for Research in Child Development. Reprinted with permission.

behavior." Multiple correlations reached predictive levels greater than 0.50 accounting for approximately 30 percent of the variance over a 9-year interval.

Additional aspects of sexuality are predictive. Age of menarche is related to adult orgastic capacity and sexual activity in both women (Raboch & Bartak, 1981) and men (Raboch & Mellan, 1979). In a review of the literature on early menarche, Surbey (1990) found a significant positive correlation between mothers and daughters' menarcheal ages and for early menarche to be associated with a cluster of social and sexual behaviors related to a woman losing her mate or never living with the father of her child. Promiscuity, high school drop out, and other problem behaviors were also more likely.

In a longitudinal Swedish study of 1,400 individuals, Magnusson (1992) found that early-maturing girls had cheated, been truants, got drunk, and tried marijuana more often than late-maturing girls. Conflicts with parents and teachers were more common and the early-maturing girls were less interested in school and future education. The early-maturing girls entered pair relationships earlier, married earlier, had children earlier, and entered the labor market earlier.

Environmental *r-K* theories could be integrated with the genetic polymorphism perspective that individuals are genetically inclined to one developmental pathway over another. Many have insisted, however, that the racial pattern can be explained, even from a reproductive strategy perspective, "without necessitating any underlying genetic variability" (Mealey, 1990: 387). For example, Mealey reported international findings on infant mortality showing the pattern of Negroids most, Caucasoids intermediate, and Mongoloids least. But, she held that this pattern could be parsimoniously explained through poor maternal nutrition leading to high overall mortality. She concluded:

> All in all, I find the pattern that Rushton presents interesting and worth pursuing; but his interpretation is not the only one compatible with existing data. Differential utilization of reproductive strategies may be environmentally contingent rather than genetic, and apparent group differences a result, therefore, of the segregation of different human groups into different environments.

Certainly the potency of nutrition as an environmental factor seems reasonable. It has recently been advanced as an important variable for consideration by R. Lynn (1990b) and by Eysenck (1991a, 1991b). Across ages and settings, studies have shown that adding a vitamin and mineral supplement to normal diets increased intelligence and positive social behavior such as paying attention, keeping one's temper, and refraining from fighting (Eysenck & Eysenck, 1991). Eysenck elaborated (1991b: 329): "The possibility needs at least to be considered that there may be *biological* ways of improving brain function, including giving the brain additional nourishment to enable it to function at an optimal level." R. Lynn (1990b) suggested that improved nutrition may have been the crucial factor underlying the massive rise in mental test scores over the past 50 years in 14 European and American nations, as documented by Flynn (1984, 1987).

Eysenck (1991a: 124) applied a nutrient deficiency hypothesis to the pattern of race differences:

> [I]t may be useful to point to ways of testing some of the consequences which would seem to follow from my hypothesis. It would seem that Negroid children should benefit significantly more from dietary supplementation than Caucasoid, and Caucasoid slightly more than Mongoloid. Equally, determination of vitamin and mineral deficiencies should find these more plentiful in Negroid than in Caucasoid, and in Caucasoid than in Mongoloid children. African blacks should come out worst, and benefit most. These suggestions are easily testable and findings should be of obvious social and scientific importance.

However, there is no evidence to show that nutrition causes an inverse relation between brain size and gamete production. Postulating some genetic variance seems indispensable to explain the consistency of the racial ordering across so many attributes, including the macrophysiological variables of brain size, egg production, and hormone level. A mixed 50 percent evolutionary and 50 percent environmental model fits the data better than either the 100 percent environmental or the 100 percent genetic alternatives.

It is always easy to hypothesize poorly defined causal factors to explain race differences for which there is actually no scientific evidence. Jensen (1973) labeled these "X-factors," that is, factors that can account for anything, but cannot be proved or disproved. Most analyses of racial differences are superficial and diffuse. If understanding in this area is to advance, it is essential that hypotheses be made with greater clarity and with the capacity for generating differential predictions.

The mechanism of paternal provisioning has been postulated by E. M. Miller (1993, 1994) to be a more exact specification of the evolutionary process by which the races became differentiated. A continuum of male paternal effort is focused on, ranging from none to maximum. Miller proposed that, in warm climates, females can typically gather enough food to support themselves and their children. In cold climates, however, hunting is required, and females typically do not hunt. Thus, males in cold climates were selected to devote more of their effort to provisioning and less to seeking matings. Thus, for males, during the hunter-gatherer period of human evolution, the optimal combination of mating effort and paternal investment varied with the severity of the winters. In Africa, a strong sex drive, aggression, dominance seeking, impulsivity, low anxiety, sociability, extraversion, and a morphology and muscle enzyme suitable for fighting lead to mating success, whereas in northeast Asia, altruism, empathy, behavioral restraint, and a long life assisted success in provisioning. Although Rushton and Ankney (1993) suggested that Miller's account is not different from *r-K* theory, Miller's work does show the value of highlighting particular processes.

Is Race Science Immoral?

Some have claimed that human sociobiology is not a science and exists only to justify existing social inequalities; they attack sociobiology for viewing war and xenophobia as inevitable parts of human nature. It is claimed that a socially just society is impossible if "selfish" genes truly act to influence, in the service of their reproduction, our mores, our social institutions, and our culture. As Lewontin et al. (1984: 18) put it:

> Biological determinism is, then, a reductionist explanation of human life in which the arrows of causality run from genes to humans and from humans to humanity. But that is more than mere explanation: It is politics. For if human social organization, including the inequalities of status, wealth, and power, are a direct consequence of our biologies, then, except for some gigantic program of genetic engineering, no practice can make a significant alteration of social structure or of the position of individuals or groups within it.

At the extreme, sociobiological work, especially on race, is associated with the Nazis. It is held that the Nazis would not have achieved power if their general ideology had not been widely accepted in Germany. They could not have realized their racial program—including the murder of Jews, Gypsies, and the insane—without the help of an ideology of biological determinism (Lerner, 1992; Lewontin, 1992; Muller-Hill, 1988, 1992). This is the position taken by Richard Lerner (1992: 147) in *Final Solutions:*

> Rushton's thinking, so redolent of Nazi-era political and scientific pronouncements about advances in cures of genetic disease, is nothing more than the most recent instance of genetic determinist ideology promoted as science. His work, and that of many other contemporary sociobiologists, is poor science and represents a fatally flawed basis for prescribing social policy. Scientists and citizens alike must confront both these domains of shortcomings. If we do otherwise, we are allowing history to repeat itself.

The underlying logic of these political critiques is grievously flawed. Scientific theories do not cause people to commit murder. Nonetheless, all ideas can be used to justify hatred. But here, religious and egalitarian ideas have just as bad a history. The Reign of Terror following the French Revolution (1789) and the 70 years of Communist dictatorship following the Russian Revolution (1917) show how readily idealism can be perverted. Thus, it is totalitarianism in the service of fanaticism that causes people to be murdered, not theories of human nature.

Opponents of the genetic study of racial differences are either unable or unwilling to separate their political agendas from the scholarly pursuit of truth; many seem to deny that it is even possible, a view that stems from nihilistic ideas of the relativity of truth and Marxist claims that even scientists are motivated by class interests. Perhaps there is some reality here and one could go further and postulate that ideologies also reflect genetic interests (chap. 4). Obviously, abundant sources of bias operate. The scholars we should try to emulate, however, are the ones who have managed to transcend the particulars of their individual circumstances in order to discern truth more closely.

There are no necessary policies that flow from race research. The findings are compatible with a wide range of recommendations: from social segregation, through laissez-faire, to programs for the disadvantaged. Yet effective public policies must be based on sound scientific conclusions rather than popular assumptions or misconceptions. Social problems of poverty, crime, drug abuse, and unemployment often have an ethnic dimension, whether examined in "developing," "ex-communist," or "developed" countries (Klitgaard, 1986). As the world continues a trend toward a global village it will be more necessary than ever to come to terms with the degree of genetic variation within the human species.

From an evolutionary point of view it is to be expected that separate breeding populations will come to differ, genetically, in the mechanisms underlying their behavior. This is because behavior, like morphology, represents at least in part, the adaptation of gene pools to particular environments. The existence of genetic variance both within and between populations is, in fact, the first postulate of Darwinian theory. (The second is that some parts of this variance are more successful at replication than are other parts.)

Rejection of a genetic basis for human variation is not only poor science, it is likely to be injurious to both unique individuals and complexly structured societies. Nor does adopting an evolutionary outlook disconfirm the democratic ideal. As E. O. Wilson (1978) put it: "We are not compelled to believe in biological uniformity in order to affirm human freedom and dignity" (p. 52). He went on to quote the sociologist Bressler (1968):

> An ideology that tacitly appeals to biological equality as a condition for human emancipation corrupts the idea of freedom. Moreover, it encourages decent men to tremble at the prospect of "inconvenient" findings that may emerge in future scientific research.

The deeply pious Blaise Pascal said, regarding the condemnation of the Copernican hypothesis: "If the earth moves, a decree from Rome cannot stop it." As Enrico Fermi remarked, "Whatever Nature has in store for mankind, unpleasant as it may be, men must accept, for ignorance is never better than knowledge." The danger comes when we violate Fermi's adjuration (often with humanitarian arguments), not when honest scholars discuss ideas freely and openly. Ultimately, the study of racial differences may help us to appreciate more fully the nature of human diversity as well as the binding commonalities we share with other species (E. O. Wilson, 1992). That, too, would be one of the legacies of the Darwinian perspective.

13

Conclusions and Discussion

Across time, country, and circumstance, African descended people show similarities that differentiate them from Caucasoids who, in turn, show similarities differentiating them from Orientals. Although variation occurs from country to country, consistency is found within racial groups with Chinese, Koreans, and Japanese being similar to each other and different from Israelis, Swedes, and American whites, who, in turn, are similar to each other but are different from Kenyans, Nigerians, and American blacks.

The stepwise function of racial characteristics are summarized in Table 1.1. Mongoloids and Caucasoids have the largest brains, the slowest rate of dental development, and produce the fewest gametes. No environmental factor is known to cause an inverse relation between brain size and gamete production nor cause so many diverse variables to cohere in so comprehensive a fashion. There is, however, a genetic factor: evolution.

The Main Findings

Brain Size

The size of the brain has been estimated using three main procedures: weight at autopsy, within-skull (endocranial) volume, and external head volume. Data collected over 150 years were summarized in chapter 6 and averaged. Mongoloids were found to have a sex-combined brain volume of 1,364 cm^3, Caucasoids 1,347 cm^3, and Negroids 1,267 cm^3. While sampling and methodological difficulties may be identified in each source, results obtained from diverse procedures allow a triangulation on probable truth. The sex-combined world average brain size was estimated to be 1,326 cm^3.

The racial differences in brain size show up early in life. At birth, 17,000 white infants in a U.S. national study had significantly larger head perimeters than 19,000 black infants even though, by 7 years, black children were taller and heavier (Broman et al., 1987). In all groups, head perimeter at birth and at age 7 correlated with IQ at age 7 from 0.10 to 0.20. Small differences in brain volume translate into millions of excess neurons.

Intelligence

Among humans there is a small but robust correlation between brain size and intelligence. Using a simple tape measure, head perimeter reliably correlates between 0.10 and 0.30 with intelligence test scores for children, university students, and military conscripts (Table 2.2). The relationship has been found among Oriental students as among white students (Rushton, 1992c) and among black children as among white children (Broman et al., 1987). Correlations of about 0.40 between brain size and IQ have been confirmed in studies using magnetic resonance imaging to measure adult brain size *in vivo* (Andreasen et al., 1993; Raz et al., 1993; Wickett et al., 1994; Willerman et al., 1991).

Race differences in intelligence have been noted since the time of World War I when widespread testing began with blacks scoring about 15 IQ points lower than whites in the United States, the United Kingdom, the Caribbean, and in sub-Saharan Africa. Orientals score higher than whites on exactly the same measuring instruments, whether tested in Canada and the United States, or in their home countries. A major review of the global distribution of intelligence by R. Lynn (1991c) found the racial pattern to occur whether assessed by standard tests, by cognitive decision times, or by contributions to civilization. Lynn also reported that nonhybridized African blacks scored significantly lower than the hybridized blacks in the United States and Caribbean.

Speed of Maturation

On numerous measures of dental and physiological maturation, the distinct racial pattern emerges across the life span. Blacks are fast, compared with Caucasians, while Orientals are slow. For example, black babies have a shorter gestation period than white babies and yet are born physiologically more mature with superior muscular strength and eye-hand coordination. As infants they are able to crawl, walk, and dress earlier than whites and Orientals. Black toddlers typically begin to walk at 11 months, compared to Caucasians at 12 months, and Mongoloids at 13 months. Speed of dental development, indexed by onset of permanent molar teeth shows Africans to average about 5.8 years and Europeans and northeast Asians at 6.1 years. Other life-cycle traits, including age at first intercourse and age at first pregnancy, as well as longevity, show a similar set of differences among the three populations.

Personality

In personality, blacks are less inhibited than whites who are less inhibited than Orientals. With infants and young children, observer ratings are the main method employed, whereas with adults the use of standardized tests are more frequent. One study carried out in Quebec examined 825 4- to 6-year-olds in French language classes for immigrant children. Teachers consistently reported better social adjustment and less hostility-aggression from Asian children than from Caucasian children than from black children. With adults, Rushton (1985b) aggregated the results from 25 countries using the Eysenck Personality Questionnaire and found 8 Oriental samples (N = 4,044) to be less sociable and more anxious than 30 Caucasoid samples (N = 19,807) who were less sociable and more anxious than 4 African samples (N = 1,906).

Marital Relations

Marital stability can be assessed by rate of divorce, out-of-wedlock birthing, child abuse, and delinquency. On each of these measures, the rank ordering within American populations is Oriental < white < black. The unique African-American pattern is also to be found in Africa, south of the Sahara, and to predate the colonial period (Draper, 1989). In Africa, biological parents do not expect to act as a unit to be the major provider for their children. The African pattern typically contains some or all of the following distinctions: (1) the early onset of sexual activity; (2) loose emotional ties between spouses; (3) the expectation of sexual union with many partners, and children by them; (4) lowered maternal nurturing with long-term "fostering" of children, sometimes for several years, to nonprimary caretakers, with the stated reason sometimes being to remain sexually attractive to future sexual partners; (5) increased male-male competitiveness for females and lowered paternal involvement in child rearing or maintenance of single pair-bonds; and (6) higher fertility, despite education and urbanization.

Crime

In law abidingness, Asian Americans are underrepresented and African Americans overrepresented in crime. Internationally, African and Caribbean countries report twice the amount of violent crime (murder, rape, and serious assault) as do European or Middle East countries and three times more than do countries in the Pacific Rim. Summing crime data from INTERPOL and averaging across years gives figures per 100,000 population, respectively of 142, 74, and 43. A similar disproportionate racial pattern is to be found within industrialized Western cities such as London, England, and Toronto, Canada, as well as cities within the USA.

Reproductive Behavior

Differences in reproductive anatomy and physiology exist, including in the rate of gamete production caused in part by differential rates of ovulation.

Data collected from the Kinsey Institute for Sex Research, the World Health Organization, and from around the world consistently show a racial pattern for intercourse frequencies (whether assessed maritally, premaritally, or extramaritally), secondary sexual characteristics (salient voice, muscularity, buttocks, and breasts), biologic control of behavior (periodicity of sexual response, predictability of life history from onset of puberty), as well as in androgen levels and sexual attitudes.

Differences in sexual activity translate into consequences. Teenage fertility rates around the world show the racial gradient. So does the pattern of sexually transmitted diseases. World Health Organization Technical Reports and other studies examining the worldwide prevalence of AIDS, syphilis, gonorrhea, herpes, and chlamydia typically find low levels in China and Japan and high levels in Africa, with European countries intermediate.

Conclusion

In sum, the racial gradient of Oriental-white-black occurs on multifariously complex dimensions. From brain size, intelligence, and personality to law abidingness, social organization, and reproductive morphology, Africans and Asians average at opposite ends of the continuum, with Caucasian populations falling intermediately. This racial ordering is reflected in global rankings made by Orientals, as well as by whites. In a social perception study, Orientals viewed themselves as having more intelligence, industry, anxiety, and rule-following behavior than whites or blacks, while being significantly lower in activity level, sociability, aggressiveness, strength of the sex drive, and genital size (Table 7.4).

Reproductive Strategies

The ultimate aim of science is to causally explain the natural world rather than only to describe it. Accounting for the total array of international evidence summarized above necessitates a more powerful theory than would be required to explain any single dimension from the set. It also requires going beyond the particulars of any one country.

My thesis is that archaic versions of what were to become the modern Caucasoid and Mongoloid peoples dispersed out of Africa about 100,000 years ago and adapted to the problem of survival in predictably cold environments. The evolutionary process required a bioenergetic trade-off that increased brain size and social organization (*K*) at the expense of egg production and sexual behavior (*r*).

The *r*-*K* scale is generally used to compare what are often widely disparate species, but I (Rushton, 1992b: 817-18) used it to describe the immensely smaller variations within the human species:

> Generalizing from the animal literature to human differences, the more *K* the family, the greater should be the spacing between births, the fewer the number of offspring, the lower the rate of infant mortality, the more stable the family system, and the better developed the parental care. The more *K* the person, the longer should be the period of gestation, the higher the birthweight, the more delayed the onset of sexual activity, the older the age at first reproduction, the longer the life, the more physiologically efficient the use of energy, the higher the intelligence, the more social rule-following the behavior, and the greater the altruism. Thus, diverse organismic characteristics, not otherwise relatable, are presumed to covary along a single dimension.

Because the races differ on many of the *K* characteristics, I hypothesized that Orientals are more *K*-selected than Caucasoids, who in turn are more *K*-selected than Negroids. Thus, the posited racial differences in behavior belong in a broader evolutionary context than had been considered to date.

An African Origin

The ancestors of modern humans, the australopithecenes, *Homo habilis,* and *Homo erectus* all made their first appearances on the African continent. Thus, Africa is the cradle of humankind. There are two competing theories, however, to explain how racial differentiation occurred during the final stages of hominid evolution. These are the Multiregional and the Single Origin theories.

Both theories agree that by a million or more years ago *Homo erectus* had emerged out of Africa to populate Eurasia. They are divided on whether the descendants of these *erectus* populations (the Neanderthals in Europe, Beijing Man in China, and Java Man in Indonesia) gave rise to modern ancestors, or whether these were evolutionary dead ends supplanted by a wave of anatomically modern people arising in Africa only 200,000 years ago.

The position taken in this book has been to favor the single origin "Out of Africa" model. Chapter 11 reviewed the genetic, paleontological, archaeological, linguistic, and behavioral data supporting this conclusion. However, it is not crucial for the general position whether the races began their divergence 1 million years ago or only 100,000 years ago.

Given an African origin of less than 200,000 years ago, a dispersal event out of Africa about 100,000 years ago, and a peopling of the rest of the world thereafter, the question arises as to how these events led to the behavioral profiles found among the races. The suggestion is made that colonizing temperate and cold environments led to increased cognitive demands to solve the problems of gathering and storing food, gaining shelter, and raising children successfully in cold winters, including the ice ages, which ended only about 10,000 years ago. As the original African populations evolved into Caucasoids and Mongoloids, they did so in the direction of larger brains, slower rates of maturation, and lower levels of sex hormone with concomitant reductions in sexual potency, aggressiveness and impulsivity, and increases in family stability, forward planning, self-control, rule-following and longevity.

Genes in Addition to Environment

Many of the observed racial correlations are said to be due to purely cultural modes of transmission. The Chinese and Japanese are known to provide intact family backgrounds where they socialize conformity, restraint, and tradition. An opposite pattern is found among African-descended people who come from less integrated families and who are undersocialized for achievement. However, the physiological data on the size of the brain, the rate of maturation, and the production of gametes, as well as the cross-cultural consistency of the racial pattern, shows that genetic and evolutionary influences also play a role.

Purely environmental explanations of the differences cannot explain the complete pattern of the life history. Also impossible to explain from an environmental perspective is why the group differences are strongest on those items with the greatest heritability. For example, the most heritable subtests of the Wechsler Intelligence Scale for Children predicts best the magnitudes of the black-white differences (Rushton, 1989e). Similarly, the higher a test's *g* loading, the more predictive it is of black-white differences (Jensen, 1985, 1987b). These are *differential* expectations. Heritable *g* would only predict difference scores if those difference scores were under genetic influence.

The results from a longitudinal study of black children adopted by white families also supports the genetic perspective (R. A. Weinberg et al., 1992). After being raised for 17 years in white families, the black children do not resemble their white siblings. At 7 years of age the black children's IQ was comparable to those of their white siblings, but 10 years later the black children had reverted to their population mean in IQ and educational achievement.

Another line of reasoning for the heritability of racial group differences is that many of the variables on which the races differ are substantially heritable. Chapter 3 reviewed the behavior genetic literature on intelligence, rate of maturation, strength of the sex drive, altruism, family structure, and law abidingness. Occasionally heritabilities have been calculated for races other than Caucasoids and found to be comparable. Thus, a greater than 50 percent heritability for mental ability was calculated for 123 pairs of black adolescent twins by Osborne (1978, 1980) and a heritability of 58 percent was reported for several hundred Japanese 12-year-old pairs by R. Lynn & Hattori (1990).

Generalizing the *r-K* Formulation

If one generalizes the information from the macro-scale characteristics outlined in Table 10.1 and Figure 10.3 to the within-race human variation,

TABLE 13.1
Direction of Correlations Among Human Life-History Variables Found to Date

Life-history variables	Herit-ability	SES	Race	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Dizygotic twinning	+	+	+																
2. Birth spacing	0	+	0	+															
3. Family size	+	+	+	+	+														
4. Marital stability	0	+	+	+	0	0													
5. Parental care	0	+	+	0	0	0	+												
6. Infant mortality	0	+	+	+	0	0	+	+											
7. Gestation period	0	+	+	+	0	0	0	0	+										
8. Birth weight	+	+	+	+	0	0	0	0	+	+									
9. Age of puberty	+	–	+	+	0	0	+	+	0	0	0								
10. Age of first coitus	+	+	+	+	0	0	+	+	0	0	0	+							
11. Age of reproduction	+	+	+	+	0	0	+	+	0	0	0	+	+						
12. Stature	+	+	–	+	0	0	0	0	0	0	0	0	0	0					
13. Longevity	+	+	+	+	0	0	+	+	0	0	0	0	0	0	0				
14. Intelligence	+	+	+	+	+	+	+	+	+	+	+	–	0	0	+	+			
15. Law abidingness	+	+	+	+	0	+	+	+	+	0	0	0	+	+	0	+	+		
16. Sex drive	+	0	+	+	0	0	0	0	+	0	0	0	0	0	0	0	0	+	

Note. Updated from Rushton (1985, p. 450, Table 2). Copyright 1985 by Pergamon Press. Reprinted with permission. Positive signs document correlations in accord with the theory, negative signs document those contradictory, and zeroes represent those not yet known.

several falsifiable predictions can be derived. A summary of the variables expected to intercorrelate is shown in Table 13.1, along with positive and negative evidence and identification of those variables not yet examined.

From Table 13.1 it can be seen that while many variables remain to be investigated, of those that have been, most are in the expected direction. There are some anomalies. Although it is predicted that the higher a person's socioeconomic status, the later he or she would enter puberty, the opposite appears to be true (Malina, 1979). Another contradictory finding occurs with body size. Because large body size is indicative of a *K*-strategy, Mongoloids should be larger than Caucasoids or Negroids, and yet the opposite is true. Large body size should dispose to law abidingness, and yet the evidence here too is in the opposite direction. Perhaps the most striking aspect of Table 13.1, however, is the infrequency of such lapses. Additional relationships among the variables can be considered. While some of the ideas are speculative, they may be worthy of further investigation.

Family Structure

Double ovulation and the production of two-egg twins has been related to several *r-K* traits. Mothers of dizygotic twins can be considered to represent the *r*-strategy. Their characteristics have been contrasted with mothers of singletons representing the *K*-strategy (Rushton, 1987b). Predictably, the mothers of dizygotic twins are found to have, on average, a lower age of menarche, a shorter menstrual cycle, a higher number of marriages, a higher rate of coitus, more illegitimate children, a closer spacing of births, a greater fecundity, more wasted pregnancies, a larger family, an earlier menopause, and an earlier mortality. Further, twins typically have a shorter gestation, a lower birth weight, a greater incidence of infant mortality, and a lowered IQ.

Other family structure variables such as marital breakup and single parenting are related to *r*-characteristics such as child abuse, lower intelligence, educational dropout, sexual precocity, and juvenile delinquency (Draper & Harpending, 1988; J. Q. Wilson & Herrnstein, 1985). To quote again the distinction made by Draper and Harpending (1988: 349): "Father-present societies are those where most males act like dads and father absent societies are those where most males act like cads."

Sexuality

The developmental transition in the lives of most young people from virginity to nonvirginity takes place within a network of individual, social, and behavioral factors that go beyond mere covariation. In two longitudinal studies, Jessor et al. (1991) found that early onset of sexual intercourse was predicted from knowledge of whether adolescents had low scores in academic achievement and religiosity, and high scores on measures of deviance and "problem behavior." Multiple correlations reached predictive levels greater than 0.50 accounting for approximately 30 percent of the variance over a 9-year interval.

Personality and sexuality have been related. Eysenck (1976) found that, compared to introverts, extroverts typically have intercourse earlier, more frequently, and with more different partners. These findings were replicated by Barnes, Malamuth, and Check (1984). More historically, in *Civilization and Its Discontents,* Freud (1930) explained the existence of a positive correlation between restrained sexuality and the production of culture through the psychodynamics of repression and sublimation. The perspective being outlined here explains it in terms of genetically correlated traits. Energy can be allocated to reproductive effort either directly through sexual behavior or indirectly through the ability to produce complex social institutions and thereby compete when resources are scarce.

Sexual behavior varies by social class. Weinrich (1977) examined over 20 studies from the world literature and concluded that the lower the socioeconomic status, the earlier the age of first coitus, the greater the likelihood of premarital coitus and coitus with prostitutes, the shorter the time before engaging in extramarital affairs, and the less stable the marriage bond. Weinrich (1977) also found that the higher the socioeconomic status, the more likely the individual was to engage in sexual activities beyond those directly leading to conception, including fellatio, cunnilingus, petting, and affection, and coitus during menstruation. Moreover, although lower socioeconomic status adolescents apparently knew as much about birth control devices as upper socioeconomic status adolescents, they used them less frequently.

Of interest are social class differences in the production of two-egg twins. Monozygotic twinning is nearly constant at about 3 1/2 per 1,000 in all groups. Dizygotic twinning, however, is greater among lower than among upper social-class women in both European and African samples (Golding, 1986; Nylander, 1981).

Altruism and Law Abidingness

Because they are lower in altruism and disrupt rather than maintain social organization, criminals are considered to represent the *r*-strategy. Ellis (1987) found that criminals have the following *r*-strategy traits: large numbers of siblings (or half-siblings); families in which parents no longer live together; shorter gestation periods (more premature births); more rapid sexual maturation; greater copulatory frequency outside of bonded relationships (or at least a preference for such); less stable bonding; lower parental investment in offspring (as evidenced by higher rates of child abandonment, neglect, and abuse); and a shorter life expectancy.

Antisocial and other problem behaviors like alcohol and drug abuse are linked to early onset of sexual intercourse (Jessor et al., 1991). Among adolescents, 36 to 49 percent of the variance in nonsexual forms of deviance in siblings of either sex could be explained by the amount of sexual behavior engaged in by the other (Rowe et al., 1989).

Conscientiousness at work, as well as more obvious criminal behavior, has also been linked to temperament and intelligence (Elander, West, & French, 1993). Some evidence has suggested that introverts are more punctual, absent less often, and stay longer at a job, whereas extroverts spend more time talking to their workmates, drinking coffee, and generally seeking diversion from routine. Accidents by bus drivers have also been found to be predicted by intelligence and extraversion (Shaw & Sichel, 1970).

Health and Longevity

As shown in Figure 10.3, humans are the only primates with a post-reproductive phase. One explanation for menopause is that since the human body becomes weaker with age, women eventually reach a point where continued childbearing would endanger their lives. While there is no equivalent pressure on men, sperm production declines with age. By 45 years of age, a man is producing only 50 percent of the sperm he was producing at 18 years of age, and most older men have difficulty attracting fertile females. Thus, in the evolutionary past, older people better aided copies of their genes by caring for grandchildren and the extended family than by producing additional offspring themselves. With increasing *K*, grandparents will have to remain healthier and live longer to be able to do this effectively since both their own offspring and their children's offspring will be delaying reproduction to later ages. In both developed and developing countries early maternal death is associated with short spacing of births and total number of children.

Lower socioeconomic classes have higher death rates than upper socioeconomic classes and these differences have increased in the past several decades. *The Black Report* and other studies record a growing disparity in death rates between occupational classes in England and Wales (Black et al., 1982; Whitehead, 1988; Marmot et al., 1991). For example, in 1930 people in the lowest social class had a 23 percent higher chance of dying at every age than people in the highest social class. By 1970, this excess risk had grown to 61 percent. A decade later it had jumped to 150 percent (Black et al., 1982). This increasing disparity presents a paradox especially when a national health service system has long existed in Britain to minimize inequalities in health-related services.

Similar gaps have been noted in France and Hungary during the past two decades (Black et al., 1982). The inverse relation between mortality and socioeconomic status has also been increasing in the United States. One large study showed that over the 26-year period between 1960 and 1986, health inequalities according to educational level increased for whites and blacks by over 20 percent with respect to women and by over 100 percent with respect to men (Pappas et al., 1993).

The increasing correlation of health and social class is explainable from an *r-K* perspective when it is appreciated that removing environmental barriers to health increases the variance accounted for by genetic factors (Scriver, 1984). In a parallel way, increasing equality of educational opportunity leads to an increase in the heritability of educational attainment (Heath et al., 1985). Generally, removing environmental impediments makes individual-difference variance more dependent on innate characteristics. This implies that, in the 1990s at least, and on average, more genes coding for good health and longevity exist in persons of the upper classes than in persons of the lower classes (Rushton, 1987a).

Intelligence

Many studies show a negative relation between intelligence and family size (Vining, 1986). Others have found that when family size is held constant, birth spacing is important: the greater the spacing between births, the higher the intelligence of the children (Zajonc, Markus, & Markus, 1979; Lancer & Rim, 1984). Intelligence is also related to speed of maturation, temperament, social organization, health, and longevity (Jensen, 1980a).

The central role of intelligence in law abidingness is demonstrated by the finding that IQ has an effect on delinquency independent of family background, race, or class. Siblings reared together in the same families show almost the same degree of association between IQ and delinquency as is found in the general population (Hirschi & Hindelang, 1977). The relation between IQ and delinquency was measured by self-reports as well as by incarcerations, so the result is not just due to clever people evading capture. Less intelligent people often lack behavioral restraint, marriage-bonding techniques, adequate parenting styles, and moral rules, and are less capable of creating stable personal circumstances or of predicting their environment.

Personality

Extroverts may be less *K* than introverts for they are described as "active," "impulsive," and "changeable" while introverts are "careful," "thoughtful," and "reliable" (Eysenck & Eysenck, 1975). With respect to academic success, some evidence suggests that while extraverted children may perform better in school up until puberty, after this introverts gain a progressive advantage (Anthony, 1977; Eysenck & Cookson, 1969). Jensen (1980a) reported a tendency for introverts to perform faster on reaction-time measures of intelligence than extroverts. Finally, there is the evidence that extroverts are less conditionable and more criminal than introverts (Eysenck & Gudjonsson, 1989). An underlying dimension of "behavioral restraint" may be involved (Gray, 1987).

Masters (1989) suggested an *r-K* integration of Cloninger's (1986) three-dimensional system of personality based on neurotransmitter functions. According to Cloninger, harm avoidant vs. risk-taking is associated with serotonergic transmission, novelty-seeking vs. stereotyping rests on dopaminergic transmission, and reward dependence vs. social independence rests on noradrenergic transmission. Masters hypothesized that *r*-strategists are those with risk-taking, novelty-seeking, and reward-dependent personalities while *K*-strategists are those with harm-avoidant, conventional, socially-independent personalities.

Masters went on to connect *r-K* strategies with preferences in assortative mating (chapter 4). *K*-strategists were said to prefer others who were genetically similar, in part, because they are not risk takers, whereas *r*-strategists do not necessarily prefer similarity, in part, because they seek novelty. Thus, spousal similarity will be less in *r*-strategists. Masters used *r-K* theory to explain why interethnic dating is more frequent among poorer *r*-groups (e.g., in Hawaii) than in wealthier *K*-groups.

Social Class Differences

Sociobiological theorizing leads to the expectation that terrestrial primates such as *Homo sapiens* will form themselves into dominance hierarchies with those at the top exhibiting higher levels of whatever traits make for success in that culture and in turn get a greater than equal share of whatever scarce resources are available. In hunting societies those at the top will be the best hunters; in warrior societies those at the top will be the best warriors, and so on. As the last few pages and Table 13.1 show, socioeconomic status correlates substantially with most of the variables psychologists are interested in, including intelligence, health, sexuality, crime, aggression, family structure, and social attitudes. It seems reasonable to suggest that within races higher socioeconomic groups are more *K*-strategists than lower socioeconomic groups (Rushton, 1985a).

With regard to intelligence the socioeconomic hierarchies of technological societies are built on intelligence, measured by standard IQ tests. Several reviews of this literature have appeared (Herrnstein, 1973; Jensen, 1980a). The basic finding is that there is a difference of nearly 3 standard deviations (45 IQ points) between average members of the professional and the unskilled classes. These are group-mean differences, with considerable overlap of distributions. Nonetheless, the overall correlation between IQ and social class is about 0.50.

Within-family variation has been known for some time in the literature on intelligence. In studies of intergenerational social mobility, Mascie-Taylor and

Gibson (1978) and Waller (1971) obtained the IQ scores of both fathers and their adult sons. They found that children with lower test scores than their fathers had gone down in social class as adults while those with higher test scores had gone up. Within-family differences also occur in sexuality with some siblings adopting the early onset syndrome (Rowe et al., 1989). As Weinrich (1977) noted, adolescents moving from one social class to another behave like their acquired class rather than the class they were socialized in by their parents.

In the study of external head measurements from a stratified random sample of 6,325 U.S. Army personnel, Rushton (1992a) found that after adjusting for the effects of stature, weight, sex, and race, the cranial capacity of officers averaged 1,393 cm^3 and that of enlisted personnel, 1,375 cm^3.

Biological Mediators

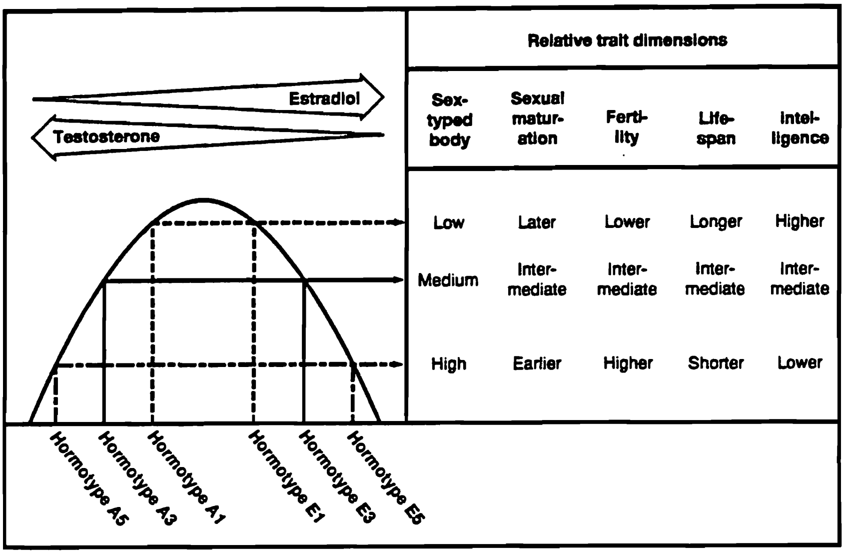
One advantage of an evolutionary perspective is the focus it brings to underlying physiology including the endocrine system. As indicated in chapter 8, there are reliable differences among the races in testosterone. Relative to whites, blacks have more and Orientals have less.

Testosterone may order many of the racial differences, for it has been related to self-concept, temperament, sexuality, aggression, and altruism, in women as well as in men (Baucom, Besch, & Callahan, 1985; Dabbs, Ruback, Frady, Hopper, & Sgoutas, 1988). In a study of 4,462 U.S. male veterans, where extensive archival records were available, Dabbs and Morris (1990) found testosterone correlated with reports of childhood delinquency, adult delinquency, drug use, alcohol abuse, military misconduct, and having many sex partners. Testosterone is also involved in the development of secondary sexual characteristics such as muscularity and depth of voice (Haeberle, 1978; Hudson & Holbrook, 1982) as well as the organization and structure of the brain.

A person's position on the *r-K* dimension might be set by a hormonal switch mechanism. Reproductive strategies need to be coherent and harmonized, not with some traits going to one pole and other traits going to the opposite pole. Inasmuch as the switch regulator is genetically based, it suggests a functional polymorphism within populations, with extreme *r*-strategists at one end and extreme *K*-strategists at the other, with most people being normally distributed between the two and environmental factors modifying and fine-tuning the system.

A sex hormone model to explain *r-K* strategies was provided by Nyborg (1987). He extrapolated for life-history traits the optimum level of estradiol that he had previously proposed to explain spatial ability. Because hormones go everywhere in the body they are uniquely able to exert more or less simultaneous effects and coordinate widespread development and functioning.

Figure 13.1: Sex Hormone Model for Coordinating Development Across Body, Brain, and Behavioral Traits



Relative trait dimensions				
Sex-typed body	Sexual maturation	Fertility	Life-span	Intelligence
Low	Later	Lower	Longer	Higher
Medium	Intermediate	Intermediate	Intermediate	Intermediate
High	Earlier	Higher	Shorter	Lower

Men are classified in accordance with testosterone concentration into hormotypes A5 (high testosterone) to A1 (low testosterone) and women are classified into hormotypes ranging from E1 (low estradiol) to E5 (high estradiol). Men with high testosterone and women with high estradiol are the most sex-typed. Men with low testosterone and women with low estradiol are most similar to each other (androgenous). In this model Mongoloids are A2/E2, Caucasoids A3/E3, and Negroids A4/E4. After Nyborg (1987).

Nyborg's model provided an explanation of covariant trait development based on "hormotyping."

Hormotyping classifies people in accordance with the balance among their plasma concentration of androgens such as testosterone and estradiol. As shown in Figure 13.1, an inverse relation between testosterone and estradiol is assumed. Males can be hierarchically ordered with 5 levels of androgen from A5 (most) to A1 (least) and females can be classified by levels of estradiol from E1 (least) to E5 (most). Hormotypes A3 and E3 represent individuals with close to average male testosterone values or average female estradiol values, respectively. Hormotypes A1 and E1 represent so-called androgynous males and females, that is, males who in addition to ordinary masculine traits also show some clearly feminine traits, or females who in addition to the usual feminine traits show some clearly masculine attributes as well.

Figure 13.1 shows that at the beginning of the inverted U-shaped curve, the most androgenized males (A5) would be furthest from the zenith of *K* with intermediately androgenized males (A3) closer and the least androgenized males (A1) closest. With increasing degrees of estrogenization (E1 to E5) females move away from zenith. Nyborg (1987, 1994) proposed that Orientals are typically hormotype A2/E2 and Africans are hormotype A4/E4. The graphics to the right of the curve show the direction of effects on various traits of increasing testosterone.

Nyborg (1994) predicts that blacks should be more sexually dimorphic than whites who should be more sexually dimorphic than Orientals. Numerous other falsifiable predictions are possible from this heuristic model. If this, or some other hypothesis like it was eventually confirmed, it would provide a commanding proximal explanation of how the various traits distribute themselves as they do.

A model like the one shown in Figure 13.1 can readily accommodate bidirectional causality. So far it has been implied that optimal neurohormonal balances are inherent. As Kemper (1990), among others, has pointed out, hormonal processes are themselves susceptible to social influence. For example, testosterone in both men and women is affected by dominance acquired through valued social attainments. Kemper reviewed several studies showing that testosterone levels became elevated in young men who won tennis matches, wrestling matches, or entry to medical school, but they showed a decline in the losers. Similarly, Masters (1989) cited work on the effects of many environmental factors, including carbohydrate intake, exposure to light, and social interaction on neurotransmitter levels, such as serotonin. In chapter 12, the hypotheses of Eysenck and R. Lynn were discussed on the importance of nutrition.

A central locus for research attention is brain functioning. Brain size has become the key factor in life-history theory, acting as the biological constant determining many variables, including the upper limit on the size of the group cohesively maintained through time (Dunbar, 1992), as well as such life history variables as speed of physical maturation, degree of infant dependency, and maximum recorded life span (Harvey & Krebs, 1990; Hofman, 1993).

It is of interest to wonder where the 90 cm^3 difference between Mongoloids and Negroids (perhaps 500 million neurons) is located. The relation between brain size and intelligence was discussed in chapter 2. The brain obviously mediates other variables too. Gray (1987) has described the cytoarchitecture and functioning of the behavioral inhibition and other systems that he postulates underlie such relevant components of temperament as cautiousness and sociability, which also differentiate the races. Recently initiated Magnetic Resonance Imaging studies, and other mapping techniques, in conjunction with tests of various mental abilities, are certain to illuminate further these fascinating aspects of human biology.

The Fertility Paradox

The main theme of this book is that human behavior is determined by a biological imperative to preserve and replicate DNA. The means by which this will be accomplished will differ as a function of both genetic and ecological circumstance. Only recently has the importance of individual variation in the control of reproductive behavior begun to be investigated. Previously, it was assumed that fluctuations in population size were essentially an ecological problem, not a genetic one. The application of such analyses to human behavior may be especially novel.

One application of *r-K* theory is to the "fertility paradox." Vining (1986) asked why, if the replication of genetically similar genes is as strong a biological imperative as sociobiological theorizing suggests, are so many European populations experiencing negative growth? He reviewed data to show that, apart from a few cohorts who bore their children during the unique period of rising fertility from 1936 to 1960, there is a characteristically inverse relationship between fertility and "endowment" (wealth, success, and measured aptitudes).

The fertility paradox has been analyzed over centuries. Gobineau (1853-1855) had asked why great civilizations seemed destined to decay. He considered the reasons put forward by others—decline of religion, fanaticism, corruption of morals, luxury, bad government—and rejected them all on the evidence of history. Instead he provided an answer in terms of ethnicity and race. The character of a civilization was determined by the traits of the dominant race, often created by the union of several related tribes. If wealth grows, cities develop, and an international society forms. Among the new arrivals are persons belonging to ethnic taxa that have never initiated a civilization. Degeneration sets in and the intrinsic worth the people originally possessed becomes lost, for the population no longer has in its veins the same quality blood with which it began.

R. A. Fisher, who synthesized Mendelian genetics with Darwinian evolution, also discussed the question of why civilizations decay. In his book *The Genetical Theory of Natural Selection* (2nd ed., 1958), he showed that ruling groups fail to reproduce themselves because of low fertility. Fisher (1958) hypothesized a trade-off between the capacity for economic success and fertility. As discussed, this trade-off is more profound than Fisher realized, being related to a whole complex of characteristics partly genetic in origin. When there are abundant resources, selection pressures are off and natural selection favors *r*-genotypes so that segment of the population expands. Eventually, saturation point is reached and the population crashes (Malthus, 1798). With selection pressures back on, selection again favors *K*-genotypes. This occurs with rodents (C. J. Krebs et al., 1973) and a direct parallel is suggested with humans. With humans the situation is complicated by culture, which must also be taken into account.

If a gene-culture coevolutionary framework is correct (Lumsden & Wilson, 1983), then many interesting questions can be raised about the relation between genes, culture, and population growth. As discussed in chapters 3 and 4, epigenetic rules guide development over the life span, biasing individuals to learn or to produce those patterns of culture, from the available array, maximally compatible with their genotypes. The consequences, of course, feed back to affect the gene frequencies of subsequent generations.

Given that efficient energy use is a *K*-strategy (Table 10.1), does metabolic rate covary with body build and a preference for restrained social behavior? Given that colonization is an *r*-strategy (Table 10.1), are people who frequently move their habitat less *K* than those who do not? Given that degree of social organization varies with *K* (Table 10.1), are people who prefer less-structured interpersonal social systems less *K* than those organizing themselves into more formal ones? Assuming similar genotypes detect and seek each other out for friendship and marriage (chap. 4), is there social assortment on the *K* dimension? And, if people create cultures compatible with their genotypes, are all these tendencies not only related to each other but also to sociopolitical attitudes (e.g., order vs. freedom) and ultimately, to demographic trends and the very sweep of history?

Afterword

Race, Evolution, and Behavior describes three distinct racial profiles ranging over 60 anatomical and social variables, including brain size, personality and temperament, sexual habits and fertility, and speed of maturation and longevity. East Asians are, on average, slower maturing, higher achieving, more maintaining of family structure, more law abiding, and less sexually active than Africans, who tend to the opposite in each trait, with Europeans regularly falling between the other two racial groups. This racial matrix is internationally generalizable and therefore goes well beyond U.S. particulars. Evolutionary (and hence genetic) models are needed to reconcile the disparate sets of data. Exclusively sociocultural models will not do the job.

Following its publication, several reviewers offered positive assessments, sometimes accompanied by substantive critique (e.g., Brand, 1995; Browne, 1994; Flew, 1995; Francis, 1995; Gottfredson, 1996; Harpending, 1995; Lynn, 1996a; Ree, 1996; Salter, 1996; Snyderman, 1994; Taylor, 1994; Thiessen, in press; Whitney, in press; commentary in Jacoby & Glauberman, 1995). Other reviewers criticized the work as "bad science" (e.g., Ahmad, 1995; Armelagos, 1995; Barash, 1995; Brace, 1996; Blinkhorn, 1994; Lewontin, 1995; Palmer, 1995; Relethford, 1995; Sperling, 1994; Wahlsten, 1995; commentaries in Jacoby & Glauberman, 1995). One reviewer called the book a "betrayal of science" (Kamin, 1995). This Afterword responds by bringing the reader up to date on what has occurred, scientifically speaking, since the book went to press 3 years ago. Some of the data that have accumulated were gathered by me, some were gathered by colleagues, and some were gathered by people I don't even know. Together, however, they confirm much of what was written in the book.

Bell Curves

The simultaneous publication of Richard Herrnstein and Charles Murray's (1994) *The Bell Curve,* Seymour Itzkoff's (1994) *The Decline of Intelligence in America,* and the one you hold in your hands, all addressing the issue of race, genetics, and IQ, made it likely that they would be jointly reviewed. On October 16, 1994, Malcolm Browne, science writer at the *New York Times,* linked them in his *New York Times Book Review*. Browne concluded that "the government or society that persists in sweeping their subject matter under the rug will do so at its peril." Sweeping the topic under the rug, however, is exactly what was attempted.

The Bell Curve took most of the attention. It reported original analyses of 11,878 youths (3,022 of whom were African American) from the 12-year National Longitudinal Survey of Youth (NLSY). Most 17-year-olds with high scores on the Armed Forces Qualification Test (black as well as white) went on to occupational success by their late twenties and early thirties whereas many of those with low scores went on to welfare dependency. The average IQ for "African" Americans was found to be lower than those for "Latino," "white," "Asian," and "Jewish" Americans (85, 89, 103, 106, and 115, respectively, pp. 273–78).

The flashpoint of discussion was whether the black/white difference was partly genetic in origin. *The Bell Curve* presented a clear rendition of the usual syllogism, that (a) IQ test scores are heritable in both black and white populations, (b) white IQs average higher than black IQs, therefore probabilistically (c) the black/white IQ difference is partly heritable. This syllogism, plus other findings like the black/white IQ difference being related to a test's heritability and to its loading on the general factor, or psychometric *g*, led a plurality of experts in behavioral genetics and psychometrics to give their opinion that part of the black/white IQ difference *was* genetic in origin (see p. 9 of this book). Herrnstein and Murray's book represented the mainstream view of IQ researchers.

My great admiration for *The Bell Curve* was overshadowed by the fact that it did not deal thoroughly enough with the genetic basis of racial differences. Equivocation was displayed even on whether "races" existed, and the position taken seemed unnecessarily vulnerable to environmentalist attack. Accordingly, I sifted the evidence it presented in a special symposium on *The Bell Curve* in *Current Anthropology* (Rushton, 1996a) and set out a basis for why the differences could only be understood fully from a gene-based evolutionary perspective. In an interesting afterword to the paperback edition of *The Bell Curve,* Murray accepted that Herrnstein and he had played down the heritability of race differences. Citing *Race, Evolution, and Behavior,* Murray drew attention to the significant and substantial relationship that exists between brain size and measured intelligence, to the differential distribution of brain size across races, and to the very low IQ scores of Africans south of the Sahara.

The furor over *The Bell Curve* led the American Psychological Association (APA) to establish an 11-person task force to fill an "urgent need" for an authoritative report "about the meaning of intelligence test scores and the nature of intelligence" (Neisser et al., 1996: 77). The report is generally even-handed, but on race it concluded: "There is certainly no [empirical] support for a genetic interpretation" (p. 97). Because this conclusion is likely to be cited against *Race, Evolution, and Behavior,* I will respond in some detail.

Among the facts omitted by the APA report are the following: (1) racial differences in IQ and speed of decision making found within the United States are paralleled by those found internationally; (2) IQ scores relate to brain size and, around the world, race differences in brain size parallel those in IQ; (3) IQ subtests high in heritability predict racial differences better than do subtests low in heritability; (4) transracial-adoption studies find that East Asian adoptees grow to score higher on IQ tests than do white adoptees whereas black adoptees grow to score lower than do white adoptees; (5) regression to the mean is greater for black children of high IQ parents and siblings than it is for white children of high IQ parents and siblings; (6) environmental influences on behavior are primarily those occurring within families rather than those occurring between families, thereby implying that factors such as racism and social class do not explain racial differences; (7) other variables such as crime, testosterone, the rate of dizygotic twinning per 1,000 births (caused by a double ovulation), and sexual behavior show the same international racial pattern as do IQ scores, with Europeans averaging intermediate to Asians and Africans, thereby implying IQ differences are part of a broader-based life history with roots deep in evolution.

The APA report assigned Asian Americans an average IQ of 98 based on a review by Flynn (1991). But Lynn (1993) showed that Flynn had "overcorrected" downwards an original review by Vernon (1982), not cited by the APA task force, which found Asian American IQ averaged 106. Omitted, too, was *The Bell Curve*'s own NLSY data showing an Asian American IQ of 106. This particular lapse was especially curious given that it was the debate over *The Bell Curve* that had led the APA to set up its task force in the first place!

Although the report admitted that Asian Americans did better than European Americans on a range of aptitude tests (e.g., ACT, SAT, GRE, MCAT), which are known to measure reasoning ability and to correlate highly with IQ, these were described as "content-oriented achievement tests" and linked to the high grades Asian Americans gain in school. Higher Asian IQ scores found in Asia were also disparaged but, again, with an acceptance of their superior school achievement. The generally greater performance of Asians despite equal or lower IQ was attributed to "cultural attitudes toward learning," "structural differences in the [Asian] schools," and possibly even "spatial ability" and "gene-based temperamental factors" (p. 92).

The APA report did not balance the equation by mentioning the gene-based temperament factors (discussed in chapter 7) that may play a role in black underachievement. Instead, the report emphasized "bias" in the tests, continuing discrimination, the alleged diminishing magnitude of black/white IQ differences over time, and the nature of African-American culture, which was said to alienate black children from the kind of educational processes that work with others. One might reasonably hypothesize, however, that some dysfunctional aspects of African-American culture, including denigration of educational achievement (D'Souza, 1995), are *products* of, rather than causes of, low IQ.

The APA report did not mention the IQ scores of blacks outside the United States. From a 1991 review by Richard Lynn, and a subsequent South African study by Kenneth Owen, I followed Lynn and estimated (chapter 6) that the average sub-Saharan African IQ was about 70. Blinkhorn (1994), Peters (1995), and Wahlsten (1995), among others, concluded that the rest of the book was suspect if it was reporting without comment an IQ level that implied that, by European standards, half the population of black Africa was "mentally retarded." Two subsequent studies, however, have been published on African IQ. First, Zindi (1994), a black Zimbabwean, matched 204 12- to 14-year-old black Zimbabwean pupils and 202 white English students from London inner-city schools for sex, educational level, and "working-class" background. Zindi's (1994) analysis of a variety of tests, including of nonverbal performance, found African children consistently scored two full standard deviations lower than did English children. Second, Lynn (1994) examined scores for Ethiopian immigrants to Israel on the Raven's test, matched them against European norms, and found a mean IQ of 70.

Within the United States, additional studies have confirmed the Asian/European/African gradient. Lynn (1996b) examined the standardization data of the Differential Ability Scale for a representative sample of the population stratified by age, sex, race, geographical location, urban-rural areas, parental socioeconomic status, and educational preschool enrollment. The main sample consisted of 2,260 children aged 6 to 17 years old. The Asian children's IQ averaged 107, the white children's IQ averaged 103, and the black children's IQ averaged 89. In a younger sample of 1,000 2½- to 6-year-olds, Lynn (1996b) found that the IQ of blacks was 85 and that of whites was 100, suggesting the APA report's conclusion that the black/white difference "may be declining" (p. 97) was inconsistent with the evidence. Another study of 3-year-olds (matched on age, gender, birth order, and maternal education for the fourth edition of the Stanford-Binet Intelligence Scale) found the average IQ for blacks was 85 and for whites 100 (Peoples, Fagan, & Drotar, 1995).

The *g* Factor

So misleading was discussion about *The Bell Curve* on IQ and the *g* factor that 52 scholars (myself included) published a statement outlining some of what is known about intelligence in the *Wall Street Journal* (December 13, 1994). IQ scores predict accident proneness, child neglect, crime and delinquency, health, and many other factors in addition to educational success and job competence. Moreover, critics rarely mention that IQ is correlated with a number of brain variables such as its size (see next section), electrical potentials, speed of operation on elementary cognitive tasks, speed of neural and synaptic transmission, and rate of glucose metabolism during cognitive activity.

Theoretically intriguing is the fact that correlations among different mental tests generally range from about 0.20 to 0.80. This empirical phenomenon, which is one of the most solidly substantiated facts in psychology, can be interpreted to mean that mental ability tests measure something in common. Charles Spearman called this "something" the *general* factor, which he symbolized as *g* (see this book on pp. 33–36, 54–55, 138–39, 186–88). Whether called "Spearman's *g*," "psychometric *g*," or just plain *g*, this construct refers to the component of individual difference variance that is common to all tests of mental ability. The *g*-factor is the *sine qua non* of all "IQ" tests, no matter what other sources of variance such tests may measure.

Much new work has taken place on the underlying basis of intelligence. Foremost among this is research on "inspection time" (Deary & Stough, 1996). In this paradigm, subjects quickly inspect two lines that are displayed for fractions of a second and then decide which of the two lines is longer. More intelligent people, as measured by standard IQ tests, require a shorter stimulus duration to reach a given level of accuracy. Overall correlations between IQ tests and fast intake speed reach 0.50 and higher. The correlations with inspection time are highest with the *g*-factor.

Brain Size and Cognitive Ability

The published research on this topic has now been summarized by Rushton and Ankney (1996). The well-established relationship has been most clearly shown using Magnetic Resonance Imaging (MRI), which creates, *in vivo,* a three-dimensional image of the brain. An overall correlation of 0.44 was found between MRI-measured brain size and IQ in 8 separate studies with a total sample size of 381 nonclinical adults, which is roughly equivalent to the strength of the relationship between socioeconomic status of origin and IQ. From 7 MRI studies of clinical adults (N = 312) the overall correlation was 0.24; from 15 studies using external head measurements with adults (N = 6,437) the overall correlation was 0.15, and from 17 studies using external head measurements with children and adolescents (N = 45,056) the overall correlation was 0.21. The relation between brain size and IQ appears early in life, for head perimeter at birth correlates with IQ scores at age 7, as determined in the National Collaborative Perinatal Project study of thousands of white and black children (described on pp. 37–41).

A functional relation between brain size and cognitive ability is implied in two studies by Jensen showing the head size/IQ relation *within* as well as *among* families. A tendency for a sibling with a larger head to have a higher IQ than a sibling with a smaller head is of special interest because it controls for many of the sources of variance that distinguish families such as cultural background and socioeconomic status. Jensen (1994) examined 82 pairs of monozygotic and 61 pairs of dizygotic adolescent twins and extracted the general factor, or psychometric *g*, from their IQ tests and found it correlated with head size across individuals ($r = 0.30$), within twin pairs ($r = 0.25$), and between twin pairs ($r = 0.32$). Jensen and Johnson (1994) examined the head size/IQ relation in several hundred pairs of siblings from the National Collaborative Perinatal Project and found that at 7 years of age (although not at 4 years) a significant correlation existed within families ($r = 0.11$) as well as between families ($r = 0.20$).

It is understandable that correlations between IQ and overall brain size will be modest. First, much of the brain is not involved in producing what we call intelligence; thus, variation in size/mass of that tissue will lower the magnitude of the correlation. Second, IQ, of course, is not a perfect measure of intelligence and, thus, variance in IQ scores is an imperfect measure of variation in intelligence. Although brain size accounts for only a small percentage of variation in cognitive ability, it is important to note, following Hunter and Schmidt (1990), that small correlations can have large effects. For example, although the MRI-established brain size/IQ correlation is only about 0.40, when squared it shows that 16 percent of the variance is explained, and it shows that, from regression predictions, for every 1 standard deviation increase in brain size, IQ will increase, on average, by 0.40 standard deviations.

Race Differences in Brain Size

Two corroborations have been made of black/white differences in brain size. Using magnetic resonance imaging to measure brain volume in a combined sample of 108 normal and clinical subjects in Britain, Harvey et al. (1994) found that 41 people of African and Caribbean background had a smaller brain volume than did 67 people of European background. However, Harvey et al. (1994) provided little information on ethnicity and no details on how, or if, the samples were matched for age, sex, or body size. Nonetheless, this MRI study would seem to be a harbinger of research to come.

In a study of cranial capacity in black and white adolescents, Rushton and Osborne (1995) examined data from 472 individuals aged 13 to 17 years comprising 222 whites and 250 blacks. Measures were taken of head length, head breadth, age, sex, race, height, weight, and cranial size estimated from head length and head breadth using standard equations. Age differences were found such that cranial size increased over the years 13 to 17 from 1,233 cm^3 to 1,279 cm^3. After adjusting for the effects of age and sex, but not for body size, white adolescents averaged a cranial size of 1,278 cm^3 and black adolescents averaged 1,241 cm^3, a difference of 36 cm^3. But the white adolescents were taller and heavier than were the black adolescents, so adjustments were also made for body size (stature and weight). White adolescents then averaged a cranial capacity of 1,269 cm^3 and black adolescents 1,251 cm^3, a difference of 18 cm^3.

TABLE A.1
Cranial Capacity (cm³) by Race (male only) in Home Continent and United States

	Home Continent								
	Asians	**N**	**Year**	**Europeans**	**N**	**Year**	**Africans**	**N**	**Year**
Autopsies (g x 1.036 = cm³)	1,422	16[1]	1918	1,440	13[2]	1922	1,273	4[3]	1895
Endocranial volume	1,491	1[4]	1984	1,441	1[4]	1984	1,338	1[4]	1984
Uncorrected head size	1,359	7[5]	1968	1,424	20[6]	1958	1,292	13[7]	1937
Corrected head size	1,416	2[8]	1975	1,378	1[9]	1975	1,337	1[9]	1975
Mean	*1,422*	*26*	*1961*	*1,421*	*35*	*1960*	*1,310*	*19*	*1948*
Mean of uncorrected and corrected head size	*1,388*	*9*	*1972*	*1,401*	*21*	*1967*	*1,315*	*14*	*1956*
	United States								
	Asians	**N**	**Year**	**Europeans**	**N**	**Year**	**Africans**	**N**	**Year**
Autopsies (g x 1.036 = cm³)	—			1,430	5[10]	1935	1,341	4[11]	1915
Endocranial volume	—			1,452	1[12]	1942	1,389	1[12]	1942
Uncorrected head size	1,465	1[13]	1992	1,483	14[14]	1962	1,436	2[15]	1959
Corrected head size	1,486	1[13]	1992	1,462	1[13]	1992	1,441	1[13]	1992
Mean	1,476	2	1992	1,457	21	1958	1,402	8	1967
Mean of uncorrected and corrected head size	*1,476*	*2*	*1992*	*1,473*	*15*	*1977*	*1,439*	*3*	*1976*
Increase in USA:									
(a) using all data	54 cm³			36 cm³			92 cm³		
(b) using head size date	88 cm³			72 cm³			124 cm³		
(c) head size % increase	6.3%			5.1%			9.5%		

Note: N = Number of studies. Year = Mean year data was published. [1]16 studies from Table 6.6. [2]13 studies from Table 6.6. [3]4 studies from Table 6.6. [4]Beals et al. study from Table 6.6. [5]4 samples from Table 6.3, plus 3 samples from Table 6.5. [6]7 samples from Table 6.2, 6 samples from Table 6.3, 7 samples from Table 6.5. [7]11 samples from Table 6.2, plus 2 samples from Table 6.5. [8]Rushton (1991, 1994) studies from Table 6.6. [9]Rushton (1994) study from Table 6.6. [10]5 studies from Table 6.6. [11]4 studies from Table 6.6. [12]Simmons (1942) study from page 110. [13]Rushton (1992) study from Table 6.6. [14]2 samples from Table 6.2, 10 samples from Table 6.3, 1 sample from Table 6.5, plus Rushton (1992) study from Table 6.6. [15]1 sample from Table 6.2, plus Rushton (1992) study from Table 6.6.

To determine whether the international distribution of brain size matched the pattern of IQ scores with blacks scoring 15 points higher in the United States than in Africa but with Asians and Europeans scoring the same in the United States as in their home continents, I re-examined the brain size data reported in chapters 5 and 6. Set out in Table A.1 are the most complete (male only) results. All races averaged larger brain sizes in the United States than in their home continents, but the gain was larger for Africans (92 cm^3) than for Asians (54 cm^3) or Europeans (36 cm^3). When comparisons are based only on the corrected and uncorrected head size data, where the cells are complete for all groups, once more the gain is larger for Africans (124 cm^3 or 9.5 percent) than it is for Asians (88 cm^3 or 6.3 percent) or for Europeans (72 cm^3 or 5.1 percent).

Table A.1 also gives the mean year of publication for each set of studies. These show a publication 20 years earlier for the home continent data. A secular trend in cranial capacity is also found across the 22 grouped data sets ($r = 0.48$, $p < 0.05$; with race statistically controlled, 0.39, $p < 0.05$). This secular increase is in accord with Miller and Corsellis's (1977) study of autopsy records in England showing a brain weight increase in men of 0.66 g per year (0.68 cm^3) from a mean of 1,372 g (1,421 cm^3) for those born in 1860 to 1,424 g (1,475 cm^3) for those born in 1940—a total of 52 g (54 cm^3). Recall that mean IQs in all economically developed nations have also been increasing over time, by about 3 IQ points a decade (pp. 191, 245, 255). The simplest explanation for all these gains is better nutrition. In addition, in the United States, blacks gain a 25 percent Caucasian genetic admixture as they do also for IQ (see p. 136).

The disaggregated data in Table A.1 are generally in accord with the Asian-white-black gradient in brain size, but there is a paradox. The brain size increases in Asians and Europeans living in the United States is not matched by any known gain in IQ over their home continent counterparts. On some measures, Asians living in Asia averaged smaller crania than did Europeans or Africans living in the United States. More and better studies are obviously needed to allow appropriate control for the larger body size of Americans (impossible in these particular data) and the use of MRI to identify features of the brain that correlate more highly with IQ than does volume.

Heritability

Researchers continue to find evidence for within-race heritabilities. As discussed in chapter 3, both adoption studies and the comparison of identical and fraternal twins allow assessment of genetic and environmental contributions to be made. In the study just described (Rushton & Osborne, 1995) of cranial size differences in black and white adolescents, the sample was made up of 236 pairs of twins (111 white pairs, 125 black pairs). For the total sample, the genetic contribution ranged from 38 percent to 51 percent, depending on particular adjustments for age and body size. Environmental effects common to both twins (such as parental socioeconomic status) ranged from 6 percent to 20 percent and environmental effects unique to each twin (such as illness and trauma) ranged from 42 percent to 52 percent. The proportionate contributions did not vary systematically by sex or race.

The heritability of aggression and crime has been much studied, but little or no genetic evidence has existed for violence,*per se*. To fill this gap, Rushton (1996b) examined retrospective self-reports about such violent acts as the destruction of property, fighting, carrying and using a weapon, and struggling with a policemen. The sample consisted of 274 adult twin pairs raised together from the University of London Institute of Psychiatry Twin Register. Correlational and model fitting analyses were carried out. For men, genetic influences accounted for 55 percent of the variance, whereas for women, most of the variance was due to environmental factors.

At the molecular level, Robert Plomin predicts that four years from now, social scientists will routinely use DNA markers in their research. His focus is on quantitative trait loci (QTL) which assumes that complex dimensions like intelligence and aggression are due to a small number of genes with effects of varying size rather than to the "one-gene, one-disorder" or the polygenic "many-genes-of-infinitesimal-effect-size" alternatives. In the QTL approach, genes contribute cumulatively and interchangeably, much as risk factors contribute to vulnerability. QTL associations for intelligence, personality, and crime now regularly appear in technical journals (e.g., Plomin et al., 1995; Cloninger et al., 1996). Once replicable effects of a reasonable size are established, it will be only a short step to seeing if the races differ in the allele.

Black Heritabilities

The powerful analogy of how seeds given a normal environment grow plants of full height but those given a deprived environment grow plants of stunted height has been used many times in the debate over race to show indisputable environmental effects. Recently, Block (1995) used a version of the analogy to launch a full-scale attack on the use of heritability. But it is an *empirical* question whether heritabilities for blacks are the same as, or different from, those for whites. It is a truism among geneticists that as environments become less impeding and more equal, genetic contributions become larger. For example, over the last 50 years, as environmental barriers to health and educational attainment have fallen, the variance accounted for by genetic factors has increased (Scriver, 1984; Heath et al., 1985). In animal studies, low heritabilities for body size variables are typically interpreted as showing a suppressant effect of the environment on natural growth.

The relevant question thus becomes: "Are heritabilities for blacks lower than those for whites?" Evidence for his proposition comes from the already discussed study of cranial capacity in black and white twins (Rushton & Osborne, 1995). A somewhat higher range of heritabilities (depending on corrections for age and body size) was found for whites than for blacks (47 to 56 percent *vs.* 12 to 31 percent), and a somewhat lower range of environmentalities was found for whites than for blacks (44 to 53 percent *vs.* 69 to 88 percent). Environmental factors could be having a more detrimental effect on brain development among blacks than among whites. These differences, however, did not achieve normal levels of statistical significance but they do point the way to how twin studies may inform about differentially harmful environments.

Support for generalizing within-group heritabilities to between-group differences comes from new work showing that the origins and structure of intellectual and social variables are virtually identical for blacks, whites, and Asians within the United States. Rowe, Vazsonyi, and Flannery (1994) used diverse but representative data sources to compare the similarity of correlation matrices for developmental and outcome variables for the various groups. The matrices were as similar to each other as were matrices computed from random halves within the same ethnic group. Ree and Carretta (1995) found a near identity of structure of intellect for ethnic groupings with the normative sample of the Armed Services Vocational Aptitude Battery (ASVAB) used to select applicants for all military enlistments in order to assign them to first jobs. Carretta and Ree (1995) found the same result with the more specialized Air Force Officer Qualifying Test (AFOQT), a multiple-aptitude battery given to applicants. Thus, average group differences result from different levels of the same processes, be they genetic or environmental. Rowe et al. (1994: 412) concluded:

> Researchers should also be encouraged: Results they obtain for one ethnic group or in one U.S. geographic location will probably generalize to other groups and locations. Powerful generalization is the hallmark of a successful scientific enterprise; it bodes well for the future success of social science that developmental processes are alike in many subgroups of *homo sapiens.*

Genetic Similarity Theory

Chapters 4 and 5 described how race consciousness, and its frequent concomitant racism, occurs in cultures throughout history and the world over. Chapter 4 also reviewed evidence showing that individuals typically recognize, prefer, invest in, and grieve most for the members of their species with whom they share the most genes. In her positive review of this book, Gottfredson (1996) thought that one of the more interesting sections was the one showing an evolutionary basis for ethnocentrism. She wrote: "The data are startling for the uninitiated. For example, spouses and close friends tend to be most alike on the most heritable traits."

Genetic similarity theory left others unimpressed. Waqar Ahmad (1995), writing in the *New Scientist,* claimed I had "hijacked" Richard Dawkins's idea of the selfish gene. More regrettable was an exchange in the journal *Animal Behaviour* with Russell and Wells (1994, 1995) who had been initial coauthors on genetic similarity theory and on some of the early evidence in its favor (chapter 4). Now they had moved to an "open verdict." The main empirical reasons they gave for their change of position were that: (1) assortative mating cannot always be shown to occur; (2) assortative mating sometimes occurs for purely environmental reasons; and (3) cross-ethnic marriages are frequent. I (Rushton, 1995a) replied with the standard behavioral genetic logic that even when environmental factors can be shown to make phenomena complex, genetic factors are not thereby ruled out. To rule genetic factors out it would be necessary to measure both environmental and genetic factors in the same study. Unfortunately, while sociobiological research with nonhuman animals continues unabated on the relative importance of genetic and environmental factors underlying nepotistic discrimination (e.g., Arnold et al., 1996), the parallel work with humans lags well behind.

Crime

A novel study of *When Women Kill* examined 296 female-perpetrated homicide cases cleared by arrest in 1979 and 1983 in the cities of Atlanta, Baltimore, Chicago, Houston, Los Angeles, and New York City (Mann, 1996) . Racial disproportions were similar to those found in male-perpetrated homicides. Of the arrests, 75 percent were African-American women, 13 percent were European-American women, and none were Asian-American women (the remainder were "Latina"). Typically, the offender was a single, thirty-one-year-old unemployed mother with less than a high school education who had been arrested in the past. The "socialization-only" reasons often given for black men fit more awkwardly for black women who are nominally precluded from expectations of violence. For example, there is no "expectation" for a macho image for females.

Although it may be little more than a cliché to point out that blacks commit proportionately more crimes of violence than do whites or Asians, the causes thereof remain moot. A government commission in Ontario (1996) reported that blacks were five times more likely to be in jail than were whites and ten times more likely than were Asians. The commission argued that the disproportion was due to systemic anti-black racism operating throughout the Ontario criminal justice system.

The commission's report omitted consideration of the international data. As reported in chapter 7, analyses of INTERPOL Yearbooks for 1984 to 1986 showed a global racial pattern going well beyond Canadian, British, and U.S. particulars. Subsequently, Rushton (1995b) replicated these results using the 1989–90 INTERPOL Yearbook. The rate of violent crime (murder, rape, and serious assault) was three times higher in 23 African and Caribbean countries than it was in 12 Asian or Pacific Rim countries, with 41 European countries intermediate. Summing across crimes for Asian, European, and African countries gave rates per 100,000 population, respectively, of 32, 75, and 240.

Sexual Behavior and AIDS

Fueled in part by concern over the lethal epidemic of sexually transmitted disease, several major surveys of sexual behavior have confirmed the Asian/white/black pattern described in chapter 8. One study of 356 Asian and 346 non-Asian university students at the University of British Columbia in Canada found that Asian students were significantly more "restrained" than were non-Asian students on measures of interpersonal sexual behavior (e.g., petting, intercourse), intrapersonal sexual behavior (e.g., fantasy, masturbation), and sexual permissiveness (e.g., lifetime number of partners, number of "one-night stands"). The length of residency in Canada was typically unrelated to Asian behavior. Asian students born in Canada were as restrained as those who had only recently immigrated (Meston, Trapnell, & Gorzalka, 1996).

One prominent environmentalist theory of sociosexuality holds that Chinese people, relative to Europeans, inhabit a "collectivist" rather than an "individualist" culture, thereby leading to self-restraint. Meston et al. (1996) pointed to a problem with this theory, namely, Africans also embrace collectivist cultures but are *less* sexually restrained than are Europeans. Moreover, the authors noted, sexual restraint in China is apparent over a 1,000-year period of history covering several epochs so needs a more deeply rooted explanation. Meston et al. concluded that their results supported "[Rushton's] hypothesis of 'racial' (i.e., biological or genetic) differences among ethnic groups in sexual expressiveness and drive" (p. 64).

Results from the *A Youth At Risk Behavior Survey* featured in chapter 8 continue to be published by the Centers for Disease Control and Prevention. Large-scale surveys of sexual behavior in the United States (Laumann, Gagnon, Michael, & Michaels, 1994) and Britain (Johnson, Wadsworth, Wellings, Feld, & Bradshaw, 1994) have also appeared. All these tend to confirm that blacks are sexually more active at an earlier age than whites who are sexually more active at an earlier age than Asians.

In chapter 8, I drew out the implications of racial differences in sexual behavior for the worldwide distribution of sexually transmitted diseases such as AIDS. The rapid worldwide rate of increase in AIDS continues (currently 26 percent a year) and, in their latest report, the World Health Organization (1996) showed that over one and a quarter million adult cases had been reported from 193 countries as a result of the pandemic. Allowing for under-diagnosis, incomplete reporting, and reporting delay, the true figure is estimated to be about 6 million, and approximately 17 million people are estimated to have the human immunodeficiency virus (HIV) which causes the disease.

The World Health Organization (1996) extrapolated for each country the per capita prevalence of HIV. The results are truly stunning. Forty-seven countries were estimated to have 1 percent or more of their sexually active population living with HIV. Thirty-seven of these countries were in sub-Saharan Africa and seven were in the Caribbean. A sampling: Botswana, Zimbabwe, Zambia, and Uganda have upwards of 20 percent or more of their population living with HIV; South Africa, Kenya, Mozambique, and Zaire have from 3 percent to 10 percent living with HIV; in the Caribbean, Haiti, Bahamas, Barbados, and Belize have 2 percent or more of their population infected; and Jamaica, Bermuda, and the Dominican Republic have more than 1 percent.

U.S. data show that African-Americans have rates similar to their counterparts in black Africa and the black Caribbean, with 3 percent of black men and 1 percent of black women living with HIV (Rosenberg, 1995). This survey, appearing in *Science,* drew correspondence to the effect that "race" was not causal to the incidence rates but was merely a marker for social factors such as poverty, which were the real causes (Males, 1996; McMillan, 1996). Rosenberg (1996) replied, noting that: (1) even with socioeconomic indicators controlled, sexually transmitted infections remained higher among African-Americans than among other groups; and (2) "cultural variations in behavior," distinct from socioeconomic status, were part of the complex web of causation. None of the correspondents pointed to the racial distribution elsewhere in the world nor to the fact that in Africa, it is *high* socioeconomic status that puts people at risk, mainly by increasing their access to sexual partners. Throughout the world, the virus must be considered endemic to black populations.

But Do Races Exist?

As this book shows, the construct validity of the three major races, Mongoloid, Caucasoid, and Negroid, has been established at the anatomical and behavioral level across both time and national boundaries. If race is simply arbitrary, consistent relationships of the type presented would not occur. Nonetheless, critics continue to call definitions arbitrary and subjective. The biologist Jared Diamond articulated this widespread viewpoint in the November 1994 issue of *Discover* magazine by surveying half a dozen geographically variable traits and forming very different "races" depending on which traits he picked. Classifying people using anti-malarial genes, lactose tolerance, fingerprint whorls, or skin color resulted in Swedes of Europe being placed in the same grouping as the Xhosa and Fulani of Africa, the Ainu of Japan, or the Italians of Europe.

Most of Diamond's classifications, however, make no sense, because they have little, if any, predictive value beyond the initial classification. More significantly, they confuse the scientific meaning of race, that is, a recognizable (or distinguishable) *geographic* population. In science, the validation of constructs such as race depends on a network of predictive relationships.

Testosterone

The possible role of testosterone in mediating crime, reproductive behavior, and other variables was discussed throughout the book. New work by Harris, Rushton, Hampson, and Jackson (1996) showed testosterone mediates aggression and nurturance. Salivary testosterone was examined in 306 university students and, in both men and women, it was found that those with high testosterone were more aggressive and less nurturant on self-report questionnaires than were those with low testosterone. Men also averaged five times the amount of testosterone in their saliva as did women and were more aggressive and less nurturant than were women.

Group characteristics arise from the nature of the people who belong to the groups. Among the qualities that affect people's behavior in groups is testosterone. Dabbs, Hargrove, and Heusel (1996) assessed testosterone levels from saliva samples in various fraternity groups in the United States and found that those fraternities whose members were high in testosterone tended more to be noisy, rude, and unruly whereas those fraternities whose members were low in testosterone tended to smile more and be academically successful and socially responsible.

r-K Reproductive Strategies

Chapter 10 described the work of the primatologist Adolf Schultz who held that as one "ascends" in the primate order from prosimians to monkeys to apes to humans, an increased absolute amount of time is devoted to each stage of development: gestation, infancy, childhood, and adulthood (Figure 10.3). Ecological theory suggests that this pattern of prolonged development reflects an increasingly *K*-selected strategy on the part of the primates including other such features as parental care, small litter size, large body size, and big brains. Generalizing from across primates to within humans, chapters 7 and 10 reported East Asians had the most prolonged development, Europeans the next most prolonged, and Africans the least prolonged.

A symposium was published in the 1996 issue of the *American Journal of Physical Anthropology* on comparative speed of tooth development among orangutans, chimpanzees, early hominids, and modern humans, some of it explicitly citing an *r-K* perspective, that confirmed trends reported in chapter 10. One study by Anemone, Mooney, and Siegel (1996) used dental x-rays and computerized tomography (CT) to find that the 3 million-year-old australopithecenes had a rapid, essentially "apelike" dental development and, by inference, apelike life history pattern, and that chimpanzees had a more rapid dental development than did humans. Among humans, sub-Saharan Africans had a more rapid dental development than did white French Canadians who had a more rapid rate than did Amerindians (Tompkins, 1996a). African populations also averaged larger jaws and bigger teeth than did Europeans.

Tompkins (1996b) went on to compare the relative development of permanent teeth in a sample of nearly one hundred 50,000-year-old Neanderthal/archaic *Homo* and Early Modern/Upper paleolithic hominids with the human samples. Both fossil hominid groups differed in having a more rapid dental development than did French Canadians, but they were matched by the southern Africans (except, possibly, the Neanderthal/archaic *Homo* group who were especially advanced). Tompkins (1996b) suggested "that the fossil hominids and southern Africans are characterized by similar potentials for more precocious skeletal maturation than in French Canadians (and other European/Euroamerican populations)" (p. 115).

Other researchers too have provided *r-K* related analyses of human variation. Cited in text were works by Ellis and Miller, both of whom have continued their research. Ellis (1994) reviewed literature suggesting genetic covariation between height, health, social status, brain size, and intelligence. Miller (1995) presented studies showing that black Americans spend more money on clothes than do white Americans and that blacks average greater skull thickness than do Asians or whites. Miller's interpretation was that blacks expend more effort than do whites on fighting and mating relative to parenting.

Out of Africa

Evidence mounts that the recent African model of human origins described in chapter 11 is correct. The "African Eve" theory posits a beginning in Africa some 200,000 years ago, an exodus through the Middle East with an African/non-African split about 110,000 years ago, and a Caucasoid/Mongoloid split about 41,000 years ago. Thus, all non-African human populations descend from an anatomically modern *H. sapiens* ancestor that evolved in Africa and then spread and diversified throughout the rest of the Earth, supplanting any *Homo* populations still present outside of Africa. Migration out of Africa may have occurred in a single or in multiple waves.

Among recent works confirming the Out of Africa model is Cavalli-Sforza, Menozzi, and Piazza's (1994) massive *History and Geography of Human Genes,* a compilation of data from 2,900 articles. African samples repeatedly showed the largest amount of genetic variation which is consistent with the view that Africans are the oldest population because this allowed more time for mutations to occur. Based on genetic similarities and differences, Africans also showed the greatest distance from other populations. The genetic distance between Africans and Europeans is twice that between Europeans and East Asians. Interestingly, the European/Amerindian distance is slightly less than the one between Europeans and East Asians. This last finding was validated by work sequencing the Y chromosome showing an Amerindian/East Asian split about 30,000 years ago (Underhill, Lin, Zemans, Oefner, & Cavalli-Sforza, 1996).

Subsequent support for the Out of Africa model comes from Horai et al. (1995) at the National Institute of Genetics in Japan who sequenced all 16,500 bases in the mtDNA genome for three humans, one each from Africa, Europe, and Japan, and four apes (common and pygmy chimpanzees, a gorilla, and an orangutan). By comparing the differences in mtDNA sequences between the orangutan and the other apes, who are generally acknowledged to have split apart 13 million years ago, Horai was able to calculate the rate at which mtDNA mutations occur once populations split off from a common ancestor. Then, applying that rate to the three human lineages, Horai et al. inferred that they last shared a common ancestor 143,000 years ago, plus or minus 18,000 years. And, as the African lineage has the most diversity, Horai et al. concluded that last common ancestor lived in Africa.

Another corroboration of the recent out of Africa model comes from Tishkoff et al. (1996) who examined 1,600 individuals from 42 worldwide populations for a specific variation of the DNA sequence on human chromosome 12. As with other parts of the genome, extensive variety was found among groups in sub-Saharan Africa but few differences found among those in Asia, Europe, or the Americas. Of the 24 possible variations, 21 were found in sub-Saharan Africa, from Nigeria to Kenya and south. Tishkoff et al. (1996) concluded that all non-Africans evolved from a single common ancestral population which migrated out of northeast Africa. The migrant population could have been as few as 1,000 and the migration occurred no earlier than 100,000 years ago and could be as recent as 70,000.

Evolutionary selection pressures are different in the hot savanna, where Negroids evolved, than in the cold Arctic, where Mongoloids evolved. I proposed that the farther north the populations migrated out of Africa, the more they encountered the cognitively demanding problems of gathering and storing food, acquiring shelter, making clothes, and raising children successfully during prolonged winters. As these populations evolved into present-day Caucasoids and Mongoloids, they did so in the direction of larger brains, slower rates of maturation, and lower levels of sex hormone with concomitant reductions in sexual potency, aggressiveness, and impulsivity, and increases in family stability, advance planning, self-control, rule following, and longevity. Each population became adapted to the environment in which it evolved.

Progress in Evolution?

In their reviews, Lynn (1996a) and Peters (1995) both referred to my ranking of species on evolutionary scales. For Peters, this was a highly contentious idea but in Lynn's positive review, he described me as proposing that the

K-strategy was "evolutionarily more advanced" and that the Oriental race was "the most evolved." In fact, I did not use either of these phrases in the book, although I had alluded to similar ideas in previous writing. Regardless, the topic of evolutionary progress provides an intellectual challenge of the first order and needs to be addressed. Figure 10.2 (p. 202) does imply a move from simple *r*-type animals producing thousands of eggs but providing no parental care to more complex *K*-type animals producing very few offspring.

The question of progress in nature has fascinated since Aristotle. Aristotle suggested that organisms could be hierarchically graded along a *scala naturae* marked by minute continuous steps from the inanimate, through plants, to the animals. He offered overlapping criteria for ranking along this scale including "perfectibility" (closeness to a Platonic God), "soul" (capacity for rational discourse), and method of reproduction. For example, regarding reproduction, he wrote in the *History of Animals*:

> Now some simply like plants accomplish their own reproduction according to the seasons; others take trouble as well to complete the nourishing of their young, but once accomplished they separate from them and have no further association; but those that have more understanding and possess some memory continue the association, and have a more social relationship with their offspring.

The Greek philosopher's biology is remarkably current. Based on detailed observation, Aristotle noted many of the principles that lie at the heart of the *r-K* analysis undertaken in this book including the inverse relations between seed output, parental care, and intelligence. The historian Arthur Lovejoy, in his 1936 book *The Great Chain of Being,* concluded that Aristotle's arrangement of all things in a single order of magnitude was one of the most important ideas in Western thought.

Darwin (1859) referred frequently to evolutionary progress in the *Origin of Species*. This was necessary not only to refute concepts of a steady-state world but also to counter a newly developed school that denied any difference in perfection between the simplest and the most complex organisms, which would be an implicit denial of improvement through natural selection. In his book *Sociobiology* (1975), E. O. Wilson also promoted the idea of biological progression, outlining four pinnacles in the history of life on Earth: first, the beginning of life itself in the form of primitive prokaryotes, with no nucleus; then the origin of eukaryotes, with nucleus and mitochondria; next the evolution of large, multicellular organisms, which could evolve complex organs such as eyes and brains; and finally the beginnings of the human mind.

John Bonner (1980), in his book *The Evolution of Culture in Animals,* showed that the later an animal emerged in earth history the larger was its brain and the greater was its culture. Pursuing the issue in a subsequent book, *The Evolution of Complexity* (1988), he asked "Why has there been an evolution from the primitive bacteria of billions of years ago to the large and complex organisms of today?" Bonner held that it was quite permissible for paleontologists to refer to strata as upper and lower, for they are literally above and below each other and, because the fossils in the lower strata will, in general, be more primitive in structure as well as belong to a fauna or flora of earlier times, so "lower" and "higher" were acceptable terms. Bonner (1988: 6) noted that it was even acceptable to refer to lower and higher *plants,* slime molds versus angiosperms for example. It only became a "sin" when a worm was classified as a lower animal and a vertebrate a higher one, even though their fossils too will be found in lower and higher strata.

Paleontologist Dale Russell (1983, 1989) quantified increasing neurological complexity through 700 million years of Earth history in invertebrates and vertebrates alike. The trend was increasing encephalization among the dinosaurs that existed for 140 million years and vanished 65 million years ago. Russell (1989) proposed that if they had not gone extinct, dinosaurs would have progressed to a large-brained, bipedal descendent. For living mammals he set the mean encephalization, the ratio of brain size to body size, at 1.00, and calculated that 65 million years ago it was only about 0.30. Encephalization quotients for living molluscs vary between 0.043 and 0.31, and for living insects between 0.008 and 0.045 but in these groups the less encephalized living species resemble forms that appeared relatively early in the geologic record, and the more encephalized species resemble those that appeared later.

The hominid brain has nearly tripled in size over the last 4 million years. *Australopithecenes* averaged a brain size of about 500 cm^3, the size of a chimpanzee. *Homo habilis* averaged about 800 cm^3, *Homo erectus* about 1,000 cm^3, and modern *Homo sapiens* about 1,350 cm^3. In Figure 10.3 of this book (p. 205) *Homo sapiens* is to be found at the end of a *scala naturae* of characteristics. The once traditional view that man is the "most developed" of species, gains novel support from the perspective of an *r-K* dimension. As E. O. Wilson (1975) put it: "In general, higher forms of social evolution should be favored by *K* selection" (p. 101).

Conclusion

The main contribution envisaged for *Race, Evolution, and Behavior* was theoretical—to advance an *r-K* reproductive analysis of human diversity. This seemed a straightforward application of well-established ideas from population biology to the human species, anchoring humans and their social systems within the Darwinian paradigm. No environmental factor is able to explain the consistency of the international pattern of racial differences across so many variables. Evolutionary (and hence genetic) models are required.

As Linda Gottfredson observed in her review in *Politics and the Life Sciences,* much self-censorship operates among social scientists regarding making public pronouncements about race differences. It is difficult to disagree with the conclusion arrived at by Murray (1996) following his review of the aftermath to *The Bell Curve*: on the topic of race, social science is corrupt. Yet, it is heartening to believe that it is also the vitality of social science research that shows up this sterility and points the way to a more encompassing worldview.

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Glossary

No definition is absolute and scientific constructs are always subject to controversy and debate. They are proposed in order to classify and coordinate large numbers of facts. It is hoped that the following definitions may be of use.

ADAPTATION. In biology, a particular anatomical structure, physiological process, or behavior that improves an organism's fitness to survive and reproduce. Also, the evolutionary process that leads to the acquisition of such a trait.

AGGREGATION. Formed by the collection of particulars into a sum total.

AGGRESSION. A physical act or threat of action by one individual intended to reduce the freedom or genetic fitness of another.

ALLELE. A particular form of a gene, where multiple such forms occur. Sickle-cell anemia is caused by one such variant of a gene; another variant of the same gene contributes to the normal hemoglobin.

ALTRUISM. Self-destructive behavior performed for the benefit of others.

ASSORTATIVE MATING. Mating of individuals that are more similar phenotypically than if they were mating at random.

AUSTRALOPITHECUS. The genus of early hominids known from 4 million to 2 million years ago before the appearance of the genus *Homo*. These "man-apes" lived during the Pleistocene Epoch and possessed postures similar to those of modern men but brains not much larger than those of modern apes.

BASE PAIR. A pair of organic bases constituting a letter of the genetic code; usually adenine (A) paired with thymine (T), or cytosine (C) paired with guanine (G). Each base is found on one strand of the DNA double helix and opposes the other base at the same position on the second strand. The code is then read off as a sequence of four possible letters on the double helix, AT, TA, CG, and GC. Versions of the same gene differ by the sequence of these four letters.

BEHAVIOR GENETICS. The scientific study of the genetic and environmental contributions to behavior.

BEHAVIORISM. A school of psychology founded by John B. Watson in which psychology is defined solely as the study of behavior; all data therefore must come from observable behavior.

BRAIN. The part of the central nervous system enclosed in the cranium of man and other vertebrates, consisting of a soft, convoluted mass of gray and white matter and serving to control and coordinate the mental and physical actions.

BROW RIDGES. Constituting a bar of bone over the eyes in apes and early hominids, these are varied in development in later hominids and diminished in modern people to slight-to-moderate bony swellings over each eye.

CARRYING CAPACITY. Usually symbolized by *K*, the largest number of organisms of a particular species that can be maintained indefinitely in a given part of the environment.

CAUCASOID RACE. A major racial division of mankind originally inhabiting Europe, North Africa, western Asia, and India. Individuals are depigmented to a greater or lesser degree. Hair in males is generally well developed on the face and body, and is mostly fine and wavy or straight. A narrow face, prominent narrow nose, and narrow lips are typical.

CHROMOSOMES. Paired sections of the DNA in the nucleus of a cell bearing genes in a linear order. The number varies in different species: in *Homo* the number of pairs is 23.

CLASSIFICATION. The categories of life form a hierarchical system going from higher to lower: Kingdom, Phylum, Class, Order, Family, Genus, Species, with further subdivisions being possible, such as superfamilies and subspecies. Living humanity is placed in the preceding categories as follows: Animalia, Vertebrata, Mammalia, Primates, Hominidae, *Homo sapiens.*

COEVOLUTION. The evolution of two or more species due to mutual influence; for example, many species of flowering plants and their insect pollinators have coevolved in a way that makes the relationship more effective. *See also* GENE-CULTURE COEVOLUTION.

CORRELATION. An index of the degree of relationship between two variables, expressed as a coefficient of correlation, which ranges from 0 to ±1.

CRANIOMETRY. The science of measuring skulls.

CRANIUM. The skull of a vertebrate. The part of the skull that encloses the brain.

DARWINISM. Evolution by natural selection, originally proposed by Charles Darwin. The modern interpretation of the process is called neo-Darwinism; it incorporates all we know about evolution from genetics, ecology, and other disciplines.

DEMOGRAPHY. The study of birth rates, death rates, age distributions, sex ratios, and size of populations—a fundamental discipline within the larger field of ecology.

DENSITY DEPENDENCE. The increasing severity by which factors in the environment slow down growth of a population as the organisms become more numerous and hence densely concentrated. Density-dependent factors include competition, food shortage, disease, predation, and emigration.

DETERMINISM. A fixed-cause effect model usually implying that an outcome is narrowly constrained by very few variables. Thus, "genetic determinism" means to many that behavior is rigidly constrained by the genes, while "cultural determinism" means that behavior depends almost entirely on the particularities of the surrounding culture.

DEVELOPMENT. The process of coming into being, unfolding, maturing, being built up.

DNA (DEOXYRIBONUCLEIC ACID). The fundamental hereditary material of all living organisms. The carrier of the genes. It consists of extremely long paired sugar-phosphate chains (the "double helix"), which are joined by pairs of four kinds of organic bases. The order of these last gives the codes by which the genes (segments of the DNA chains) control the formation of proteins.

DIZYGOTIC (DZ) TWINS. Fraternal twins, arising from the fertilization of two eggs by two sperm.

DOMINANCE. In genetics, the expression of one form of a gene (allele) over another form of the same gene when both occur on the same chromosome; the gene for normal blood clotting, for example, is dominant over the one for hemophilia (failure to clot). In ecology, the abundance and ecological influence of one species or group of species over others: pines are dominant plants and beetles are dominant animals. In animal behavior, the control of one individual over another in social groupings.

ECOLOGY. The scientific study of the interaction of organisms with their environment, including both the physical environment and the other organisms that live in it.

EMERGENIC. Arising as a novel or emergent property resulting from the interaction of more elementary properties. The distinctive feature of emergenesis is the notion of configurality, which implies that change of any one component results in a qualitative, or a large quantitative, change in the emergenic trait.

ENDOCRANIAL. Within the cranium or brain case. The endocranial volume of a chimpanzee is about 500 cm^3 and that of a modern human about 1,300 cm^3.

ENVIRONMENT. The surroundings of an organism or a species: the ecosystem in which it lives, including both the physical environment and the other organisms with which it comes in contact.

ENVIRONMENTALISM. The form of analysis that stresses the role of environmental influences in the development of behavioral or other biological traits. Also, the point of view that such influences tend to be paramount in behavioral development.

EPIGENESIS. The process of interaction between genes and environment that ultimately results in the distinctive behavioral, cognitive, and morphological traits of the organism.

EPIGENETIC RULE. Any regularity during epigenesis that channels development of a trait in a particular direction. Epigenetic rules are ultimately genetic in basis and depend on the DNA developmental blueprint.

ETHNOCENTRISM. A complex of attitudes whereby members of one ethnic group consider themselves superior or at least preferable to another ethnic group on the basis of their own conception of what is socially, culturally, biologically good or right. *See also* RACISM.

EVOLUTION. Any change in the genetic constitution of a population of organisms. Evolution can vary in degree from small shifts in the frequencies of minor genes to the origins of complexes of new species. Changes of lesser magnitude are called microevolution, and changes at or near the upper extreme are called macro-evolution.

EVOLUTIONARY BIOLOGY. An umbrella term for a broad array of disciplines that have in common their focus on the evolutionary process.

FECUND. Bearing or capable of producing offspring in abundance.

FERTILE. Bearing or capable of bearing offspring.

FITNESS. *See* GENETIC FITNESS.

G. The first principal component or general factor of intelligence that emerges when factor analysis is carried out on any diverse set of mental tests. The higher a subtest loads on *g* the more reflective of mental ability it is. Black-white differences in mental ability are largest on the *g* factor.

GAMETE. The mature sexual reproductive cell: the egg or the sperm.

GENE. The basic unit of heredity; a section of the giant DNA molecule long enough to code for one protein.

GENE-CULTURE COEVOLUTION. The coupled evolution of genes and culture.

GENE FREQUENCY. For the population as a whole, the percentage of genes at a particular locus that are of one form (allele) as opposed to another, such as the allele for sickle-cell hemoglobin that can be distinguished from the allele for normal hemoglobin.

GENETIC CODE. *See* BASE PAIR.

GENETIC FITNESS. The contribution to the next generation of one genotype in a population relative to the contributions of other genotypes.

GENOTYPE. The genetic constitution of an organism.

GONAD. An organ that produces sex cells; ordinarily either an ovary (female gonad) or testis (male gonad).

GROUP SELECTION. Any process, such as competition, the effects of disease, or the ability to reproduce, that results in one group of individuals leaving more descendants than another group. Selected groups can range in size from kin to tribe to population to species.

HERITABILITY. The proportion of variance in a trait within a population that is attributable to genetic variance among the individuals composing the population.

HOMINID. Any member of the human family Hominidae (all species of *Australopithecus* and *Homo*).

HOMO. The genus of true men, including several extinct forms (*H. habilis, H. erectus, H. neanderthalis*) as well as modern man (*H. sapiens*), who are or were primates characterized by completely erect stature, bipedal locomotion, reduced dentition, and above all an enlarged brain size.

HOMO ERECTUS. The species recognized as including fossils dated from about 2 million to 400,000 years ago from Africa, the Middle East, Java, and China, with brains varying around 1,000 cm^3 and with robust skulls, but skeletons generally modern in size and shape.

HOMO HABILIS. The earliest recognized species of *Homo,* appearing 2.4 million years ago in East Africa and associated with the first recognizable stone tools. Distinguished from australopithecenes by enlarged brain and reduced face, the skeleton, however, retained primitive traits not seen in later *Homo.*

HOMO SAPIENS. The formal species name for living mankind. It is also extended to cover populations known from fossils that are distinguished as being above the evolutionary level of *Homo erectus.* There is debate over whether Neanderthals are to be included as a subspecies of *Homo sapiens* or made into a separate species.

HORMONE. Any of various internally secreted compounds such as insulin or testosterone, formed in the endocrine glands, that affect the functions of specifically receptive organs or tissues when carried to them by the body fluids.

HUMAN NATURE. In the broader sense, the full set of genetically based behavioral predispositions or traits evolved by natural selection that characterize the human species; and in the narrower sense, those predispositions that affect social behavior.

INBREEDING. The mating of kin.

INTELLIGENCE. General mental ability. *See* G. The capacity for reasoning, understanding, and for similar forms of mental activity. Quick to understand.

IQ *or* INTELLIGENCE QUOTIENT. A person's mental age divided by chronological age, expressed as a multiple of 100. The IQ of a 10-year-old child whose mental age equals that of the average 12-year-old is 120.

K. Symbol for the carrying capacity of the environment.

KIN SELECTION. Selection of genes causing individuals to favor the survival and reproduction of relatives (in addition to offspring) who possess the same genes by common descent. Kin selection is one way in which altruistic behavior can evolve as a biological trait.

K-SELECTION. Selection favoring the qualities needed to succeed in stable, predictable environments where there is likely to be heavy competition for limited resources between individuals well equipped to compete, at population sizes close to the maximum that the habitat can bear. A variety of qualities are thought to be favored by *K*-selection, including in mammals, long life, large brains, and small numbers of intensively cared-for offspring. Contrast with *r*-selection. *K* and *r* are symbols in the conventional algebra of population biologists.

K-STRATEGY. A set of reproductive characteristics that tends to maximize use of resources by emphasizing intensive nurture and a slow reproductive rate, with concomitant increase in complexity of nervous system and larger brain (cf. *r*-strategy).

LIFE CYCLE. The entire life span of an organism from the moment it is conceived to the time it reproduces and on to the time that it dies.

LIFE HISTORY. A genetically organized suite of characters that have evolved so as to allocate energy to survival, growth, and reproduction.

MATURATION. The automatic development of a pattern of behavior that becomes increasingly complex or precise as the animal matures.

MEAN. The numerical average.

MONGOLOID RACE. A major racial division of mankind found in all Asia except the west and south (India), in the northern and eastern Pacific, and in the Americas. The skin is brown to light often with a yellowish tinge; hair is coarse, straight to wavy, and sparse on the face and body. The face is broad and tends to flatness. The eyelid is covered by an internal skinfold. The teeth often have crowns more complex than in other peoples, and the inner surfaces of the upper incisors frequently have a shovel appearance.

MONOZYGOTIC (MZ) TWINS. Identical twins, arising from the fertilization of one egg by one sperm.

NATURAL SELECTION. The differential contribution of offspring to the next generation by various genetic types belonging to the same population. This mechanism of evolution was proposed by Charles Darwin and is thus also called Darwinism. Distinguished from artificial selection, the same process but carried out with human guidance.

NEANDERTHALS. A type of powerfully built, cold-adapted Paleolithic man who inhabited Europe and central Asia from about 125,000 to about 30,000 years ago. Some call them a subspecies of modern humans but others, who believe they are not directly ancestral to modern humans, see them as a distinct species.

NEGROID RACE. A major racial division of mankind originating and predominating in sub-Saharan Africa. Skin pigmentation is dense, hair wooly, nose broad, face generally short, lips thick, and ears squarish and lobeless. Stature varies greatly, from pygmy to very tall. The most divergent group are the Khoisan (Bushman and Hottentot) peoples of southern Africa.

PALEOLITHIC. The Stone Age, a cultural period during which hominids were dependent entirely upon hunting and gathering using subsistence techniques. A division has often been made into the lower, middle, and upper paleolithic based on improvements in stone-working techniques.

PALEONTOLOGY. The scientific study of fossils and all aspects of extinct life.

PERSONALITY. The more or less stable and enduring organization of a person's character, temperament, intellect, and physique, which determines his unique adjustment to the environment. Character suggests will power and conscious decision making; temperament suggests emotionality; intellect implies intelligence; and physique includes bodily configuration and neuroendocrine endowment.

PHENOTYPE. The observed traits of an organism created by an interaction of the organism's genotype (hereditary material) and the environment in which it developed.

PLEISTOCENE. "Almost recent." The period beginning 1.7 million years ago and ending about 10,000 years ago with the last glacial retreat, loosely called the "Ice Age," consisting of a series of glacial and interglacial periods. It is associated with rapid hominid evolution.

POPULATION. In biology, any group of organisms belonging to the same species at the same time and place.

PRIMATE. Any mammal of the order primates, such as a lemur, monkey, ape, or man.

PRIMITIVE. Referring to a trait that appeared first in evolution and gave rise to other, more "advanced" traits later. Primitive traits are often but not always less complex than the advanced ones.

PROGRESS. Cumulative improvement. Increasing differentiation and movement forward in the course of development.

PROTO-. Used as a prefix, the term implies an early form of either a biological or a cultural organism, out of which later (usually more complex) varieties can be demonstrated to have evolved.

r. The symbol used to designate the intrinsic rate of increase of a population.

RACE. A group related by common descent, blood, or heredity. A variety, a subspecies, a subdivision of a species characterized by a more or less distinctive combination of physical traits transmitted in descent. A genetically distinct inbreeding division within a species. Often used interchangeably with the term subspecies. In humans the 3 major races of Caucasoid, Mongoloid, and Negroid can be distinguished on the basis of skeletal morphology, hair and facial features, and molecular genetic information.

RACISM. Hatred or intolerance of another race. The treatment of all members of another race as though they were all the same, usually in order to do them harm.

REPRODUCTIVE STRATEGY. *See* *r*- and *K*-strategy.

r-SELECTION. Selection for the qualities needed to succeed in unstable, unpredictable environments, where ability to reproduce rapidly and opportunistically is at a premium, and where there is little value in adaptations to succeed in competition. A variety of qualities are thought to be favored by *r*-selection, including high fecundity and, in mammals, short life and small brains. Contrasted with *K*-selection. It is customary to emphasize that *r*-selection and *K*-selection are the extremes of a continuum, most real cases lying somewhere between.

r-STRATEGY. A set of reproductive characteristics that tends to maximize the potential rate of population increase at the expense of intensive nurture of young and efficient resource utilization (cf. *K*-STRATEGY).

SELECTION. *See* NATURAL SELECTION.

SELECTION PRESSURE. Any feature of the environment that results in natural selection; for example, food shortage, the activity of a predator, or competition from other members of the same sex for a mate.

SEX RATIO. The ratio of males to females (for example, 3:1 equals 3 males to 1 female).

SOCIOBIOLOGY. The systematic study of the biological basis of all social behavior.

SPECIES. The basic unit of biological classification, consisting of a population or series of populations of closely related organisms that freely interbreed with one another in natural conditions but not with members of other species.

STANDARD DEVIATION. A measure of dispersion of a frequency distribution. It is equal to the square root of the variance.

TESTOSTERONE. The sex hormone $C_{19}H_{28}O_2$, secreted mainly by the testes, that stimulates the development of masculine characteristics.

THRESHOLD. The point at which a stimulus is of sufficient intensity to begin to produce an effect.

TRAIT. An inherited or acquired characteristic that is considered consistent, persistent, and stable.

VARIANCE. The most commonly used statistical measure of variation (dispersion) of a trait within a population. It is the mean squared deviation of all individuals from the sample mean.

ZOOLOGY. The scientific study of animals.

ZYGOTE. The cell created by the union of two gametes (sex cells), in which the gamete nuclei are also fused.

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