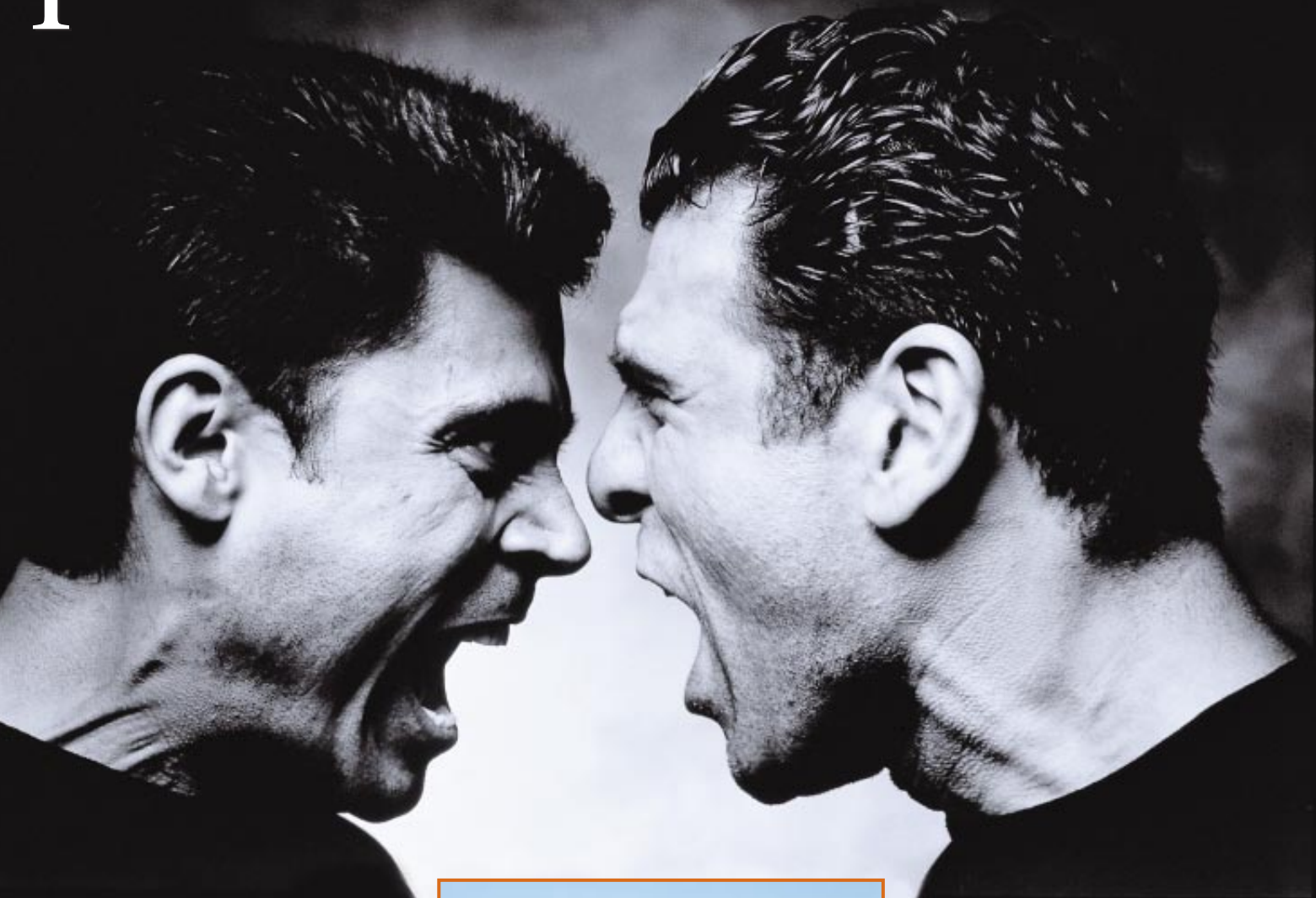


I

DEFINING MEN



HEAD TO HEAD: Men and other animals such as elephant seals often fight over status. Competition for mates helps to explain such risky tactics.

Darwinism and the Roots of

How long people live varies among times and places, but women almost always live longer. According to current estimates by the United Nations, Japan leads the world in life expectancy at birth: 76.9 years for males and 82.9 for females. In the U.S. the corresponding figures are 73.4 and 80.1 years, and in Russia, 58.0 versus 71.5. Of more than 200 countries, men outlive women only in the Maldives and Nepal, where birth rates are exceptionally high and may contribute to mortality among women. The typical female advantage was probably as evident in our preagricultural ancestors as it is in modern society.

Why do men die younger? There is no single answer. Demographers distinguish external causes of death (homicides, suicides and accidents) from internal causes (disease). In modern countries, males die at higher rates than females from both internal and external causes, at all ages, and differences between the sexes in external mortality in adolescence and young adulthood are especially striking [see illustration on page 11]. What limited evidence is available indicates that the same is true in foraging societies, which are more like those in which humans evolved.

External mortality in young men is largely a consequence of their behavior. They drive more recklessly than women or older men, for example, and they are relatively unconcerned about the hazards of taking street drugs and about invisible threats such as environmental contaminants and sexually transmitted diseases [see "Teenage American Males: Growing up with Risks," on page 86]. They are also more inclined to choose immediate rewards over larger but later ones and more often experience a close

brush with danger as a rewarding thrill. They are more likely than other demographic groups to escalate an altercation to a dangerous level, to kill and to be killed.

Why are young men more risk-loving than other people? The ubiquity of these tendencies across cultures implies that they cannot be simply a consequence of modern society. The question must instead be addressed like others that concern life history and differences between the sexes, such as why men tend to be a little taller than women and to experience puberty a little later. What needs explaining is how and why these aspects of human nature evolved.

Sexual Selection and Sex Differences

A major source of differences between females and males is sexual selection, the component of Darwinian natural selection that consists of non-random differences in mating success. Over evolutionary time, sexual selection engenders distinct attributes in females and males whenever the mating tactics that leave the most descendants are different for the two sexes.

Consider, for example, a species in which females provide most of the time and energy needed to raise young. In such creatures, a male's reproductive posterity depends directly on the number of his mates, but a female has less to gain from polygamy because a single sperm donor can impregnate her many times. Thus, sexual selection tends to equip males with competitive traits that help them have as many sexual contacts as possible and tends to equip females with discriminatory traits that help to assure that especially healthy or other-

wise superior males sire their young.

The northern elephant seal provides a famous example. Whereas a female can give birth to and raise only one pup a year, at best, a successful bull may sire dozens of pups. The males weigh four or five times as much as the females, even though growing bigger means maturing later, and they are much more violent, fighting to gain access to females. Males and females have evolved to look and act so differently because the reproductive prize for those who attain top rank is much higher for males than for females, and bigger prizes warrant bigger bets.

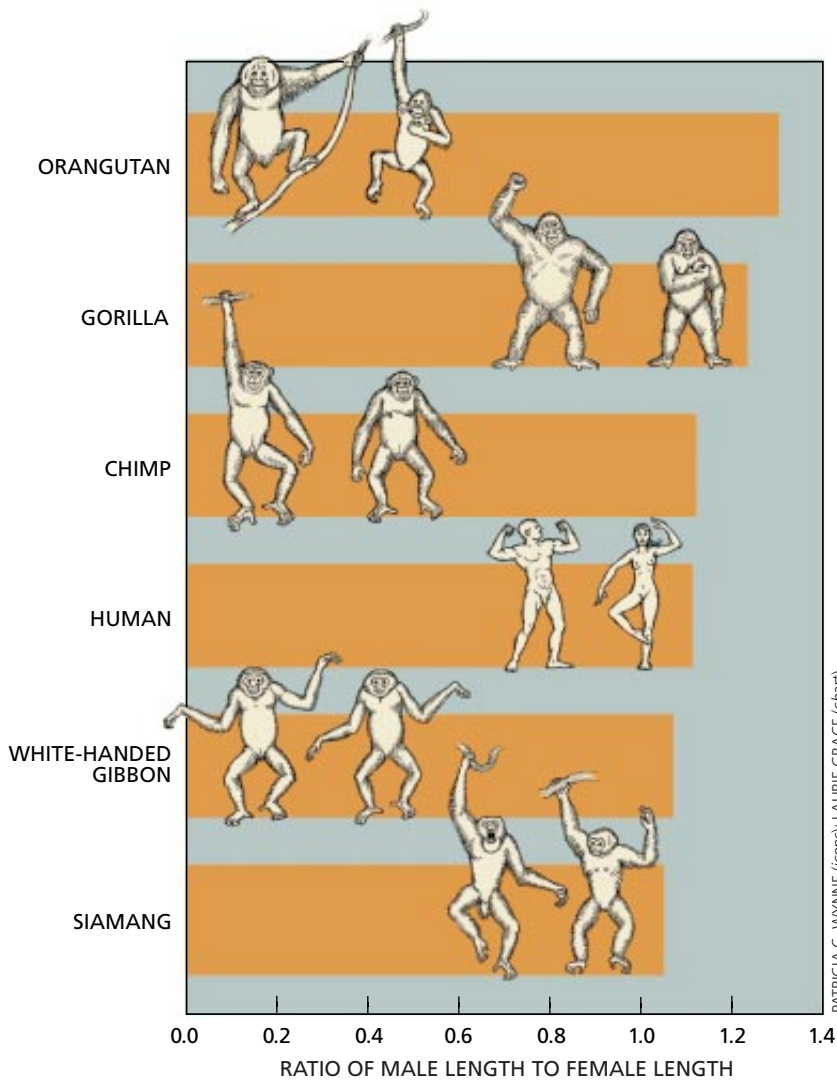
Even a male that survives to maturity is on average much less likely than a female to reproduce, because of competition from other males. This situation selects strongly for males that fight recklessly to attain the status of "beachmaster." In evolutionary terms, a long-lived, peaceful celibate has done no better than a male who dies after losing a battle: both will be nobody's ancestors. As many as 85 percent of male elephant seals die before they reach breeding age, and many die from wounds after this age. High male mortality from fighting is seen in other species with similar mating systems.

The situation is quite different in mammals that form enduring pairs and share the burden of parenting, such as foxes, beavers, some small African antelopes and a few species of monkeys. In these monogamous mammals, females and males are about the same size, about equally armed and armored, and about equally combative. Evolutionists attribute this similarity to the fact that the distribution of reproductive success among members of one sex is matched in the other sex, so that fe-

M *Men's evolutionary heritage probably has made them risk takers. But some of the harmful consequences can be moderated*

by Martin Daly and Margo Wilson

Machismo



MALES are much bigger than females in polygynous orangutans and gorillas but are of similar size in monogamous siamangs. The human male-female difference is intermediate, which is consistent with our species' evolutionary history.

males and males have been selected to compete with their same-sex rivals with about equal intensity.

Different species practice polygamy to varying extents. Elephant seals represent an extreme: large numbers of fertile females nurse close together, so one bull can keep other males away from his "harem." When females are more spread out, successful male mammals are often polygamists on a smaller scale. A crude but useful index of the degree of polygamy is the ratio of the variability in reproductive success among males (measured by a statistic called the variance) divided by the same statistic computed for females.

For a truly monogamous species, this ratio equals one. If the reproductive success of females is more variable than that of males, the ratio is less than one, and the system is effectively polyandrous (one female mates with multiple males). If the ratio exceeds one, which is the more common case, the system is effectively polygynous (one male mates with multiple females). For the ele-

phant seal, we estimate the ratio at 4.2.

If you rank a group of related mammalian species such as seals or primates by their effective polygamy index, several other features of their biology will fall roughly in order. Where the index is larger, males have more conspicuous weaponry, and relative to females they are bigger and reach reproductive maturity later. Furthermore, they have a shorter maximum life span, for reasons we will explain shortly. In species whose effective polygamy index is close to one, the sexes tend to be similar in all these attributes. The sex differences in various species are the predictable consequence of the relative intensity of sexual selection in males and in females.

It is clear where the human animal fits into this comparative scheme. The difference in male and female body size—less extreme than in the other great apes but greater than in exemplary monogamists—suggests that we evolved under conditions of slight effective polygyny: the most prolific fathers had more children than the most prolific

mothers. Yet more males than females died childless, because if some men have more than one wife, others must have none. The slightly later puberty in boys than in girls is consistent with this suggestion, as is the tendency for men to deteriorate and die a little sooner.

Patterns of marriage and reproduction support the same conclusion. Before the emergence of agriculture, towns and complex economies a few thousand years ago, it was probably impossible for one man to keep many wives. In many foraging societies, however, the most successful hunters may have two or three wives, either simultaneously or successively, and some evidence indicates that they have more extramarital affairs than less successful men do.

For !Kung San living as foragers in the Kalahari Desert of Botswana a few decades ago, the effective polygamy index was about 1.4, and for Ache foragers in Paraguay it was about 1.6. It is clear that in these and other traditional societies, social status has always played a key part in a man's reproductive success and that a crucial factor determining that social status has been his competitive prowess. The polygamy index in modern nations probably still slightly exceeds 1, because men are more likely than women to have children with successive marriage partners. All these estimates neglect cases in which the declared father is not the real one: correcting for them would probably raise the estimates somewhat. In any event, we believe an evolutionary history of slight effective polygyny explains the tendency of men to be greater risk takers, a tendency that lowers their average life span.

Violence as Competitive Risk Taking

Men kill one another in competitive conflicts over both material goods and less tangible social resources far more than women do. The late U.S. criminologist Marvin E. Wolfgang dubbed the most common variety of homicide the "trivial altercation." Two men get into a dispute over a real or imagined insult,

perhaps a small debt or a minor social entitlement, usually in front of witnesses with whom they are acquainted. They are unable or unwilling to give way as the conflict escalates to a deadly level. Such cases are prevalent wherever the murder rate is high and constitute about half of all homicides in the U.S.

Calling the initiating disagreement “trivial” is, of course, a value judgment, and its implicit disparagement is unwarranted. Low-status men who become embroiled in barroom disputes are defending their honor as surely as were high-status duelists in times past. A reputation for refusing to succumb to threats may be the most valuable asset a low-status man possesses, and we do not know the average risks and benefits of the available options well enough to judge whether dangerous decisions in these situations are foolish.

In modern nations, killers are mostly of low status, but this was not always so. High-status men kill, too, but they can forgo personal violence when law and other societal institutions afford them other means of enforcing contracts and deterring competitors. In societies that lack such institutions, a credible threat of violence is essential for acquiring and keeping a high status. Napoleon A. Chagnon of the University of California at Santa Barbara has shown that among the Yanomamö in Amazonia, men who have killed have more wives and children than those who have not, and their society is surely not unique in this.

Still, low status, whatever its cause, often invites risk taking, for as Bob Dylan sang, “When you got nothin’, you got nothin’ to lose.” Poor prospects for employment, marriage and reproduction may make risky tactics of social competition such as robbery and violent confrontation more attractive. If so, we would expect them to be more prevalent among the unemployed, the single and the childless. The available data are supportive: employed men and married men do kill male rivals at much lower rates than their unemployed and single counterparts do [see illustration at top of next page]. Nobody has yet determined whether fatherhood has additional effects.

The immense sex difference in murderous rivalry is apparently universal. But rates of such killing vary dramatically among times and places [see “Men, Honor and Murder,” on page 16]. Despite a recent decline in homicides in

the U.S., killings during altercations and robberies still happen at per capita rates many times higher than those in Scandinavia or Japan. Even U.S. rates, however, are dwarfed by those that have recently prevailed in societies that lack policing or central authority, such as various tribal communities in Amazonia and New Guinea.

Daring Tactics for Winning Big

Even for poor men with bleak prospects, violence may not be worth the risk. But when it is clear to all that some of the winners in social competition are winning big, dangerous tactics may become more attractive. This notion raises the intriguing possibility that the inequitable distribution of goods (or the perception of it) may play a greater role in promoting violence than poverty itself does.

Some findings support this idea. In comparisons between different countries and across the U.S., measures of income inequality are slightly better predictors of homicide rates than are average household and personal income. We have found the same to be true on a finer scale as well. In comparisons between neighborhoods in Chicago, income inequality is a better predictor of homicide rates than median household income is.

The best predictor of homicide rates in Chicago neighborhoods, however, is not an economic measure but a demographic one: the local life expectancy. Where life may be short anyway, men appear to be readier to resort to violence. In the worst of Chicago’s 77 neighborhoods, male life expectancy at birth in

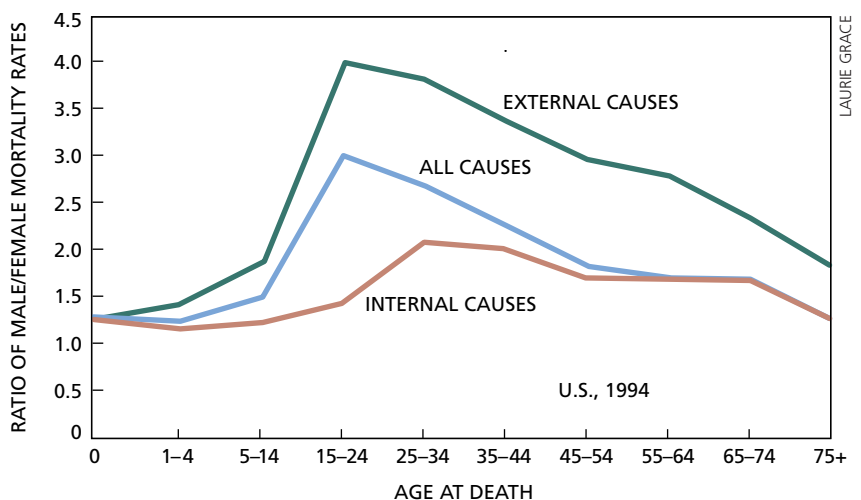
1990 was just 54 years, even with the contribution of homicide to mortality statistically removed. (Before homicide was removed, the figure was 51 years.) In the best neighborhood, life expectancy was 77 years [see illustration on page 14]. Whether awareness that death may come early actually affects a man’s readiness to turn to violence, as we have proposed, is a question for future research.

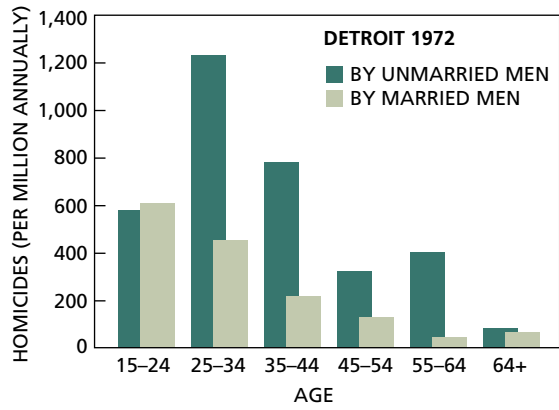
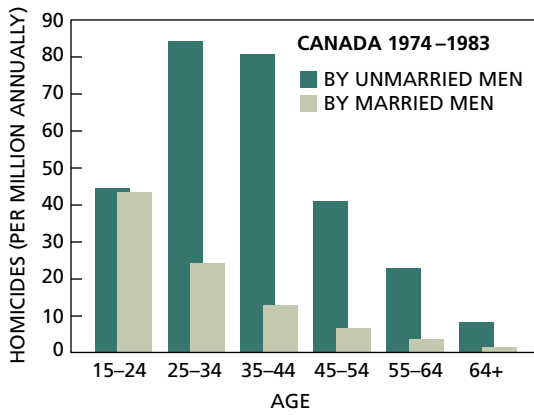
Although excess male mortality from external causes is striking, the lion’s share of U.S. women’s nearly six-year advantage in life span is the result of lower rates of death from internal causes, such as cancer and heart disease. But men’s greater taste for risk is still highly relevant.

If reckless driving kills you, your death will be classified as external, but smoking is reckless, too, and the deaths that it causes are deemed internal. Some exposure to infectious disease is influenced by behavior, particularly sexual behavior, and what we eat and where we live also have predictable effects on the risk of coming into contact with infectious agents and toxins. Moreover, the likelihood of death often depends on how soon a condition is detected and treated, and several studies have found that men monitor their health less assiduously than women do [see “Longevity: The Ultimate Gender Gap,” on page 106].

Still, even after all the reckless behav-

MALE DEATH RATES exceed female rates. The ratio is greater than one at all ages for both internal causes of death (disease) and external causes (accidents, homicides and suicides).





UNMARRIED MEN kill unrelated men at higher rates. Homicide rates throughout Canada and in Detroit differ dramatically, but both sets of data show that married men kill substantially less often than unmarried men do.

ior and lifestyle differences are allowed for, it remains true that on average men senesce, or deteriorate generally, somewhat earlier than women do. Surprisingly, even this trait can be linked to men's greater acceptance of risk, but the connection is a subtle one and works on an evolutionary timescale.

Accidents, enemies and infectious diseases ensure that of a group of people born in the same year, the proportion

surviving decreases as the group ages. The result is that selection is weaker on traits that appear late in life: something that kills only old people can have little effect on the number of descendants they leave. Meanwhile selection for whatever may be required to reproduce early and successfully—such as competitive ability—is intense. Thus, mutations that engender physical and psychological advantages early in life tend to increase in number under selection and eventually become

part of a species' adaptive design, even if they also have detrimental effects in old age.

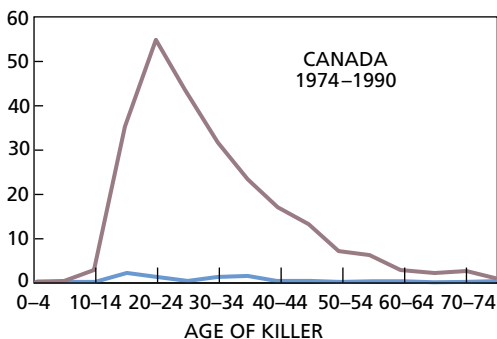
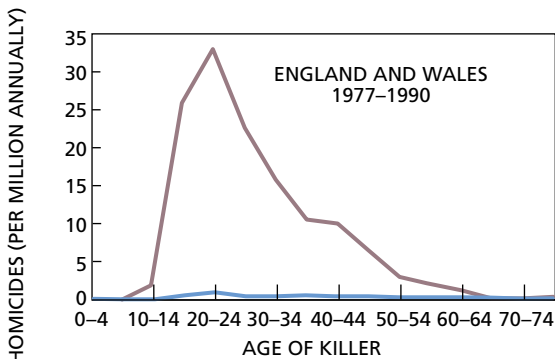
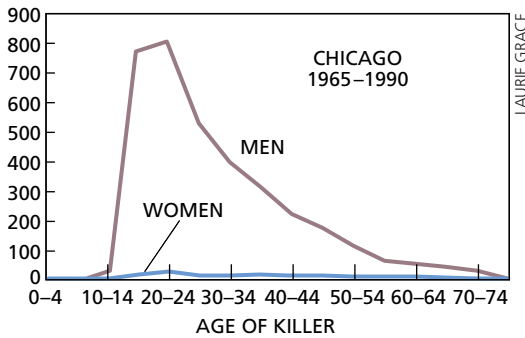
One implication of this theory is that researchers are unlikely to find a single "silver bullet" that will halt or reverse senescence, which probably entails processes of deterioration that develop in synchrony because of past selection. Another implication is that over evolutionary time, the levels of mortality that prevail early in life affect later rates of senescence. If in the natural environment more individuals are killed before senescence in species A than in a similar species B, then selection will be weaker in later life in species A, sim-

ply because fewer individuals survive to be old. Mutations that are beneficial in the younger years but harmful later will consequently be more strongly selected for in species A. As a result, it is apt to senesce earlier and die younger, even when extrinsic sources of mortality are eliminated, as in a zoo. The same principle applies to comparisons between the sexes within species: the sex with the higher nonsenescent mortality rates early in life will evolve to senesce earlier.

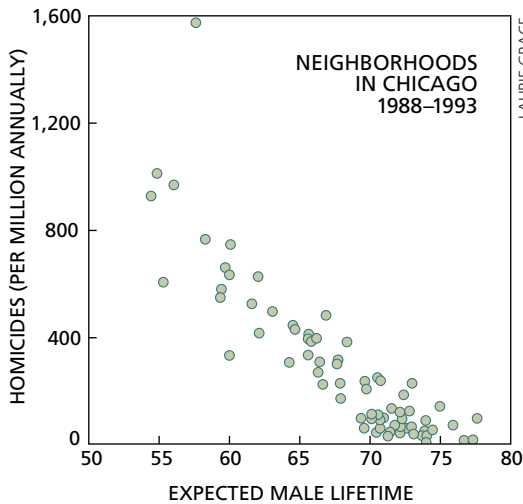
A recent analysis of the life spans of monkeys and apes in zoos inadvertently supports this idea. John Allman and his colleagues at the California Institute of Technology found that males die younger than females in precisely those species, such as gorillas and spider monkeys, in which effective polygyny is extreme. In contrast, male and female life expectancies are the same in the monogamous siamang and Goeldi's monkey, and males actually outlive females in another monogamous species, the owl monkey. White-handed gibbons, unlike the closely related siamang, have a mortality pattern like that of more polygynous apes, which was at first surprising because gibbons, too, had been considered monogamous. Recent observations of "adulterous" liaisons, however, indicate that wild gibbons are not such faithful monogamists after all.

In many species, males compete seasonally for mating opportunities and suffer injury and exhaustion in the process. When there are no more fertile females with which to mate, fighting loses its appeal and weapons such as antlers may be shed.

Such seasonally variable tactics are commonly controlled by changes in blood levels of androgens (testosterone and related hormones) produced in the testes, which affect muscularity, metabolism and motivational structures in the brain. Outside the mating season,



MEN AND WOMEN KILL unrelated persons of the same sex at greatly different rates. Most of these homicides arise from escalated disagreements over status and perceived insults. The huge difference between the sexes is seen everywhere, despite enormous differences in overall homicide rates.



LOCAL MALE LIFE EXPECTANCY is the best predictor of homicide rates in Chicago's 77 neighborhoods, even when it is computed with the effects of homicide removed (graph). Men who perceive an uncertain future may be more willing to take risks.

Biologists have theorized that physical attributes used to intimidate rivals or to advertise health to potential mates must be features that a weakling could not fake, because natural selection favors those who respond correctly to "honest" signals of quality and ignore others. Individuals who are fooled by a fake signal will tend to have lower reproductive success in the long run, because their offspring with the faker will be less hardy than the offspring of genuinely healthy mates; gullible individuals will therefore become less common in succeeding generations while individuals who ignore the "dishonest" signal proliferate.

According to this "handicap theory," androgen-dependent decorations such as the peacock's tail are honest signals of male vigor that are attractive to females precisely because they require an animal to compromise its immune system or handicap itself in other ways that a male of lesser quality could not: they guarantee his physical toughness and suggest that offspring created with him will be tough, too. This initially controversial idea has gained support in studies on various animals, and researchers have just begun to investigate its possible relevance to human male attributes.

Several researchers, including Alan Booth of Pennsylvania State University, James M. Dabbs, Jr., of Georgia State University and Allan C. Mazur of Syracuse University, have shown that blood levels of male hormones are affected by competitive behavior. Testosterone be-

gins to rise when a man is about to compete, whether in a strenuous athletic contest or something as cerebral as a chess match. The winner's testosterone continues to rise after the competition, but the loser's falls.

We hypothesize that such changes are part of a process by which competitive success or failure affects men's willingness to take a chance in a wide range of social actions, including approaching women. This idea has yet to be tested, but evidence already points to an association between changing social circumstances and testosterone levels. Mazur and his colleagues have used data from a study of 2,100 U.S. Air Force veterans to show that testosterone levels fall after marriage but rise again in those who divorce. Other studies show that levels fall lower still in new fathers who are helping to rear their infants. It is tempting to speculate that social circumstances such as competitive success, marital status and fatherhood influence assertiveness, violence and risk taking through their effects on testosterone. The behavioral effects of fluctuating hormone levels remain controversial, however, because the human data consist of correlations rather than experimental results, and the effects of hormones can be slow and cumulative rather than immediate.

Much remains to be learned about the links among men's physiology, psychology and behavior, but it is already apparent that men are more risk-prone than women in all these domains. The implication is certainly not that male recklessness and violence are universal or inevitable, for both evolutionary theory and the available evidence support the view that the more destructive forms of risk taking and competition are products of inequity and desperation. There is good reason to believe that the burdens that male risk taking imposes on society could be reduced by distributing material resources more equitably. ⁵⁴

testes often shrink and may be withdrawn into the body.

Circulating testosterone has detrimental effects beyond promoting violence and risk taking. Prostate cancer, a leading cause of death in men, develops under the influence of testosterone and can be treated with drugs that inhibit androgens' effects. Testosterone also suppresses the immune system, which may explain why androgen-inhibiting drugs can apparently help male mammals combat infections. Furthermore, castration at an early age can increase the life span of some male mammals. (This might work for men, too, but we doubt that it will become a popular way to extend human lives.)

Testosterone Poisoning

The evolutionary theory of senescence makes it easier to understand the puzzle of why a naturally circulating substance like testosterone should constitute a health hazard. Moreover, recent work on the evolution of social signals suggests that "testosterone poisoning" may be more than just an unfortunate by-product of selection for success in reproductive competition.

The Authors

MARTIN DALY and MARGO WILSON are professors of psychology at McMaster University in Hamilton, Ontario. Both began their scientific careers in animal behavior, Daly studying rodent socioecology and Wilson studying behavioral endocrinology of rhesus monkeys. They still do behavioral research on desert rodents, but their primary focus is now on epidemiological studies of homicides as an "assay" of interpersonal conflict. They are the co-editors of the journal *Evolution & Human Behavior*, and Wilson is just completing a term as president of the Human Behavior & Evolution Society.

Further Reading

HOMICIDE. Martin Daly and Margo Wilson. Aldine de Gruyter, 1988.

LIFE EXPECTANCY, ECONOMIC INEQUALITY, HOMICIDE, AND REPRODUCTIVE TIMING IN CHICAGO NEIGHBOURHOODS. Margo Wilson and Martin Daly in *British Medical Journal*, Vol. 314, No. 7089, pages 1271-1274; April 26, 1997.

WHY WE AGE: WHAT SCIENCE IS DISCOVERING ABOUT THE BODY'S JOURNEY THROUGH LIFE. Steven N. Austad. John Wiley & Sons, 1997.

MALE, FEMALE: THE EVOLUTION OF HUMAN SEX DIFFERENCES. David C. Geary. American Psychological Association Press, 1998.