Introduction

Mary Maxwell

The title of this book, *The Sociobiological Imagination,* recalls the title of C. Wright Mills's book, *The Sociological Imagination.* Mills claimed, in 1959, that the academic subject of sociology had caught on with the public. A few decades after sociology's arrival on university campuses, he said, the sociological imagination was part of everyday thinking. Journalists, for example, had begun to report the phenomenon of unemployment as a sociological trend, as having to do with broad social and economic forces rather than with particular workers or factories. No doubt a similar book could have been written around the same time, entitled "The Psychological Imagination," concerning the popular acceptance of theories of psychology. The academic terms *repression, conditioning, neurosis,* and *sublimation,* for example, had come into ordinary lay usage.

The book at hand deals with the rapid spread of the ideas of sociobiology. Unlike Mills's *Sociological Imagination,* though, this book will not be concerned with the way those ideas have reached the general public. The public understanding—or, more often, misunderstanding—of sociobiology is not, I ween, worthy of a celebratory volume. Instead, it is my plan here to demonstrate the wide influence sociobiology has had on other *academic* disciplines. In eighteen chapters, scholars from such fields as philosophy, psychology, anthropology, and political science discuss how their areas of knowledge have been illuminated by, or challenged by, the new ideas of sociobiology.

The purpose of this book is threefold. First, it is meant to acknowledge that the proliferation of sociobiological ideas is

a remarkable phenomenon in itself. It would be hard to think of another example in which one major new theory has had such extensive intellectual ramifications. Second, this book is intended to show that the majority of the developments in human sociobiology have in fact taken place in various disciplines outside of biology. The reader will see that, for the most part, sociobiologists have not personally invaded other academic areas. Rather, qualified scholars in those other areas have taken the basic theory of sociobiology and used it, and developed it, with respect to their own subject matter, their own theoretical concerns. If one were to ask today, Where is the corpus of human sociobiological research?, the reply would have to be that it is located in these disparate places. (Note: in this book, each chapter—with the exception of those on aesthetics and history— has been written by a member of the respective discipline.)

Third, by presenting the multifaceted discipline of sociobiology in this way, this book should stand as a useful introduction to the major principles of sociobiology. It is by no means meant to serve as a textbook; readers will be referred elsewhere for technical discussions. Nor is it meant to be a complete record of developments within each field. Some of the chapters in fact cover only one or two issues—enough to give the reader a sense of how the work is done. Nevertheless, a reasonable picture of contemporary sociobiological research, and the direction of future research, should emerge from these pages.

Let me now give a brief sketch of the field of human sociobiology, which can be said to have become "reified" in 1975 upon the publication of E. O. Wilson's *Sociobiology: The New Synthesis*. I shall outline its two major stages, which I see as centering on two theories—the theory of genetic altruism, also known as "inclusive fitness," and the theory of gene-culture coevolution, sometimes known as "evolved constraints." Before getting to that, however, I must backtrack to the late 1960s and early 1970s when human ethology was coming into bloom.

ETHOLOGY

Ethology—the scientific study of animal behavior—had been developed since the 1930s, mainly in Europe, as the study of

instincts—for example, how an animal deals with predators, how it finds food, and so forth. Whereas it had been appreciated since Darwin's time that anatomical features were genetically inherited, it now became apparent that behaviors were likewise genetically inherited. And whereas it had been realized that anatomical features could be accounted for by natural selection—that is, these functions were adaptations to the environment that helped their owners to be "selected" in evolution—it now became realized that behaviors, too, are adaptations. Suddenly, animal behaviors that had been curiosities (say, the mating dance of the fly, or migratory patterns in ungulates) now came in for Darwinian analysis.

In cases where the animal behavior in question happened to resemble a human behavior, it seemed logical to suggest that the human behaviors, too, were based on instinct. Human ethology received widespread notice by way of several popular books. Konrad Lorenz, an ethologist who had become known for his theory of "imprinting" in geese, wrote provocatively about the human propensity for violence in his 1967 book, *On Aggression*. Robert Ardrey, who was a playwright rather than a scientist, took up the hypothesis that territorial behavior in humans was the same preprogrammed phenomenon as seen in animals. He published this idea in 1971, titling his book, *The Territorial Imperative,* to refer to this instinct. Desmond Morris, a zoologist, pointed out numerous points of comparison between human and animal behavior in *The Naked Ape* (1969)—notably in regard to sexual activity. (Accordingly, this book reached a large audience by being serialized in tabloid newspapers.)

Around the same time, in 1971, Jane Goodall published *In the Shadow of Man*. Her mission was not to show that humans were like chimpanzees, but to show that many chimpanzee behaviors were astonishingly humanlike. In any case, her book added to the general idea that some of our human behaviors may be genetically given rather than invented by culture. The anthropologists Lionel Tiger and Robin Fox took up specifically the problem of how cultures come to invent the very things for which people are already genetically predisposed. The rituals of courtship, for example, which anthropologists had always assumed to be "invented," were now hypothesized by Tiger and Fox to be based on the "biogram" of our species, and to be

similar in some ways to animal rituals of courtship. The same could be said of, say, political leadership. The cover of the paperback edition of their 1971 book, *The Imperial Animal,* featured an ape wearing ermine and a crown and holding a sceptre.

It is not now possible—and I suspect will never be possible—for us to measure precisely the contribution these human ethological studies made to the sociobiological imagination. Clearly they were widely disseminated and discussed, and given time, they perhaps would have led to many developments in the academic disciplines represented in this book. In their day, however, they were generally not considered academically respectable. This was partly due to a moral objection—the popular ethologists played up many of mankind's less desirable traits and implied that these traits were insurmountable. It was also due to an intellectual objection—the way in which "instincts" actually translated into human behavior remained a mystery. There was no way to show whether humans were performing certain actions because they freely chose to do so, or because they were "genetically determined" to do so. Hence, it seemed that the two alternative explanations—nature and nurture—were equally valid; intellectuals could hold one opinion or the other, more or less according to taste, since science could not offer a ruling.

SOCIOBIOLOGY

This situation changed, beginning in 1975 with the publication of *Sociobiology* by the entomologist (insect specialist) E. O. Wilson. Wilson's book had been "in the works" to synthesize certain major theoretical developments in biology, quite apart from the human ethology studies just mentioned (though those studies obviously contributed to Wilson's speculations about the human species in the final chapter of his book). *Sociobiology* is a large and unquestionably scientific book concerned mainly with the sociobiology of animals. "Sociobiology" does not mean "the biology of people," as is often assumed; it means "the biology of society." Societies are found in many nonhuman species; the new discipline of sociobiology studies how these societies first evolved, and how patterns of the animals' social

behavior continue to be governed by genes. Needless to say, this part of the work is uncontroversial: no one seems to mind when a biologist points out how the food-sharing practices of ants, for instance, is an inherited trait.

The principal theory on which the science of sociobiology is based is one that was put forth by another entomologist, William D. Hamilton, in 1964. It is known as the theory of genetic altruism, or kin altruism, or kin selection, or inclusive fitness. This theory shows how it is biologically possible for an individual animal to have a genetic trait that causes it to perform some unselfish action—some action that favors the survival of another individual at expense to itself. This was no small discovery in biology—many great minds had been working on it for years. The "Darwinian synthesis" of the 1930s had linked Darwin's theory of natural selection to the science of genetics and the science of ecology, but further developments were held up by "the problem of altruism." Biologists were frustrated by the lack of a theoretical explanation for many of the social behaviors that were easily observed in nature.

Hamilton's (1964) solution to the problem of altruism—which came to him through his study of bees—was that an individual, Ego, can perform an altruistic act if it helps another member of the family, since that member of the family possesses some of Ego's genes (that is, copies of the same genes as Ego possesses). By helping that member in some way to survive and thus reproduce, Ego is thereby helping its own genes to proliferate in the next generation. This is true even if Ego's altruistic act causes Ego's premature death or Ego's failure to leave direct descendants. As long as Ego's genes get included in the next generation through "collateral descendants," the altruistic trait can be passed on. Altruistic behavior is thus no longer a biological mystery. It is not always the *individual* that is selected for, as in the traditional theory of natural selection—the *family* with the trait can be selected for, hence Hamilton's theory is sometimes known as "kin selection."

Hamilton's theory is simple—so simple, Wilson says, that a person could work it out on the back of an envelope in three minutes—but one that, Wilson admits, he would probably never have thought of (1985, 478). The essence of Hamilton's theory is "genetic selfishness," or, as Richard Dawkins (1976, revised

1989) calls it, "the selfish gene." The key point is that altruism is not "really" performed for the good of others, it is performed for the good of the gene that selfishly "wants" to be included in future generations. Thus, biological altruism always has a payoff for the donor—in the long run (as long as we think of the well-proliferated gene as being the winner, even after the altruistic individual's death).

This is quite a different perspective from trying to account for an altruistic act in terms of its more obvious effects, namely, the beneficial effects it has on the recipient. For decades, biologists had tried to figure out why certain behaviors contribute to "the good of the group." It is now widely accepted, following the insights of Hamilton and of George C. Williams (1966) that evolution does not occur for the good of the group. It occurs only for the good of the individual or the good of the genes. There are enormous—and largely unexpected—ramifications of this basic sociobiological theory for human life. Most of the chapters in the first half of this book discuss these ramifications. The chapters in the second half of the book mostly discuss the ramifications of a "second stage" of sociobiological theory, namely gene-culture theory—which deals exclusively with the human species.

GENE-CULTURE THEORY

I stated earlier that the human ethology ideas of the late 1960s and early 1970s led to polarity over nature-nurture, which, I hinted, was "resolved" by the arrival of sociobiology. Of course, that resolution was appreciated at first by only a few scholars; sociobiology hardly swept through the groves of Academe. Indeed, for a few years after its publication, Wilson's *Sociobiology* was more or less taboo among scholars of the humanities and social sciences, and Wilson himself was thought to be the new personification of social Darwinism. Much of this reaction was purely ideological—genetics as applied to humans had earned a bad name and was automatically associated with certain political policies. However, there were also the same grounds for rejecting human sociobiology as there had been for rejecting human ethology, namely, that it did not account for the mind. Despite sociobiology's finding the key to the

genetics of social behavior—at least in animals—it still failed to show how culture came about, or how individuals exercise free choice in the face of genetic constraints.

Various biologists began to put together some ideas about the relationship between genes and culture. Early writers in this field were William Durham (1978), L. L. Cavalli-Sforza and M. W. Feldman (1981) and Robert Boyd and Peter J. Richardson (1985). In 1978, Charles Lumsden initiated a collaboration with E. O. Wilson that led to the theory of gene-culture coevolution (Lumsden and Wilson 1981, 1983). Culture evolves, they said, through genes that design the human mind. In evolutionary time, some individuals had certain "mental mutations"—so to speak—that made them able to invent, or imitate, some cultural artifact or cultural behavior. These individuals may have survived better than others who did not possess such mutations (that is, such genes). Thus, to oversimplify greatly, genes and culture *coevolve:* the genes help the cultural items (known as "culturgens") to proliferate, and the cultural items (warm clothing, fish hooks) help their bearers to survive.

The essence of this theory is that the inherited mental traits consist mainly of *preferences* for one thing over another, and thus lead to a similarity of cultural forms that people eventually invent (thus solving the riddle of the universality of certain cultural institutions). In the Lumsden-Wilson theory, inherited mental traits also lead to "semantic" understanding, such that words and concepts conjure up roughly the same thing to all users of a particular language.

Throughout the 1980s, much work was done by psychologists in an effort to explain how evolved "rules" in the brain lead to preferential, or constrained, learning of certain things over others. Indeed, psychologists now attempt to find out how genes can (if they can) govern *thought.* Leda Cosmides and John Tooby (1989) have come up with the idea that different types of thinking, or mental "computations," evolved to deal with different social and environmental events. Thus, we may have a set of cognitive operations that gets switched on when we are faced with threat, or cheating, or finding a mate. This is quite different from the traditional view of the mind as receiving all its thoughts through learning—in fact, it is almost reminiscent of the pre-Lockean notion of innate ideas. This research is sometimes known as the study of "evolved constraints."

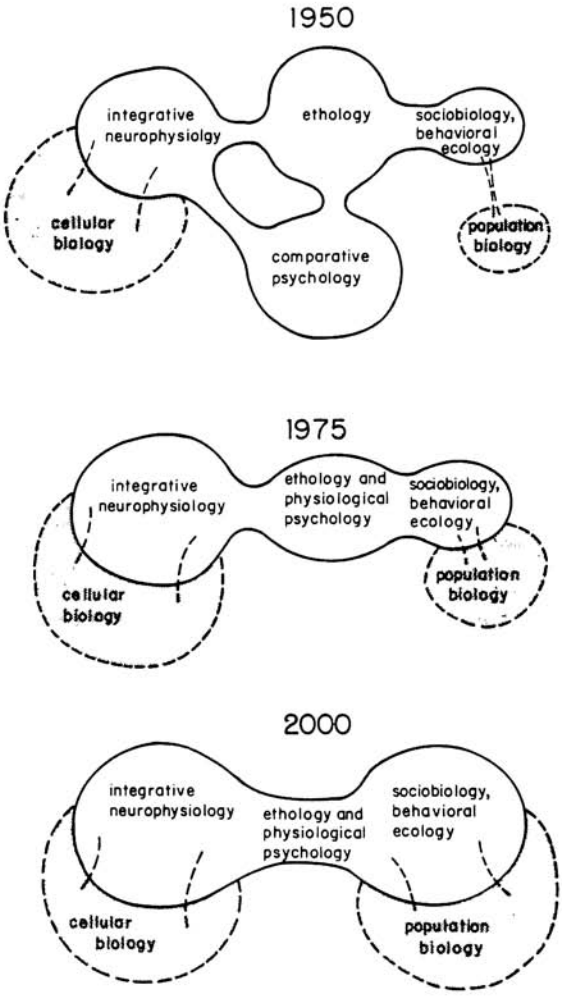

Figure 1. E. O. Wilson's projection, for the year 1950 to the year 2000, of the relative number of ideas from various disciplines in and adjacent to behavioral biology. (Reprinted from Wilson, 1975, with permission.)

In 1975, E. O. Wilson drew what he called a "subjective conception of the relative number of ideas in various disciplines" that bore on behavioral biology (see fig. 1). He showed how they had changed from 1950 to 1975 and projected how they might change from 1975 to 2000. As we draw closer to the turn of the

century, it appears that the middle of the "dogbone" in the future picture should probably be thicker, to account for the increasing work by psychologists. Of course, it must be remembered that Wilson's conceptualization has more to do with animal sociobiology than with humans.

PLAN OF THIS BOOK

As stated earlier, the purpose of this book is threefold—to acknowledge the remarkably wide influence of a central idea, to demonstrate that the research of human sociobiology takes place in disparate fields, and to introduce the major principles of sociobiology. In regard to the first item, this book acknowledges the influence of a central idea simply by presenting evidence that the sociobiological idea *has* spread to many other fields. There has been no attempt by myself or the other authors to chronicle how the idea got spread, that is, to trace the particular pathways of knowledge. That would be an interesting topic, and one which historians of science will no doubt undertake, but is not something we could accomplish in these pages.

In regard to the second item, the demonstration that the research of human sociobiology takes place in disparate fields, it will not be surprising to find that the fields that have been most involved, to date, are psychology and anthropology. Crawford's chapter on psychology, Kenrick and Hogan's chapter on cognitive psychology, Nesse's chapter on psychiatry, and Iron's chapter on anthropology all make strong claims as to the importance of sociobiological theory for guiding new research in their fields. Masters's chapter on political science outlines experiments that could yield new knowledge about politics; Beckstrom's chapter on law suggests one way in which sociobiology could inspire new empirical research. Betzig's chapter on history contends that historians have missed out on a radical new (sociobiological) perspective on human history, and presents new problems for historians to solve.

As mentioned, the first half of the book emphasizes the theory of altruism, the second half emphasizes gene-culture theory. Ruse's chapter on epistemology and Lumden's chapter on aesthetics discuss ways in which gene-culture theory

illuminates science and art, respectively. Van der Dennen's chapter on conflict studies mentions one way in which the study of war could be aided by gene–culture considerations. Two chapters are critical of gene–culture theory: Reynolds's on the socioecology of religion, and Karpinskaya's on Marxist thought (the latter, from an angle one might not expect!) Two earlier chapters incorporate criticism of the theory of altruism: Chandler's on ethical philosophy, and Galdikas and Vasey's on primatology.

Three chapters have to do with the influence (or potential influence) of general evolutionary theory, rather than specifically sociobiological theory, on their fields. They are Frank's chapter on economics, Hurford's chapter on linguistics, and Bernhard and Glantz's chapter on management theory. One chapter has mainly to do with the *non*influence of sociobiological theory on a given field, namely van den Berghe's chapter on sociology (although its author is a prominent user of that theory in regard to sociology).

In regard to the third purpose of this book, to introduce the major principles of sociobiology, I have attended to this in two ways. The first consists of appending a glossary to this introduction. Although it is perhaps not customary for readers to imbibe glossary items in alphabetical order, this particular glossary was written with just that in mind. The easy sociobiological definitions (by some quirk of fate or editorial meddling) come at the beginning of the alphabet, and the more complex ones later. ("Natural selection," for example, moved its way up by being renamed "Darwin-Wallace theory of natural selection.") The glossary items also direct the reader to particular chapters; thus, for example, the entry *Reproductive Success* directs the reader to discussions of this in chapters 4 and 7; the entry *Epigenetic Rules* directs the reader to chapters 11, 15, and 17.

The second way of introducing the major principles of sociobiology consists of having each chapter author say as much as she or he needs to say—about reciprocal altruism, the theory of differential parental investment, or whatever— to be able to argue her or his case. This has resulted in some repetition, but repetition is no doubt needed by the novice and should make the old pro feel—well, like an old pro. Also, authors

have also been asked to resist the temptation to write in the way they normally write for colleagues, and to concentrate on things of interest to the lay reader. (And who is not a lay reader, when a book involves eighteen disciplines?)

OTHER SOURCES

Breathes there a student who never before has delved into sociobiology, he might begin by reading the book of that name (or at least Wilson's 1980 *Sociobiology: The Abridged Edition*), or Robert Trivers's highly illustrated *Social Evolution* (1985). He might equally well begin by trying a work of "applied sociobiology" that also contains basic theory, such as Pierre van den Berghe's *The Ethnic Phenomenon* (1981) or Richard Alexander's *The Biology of Moral Systems* (1987). To locate other works, he may thumb through the combined bibliography of the volume at hand, or may peruse a lengthier catalogue such as *A Bibliography of Biosocial Science* by Hiram Caton and Frank Salter.

Journals in which articles on human sociobiology appear regularly are easy to list because they are very few. *Behavioral and Brain Sciences* is one; it often covers a new aspect of sociobiology in depth, with numerous authors proffering "peer commentary." *Politics and the Life Sciences* does the same, particularly—but not exclusively—for books in political science. *The Journal of Social and Biological Structures* carries original articles and sometimes publishes symposia on sociobiology. *Ethology and Sociobiology* is the meeting place for those in the front line of sociobiological research; it occasionally publishes retrospectives and hosts heated debates. *Human Nature* is a new journal, aiming for the general reader; *Biology and Philosophy* aims at philosophically minded scientists and scientifically minded philosophers. As one can see from citations at the end of this book, there are also mainstream journals that carry occasional sociobiological articles, for example, *Current Anthropology, Primates, American Anthropologist, the Journal of Human Evolution, Philosophy, Perspectives in Biology and Medicine,* and *Zygon: Journal of Science and Religion.*

As well, there are societies that have annual meetings and send out regular newsletters, often with very up-to-date reviews

of books on sociobiological topics. These include the Human Behavior and Evolution Society, the European Sociobiological Society, the Human Ethology Society, the International Society of Human Ecology, and the Association of Politics and the Life Sciences.

GLOSSARY

Altruism. In common parlance, the word *altruism* means generosity or a particularly selfless act or attitude. In biology, altruism likewise means an act that helps another, but since the 1964 work of W. D. Hamilton, the term means "an act by which one individual helps another in a way that benefits the (altruistic) individual's genes" (see *kin altruism* below). Since the 1971 work of Robert Trivers, it also means "an act by which one individual helps another in expectation that an equal or greater favor will be returned" (see *reciprocal altruism* below). For a philosophical discussion of the problematical definition of altruism, see chapter 9.

Balance of power. Why did hominids or early humans form larger and larger groups? Such agglomerations require more altruism of individuals than does living in small family groups, and so appear costly and unadaptive. Richard Alexander (1979) hypothesizes that the explanation for group living among hominids is defense of one group against another. Hominids cooperated in order to balance the power of rivals. See chapter 13 for discussion of the origin of warfare.

Cultural selection. This term refers not to a biological but to an historical process. In the Darwin-Wallace theory of natural selection (see below) one speaks of a trait—or its possessor—being "selected for" or "selected against," meaning that the pressures of the environment cause certain biological traits to survive over others. In human history, a culture may be selected against, for example, if its technology is unable to compete with that of a more advanced culture. Cultural selection may, but does not necessarily, involve the disappearance of the people who practice the culture, as in the case of the genocide of Tasmanian aboriginals by European settlers. For comparison of cultural selection with other modes of change, see chapter 12.

Darwin-Wallace theory of natural selection. This is the theory explaining the evolution of life (both plants and animals) over eons, and thus explaining the multiplicity of species. It was independently arrived at in the middle of the nineteenth century by Charles Darwin and Alfred Russell Wallace. Its major premises are as follows: (1) There is an abundance of young born in most species (sometimes thousands of offspring born to one parent). (2) Only a fraction of these can survive to reproductive age. (3) There is variation among individuals as to characteristics (later recognized to be based on assortment of genes, and occasional mutations in genes). (4) The most "fit" individuals, that is, the ones with characteristics best suited to the environment, will survive and reproduce, passing on those traits to progeny.

Darwinian algorithm. An algorithm is a recurring computation or a logical process in which a particular choice gives rise to another sequence of choices. A physician can arrive at a medical diagnosis algorithmically, for example, by narrowing down the possibility of certain diseases according to the presence or absence of key symptoms. The term *Darwinian algorithm,* coined in 1985 by Leda Cosmides, refers to the idea that certain mental processes (and the physiology supporting them) evolved by natural selection. For example, there may be an algorithm that people (or animals) automatically use to compute the seriousness of a threat by a predator. This work by Cosmides and Tooby is discussed in chapters 1, 10, 13, and 18.

Epigenesis. The word *genesis* means "origin," *epi* means "after." The biological theory of epigenesis holds that what happens after the origin of a new life at conception is the carrying out of instructions that are present in the first cell—but that this process is at least partly dependent on the environment. The first environment of the embryo for a mammal is the womb; the later environment is outside.

Epigenetic rules. Why do we learn certain things and not others? Why do most people "see" things the same way? It may be that we inherit genes for mental processes that cause us to take in information from the environment in more or less prescribed ways. E. O. Wilson (1978) suggested that we inherit "learning rules." Lumsden and Wilson (1981) refer to these as "epigenetic rules." See chapters 11, 15, and 17 for theory and examples.

Ethology. Ethology is the study of animal behavior with particular reference to the evolutionary explanation of the behavior. A related field, behavioral ecology, emphasizes the environmental factors—such as types of food resources, or predators—that make certain behaviors adaptive in evolution. For a study in human ethology, see chapter 8.

Fitness. This term does not refer to trimness of figure obtained by exercise! Fitness is a measure of one's ability, relative to other members of the same species, to survive and leave progeny. Evolutionary biologists frequently refer to this as "Darwinian fitness" or "reproductive fitness," emphasizing that one is not fit unless one reproduces. The word *fitness* can also be used to indicate one's fitness to a particular environment. The "survival of the fittest" means that those who are fit in their environment (giraffes with long necks to reach high foliage) will survive. In the sense mentioned above, in which fitness is an actual measure of survival, the phrase *survival of the fittest"* is rather circular.

Gene. The gene is the basic unit of heredity. Genes recombine differently in each generation, in species with sexual reproduction. Such recombination accounts for most diversity, while mutations account for evolutionary change. Genes are contained in every living cell. Gregor Mendel "knew about" genes indirectly from his experiments with garden peas in 1866. James Watson and Francis Crick, in 1953, found the actual mode by which a gene gives out instructions for development.

Gene-culture coevolution. It used to be thought that humans had some general capacity for culture—a receptor, or blank state—that allowed them to absorb whatever their culture offered them. That, however, does not explain how cultures get started in the first place, or why very distant cultures often bear much resemblance to one another. Various sociobiologists have now put forth models to show how culture could have evolved biologically, in the sense that there could be brain mechanisms that influence the adoption of certain cultural practices or artifacts. See the Introduction for the Lumsden-Wilson theory of coevolution; see chapters 11 and 15 for applications of it, chapter 12 for comparison to other theories of cultural evolution, and chapters 12 and 14 for criticism of it.

"Hey, man. What's happening?"

© *The New Yorker*

Group selection. Within sociobiological circles, belief in this phenomenon marks you as a member of the out-group. The theory of group selection is viewed as one of the great mistakes made by earlier biologists—notably, by Wynne-Edwards (1962). It holds that traits (particularly altruistic traits) that make Group A more fit than Group B (as a group) can proliferate because Group A will survive and Group B will die out. For instance, a group or population of animals that limits its birthrate would avoid overconsumption of resources and consequent famine, hence it would do better than a group of prolific profligate individuals. The flaw in group-selectionist thinking is that there is no way to explain how the *early* mutants with this self-sacrificing trait would survive—they would obviously be out-reproduced by their fellow group-members. For the most part, it has now been shown (by George C. Williams [1966] and others) that the illusion of group selection can usually be explained by individual selection or by kin selection (see below). As applied to the human species, however, group selection may be possible, since one group of humans can consciously organize their altruistic behaviors and wipe out a rival group. See chapter 13.

Inclusive fitness. This is a measure of how many of Ego's genes are *included* in future generations. An individual's

inclusive fitness refers to both her own reproductive fitness (how many offspring she has) and the extent to which she influences the fitness of other relatives (such as indirect descendants). An altruist may have low reproductive fitness yet still have high inclusive fitness, if her altruism is "well-aimed." That is, it should be aimed only at relatives and only at helping them in ways that enhance their reproductive fitness. The notion of inclusive fitness as formulated by William D. Hamilton (1964) is the basis of sociobiological theory. See references to this in chapters 1, 2, 4, 6, 7, 8, 9, and 18.

Is-ought. One of the early philosophical complaints about sociobiology, or earlier about Darwinism, was that the study of how a thing "is" in nature is tantamount to an appraisal that that is how it "ought" to be. Aggressive behavior is one famous example, as is the more abstract principle of "struggle for existence." The logic goes something like this: if nature (God) has mandated that there be a struggle in which the aggressive win, then civilization (modern humans) should not go against this by legislating gentleness, welfare assistance, and so forth. Most sociobiologists now tread a careful path in this area. See chapter 2 for the distinction between using sociobiological research in a facultative way rather than in a norm-setting or goal-setting way.

Kin altruism. Altruism performed toward kin. See also *reciprocal altruism.* Discussions appear in chapters 2, 6, 9, and 18.

Kin selection. John Maynard Smith (1976) coined the term *kin selection* to account for the evolutionary phenomenon that takes place according to Hamilton's formula of inclusive fitness. Instead of the individual undergoing selection, it is the family or kin group that undergoes selection. Note that kin selection is thus a type of group selection (see above), but it is a "correct" type. It does not encounter the difficulty of the "early mutants." Early mutants who help family members may die, but their mutant altruistic traits can live on through the collateral descendants whom they help.

Lamarckism and Lysenkoism. Named after a great, if mistaken, biologist, Lamarck, *Lamarckism* is a convenient term for what modern biologists do not believe in: they do not believe that acquired traits are passed on to progeny. One cannot improve one's genetic stock by exercise; giraffes who stretch

their necks do not give birth to giraffes with longer necks. Lamarckism had a revival as Lysenkoism in Russia, with disastrous consequences for agriculture. The Soviet biologist Trofim Lysenko in the 1930s, in line with the Marxist doctrine of environmental influence, believed that acquired characteristics (for example, in plant species) could improve the genetic stock. See chapter 14 for Marxist commentary on this.

Learning. The theory of learning has changed greatly since the behaviorist heyday of the 1960s. Psychologists now look at the costs and benefits of learning (see chapter 18) and at learning that is situation-specific (see chapter 10). See also *epigenetic rules,* above.

Level of selection. Sociobiologists are very keen on distinguishing between levels of selection: group, kin, individual, and even selection at the level of the gene, that is, genetic selection (see *selfish gene,* below). After reading, say, chapter 4 or chapter 7 of this book, the novice may try her luck at identifying the level of selection that was most discussed in that chapter. Hint: in chapter 9 it is genetic selection; in chapter 5 it is individual; in chapter 6 it is kin; in (part of) chapter 13 it is group. A case can be made, though, that it is always genetic selection.

Life histories. Every animal has a life to lead that may include various stages, calling for different behaviors. Ethologists, sociobiologists, and now evolutionary psychologists are interested in explaining the range of behaviors involved throughout an individual's lifetime. What is an adaptive behavior for an infant may be maladaptive for an adolescent. See chapters 1, 10, and 18 for psychologists' use of the life-histories concept.

Mating strategy. A human individual can consciously work out a mating strategy—by planning, for example, to marry a wealthy person or a person who does not already have children. Such strategies could increase his or her inclusive fitness. Sociobiologists believe that most animals, including humans, have inherited predispositions for engaging in particular mating strategies that will increase their inclusive fitness. These predispositions operate below the conscious level of awareness, as though the genes were demanding that the individual maximize her or his number (and quality) of

offspring. It is possible that such behavioral predispositions result in the human invention of certain cultural customs about marriage choice. See chapters 4, 7, 10, and 18.

Maximize. This term, as in "maximizing one's fitness," and *optimal,* as in "seeking optimal strategies," are terms used by biologists in the tradition of economics or game theory. They typify the level of abstraction at which sociobiologists frequently operate. These words almost never refer to conscious planning by individuals; rather, the impulse to maximize is deduced from the successful results.

Monogamy. Among mammals, monogamy (having a sole mate) is unusual, for reasons having to do with sexual selection (see below). Humans are mammals, and therefore human monogamy is a peculiarity that needs to be accounted for. See chapter 7.

Nepotism. This word came into the English language through the Italian word *nepotismo,* meaning "favoring nephews" (by sixteenth-century prelates). It generally conjures up a shady practice. Yet it is only a cultural belief in "fair treatment" that gives us the idea that nepotism is wrong. Throughout the animal kingdom nepotism is the norm for social species. I go further: the practice of nepotism *defines* social species. Moreover, as shown above, the ability of altruism to be passed on genetically depended in the first instance on its being a practice directed exclusively toward relatives. See chapters 4, 7, 13, and 18. Concerning nepotism in the courtroom, see chapter 2.

Parent-offspring conflict. Every child "has words" now and then with his parents—or vice versa. Why is this so? According to Robert Trivers's 1974 theory of parent-offspring conflict, it is because a parent and his children have somewhat conflicting interests. The parent *is* interested in helping his child, because that will make the child grow to maturity and help the parent's reproductive fitness. But the parent also has an interest in turning his attention away from that particular child and investing in reproducing and raising others. See chapter 6 for application of this theory in primates, chapter 1 for humans.

Parental investment theory. To a sociobiologist, *parental investment* means something more fundamental than saving for college tuition, and it is more complicated. Robert Trivers's theory of parental investment (1972) builds on Darwin's theory

of sexual selection (see below). It is also called "differential parental investment" to indicate that a female parent has reason to invest in offspring in a different way than the male. Very often in nature, the female invests a lot, and the male invests little or nothing—beyond the act of mating. This dictates that the female may use very different criteria than the male for choosing a mate. See chapters 1, 4, 7, and 10.

Reciprocal altruism. "You pick my lice, I'll pick yours." Grooming among monkeys is an example of altruistic behavior that is often done on behalf of kin (see *kin altruism* above), but it is also done on behalf of non-kin. In the latter case, it is probably a manifestation of reciprocal altruism. Robert Trivers's 1971 theory of reciprocal altruism holds that some species have evolved the trait for performing favors in expectation of a returned favor. This has probably been of enormous significance in the invention of human morality (see Maxwell 1990, 1991). It is not known how reciprocal altruism got started. See chapter 5 for discussion of the way cooperators can beat cheaters. See also chapters 1, 4, 6, 8, 9, and 18.

Reproductive success. This is simply a measure of the number of an individual's surviving offspring; it is abbreviated "RS." At social gatherings, sociobiologists are heard to ask one another What's your RS? (instead of "How many kids have you got?"). See chapters 4 and 7.

Selection pressure. Natural selection occurs when the pressures of the environment (such as difficulty of access to food or to mates, or hot climate, or the activity of predators) cause individuals with certain traits (including new mutations) to survive over others. One can say that the trait "responded" to the particular selection pressure. Ethologists and sociobiologists like to look at an evolved trait (such as territorial behavior or a mating strategy) and try to guess the selection pressure that brought it about.

Selective retention. Human societies may selectively retain certain cultural practices or may abandon them over time. Sociobiologists want to know why and how certain ones get retained. See chapter 12 for discussion, and chapters 11, 13, and 15 for examples.

Selfish gene. No gene—which is a mere collection of DNA molecules—can be said to have a selfish attitude or to make

selfish plans, since these things require a brain. Nevertheless, it is useful to pretend, as Richard Dawkins (1976) has done, that a gene thinks about its desire to survive, and that it can do so only by causing its bearer to perform actions that will result in reproduction of the gene in future generations. This heuristic device allows sociobiologists to "predict" the evolution of things that would otherwise seem impossible—notably, altruism. Dawkins (1989) admits that there is a tension between thinking of the gene and thinking of the individual. In the first image we see "independent DNA replicators, skipping. . .down the generations, temporarily brought together in throwaway survival machines, immortal coils shuffling off an endless succession of mortal ones. ." (234). In the second image, each individual body appears to consist of an obviously "coherent, integrated, immensely complicated machine, with a conspicuous unity of purpose" (234). Sociobiology employs both of these images.

Sexual selection. There is natural selection and there is sexual selection (which, also, is "natural"). For natural selection to occur, the selection pressure can be anything in the environment. For sexual selection to occur, the environmental pressure has specifically to do with the opposite sex. Charles Darwin (1871) identified two kinds of sexual selection. The first is epigamic. Here the female, say, has a preference for some visible characteristic of the male (such as colorful feathers). Males with that trait will be more successful than others in winning mates, and so the trait will proliferate—even if it is not an adaptive trait in any other practical sense.

The second type of sexual selection is inter-sexual competition. Where male mates are the "limiting resource," females have to fight with one another to establish a hierarchy of privilege for access to the males. Most often it works the other way. Among mammals, females are the limiting resource because a pregnancy "ties them up" for several months. Hence, males fight each other—not always for the immediate privilege of mating, but in general to establish their hierarchy of priority. One obvious indicator that sexual selection has taken place in a given species is *sexual dimorphism*—that is, differences in the bodies of the male and female. The male orangutan, for example, is twice the size of the female. See chapters 1, 4, 6, 7, 10, 13, and 18.