Darwinian Dominion: Animal Welfare and Human Interests

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Preface

This book is the third in a trilogy that applies evolutionary principles to understand the nature of human morality. The first two books, *Human evolution, reproduction, and morality* (1995), and *Living and dying well* (1996), considered the permissible use of humans by humans. Basic philosophical issues were discussed and an evolutionary approach was developed and applied to problems regarding human existence, including conception, birth, living a satisfactory life, and dying.

This book completes this phase of the inquiry by asking questions regarding the permissible use of animals by humans. Philosophical positions concerning animal welfare, rights, and liberation are discussed within a utilitarian framework that stresses the importance of a cost-benefit analysis of values. Attention is paid to the philosophy of science, especially the nature of explanation, the relationship of evidence to theory, and ideas regarding how to evaluate scientific change and progress. Special attention is devoted to the biological conception of species, because it looms large in philosophical discussions regarding the use of animals in research and to consume. The value and necessity of animal research to advance biological and medical science, and to the development of applications of those advances is a dominant concern.

A word of explanation is in order regarding the title, *Darwinian dominion*. The first book had a rather ordinary descriptive title—*Human evolution, reproduction, and morality*—while the second was a bit better in terms of moving beyond mere description—*Living and dying well*. While musing at my desk one evening about a title for this book, I thought of a favorite poem I had heard read by the author Dylan Thomas (1971, pp. 49–50), "And Death Shall Have No Dominion." I played his

recording of that poem, and was caught by the last three lines of the first stanza: "Though they sink through the sea they shall rise again;/ Though lovers be lost love shall not;/ And death shall have no dominion." If not Death, what, then? Of course, neo-Darwinism; hence Darwinian dominion. The word dominion I find appropriate; dominion refers to a sovereign entity in one sense of the word, and a rule of authority in another. Darwinism is a powerful disciplinary entity in the first sense, and it provides outstanding power to understand all organic systems in the second. Of course, suffering from a bit of the colon problem that inflicts academics I had to add some descriptive words: *Animal welfare and human interests*.

I must round up the usual suspects who have suffered early drafts of much of the material in all three books. A. J. Figueredo and Patricia O'Neill, both my PhD students and now professional collaborators, criticized the drafts of several chapters, contested some of my ideas, and once again forced me to greater (and briefer) clarity of exposition. In addition I owe much to Marc Hauser, who challenged some of my views, provided valuable references, and suggested radical reorganizations here and there. The MIT Press commissioned a reading of the penultimate manuscript by Michael Ruse, and I profited greatly from his comments, as well as those by some anonymous reviewers. Martin Day also read that draft and whipped me into shape on several aspects, just short of questioning my sanity in a couple of places. Curtis Hardyck, a friend and collaborator since graduate school, with his usual acerbic comments helped me appreciate where I should tighten the argument and writing.

My executive editor at The MIT Press was Betty Stanton. She coaxed and cajoled me through one major revision and then persuaded me to cut the final manuscript by 120 pages. The book is far better as a result: crisper, the logic tighter, and some tangential material deleted. Of course, some good stories were lost; they were interesting and often funny, even though they added nothing to the flow of the discussion except to amuse me during a day's writing. Betty also negotiated the paperback rights to the first two books, and they should now appear, thanks to her efforts.

Katherine Arnoldi, Senior Editor, did a superb job shepherding the copyedited manuscript though the various stages of production. She and the copyeditor, Sarah Jeffries, were magnificent; they nailed me on awk-

ward constructions and repetitious use of favorite words. The little slips attached to the manuscript that indicate a query to the author were often fun to deal with—not my usual experience when dealing with copyeditors. I am very well served by a highly gifted, understanding, and professional group of people at The MIT Press.

So, there you have it. Looking back on the past few years of my life that these books consumed, a comment by Edward Tolman (1959, p. 152), one of several great people I was privileged to study with at the University of California, Berkeley, catches my present spirit: " . . . the best that any individual scientist . . . can do seems to be to follow his own gleam and his own bent, however inadequate they may be. In fact, I suppose that actually this is what we all do. In the end the only sure criterion is to have fun. And I have had fun."

I

Basic Principles

1

Evolutionary Issues

The thesis I develop in this book is a simple one (and probably will be maddening to some). Humans have a set of cognitive abilities that develop from a suite of emotional attachments that mark them unique compared with all others not members of the species *Homo sapiens*. This avowedly speciesist belief is grounded on a complex bundle of characteristics that only humans possess. Humans have language sufficient to support a degree of complexity and level of abstraction that enables us to develop rules of law, theories of nature, principles of philosophy, and codes of conduct. We have minds capable of appreciating the minds of other beings, capable of empathy, and (unfortunately) able to perpetuate evil of unsurpassed enormity. We benefit from a developmental process that equips us to respond to human caregivers and to appeal to those caregivers from the moment of birth onward. When the human infant emerges into the human community it is recognized as a person belonging to that community, and is due respect and succor from members who have full moral standing—what philosophers call moral agency.

Other animals can suffer, can enjoy, can think, and have needs that are necessary to their good welfare and best interests. They, as are human infants, are classed by philosophers as moral patients, and as such are due respect and care for their basic needs. However, by no stretch of the imagination can their welfare interests be considered comparable with those of members of our species. I maintain that, when push comes to shove, the interests of members of our species should triumph over comparable interests of members of other species. This position does not imply that any human whim should take precedence over essential needs and deep welfare interests of nonhuman animals. It only means that

human interests should be read as high cards in any game where costs and benefits are taken into consideration. So, with this declaration, let me proceed to the task of supporting these assertions, with the hope that you will take them under serious advisement, even if you fail to be completely convinced of their infinite wisdom.

This book extends arguments begun in two previous ones concerned with the morality of various actions that affect the birth, life, and death of humans. These discussions brought to bear principles of biology, evolutionary theory, neurophysiology, medicine, and cognitive science to develop a logical, consistent, and universally applicable view of bioethics.

Moral philosophers have considered these issue for many years and have developed careful pro and con positions regarding various theories of morality. One major class of bioethical theory is utilitarianism, which considers the costs and benefits of different actions. This approach has several variants, such as the classic utilitarianism that aggregates the good over all individuals concerned, a form that meets with strong objections because of the harm it could permit to individuals. Another form is a preference utilitarianism, in which that good must be considered in terms of an individual's preferences, interests, or desires. One problem with utilitarian theories is how costs (harms) and benefits (goods) should be defined and estimated. Some suggested pleasure and pain as the currency, and others believe it should be the pursuit of life's goals, interests, and preferences.

The other major class of theory is deontological, which argues certain basic values must prevail. These values typically are couched in terms of rights, duties, or freedoms, which are offered as a system of absolute constraints that protect individuals from harm. The problem with this class of theory is that it is not clear what rights and freedoms should be recognized and established as fundamental. This is a major difficulty when rights or freedoms of different individuals come into inevitable conflict; which ones should prevail and for whom.

The philosophical concept of a social contract between individuals should serve as a major factor to constrain the actions of individuals. These social contracts are founded in aspects of biology that enhance the success of individuals to continue the process of transmitting genes to future generations. They lead to the development of tendencies that favor

kin, as well as members of one's community who can assist and reciprocate assistance given them. Social bonds between members of a family and community enhance cooperation and communication, but also can lead to distrust and enmity toward those who are not members of the community.

It has been held that a pluralistic moral philosophy honoring both utilitarian concerns and basic rights and freedoms of individuals is preferable to either monolithic view. Pluralism is an appealing position, but in many ways it runs the risk of buying into the problems of both the utilitarian and deontological camps. I propose a pluralism: I am convinced that the web of influences that impel behavior and the outcomes produced are multifaceted, that interactions among different values are highly complex, and that all actions must be considered in terms of the context within which they occur, with an allowance for the nature of all individuals involved.

In my two previous books, *Human evolution, reproduction, and morality* (Petrinovich, 1995), and *Living and dying well* (Petrinovich, 1996), I developed a bioethical thesis to provide an adequate perspective within which to consider the permissible use of humans by humans. These two books considered important issues in human life and death, basically from the perspectives of moral philosophy, evolutionary biology, cognitive science, and social psychology. There were four critical steps in the argument. One dealt with the biology of reproduction, which centers on the ultimate value (in terms of differential reproductive success) of the proximate mechanisms of cooperation and communication. A second level involved philosophical and biological bases for this differentiation between human moral agents and moral patients. I maintained that one of the most important events determining the moral status of an individual occurs at birth. At that point, a third emotional level comes into play at which attachment occurs—the organism attains the status of personhood. The neonate is recognized as a member of the human moral community, which entitles it to respect from all moral agents who, from that point on, must assume duties and responsibilities toward this moral patient. The status of personhood is the biological embodiment of the social contract that molds the family and community. It represents the end point of fetal development, and signals the successful progress of the

reproductive process that drives evolution and connects us with all of nature.

The fourth step was the attainment of the status of a moral agent. It held that only some humans have the characteristics that signal agency. These characteristics are cognitive, including the ability to understand rules, causation, and intentionality, all of which depend on the possession of language that is capable of supporting a complex syntax.

In *Human evolution, reproduction, and morality* the basic points were developed and applied to moral issues involved in reproduction—contraception, abortion, infanticide, and issues forced on us by development of new reproductive technologies, such as artificial insemination, in vitro fertilization, and surrogate motherhood. In *Living and dying well* the arguments were applied to moral issues regarding genetic screening and manipulation, especially those involved in the Human Genome Project, whose goal is to locate all genes of the human genome and establish the base sequences of all its DNA.

Attention was then turned to criteria for death, because it is now possible to keep individuals in a persistent vegetative state for long periods of time. When death should be considered to have occurred is of intense ethical concern, because organ transplantation is becoming more refined and successful, and donor organs are in desperate need; but to be of use they must be taken as soon as possible after death. Questions regarding the permissibility of suicide and euthanasia raise difficult issues that affect medical practice. These issues regarding the creation of life and prolongation of death have made it necessary to establish review boards to consider matters of medical ethics in hospitals, especially in the management of intensive care units, and indeed in all areas of health care. Questions concerning the level of health care to which all members of human society should be entitled raise many difficult bioethical issues, and it is here that moral philosophers have made strong contributions to continuing debates. Philosophers have insisted that practical medical decisions and their economic implications should be considered with a steady concern for basic moral principles that define a just society. Proactive discussions of the moral implications of developing technologies must take place before political, commercial, and legal imperatives force society to seek quick moral fixes.

The Scheme of this Book

I extend the theme in this book to develop a concept regarding life and death that is adequate to encompass a complete range of moral problems regarding the permissible use of animals by humans. In chapter 1, evolutionary issues crucial to the concepts that follow are reviewed. Chapter 2 contains a discussion of primate societies based on prehistorical archaeological data, the characteristics of two nonhuman primate societies, and human hunter-gatherer societies. The nature of early hominids and what is known of the social organization of hunter-gatherer societies are discussed. This material provides a perspective within which to consider the nature of human societies compared with communities of other animals. Chapter 3 reviews the philosophical positions alluded to above, which provide the essential background to understand the extension of bioethical concerns to the animal realm. Chapter 4 consists of a brief presentation of philosophy of science, and a discussion of research methods. The former is intended to make it possible to understand the value of specific research studies; the latter centers on the nature of theory, relationships between evidence and theory, and the nature of scientific progress.

Chapter 5 contains an extensive discussion of human fetal development and neonatal capabilities. This discussion is important because it highlights the incredible number of physiological and behavioral developments that guarantee successful entry of the neonate as a member of human society, entry that enhances the likelihood it will receive the care necessary to survive. The process of social bonding is of central importance to theories developed here, because it is essential to the elements that determine moral standing as a human moral patient. In chapter 6, infant sensory and cognitive development are addressed, as well as animal and human cognition, theory of mind, and intentionality. Critical differences exist between humans and other animals in their ability to understand and manipulate the complex symbol systems that make it possible to understand rules and the concept of causality, and to have a future orientation, all things that are required to function as a moral agent.

A direct consideration of issues involved in the permissible treatment of animals by humans is joined in chapter 7, where the views of Tom Regan regarding animal rights are discussed. That chapter includes an extended

discussion of the concept of value, because both Regan and Peter Singer wrestle with questions of how to determine the relative value of animals and humans; I do not believe that the solutions proposed by either of them are adequate to the task. The chapter concludes with a review of the legal status of animals. Chapter 8 is a continuation of these matters, wherein Singer's views regarding animal liberation are addressed. They are considered within the framework of evolutionary principles, and strong exception is taken to his statements regarding speciesism.

The book then moves to specific issues regarding the use of animals by humans, especially in experimental research. In chapter 9, the views of the research abolition and reform movements—antivivisectionists, animal rights, and animal liberation movements—are presented, followed by reactions of the scientific research community. Chapter 10 examines selected issues regarding the permissibility of research of several kinds using animals. This is done in light of considerations introduced in the preceding chapter; evidence is marshaled to speak to critical issues, and a defensible bioethical position is suggested. In chapter 11, the use of animals in basic research that is nonapplied in its original intent is discussed. A decision model is described that can be used to consider the ethical nature of such research. Specific objections to psychological research using animals are brought forward and found to have little merit. The permissible use of animals for educational purposes is also approached in light of moral principles that were developed when issues arose regarding the regulation of research practices.

The procedures used to raise animals and kill them for food raise issues that have been discussed at length by animal rights and liberation advocates. In chapter 12, whether and under what circumstances it is permissible to eat humans are addressed, followed by questions regarding the permissibility of eating animals. Arguments against factory farming and in favor of vegetarianism are considered.

Chapter 13 is concerned with ideas regarding the importance of species preservation to maintain biodiversity, as well as the permissibility of maintaining animals in zoos and as pets. Chapter 14 is a brief epilogue that concludes the long journey taken in these three books.

Although I do not consider the detailed fabric of basic evolutionary theory in the present chapter, I highlight aspects that are critical regarding

the permissible treatment of animals by humans. These address the questions of what is a species, and what is the importance of the species concept when considering taxonomic differences and their development? The species is of utmost importance when the process of reproduction in nature is concerned, because it represents the taxonomic limit within which reproduction normally occurs, and reproduction is the evolutionary engine. Because speciation is an important event, factors concerning the role of adaptation in the process of natural selection are discussed at length.

Archaeological evidence regarding the evolutionary origins of the primate series is considered in chapter 2, because it has been maintained that special regard should be accorded those nonhuman primates that are the closest phylogenetic relatives of humans. That discussion is followed by speculations regarding the probable nature of early human societies, because it was within those societal structures that much of what we consider to be a universal human nature evolved. Attention is directed to prehistoric and present-day hunter-gatherer societies to provide insights regarding the essential characteristics and further developments of human societal structures.

Humans have been built of the same stuff following the same natural regularities by which the stuff of other animals was developed. To obtain a full picture of differences and similarities between animals and the way humans should treat them, it is necessary to consider basic processes of evolution as well as the distinct qualities of different species. The natural moral sense people have is built on sympathy, fairness, self-control, and duty, and is formed out of the interaction of innate dispositions with external familial experiences. The maternal sentiments on which parental affection is based are universal in humans, and are fostered by the earliest experiences a neonate has with its caretakers, rather than being some late product of civilization.

Basic Principles of Neo-Darwinism

Several basic principles constitute the core of Darwinian theory as it has developed since *The origin of species* was published (Darwin, 1859). Ghiselin (1969, p. 232) was on the mark when he stated, "To learn of

the facts, one reads the latest journals. To understand biology, one reads Darwin." Rapid advances have been made in Darwinian theory since that remark. They are based on increased understanding of primate origins provided by recent archaeological findings, intensive studies of the behavioral ecology of a number of animal species (including insects, fish, birds, and mammals), refinement of the theoretical network of evolutionary theory, better understanding of relationships between structures and functions of organisms (the phenotype) and its underlying gene structure (the genotype), and better integration and understanding of the role of molecular biological processes in evolution.

Advances in development of the fundamental core of contemporary Darwinism support the belief expressed by Dennett (1995, p. 20): "It unifies all of biology and the history of our planet into a single grand story. Like Gulliver tied down in Lilliput, it is unbudgeable, not because of some one or two huge chains of argument that might—hope against hope—have weak links in them, but because it is securely tied by hundreds of thousands of threads of evidence anchoring it to virtually every other area of human knowledge."

Dennett (1995) identified Darwin's great idea (which he dubbed "Darwin's dangerous idea") to be evolution by natural selection. Darwin's major breakthroughs were achieved because his approach embodied at least four methodological advances, as well as several substantive ideas that provided the basis for what is now called neo-Darwinism (Petrinovich, 1973). The first advance was to view members of a species in populational terms that emphasized the importance of variability in the distribution of characteristics, rather than applying the typological thinking of the day that emphasized essential characteristics every member of a species was considered to possess.

The second advance was Darwin's reliance on the deductive method throughout his research and writing. He was a careful observer, gathered as much evidence as he could on whatever question was under consideration, and used a wide range of methods to evaluate the principles he was developing. Contrary to the view of some detractors, he did not merely amass facts in an inductive manner. Darwin used the hypothetico-deductive method in all of his studies—on the formation of coral reefs, orchids, and barnacles; his classic studies on worms; and the study of emotions in

human and nonhuman animals. He applied the theory of evolution through natural selection to all of these endeavors to organize his observations and bring them to bear on the central hypotheses (Ghiselin, 1969). Mayr (1991) observed that, although Darwin used the hypothetico-deductive method extensively, he was methodologically pluralistic, making extensive use of evidence from a wide range of sources to refute opposing ideologies.

A third methodological nicety was Darwin's insistence on a style of deduction that allowed for the probabilism required to deal with organism-environment interactions. He used probabilism both in terms of analyzing multiple causative factors, and recognizing the vicariousness of contingent evolutionary outcomes. Finally, he viewed the complex interplay of variables in a way that emphasized the flux of evolutionary processes and the complex nature of those manifold factors that influence organismic development. A given end point can be reached through mechanisms involving different classes of factors, such as natural selection, sexual selection, or genetic drift produced by mutation. The same selection pressures could produce different outcomes, any one of which might be a satisfactory solution to environmental demands. If there is only one efficient solution to a specific functional demand, very different gene complexes may come up with the same solution, albeit by different pathways. As Mayr (1970, p. 366) expressed it: "The saying 'Many roads lead to Rome' is as true in evolution as in daily affairs."

Evolution is driven by a mechanism of natural selection, similar to the Malthusian notion of competition for survival in the face of limited natural resources. Dennett (1995) argued that this idea was a purely logical one and had nothing at all to do with political ideology; it can be expressed totally in abstract and general biological terms. Dennett took pains to note that Darwin was certainly an ordinary mortal, and as such was the inheritor of modes of expression, attitudes, and biases that were part and parcel of his station in Victorian society. However, the economic metaphors that characterize evolutionary thinking today are the source of much of the power of evolutionary analyses, and one of the deep features of Darwin's discovery.

At the end of *One long argument*, Ernst Mayr (1991, p. 162), Alexander Agassiz Professor of Zoology at Harvard and the leading authority

on the progress of ideas in biology, wrote: "The basic theory of evolution has been confirmed so completely that modern biologists consider evolution simply a fact." He considered this basic theory to be a fact as much as the observation that the earth revolves around the sun, and noted that evolution provides the factual basis for the fundamental theory of natural selection on which the four additional Darwinian theories rest. These additional theories are that of common descent (that all organic beings have descended from one primordial form), that development of diversity is a critical component in the evolutionary process, the theory of gradualism (discussed below), and the theory of natural selection (including sexual selection). Mayr emphasized the critical importance of the probabilistic nature of selection, which acknowledged the role of chance in evolution. Evolution is not a monolithic theory that rises or falls depending on the validity or invalidity of a single idea, a point also made in the statement quoted above by Dennett. Dennett (1995) remarked that anyone today who doubts that the variety of life on this planet was produced by a process of evolution is "simply ignorant—inexcusably ignorant," and I strongly endorse that statement.

Species

The theory of natural selection specifies a breeding population of individuals as the unit of interaction in nature. A populational view embodies the theory that individual organisms of a given species vary in the distribution of their characteristics. This is in stark contrast to a view in which all members of a species are considered to have the same essential, static characteristics that typify and define all individuals belonging to the species. The idea of a variable distribution of characteristics leads to the conception of a systematic underlying variability in the phenotypes (appearances) of different individuals who make up the species, and it is these appearances on which natural selection operates directly. The essentialist view that every individual has the defining characteristics typifying its species leads to the mistaken belief that if an individual establishes a new population by colonizing a previously unoccupied area, that individual's descendants will all be typical representatives of the species. A populationist stance emphasizes that no two individuals are the same, and no individual is ever a typical (essential) representative of a

species. If pioneers establish colonies, dominant characteristics of the new population could be quite different from those that are most prevalent in the parent population.

The currency that constitutes the payoff in the process of natural selection is differential reproduction. Traits possessed by individuals who succeed in reproducing viable young, who are themselves reproductively successful, will come to be the most common traits in the population. Darwin reasoned that if these traits were heritable, they will be passed on to succeeding generations, and those reproducing individuals can be said to have been the fittest, given the particular environmental demands. Darwin did not know the mechanism of inheritance, because the role of the gene was not appreciated when he was writing. His solid observational base, however, made it easier for later theorists to develop what is known as the modern synthetic theory of evolution—a stage that Mayr (1991) dates to have occurred between 1936 and 1947—that introduced genetic mechanisms into the evolutionary process.

The critical unit to consider is a population of organisms capable of interbreeding (which is part of the definition of a species); individuals in the population vary in the genes each possesses; these genes are expressed in the structure and functioning of different organisms; and they are heritable. The major mode of transmission of genes from one generation to the next is, for most species of plants and animals, accomplished through sexual reproduction. In this process, a conceptus receives one-half of its genes from the mother and one-half from the father, one function of which is to maintain a desirable level of variability of genotypes and phenotypes in the population of interbreeding organisms. The centrality of the process of sexual reproduction for birds and mammals has been discussed at great length in the biological literature, and I reviewed critical steps in the argument elsewhere (Petrinovich, 1995).

Speciation Another central aspect of Darwin's theory concerns the relationship between breeding groups and their ecology. Mayr (1970) stated that geographic isolation is the most important mode of speciation among animals. He wrote (p. 179): ". . . in sexually reproducing animals a new species develops when a population that is geographically isolated from the other populations of its parental species acquires during this

period of isolation characters that promote or guarantee reproductive isolation after the external barriers break down."

New species often develop when pioneers from an established colony move into a habitat not previously inhabited by the species and found a new colony. A high proportion of the founder population might, by chance, have a gene or complex of genes that is rare in the parent population. These genes, especially if they adapt the animals to peculiarities of the new habitat, may replace those that were the more frequent ones in the parent population, and this replacement can be accomplished quickly. This sequence of events may be the most important process by which rapid evolution occurs in small speciating populations (Mayr, 1970).

Rapid speciation would be expected whenever the size of the founder population is small (favoring chance sampling variability in gene frequencies), environmental pressures favor an unusual genotype that might be present, and the founder population becomes geographically (or behaviorally) isolated, which reduces or stops gene flow between it and the parent population. If the new gene arrangement has a high selective value in the homozygous condition, it will have a good chance of becoming established, even if only 2 among 100 or 1,000 offspring survive. Large populations tend to be evolutionarily stable. Mayr considers population size to be the most important factor contributing to rate of speciation; small breeding populations are more likely to undergo speciation (and perhaps extinction) than large ones.

Three points are important. First, the process driving evolution works on the phenotype, and in that sense is not primarily a genetic event, although the characteristics selected must be heritable. Mutation supplies the gene pool with one source of genetic variation, but natural selection induces evolutionary change. As Cronin (1991) remarked, it is selection that does the "thinking" in speciation, even though that thinking is the result of random selection processes. Second, because physical and behavioral characteristics are not normally the product of a single gene, any single mutation usually will not result in a character change; such change depends on major or minor reconstruction of the genotype. Third, the selective value of a gene is not absolute, but in any individual case is largely determined by the external environment and the developmental

system within which the gene operates. When these points are recognized it is understandable why considerable evolutionary inertia exists, because pronounced changes in a trait usually require evolutionary change of considerable portions of the genotype. Large numbers of genes contribute to the shaping of any phenotypic trait, making it less likely that polygenetically based traits will be modified easily by natural selection.

The species concept is important because it plays a key role in the process of evolution by natural selection. Each species represents a different aggregate of genes that controls a unique developmental (epigenetic) system, occupies a unique environmental niche that imposes its own demands, and is usually polymorphic and polytypic, making it possible to adjust to changes and variations in the total environment. When the population becomes large enough, the species sends out pioneer populations that explore new niches and possibly become founders of a new community. Although members of each species share a set of unique characteristics, the individuals that constitute the species differ from one another. It is as Cronin (1991, p. 352) wrote: "Admittedly, we are unique. But there's nothing unique about being unique. Every species is in its own way."

Each species can be considered to be a biological experiment, and it is highly probable that the experiment will end up in an evolutionary dead-end street, with extinction the likely outcome. However, Mayr (1970, p. 374) wrote, "Without speciation there would be no diversification of the organic world, no adaptive radiation, and very little evolutionary progress. The species, then, is the keystone of evolution."

Darwin proposed that evolutionary change usually takes place through a gradual change in populations, rather than by a sudden production of new individuals that represent a new type. He considered this gradual change to occur through the production of variations among individuals in every generation, with evolution taking place because only small numbers of the variants survive to reproduce. There is, therefore, a continual generation of variability, and a differential rate of reproduction by those individuals who reproduce—variation is followed by selection.

This idea of gradualism was challenged by Eldredge and Gould (1972), who proposed that evolution proceeds through stages of punctuated equilibria; periods of changelessness (equilibrium) are interrupted by

sudden and dramatic brief periods of rapid change (punctuation). Rapid speciation takes place during these short bouts of punctuation, and when a successful new species becomes widespread and populous, another period of static equilibrium is entered. This stasis could last for millions of years, during which only minimal change is observed.

According to Mayr (1991), whenever speciational evolution occurs in large populations it is basically gradual, in spite of the sudden appearance of new species, and this suddenness is not in conflict with the Darwinian paradigm. The interesting questions are how often such major changes in founder populations occur, and what percentage of new species enter a subsequent period of stasis.

Addressing the issue of punctuated equilibrium, Dennett (1995) held that much of the dispute regarding gradualness depends on the scales used to represent evolutionary change, by which both time and change of characters are represented. The issue turns on whether speciations appear at a constant rate over time or whether at certain periods evolution is at a dead stop. If a species is successful, if it becomes large, and if there are no sudden and extreme changes in the environment, then little evolution would be expected; at least until the population exceeds the carrying capacity of the environment, which would violate the environmental change *if*. A species that has adapted successfully would not be expected to change much until one of the above *ifs* became inoperative. By definition, this makes it necessary for at least some of the variants in the population of individuals making up the species to adapt to new pressures if the species is to avoid extinction. When some are able to adapt, changes might take place in gene frequencies for some of the successfully breeding individuals; some might be pioneers and found new colonies that become isolated and speciate, and others might not survive. The picture could be construed to be a single genealogical line that passes through a bottleneck (produced by radical environmental changes that diminish the gene pool) and continue as the same species, or two or more species that pass through the bottleneck and continue as distinctly different species entities, or a species that does not meet the challenges and becomes extinct.

Dennett (1995) expressed concern that Eldredge and Gould suggested no alternative mechanisms that could produce the sudden changes they proposed. Most experts reject explanations that depend on sudden mu-

tations that would produce "hopeful monsters." If no alternative mechanism is specified, both Dennett and Mayr prefer explanations based on the standard mechanism of gradualistic micromutations and natural selection. New lineages appear on the scene as candidates to be selected as species following a period of stasis. If a species succeeds as an interbreeding group, this period of evolutionary change will be followed by another period of evolutionary stasis. It does not appear that the concept of punctuated equilibrium is as non-Darwinian as it has been characterized.

Most animal species have a range of general strategies to cope with environmental demands, and they also have a set of specialized mechanisms to deal with specific circumstances encountered while trying to make a living. One evolutionary principle that holds across animal species concerns those aspects of morphology, physiology, and behavior involved in reproduction. The reproductive episode is of profound evolutionary significance because it provides the coin of the evolutionary realm that must be cashed in to perpetuate the genes of the reproducers. A high differential reproduction rate means that characteristics responsible for that high rate will allow organisms bearing them to occupy available environmental niches more successfully than their competitors.

Adaptation

Evolutionary theorists devoted careful attention to problems of diversity and emphasized the importance of speciation. Major emphasis is on problems of phyletic evolution, which involves the process of adaptation. Evolution is not merely a change in gene frequencies, but is the result of twin processes producing diversity and adaptive change (Mayr, 1991). Classic Darwinism emphasized benefits brought about by adaptation, but underestimated the costs (Cronin, 1991). Modern Darwinism, in contrast, emphasizes that benefits of adaptations involve inevitable costs, which leads to a more flexible view, leaving room to recognize that mixed tactics can be used by different members of a species.

Both multiple simultaneous causation that influences the course of evolutionary development, and pluralistic solutions different organisms and species can make when confronted with a similar evolutionary challenge should be considered. Mayr (1991, p. 148) wrote: "In short, there are several possible solutions for many evolutionary challenges, but all of

them are compatible with the Darwinian paradigm." He construed evolution as a process similar to that of a tinkerer who makes use of whatever is most readily available in a given situation.

Natural selection can seize on any advantageous characteristic, no matter how little it has been used in the past, how small and insignificant it is, or however deeply buried it might seem. The organism exploits whatever is available and tries it. If it works, fine; if it does not, then it loses, but another one that tried a different option might succeed.

Because natural selection is such a critical concept, the processes it involves have received considerable attention, especially the role of adaptation. Considerable controversy surrounds the necessity and sufficiency of adaptations. Some worry that it is easy to claim an adaptive significance for almost anything if one tries hard enough, to spin what Stephen J. Gould called a "Just So Story." The problem with applying this caution uniformly is that much evolutionary theorizing must be done after the fact. Changes evolved over time, and the puzzle is to decide how they occurred and why. As Cronin (1991) posed it, Mother Nature herself could have been oblivious of the brilliant moves she had made until she stumbled upon them, and Dennett (1995) added that adaptationists should hardly be faulted for being unable to predict those brilliant moves.

Gould considered it important to be sure that presumed adaptations are not in reality what he called exaptations (Gould & Vrba, 1981). An exaptation refers to structures or functional characteristics that developed to serve other purposes than those served at present, or were functionless concomitants of developments that were adaptations for other purposes. These exaptations can become secondary adaptations through the force of natural selection. This terminological distinction stresses the fact that all organismic change did not come about to serve the single, particular function of interest at the moment, and it avoids teleological implications of considering all changes to be preadaptations for that function.

It is necessary to evaluate critically all adaptationist arguments because we usually must engage in what Dennett called "reverse engineering": One looks at an existing entity to figure out why it is structured as it is, given the functions it serves. Because evolution can work only by selecting and discarding existing structures, certain things might have been used;

not because they originally developed as adaptations (they could be exaptations), but because natural selection will seize on whatever is available to adapt the organism to increase its level of differential reproduction (through secondary adaptation). Again, the metaphor of the tinkerer is apt. The analyst is placed in the difficult and problematic position of affirming the consequences based on presumed antecedents. Most often this is the only way evolutionary reconstruction can be done.

George Williams (1966) succinctly identified the problem when he counseled that the concept of adaptation should not be invoked if lower-level physical or chemical processes are sufficient to explain a set of events. Yet, it can be argued that adaptation is a central concept in ecology, ethology, and evolution, and that its proper use has led to many discoveries and insights. All adaptive characteristics are the result of natural selection, but all characteristics are not adaptive (Cronin, 1991). It is crucial to appreciate the concept of adaptation if we are to understand evolution, but it must be invoked with caution to have heuristic value and lead to increased understanding of organic systems.

Phylogeny

A few general remarks are in order regarding phylogenetic development. Matters regarding the relationship of humans and the other primates are of concern to those who question the permissibility of research using some of the primates, especially chimpanzees. The concept of a branching phylogenetic tree is important, and should be kept in mind when comparing any two phyla, families, or species. Although the quantitative difference between a pair of species in the percentage difference in DNA structure (as indicated by DNA hybridization estimates) is astonishingly small, profound differences can exist in terms of morphology, physiology, behavior, and cognition. Humans differ from chimpanzees only in about 1.6% of their DNA, and from gorillas in about 2.3%; monkeys differ from humans and apes in about 7% of their DNA (Diamond, 1992). Yet, these small quantitative differences are responsible for tremendous qualitative differences between our minds and those of any other species. It can and will be held that the differences between our minds and those of other species create a wide enough gulf to make a moral difference, and I pursue that argument in depth in chapter 6.

Humans differ vastly from all other species because we are the only one that has an extra medium of design: A culture based on a complex language system. Wrangham, de Waal, and McGrew (1994) adopted this position, citing the absence of experimental evidence to support a hypothesis of cultural transmission of behavioral variants to an extensive degree for other species. With chimpanzees, the cultural transmission observed is at best inefficient and is usually absent, and those social traditions that are found are similar to those found in species of birds, species that are radically different from primates. Their conclusion was that cultural traditions for nonhuman animals arise through repeated inventions, with succeeding generations copying the recognition of opportunity, rather than the specific technique. It is this process that could explain the behavioral traditions of chimpanzees and the closely related bonobos.

Prior to Darwin, the dominant view regarding phylogeny was that of Aristotle, who proposed the *scala naturae*—the great chain of being. According to this view all organisms are part of a single linear scale of ever-growing perfection. Animal species are arranged along this ladder, going upward from lower, simpler organisms at the bottom, moving up through worms, insects, and fish, continuing to mammals (rats, cats, and dogs), ascending to the primates, and reaching the top rung of the ladder at humans. This concept was based on the belief that God created the world for the sake of humans who only stood below the perfection of the angels and God, and animals were less perfect copies of God, created for the sake of humans.

As more became known about the world of life and the diverse characteristics of different species, the unity symbolized by the *scala naturae* began to disintegrate (Mayr, 1982). By the time Darwin published the *Origin* he no longer required God as an explanatory feature, because every aspect of creation described in the Bible was contradicted by his construal of the natural world. In fact, Mayr (1991) considers Darwin's comments against special creation to be his "one long argument." One of the major triumphs of Darwinism is that it alone explains how the organic world has the appearance of deliberate design without the intervention of a deliberate designer.

The modern conception of phylogeny is that species are genetically different, with these differences having been selected in response to eco-

logical and behavioral pressures. There is not a sequential ladder, but a divergent, treelike structure with each organism's time line beginning when it is born and stopping when it dies. Either the offspring line continues or, if no offspring, the line suddenly halts. The tree of life has been spreading its branches for 3.5 billion years, and the usual mode of representing that branching is to plot time on the vertical axis, spreading the branches out along the horizontal axis, with newer, continuing branches spreading farther as phyla and species become more diverse.

Tattersall (1995) proposed that the evolutionary tree should be considered in terms of a "scenario," including information about such things as adaptation, ecology, behavior, ancestry, and time. The danger with this approach is that, because of its complexity, the compellingness of the story comes to depend too much on storytelling abilities. He concluded that analyses should begin with and proceed from simple considerations of branching diagrams (called cladograms) that indicate how closely a taxon is related to others. A tree can be developed, justified by evidence, only then moving to the level of a scenario. This approach makes it possible to identify testable elements at each step, and to arrive at a complex scenario through a series of falsifiable hypotheses.

It is not proper to conceive that any fish, for example, was the ancestor of any reptile, bird, or mammal, even though the fish line branched off first and the others branched later. The fish line continued to develop separate branches from the others, and these in turn became established on their own and continued their separate and different identities. Although the primate line split off into Old World monkeys about 25 million years ago, the main line continued branching, developing into the rest of the primates, with the monkey line continuing its separate course to the present. The branching primate line also continued its separate course to the present, with orangutans diverging about 13 million years ago and gorillas about 10 million years ago; the human line branched off about 5 million years ago (Wrangham & Peterson, 1996, p. 261, top diagram). The primate line continued to the common chimpanzee, with the pygmy chimpanzee (bonobo) diverging about 3 million years ago.

Wrangham and Peterson (1996) used recent genetic evidence to summarize primate phylogeny. The gibbon line split off early, followed by the orangutan and then the gorilla. Another line branched off and split into

the human, then the bonobo, and last the chimpanzee. They interpreted this to mean that chimpanzees *(Pan troglodytes)* and bonobos *(Pan paniscus)* are our closest living relatives and we are theirs, and chimpanzees are more closely related to humans than to gorillas *(Gorilla gorilla)*. The two most closely related species are chimpanzees and bonobos, which became separate species 2.5 to 3 million years ago. Next to this pair is humans, then gorillas, followed at a distance by orangutans. The common ancestor of chimpanzees and humans lived about 5 million years ago. *Homo sapiens* is only about 150,000 to 230,000 years old, and is considered to have evolved particularly fast, although not as fast as cichlid fishes (Goldschmidt, 1996). During this 5 million-year period immense behavioral evolution occurred within the humanoid line.

Now that a few basic concepts in evolution, important for later discussions, have been presented, it will be useful in the next chapter to examine the structure of two nonhuman primate societies, the chimpanzee and the bonobo. Their behavioral tendencies are quite different, even though they are closely related phylogenetically. Chimpanzee social organization is similar in some respects to that of humans, and that of bonobos is quite different. It will be of interest to consider what is known of prehistoric human societies that can be gleaned from archaeological data, and revealed by study of human hunter-gatherer societies that might be organized along lines that could have prevailed in the environment of evolutionary adaptation (EEA) of humans.

Similar or Different Enough?

An issue that is important to keep in mind throughout this book concerns the nature of continuities that might exist between individual members of different species. On the one hand, humans are animals who evolved in much the same way as other animals, a fact used to justify the belief that the behavior of all animals should be explained in much the same way as that of humans. On the other hand, an impeccably Darwinian approach could lead to the opposite conclusion—that concentration on psychology rather than behavior could make the study of humans markedly different from that of other animals. Similarities might be based on the sameness of strategic principles that belong ultimately to genes, with specific behav-

ioral outcomes being quite discontinuous, in the sense of there being different proximate mechanisms that attain the same ultimate goal.

It is difficult to determine when animals are so similar to humans that they provide adequate models to understand humans, and when they are so different that it is pointless to use them to gain such understanding. If animals to be used for experimental purposes are comparable with humans, is it permissible to subject them to any treatment that would not be permissible with humans? Singer (1990a, p. 52) considered the matter: "So the researcher's central dilemma exists in an especially acute form in psychology: either the animal is not like us, in which case there is no reason for performing the experiment; or else the animal is like us, in which case we ought not to perform on the animal an experiment that would be considered outrageous if performed on one of us." Russell and Nicoll (1996, p. 119) considered this remark to be as clever as it is unsound: "The fact is that animals are like us in some ways that we can study for potential human benefit and unlike us in other ways that allow for their use by ethical human beings." Their statement takes the opposite spin, that all research is permissible, whereas for Singer, none is. Russell and Nicoll noted that experiments are also done for the sake of learning about animal biology and behavior—knowledge for the sake of knowledge—and it is never known when such experiments may later prove to have relevance for human or animal health or well-being.

All organisms have similarities, certain conservative tendencies persist in all organic systems. Humans and chimps share about 98% of their genetic material, which some take to indicate almost complete similarity between the species. However, that 2% makes all the difference; humans are not only physically different, but they scale the cognitive heights to a level that is qualitatively different from any other species.

Even a 1% difference in DNA is not small (Pinker, 1994). The information content in DNA is ten megabytes, big enough for a universal grammar with room left over. In fact, the 1% difference could make all the difference because DNA is a discrete combinatorial code; one could change one bit in every byte and produce an organism that is 100% different from another.

Another cautionary tale is suggested by the fact that the tiny organism known as yeast shares about 20% of its genes with humans, and at least

one of these genes is intersubstitutable in humans and yeast. This preserved genetic similarity undoubtedly represents conservative characteristics involved in the basic functions of life, such as cellular metabolism and reproduction within the organic medium shared by yeast and human cells. Is 20% overlap enough for us to respect yeast rights (at least 20% of them), or should the cut-off be 50%, or 98%? Small quantitative differences can have immense importance, or not mean much at all in terms of determining qualities of similarity and difference that are physiologically, psychologically, and morally relevant.

The small percentages of genetic difference between humans and chimpanzees produce important differences between them (Diamond, 1992). We have an upright posture, large brain, ability to speak, sparse body hair, and peculiar sex lives. All of these differences must be concentrated in the 2% or less genetic difference between these species, two evolutionary lines that diverged about 6 to 8 million years ago. It is interesting to consider the 2% difference between humans and chimpanzees in light of the estimated 0.1% difference in genetic bases between individual humans, an estimate that was attributed to Dr. Eric Lander, director of the Whitehead Institute/M.I.T Genome Center (Hilts, 1996). This 0.1% seems quite small, but it represents the total difference in inherited qualities involved in the tremendous individual differences between peoples in terms of the natural lottery.

Tooby and Cosmides (1995) called attention to a basically different perspective that different people have regarding evolutionary processes, noting that these perspectives have general implications for the meaning of similarities and differences. One perspective is a phylogenetic one focusing on the similarities between species in terms of the inheritance of homologous features from common ancestors. A radically different perspective focuses on the evolved functional designs that adapt organisms to demands of their environment. From the phylogenetic perspective that emphasizes linearity, it is convenient to assume that few qualitative differences exist between the human brain and that of other primates or mammals. At the level of neural architecture and cellular function, gross continuities are obvious, and similarities can be used to argue that humans are just more elaborate animals from a continuous series, therefore making it morally impermissible to experiment on our phylogenetic relatives.

The adaptationist perspective emphasizes the uniqueness of each species in the ways they adapt to their particular environmental niche. With this approach it is important to investigate adaptive functional differences in such things as information-processing strategies, language ability, tool use, and coalition formation. This perspective emphasizes the importance of investigating the uniqueness of each species, suggesting it is morally permissible to understand all of these different species.

It may be that both approaches are essential and correct because they are complementary ways to view the evolutionary process (Tooby & Cosmides, 1995). Similarities should be established to understand general evolutionary tendencies, and differences should be studied to understand these tendencies in evolutionary terms.

A host of dissimilarities between human and nonhuman animals determine the treatments commonly considered permissible. Humans have kept other humans as slaves, and also keep pets. However, human slaves (at least in the United States) were treated in a different manner from animals, and laws reflected that difference. In general, it is permissible to eat animal moral patients (at least those that are not common house pets), but not human moral patients. If a band of devotees defended the practice of cannibalism on the grounds that they restricted their practice to anencephalics and the newborn, even the most dedicated carnivores among us would be unimpressed with that justification, and no doubt the strongest legal action would be taken against those individuals.

Moral Implications

In most Western slave-holding societies, humans kept as slaves, although considered property, were entitled to a considerably higher standard of care than other objects of property. In the United States, slave owners could be punished for behavior that was considered extremely cruel, at least in the eyes of other slave holders, and it was not permissible to eat slaves or kill them for trivial reasons. One reason for the protection of slaves was that humans are different from other animals—all humans have a sense of future and are therefore capable of experiencing terror to a degree not possessed by other animals (Hare, 1979). Hare also noted that slaves (and prisoners, I might add) could be subjected to atrocious

punishments for the purpose of striking terror in them and their peers. Such punishments would be ineffective, and hence not justifiable, when applied to animals.

It is permissible for me to destroy my car if I decide to, as long as I do not create a nuisance, but it is not permissible for me publicly to beat my dog to death. The reason I can beat my car and not my dog is that the dog suffers pain and has welfare interests that a car does not have. I can kill my old dog if it is suffering, but not my aged parent. This difference is maintained for complex reasons, one of which has to do with the idea of the human community and the interest in honoring social contracts.

Even though some humans (e.g., slaves, blacks, children, Native Americans, Latinos, and women) are treated badly, they still are able to argue for their place in the world in a way that is not possible for animals. Slaves could work harder to earn money and thereby purchase their freedom (Francione, 1995), a privilege that is not possible for nonhumans, who always remain property and are not able to understand the concept of freedom.

Numerous obvious differences in status between humans and animals justify different permissible treatments. Animals are seldom punished for kinds of wrongdoing that a human would be, and people are encouraged to respect an animal's nature. If a squirrel takes peanuts from a young girl's plate at a picnic and she then throws stones at it, she would likely be rebuked by a parent on the grounds that the squirrel is only doing what is necessary to survive and provide for its family (Leahy, 1991). However, if another child had stolen the nuts it would be considered proper to urge the girl to defend her property and her moral right of ownership. If the thief was an adult, the parents would most likely become involved in the defense.

Leahy observed that it is permissible to run over a dog with a car to avoid wrecking one's car, but it would not be permissible to run over a human for that reason. One can kill an animal that attacks or trespasses on one's properly, but not a child or adult human. Animals can be "put down" when they are old, but not humans, even though the animal has been a member of the family for many years. All these differences indicate a major distinction that is drawn between humans and members of other species.

Carruthers (1992, pp. 108–110) described a fantasy in which Astrid has left earth on a space rocket and is on an irreversible trajectory that will take her forever out of contact with her fellow human beings. In her rocket she carries a cat and the original *Mona Lisa* painting. Carruthers proposed two cases: In one case Astrid becomes bored and begins to use the painting as a dart board; in the other she becomes bored, ties the cat to the wall, and uses it as a dartboard. Carruthers suggested that most would intuitively agree there is a great moral difference between the two cases. He thinks that Astrid does nothing wrong in throwing darts at the *Mona Lisa*; no one will ever see the painting again (even though he allows she acted wrongly in taking it with her in the first place, because it denies earthlings the pleasure of seeing it). However, it is wrong to throw darts at the cat out of idle amusement, even though no person will ever be distressed at what she has done. He concluded that contractualism alone cannot accommodate what common sense tells us about the moral treatment of animals. Although animals are owed respect due to a respect for legitimate concerns of animal lovers, that is not enough. Throwing darts at the cat is wrong, because cruelty to an animal is wrong since the animal can experience pain and suffering. What Astrid did in both instances is bad because it manifests and expresses bad character.

There is an ordering of objects and moral patients in terms of the respect they are due, and moral agents are obliged to behave in ways that honor it. Machines and other inanimate natural objects are at the low end of the dimension, with plants receiving more consideration, many species of animals more, with pets and those beings that appear the most human-like (nonhuman primates) even more, and human moral patients the most. As Rollin (1992) humorously expressed it, animals are morally more like children than like wheelbarrows. A line is crossed when the individuals is a member of the human species, and these distinctions, too, are graded. Leahy (1991) suggested a diminishing ordering of obligation that makes sense evolutionarily: Immediate family, relations, friends and colleagues, fellow countrymen, one's racial group, people at large, animals, and natural inanimate objects. Incidentally, this ordering not only makes sense evolutionarily, but it is found in studies of human moral intuitions (e.g., Petrinovich, O'Neill, & Jorgensen, 1993; Petrinovich & O'Neill, 1996; Wang & Johnston, 1995; Wang, 1996a, 1996b).

Plous (1993) considered psychological mechanisms that are related to the human use of others. People are likely to help other humans whose race, nationality, appearance, religion, and political views are similar to their own. They also favor animals whose appearance is similar to humans, and support those endangered species that are biologically more similar to *Homo sapiens*. Animal activists rated the capacity of animals to feel pain much higher than did nonactivists, although ratings of their overall similarity to humans was similar for the two groups. It has been noted that people not only like those who are similar to themselves, but tend to befriend and marry them as well. Plous found that people would be significantly more uncomfortable eating chimpanzee meat than zebra meat, which suggests some revulsion to eating those more similar to us, a topic that is considered in chapter 12.

Attribution of degrees of similarity and higher cognitive functions to different animals corresponded to their phylogenetic group membership, with pets and primates accorded special consideration (Eddy, Gallup, & Povinelli, 1993). The ordering in terms of both similarity and cognitive function was humans, cats and dogs, nonhuman primates, other mammals, birds, reptiles, amphibians, fish, and invertebrates. Important factors that influenced the judgments were familiarity with the animals in question and the existence of an attachment bond, especially with dogs and cats.

Another complexity regarding degree of human similarity and difference to a given animal is introduced by the fact that its moral status can change depending on the perspective within which it is viewed. Herzog (1988) discussed a typology of mice: Good mice, bad mice, and feeders. In a laboratory, good mice are used for research purposes; they were bred to the purpose, and their existence depends on their utility. Their status as good mice entitles them to protection by the Institutional Animal Care and Use Committee (IACUC), and they are placed under Public Health Service (PHS), and United States Department of Agriculture (USDA) regulations.

Bad mice are free-ranging animals seen scurrying along the corridors of the laboratory. These pests are considered a threat in a lab facility, where it is important to prevent contamination between rooms. They are to be eliminated as quickly as possible. Poison is not used for fear of contaminating the good mice. Snap traps are ineffective, so the preferred method

is the "sticky trap," which essentially is a rodent form of flypaper. When a mouse steps on the trap, its fur becomes bound to the trap, and about half the animals are dead when found during daily rounds. These mice suffer a miserable death that most animal care committees would not permit in an experiment. Because the building did not have a problem with wild rodents, these bad mice must be good mice that escaped. Herzog (1988, p. 474) concluded, "Once a research animal hits the floor and becomes an escapee, its moral standing is instantly diminished."

The feeder mice are quite different: They are raised as food for snakes used for research. They are in an anomalous situation. Although protected by USDA regulations because they are mammals, they are used to feed snakes that are specifically excluded by those regulations. The situation is further clouded in the case of research on predation and antipredator tactics. Herzog proposed the following rationale: A scientist conducting research on snakes does not need to get approval of the animal committee to feed research animals a diet of live mice. Because these snakes eat only live prey, not providing them with an adequate supply of live rodents would result in their starvation and could be considered cruel. Herzog asks us suppose that the investigator is interested in the ethology of antipredator behavior in rodents. If the researcher wants to introduce live mice into a snake's cage to study the encounters, the procedures would fall under jurisdiction of the IACUC, whereas if the mouse is simply snake food its use does not have to be approved by the committee. Herzog (p. 474) concluded, "Thus, the moral (and legal) standing of the mouse depends on whether it is labeled *subject* or *food*."

Herzog's point is that moral judgments about other species are neither logical nor consistent, but are the result of both cerebral and visceral components of the human mind. As discussed when the status of pets is considered in chapter 13, the roles that animals play in our lives and the labels we attach to them deeply influence our sense of what is ethical. Herzog believes that such labels are the result of the role the animal typically occupies relative to humans—labels that influence the behavior and emotions directed toward that animal. I add that certain biologically instated moral boundaries are imperatives—children, kin, neighbors, and species, and these are influenced less strongly by other considerations than is the case when the evolutionary imperative is not involved.

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