CHAPTER ELEVEN

Beauty and the beast? Conceptualizing sex in evolutionary narratives

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Humans come in a variety of shapes, sizes, and colors (so do pigeons, fruit flies, peacocks, and many other animal and plant species). Perhaps the best example of stable biological variation within the human species is sex.[1] Each generation of humans contains males and females, and the perceived sex of individuals influences the way they are treated by their peers and the kinds of social networks in which they participate.[2] Although natural historians, philosophers, and scientists had long been interested in understanding differences between men and women in biological terms, the "woman question" became an object of especially intense scientific inquiry in the final decades of the nineteenth century.[3] Evolutionary theory was one of several explanations scientists used to discuss the origin of sex differences in biological terms: it was often suggested that femaleness was less evolved than, or a degeneration of, maleness—women were ascribed a more animalistic nature. Yet by the early twentieth century, eugenic rhetoric secured for women an evolutionary status equal to that of men, as it was recognized that they bore the racial future of Anglo-American society. The capacity of women to choose their husbands, thereby increasing the beauty and intelligence of the next generation, distinguished them from mere beasts. After World War II, scientists' attentions focused not on female love but on male aggression as the key to understanding humanity's evolutionary past. Equally loaded with cultural assumptions about the biological nature of sex differences, this frame served to create

an evolutionary picture of man the hunter and woman the sexually available mother. In the 1970s, sociobiology absorbed this gendered division of society, and simultaneously returned to an evolutionary framework that emphasized biological continuities between animals and humans.[4] Not until the 1980s was the sociobiological story reevaluated through the addition of narratives about male–female friendships and female primates as manipulative and aggressive in their own right.[5]

Biologists and feminists have consistently redrawn and renegotiated the ideological relationship between sex and evolutionary theory as a function of a shifting boundary between human and animal, and also of changing conceptions of how best to use animals as models for understanding our own behavior. Charles Darwin (1809–82) derived his theories of natural and sexual selection with no knowledge of the genetic basis of sex or behavior that came to form the backbone of sociobiological and evolutionary psychological accounts of male and female difference over a century later. Yet he assumed that the differences he observed in male and female human and animal behavior were variations requiring a biological rather than cultural explanation.[6] Throughout the past century, social scientists have challenged the underlying assumption that sex differences must be biological by calling into question the amount and quality of the research on which these conclusions were based and constructing alternative accounts of women's nature based on their own data. In spite of such active resistance to politically conservative conclusions about women's nature, sociological and cultural explanations of human behavior have failed to replace biological explanations within the popular and scientific imagination.[7] Popular convictions about the genetic, instinctual basis of our sexual behavior continue to be reproduced in newspapers, films, and even Internet dating websites.[8] Simultaneously, among biologists and anthropologists interested in primate cultures, a new synthetic picture is emerging, one in which both nature and culture contribute to the social organization and experiences of women and other female primates.

In this chapter I reflect on the various resonances between cultural and social norms one the one hand, and biological theory on the other, rather than seeking to advance any single solution as the "correct" way of adjudicating the relationship between sex and evolution. I explore the ways in which biologists, by establishing equivalencies between types of human and animal behaviors (such as territoriality or courtship), have marshaled their behavioral data in animals to explore the bounds of natural behavior in humans, and have sought to understand the relative contributions of

nature and culture in defining the boundary between woman and animal, beauty and beast.

Scientific explications of women's nature, or womanhood as a subject of science

Even Darwin was unable to use a single theory to explain both the Earth's remarkable biodiversity (the sheer number of species that have populated the planet) and the presence of semi-stable varieties of individuals within a species (like sex and, most importantly to Darwin, race). Although today we know that categories such as gender and race are not individual characteristics in a genetic sense, Darwin and many subsequent zoologists did consider them to be fundamentally biological traits. Darwin then accounted for the origin of new species with his theory of natural selection, or differential survival, and the origin of variations within species (like sex and race) with his theory of sexual selection, or differential reproduction. Darwin saw these two facets of the evolutionary process as complementary biological phenomena, and devoted a book to each.[9] The first book, *On the Origin of Species*, dealt with the process by which a single species could be transformed into multiple species over evolutionary time—his explication of the origins of interspecific variation. He needed another kind of explanation to account for differences in size, shape, coloration, and behavior of individuals within the same species. *The Descent of Man and Selection in Relation to Sex*, the second book, concerned the origins of such intraspecific variation and the persistence of those differences over time. Darwin suggested two mechanisms by which sexual selection could cause and maintain intraspecific variation in a population: male–male competition for access to reproductively available females; and female choice of the aesthetically most pleasing males with whom to mate. Whereas male–male competition would select for male weapons or armor, female choice would select for male beauty and decoration.[10]

Mechanisms for the transmutation and alteration of species over time acted as theoretical structures that scientists could use to explain what they saw as the facts of sexual and racial difference. Sexual and natural selection provided two of a wide array of scientific theories used for this purpose; yet simultaneously they reinforced and contributed to the general perception that differences between men and women were biological in nature.[11] For Victorian and Edwardian scientists, evolutionary change

in humans was linear and hierarchical.[12] When biologists placed humans within an evolutionary hierarchy, humans as a whole resided at the top of an evolutionary "ladder," but not all varieties of humans were equal. As the predominantly white, predominately male biologists considered their own biological heritage, they sought to identify differences, not similarities, between themselves and women, other ethnic groups, and animals. They consequently placed themselves at the top of the evolutionary hierarchy and used women and people of color as a kind of buffer zone, insulating themselves from their own animal legacy.[13]

Humans presented a special problem for Darwin. In some ways, evolution seemed to act in humans in the same way as it did in animals. For example, Darwin described male animals and humans as more variable than their female counterparts. Because men lived at the cutting edge of the struggle for existence, he argued, they were likely to vary in traits important to their survival. In civilized societies, women were removed from that struggle, so consequently women were less likely to differ from each other. In animals also, sexual selection acted to increase male variability, as female choice and male–male competition endowed males with extravagant horns or antlers or outrageous plumage. In other ways, humans seemed exceptional. Darwin suggested that the process of sexual selection may have been reversed in some human societies; certainly Victorian women, not men, concocted colorful displays with which to garner the attention of the opposite sex, and men, not women, chose their mates.[14]

In addition to evolutionary theory, three other scientific principles describing the law-bound nature of life came together to define women's place in the order of Victorian nature: Ernst Haeckel's biogenetic law, that is the way an individual "grows up" mirrors that individual's evolutionary lineage (ontogeny recapitulates phylogeny); the first law of thermodynamics, that is energy can change form but can never be created or destroyed; and the physiological division of labor.[15] Each field of inquiry contributed to the perception that women differed from men in their physical and mental capacities.

The idea that an individual's embryological development proceeded according to the evolutionary history of their lineage proved irresistible to some scientists. Psychologist G. Stanley Hall (1844–1924), for example, posited that the process by which a human child matures intellectually would follow the evolutionary history of humanity itself. Women and men of what he described as the "lower races" were not missing links between animals and man, but kinds of perpetual adolescents. Following the laws

of embryological development elaborated in the nineteenth century, Hall argued that, as an individual grew from a baby to an adult, the body became more complex over time and the mind became more individuated and specialized. Individuals who remained closer to the embryological type, who retained childish characteristics as adults, were thus less developed than fully functioning, individuated adults. Women, Hall continued, lagged behind men developmentally. Female faces belied their incomplete development in wide-set eyes, just as the female tendency to aggregate in groups reflected an inability to venture forth as fully developed individual personalities.[16]

Most scientists, however, found Darwin's theories inadequate explanations of sex differences and turned instead to other physiological mechanisms. Even ardent defenders of natural selection, such as the theory's co-discoverer Alfred Russel Wallace (1823–1913), dismissed sexual selection in animals, claiming that the bright coloration and plumage of males during the mating season was due to their naturally high energetic state. Only the extraordinary dullness of females required explanation and here Wallace invoked the differential action of natural selection on the sexes. He suggested that, to avoid predation, female animals required greater levels of camouflage when nesting. Over evolutionary time, natural selection acted to decrease any brightly colored plumage or eye-catching accoutrements in females. Biologists Patrick Geddes (1854–1932) and J. Arthur Thompson (1861–1933) followed a different line of reasoning to account for sex differences without an evolutionary cause: they drew an analogy between the physiology of animals and the sex cells (gametes) of humans. Small animals exhibited high metabolic rates, moved around a lot, and were highly variable (as with sperm); large animals were passive, sluggish, and conservative, with much lower metabolic rates (as with eggs). The essential nature of masculinity and femininity in adult humans derived from these energetic qualities of the sex cells. Males were exuberant and brilliantly colored as adults because they metabolized energy quickly, not because of the different action of natural selection on the sexes and not because of female choice. Geddes and Thompson used the energetics of sex, coupled with the first law of thermodynamics, to author social prescriptions for the proper behavior of men and women. If energy could not be created or destroyed but merely changed form, and if each human possessed a finite amount of energy, then the creative output of any one individual involved certain trade-offs. Because a woman's total available energy was probably less than a man's to begin with, and, because

women invested most of their energy in reproduction, little remained to devote to intellectual pursuits. When applied with reverse logic, Geddes and Thompson insisted women who went to college and became notable scholars did so at the expense of their reproductive duties to their race.[17]

Such theories contributed to the belief that men and women participated in the social body through a physiological division of labor.[18] A man's duty was intellectual and financial productivity, although men varied widely in their capacities; a woman's duty was to reproduce and maintain the moral health of her family. The physical, intellectual, and behavioral differences between the sexes were complementary within the family unit.[19]

These varied investigations into the biological nature of sexual differences not only were caused by the rising feminist challenge to Anglo-American social order in the latter half of the nineteenth century but also inspired further resistance among educated women and men who sought to undermine scientific support for separate spheres. Social activists with connections to the women's movement responded to the challenge of sex difference in an evolutionary context in a variety of ways, each designed to answer the "woman question" on their own terms.[20] Some early feminists, such as Antoinette Brown Blackwell (1825–1921), denied that sufficient amounts of data had been gathered to support the claims of women's inferiority to men. Charlotte Perkins Gilman (1860–1935) and Olive Schreiner (1855–1920), on the other hand, appropriated the rhetoric of evolutionary theory to support their claims that the sexes were complementary and equal, or even, in the cases of Elisa Burt Gamble (1841–1920) and Frances Swiney (1847–1922), to argue for women's moral superiority![21] Many of the early feminists who sought to elevate their own biological status reified racial and class distinctions through their appropriation of an evolutionary hierarchy.[22]

The increasing importance of biology in demarcating constitutional maleness from femaleness is further highlighted by the veritable explosion in the number of hermaphrodite cases at the end of the nineteenth century, as medical doctors increasingly sought to define a biological basis for human sex that could be universally applied to all individuals. When confronted with people of intermediate or ambiguous sex, medical doctors and scientists found it difficult to agree on what criteria should be used to assign to all individuals one of two dichotomous sexes. Yet whereas earlier efforts to classify intersex individuals relied on their external appearance and behavior—manner of dress, timbre of voice, and sexual preference—by

the 1890s, doctors turned to the anatomical structure of internal gonads as the repository of true sex, and after World War I to chromosomes.[23]

By the end of the nineteenth century, male and female biological differences were inscribed within a wide variety of "new" biological theories, from physiology to development and the evolutionary history of humanity. Each theory contributed to an increasingly scientific picture of physical, intellectual, and emotional differences between the sexes.

Female choice and the animal/woman divide in the early twentieth century

In the early twentieth century, concerns over controlling the evolution of human culture gained far more precedence within the context of Anglo-American eugenics (see Larson, Chapter 7, this volume) than they had in earlier decades. Some biologists and social reformers feared that natural selection no longer acted in civilized cultures with the same speed or efficiency as it did when people lived in more primitive conditions, thanks to modern medicine and urban life. By the end of World War I, fears of national disorder and racial degeneration inspired efforts to control and direct the evolutionary development of British and American societies. Recent reevaluations of the positive eugenics movement in the USA, and the embedded connection of marriage selection to love, sexual desire, and eugenic value, have pushed its period of influence both backward to the 1880s and forward into the 1950s, and have demonstrated how social activists with a broad array of political agendas, from the political right wing to the left and members of the women's movement, appropriated the rhetoric of Darwin's sexual selection to advance their ideological positions on scientific grounds.[24]

When applied to people, Darwin's theory of female choice couched the social role of women in a slightly different context than that of contemporaneous scientific theories of sexual difference. Womanhood was not merely an impressionable clay upon which selection left its mark; women possessed the ability to indelibly proscribe the intellectual, moral, and physical attributes of future generations. Scientists posited that women, through proper selection of husbands, could change the evolutionary future of the human species. The power of female choice was unleashed through differential rates of reproduction. Those women who chose eugenically sound husbands raised larger families; the next generations contained

a disproportionate number of their attractive, intelligent, and fertile offspring. This evolutionary coupling of women's aesthetic and moral ability to discern the "quality" of potential husbands and therefore the future of the race proved incredibly powerful within the growing movement to control society's development through the application of biological principles. It also distanced human evolution from animal evolution: women chose their mates; female animals merely submitted to the most attractive male.[25] Sources in popular literature testify to the resonance of female choice and male–male competition among audiences with a variety of political backgrounds. Short stories and novel-length fiction directed at the "new" woman or man touted the importance of rational reproduction, female choice based on emotional truth not economics, and strong men who could fight to survive for producing happy marriages with lots of offspring.[26]

Even biologists disinclined toward accepting sexual selection in animals nevertheless saw female choice as an important component of marriage selection in humans. They drew a sharp line between animalistic sexual instincts, where any mate would do, and the civilized reasoned choices of marriage partners. Toward the end of his long life, Alfred Russel Wallace, for example, suggested that female choice could act with greater effect in humans than in animals. Whereas animals lived in harsh environmental conditions and were still subject to natural selection, human urban existence had removed the ecological pressures on individual survival. For Wallace, the unique ecological environment of humans prevented the effects of natural selection from swamping the effects of mate choice, making humans the only species in which sexual selection had a significant effect.[27]

Two of the most influential scientists publishing on sexual selection in the early twentieth century were both interested in using biology to better understand the human predicament, but used rather different approaches: Ronald Aylmer Fisher (1890–1962), a statistician and mathematical population geneticist, used his mathematical skills to elaborate a universal of theory of evolutionary change in populations, whereas Julian Sorrell Huxley (1887–1975), grandson of "Darwin's bulldog" Thomas Henry Huxley and a zoologist in his own right, was infinitely fascinated by the natural behavior of animals. Their common vision of evolution as a directional process within a single population provided an easy means of generalizing between animal and human populations.

Although the action of natural selection could explain the physical structure of animals and people, in the 1910s Fisher suggested that only

sexual selection might explain the mental, aesthetic, and moral evolution of humans. In particular, Fisher argued that two factors would determine the evolutionary future of a population: the relative quality of breeding individuals in a population, and the quantity of offspring they produced in each generation. People could most acutely perceive mate quality, "all the traits of human excellence," under the influence of burgeoning love. Fisher lamented, however, that the most attractive and intelligent couples were not producing as many babies as couples who lacked professional or artisanal skills. He insisted that, although the action of sexual selection in animals and man was very similar, the influence of sexual selection would be more keenly developed in humans because "the choice of mate is of more importance among mankind than among most other animals."[28] As Fisher reserved for sexual selection jurisdiction over the "power of beauty, form, colour, voice, expression and grace of movement," it is not surprising that he believed the effects of sexual selection were most pronounced in humans and not in animals.[29]

When it comes to sex, historians and biologists remember Fisher for his 1930 theory of "runaway" sexual selection. Runaway sexual selection occurred when the expression of a trait in males began to evolve in lock step with preference for that trait in females. If females preferred to mate with the male who possessed the longest tail or the most colorful display or the "most" of any arbitrary trait, then Fisher posited that their choice of mates would quickly drive the expression of that trait to an extreme condition within males. Runaway sexual selection provided Fisher with a mechanism for the evolution of traits that seemed to run counter to the effects of natural selection, like a long tail or bright color in birds, or in humans the tendency of young men to sacrifice their lives in battle for the good of the country or tribe to which they belonged. Fisher suggested that, as long as some of these altruistic young men returned safely home, their exploits would surely make them the focus of a great many women's attentions. He hoped that such female choice would correct for the dysgenic effects of war.[30]

In 1914, around the same time that Fisher sought to understand the role of marriage choice in humans, Julian Huxley published a long article on the "Courtship Habits of the Great Crested Grebe" (Figure 11.1). In this, Huxley insisted that, for most animals, mate choice existed in a primitive state of "unconscious mental activities" and "inherited sexual passions."[31] By 1938, he extended his critique of sexual selection even further. Only in highly polygamous species with a skewed sex ratio could the effects of

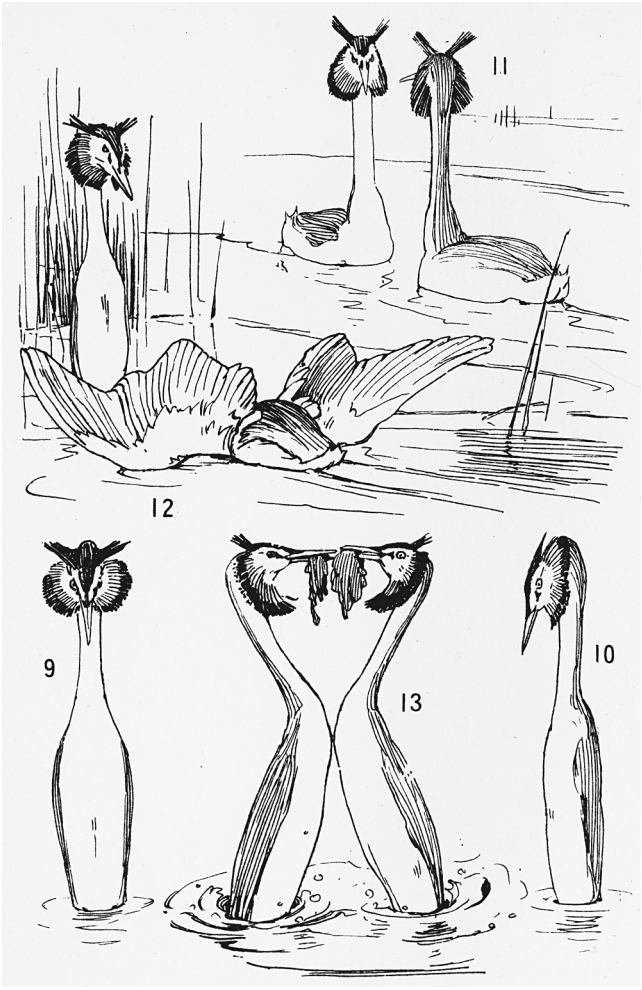

FIGURE 11.1 Great crested grebes exhibit many elements of their courtship displays after pairing up for the mating season. Huxley suggested that perhaps "love-habits" would be a better term for the grebes' mutual displays of affection. (From Julian S. Huxley, "The Courtship Habits of the Great Crested Grebe [*Podiceps cristatus*]; with an Addition to the Theory of Sexual Selection," *Proceedings of the Zoological Society* [1914] 35: 491–562 [491].)

sexual selection outweigh the effects of natural selection. Natural selection, Huxley contended, acted on courtship displays in the same way as it affected copulatory organs. The former acted on a psychological plane, the latter on a physiological plane, but both facilitated the union of sex cells and helped to keep the couple together after mating.[32] In other words, for Huxley, unlike for Fisher, the mating display itself served an evolutionary function (it wasn't arbitrary) and continued long after copulation.

In his model of mating behavior, Huxley argued that the most important function of courtship displays in animals was rather the promotion of pair-bonding between the male and female. Huxley's equation of mating display in animals with each individual sex act in humans (rather than marriage selection) resonated strongly with the sexology literature of the early twentieth century.[33] For example, Marie Stopes (1880–1958), the well-known paleobotanist turned suffragist and author of marriage manuals, suggested that courtship should not end with the marriage vows, but should instead be reenacted with every act of coitus. In her words, "wild animals are not so foolish as man; a wild animal does not unite with his female without the wooing characteristic of his race, whether by stirring her by a display of his strength in fighting another male, or by exhibiting his beautiful feathers or song."[34] In Stopes' hands, the proper equivalent of animal courtship was human foreplay and marital bonding, not spousal choice.

Both Fisher's and Huxley's models of female choice, from eugenically sound marriage partners to the decision of whether to engage in sex, paint a picture of women as sexual partners and physical embodiments of reproductive duty. Men and women might contribute equally to a productive society (however understood). As scientists like Fisher and Huxley explored the scientific bounds of natural sexuality in animals, they simultaneously redefined normal sexuality in humans in terms of their white middle- and upper-class sensibilities.[35]

Additionally, Fisher and Huxley emphasized the constitutive differences between woman and animal. Fisher's conception of female choice required that females possess the ability to discern minute differences among potential males and decide (whether consciously or not) which of these possible suitors was the best of the bunch, according to whatever criteria they employed. The process of comparison and aesthetic sensibility this implied made Fisher doubt whether the expression of female choice would ever be demonstrated in non-human animals. Huxley also insisted that animals were unlikely to be capable of true choice-based behavior,

and suggested an alternative way of conceptualizing sexual selection in animals. Over the course of his scientific career, Huxley came to prefer thinking of female choice in animals as simply the ability to distinguish acceptable mates from inappropriate ones, on the basis of the aesthetic preferences of the species and not on individual tastes.[36] Fisher and Huxley's reactions to female choice as a potential mechanism of evolutionary change illuminate the historical divergence of two models of sexual behavior, one based on rational choice (reserved for humans) and one based on instinct, which could apply equally to humans and animals.

Animal and human models of "natural" sexual behavior after World War II

With the onset of World War II and concerns over the uses and abuses of biological theory in Germany by the Third Reich (see Weindling, Chapter 8, this volume), it is unsurprising that the rhetoric of social control through selective breeding was muted in Anglo-American communities of the 1940s and '50s. European scientists interested in human behavior instead concentrated their efforts on searching for those behavioral complexes shared by all humans. American scientists still hoped to use biological theory as a basis for social control, but through environmental conditioning and behaviorist psychology, rather than breeding.[37] Although their approaches to animal and human behavior differed considerably, biologists and psychologists on both sides of the Atlantic had a common goal. They sought, first, to understand the human capacity for mass murder, a trait that seemed to distinguish people from all other animals. Only in humans had the struggle between members of the same species become so deadly. Second, biologists and anthropologists strove to create an antiracist account of human evolution, unifying all human cultures into a single coherent family.[38] Ironically, these efforts combined to produce an evolutionary narrative emphasizing "man the hunter" (or man the killer) as a universal sign of humanity and reasserted sex differences as the biological basis of gender in all human societies.[39]

American and European approaches to the question of human behavior also emphasized different ways in which one could generalize from animal observations to theories about human behavior. In the USA, the predominantly behaviorist cast of psychological investigations into animal and human actions led biologists to use animals as models of simplified human

behavior. Because behaviorists drew a strict line between the unconscious reactions of animals and the conscious, reasoned decisions of humans, animal behavior could be interpreted as roughly equivalent to human behavior without all that culture complicating things.[40] The popular writings of ethologist (animal behavior specialist) Konrad Lorenz (1903–89) in the 1950s and '60s inspired an entire genre of "pop ethology" that also generalized from animal to human. Many of his scientific peers critiqued his popular writings for their easy elisions between animals and people. Lorenz's friend and colleague Nikolaas Tinbergen (1907–88), for example, argued that, instead of extrapolating from the results of animal experiments, ethologists should apply their methods of behavioral analysis to humans. As organisms adapt their behavior to their environment, and the human environment differed radically from that of animals, observations of animal behavior provided only limited insight into the evolutionary origins of human behavior. Although this approach might seem as if it should have been appealing to anthropologists, in practice ethologists were interested in discovering the biological traits that united all humanity, while cultural anthropologists were interested in understanding the societies they studied as unique and valuable ways of life. Inevitably, these different research traditions, each invested in understanding the human predicament, came into conflict. At the core of their disagreements was the relative importance of innate human action and learned behaviors in determining the cultural and social structures of modern societies, and whether scientists should adjudicate their claims to naturalness or normality with reference to the non-human animal world or not.[41]

Before the creation of the National Science Foundation, the National Research Council–Committee for Research in Problems of Sex (NRC–CRPS) funded much of the sex research in the USA. Founded in 1921, the NRC–CRPS sponsored biological researchers who sought to uncover the genetic and hormonal basis of sex determination and differentiation. Although at its inception the NRC–CRPS had intended to conduct research on humans directly, during the 1930s the committee chose instead to fund scientists conducting basic research on animals as stand-ins for human subjects. These researchers argued that the short generation times and possible physiological manipulations of fish, mice, and birds allowed experimental investigations that were simply not experimentally or ethically viable for direct research on humans. Eventually, the committee did find a credible biologist interested in gathering direct information on human sexual habits, and today the NRC–CRPS is most often remembered as

the agency that funded the infamous questionnaires of Alfred Kinsey (1894–1956).[42]

The Kinsey reports on male and female sexual habits, published in 1948 and 1954 respectively, entered the public consciousness in an age of heightened concern about American moral identity. The pages of *Sexual Behavior of the Human Male* and *Sexual Behavior of the Human Female* highlighted a notable gap between Americans' espoused moral ideals and their actual sexual practices. By wrestling with this discrepancy, sexual identity continued its status as a critical component of the American national character. Although the Kinsey reports may not have changed public perceptions of what constituted "normal" sexual behavior, they provided a platform for a national discussion about the sexual habits and implied moral fortitude of U.S. citizens. Americans' conflicting anxieties about sexual vigor and susceptibility mirrored their perception of democracy as simultaneously a powerful agent of international social reform and a delicate ideology in need of vigilant protection.[43]

Kinsey's books provided the English-speaking public with access to behaviorist and psychobiological ideas about the potential for conditioning of human actions, personal identity, and sexual habits. His emphasis on the importance of socioeconomic class and early childhood sexual encounters in producing his observed variation in adult sexual behavior arose from a more general contention that human behavior emerges from the environmental conditions in which an individual is raised. Through his discussion of men's sexual habits, Kinsey sought to dismiss sexual orientation and race as biologically valid categories. If humans participated in particular kinds of sexual behavior then, by definition, those behaviors must be natural and therefore normal. The publication of Kinsey's books corresponded with the high water mark for the "American experiment" as a way of predicting and controlling people's actions and behaviors through the science of human behavior.[44]

Yet even Kinsey subscribed to a view of biological differences between men and women. He suggested that men exhibited a greater range of sexual behaviors than did women, in part because early sexual experiences were more important in shaping adult male sexual habits than they were in determining the later expression of sexual behavior in women. Even if most readers were shocked by the range of sexual behaviors American mothers and daughters described to Kinsey in their sex histories, biology again seemed to support the claim that women were less variable than men.[45] The public response to his reports illustrated several sexual double standards

in American sentiments about appropriate sexual behaviors in men and women. Healthy men should be sensitive to the needs of their wives inside the home and simultaneously aggressive in defense of their family and country. Inside the home, healthy women enjoyed sex and demanded foreplay from their sensitive husbands; yet not too much, lest they undermine the moral character of their husband and children outside the home. In an attempt to live up to these double standards, heterosexual couples emphasized the importance of marriage as the locus of sexual pleasure. Just as the family served as the cornerstone of postwar democratic capitalism, purchasing furniture and appliances for their home, married couples also acquired (or refamiliarized themselves with) new tricks in the bedroom.[46]

Meanwhile, on the eastern side of the Atlantic Ocean, ethologists explored the instinctive basis of animal and human behavior. Ethologists argued that environmental conditions shaped animal behavior in the same way that it shaped the physical structure of their limbs and organs. Individuals exhibiting behaviors that better enabled them to survive in their unique ecological surroundings were more likely to produce a greater number of offspring and pass along those behaviors to the next generation. Over time, natural selection shaped the behaviors characteristic of a species to the conditions of the species' existence. Although ethologists sought to understand the role of the environment in determining behavior, they typically thought in terms of generations changing in evolutionary time rather than individuals changing over the course of their life, as did their American counterparts.[47]

Methodologically, ethologists hoped to approach animal and human behavior with a similar set of analytical tools. Oxford-based Nikolaas Tinbergen synthesized these into four distinct questions that could be asked of any observed behavior. What prior experiences must an individual undergo in order to act like this now (ontogeny)? What immediate physiological or psychological machinery in the animal triggers the expression of the behavior (cause)? How does the behavior help the animal to survive in its natural environment (function)? What is the evolutionary history of the behavior and how is it related to similar behaviors in closely related species (evolution)? By asking these questions, ethologists were able to analyze behavior without recourse to hypothesizing about an inaccessible internal point of view of their subjects.[48]

One conceptual theory in particular, ritualization, enabled ethologists to search for similarities in behavioral patterns between large numbers of species.[49] For Tinbergen, ritualization denoted the process by which a

movement or posture became a specialized signal over evolutionary time. He equated signals with "derived organs" that had evolutionarily been coopted from their original function to become adapted to a new purpose. (A classic morphological example of this process is feathers, which were originally used for insulation in dinosaurs, but were later coopted by evolution for bird flight.) Julian Huxley, years after his observations of mating in great crested grebes, extended the analogy of morphology and behavior by claiming that an animal's behavioral repertoire could be divided into functional units or "behaviour-organs." The same kinds of analytical techniques could then be used to discuss the exaggeration, reduction, or functional cooption of behavior-organs in some animals as compared with others.[50]

When ethologists applied the concept of ritualization to the evolution of courtship behavior, they emphasized both the aggressive tendencies of males and the coy sexual behavior of females. Ritualization was key to both reducing intraspecific fighting to a "tournament" in which no individuals were fatally injured, and redirecting male aggression into sexual stimulation.[51] Ritualized behaviors were "signals" to other individuals of the same species—and induced an appropriate behavioral response (often sex specific). The same ritualized behavior—a colorful display on the part of a male bird—induced aggressive displays in other males, and sexually acquiescent behavior in females. Thus species-specific sexual behavior was adaptive—in Tinbergen's terminology, the *result* of natural selection for both the individual and, sometimes, for the species as well. In the case of territorial disputes, males used ritualized displays rather than actually fighting, thereby reducing the number of fatal encounters and maintaining the species. In territorial animals, courtship behavior could also act to spread competing males out over a larger area, further reducing aggression.[52]

Driven by the desire to professionalize the study of animal behavior in the field, this new approach to synthesizing behavior and evolutionary theory had profound consequences for the ways in which ethologists investigated reproductive behavior. For example, most ethologists remained profoundly uninterested in the ways behavior could shape the evolutionary future of a species, and were therefore not interested in female choice as a mechanism of evolution. When they chose to investigate the causes of intraspecific variation in animals, they were far more interested in male–male competition as a biological root of aggression than in female choice as a mechanism for structuring social relationships. In his analysis of the elaborate male mating displays of bower birds (the decorating of nest sites with items of specific colors), Alan John Marshall (1911–67) argued that the mating rituals had

not evolved as the result of female choice, but from the need of the species to coordinate female ovulation and male sperm production in response to unpredictable periods of drought and rain. He downplayed the importance of "choice-based" behaviors and instead described the mating rituals of these birds in terms of physiology and ecological necessity.[53]

When ethologists turned their attention to humans, in one sense they found it easy to include humans as simply another animal, uniquely adapted to its natural environment, exhibiting the same categories of behaviors as other species: foraging, courtship, territory acquisition, and defense. In another sense, humans represented a methodological problem in terms of identifying normal human behavior under natural conditions.[54] Yet books that purported to advance ethological interpretations of human behavior attracted a great deal of popular and scientific attention—not all of it positive.[55]

One of the first ethological treatises on human behavior took as its central theme the human tendency to make war and wreak violence on other humans, a problem of intra-specific aggression.[56] Konrad Lorenz argued in *On Aggression* (1963) that human behavioral evolution had been outstripped by technology, explaining why genocide seemed to be a uniquely human trait.[57] Modern weapons killed people at a distance and with such ruthless efficiency that they circumvented the victims' opportunities to offer signals of submission. Men were like doves; when crowded into a cage they lacked the common sense not to peck each other to death. Tinbergen and Lorenz were long-standing friends and scientific collaborators, but that didn't stop Tinbergen from suggesting in print that Lorenz had inappropriately generalized straight from animals to people. What we needed, suggested Tinbergen, were studies of man in his own right instead of "uncritically extrapolating the results of animal studies to man."[58] Humans, he suggested, were different from other animals because they exhibited an extraordinary ability to change their environmental conditions, and therefore the selective pressures, in which they lived. For Tinbergen, cultural evolution was outpacing the physical evolution of human society, as was evidenced by the ability of politicians to brainwash soldiers into thinking that fleeing was cowardly and despicable while simultaneously making killing easier through the development of long-range weapons that removed the possibility of their victims' avoiding death by signaling distress and appeasement. The parallels with the Christian doctrine of original sin were unmistakable: in order to live in an orderly and productive society, humans must overcome their innate nature.[59]

Rather than concentrating on fear and aggression, in *Love and Hate: The Natural History of Behavior Patterns* (1970), Irenäus Eibl-Eibesfeldt, founder of the field of human ethology, turned instead to courtship rituals as a structuring force of human social systems. Eibl-Eibesfeldt couched his analysis in terms of ritualized actions of humans that required no choice; the effect of courtship was to signal the emotional state of one individual to another. He suggested that "if a girl blushes we know she feels embarrassed, and if someone strikes a table with his clenched fist we know something has annoyed him." Eibl-Eibesfeldt used these examples to illustrate how human behaviors codified into rituals became both more simplified and more exaggerated "in the manner of a mime."[60] He argued that flirting in humans was a form of ritualized flight—when a woman caught the eye of a man and then quickly looked away, she was inviting him to pursue. Humans, as animals, exhibited ritualized behaviors that could be analyzed without presupposing a particular cognitive state in the individual expressing those behaviors.[61] The professionalized mechanomorphic language of the ethologists, when applied to humans as well as animals, removed agency and personality from the individuals they studied.[62]

In the postwar decades, both American psychobiologists and European ethologists emphasized sex differences as the root cause of gender distinctions in modern society. Resonating with the social mores of the period, they painted a picture of universal man as an aggressive hunter, and woman as naturally coy. Part of this description depended on biologists' removal of "agency" as a motivating cause of actions in animals, and, when they extended their analysis to humans, in human behavior as well. When combined with the sexual stereotypes implicit in assumptions that sexual behavior was more highly variable in men than in women, behavioral research of the post–World War II era provided the reading public with powerful reasons, etched in science and evolutionary theory, to believe in the primacy of biological sex differences in structuring human social organization and cultural interactions.

Sexual selection and biological determinism in the 1970s

The successes of animal film stars in the 1960s and '70s facilitated the easy slippage between human and animal social behavior in the popular imagination, from television series featuring animals as boyhood pals (like Lassie the dog and Flipper the dolphin in the USA, or Skippy the

kangaroo in Australia) to the heroic story of Elsa the lion's return to the wild in *Born Free* on the silver screen. By the mid-1970s scientific debates over the biological basis of human behavior also began to grace the pages of the *New York Review of Books*, *Time* magazine, and books aimed at non–scientifically trained audiences. The intensity of this media attention to the animalistic basis of human behavior made it seem that the construction of human behavior within an evolutionary framework was an innovative idea. Most of the outcry centered around two books. In *Sociobiology: The New Synthesis*, Edward O. Wilson interpreted patterns of social and sexual behavior in humans through the lens of evolutionary theory, which assumed that in order for selection to act on a trait, the trait in question must comprise heritable genetic differences. In *The Selfish Gene*, Richard Dawkins further suggested that organismal bodies were simply "survival machines" designed to perpetuate the genetic code they contained (see McGrath, Chapter 13, this volume). Together these books painted much the same version of men's and women's biology as before, albeit with a return to behavior as a mechanism of evolutionary change in the form of sexual selection and active female choice.[63]

Although his application of biological theory to human nature built on the work of psychologists, sexologists, and biologists before him, Wilson extended their "biologization" of human behavior and culture. He argued that "scientists and humanists should consider together the possibility that the time has come for ethics to be removed temporarily from the hands of the philosophers and biologicized."[64] Wilson's claim that even the morality of human culture should be analyzed as a biological trait engendered considerable lamentation and consternation among biologists and social scientists alike. As a result of the highly visible scholarly debates over the validity of the (socio)biological approach to human behavior, many of the earlier Anglo-American attempts to use evolutionary theory to understand human behavior were forgotten.[65]

In his review of *Sociobiology* published in the *New York Review of Books* in August 1975, developmental geneticist Conrad Hal Waddington (1905–75) argued that the core issue Wilson hoped to explain was how the altruistic basis of social interactions had arisen in a biological world defined by individual fitness and survival.[66] Waddington suggested that the answer to this question had already been solved conceptually in the 1930s, and then elaborated mathematically in the 1960s—kin selection.[67] Because our relatives are genetically related to us, helping them survive and reproduce actually helps to spread our own genes in the population. A

far more interesting question for Waddington was how to determine the relative significance of the following factors in determining someone's behavior: communication among members of a social group, individual experience, and genetics. Waddington suggested that Wilson ought to have paid more attention to resolving this nexus of influences. In fact, the relative importance of these factors became a central issue in subsequent debates over Wilson's book.

Three months later, a second review of *Sociobiology* appeared in the same journal, signed by sixteen people, some of whom worked down the corridor from Wilson at Harvard. Entitled "Against 'Sociobiology'" this review took Wilson to task for supporting biological determinism, a tradition they extended back to Spencer's cruel social policies, American eugenic beliefs in racial differences in IQ, and Hitler's policies of extermination. They claimed that Wilson's suppositions failed for five reasons that could be applied with equal efficiency to these earlier biological determinists. First, the behavior and social structure of organisms were not "organs" that could be analyzed as simple extensions of their genetic makeup. Second, biological determinism ignored the cultural transmission of ideas through human social interactions. Third, simple generalizations from non-human animals to humans on the basis of carefully crafted metaphors and analogies were scientifically flawed. Fourth, there was no direct evidence that genes for behavior exist at all. Fifth, Wilson's analyses were based on speculative reconstructions of human prehistory. Wilson responded immediately, claiming that the attack was "self-righteous vigilantism," and that he certainly did not endorse the "naturalistic fallacy" that what is, should be! Wilson's efforts to assuage his critics, however, did not stop others from joining the antisociobiology bandwagon.[68]

Additionally, in *Sociobiology* Wilson had described male and female sex roles as complementary opposites. Where males were aggressive, females were coy. Sex itself he touted as "an antisocial force in evolution. Bonds are formed between individuals in spite of sex and not because of it."[69] Wilson accounted for such fundamental differences between men and women with Darwinian sexual selection theory. He contended that these differences were the result of selection acting differently on men and women, encoding sex differences in the human genome. Males, he posited, were salesman, and females had evolved to resist their efforts. In other words, by playing hard to get, females would land themselves a more vigorous mate.

Appearing only a few months later, Dawkins' *Selfish Gene* added fuel to an already blazing fire. Dawkins provocatively asserted that animal and

human bodies were simply genetic-replication devices. Although Dawkins was careful to assert in the first few pages of the book that he was "not advocating a morality based on evolution," in the *Selfish Gene* he framed sexual stereotypes as biological, not cultural, entities.[70] Dawkins argued that the nature of maleness and femaleness arose because the gametes of males (sperm) were significantly smaller and more numerous than the gametes of females (eggs). All sex-based behavioral differences, Dawkins continued, stemmed from this one significant fact, lending men the ability to reproduce at a virtually unlimited rate, while females were limited by their capacity to bear only one child at a time.[71] Although women might choose males by different strategies (by looking for a good father or the male with the highest-quality genes), Dawkins maintained they were the choosy sex, whereas males were more profligate in their sexual attentions. His analysis of sex differences based on gamete physiology could almost have been lifted from Geddes and Thompson's treatise on sex differences eighty-six years earlier. By 1989, when a second annotated version was released, Dawkins had softened this claim, and instead suggested the relative size of gametes did not determine behavioral differences in adults, but that both were a consequence of the two-sex solution to genetic recombination.[72] The sex differences themselves remained. Much like Darwin, Dawkins added a final note to his chapter on sex: if a biologist were to analyze human sexual systems based on appearance alone, he (or she) would be likely to determine that in humans the process of sexual selection was reversed as it is the females of the species who spend so much time and attention on their appearance and the men who hold the power of mate selection![73]

Following the publication of *Sociobiology* and *The Selfish Gene*, many second-wave feminists objected strenuously to Wilson and Dawkins' characterizations of men as sexually vigorous and women as passive or coy.[74] The rise of second-wave feminism had begun much earlier. In her 1963 bestseller *The Feminine Mystique*, Betty Friedan urged suburban housewives to recognize their frustrations with the social proscriptions defining their lives.[75] Women needed to break down the stereotypes that defined femininity, she claimed. Also published in 1963, the psychological studies of William Masters and Virginia Johnson simultaneously illuminated the psychology and physiology of the female sexual response, including women's capacity for multiple orgasms.[76] The sexual revolution drew even more popular attention to the variety of women's sexual choices in society.

By the 1970s, then, the debates over the stereotypical depictions of sex in Wilson and Dawkins' books helped to crystallize an anti-evolutionary-theory contingent among feminists.

A young feminist primatologist, Sarah Blaffer Hrdy, was one of the few people to read Wilson's chapter 15, "Sex and Society," before its publication; at the time, Hrdy was a Ph.D. student in anthropology at Harvard, where Wilson worked.[77] Whether or not Hrdy's objections to Wilson's book coalesced when she first read his manuscript, several years later she published a scathing critique of the enduring role of the "coy" female and "active" male in evolutionary theory.[78] In this book, Hrdy identified sexual selection as "one of the crown jewels of the Darwinian approach basic to sociobiology," and argued that the theory of sexual selection was based on "partially true assumptions" that portrayed females as sexually passive, yet highly discriminating, and males as sexually aggressive and undiscriminating.[79] Wilson had based much of his analysis of sexual selection on two publications by a young biologist, Robert Trivers.[80] Hrdy contended that Trivers had uncritically imported sexual stereotypes about passive women and active men into his work. She argued that when Trivers' essay on sexual selection became "the second most widely cited paper in all of sociobiology," other biologists, in turn, integrated the myth of the "coy female" into their evolutionary theorizing about the sexual relations between males and females.[81] Hrdy further suggested that the coy-female stereotype gained acceptance within the biological community because of male scientific bias, and that only the recent advent of women into the biological sciences had begun to alter the application of sexist stereotypical human behavior to animals.

Hrdy intended her analysis of the "coy female" as a critique of experimental practice and theorizing in 1980s sexual selection research, yet it also served to highlight how central the ethological model of mate choice had become to the animal behavior community. Sociobiologists had combined a pre–World War II conception that behavior (especially female choice) could describe the evolutionary past and help to predict the evolutionary future of human sociality, with an ethological mechanomorphic model of female mating behavior devoid of true "choice." Although this model allowed ethologists to professionally distance themselves from their animal subjects, when applied to human mating behavior it depicted women as socially and sexually passive while promoting men as instinctually aggressive in their social and sexual behavior.

Bridging the gap between feminism and evolutionary theory

In recent decades primatological research has highlighted the cultural complexities of primate social interactions, thereby causing a reconsideration of boundaries demarcating nature from culture, animal from human. As the controversies over sociobiology continued to develop, a younger generation of biologists and primatologists began to create new scientific narratives about sexual identity and evolutionary theory, seeking to provide depth and reason to female social and sexual behavior. Primatologists such as Jeanne Altman, Barbara Smuts, Sarah Blaffer Hrdy, and Patricia Gowaty offered critiques of female passivity and sought to provide alternative evolutionary narratives with their research.[82] They hoped their research would not only redress what they identified as male bias in the primatological literature on sex but also convince feminists that biological theory was not antithetical to their goals. Simultaneous efforts to understand the capacity for language in primates, especially in bonobo chimpanzees, have strengthened biologists' convictions that a simple dichotomy between animal nature and human culture is untenable.

By the 1990s, primatological research helped to destabilize the "man the hunter" paradigm by adding narratives about sexually assertive, polyandrous, strategizing females, producing a new "female perspective" within evolutionary biology.[83] Jeanne Altman's research on baboons in Amboseli National Park, Kenya, helped to break down cultural assumptions about the universal nature of mother love.[84] She showed how baboon mothers changed their behavior toward their offspring as a result of changes in habitat, environmental variation, or their social relationships within the troop (Figure 11.2). Also working on baboons, Barbara Smuts elucidated the close associations that form between male and female baboons that can last lifetimes, not solely as sexual partners, but as "allies."[85] Smuts' research provided insights into why the top male doesn't always get to mate with the reproductively available female, and described the ways in which female baboons strategized and manipulated their social relationships. The assertive female baboons central to her research varied in their predilections for lovers and allies. In Altman's and Smuts' descriptions, female baboons were far from mere baby incubators, the passive recipients of male attention and behavioral structure. Published several years later, Hrdy's *Mother Nature* offered a broad synthesis of maternal behavior in a variety of primates, and carried much the same message—primate societies were not structured solely by competition between males.[86] Fe-

FIGURE 11.2 Baboons have served as models of human social behavior among anthropologists for almost fifty years. During this period, biologists' interpretations of baboon behavior have shifted from mostly emphasizing aggressive interactions between large males as the basis of social structure to incorporating both male and female behavior as important to understanding group dynamics. (Photo by Dorothy Cheney.)

males define and redefine their reproductive strategies in order to gain the assistance of other individuals in raising their offspring. Whether help in offspring care and provisioning comes from grandmothers, sisters, unrelated females, or multiple males in the group, a single female almost never raises her infants alone. Simultaneously, biologists have been paying more attention to situations in which male and female desires come into conflict. Patricia Gowaty's research has demonstrated the crucial importance of male coercion in limiting and defining the options available to females; females, she argues, behave differently when they can freely chose their mates and reproductive strategies than when those choices are constrained by their social situation.[87]

These female scientists travel a narrow and arduous path between the objective stance from which they analyze their animal subjects and a simultaneous recognition that their research, like the research of their male counterparts, is affected by the political and social climate in which they work. Many of them have self-consciously tried to produce valuable and insightful contributions on the place of women in nature and to appreciate the complexity and nuances of human social structures more generally.

The rise of these new narratives about female primates, including women, couched in the language of sociobiology corresponded to the rise of a new subdiscipline in the history of science devoted to women's encounters with science as producers and subjects of biological research. Female scientists, like their male counterparts, draw on their own experiences and political climate in the decisions they make to follow the leads they find interesting, and in framing the lives of their female subjects as active creators of their biological and social destinies. Their scientific narratives are accessible to both professional and popular audiences, and are often coupled with calls for the preservation of primate habitats and ecologies that are in the process of being destroyed.[88]

Bonobos, also known as pygmy chimpanzees, began to replace baboons as the primate species thought to most closely resemble our early hominid ancestors in the 1990s. Their apparent facility with language, ease in walking upright, and tendency to use sexual relations as a tool for conflict resolution brought the bonobo to popular attention. From his interactions with bonobos, Frans de Waal, for example, has argued that both learned experiences and innate capacities for social interactions define chimpanzee and human culture. Sue Savage-Rumbaugh has similarly suggested that bonobos are capable of abstract thought, empathetic understanding of another's experiences, recognizing themselves in a mirror, and communicating their emotional experiences to other individuals. A simple dichotomy between animal nature and human culture is becoming increasingly less tenable as we learn more about non-human animal cultures, making scientific theories about sex differences and social relations in ape communities seem even more relevant for understanding our own culture.[89]

Perhaps as a result, a true rapprochement between feminism and evolutionary biology has been elusive. Evolutionary psychologists and popular writers continue to produce biological narratives that reproduce old sexual stereotypes: men seek large numbers of young, vibrant, fertile partners in order to maximize their total number of offspring, and women seek older, economically secure husbands to provide their offspring with financial support and stability. In one extreme case, Randy Thornhill and Craig Palmer argued in *A Natural History of Rape* that social scientists misunderstood biological imperatives when they described rape as fundamentally about power, not sex. Rape, Thornhill and Palmer suggested, may have been selected for as an alternative reproductive strategy for men who cannot gain offspring any other way. Their account of male and female sexuality flew in the face of vast quantities of social science research on humans, but ac-

corded well with male reproductive strategies in scorpion flies (Thornhill's model organism of choice). Perhaps not surprisingly, many reviewers criticized the book, noting that scientists should not generalize conclusions from one animal model directly to humans, especially when that model is only distantly related to humans.[90]

In a nutshell

The strategy of using "natural" animal models in the search for explanations of sex differences has a long-standing tradition in twentieth-century biological science, from Darwin's theory of sexual selection, to Fisher's eugenic politics in the 1920s, and even Kinsey's research on the variability of human sexuality. Yet the hardening of evolutionary biology into a rigid adaptationist framework after World War II lent new credibility to biologists who sought to understand the biological basis of human behavior through an evolutionary lens.[91] Despite recent efforts by primatologists to describe behavioral development without recourse to a nature–nurture dichotomy, their message is just beginning to find its way into popular discourse. The power of "nature" as the arbiter of difference between woman and man, human and animal, continues to endure independently of whether scientific explanations of difference are evolutionary, physiological, or genetic in nature.

83. E. O. Wilson, *Sociobiology: The New Synthesis* (Cambridge, MA: Harvard University Press, 1975).

84. Wilson, *Sociobiology*, 379.

85. Wilson, *Sociobiology*, 382.

86. E. O. Wilson, *On Human Nature* (Cambridge: Cambridge University Press, 1978).

Chapter Eleven

1. Although historians and social scientists today almost universally recognize the socially constructed nature of race, historically many biologists have claimed race as another example of stable biological variation within humans. For example, see Michelle Brattain, "Race, Racism, and Antiracism: UNESCO and the Politics of Presenting Science to the Postwar Public," *American Historical Review* (2007) **112**: 1386–413; Charles Darwin, *The Descent of Man, and Selection in Relation to Sex, with an Introduction by James Moore and Adrian Desmond*, 2nd ed. (London: Penguin Books, [1879] 2004), 652–75.

2. I do not mean to suggest that "male" and "female" are immutable categories, but simply that both male and female individuals are produced in each generation; see Joan Roughgarden, *Evolution's Rainbow: Diversity, Gender, and Sexuality in Nature and People* (Berkeley: University of California Press, 2004).

3. Carolyn Merchant, *The Death of Nature: Women, Ecology, and the Scientific Revolution* (San Francisco: Harper & Row, 1980); Londa Schiebinger, *Nature's Body: Gender in the Making of Modern Science* (New York: Beacon Press, 1993), reissued with a new preface (New York: Rutgers University Press, 2004); Patricia Fara, *Sex, Botany, and Empire: The Story of Carl Linnaeus and Joseph Banks* (New York: Columbia University Press, 2004).

4. I use *gender* here as a category describing the social roles of men and women in human society. As the material in the chapter covers biologists' research on presumed universal differences between male and female animals and humans, I prefer to use the actor's category, *sex*. Anne Fausto-Sterling, *Sexing the Body: Gender Politics and the Construction of Sexuality* (New York: Basic Books, 2000). Additionally, throughout this chapter I refer to all non-human animals simply as "animals."

5. Donna Haraway, *Primate Visions: Gender, Race, and Nature in the World of Modern Science* (New York: Routledge, 1989).

6. Cynthia Eagle Russett, *Sexual Science: Victorian Construction of Womanhood* (Cambridge, MA: Harvard University Press, 1989).

7. Stevi Jackson and Amanda Rees, "The Appalling Appeal of Nature: The Popular Influence of Evolutionary Psychology as a Problem for Sociology," *Sociology* (2007) **41**: 917–30.

8. Some Internet dating sites allow members to vet hopeful applicants on the basis of their photo alone: http://www.darwindating.com/ and http://us.beautifulpeople.net/

9. Charles Darwin, *On the Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life* (London: John Murray, 1859); Darwin, *The Descent of Man.*

10. James Moore and Adrian Desmond, "Introduction," in Charles Darwin, *The Descent of Man, and Selection in Relation to Sex*, 2nd ed. (London: Penguin Books, 2004), xi–lviii.

11. Eveleen Richards, "Darwin and the Descent of Woman," in *The Wider Domain of Evolutionary Thought*, ed. David Roger Oldroyd and Ian Langham (Dordrecht: D. Reidel, 1983), 57–111.

12. Michael Ruse, *Monad to Man: The Concept of Progress in Evolutionary Biology* (Cambridge, MA: Harvard University Press, 1997).

13. Russett, *Sexual Science*, 14; Nancy Leys Stepan, "Race and Gender: The Role of Analogy in Science," *Isis* (1986) **77**: 261–77; Francis Galton, *Hereditary Genius: An Inquiry into Its Laws and Consequences* (London: Macmillan and Co., 1869).

14. Russett, *Sexual Science*, 83–4; Darwin, *The Descent of Man*, 2nd ed., 654.

15. In *Sexual Science*, Russett addresses each of these issues in turn: the biogenetic law (chapter 2), laws of thermodynamics (chapter 4), and the physiological division of labor (chapter 5).

16. Russett, *Sexual Science*, 54–63; Ernst Haeckel, *Generelle Morphologie der Organismen* [General biology of organisms] (Berlin: Georg Reimer, 1866); Karl Ernst von Baer, *Entwicklungsgeschichte der Thiere: Beobachtung und Reflexion* [Developmental history of the animals: observation and reflection] (Königsberg: Bornträger, 1828); G. Stanley Hall, *Adolescence*, 2 vols. (New York: D. Appleton, 1904). For an excellent and thorough discussion of the history of evolutionary and developmental theory, see Stephen Jay Gould, *Ontogeny and Phylogeny* (Cambridge, MA: Harvard University Press, 1977).

17. On Wallace, Darwin, and sexual selection, see Helena Cronin, *The Ant and the Peacock: Altruism and Sexual Selection from Darwin to Today* (Cambridge: Cambridge University Press, 1991). On Geddes and Thompson, see Russett, *Sexual Science*, 90–1, 108–21; Patrick Geddes and J. Arthur Thompson, *The Evolution of Sex* (London: Walter Scott, 1889).

18. This belief certainly pre-dates the late nineteenth century, but was seized upon with renewed vigor by nineteenth-century scientists. See Merchant, *Death of Nature*; Londa Schiebinger, *The Mind Has No Sex? Women and the Origins of Modern Science* (Cambridge, MA: Harvard University Press, 1989); Lisbet Koerner, *Linnaeus: Nature and Nation* (Cambridge, MA: Harvard University Press, 1999); Barbara Taylor and Sarah Knott, eds., *Women, Gender, and Enlightenment* (New York: Palgrave Macmillan, 2005); and Ann Shteir and Bernard Lightman,

eds., *Figuring It Out: Science, Gender, and Visual Cultural* (Dartmouth, MA: Dartmouth College Press, 2006).

19. Russett, *Sexual Science*, 136–7.

20. Sally Gregory Kohlstedt and Mark R. Jorgensen, "'The Irrepressible Woman Question': Women's Responses to Evolutionary Ideology," in *Disseminating Darwinism: The Role of Place, Race, Religion, and Gender*, ed. Ronald L. Numbers and John Stenhouse (Cambridge: Cambridge University Press, 1999), 267–94; George Robb, "Eugenics, Spirituality, and Sex Differentiation in Edwardian England: The Case of Frances Swiney," *Journal of Women's History* (1998) **10**: 97–117.

21. Antoinette Brown Blackwell, *The Sexes Throughout Nature* (New York: G. P. Putnam's Sons, 1895); Charlotte Perkins Gilman, *Women and Economics: A Study of the Economic Relation between Men and Women as a Factor in Social Evolution* (Boston, MA: Small, Maynard & Company, 1898); Olive Schreiner, *Woman and Labour* (reprint, London: Virago, 1978); Eliza Burt Gamble, *The Evolution of Woman: An Inquiry into the Dogma of her Inferiority to Man* (New York: G. P. Putnam's Sons, 1894); Frances Swiney, *The Awakening of Women or Woman's Part in Evolution*, 3rd ed. (London: William Reeves, 1908).

22. Diane Paul, *Controlling Human Heredity: 1865 to the Present* (Atlantic Highlands, NJ: Humanities, 1995); Diane Paul, *The Politics of Heredity: Essays on Eugenics, Biomedicine, and the Nature-Nurture Debate* (Albany: SUNY Press, 1998); Penelope Deutscher, "The Descent of Man and the Evolution of Woman," *Hypatia* (2004) **19**(2), 35–55.

23. Alice Dreger, *Hermaphrodites and the Medical Invention of Sex* (Cambridge, MA: Harvard University Press, 1998).

24. Daniel Kevles, *In the Name of Eugenics: Genetics and the Uses of Human Heredity* (New York: Alfred A. Knopf, 1985); Wendy Kline, *Building a Better Race: Gender, Sexuality, and Eugenics from the Turn of the Century to the Baby Boom* (Berkeley: University of California Press, 2001); Paul, *Controlling Human Heredity*; Susan Marie Rensing, "Feminist Eugenics in America: From Free Love to Birth Control, 1880–1930," Ph.D. thesis, University of Minnesota, 2006; George Robb, "The Way of All Flesh: Degeneration, Eugenics, and the Gospel of Free Love," *Journal of the History of Sexuality* (1996) **6**: 589–603.

25. Kline, *Building a Better Race.*

26. For British fiction, see Angelique Richardson, *Love and Eugenics in the Late Nineteenth Century: Rational Reproduction and the New Woman* (Oxford: Oxford University Press, 2003). For American fiction, see Bert Bender, *The Descent of Love: Darwin and the Theory of Sexual Selection in American Fiction, 1871–1926* (Philadelphia: University of Pennsylvania Press, 1996); Bert Bender, *Evolution and "the Sex Problem": American Narratives during the Eclipse of Darwinism* (Kent, OH: Kent State University Press, 2004).

27. Alfred Russel Wallace, "Human Selection," *Fortnightly Review* (1890) **48**: 325–37; Alfred Russel Wallace, *Social Environment and Moral Progress* (New York: Cassell and Company, 1913), 140–1.

28. Ronald A. Fisher, "Evolution of Sex Preference," *Eugenics Review* (1915) **7**: 184–92 (191).

29. Fisher, *Eugenics Rev.* (1915) **7**: 189; Ronald A. Fisher, "Positive Eugenics," *Eugenics Review* (1917) **9**: 206-12.

30. Ronald Fisher, "Sexual Reproduction and Sexual Selection," in *The Genetical Theory of Natural Selection* (Oxford: Clarendon Press, 1930), chap. 6, 121–45.

31. Julian S. Huxley, "Courtship Habits of the Great Crested Grebe," *Proceedings of the Zoological Society of London* (1914) **35**: 92.

32. Julian S. Huxley, "Darwin's Theory of Sexual Selection and the Data Subsumed by it, in the Light of Recent Research," *American Naturalist* (1938) **72**: 416–33; Julian S. Huxley, "The present standing of the theory of sexual selection," in *Evolution: Essays on Aspects of Evolutionary Theory*, ed. Gavin de Beer (London: Oxford University Press, 1938), 11–42; Julian S. Huxley, Ludwig Koch, and Ylla, *Animal Language* (New York: Grosset & Dunlap, 1938; reprint, 1964).

33. Peter Laipson, "'Kiss without Shame, for She Desires It': Sexual Foreplay in American Marital Advice Literature, 1900–1925," *Journal of Social History* (1996) **29**: 507–25.

34. Marie Carmichael Stopes, "Mutual Adjustment," in *Married Love, or Love in Marriage*, with preface and notes by William J. Robinson, M.D. (New York: Critic and Guide Company, 1918), chap. 5.

35. Julian B. Carter, *The Heart of Whiteness: Normal Sexuality and Race in America, 1880–1940* (Durham, NC: Duke University Press, 2007).

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37. Rebecca Lemov, *World as Laboratory: Experiments with Mice, Mazes, and Men* (New York: Hill and Wang, 2005).

38. Edward Steichen, *The Family of Man* (New York: published for the Museum of Modern Art by Simon and Schuster, 1955).

39. Haraway, *Primate Visions*.

40. For example, see Harry Harlow's research on the maternal instinct. Deborah Blum, *Love at Goon Park: Harry Harlow and the Science of Affection* (Cambridge, MA: Perseus Books, 2002).

41. Konrad Lorenz, *King Solomon's Ring: New Light on Animal Ways* (New York: Cromwell, 1952); Konrad Lorenz, *On Aggression*, translated by Marjorie Latzke (London: Methuen, 1966; original German edition, 1963). For a critique of Lorenz's popular writings, see Nikolaas Tinbergen, "On War and Peace in Animals and Men: An Ethologist's Approach to the Biology of Aggression," *Science* (1968) **160**: 1411–18.

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Chapter Twelve

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