

National Gallery of Art, Washington, D.C. Rosenwald Collection.

Adam and Eve (1504), by Albrecht Dürer. "It is not good that the man should be alone," said the Lord (Genesis 2:18). The solution: woman. Despite the Lord's intentions, the sexes' first encounter was not a total success.

Men and Women

The most perfectly organized societies in nature are sexless ones, or those where sex differences have been minimized or somehow suppressed. In America, during the turbulent late 1960s and '70s, feminists began to suggest, in effect, that our own complicated society ought to move in that direction. The role of housewife and mother was disparaged as "unfulfilling"; women entered the labor force by the millions; discriminatory laws were struck down; divorce rates soared. Yet, as scholars note, boys and girls still behave differently as youngsters. The call to motherhood remains strong even to ambitious career women. Males and females continue to look at the world through different eyes. In an odd way, the feminist drive for sexual equality has spurred rather than eroded scholarly efforts to examine "masculinity" and "femininity." Here, anatomist John Fleagle looks at our evolutionary heritage; editor Cullen Murphy surveys the growing mass of research on sex differences in behavior; and constitutional scholar A. E. Dick Howard summarizes relevant developments in the law over the past two centuries.

IN THE BEGINNING

by John G. Fleagle

Sex differences first became a "social" issue some 600 million years ago. Into a world teeming with single-celled, asexual organisms there came a new kind of living thing, one that could not propagate by simple cellular division because it contained only one-half of the necessary genetic material. In order to reproduce, it had to acquire the other half by being fertilized. While oysters, orchids, and orangutans today "have sex" in different ways, the basic principle was laid down in the Cambrian age: For most species, it would take two to tango.

Sex was a watershed. In asexual organisms, such as algae, variation is limited; all organisms of a species are essentially

clones. No species can adapt rapidly to a new environment. Life on Earth was asexual for three billion years, and for three billion years life on Earth resembled a thin vegetable soup. Evolution was slow.

By contrast, every product of sexual reproduction is different, resulting from a mixture of two sets of genes. Not all of the organisms given life in this manner will survive in altered environments, but those that do have a fair chance of passing on the traits that made the difference. Sex stoked evolution, stoking it further when sexual "selection" became a consideration among the higher organisms that sex made possible, and often continuing to help it along by means of a sexual division of labor *after* procreation—among many fish, birds, mammals—that complemented the duality of fertilization itself.

A Living Legacy

Looked at coldly, sex may seem an absurd mechanism, disorderly, a generator of strife in nature as in society; much of human literature depicts sex mocking our intelligence, or challenging it. Yet, as Stephen Jay Gould has written, "odd arrangements and funny solutions are the proof of evolution—paths that a sensible God would never tread but that a natural process, constrained by history, follows perforce." As an evolutionary strategy, sexual reproduction *worked* for hundreds of millions of species. Eventually it produced *Homo sapiens*.

Homo sapiens now numbers some 4.5 billion individuals. Of these, few if any continue to live under conditions remotely approximating those in which humans lived and bred during 99 percent of their history as a species, before agriculture and animal husbandry abruptly changed the trajectory of our culture. Yet the genetic legacy of our past persists in all of us to an extent that is unquantifiable but certainly significant.

Included in this legacy are the numerous physical differences between men and women. Looking beyond the obvious differentiation in reproductive function and apparatus, one observes that most women are smaller than most men and have more body fat but less body hair. Newborn males are less likely to survive infancy than are newborn females. While not obvious

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at a glance to oglers at swimming pools, the tooth structures of men and women are instantly distinguishable to physical anthropologists, archaeologists, and forensic scientists. Lately, more subtle but no less distinctive differences have been discovered in brain cells.

Three Perspectives

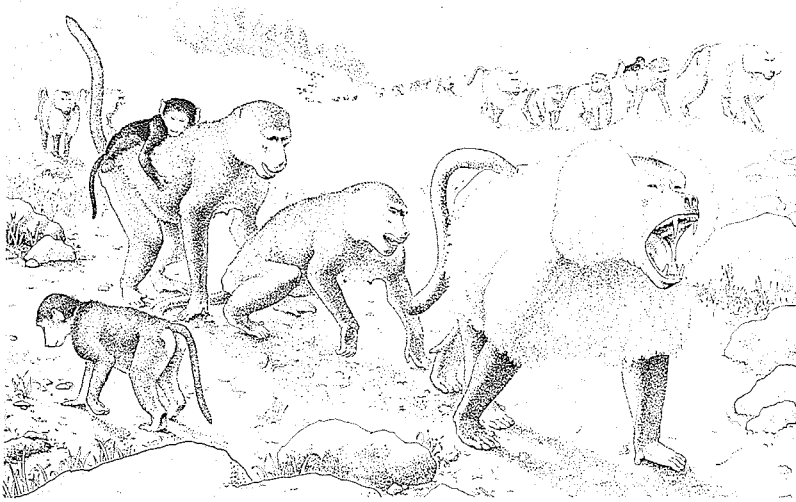
There must be—or have been—good reasons for such differences, for Nature is sometimes capricious with her favors, but rarely profligate. The search for those reasons has occupied an expanding (but still small) group of serious scholars drawn from many disciplines: paleontology, sociology, anthropology, biology, anatomy, zoology, sexology. It is a demanding field of inquiry, where facts are few and interpretations controversial.

The origins and implications of sexual differences in humans can be approached from only three directions, none of them totally satisfying, and none of them truly independent of the others. One way is to observe the behavior of our primate relatives. Another is to look at the fossil record. A third is to ponder human behavior today. Let us take these in order.

Compared to monkeys and apes, the physical differences between men and women—"dimorphism," to use the scholars' shorthand—are in some ways standard, in others confusingly unique. The truth is that monkeys and apes are themselves a very diverse lot. At one extreme, we have animals such as baboons in which males are nearly twice the size of females and have long, dagger-like canine teeth.* At the other extreme are animals such as the graceful gibbons of Southeast Asia or the tiny marmosets of South America in which males and females are virtually identical in size and appearance; to an untrained observer, even their genitals look alike. Then, there are the many intermediate species where sexual differences—in size, teeth, coloring—do exist but are limited and sometimes intermittent. Male squirrel monkeys, for example, seem to put on extra weight only for the breeding season.

There is a pattern in all this diversity: The degree of dimorphism appears to vary with the kind of social organization in which the various animals live. Species with the greatest male-

*A word needs to be said at the outset about teeth, since the reader will encounter mention of them frequently in this essay. To an anatomist, teeth are like fingerprints; from a single tooth a specialist can determine an animal's species, size, sex, and age, reconstruct the shape of its jaw, tell you what it liked to eat. Teeth are especially valuable to paleontologists, who are always working in the dark, trying to visualize creatures no one has ever seen. Teeth have one further advantage: They are extremely durable and may survive intact for millions of years.



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Polygynous, highly dimorphic hamadryas baboons leave their sleeping rock, each male followed by his harem, infants clinging to their mothers.

female differences in body size and canine size are polygynous. They live in small groups of one adult male and several adult females plus their offspring (like the sacred langurs of India) or in larger groups of several adult males and numerous adult females (like the large baboons of Africa). Species with no significant sexual differences live in monogamous family units.

The reason for this is sexual selection. Most sexual differences are the result of competition among members of one sex for reproductive access to members of the other sex; the sex that invests the least amount of time and energy in the offspring is the one in which the most intense competition occurs. In mammals, it is the females who carry the offspring before birth and nurse them afterward. The number of offspring that a female mammal can produce in any year is severely limited by the effort of gestation and lactation. Male mammals do not necessarily have such a heavy investment in each child. In many species, all the male contributes to his progeny is one sperm and the time it takes to copulate (three to four seconds in rhesus monkeys).

The potential reproductive success of a male mammal is thus much greater than that of any female. In a troop of monkeys or a herd of deer, a single adult male could father a dozen

or more offspring in one year while a female could only produce one. To do so, of course, he would have to fend off his randy brethren, but that may be possible if his canines or antlers are large enough (hence dimorphism). If successful, he will sire most of the offspring in a particular group and thus contribute disproportionately to the next generation.

This is an extreme situation. For most primates, and, happily, the majority of humans, fathering, like mothering, involves more than a chance copulation. In some species, fathers spend as much time and energy on their children as do mothers. While no male mammals carry their offspring around before birth (as male seahorses and certain frogs do), some carry them around for years after birth—take the siamang gibbons, for instance. While they cannot give milk to the infants, they *can* take the infants to food and show them what to eat.

Charming the Females

As we might expect, then, when males become indispensable in the rearing of young, most of the “nonmechanical” sexual differences in such things as teeth and size are reduced. This is not because competition among males for females is reduced. It is because competition among females for males is just as strong. Every female is looking for a “good man” as provider and protector. Hence, we get monogamous species organized into something close to nuclear families.

Sexual selection, Charles Darwin wrote in 1859, involves not only “the power to conquer other males in battle” but also “the power to charm the females.” And, as recent research makes plain, the “power to charm the females” is usually complemented by the “power of females to manipulate the males.”*

So much for contemporary monkeys and apes. Studying them may yield as many questions as clues, but many of the clues are solid. Of course, there are few “primate patterns” that we can ascribe with much assurance to our own heritage; the diversity is just too great. The best clues lie in the correlation we seem to find between the physical structure of the sexes within a species and that species’ social organization. This, when consid-

*Other factors probably influence sexual dimorphism in contemporary primates. Larger species show greater sexual differentiation than smaller ones do, although we don’t know why. Also, we know that feeding patterns can vary from sex to sex. A related factor is what are called “energy budgets.” One might initially suspect that, because they are smaller, females of sexually dimorphic species would use less energy than the larger males. However, because they usually have the additional demands of pregnancy and lactation, the caloric and nutritional needs of a small female are often *greater* than those of the larger male. Is the smaller size of the female in part a compensation for these extra demands?

ered in conjunction with what we have learned of contemporary primitive societies, can aid us in reconstructing the behavior of our extinct human ancestors, creatures we encounter only through fragments of bone or an occasional stone tool.

Our earliest known direct ancestor was an animal called *Aegyptopithecus zeuxis*. It lived about 30 million years ago in forests alongside a large meandering river near the present day Nile in Egypt. We have many pieces of its jaw with lots of teeth; we have a skull; and we have various bones of the arm and foot. There is enough to suggest that *Aegyptopithecus* was a sexually dimorphic species with males having larger canines and a much larger body size than the females. From this we conclude, by analogy with extant primates, that *Aegyptopithecus* was not monogamous but rather lived in polygynous groups, groups with more breeding females than males. The amount of male investment in child care was relatively small.

Hunters and Gatherers?

By about 10 to 12 million years ago, we get the first vague inkling of hominids. The recognizable "humanity" of these creatures—generally called *Ramapithecus* or *Sivapithecus*—is minimal. *Ramapithecus* were about the size of a chimpanzee. Like later humans, however, they seem to have had relatively broad, flat molar teeth and short broad canines. Unfortunately, the fossils from these animals are few and fragmentary, and it is virtually impossible to determine how many species are involved, much less the appearance of the two sexes of any one species.

Four million years ago, we finally come to creatures that are unquestionably hominids—members of our own family. The most famous hominid fossil is the partial skeleton of a young woman affectionately known as Lucy; the more formal name of the species she represents is *Australopithecus afarensis*, named after the Afar region of Ethiopia, where paleoanthropologist Donald Johanson of the Cleveland Museum of Natural History brought it to light in 1974.

Lucy, the most complete early hominid ever found, was about 3.5 feet tall. The males of the species were apparently much larger. These creatures had a small ape-like brain that was no bigger than an orange. Their teeth were not very sexually dimorphic. They were decidedly human in one very important regard—they walked upright on two legs. This fact was confirmed in 1976, with Mary Leakey's discovery of fossilized *Australopithecus* footprints at Laetoli in Tanzania.

What was the life of these early hominids like? How can we

explain the evolution of such distinctive human features as bipedalism and, later, tool use and increased brain size? And what, if anything, does sex have to do with it?

In the orthodox view of human evolution, early hominid society was seen to be based on an economy in which men hunted and women stayed home tending children, gathering wild vegetables, and awaiting the return of their husbands. Early hominids have frequently been described in terms that make them seem virtually identical to existing hunter-gatherer societies such as the !Kung bushmen of Southeast Africa—a definite injustice to both groups.

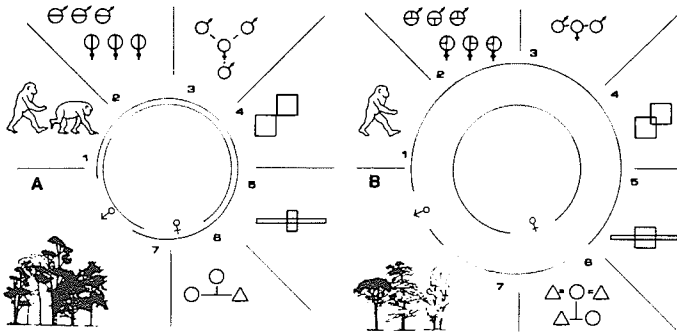
Recently this “man the hunter” image has been challenged on two fronts.

Adrienne Zihlman and Nancy Tanner, anthropologists at the University of California at Santa Cruz, rightly note that some of their colleagues, past and present, have shown an unwarranted male bias in their characterizations of living hunter-gatherer groups (and thus in their assessment of early hominid evolution). Women, they point out, provide the bulk of the food for these groups, for the meat supply is often unreliable. “Gatherer-hunter” is a more accurate description of their economies. Gathering by females, not male hunting, they argue, was probably the basic hominid adaptation. Bipedality, tool use, and increased intelligence all evolved in conjunction with this activity. (Zihlman speculates that the first “tool” may have been a sling “invented by mothers to carry their offspring who could not cling or walk.”)

Why Intelligence Evolved

Zihlman and Tanner see *Australopithecus* as very much like the chimpanzee (with whose genes 98 percent of ours are identical). Females and their offspring formed a basic foraging unit, and males foraged independently. There was no rigid social structure but rather a loose cluster of kin groups centered about females. Early hominids were different from chimpanzees, they believe, in that males were relatively more cooperative with females and not so aggressive toward one another. But males and females did not form permanent social bonds. Both sexes were promiscuous, with females, not surprisingly, showing a preference for more altruistic, sociable males.

Owen Lovejoy of Kent State University has a very different view of *Australopithecus*. He agrees with Zihlman and Tanner that hunting is not the key to early hominid evolution—nor is tool use or increased brain size, since both appeared more than

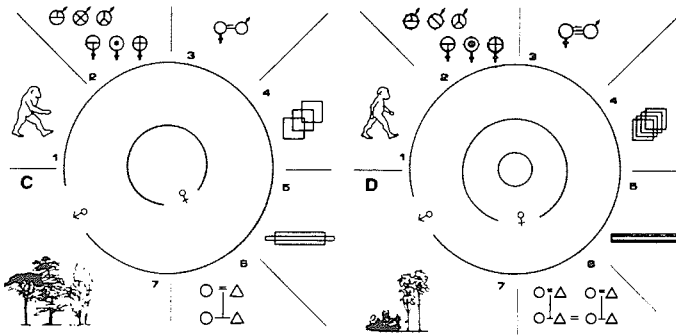


**THE LOVEJOY MODEL: SEX AND HUMAN EVOLUTION
DURING THE PLIOCENE AGE (5 to 2 million years ago)**

These diagrams illustrate the evolving conditions that, in concert, may have produced a fully erect hominid—and a recognizable family unit. Section 1 of each traces the progress of erectness. Section 2 refers to “epigamic” differentiation: Secondary sex characteristics make individuals more distinctive. Greater sexual selectivity results, gradually promoting monogamy (3), and an ability to raise three or four children at a time instead of seeing one to adulthood, then bearing the next (4). In section 5, the long bar represents the menstrual cycle, the rectangle the female’s period of sexual receptivity, which increasingly lengthens. Kinship relations are

a million years after *Australopithecus afarensis*.

In Lovejoy’s model, the evolutionary “breakthrough” of early hominids and their divergence from the line leading to modern-day apes was due to increased reproductive abilities—in particular, male provisioning of women and children. Bipedality and the consequent freeing of the hands made it possible for *Australopithecus* males to forage far from home and bring back food to the females and dependent young. Spared the need to provide their own sustenance, females could do a better job of raising more children to maturity. The social organization would have been monogamous, assuring males that the mouths they fed belonged to their own offspring, not to someone else’s. (The low canine dimorphism in *Australopithecus* supports this notion.) Lovejoy believes that the “intense social activity” of these family units—grooming, communicating, teaching the young—lies behind the rapid evolution of human intelligence.



By permission of C. Owen Lovejoy.

changing (6); the initial bond between mother and children expands into a family group with the male as responsible parent (circles and triangles denote males and females). All of this occurs within a changing environment (7), as tropical rain forest gives way to open woodland and savanna. The circles at the center denote foraging and movement. The inner circle is the core area, where women and infants spend their time; outer circle is the male range. In Diagram A, the circles are nearly the same; the female is not being given food by the male and must find her own. In B, the male travels farther to leave more food at the core for the female—and her larger family. In C, the male is bringing food back to his mate; she forages less. Finally, in D, a permanent home base is established. The mother can leave infants in care of aunts or older daughters and range more widely herself.

Like Desmond Morris, author of *The Naked Ape*, Lovejoy also argues that monogamy promoted several features unique to humans. Evolution of a conspicuous penis in males and of prominent breasts and buttocks in females provided a degree of individuality and enhanced sexual attraction. The loss of the estrus cycle in human females meant that they were always sexually receptive; unaided by any external cues of fertility—i.e., going into heat—hominids had to copulate regularly to ensure conception. This, Lovejoy contends, “would increase pair-bond adhesion and serve as a social display asserting that bond.”*

*In the loss of estrus, zoologist Sarah Hrdy sees more than a hint of female manipulation. Concealed ovulation may have allowed females to “confuse the issue of paternity” in order to “draw several different males into the web of possible progenitors.” Then as now, such a situation had its advantages. A controversial review of the literature on loss of estrus and related topics can be found in Donald Symons, *The Evolution of Human Sexuality* (1979); Symons’ views are challenged, or qualified, by Hrdy in “The Evolution of Human Sexuality: The Latest Word and the Last,” *The Quarterly Review of Biology* (September 1979).

What about the extreme *size* dimorphism noted in several species of *Australopithecus*? According to Lovejoy, the larger size of the males, who spent longer periods of time traveling to and from food sources, gave them greater protection from predators; the smaller size of the stay-at-home females enabled them to better hide from their enemies (and, for good measure, reduced their caloric-protein requirements).

Sarah Hrdy and William Bennet of Harvard University have questioned Lovejoy's association of monogamy and extreme size dimorphism because of its rarity among other primates. Along with Walter Leutenegger at the University of Wisconsin, they suggest that *Australopithecus afarensis*, like other very dimorphic primates, was probably not a paragon of uxoriousness. What the polygyny theorists cannot explain is the lack of canine dimorphism in early hominids. If male-male competition was truly responsible for male-female size differences, why didn't it involve the large canines associated with "bluff and threat" tactics? Perhaps, as NYU anthropologist Cliff Jolly has suggested, canine reduction in hominids was unrelated to their social life and simply reflected dietary habits and the way they chewed their food.

Genes, Culture, Evolution

Sometime between one and two million years ago, *Homo erectus*, a member of our own genus, first appeared in Africa. *Homo erectus*, a very human-like creature, is almost invariably described as being similar to a living "hunter-gatherer," much to the dismay of Zihlman and Tanner who argue that there is no evidence for a heavy reliance on big-game hunting until about 500,000 years ago. Only then, they say, would a meaningful division of labor have appeared, as men killed the game, and women gathered fruits and vegetables and butchered the kills.

It would help to know how much bigger men were than women during this period, but that is something we just cannot establish. There aren't enough complete skeletons. Everyone agrees, however, that sexual dimorphism in *Homo erectus* was less than that in *Australopithecus*.

Homo erectus gave rise to *Homo sapiens* about 100,000 years ago. Among the extinct populations of our own species are the much-maligned Neanderthals, who lived in Western Europe between 100,000 and 40,000 years ago. These big-brained, heavily built people differed from contemporary humans in many ways, but sexual dimorphism was not one of them. Erik Trinkhaus of Harvard has shown conclusively that Neanderthal females

were, on average, about 10 percent smaller than males, which is about the same difference we find between men and women today. The same holds true for the Neanderthals' more successful contemporary, *Homo sapiens sapiens* (Cro-Magnon "Man").

By now, however, it no longer makes sense to look at humans from a purely paleontological point of view. The Neanderthals, for instance, inhabited a complex culture; they had language, religion, medicine. They probably wore clothes. Culture was a new way of passing on behavioral traits from one generation to the next. It was an evolutionary invention that enabled humans to adapt to new environments with even greater flexibility, and it rendered some previous adaptations obsolete. In a sense, then, human beings' behavior during the past 100,000 years evolved faster than did their bodies. For this reason, the leap by analogy from primate or hominid behavior to our own becomes especially treacherous, even if we concede that the roots of culture lie in our genes.

What meaning, then, does our long sexual evolution have for men and women in 1981? The answer is complicated and, even in terms of physiology, as yet incomplete.

Our basic mammalian heritage remains a fact of life. Differences in absolute size and strength continue to characterize men and women, although they have probably been decreasing for thousands of years, with men gradually becoming more like women. Such differences were more important in the past than they are now. In the West, and even in developing nations (where rural women have long engaged in arduous tasks), the male's physical advantage in size and strength seems increasingly irrelevant for all but a few jobs.

"The Twig Is a Little Bent"

Only women can bear and nurse children. "We may regret this fact, glory in it, or simply accept it," zoologist David Barash has written, "but it remains, nevertheless, an indelible part of our biology." Someone must also raise the kids; young primates cannot take care of themselves. Beyond birth, however, it no longer *has* to be the mother who invests the most time and energy in child care. Culture now provides other options.

Usually, however, it *is* the mother. Just as it is always the men who go to war, women's predominant role in the socialization of children is virtually universal. So is a division of labor by sex—a phenomenon, by the way, that need not be excoriated as exploitation. (A sexual division of labor in other animals usually means that the male is contributing more, not less, to his off-

spring's well-being.) We know that certain "male" and "female" traits—aggressiveness in the one, for example, and a maternal instinct in the other—were under positive selection for millions of years. Many of these differences are hormonally induced; men's and women's brains differ in this as in other ways. "At birth," E. O. Wilson has said, "the twig is already a little bent." For this reason, boys and girls brought up in a "neutral" environment would probably still end up behaving like boys and girls—a phenomenon documented among the !Kung San, who raise their children without regard to sex.

Most humans, however, are not brought up in a sexually neutral fashion, which brings us back to culture. The nature/nurture argument is a cliché, but that does not undermine the validity of the debate. All cultures have distinguished between men and women—usually but not always by reinforcing what sex differences there are. Most of what are now perceived as injustices done to women over the millennia can probably be laid at culture's door, bearing in mind that culture, at least in part, is a product of biology.

Hence, one should not look for simple explanations of sex differences in behavior. Our own evolutionary history is especially difficult to unravel, partly because of our biased viewpoint, and partly because, as bipedal, naked apes with big brains, we are so unlike any other mammal that no analogy is quite appropriate. But simple explanations, often tinged by ideology, are the currency of much popular writing on the subject. Some hold that sexual roles are genetically fixed in their entirety. Others would like to believe that all of the behavioral differences between the sexes are learned. Neither explanation is adequate, and both miss the important point: Sex differences, genetic or learned, need not lead to injustice. Of course, "need not" and "do not" are old foes.

We have a long evolutionary history of sexual differences both physical and cultural. Pretending that we don't is as foolish as pretending that those differences somehow paint us into a corner. Both genes and culture can change, but both are inherently conservative. Ultimately, history will show, I think, that genes prove to be more flexible than societies, that culture is the harder nut to crack.