how sex works

WHY WE LOOK, SMELL, TASTE, FEEL, AND ACT THE WAY WE DO

DR. SHARON MOALEM

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To my parents

contents

introduction

We're here to explore human sexuality from beginning to end—what we like and why we like it; how it makes us feel; how it can go wrong; and how human intervention, through cultural traditions, scientific discovery, or both, can divert nature's path—across history, geography, culture, gender, and orientation . . . how sex works.

Along the way, we're going to look at nature's silent hand in the development of human sexuality. Over and over you'll be surprised to discover the evolutionary influence on, well, just about everything: the physical characteristics we find attractive and the personality types we're drawn to; the sexual acts that give us pleasure and why; even fidelity, infidelity, chastity, and promiscuity.

The truth is, evolution and sex are joined at the hip; they've been intimately involved for eons. Evolution has two overriding

concerns for every single species—reproduction and survival. And it's constantly working to improve the odds of both, through what amounts to a grand genetic game of trial and error. If a new trait gives its owner an advantage at surviving or reproducing, then that trait's going to spread throughout the gene pool of the species as those that possess it survive longer and reproduce more often, passing the trait on to their offspring. And the flip side, of course, is that a trait that makes it harder for an individual to survive or reproduce isn't going to last very long, because its owner isn't going to pass it on much, if at all.

What does all this have to do with sex? Well, if the process of evolution is stirring up the gene pool in a constant search for competitive advantage, sex is the mixing bowl.

Actually, sex isn't the only card evolution has to play.

Nature has other options. Asexual reproduction is actually thought to have come first, and lots of organisms still do it that way. In its simplest form, asexual reproduction occurs through processes such as *binary fission*, which is when single-celled creatures like bacteria, divide into two carbon copies of themselves. So, one of the things we're going to examine is why nature steered us toward sex, when it is so much more complicated and time-consuming.

We're going to begin our exploration of human sexuality where most people outwardly begin theirs—at puberty, where hormones and history collide in a biological and emotional process that begins the transformation of girls into women and boys into men. We'll look at the physical hallmarks of adult sexuality—square jaws, round breasts, male height, female hips—and consider how they relate to our biological goals. And

we'll examine what happens when changing cultural habits and standards intersect with chemistry and biology. Why has the average age of a girl's first period plummeted over the last 150 years? In the context of growing awareness over the horrific practice of female circumcision, is there any health benefit to be found in male circumcision or should it be likewise banned? Can women, like men, ejaculate? What's the point of having pubic hair, and what happens to pubic lice when you get a Brazilian wax? And why, unlike almost all other mammals, do most human women outlive their fertility by decades?

Then we'll turn to a subject that has fascinated scientists, artists, and pretty much every man or woman who's ever lived—beauty; or, to put it in technical terms, what creates attraction and arousal? We'll look at the truth lurking beneath the clichés: tall, dark, and handsome men; hourglass-shaped women; and the "spring fever" that brings them together. We'll uncover the fascinating truth behind something most women know intuitively, but science is just beginning to take note of—the powerful role of scent in the chemistry of attraction. Just like a real mom, mother nature takes a keen interest in who you bring home; millions of years of biological engineering are at work trying to help you find the right mate and keep them. And then we'll look at how a popular little pill can throw the whole scent system haywire.

The chemistry of arousal leads directly into a discussion of the sexual act itself. What exactly happens when you have an orgasm? And why do humans have them anyway? Is it possible that all those hopeless romantics who think good sex and real love enhance each other aren't so wrong after all? And if they're right, then what about all those unrepentant cyn-

ics who are convinced that cheating is natural? Finally, we'll shatter the myth of another male monopoly on sexual function: women can be orgasmic, as we now take for granted, but did you know that they can ejaculate too? How? When? And, most importantly, why?

Then we'll turn back to the key evolutionary question: why sex? From a biological perspective, sex is very expensive, and I'm not talking flowers and fancy dinners. Reproduction through sex uses lots of resources, in terms of energy spent seeking out sexual partners, competing for them, keeping them, and mating—all for something less than guaranteed, reproductively speaking. So why sex?

When an organism reproduces asexually, it basically clones itself—meaning all the parasites that it may have acquired through life. One of the biggest advantages of sexual reproduction is that it allows parents to wipe the biological slate clean and occasionally protect their children from some of the sexual and biological misadventures they themselves may have had. The other advantage is the genetic reassortment mentioned earlier: every time we throw the genetic dice, there's a chance that new traits will develop in our offspring, like an immune system that can outwit existing or emerging viruses or bacteria.

But evolution is all about trade-offs: life on two legs makes us taller, but slower. Sexual reproduction gives a chance to protect our children from inheriting parasites and gives them a chance to develop new traits, but it comes with its own set of liabilities. For starters, sex can be a lot more error-prone, for the simple reason that it takes males and females to pull off successfully. So we'll look at how sexual reproduction can go

wrong, which happens a lot more often than you might think. When it does—when a child is born with ambiguous genitals, faulty reproductive wiring, hormonal imbalances, or a combination of these disorders of sexual development—what can be done to help that child? More to the point, what *should* be?

Sexual reproduction obviously requires sexual contact with a member of the opposite sex (excepting modern technology, of course). So what happens when individuals are attracted to others of the same gender? And if homosexuality prevents reproduction, why is it common in so many different cultures around the world—especially in men? For that matter, why is it common in so many species: sheep do it, monkeys do it, even killer whales do it.

One of the biggest "costs" of sex is that it exposes individuals to the possibility of sexually transmitted infections (STIs). As always, no evolutionary development in one creature goes unexploited by another—we'll look at how STIs take advantage of biological parts that actually arose to help protect the next generation from parasites and pathogens. We'll explore how some of these invaders may even subvert the chemistry of desire to aid their own reproduction, by making their carriers more *explorative*. And, of course, we'll look at how to prevent them.

Speaking of prevention, we'll examine the surprising proliferation of natural contraception throughout the plant and animal kingdoms.

One thing to keep in mind: this is a book about how sex works, which means it's a book about how body parts connect to each other and to other bodies. That means every once in a while we're going to take a little anatomical detour into the

why and how, in order to enhance our understanding of the complexities of human sexuality.

In that spirit, let's begin at the beginning—anatomically speaking, that is. As we set out to explore how sex works and examine all the fascinating differences between male and female sexuality, keep this in mind: ovaries and testes—and the sexual organs most likely to give us pleasure when stimulated, the penis and the clitoris—started out in the very same place, from the very same parts.

CHAPTER 1

girls just want to have fun

If you're a woman, you almost certainly remember the first time you got your period. The first menstruation, called menarche, is only one in a series of events that mark the transformation of girls into young women, but it is one that has been loaded with cultural significance throughout human history. For a long time, menarche was thought to coincide with the onset of fertility. Now we know that most girls do not ovulate with menarche; in fact, it can take a year or two after their first menstruation before ovulation even becomes regular.

Something strange is affecting the age of menarche, making parents and researchers take note and wonder alike. The average age of menarche has crashed from a *traditional* seventeen to just twelve, in the evolutionarily brisk span of just 150 years. So what

is turning young girls into young women so quickly? There are lots of theories, but no clear answers.

According to the *psychosocial acceleration theory*, the root cause is increased stress, and a few studies have, in fact, found a correlation between increased stress and earlier menarche. Here's the theory: if young girls in our increasingly complex society experience a lot of stressors early on, their bodies take it as an indication that they have been born into stressful times. In earlier eras, stress was usually the result of circumstances that threatened survival, such as conflicts or famine. In those situations, there might be an evolutionary benefit to earlier menarche, because it would give an individual a chance to reproduce faster, perhaps before succumbing to local threats. For most women in the developed world, the source of today's stress is probably not war or famine. But as far as your brain and body are concerned, stress is stress and it produces the same result.

Then there's a theory that menarche can be triggered in girls who spend little time around their biological father and lots of time around unrelated men. A large study involving 1,938 college women, published in 2006 in the *American Journal of Human Biology*, indicated that both the absence of biological fathers and the presence of half brothers and stepbrothers had an impact on earlier menarche. According to this theory, the absence of one's father and the presence of unrelated men signals a young woman that it's time to start looking for a mate. And how is that signal sent? Well, it might be by scent. As we'll discuss in more detail later, many animals receive chemical signals through smell, and there is real evidence that humans do as well.

Another theory that has been garnering considerably more

weight over the last few years revolves around the skyrocketing rates of childhood obesity. One recent study that looked at weight and age of menarche was conducted by Joyce Lee at the University of Michigan. Lee tracked 354 girls from the time they were three until they were twelve. She found that there was a clear link between extra weight and early puberty. In her study, obese girls—twenty-two pounds or more overweight—had an 80 percent chance of developing breasts before they were nine years old and reaching menarche before they turned twelve.

One study suggests, however, that it's not *how much* fat a girl carries, but *where* she carries it that is driving early puberty. According to William Lassek, a researcher at the University of California at Santa Barbara: "What our findings suggest is that menarche is likely to occur when girls have stored a certain minimal amount of fat in the hips and thighs, and that girls who tend to store more fat around the waist—who have abdominal obesity—are likely to have delayed menarche."

Scientists know that sufficient fat stores are key to the onset of menarche. And as Lassek points out, fat located in the lower part of the body is chock full of the omega-3 fatty acids that are so important for fetal brain development. "This fat is protected from everyday use like money deposited in a bank," says Lassek. "You are not allowed to withdraw it until late pregnancy."

Whatever the biological cause, it's clear that many girls are entering sexual maturity long before they reach emotional maturity, especially today when it takes more emotional maturity than ever to navigate a complicated world. "This long period of mismatch is very confusing for young people," says

Peter Gluckman of the University of Auckland, New Zealand. His book, *Mismatch: Why Our World No Longer Fits Our Bodies*, calls for significant changes in education to help bridge the gap. Gluckman believes that the early age of menarche we're seeing today is likely our set point for menstruation—the norm, given good health and nutrition. According to Gluckman, with the advent of agriculture the overall level of nutrition dropped, resulting in a decrease in nutritional health, and increase in the age of menarche. Early menstruation creates a mismatch for some girls. They may be physically ready, but emotionally and intellectually unable to handle the responsibilities of adult sexuality.

Menarche is essentially the culmination of puberty in girls. Puberty itself is the incredible collection of physiological processes that transform children into adults, with sexually mature bodies capable of reproduction. We're constantly uncovering more of the biological nuances associated with the onset of puberty. For example, scientists have recently discovered a protein called *kisspeptin* (named in honor of Hershey Kisses by researchers at the Penn State College of Medicine), which plays an important role as a biological signal in starting both puberty and ovulation.

But even though the physical transformation into a sexually mature human being is more or less on biological autopilot, adult sexuality is anything but just biological. Modern sexuality is the intersection of biology, society, and history.

What we need, what we want, what we like, and how we like it are all shaped by a combination of evolutionary imperatives, cultural training, and individuality. Evolution, of course, has a keen interest in encouraging us to have sex, even if it

comes at a significant cost. The guiding imperative for any species is survival. At least for us, and for most vertebrate animals, no sex means no babies, and no babies means extinction. Having an interest in our sex lives clearly has evolutionary advantages. But before we get too far into how sex works, let's begin by looking at how girls become women, how women become sexual, and how those changes affect the way men (and other women) perceive them.

THE BIGGEST OUTWARD manifestation of puberty is the development of secondary sexual characteristics. In girls, this means breasts and rounded hips, usually accompanied by more body hair; especially the growth of hair under the arms and in the pubic area. Within about two to four years of the onset of puberty, most girls have breasts that are nearly mature.

Human breasts are unique among primates: we are the only species in which breasts enlarge at puberty and remain enlarged throughout life. Among apes and our other primate cousins, breasts only swell when a female is nursing. Even then, they don't swell very much; it's often difficult to even notice them underneath primate body hair. But human breasts have two functions: one parental and the other sexual, and both functions appear to have played an evolutionary role.

Human breasts are composed of fat and modified sweat glands, called *mammary glands.* The fat is what makes them noticeable. The mammary glands can produce milk, which is a specially configured mixture that includes carbohydrates, protein, fat, vitamins, minerals, and hormones—exactly what

the baby needs. Besides facilitating mother-child bonding, breastfeeding also provides babies with antibodies, which are not found in commercial formula and can provide crucial protection against infections. This is one of the main reasons breast-feeding is considered so important to an infant's health. The ducts of the mammary glands terminate at the nipple, which is surrounded by a modified circle of darker skin called the *areola*. Areolae (plural for areola) contain sebaceous glands called *Montgomery's glands*, which release a small amount of oily liquid to protect the nipples and the areolae; this is especially important for the prevention of sore and cracked nipples during breast-feeding.

What's amazing about milk production, or lactation, is that the composition of the milk actually changes with the age of the infant, matching his or her changing nutritional needs. Most countries today recognize the importance of providing human milk for infants, but a few nations, such as Norway and Sweden, go one step further to make sure that babies receive age-matched milk. They have developed extensive milk donor programs, essentially, "milk banks" that provide human milk for infants whose mothers cannot breast-feed. Donor mothers are screened for diseases that can be transmitted through breast milk, such as HIV and hepatitis B, and then their milk is collected. The donated milk is usually pasteurized and frozen to reduce the chance of contamination. I first came across milk banks during a research trip to Sweden a few years ago and was really surprised at just how passionately doctors and parents believed the milk banks improved the health of infants. There are a few milk banks in the United States, but nowhere near the same scale. Given the millions of dollars we spend every

year on labor and delivery floors to ensure healthy babies, you'd think we could invest a small fraction in new techniques to support one of the oldest infant health aids on Earth.

LIKE EVERYTHING ELSE, breast size and shape, as well as areola size and color, can vary widely in humans. The color of the areola is especially variable, ranging from quite dark to very pink in some fair-skinned individuals. Large areolae are important visual cues, creating the illusion of a larger breast. Breast size may send important visual signals about a woman's potential fertility. Anything that appears to enhance breast size may make a woman more attractive; hence, the importance of the areola.

The average size of breasts actually seems to be getting bigger: one recent British report indicated that the average breast had gone from a 34B to a 36C in just ten years. Pregnancy and breastfeeding have a significant, yet somewhat reversible, impact on breast size as the mammary glands expand and then fill with milk. In the average breast of a woman who is not producing milk, the ratio of glandular to fatty tissue is about 1:1; in a lactating woman it's more like 2:1. And areolae often get considerably darker and somewhat larger during pregnancy and can stay that way after delivery, which may help babies find their mother's nipples. During our history, when clothing was more optional and polygamy the norm, larger and darker areolae may have been a badge of fertility, signaling the possibility of past pregnancy to interested onlookers.

So why are the breasts of human females so different from those of all other female primates? Since it's the fatty tissue

that gives them their distinctive roundedness, we should look to the fatty tissue for an explanation. All *kinds* of theories have been offered—the fatty tissue protects the mammary glands and keeps milk warm; it provides an anchor, a substitute for maternal fur that other primate babies cling to when feeding; large, round breasts are a signal to males that their owner is fertile and has the biological resources (in reserve) to be a mother. There is also likely a connection to sexual attraction, since we know that breasts, including the nipples, can swell by as much as 25 percent when a woman is aroused.

Zoologist and bestselling author Desmond Morris believes that female breasts are actually a mimic of the buttocks. Among most primates, the male mounts the female from behind; the bright red coloring on some female buttocks around the genitals acts as a sexual signal. Morris theorizes that as humans became upright and bipedal, the optimum sexual position became face-to-face and females evolved twin globular breasts to mimic the twin globular cheeks of the buttocks.

When it comes to breasts, there are *lots* of theories. But it may also be that the best answer is the simplest—the fat stores are like an insurance policy, they're there to provide energy to potentially pregnant or nursing women when food is scarce. Ample breasts may also send a signal, to anyone who might be interested, that a woman has sufficient fat to support having and nursing a baby.

Men also have breasts and nipples, of course, but what you may not know is that they have mammary glands too. Although it's rare, as compared to women, having breast tissue means that men can also get breast cancer. Under most circumstances, male mammary glands are essentially dormant

and men do not lactate, but under certain conditions, men's breasts have been known to produce milk. For example, some prostate cancer patients have received female sex hormones as part of their treatment to slow the growth of their cancer, and those hormones have sometimes triggered male lactation. And transsexual men on high doses of estrogen may also respond to nipple stimulation with lactation.

Men experiencing extreme starvation have also been known to lactate. It is thought that starvation triggers prolactin secretion from the anterior pituitary (located at the base of the brain), causing the male mammary glands to produce milk.

Although it has yet to be fully studied (medical ethics thankfully don't easily allow us to deliberately starve men just to test the hypothesis), male lactation may just be an evolved response that allows men to produce milk to feed their babies in times of extreme starvation. It is also not uncommon for newborn boys and girls to produce breast milk for a week or two after they're born. Their infant mammary glands produce milk because their bodies are still flooded with hormones from their mothers, which they were exposed to in utero. These are the very hormones their mothers' bodies produce to fill their own breasts with milk. Lactation in newborns, which is perfectly harmless, is sometimes called *witch's milk*. Myth has it that witches looking to feed their familiars were stealing it from helpless babies.

When it comes to breasts and nipples, two of each is the norm, but this is by no means an ironclad rule. Why two? It's all about litter size: humans tend to have one or two babies at a time, so two breasts, with two nipples, usually does the trick.

But there is at least a 5 percent chance that an extra nipple will occur—in men as well as in women. Former rapper turned actor Mark Wahlberg has a third nipple; so does British singer and talk-show host Lily Allen. Technically, they're called supernumerary or accessory nipples, and they usually occur along the "milk line," which runs from the armpit, through the normal nipple, down through the groin, and ends at the inner thigh. "Usually" is the operative word—they've been documented as far away from the chest as the bottom of the foot!

Supernumerary nipples can range from a patch that looks like a mole to a complete third breast, with nipple, areola, and milk-bearing mammary glands. In 2005, researchers from the UK discovered the Scaramanga gene, aptly named after the villain from the James Bond novel and film, *The Man with the Golden Gun*, who had three nipples. The Scaramanga gene, now called Neuregulin 3, was initially reported to be involved in breast development in mice. A third nipple is not only a physiological curiosity. A case report in the *New England Journal of Medicine* in 2005 described a forty-two-year-old woman with what appeared to be a mass near her breast. A biopsy later revealed that it was an adenocarcinoma, a type of cancer that originates from glandular tissue. In this case the cancer most likely arose from the woman's third nipple.

Nipples in both men and women are filled with many nerve endings that can be a source of sexual pleasure when stimulated, ranging from mild to intense. Some women have such sensitive nipples that they can experience orgasm from nipple stimulation alone.

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BREASTS AREN'T THE only way girls' bodies change over the course of puberty. The increased volume of estrogen coursing through their bodies causes their pelvis and hips to widen. It also dramatically alters the relative amount and distribution of body fat, depositing fat on the hips, buttocks, thighs, and *mons veneris* or *mons pubis* (Latin for pubic mound, the pad of fat underneath a woman's pubic hair in the area above her genitals). Before puberty, the average girl has 6 percent more body fat than the average boy her age; by the time puberty is completed, she has almost 50 percent more.

The extra fat stores on the hips, buttocks, and thighs probably serve the same purpose as the fat stores in the breasts. As we've discussed, fat tissue is a form of portable energy storage, and fertile females are likely to need additional energy for pregnancy and nursing, especially if they are migrating long distances. And, of course, the reason for a woman's wider hips and pelvis (without regard to fat accumulation) is pretty straightforward—it makes childbirth more reasonable, by increasing the size of the birth canal.

But here's where it gets interesting: despite the current obsession with supermodel waifs and androgynous shapes, it seems most gentlemen prefer hips. Across cultures and throughout history, the classic hourglass figure—relatively narrow waist, wide hips—is considered the standard for female attractiveness. Researchers at the University of Texas at Austin worked with colleagues in China and India to examine thousands of works of American, British, Chinese, and Indian literature, some dating as far back as the first century A.D.

to the present. And without exception, when waists came up romantically, they were narrow; when hips came up, they were wide; when breasts were discussed, they tended to be large, although there were certainly some exceptions.

In the early seventeenth century, the British poet John Harrington described a beautiful woman this way:

> Her skin, and teeth, must be clear, bright, and neat . . .
> Large breasts, large hips, large space between the browes,
> A narrow mouth, small waste[*sic*] . . .

Other social research has produced a similar result. In *Why Sex Matters: A Darwinian Look at Human Behavior*, Bobbi Low, a professor at the University of Michigan, writes: "Across all sorts of cultures with quite different specific ideas about beauty, both men and women see as most attractive a female waist-to-hip ratio of about 7/10 to 8/10."

Why?

Well, here's one thing we know for sure: women with hourglass figures are more fertile. In 1996, Harvard researchers Peter Ellison and Susan Lipson linked higher levels of the hormone estradiol at the right time to higher fertility. A 2004 Polish study that included Ellison and Lipson concluded that women with large breasts, narrow waists, and noticeably larger hips had 30 percent higher levels of estradiol overall and mid-cycle, at the time of peak fertility, than other women. Grazyna Jasienska, the leader of the Polish team stated: "If there are 30 percent higher levels, it means they are roughly three times more likely to get pregnant." Not everyone might agree with Dr. Jasienska's conclusions, but if hourglass figures go hand in

hand with higher estradiol, and higher estradiol means higher fertility, then women with hourglass figures are more likely to conceive and pass their genes on—which means evolution will favor hourglasses too.

Devendra Singh, the psychologist behind a University of Texas study of romantic literature, has another theory. Medical research today shows that abdominal fat poses a very different level of health risk than hip and buttocks fat. People with large amounts of belly fat—so-called apple shapes—have a higher risk of heart disease, diabetes, and various cancers than those who carry their fat on their buttocks, hips, and thighs—so-called pear shapes. Dr. Singh thinks people may be programmed to prefer narrow waists because they know they're healthier. Of course, it may be social programming, not genetic programming—we may tend to choose thinner partners today because we equate thinness with health. And, of course, in some cultures, where food is historically scarce, a preference for visibly larger women may have developed because a bigger size is a better indicator of good nutrition and thus fecundity (increased level of fertility). Anyone who's ever been to an art museum or paged through an art history book with a section on Renaissance or Baroque art has seen portraits of women who certainly seemed to have had healthy appetites—and the wealth to sate them.

Even more fascinating, a recent study suggests that curvy moms have more clever kids. William Lassek of the University of Pittsburgh and Steven Gaulin of the University of California, Santa Barbara, used data from the National Center for Health Statistics to show that children whose mothers had wide hips and a waist-to-hip ratio of 7 or 8 to 10 routinely

scored higher on intelligence tests. It turns out there's a possible explanation—hip fat contains specific fatty acids acquired through the mother's diet that are critical to development of the brain in fetuses.

IN THE HIERARCHY of attraction, emerging research suggests that one physical characteristic trumps all others—symmetry. By symmetry, I mean exactly that—eyes the same shape, dimples on both cheeks, legs the same length, hands the same size—you name it, left and right sides the same. Across the animal kingdom, males and females find the opposite sex more attractive when their left and right sides match, and humans are no exception.

While some people may find a man born with a crooked nose ruggedly handsome and while Marilyn Monroe's beauty mark may be the asymmetrical exception that proves the rule of her otherwise symmetrically beautiful face, in study after study, the more symmetrical a face, the more attractive members of the opposite sex find it. When pairs of body parts don't match exactly—a right foot bigger than a left foot, a grin that curls up only on one side—it's called *fluctuating asymmetry*. More on the sexuality of symmetry later, but for now, let's consider one more interesting connection between symmetry, sexual attraction, and success in the evolutionary endgame—reproduction.

One of the more noticeable examples of fluctuating asymmetry occurs with female breasts. Many women have breasts that are not the same size or exact shape; in fact, it's actually quite common. Having asymmetrical breasts doesn't affect a