

CONTENTS

Acknowledgments vii

Introduction: Sex Biology Is Interesting	1
1 The Evolution of Sex	5
2 Animal Sex Biology: Mixing It Up	22
3 Humans Are Messy	38
4 Humans Then	48
5 Humans Now	74
6 No Biological Battle of the Sexes	109
7 Why the Binary View Is a Problem	125

Notes 151

Index 193

Introduction

SEX BIOLOGY IS INTERESTING

IMAGINE YOU are a fish called the bluehead wrasse, living off the coast of Florida. As you grow up, you, just like all the other bluehead wrasse your age and size, develop one set of reproductive organs. You are what we'd call female, so you produce eggs. There is only one very large member of your group, and they are the group male, so produce sperm. But over the next few weeks you grow really fast, becoming the second-largest fish on your reef. Then the male gets eaten. Almost immediately your body starts to change, your reproductive organs mold, shift, and alter their form. *You* become the group's sperm producer. As a bluehead wrasse, you can have one body and one set of DNA, but multiple forms of reproductive biology across your lifetime.

Bluehead wrasse reproductive biology is not the most common pattern in the animal kingdom, but it's also not that weird. When most people think of the biology of reproduction, they typically envision two fixed kinds in each species: female and male. This is (mostly) right when it comes to the reproductive organs themselves, but not accurate for entire bodies and lives.

Most species do have two types of reproductive organs, and they are often found in two slightly different forms of that species' body plan. But not always. As with the wrasse, many fish start out with one set of reproductive organs, and once they grow to a certain size, they redo their anatomy and develop a new set of reproductive organs. Each earthworm's body has both types of its species' reproductive organs. Bees have two kinds of reproductive organs across three kinds of bodies. All mammal mothers lactate, but in some species of bat, fathers do too. And, as in the two different types of orangutan male, one with big face flanges and the other without, there can also be quite a bit of variation in bodies and behavior even among those individuals within the same species that have the same reproductive organs.

There is an explosion in research on the biology of reproduction—what we'll call sex biology—in the animal kingdom. While we continue to find that there are important differences in reproductive biology producing female, male, and sometimes intersex bodies in any given species, there is also a lot of variation, and overlap, in the actual biology and behavior that make up these categories. The variation we observe across the animal kingdom doesn't represent unusual exceptions to some kind of rule of sex; rather, this spectrum of variation tells us that females and males are not two different kinds of thing. Sex biology is not about two distinct kinds, a binary; instead, it's about patterns of variation in bodies, behavior, and lives that differ, overlap, and intertwine. Sex biology, as it turns out, makes life quite interesting.

The explosion in research is not limited to how other animals "do sex." There is also enormous investigation into human bodies, reproductive processes and patterns, health, hormones, genitals, genetics, behavior, and other related topics. For

example, we now know that human brains don't come in "male" and "female" versions. Also, unlike some other mammals, all human caretakers (regardless of their reproductive organs) can undergo changes in their brains, bodies, and behavior when they take care of babies. Fascinatingly, human sexual behavior, including the targets of attraction and arousal, is not necessarily linked to what kind of reproductive organs one has. And, most importantly, human sex is never just about biology; we have gender too.

In short, there is a lot going on in science regarding sex and gender in humans. Unfortunately, there is also a ton of misunderstanding in society about what biology, especially sex biology, tells us and what it doesn't tell us. And there is lack of awareness of just how diverse and variable humans are. To better understand biology and sex in humans, we need to learn about our bodies, histories, cultures, and behavior. We have to understand what it means that everything about humans is a supercomplicated blend of biology and culture. We need to combine our knowledge of biology, sex, and the human experience into a new narrative. My goal in this book is to put forward this new narrative and show how the biology of sex actually works, what it does and does not tell us, and how we might incorporate this knowledge into our education, lives, and laws.

To do so, I will first summarize what is currently known about the biology of sex in animals and how, and why, that relates to humans. This is important because understanding animal biology is at the heart of understanding human biology (we are, after all, animals). From there, I will illustrate what we know about sex, in biology and behavior, in the human past and present, across the last two million years of our lineage's existence and among the eight billion humans living today. What this knowledge from the animal world, the human past, and the

human present shows us is that biology as it relates to sex is not binary, meaning that it does not come in two distinct kinds: male and female. This is not to say that females and males are the same. They aren't. Nor is it that biological variation related to sex does not matter. It does. It's just that not all humans fit neatly into the categories of female or male, and biological measures of human bodies rarely segregate into two non-overlapping categories. Neither "female" nor "male" describes a uniform or distinct biological type.

I will conclude by discussing why a binary view is a detrimental way to think, and talk, about sex biology and the human experience. Reproductive biology is an important structuring part of human lives; however, producing ova or sperm, having XX or XY chromosomes, or having a clitoris or a penis, does not tell us nearly as much biologically as many believe. Nor does it consistently or accurately inform us about an individual's childcare capacity, homemaking tendencies, interest in literature, engineering and math capabilities, or tendencies toward gossip, violence, compassion, or a love of sports. By contrast, placing reproductive biology in the context of the rest of the body, and in relation to behavior, history, society, and experience, we are much better prepared to ask, and answer, questions about health, habits, proclivities, happiness, and the many ways to successfully be human.

However, at its core, biology is about evolution, and evolutionarily speaking there is a lot of variation in sex biology and behavior, both across and within species. So, to really understand how biology and sex work in humans, we need to start not with us today but right back near the start of life on earth, with the evolution of sex.

INDEX

- ACTH (adrenocorticotrophic hormone), 93
activation differences, 101
ADHD (attention deficit hyperactivity disorder), 135
adipose tissues, 87–88; deposition of, 88. *See also* fat
adrenal glands, 91–92, 93
adverse drug events (ADEs), 186n23
age, correlation of sexual activity with, 127
aggression, 112–13; battle of the sexes argument on, 119, 121; participation in antisocial, 120; testosterone and, 96; variations in, 118–20
agreeableness, 113
algae, blue-green, 5
allocare, 60–61, 164n35. *See also* childcare
altricial offspring, 30
Ambien (zolpoidem), 132–33, 140
amphibians, 13, 20
anal sex, 115–16
androgens, 89, 92; concentrations of, 33; hormone exposure and, 33
andropause, 94
anemonefish, 27
animals: evolution of, 152n12; problems with testing of, 186n14; sex biology of, 3–4, 22–37, 47; study of sex and variability in, 125. *See also specific animals*
anisogamy, 9–10, 11, 63, 73, 152n12; assumptions about, 116; classic position in biology in, 110; emergence of, 7–8; original model of, 51; parental care and, 10, 19; simplistic view of, 19
anti-Mullerian hormones (AMHs), 172n24, 174n43
antiplatelet therapy, 136
ants, 24
anxiety, 135
apes, 52–56; sexual activity in, 64–65; tool use of, 69
aquatic species, 13. *See also* fish
Aristotle, 9
arousal, physiological system of, 127
art, 60, 71, 72
asexual reproduction, 5, 6, 7, 25, 127
Australopithecines, 57–58, 59
autistic spectrum, 135
baboons, 51
bacteria, 5; division of, into archaeobacteria and eubacteria, 151n2
Bateman, Angus, 9–11, 63, 109, 152n12, 152n14

- “battle of the sexes” concept, 110, 121, 122–23
- Beauvoir, Simone de, 42–43
- bees, 24, 35, 155n5; reproductive organs in, 2
- behavioral diversity, 54
- bimodal definition of sex, 39–40
- binary view of sex biology, 4, 84–85, 125–50; cardiac disease in, 135–36; inadequacy of, 3–4, 21, 39–40, 149–50; making family as part of, 129–31; in medical research and treatment, 131–35; organ transplant as aspect of, 136–37; pervasiveness of, 125; pregnancy in, 137–39; sex contextualism in, 139–40; sexuality and sexual orientation in, 126–29; sports and, 141–47
- biocultural framing, 45, 46
- biocultural view: of humans, 40–42, 47, 109; of organs, 90–91
- biological binary, 8
- biological differences in communication, 109
- biological sex, 158n1; gonads and, 86
- biology, 11, 40; animal, 3–4, 22–37, 47; gender and, 45; human, 84–86; reproductive, 1–2, 3–4, 11, 12. *See also* sex biology
- biomedical research, 140
- biopsies, 85
- bipedalism, 88
- birds, 16, 23; heterosexuality in, 128; parental care by, 18, 19–20, 30–31, 161n2. *See also* particular species
- birth mothers, reproductive process in, 130
- bisexuality, 127
- Bitch: On the Female of the Species* (Cooke), 36
- body size and strength, 110–11
- bonobos, 54, 55, 56, 64, 128
- brains, 3, 100–104; size of human, 41
- California sheephead fish, 27
- canine teeth, 50, 53, 70; dimorphism in, 57, 163n25
- cardiac disease, binary view of, 135–36
- cetaceans (whales and dolphins), 18
- childcare: animals and, 18–20, 32, 49; humans and, 55, 66, 110; role of group in 59–63, 68, 71
- chimpanzees, 54–55, 56, 64; sexual behavior in, 64; subspecies of, 165n51
- chromosomes, 4, 5, 158n1; multiple sets of, 25, 155n8; sex, 104; twenty-third, 44, 46, 85, 99, 104, 106; X, 38, 88, 95, 104–5, 108; XX, 85, 95, 105, 158n1; XY, 46, 99, 105, 106, 137; Y, 38, 88, 104–5
- clitoris, 16, 17, 33, 45, 86, 114
- cloaca, 16, 30
- clothing, 41, 43
- cognition: battle of the sexes argument on, 121; differences between males and female in, 111–12; as nonbinary, 113
- “Cohens *d*” measure, 112–13
- communication: biological differences in, 109; dynamics in, 112
- comparative approach, defined, 48
- connectome, 100
- coprodeum, 16
- cortisol, 98
- crocodilians: infant care by, 18, 30; sex biology in, 28–29
- cultural meaning, assignation of, 67
- cyanobacteria, 5
- Cytochrome P450 (CYP), 134

- Darwin, Charles, 9, 14, 109, 152n12; on sexual selection, 50–51
- DAX1 (nuclear receptor protein), 106
- dementia, 135
- depression, 135
- developmental dynamics, 108
- DHEA (dehydroepiandrosterone), 93
- DHT (dihydrotestosterone), 53
- dimorphism, 55, 155n1; sexual, 30–31, 51, 53, 55, 59, 101, 108, 179n5
- dinosaurs, 30
- discontinuity, evolutionary 56
- diversity in sex biology, 149–50
- DNA, 1, 8, 104–7, 110, 151n1; in eukaryotes, 5; information revealed by, 77
- dolphins, 18
- drones, 24
- drugs: effect on 3G males and 3G females, 132–33. *See also specific names*
- duck-billed platypus, 14
- ducts, Mullerian and Wolffian, 85–86, 99
- dyslexia, 135
- eagles, 31
- eating disorders, 135
- eggs, 14, 16–17, 29. *See also ova*
- elephants, 18, 23
- embryos, development of zygotes into, 18, 20, 21
- endocrine system, 91–92, 185n7
- endometrium, 98
- estradiol, 94
- estrogen, 92, 99
- eubacteria, 151n2
- eukaryotes, 5–6
- evolution, 11, 56; animal, 152n12; of sex, 4, 5–21
- extroversion, 112
- EXX*₂ gene, 172n24
- fallopian tubes, 97
- family, making of, as binary view problem, 129–31
- fat, 86, 87–88; brown, 87; variation in deposition, 88. *See also* adipose tissues
- Fausto-Sterling, Anne, 115
- females, 1, 12, 42–43, 50, 108; biologists' use of term, 12, 39; body size of, 134; brains in, 120; childcare and, 19; cognition in, 111–12; communication between males and, 109; in dominance, 162n14; height distribution in, 74–75; physical skills of, 113; relationships with males, 109; sexual activity by, 127–28; Sociosexual Orientation Inventory (SOI) measure of, 117; variation between males and, 109, 124. *See also* 3G females; women
- female/woman distinction, 42, 122–23, 170n1
- femininity, 33, 42, 43, 83, 103, 123
- fetuses, 14, 17–18, 20, 28, 97; fetal development, 17, 153n21
- fish: anemonefish, 27; bluehead wrasse, 1–2, 26–27; California sheepshead as, 27; caretaking in, 19–20; female-mimics, 26–27; gobies, 27–28; sex biology change in, 27; teleost, 26
- fixed sex differences, 22
- flanges, 53, 54
- follicle-stimulating hormone (FSH), 53, 94, 97–98
- fossil record, 48, 56, 59, 62, 68, 69–70, 122

- frogs, 13
- fruit flies, 10, 152n12
- galactorrhea, 99
- gall bladders, 90
- gametes, 7–8, 15, 36, 39; fusion of, 14, 16, 20, 24, 28, 31–32, 153n18; getting together, 11–15; large, 50; large versus small producers of, 23–24, 50, 121; production of, 40; types of, 8
- gametogenesis, 85
- gay gene, quest for, 126
- gender, 42–45, 67–73; behavior patterns in, 120; binary views of, 123, 126; biology and, 3, 45; as a cultural experience, 44; defined, 68; expectations and experiences in, 159n8; global dynamics in, 44; multidimensionality of, 123; in neurobehavioral disorders, 135; norms in, 43–44; relationship with biology, 45; roles in, 43, 159n13.
See also under sports
- “gender/sex” term, 45–46
- genetic processes, 108, 151n1
- genital-genital contact, 63
- genitals: animal, 32–33; human, 16–17, 18, 84–86, 114
- genital tubercle, 85
- gestation, 14, 23
- gibbons, 53
- Gila monsters, 29
- gonadal ridge, 85
- gonadarche, 93
- gonads, 15–16, 108; biological sex and, 86; formation of, 85
- gorillas, 51, 52, 54, 64
- gynecomastia, 87
- hair, 88, 89–90, 173n34
- Haldane, J. B. S., 36
- hawks, 31
- hearts, 90, 98, 136; transplantation of, 137
- height distribution in men and women, 74–75, 76
- helping, 112
- hematopoietic stem cell transplantation, 135, 137
- Hemiptera, 24–25
- hermaphrodites, 153n17
- heteronormativity, 116
- heterosexuality: aggression between partners in, 119; in mammals and birds, 128; as natural mode of sexual behavior in humans, 127; sex binary and, 126
- Hippocrates, 9
- hirsutism, 89
- homicide, patterns of, 120
- hominins 48; lack of canine dimorphism in, 163n25
- hominoids (apes), 48, 56–58; humans as, 52–56
- Homo*: humans as genus, 58–60; social organization in, 122; two-adults-plus-offspring as core social structure for, 122
- Homo sapiens*, 123
- homosexuality, 116, 126, 127
- hormones, 91–97; gonadal production of, 92; luteinizing, 53, 54, 94, 97–98.
See also specific hormones
- HOXA*₁₃ gene, 172n24
- human(s), 38–47; biocultural view of, 40–42, 108, 109, 118; biological variation of traits in, 107–8; development of genitals in, 85;

- evolutionary history of, 49, 73; as genus *Homo*, 58–60; as hominoids, 52–56; level of sex in, 118; makeup of families among, 130–31; as primates, 48; sexual behavior in, 3; shaping of, 73; social pair bonding in, 67
- human biology, genitals and, 84–86
- human bodies: material structures of, 40–41; variation in, 78–80, 125
- human brain, size of, 41
- human evolution, 49f, 111; hetero-sexual, 66; pair bonds in, 66
- human sex biology, 48–49, 75–76; complications of, 39–40
- human transcriptome, 106–7
- hunting, 70
- hyenas, 12, 32–33, 36, 96
- Hymenoptera (bees, ants, and wasps), 24
- hypercooperation, 59
- hypertensive disorders, 138
- hypothalamic-pituitary axis (HPA), 85
- hypothalamic-pituitary-gonadal (HPG) axis, 93
- hypothalamic-pituitary-ovarian (HPO) axis, 93, 97–98
- hypothalamus, 91

- INAH-3 nucleus, 101, 126
- infants. *See* childcare
- inhibin, 94, 174n43
- insects, scale, 24
- insomnia, battling, 133
- internal fusion systems, 16–18
- International Olympic Committee and World Athletics, 141
- intersex category, 12, 25, 153n17
- introversion, 112
- isogamy, 7

- kangaroos, 12
- kidneys, 90, 136

- labia, 33, 45, 85, 86
- labioscrotal/urogenital fold, 17
- lactation, 14, 18, 19, 23, 99
- large-gamete production, 50
- leadership, 112
- lemurs, 52, 162n14
- LeVay, Simon, 126
- LGBTQ families, prejudice against, 129–30
- limbic system, 185n7
- LIM1 gene, 172n24
- Lion King, The*, 32
- liver, 90, 98; transplantation of, 137
- lizards, 28–29
- lungs, 90; transplantation of, 137
- luteinizing hormone (LH), 53, 54, 94, 97–98

- macaque monkeys, 51
- male/man distinction, 42, 122–24, 170n1
- males, 1, 12, 50, 108; biologists' use of term, 12, 39; body size in dominating group, 50; brains in, 120; cognition in, 111–12; communication styles of, 109; conflict between females and, 111; flanged and unflanged, 54; height distribution in, 74–75; mammal, 155n1; one-to-one universal truths in, 149; oral sex and masturbation in, 115; physical skills of, 113; promiscuity and, 124; relationships with females, 109; size of INAH-3 in gay versus straight, 126; Sociosexual Orientation Inventory (SOI)

- males (*continued*)
 - measure of, 117; universal dominance of, 109; variation between females and, 109, 124. *See also* 3G males; men
- mammals, 17, 18, 31, 48–49; core premise of the battle of sexes and, 110; gametic fusion in reproduction, 129–30; heterosexuality in, 128; internal gestation in, 28; male, 155n1; marsupial, 153n21; masturbation in, 114–15; pair bonds in, 67; physiological and behavioral care of, 161n2; placental, 153n21; postbirth care in, 32; reproductive biology in, 20; reproductive physiology in, 23–24; sex biology for, 33; social, 164n35
- mammary glands, 18
- mandibular ramus, 80
- “man’s mind,” differences between “woman’s mind” and, 113–14
- marsupials, 153n21, 161n1
- masculinity, 42, 44, 95, 103, 123;
 - clothing and, 43
- masturbation, 113–15; self-reported, 127
- mating types (aka sexes), 6
- medical research: binary view bias in, 131–35; sex contextualism in, 139–40
- men: biocultural makeup of, 41;
 - common assertions about, 109, 124; gender classification of, 42–44, 69, 124; sexual activity of, 115–17; social roles of, 38; 3G categories and, 47, 69, 136. *See also* males; testosterone; 3G males
- menarche, 93–94
- Men Are from Mars, Women Are from Venus* (Gray), 109–10, 179n1
- menopause, 94; physiological changes in, 128; sex biology of, 116
- menstruation, 97–98
- meta-analyses, 180n8
- minds, difference between men’s and women’s, 113
- “mind” studies, 112–13
- mole rats, naked, 12, 35, 36, 96
- monkeys: baboons, 51; macaques, 51; tamarins, 12; titis, 96
- monogamy: in animals, 34–35, 36; in humans, 66, 122, 157n32, 166n66
- motor behaviors, 112
- Mullerian ducts, 85–86
- muscles: concentric versus eccentric
 - contractions of, 171n11; factors in performance of, 83; relationship between strength and architecture of, 80–81; in shaping human bodies, 80–84; strength of, 80–81; 3G assessments of, 82–83; in 3G females versus 3G males, 81; variation in, 81–83
- myotonia, 185n7
- National Academies of Science, Engineering, and Medicine, 138
- National Health and Nutrition Examination Survey (NHANES), 78–79
- natural selection, 9
- Neanderthals, 70, 165n44; teeth in, 70
- negotiation, 112
- neurobehavioral disorders, 135; gender in, 135
- neurobiology, 100–104
- niche construction, 154n29
- nonlinear scaling relationship between region and brain size, 177n71
- obstructive coronary artery disease (CAD), 135–36
- one sex model, 9

- orangutans, 53–54, 64; sex biology of, 54; social lives of, 54; types of, 2
- organs: sex biology and, 90–91; transplants of, as aspect of binary view problem, 136–37
- ova, 8, 13, 15
- ovaries, 15–16, 17, 92, 94
- ovotestis, 16, 153n17
- ovulation, 97–98
- oxytocin, 185n7
- pair bonds, 52, 53, 65–67, 122, 130, 167n70
- pancreas, 92
- Pan* genus, 54–55, 64
- parathyroid glands, 91
- Parker, G. A., 10, 152n14
- parthenogenesis, 12, 25
- PAX*² gene, 172n24
- peafowl, 110
- pelvic girdle, 59, 79
- penis. *See* genitals
- periodic table of elements, 22–23
- Phelps, Michael, 145
- phenotypes, development of bodily, 91
- physiology, reproductive, 23, 156n26
- pituitary gland, 91, 92
- placenta, 17
- placental mammals, 153n21
- polycystic ovary syndrome (PCOS), 95
- polyploidy, 25
- power-lifting competitions, 82
- pregnancy, 98–100, 108; binary view of, 137–39
- primates, 48–52; father as caretaker in, 49; humans as, 48; masturbation in, 114–15; monogamy in, 34, 35, 36; mother as caretaker in, 49; pair-living, 52; patterns of care in, 52; reproductive sex in, 64; sex biology and behavior in, 49–50; sexual behavior of, 128; sexual selection in, 51; shapes and sizes of, 52; social behavior and relationships among, 33–34, 50; social sex in, 63
- proctodeum, 16
- progesterone, 92, 94, 97
- prokaryotes, 5, 6
- prolactin, 99
- protobirds, 30
- pseudogynecomastia, 87
- pseudopenis, 33
- psychiatric conditions, 135
- psychological states and behaviors, 112
- puberty, 87, 93, 94–95; mini puberty, 93, 94
- race, 91, 186n19
- religious beliefs, 44, 129
- reproduction: asexual, 2, 5, 6, 7, 28, 127; organs in, 1–2; patterns and trends associated with, 23; sexual, 6, 7, 8; sexually dimorphic patterns associated with, 32; types of organs in, 2
- reproductive biology, 11, 20; differences in, 2, 4
- reproductive physiology, 23, 156n26
- reproductive skew, 63
- reptiles: infant care by, 29–30; sex biology in, 28–30
- salamanders, 13
- scrotum, 33, 85
- sea horses, 13
- Semenya, Caster, 141, 143
- sensory stimulus, 185n7
- sex: as bimodal, 39–40; evolution of, 4, 5–21; purposes of, 6–7, 11, 63–65; self-reported, 161n23

- “sex at birth” term, 46, 47, 77
- sex binary, 36–37, 97; as tied to
 - heterosexual reproduction, 126
- sex biology, 1–4, 5–21, 54, 65, 76–77, 127;
 - basic animal, 22–37, 47; binary views of, 4, 39–40, 84, 126; climate-influenced, 28–29; copulation, 13, 14;
 - as culturally contextualized pattern, 139; diversity in, 149–50; human experience of, 39–40, 42; importance of, 45; mammalian, 36;
 - medical binary view of, 131; of menopause, 116; misunderstandings of, 22; niche construction in, 154n29;
 - organs and, 90–91; patterns in, 23, 110, 124; triggers for change in fish, 27; typical, 39; variations in, 4, 18, 26–27, 29, 77, 110, 124, 130. *See also* biology
- sex chromosomes, 104
- sex confirmation testing, 141
- sex contextualism, 189n44; in binary view problem, 139–40
- sex differences, 76–77
- sex diversity and variability, 125
- sexism, 136, 186n19
- sex organs. *See* genitals
- sex reproduction, 39
- sexual activity: age and, 127; difficulty in collecting data on, 115; as social tool, 64; women’s participation in, 127–28
- sexual arousal, 117–18
- sexual assault, 182n32
- sexual behavior of primates, 128
- sexual dimorphism, 30–31, 51, 53, 55, 59, 101, 108, 179n5
- sexual interactions, 55
- sexuality, 112, 115; battle of the sexes argument on, 121; as binary view problem, 126–29; gender/sex-related variation in self-reported perspectives, 118; responding to questions about, 182n26; self-reporting on, 113; as somatic fact and cultural effect, 115
- sexual orientation, 116, 129
- sexual pair bond, 67
- sexual reproduction, 7, 8, 63–64;
 - evolution of, 6
- sexual selection, 9, 50–51
- sexual violence: initiation of, 127;
 - patterns of, 120
- sex uniformity, 22
- siamangs, 53
- skeletons, patterns of variation in, 79
- skulls, 80
- social pair bond, 67
- social sex, 64
- sociosexuality, 118
- Sociosexuality index (SOI), 127
- songs, 53
- SOX9, 106
- spatial-ability skills, 112
- spawning, 13
- sperm, 8, 15, 131
- sports: binary view problem and, 141–47; gender-uniform, 145; impact of sex categories in, 83, 140; running, 143–44; testosterone and, 141, 142
- SRY gene, 105
- strength training, 80, 82–83
- teeth: canine, 50, 53, 70; Neanderthal, 70
- testes, 15–16, 92, 94, 114; undescended, 141
- testes determining factor (TDF), 105

- testosterone, 53, 54, 91, 92, 94–97, 119, 185n7; range of functions in, 146–47; sexual arousal and, 117–18; sports and, 141, 142, 144; variation in circulating levels of, 134, 141–42, 146
- 3G categories, 46–47, 161n23
- 3G females, 46–47, 50, 56–57, 186n22; battle of the sexes argument and, 122; biology associated with, 50; bodies of, 62; brains of, 100; cardiac disease in, 135–36; as correct nucleus of family, 130; defined, 46; differences from 3G males, 62, 65; effect of drugs on, 132–33; height of, 74–75, 112; human hair in, 89, 90; infant care by, 110; in laboratory research, 131–32; muscle strength in, 80–84; nutritional and caloric needs of, 68; organs in, 90; organ transplants in, 136–37; pelvic girdle in, 79; physical description of, 68; pregnancy and related physiological changes in, 137–39; sexual nature of, 109–10. *See also* females; women
- 3G males, 46–47, 56–57; battle of the sexes argument and, 122; biology associated with, 50; bodies of, 62; brains of, 100; cardiac disease in, 135–36; as correct nucleus of family, 130; defined, 46; differences from 3G females, 62, 65; DNA in, 110; effect of drugs on, 132–33; height of, 74–75, 112; hyperaggression in, 120; initiation of homicide and sexual assault by, 119–20; in laboratory research, 131–32; muscle strength in, 80–84; organs in, 90–91; organ transplants in, 136–37; pelvic girdle in, 79; physical description of, 68; reproductive strategy of “more sex, less investment,” 113; sexual nature of, 109–10; testosterone in, 111; types of, 53. *See also* men; males
- thyroid glands, 91
- tissues, adipose, 87–88
- transgender individuals: early acceptance of, 43–44; growth in legislation against, 147; restroom prohibitions and, 147–49; sporting events and, 144–45
- transplantation: heart, 137; hematopoietic stem cell, 135; liver, 137; lung, 137
- Trivers, R. L., 10, 152n14
- turtles, 28
- two sex model, 9
- UK Biobank dataset, 102–3
- undescended testes, 141
- unflanged males (orangutan), 54
- urodeum, 16
- vaginas, 16, 45
- vasocongestion, 185n7
- vasopressin, 185n7
- vellus hair, 89
- vertebrates: egg laying in, 16–17; gonads in, 15–16
- vocalizations, 53
- voluntary activation, 81, 83
- wasps, 24
- WEIRD (Western, Educated, Industrialized, Rich, Democratic) nations, 84
- Wilson, E. O., 10, 109, 152n14
- Wnt4, 106
- WNT gene, 172n24

202 INDEX

- women: biocultural makeup of, 41;
common assertions about, 109, 124;
gender classification of, 42–44, 69,
124, 143; sexual activity of, 115–17;
social roles of, 38; 3G categories
and, 47, 136. *See also* females
worms, sex biology of, 2, 25, 26
- X and Y chromosomes. *See under*
chromosomes
- zolpidem (Ambien), 132–33, 140
- zygotes, 12, 13, 14, 17, 24, 153n18;
development into embryos of,
20, 21