



## Evolution's Rainbow: Diversity, Gender, and Sexuality in Nature and People

*Joan Roughgarden*

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In this innovative celebration of diversity and affirmation of individuality in animals and humans, Joan Roughgarden challenges accepted wisdom about gender identity and sexual orientation. A distinguished evolutionary biologist, Roughgarden takes on the medical establishment, the Bible, social science—and even Darwin himself. She leads the reader through a fascinating discussion of diversity in gender and sexuality among fish, reptiles, amphibians, birds, and mammals, including primates. *Evolution's Rainbow* explains how this diversity develops from the action of genes and hormones and how people come to differ from each other in all aspects of body and behavior. Roughgarden reconstructs primary science in light of feminist, gay, and transgender criticism and redefines our understanding of sex, gender, and sexuality. Witty, playful, and daring, this book will revolutionize our understanding of sexuality.

Roughgarden argues that principal elements of Darwinian sexual selection theory are false and suggests a new theory that emphasizes social inclusion and control of access to resources and mating opportunity. She disputes a range of scientific and medical concepts, including Wilson's genetic determinism of behavior, evolutionary psychology, the existence of a gay gene, the role of parenting in determining gender identity, and Dawkins's "selfish gene" as the driver of natural selection. She dares social science to respect the agency and rationality of diverse people; shows that many cultures across the world and throughout history accommodate people we label today as lesbian, gay, and transgendered; and calls on the Christian religion to acknowledge the Bible's many passages endorsing diversity in gender and sexuality. *Evolution's Rainbow* concludes with bold recommendations for improving education in biology, psychology, and medicine; for democratizing genetic engineering and medical practice; and for building a public monument to affirm diversity as one of our nation's defining principles.

## Evolution's Rainbow: Diversity, Gender, and Sexuality in Nature and People Details

Date : Published May 17th 2004 by University of California Press (first published January 1st 2004)

ISBN : 9780520240735

Author : Joan Roughgarden

Format : Hardcover 474 pages

Genre : Science, Nonfiction, Gender, Glbt, Queer, Lgbt, Sexuality, Biology



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## **From Reader Review Evolution's Rainbow: Diversity, Gender, and Sexuality in Nature and People for online ebook**

### **Danika says**

This book is more engaging for what it could be than what it is. It skims wonderful ideas, but tries to take on too much, encompassing gender and sexuality in culture, zoology, and human biology. This is an impossible task for one book, considering that more than a dozen books have been written about Two Spirited people, for example, which is just one cultural take on gender. I found the author slightly unreliable, especially when it came to the cultural aspects of gender.

That being said, I think that everyone should read the zoology sections. This is where the book shines and accomplishes exactly what it needs to accomplish. It shows a brief overview of the truly amazing rainbow of what sex and gender can mean in nature, which can give a bit of perspective on how seriously we take gender identities. For me, it soothed my gender queer parts, showing that they were not freakish, in fact, they were hardly strange at all in the bigger scope of things.

I would never take this book as the word on gender and sexuality, but rather a selection of interesting ideas, tiny tastes collaged to create a valuable sense of possibility.

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### **Rachel says**

I LOVED the first two-thirds of the book. The author made a wealth of scientific information not only readable but fascinating. Her arguments for modifying evolutionary theory are convincing. As she points out, theories are affected by cultural assumptions. Looking at biology and animal behavior through a lens of cooperation for mutual benefit, rather than one of domination and trickery, gives rise to many interesting possibilities, some of which seem to be a better fit with reality. I also love her spirited advocacy of gender diversity in the scientific community and the overall culture.

However, the later part of the book, when she admittedly ventures outside her areas of expertise, was riddled with unreliable information and dubious opinions. Two examples: the section on genetic engineering didn't seem to belong in the book, and interpretations of biblical passages seemed pretty unlikely. I wish the publisher had loosed a more stringent editor on it. A copy editor too--honestly, misspelling Astarte?

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### **Amir The Fat Bookworm says**

It was not a book that I agreed with all the way, but the parts I agreed with, was from my opinion more than awesome. And It is a book in need of attention more than it has right now. I strongly suggest this book to any and all scholars out there.

I shall reread this book in the future.

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### **Prithvi Shams says**

This book seemed a bit unpalatable at first as I was not used to seeing gender and sexuality as something that defies rigid categorization. The merit of this book lies in convincing the reader that gender is not necessarily affixed to sex, that gender need not be a binary phenomenon. Transgendered, intersexed, bisexual and homosexual people are not "diseased" merely because they're different from the heterosexual norm; these people are just different colours on the rainbow of gender and sexuality. A significant portion of this book is dedicated to breaking down the gender and sexuality binary in the animal world. While I have some reservations regarding the scientific vigor of these chapters, I do feel the writer has made her point about the diversity of gender and sexuality.

What's most important - my views have diverged a lot from before I read this book. A book can not have more to its credit.

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### **Nathan Cottrell says**

This is not science. While it's good to see that someone is trying to dispel myths about human sexuality and encourage acceptance of all people, to make the claim that this is science is beyond understanding.

The author claims that she has "disproved" Darwinian Sexual Selection, but this is not the case at all.

Does anyone really believe that one "gender" of bullfrog is an immature non-mating male and another "gender" of bullfrog is the same male as an adult???? Ridiculous. This isn't shifting genders but rather MATURING, much like all other animals do.

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### **Nathan says**

A very fascinating read all around - the first third has a lot of technical information, which I actually appreciate, even if I don't completely understand what is being said about the effects of chromosomes and genes and their interaction, or if I have a hard time digesting statistical data. This aspect of the book might turn off a layperson, but it is balanced out with well-written anecdotal explanations.

The book is split into three parts - the first describes and illustrates diversity in nature, especially cases of multiple genders, social organization, and sexuality. The entire book contests the Darwinian theory of sexual selection, as well as modern medical and psychological approaches to gender and diversity in general...

The second part investigates human biology and genetics and sexuality, and deals with such issues such as the search for the elusive "gay gene" or "trans gene," and the ways that society has dealt with these things (as well as inter-sexed individuals)...

The third part discusses human culture and how "differently gendered" people have been accepted or understood or interpreted in various cultures throughout time. This includes what the ancient Greeks, Romans, Hebrews and early Christians had to say, taken in context of the time, as well as contemporary examples from cultures worldwide today.

All in all, a fascinating book - it was very enlightening, even with skimming through the technical parts ;)

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### **Snail in Danger (Sid) Nicolaides says**

I mostly read/flipped through this in a systematic fashion, hunting for information on specific topics (hermaphroditism and sexed/gendered division of reproductive labor). The rest of this though ... argh. Keep your politics out of my science please? (Even though in general I likely agree with the author's basic perspective.) And stop stretching things and inaccurately applying your paradigms to make points, even if they're points I agree with?

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### **Karli says**

Humanists cannot continue to theorize gender and sexuality without a nod to science. Joan Roughgarden provides the fuel for the feminist fire in breaking down the sex/gender binary and paving the way for a spectrum of gender and sexual expression across the species in the animal kingdom, and yes, that includes humans!

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### **Natik says**

This is a very rigorous scientific book that's definitely a step above in complexity compared to most "pop sci" books. Nonetheless, she does give enough background that a non-biologist could make sense of things (probably with some extra Internet searches).

The main argument here really rams home that animals (and people) **WITHIN** one species can be drastically different. We then no longer think of "the rule" and some weirdo mutant "exceptions" but start really appreciating the full range of variations. Did you know that some kinds of fish have 3 very distinct type of male within the same species? They are even different sizes and colors! Neither one of these males is "the best" or is preferred by all females, rather each one wins and loses in his own way.

Reading it will have you start thinking about sexual diversity in our world, but I think her last section on human politics was very out of place. The tone throughout the entire book makes her political opinions very clear. Even if you agree with them, it is still off-putting. I just don't think that is a good mix with a rigorous science book.

After you have read this book, you will feel a lot better the next time an annoying "Men do X! Women do Y!" study comes out because you know their generalizations mean little if we have some multi-peaked or flattened curves going on in the data!

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### **Danny says**

Roughgarden is incredibly biased, and she admits as much from the get-go. Nonetheless, there were many moments during this book that her clear sense of bias made me question the validity of the claims she was

making. Some chapters in particular seemed to be included so that she could share her opinions on a given topic that didn't necessarily feel as if it contributed to her overall arguments.

This book is dense and she covers a lot of ground. It's a good read, but be sure to get a degree in biology first. Some of the information in here is really important and I hope that someday a more accessible version of this material is published.

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### **Becca says**

I had some extreme ambivalence about this book. Ultimately, it is an extremely ambitious book with a broad scope, aiming to be one of the major pieces of gender and sex literature for several groups, including biologists, educators, trans, intersex/people with differences in sexual development and genderqueer individuals, queer groups debating whether to include trans issues, politicians and doctors. So the fact that it was a little weak on some of these fronts was to be expected and cannot be said to detract from the overall groundbreaking nature of the book.

The book is organized into three parts: gender, sex and sexual orientation in animal organisms; gender, sex and sexual orientation in people, and finally, the history of gender variation in human societies.

Not surprisingly, given that Dr. Roughgarden is an organismal biologist, the first part is by far the strongest. And it's not just strong relative to the rest of the book, it is truly a superlative work. It explores first the biologic definition of sex and speculates about species in which there could be more than two sexes on the basis of diversity of gamete size in several known species. She then goes on to discuss hemaphroditism (sequential and simultaneous.) I didn't find much of this novel, probably because I consider myself somewhat of an amateur ichthyologist, and most of these early examples involved reef creatures I was already familiar with, but Roughgarden still presents it in a way that it is compelling and flows well with the earlier portion of the book on sex. The absolute best part of the book is about gender in animal species: Roughgarden explores several species (mainly birds, lizards, fish and insects, initially) looking at the diversity of gender roles and family structures that exist in different species. She speculates as to the evolutionary advantages of having a diversity of gender roles, in that it allows for rapid response to shifting environmental factors, and argues that it provides an increased chance of offspring survival in other cases. Finally, looking at mostly primates, Roughgarden discusses same sex relationships in the animal kingdom, again arguing that same sex relationships fill an evolutionary niche, by helping negotiate alliances that increase the chance of offspring survival. Importantly, in all of this, Roughgarden is very clear that exploration of gender, sex and sexual orientation variance in animals is important for our understanding of diversity, but she does NOT argue that LGBT people should be supported BECAUSE of the occurrence of parallel traits in animals, but rather just because it's moral to support them. She explicitly states that much of animal behavior should not be accepted in humans and much of human behavior that is valuable is not found in animals. I think warning people of how easy the naturalistic fallacy would be here and actively discouraging her readers from failing for it was both courageous and intellectually honest.

So ultimately, I have only two gripes with this entire first part, and both are completely semantic. One is that she continually refers to her idea of the "genial gene" (genetic traits that have evolved to encourage interorganism cooperation so as to encourage survival of offspring and thereby increase individual reproductive fitness) as being in conflict with the Dawkinsian idea of the "selfish gene" (genes evolve to increase survival of themselves.) These are not at all in conflict. They are both consistent with evolutionary biology as it is currently understood and the "selfish gene" hypothesis supports the evolution of genetic traits

that are "altruistic" in behavior if that supports the expansion of the gene in the population. The second is that Roughgarden insists on referring to genetic diversity as a "genetic rainbow." In the middle of a narrative that is otherwise talking about gametes, alleles, and other complex biologic topics, all of a sudden using "rainbow" as a scientific noun is jarring and undermines Roughgarden's credibility. I know that she wanted to increase readability, but honestly, anyone who gets through this first section has the reading comprehension to understand the word "diversity."

The next two parts are rockier. I had the hardest problem with the middle part, in which Roughgarden makes several diversions. One is to criticize American medicine for overpathologizing people especially with genetic conditions. She makes an argument that if a trait has a certain population frequency, it must not be that pathologic. This argument is technically true: for a given allele frequency, there is a bound on the effect on reproductive fitness, given a limited *de novo* rate of mutation. However, this argument ignores the possibility of heterozygote advantage, given that many (most?) of the conditions that she argues therefore must be beneficial or neutral are autosomal recessive. In addition, the discussion of reproductive fitness is not a value judgement -- one of the conditions that she agrees must be the most deleterious to reproductive fitness, complete androgen insensitivity, is a condition that I would strongly argue should not be pathologized: people (usually women) with complete AIS require the use of advanced reproductive technology to have biologically gonads, because they have sperm-producing gonads, female genitalia and usually identify as women. That's a huge reproductive hit, but an otherwise normal person. On the other hand, she argues that salt-wasting congenital adrenal hyperplasia is overpathologized, and as a medical geneticist, I'm going to defend my right to pathologize genetic conditions that kill infants. She then extends herself to genetic conditions in general (not just differences in sexual development) and generalizes that the risks of genetic engineering, as well as the ethical risks of selective reproductive technology outweigh any benefit to treating these patients, whom she claims are overpathologized. Again, I'm sensitive, because this is my job, which I have a doctorate and extensive postdoctorate training in, but I see children die because of their "genetic trait, which is not necessarily a disease" and it is extremely sad. I have helped couples select embryos that do not carry the genetic condition that their sibling died of and I'm not sorry.

Dr. Roughgarden recommends at the end that the FDA certify whether a condition is a disease before a doctor can treat it, and I think this argument really showcases ignorance of the medical bureaucracy and the issues involved: FDA approval is an extremely slow process, even now, sticking to Food and Drugs, which there are clear processes for. The number of just human genetic diseases is in the thousands. She herself uses examples of allelic conditions where at one end there is clear disease and the other end is more a variant of normal (such as AIS and CAH above.) I daily see patients with alleles that have never before been reported. If I needed FDA approval to see a patient in my clinic based on their individual allele, it would probably take a decade for each patient to be approved! I wish that Dr. Roughgarden had been given an opportunity to attend a medical genetics clinic. I think modern medical geneticist are by and large thoughtful and avoid unnecessary pathologizing. I suspect that this is simply a case where Dr. Roughgarden, brilliant as she clearly is from the first chapter, is not as up to date on medical genetics. To be clear: I agree with her completely that patients with DSDs were historically overpathologized and were victimized by poorly considered operative strategies, and I understand that given her expertise in gender and sex she would be suspicious of the rest of the field.

I liked other parts of this chapter: Dr. Roughgarden thoroughly debunks the idea that there are substantial gender differences in humans. She then reviews the gender differences that have been reported and puts them into context for the reader. I wished she would have gone even further into rejecting the idea that there is scientific scaffolding for meaningful gender dimorphism in humans, but she does discuss this a little in part three, where she explores several cultures that have had a third gender as a category for either people with DSDs or people who are trans. This part is a little rocky, because at times, she imposes her categories on the narratives of the people she is summarizing. Although she is careful, she sometimes uses pronouns or nouns

that are gendered differently than what the person used, claiming that the person would have identified as fe/male had that society allowed it. On the whole, I found it relatively interesting to look at the historic and geographic span that gender variation has occupied and encouraging to look at societies that were largely accepting of gender variation.

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### **Daniella says**

Didn't actually have time to finish reading it. The science still isn't there, but she raises incredibly good questions and had a very good analysis. My professor might not like her, but I think she raises important questions that need to be investigated. the second portion delves more into sociology and such which was interesting, but not my focus was on the evolutionary biology portion. The cell developmental bio was odd. I like how she was very open about her motivations and unafraid of being called biased or whatever.

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### **Roxanne says**

This is a very ambitious, yet readable, work. Roughgarden takes on the binary in sex, gender and sexuality. She takes to task Darwin's sexual selection theory, evolutionary biologists, social scientists, psychologists and physicians.

She spends a lot of time at the beginning laying out dozens of examples of non-binary social and sexual arrangements in nature. This could get tedious, but I suggest sticking it out as best you can; she makes a convincing argument for reworking the sexual selection theory, and for casting a critical eye at the way biologists interpret what they see.

Roughgarden looks at sex and gender in human societies, and tackles Judeo-Christian history and the way it has shaped modern religious views of gender-variance.

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### **Brownbetty says**

This is an entertaining, educating, and fairly persuasive book. Roughgarden is very deliberately writing this book primarily to make an argument, and secondarily to educate. This is sometimes a slightly infelicitous mix; she uses general, rather than scientific vocabulary, most of the time, sometimes to the detriment of the argument she is making.

Roughgarden is an evolutionary biologist, and some of the arguments she is making are far more relevant to the field than to the layperson, so I may be misunderstanding her somewhat, but I believe she is arguing, basically: 1) Diversity is the engine of evolution, and when we classify diversity as deviance, we are, in the best case scenario, missing the point, and in the worst case scenario, doing actual harm to ecologies, species, and people. Specifically, we are misunderstanding sexual and gender diversity, because of our ideas of how gender works in humans.

Her second disagreement with the field is, as I understand it, that 2) sexual selection is not even a thing. This point was much more fuzzily caught by me, because my understanding of this part of the theory is pretty surface. She seems to be arguing that, firstly, we should understand reproduction of sexed species to be a

cooperative, rather than competitive endeavour, or at least, not discount cooperative theories of animal behaviour, just because we expect to see a competitive one. And secondly, sexual selection theory produces a lot of evo. psych. douchebaggery, so really, why keep it? (I'm going to be as up front as possible: I'm pretty sure her argument is better than I am representing it here! But I missed out on a lot of it.)

I think Roughgarden is on her strongest ground when she argues that gender diversity in nature is far broader than even science usually represents it as. Anyone familiar with Humon's comics knows that nature has a lot of ways of doing gender, but Roughgarden goes further. In cases such as the side-blotched lizard, which in Humon's comics is described as having two male 'types', Roughgarden argues that as these male types demonstrate distinct reproductive behaviours, and distinct phenotypes, does it not make sense to speak of them as being different genders? If clownfish are born male, and may later become female, then really, does it not make more sense to say there is only one gender of clownfish?

A note on vocabulary: Roughgarden is usually speaking of gender, but she sometimes refers to "biological sex" by which she means something *highly specific*: the property an organism has of producing large or small gametes. She doesn't care about your gonads, your hormones, your gender presentation, or your plumbing when she speaks of biological sex; she only cares about your gamete size. That is, she is a trans woman, and she would consider *herself* "biologically male." I would not generalize from this to make any assumptions about how any other trans folk might consider themselves, and in the common parlance, "biological sex" is usually used to make essentializing assumptions about gender. That is not how Roughgarden is using it. She means gametes. This obviously has nothing to do with how we deal with gender socially, since most people who have not given birth are simply assuming we have the gametes associated with the gender we were assigned at birth.

Roughgarden argues that because we assume that animals are bi-gendered, bi-sexed, and 'naturally' heterosexual, we (by which she means both the population at large, and the scientific community) miss or misrepresent what is actually going on. She provides quite a few charming examples. One, that of the bighorn sheep, illustrates a problem I have with her vocabulary: she occasionally sacrifices accuracy for accessibility in ways that I think confuse the point. She delightfully describes the typical male bighorn sheep: he spends most of his life in an all male society, engaging in plenty of sexual activity with the other males. He only engages in sex with females during the rutting season, and only during the three or so days when a given female is receptive/permits it.

Some males, however, are not interested in hot ram-on-ram action. These males live with the females year round, and adopt some female behaviours, like squatting to pee. Roughgarden points out that, rather hilariously, these males are considered aberrant, and somewhat 'effeminate.' And here is where it gets confusing. She says: "The 'aberrant' ram is the one who is straight—the lack of interest in homosexuality is considered pathological. [...] According to the researchers, what's aberrant is that a macho-looking bighorn ram acts feminine! He pees like a female—even worse than being gay!"

And while she makes her point about the incredibly confused state of affairs that occurs when we try to impose our gender roles on animals, I find that the use of 'gay' and 'straight' and even homosexual and heterosexual, to a lesser degree, really confuse the issue. For one thing, it's not clear to me that the rams who don't have an interest in other rams are actually interested in ewes, and for another, 'male-oriented except for reproductive purposes' is not how we usually understand the term 'gay,' either. (I have no doubt that a non-zero, and perhaps substantial? number of gay men would be perfectly happy to have intercourse with a woman for a brief period, if the outcome was a child, and there was a socially supported mechanism for doing so, but that's not how the identity is constructed.)

Which leads me to simultaneous frustration that Roughgarden does not go into more detail in her cases (Do the ewes engage in ewe-on-ewe? Does ram-on-ram decrease during mating season? SO MANY QUESTIONS) and also perfectly illustrates the problem with trying to impose human sexual orientations onto animals.

(Pages 139-40 includes a hilarious account of agricultural science attempting to determine the genetic origin of gayness in sheep. Recommended universally.)

Roughgarden also argues that a lot of same-gender animal sexual activity which is understood as either deceptive or occurring because the animal is too dumb to realize they are mounting another of their gender, is either because, a) the animal knows perfectly well what gender they are mounting, and prefers it that way, or because b) sexual activity can have survival benefits beyond propelling one's gamete's into the crucible of genetic recombination; it can be fun, promote social bonding, or be an exchange of favours. (I think this has something to do with her sexual selection argument, again, but I am SUPER NOT CLEAR ON THAT PART.)

Roughgarden is skeptical-to-hostile to most forms of genetic engineering, cloning, etc., both because she distrusts capitalism's motives in interfering with the genome, and because, once again, it is a counter-diversity force. Fair enough on both points, lady.

I found Roughgarden fairly persuasive, although she lost me when she got into the extreme biological nerdery. She goes into a level of chromosomal detail that was frankly quite wasted on me. She was most convincing (and in fairness, entertaining, so in all likelihood, my own level of interest played a part) when she discusses different animal models of gender and sexuality. She's least convincing when she leaves her area of expertise. In the opening of her chapter, "Psychological Perspectives" she says, "some reviewers felt a purely biological account of gender and sexuality was incomplete and needed to be rounded out with psychological perspectives. Reviewers felt that transexualism in particular needed more discussion. Well, okay."

I think the aforesaid reviewers should consider the resulting chapter to be their punishment.

(I also think she makes an error discussing the naked mole rat. She seems to imply the queen actually gains vertebrae during pregnancy, but my googling and wandering around in various databases suggests that the vertebrae themselves elongate. THIS IN NO WAY AFFECTS HER ARGUMENT BUT I CAN'T LET IT GO.)

Those caveats aside, this is a well written and well argued book.

The book closes by arguing that human gender and sexual diversity should, by and large, be understood as part of 'evolution's rainbow', rather than pathologised, and she advocates spreading this idea as widely as possible. I think this would be beautiful.

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### **Mortalform says**

If you have not read this book you are missing out on a vital debate

I have found very few non-fiction books that are so readily gripping. Not only is Roughgarden addressing a fundamental issue that affects us and all creatures, but she is presenting an extremely important argument against one of the founding principals of our societies. A pleasure to read, a pleasure to pause and muse on what was just read and a pleasure to resume.

This book is organized in an incredibly efficient way, the way I was taught to write persuasive essays. Roughgarden presents her subject and arguments within the first few pages and each of the subsequent chapters deals with one element of her beautiful theory, reviewing examples that support it, addressing clearly the opinions of her opponents and tidily proving why they are erroneous.

How does biology account for such a huge population that doesn't match the template science teaches as normal? p 1

The fundamental problem is that our academic disciplines are all rooted in Western culture, which discriminates against diversity. Each discipline finds its own justification for this discrimination. This book blows the whistle on a common pattern of disparaging gender and sexuality variation in academia and predicts foundational difficulties for [the] disciplines of [ecology and evolution, molecular biology and medicine as well as the social sciences]. p2

[Joan Roughgarden] suggests a new theory that [she] calls 'social selection'. It envisages animals as exchanging help in return for access to reproductive opportunity, producing a biological 'labor market' for mutual assistance by employing reproductive opportunity as currency. This theory proposes that animals evolve traits that qualify them for inclusion in groups that control resources for reproduction on safe places to live and raise offspring. P6

Darwin is known for three claims: that species are related to one and other by sharing descent from common ancestors, that species change through natural selection, and that males and females obey universal templates—the males ardent and the females coy. This third claim results from Darwin's theory about natural selection, and this claim, not the first two, is specifically what is under challenge...I've suggested a new theory that I call "social selection." This new theory accommodates variation in gender and sexuality. It envisages animals as exchanging reproductive opportunity as currency. This theory proposes that animals evolve traits that qualify them for inclusion in groups that control resources for reproduction and safe places to live and raise offspring. These traits, called social-inclusionary traits, are either possessed only by the females and unexplained by any theory, such as the penis of female spotted hyenas, or possessed only by males and interpreted as secondary sex characteristics even though they are not actually preferred by females during courtship. P 6

Part 2 shows how science seizes on the often tiny anatomical differences between people, and on differences in life experience, to differentiate them from an artificial template of normalcy and deny a wide range of people their human rights by defining them as diseased. p7

I find that refuting sexual selection theory imbues female choice with responsibility for decision about power and family far more sophisticated than what Darwin envisioned, and empowers varied expressions of gender and sexuality. p 10

Sexual reproduction cuts a population's growth rate in half – this is the cost of sex. Only females produce offspring, not males. If half the population is male, then the speed of population growth is half that of an all-female population. An all-female population can quickly out-produce a male/female species, allowing an all-female species to survive in high-mortality habitats where a male/female species can't succeed...the benefit

of sex is survival over evolutionary time... the advantages of sex are also demonstrated by species who can use sex or not, depending on the time of year. p 17

Butterflies who's enzymes work at cold temperatures thrive in dark, damp years, while butterflies who's enzymes function best at hot temperatures do better in sunny drought years. All butterflies are perfectly good butterflies, even if the abilities of some don't match the opportunities currently supplied by the environment. p 21

Biologists call the ratio of receptive females to willing males the "operational sex ratio." The operational sex ratio isn't fifty-fifty because the sex with the higher parental investment is occupied with raising the offspring and is relatively unavailable for mating compared with the other sex. p 46

The evolution of the mammalian placenta and pouch is usually presented as a psychological advance, an adaptation for nurturing embryonic development in a climate that had cooled globally since the time of dinosaurs. Alternatively, the evolutionary force behind the placenta and pouch may have been for females to assume control of their offspring. A side effect is that males then acquire incentive to control females. p 48

Presenting mate guarding as a tactic by which males protect their investment ignores the female perspective. Females are viewed as land in which males plant seeds and which they guard if necessary. Yet females are probably active players in whether they are guarded or not.

The Idaho and Belding's squirrels may have evolved to experience pleasure differently. A female Idaho squirrel may like being squeezed into a burrow, a male may enjoy having a female behind him as he stuffs the burrow's entrance, like a guy taking a girl for a spin in his red convertible- fun for both. Yet for a female Belding's ground squirrel squeezing into burrows could be a total turnoff an the reason she doesn't permit the guarding. Species differences in how power is eroticized make it difficult to discern whether animals have freedom of choice during mate selection and in their family lives. p 52

The record-holders for male sexual coercion are the orangutans, in which most copulations by subadult males and nearly half of all copulations by adult males occur after a female's fierce resistance has been violently overcome. Other primate species showing lots of male aggression against females include white fronted and wedged-capped capuchins, black spider monkeys, and brown lemurs. Females' counterstrategies include avoiding areas where males are found, joining a male's territory or harem to gain his protection, and forming coalitions to fight off the males. P53

[The male] has two directions in which he can invest social effort. Within-sex effort involves competing with other males and/or building coalitions with them to access females. Between-sex effort involves 'coalition-building' with a female to raise offspring together. Whether a male winds up with more offspring overall from within-sex or between-sex coalition-building depends on circumstances. This is the animal equivalent of balancing career and family.

Monogamy then emerges when (a) building relationships with a female is more advantageous to a male's reproductive success than building relationships with other males, and (b) building a relationship with a male is more advantageous to a female's reproductive success than raising young by herself or in conjunction with other females. In general, different mating systems emerge from different optimal allocation of social effort to between-sex and within-sex relationships. P56-57

Mating is ...more about maintaining the between-sex and same-sex relationships needed to provide food and safety for the young than about sperm transfer as such. p 176

