

A plea for diversity

Joan — formerly Jonathan — Roughgarden rejects established evolutionary ideas about gender roles and sexuality. Everyone wants to discuss the parallels with her personal experience. But the science speaks for itself, she tells Virginia Gewin.



L. CICERO/STANFORD NEWS SERVICE

Joan Roughgarden has devoted herself to challenging the ‘male’s-eye view’ of animal mating patterns.

Darwin’s legacy is under attack. His fundamental theory of evolution by natural selection retains its status as the bedrock of modern biology, but a new generation of researchers is challenging his later ideas about evolutionary aspects of sex and gender. And this movement has just gained an eloquent spokesperson — albeit a somewhat reluctant one — in Joan Roughgarden, a theoretical ecologist at Stanford University in California.

Roughgarden is now putting the finishing touches to *Evolution’s Rainbow*, a book that catalogues the enormous variety of gender roles and sexual behaviours that are present in the animal kingdom. Her thesis is that this diversity undermines the generality of Darwin’s prevailing theory of ‘sexual selection’, with its underlying vision of ardent males vying for the favours of coy, choosy females. “I want to be fair to Darwin’s memory, but give a voice to the shared discontent,” she says.

Roughgarden’s unusual personal journey is bound to generate unprecedented publicity for this evolutionary debate. Five years ago, at the age of 52, Roughgarden — then known as Jonathan — surprised colleagues by undergoing a sex change. Although she admits that her experiences have helped to shape her scientific interests, she’s worried that her story will be sensationalized by an inquisitive media. Indeed, at points during the interviews for this article, these concerns led to some uncomfortable moments, as *Nature’s* questions

probed more deeply into Roughgarden’s personal territory than she was happy with.

So let’s start with the scientific background, and the orthodoxy that Roughgarden wants to overturn. Darwin devised his theory of sexual selection to explain traits such as peacocks’ tails and stags’ antlers, which seem to handicap their possessors in the everyday struggle for survival. He argued that such adornments evolve because they confer a sexual advantage, either by allowing males to compete directly with one another to gain access to mates, or by giving them a means to impress females. Darwin’s successors embellished the theory, cementing the view that the basic pattern is one of promiscuous, competitive males and picky females. This dichotomy, theorists argued, stems from the fact that eggs are more costly to produce than sperm, meaning that females must choose a mate carefully to ensure the best outlook for her investment.

Female intuition

This leaves little room for the idea that females might, under some circumstances, be just as competitive and promiscuous as males. It also offers no explanation for homosexuality, which is seen by many of Darwin’s heirs as a theoretically inconvenient aberration. By providing an atlas of departures from the stereotypes of sexual selection, *Evolution’s Rainbow* is Roughgarden’s counter-manifesto.

Some researchers — many of them

women — began documenting animal examples of female promiscuity as long ago as the 1970s. Many were simply ignored, or else marginalized as ‘feminist’ thinkers. “They weren’t heard and couldn’t find a place in the system,” laments Roughgarden, who acknowledges that her own experiences of discrimination have driven her to rail against such injustices. “My experience has given me an edge and motivation to speak up that someone who has not been so stigmatized may not feel so keenly,” she says.

Roughgarden traces the epiphany that led to *Evolution’s Rainbow* back to her participation in a gay-rights parade in San Francisco, shortly before her transition. “Looking at all these people, I knew biology — my field — said these people were impossible,” she says. The conclusion, for Roughgarden, was inescapable: “These people aren’t wrong, it’s the theory that’s wrong.”

So began Roughgarden’s move into the arena of sexual selection, the latest in a series of jumps that have seen her work on subjects as diverse as the foraging behaviour of Caribbean lizards, the biological oceanography of barnacles, and ecological economics. As Roughgarden sees it, Darwin’s theory offers no convincing explanation of phenomena such as the anatomy of female spotted hyenas (*Crocuta crocuta*), which have genitals that are outwardly indistinguishable from those of males. *Evolution’s Rainbow* is, in part, the story of her search for the answers

to such biological condundrums.

Roughgarden argues that, when it comes to gender and sexuality, the distorting lens of sexual-selection theory has tricked evolutionary biologists into abandoning their usual rigour in trying to explain diversity. It has been too easy, she suggests, to dismiss certain phenomena as anomalies or mistakes, rather than trying to understand why they evolved.

Roughgarden believes that we will begin to understand nature's diversity of sexual and gender expression if we pay more attention to the social interactions between the animals involved. To explain traits such as the female spotted hyena's 'penis', Roughgarden proposes a theory of 'social inclusion'. In many species, she suggests, an animal's reproductive success is dependent on its membership of a social group that controls access to key resources. In such instances, preferences among group members for an arbitrary trait can cause it to evolve rapidly in a runaway manner.

Select groupings

This 'social selection' is similar, in essence, to Darwin's concept of sexual selection by female choice. "The difference," explains Roughgarden, "is that the benefit conferred on an animal carrying a social-inclusionary trait springs from being incorporated into powerful same-sex groups, and not from being preferred during mate choice by the opposite sex." Roughgarden predicts that a female spotted hyena with a small 'penis' would be excluded from female groups, and would thus be denied the opportunity to reproduce. "Exclusion is the social equivalent of lethality — the strongest form of natural selection," she concludes.

These ideas were developed against the background of the public emergence of

Roughgarden's female persona. For many people, the influence of this experience on the ideas expressed in *Evolution's Rainbow* is intriguing. But Roughgarden fears that an excessive fascination with her personal circumstances could undermine the book's scientific message. Indeed, she turned her back on Princeton University Press, which was originally lined up to publish the book, after her editor asked her to draw explicit parallels between her life and what she observed in nature. She has now teamed up with the University of California Press, which intends to publish *Evolution's Rainbow* early next year.

Roughgarden's entry into the sexual-selection debate is welcomed by many in the field — not least because of her unique personal perspective. "She brings special sensitivity to aspects of social diversity that I'm not sensitive to," says Patty Gowaty of the University of Georgia in Athens, whose own work on deviations from the predictions of sexual-selection theory has, on occasions, been attacked for its feminist overtones. Stephen Shuster, an invertebrate zoologist at Northern Arizona University in Flagstaff, agrees. "You've got to include different perspectives," he argues.

But some scientists privately wonder if — whether she likes to admit it or not — Roughgarden's own experiences of social exclusion have biased her view of the natural world. Even the broadly supportive Shuster, who is open to the idea of social selection operating alongside sexual selection, feels that Roughgarden goes too far in attacking Darwin's theory. "She throws out a very healthy baby with some slightly soiled bathwater," he says.

Roughgarden is affronted by suggestions that she has allowed her objectivity to be undermined. Indeed, she sees this critique as yet another manifestation of social discrimination. The straight white men who

dominate studies of evolutionary biology are rarely required to defend themselves against such accusations, says Roughgarden, who believes that they, in fact, have a stronger case to answer than she does. For example, she argues that biologists' prejudices have frequently caused them to record mountings as being male on female — without verifying the sexes of the animals involved.

Moving on

Roughgarden wants to put her old life as Jonathan behind her, rather than having it dissected in the context of her science. Her academic peers describe Joan as a much happier individual, but Roughgarden says only that she feels "more human" as a woman.

When it comes to the discrimination that she experienced at Stanford after her transition, however, Roughgarden is more forthcoming. One male colleague even asked her to avoid the temptation to "dumb down the science" as a woman, she says. Roughgarden also claims that she was asked to step down as head of Stanford's Earth Systems Program, the much-lauded interdisciplinary undergraduate course that she established in 1992. But Franklin Orr, who was then Stanford's dean of Earth sciences, asserts that Roughgarden decided to quit in 1999 after discussing the time commitment involved.

In some ways, Roughgarden sees herself as lucky. Many transgendered people are hounded out of their jobs. She attributes the fact that she is still at Stanford to the support of Condoleezza Rice, formerly the university's provost and now President George W. Bush's national-security adviser. But this good fortune was a double-edged sword: although many transgendered people can begin a completely new life, Roughgarden could not do so without abandoning her scientific career — Joan's academic reputation depends largely on Jonathan's distinguished publication record.

Perhaps unsurprisingly, given her experiences, Roughgarden is something of a political animal. She stood, unsuccessfully, for the office of supervisor of her district in San Francisco in 2000, and is active on diversity issues at Stanford. Even her science has a political dimension. Roughgarden is convinced that the vernacular of sexual-selection theory — which, for example, labels males that don't engage in head-on competition for mates as 'sneaky', or 'female mimics' — perniciously permeates our understanding of human sexuality. "It denies minorities their dignity," she claims.

Roughgarden hopes to replace such thinking with "a unifying theory" that will celebrate the diversity of sexual and gender expression, rather than repress it. When *Evolution's Rainbow* hits the shelves, we shall see whether the world is ready to embrace her vision. ■

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Making a splash: could a new theory of 'social inclusion' explain female spotted hyenas' unusual anatomy?