

# Sex: Advantage

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Advanced article

Article Contents

- Introduction
- Theories and Tests for the Advantage of Sex

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One of the most important unanswered questions in evolutionary biology is why sexual reproduction is so common. In theory, sex is so costly that individuals that reproduce sexually should be at a major disadvantage relative to asexually reproducing competitors. This leads to the expectation that sex should lose in competition with asexual reproduction and thus be rare in nature, which is in striking contrast to its widespread occurrence. It is this profound disconnect between theory and reality that has motivated decades of research into potential advantages of sexual reproduction. While much progress has come from these efforts, why sex predominates is still unclear. It is likely that part of the answer is linked to an advantage of sex under pressure from coevolving parasites. Other important processes may be more efficient clearance of deleterious mutations and other costs associated with asexuality that are not direct consequences of the lack of recombination.

## Introduction

### What is sexual reproduction?

Sexual reproduction is defined as the production of offspring via recombination between two distinct parental genomes (recently reviewed in Schurko *et al.*, 2009). Nearly all eukaryotic taxa are sexual, at least some of the time. Why sexual reproduction is so common is paradoxical because sex is extremely costly relative to asexual

reproduction and should thus be lost when sexuals experience direct competition with asexuals. See also: DNA Recombination; Linkage and Crossing over; Variation, Within Species; Introduction

### Costs of sexual reproduction

#### The cost of males

The most important cost of sex is that of male production (Maynard Smith, 1978). The cost of males is best illustrated by a comparison of the growth rate of otherwise equal sexual and asexual populations. Females that reproduce asexually only make daughters, whereas sexual females produce both sons and daughters. This discrepancy in the rate of daughter production has important consequences when sexual and asexual females compete for the same resources. If all else is equal between the two groups (e.g., females have similar life histories, physiological tolerances, dietary needs, biological enemies and habitat preferences, and are sympatric), sexual females are predicted to lose in competition to asexual females. This is simply because males do not make offspring directly, and thus do not contribute to the growth rate of the sexual population (Figure 1). Hence, the cost of males refers to the slower growth rate of the sexual population caused by male production. Modelling the severity of this cost reveals that a sexual population of  $10^5$  individuals (sex ratio 1:1) is expected to succumb to an invasion of a single asexual mutant in less than 50 generations (Lively, 1996). The rapidity with which sex is expected to be lost is why the maintenance of sex under the pressure of invading asexuals is such an intriguing problem for evolutionary biologists. Clearly, whichever mechanism(s) are maintaining sex must operate rapidly enough that they can generate advantages for sex within a few dozen generations. See also: Fitness and Selection; Natural Selection; Sex Ratio

#### The cost of recombination

Recombination has a direct cost in organisms that are well adapted to their environment: it breaks apart favourable gene combinations ('recombination load'; recently reviewed in Otto, 2009). It is not currently clear how common or important recombination load is when

ELS subject area: Evolution and Diversity of Life

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# Sex And Advantage

**International Labour Office**



## **Sex And Advantage:**

*The Evolution of Sex and its Consequences* S.C. Stearns,2013-11-21      The Evolution of Sex Sir Patrick Geddes,John Arthur Thomson,1889      Evolutionary Interpretations of Aging, Disease Phenomenon, and Sex Giacinto Libertini,2011

Handbook of Employee Benefits and Administration Christopher G. Reddick,Jerrell D. Coggburn,2008-04-09 Fiscal realities and changing social priorities are requiring a dramatic shift in the way that benefits are selected and awarded to employees especially in the public sector This means that public administrators and policy researchers must consider new parameters and contingencies both financial and social when evaluating choices and making pol      *Sex, God, and the Brain* Andrew Newberg,2024-08-06 For the modern world it seems as if sexuality and spirituality have always been at odds But what if the two are actually deeply connected And what if science could prove this connection From neuroscientist Andrew Newberg *Sex God and the Brain* argues that our religious and spiritual experiences derive directly from our sexual being While others have speculated on a connection between religion and sex Newberg is the first to demonstrate with groundbreaking brain scan research gained through Orgasmic Meditation studies that the underlying biological mechanism of religious spiritual and sexual experiences are identical With research technical enough for academics but explained simply enough for the everyday reader *Sex God and the Brain* will reframe our understanding of the link between spirituality and sexuality      **College Sex - Philosophy for Everyone** Michael Bruce,Robert M. Stewart,2011-01-11 Written with insight and humor *College Sex Philosophy for Everyone* investigates a broad array of philosophical issues relating to student sex Examines the ethical issues of dating cheating courtship homosexual experimentation and drug and alcohol use Considers student teacher relationships sexual experimentation the meaning of sex in a college setting and includes two essays based on influential research projects on friends with benefits Many of the authors teach classes that explore the philosophy of love and sex and most are scholars from the Society of the Philosophy of Sex and Love      Sex Differences in Neurology and Psychiatry ,2020-09-30 *Sex Differences in Neurology and Psychiatry* Volume 175 addresses this important issue by viewing major neurological and psychiatric conditions through the lens of sexual dimorphism providing an entirely novel approach to understanding vulnerability factors as well as potential new treatment strategies in several common neuropsychiatric disorders The handbook comprises four major sections 1 Introduction to sex differences in neuroanatomy and neurophysiology 2 Description of the impact of genetic epigenetic sex hormonal and other environmental effects on cerebral sex dimorphism 3 Review of sex differences in neurologic disorders and 4 Review of sex differences in psychiatric disorders Explores sex differences in human neuroanatomy and neurophysiology Offers a pathway toward a gender specific treatment of neurologic and psychiatric disorders Provides an overview of the genetics of sex hormones human brain structure and function as well as the epigenetics environment and social context      WOMEN & ECONOMICS: A Study of the Economic Relation between Men and Women as a Factor in Social Evolution Charlotte Perkins Gilman,2017-08-07 Women and

Economics is a book written by Charlotte Perkins Gilman and published in 1898. It is considered by many to be her single greatest work and as with much of Gilman's writing the book touched a few dominant themes: the transformation of marriage, the family and the home with her central argument the economic independence and specialization of women as essential to the improvement of marriage, motherhood, domestic industry and racial improvement. The 1890s were a period of intense political debate and economic challenges with the Women's Movement seeking the vote and other reforms. Women were entering the work force in swelling numbers seeking new opportunities and shaping new definitions of themselves. It was near the end of this tumultuous decade that Gilman's very popular book emerged. Charlotte Perkins Gilman 1860-1935 was a prominent American feminist sociologist, novelist, writer of short stories, poetry and nonfiction and a lecturer for social reform.

**Domestic Partner Benefits** Todd A. Solomon, 2006      **Good Sex** Raymond A. Belliotti, 1993. Rules about sexuality written and unwritten have existed in every culture as have disagreements over what is and isn't acceptable. Must morally permissible sex have only one function? Must it be heterosexual? Must it occur within the confines of the institution of marriage? Must it be accompanied by requisite emotions such as love and intimacy?      The Women Founders Patricia Madood Lengermann, Gillian Niebrugge, 2006-12-31. An essential volume for anyone interested in the history of sociology, the development of sociological theory or the history of women in the profession. This well researched, compellingly argued book makes the case for the active and significant presence of women in the creation of sociology and social theory in its founding and classic periods. Further, Lengermann and Niebrugge explain how the women came to be erased from the history of sociology and identify the political and intellectual currents that now make their recovery both possible and important. The volume focuses on 15 women in eight chapters. Each chapter begins with a biographical sketch situating each thinker's ideas in a historical, social and cultural context. Next, the authors analyze the woman's theory, summarizing its underlying assumptions, explicating its major themes and introducing key vocabulary. The chapter concludes with excerpts from the original texts of the women founders. All the theories discussed in this text share a moral commitment to the idea that sociology should and could work for the alleviation of socially produced human pain. The ethical duty of the sociologist is to seek sound scientific knowledge to refuse to make the knowledge an end in itself, to speak for the disempowered, to advocate social reform and to never forget that the appropriate relationship between researcher and subject is one of mutuality.

*The Descent of Man and Selection in Relation to Sex* Charles Darwin, 1901      **Domestic Partner Benefits for Federal Employees** United States. Congress. Senate. Committee on Homeland Security and Governmental Affairs, 2009      **New Directions in Sex Therapy** Peggy J. Kleinplatz, 2024-10-09. *New Directions in Sex Therapy: Innovations and Alternatives* Third Edition focuses on new and cutting edge therapy paradigms as alternatives to conventional clinical strategies, challenging practitioners to expand our thinking about how to deal with sexual concerns. In the third edition of this award winning book, Peggy J. Kleinplatz, Ph.D., brings together the best therapists and sexologists to advance beyond predominant

approaches to sexual difficulties Part I highlights the major problems and criticisms facing sex therapy and furnishes a rationale for new directions with chapters on ethics heteronormativity and comprehensive sexual education healthcare as human rights issues Part II demonstrates new approaches to dealing with traditional sex therapy concerns including sexual desire discrepancies difficulties with erections and orgasms and sexuality in older couples There is also attention to concerns typically overlooked including those related to consensual nonmonogamy sexuality and disability and marginalized populations This edition is replete with helpful new clinical illustrations across the spectrum of theoretical orientations such as EFT EFIT narrative relational psychodynamic CBT experiential and group therapy modalities to demonstrate these approaches in action There are also queer informed perspectives on sex and relationships and innovative contributions on the person of the therapist and on promoting optimal erotic intimacy This book is intended for students and clinicians who deal with sexual issues and concerns in therapy clinicians of every kind novices and advanced practitioners rather than only those who define themselves as sex therapists

**Battleground: Sports** Michael Atkinson, 2008-12-30 Mega events like the Olympics the World Cup of soccer the World Series of baseball cycling s Tour de France and the Super Bowl draw our attention to the deep cultural significance of sport and its role in fostering social bonds Yet when it comes to sport there is no shortage of debate stereotypes regarding sexuality race gender and children have been hotly contested by critics for over 40 years Even today sport is one of the very few socially accepted sites of violence intense competition and controlled forms of social disorder Battleground Sports presents the 100 most contentious public and private controversies of the sports world Highlighted throughout are debates surrounding ethnicity gender sexuality and social identity sports fan behavior as well as the role of governments and corporations Engaging and accessible to a wide variety of readers this fascinating reference illustrates how sports controversies reflect the historically enduring and changing nature of our broader cultures and the social battles we engage on a day to day basis surrounding the struggles for equality debates about social violence the ethics of competition the politics of civic life the creation of global communities and the State s role in protecting citizens Entries contain an array of thoughtful perspectives on historic and current controversies and allow readers to formulate their own conclusions Enhanced with a timeline a thorough guide of print and electronic resources for high school and undergraduate student research this one stop reference goes beyond the newspaper headlines to provide readers with a guide map for understanding what sport controversies teach us about our culture and ourselves

*Pathways to Sexual Aggression* Jean Proulx, Eric Beauregard, Patrick Lussier, Benoit Leclerc, 2014-03-14 Most people who read an article in the newspaper about the brutal rape of a woman by a stranger or the long standing sexual abuse of a young boy by his step father have a strong visceral reaction which is a mix of anger fear and incomprehension Apart from these aversive reactions several questions also come to people s minds Was this offender crazy or sexually obsessed What is the purpose of such outrageous acts To answer these questions the authors of this book review theoretical and empirical models of the processes that lead men to

sexually assault children or women whilst also presenting new results and models on this topic In particular this book focuses on empirical analyses of the pathways of six types of sexual aggressors three of which marital rapists hebephilic sexual aggressors and polymorphic sexual aggressors have never been investigated before Drawing on a large dataset on the offending processes of sexual aggressors this book analyzes the influence of personality factors and lifestyle factors on offending pathways and brings together key researchers in the field of sexual aggression This book will be of interest to psychologists psychiatrists criminologists and social workers involved in the study assessment and treatment of sexual aggressors In addition this information will be crucial for practitioners involved in the follow up of these offenders in the community and will interest researchers and graduate students in the field of sexual aggression

**The Evolution of Sex Determination** Leo Beukeboom,Nicolas Perrin,2014-06-12 Sexual reproduction is a fundamental aspect of life It is defined by the occurrence of meiosis and the fusion of two gametes of different sexes or mating types Sex determination mechanisms are responsible for the sexual fate and development of sexual characteristics in an organism be it a unicellular alga a plant or an animal In many cases sex determination is genetic males and females have different alleles or different genes that specify their sexual morphology In animals this is often accompanied by chromosomal differences In other cases sex may be determined by environmental e g temperature or social variables e g the size of an organism relative to other members of its population Surprisingly sex determination mechanisms are not evolutionarily conserved but are bewilderingly diverse and appear to have had rapid turnover rates during evolution Evolutionary biologists continue to seek a solution to this conundrum What drives the surprising dynamics of such a fundamental process that always leads to the same outcome two sex types male and female The answer is complex but the ongoing genomic revolution has already greatly increased our knowledge of sex determination systems and sex chromosomes in recent years This novel book presents and synthesizes our current understanding and clearly shows that sex determination evolution will remain a dynamic field of future research The Evolution of Sex Determination is an advanced research level text suitable for graduate students and researchers in genetics developmental biology and evolution

**Compulsory Sickness Insurance** International Labour Office,1927

**The Case for Marriage** Linda Waite,Maggie Gallagher,2001-10-09 A groundbreaking look at marriage one of the most basic and universal of all human institutions which reveals the emotional physical economic and sexual benefits that marriage brings to individuals and society as a whole The Case for Marriage is a critically important intervention in the national debate about the future of family Based on the authoritative research of family sociologist Linda J Waite journalist Maggie Gallagher and a number of other scholars this book s findings dramatically contradict the anti marriage myths that have become the common sense of most Americans Today a broad consensus holds that marriage is a bad deal for women that divorce is better for children when parents are unhappy and that marriage is essentially a private choice not a public institution Waite and Gallagher flatly contradict these assumptions arguing instead that by a broad range of indices marriage is actually better for

you than being single or divorced physically materially and spiritually They contend that married people live longer have better health earn more money accumulate more wealth feel more fulfillment in their lives enjoy more satisfying sexual relationships and have happier and more successful children than those who remain single cohabit or get divorced The Case for Marriage combines clearheaded analysis penetrating cultural criticism and practical advice for strengthening the institution of marriage and provides clear essential guidelines for reestablishing marriage as the foundation for a healthy and happy society A compelling defense of a sacred union The Case for Marriage is well written and well argued empirically rigorous and learned practical and commonsensical William J Bennett author of The Book of Virtues Makes the absolutely critical point that marriage has been misrepresented and misunderstood The Wall Street Journal [www.broadwaybooks.com](http://www.broadwaybooks.com)

*The East, the West, and Sex* Richard Bernstein, 2010-07-27 In this wide ranging history Richard Bernstein explores the connection between sex and power as it has played out between Eastern cultures and the Western explorers merchants and conquerors who have visited them This illuminating book describes the historical and ongoing encounter between these travelers and the morally ambiguous opportunities they found in foreign lands Bernstein's narrative teems with real figures from Marco Polo and his investigation into the harem of Kublai Khan the nineteenth century American missionary Isabella Thoburn and her efforts to stamp out the sinfulness of the Mughal culture of India Gustave Flaubert and his dalliances with Egyptian prostitutes to modern day sex tourists in Southeast Asia as well as the women that they both exploit and enrich Provocative and insightful *The East The West and Sex* is a lucid look at a pervasive and yet mostly ignored subject

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## **Table of Contents Sex And Advantage**

1. Understanding the eBook Sex And Advantage
  - The Rise of Digital Reading Sex And Advantage
  - Advantages of eBooks Over Traditional Books
2. Identifying Sex And Advantage
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Sex And Advantage
  - User-Friendly Interface
4. Exploring eBook Recommendations from Sex And Advantage
  - Personalized Recommendations
  - Sex And Advantage User Reviews and Ratings
  - Sex And Advantage and Bestseller Lists
5. Accessing Sex And Advantage Free and Paid eBooks
  - Sex And Advantage Public Domain eBooks
  - Sex And Advantage eBook Subscription Services
  - Sex And Advantage Budget-Friendly Options
6. Navigating Sex And Advantage eBook Formats



- ePub, PDF, MOBI, and More
- Sex And Advantage Compatibility with Devices
- Sex And Advantage Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Sex And Advantage
  - Highlighting and Note-Taking Sex And Advantage
  - Interactive Elements Sex And Advantage
- 8. Staying Engaged with Sex And Advantage
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Sex And Advantage
- 9. Balancing eBooks and Physical Books Sex And Advantage
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Sex And Advantage
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Sex And Advantage
  - Setting Reading Goals Sex And Advantage
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Sex And Advantage
  - Fact-Checking eBook Content of Sex And Advantage
  - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
- 14. Embracing eBook Trends
  - Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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