

THE CONCEPT OF EFFECTIVE RECOMBINATION RATE AND ITS APPLICATION IN SPECIATION THEORY

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The goal of this study is to develop a unifying theoretical framework to quantify the strength of reproductive isolation. We propose the use of the "effective recombination rate," which measures how fast associations of genes are broken by interlocus recombination. Applying the well-established theory of the effective migration rate, we derive two techniques to investigate the effective recombination rate in models of speciation: the weak migration approximation for parapatric scenarios and the weak recombination approximation for sympatric scenarios. We illustrate the use of these two methods by two examples each: (1) single-locus genetic incompatibility and (2) two-locus genetic incompatibility for the first method, and (3) assortative mating and (4) assortative mating combined with disruptive selection for the second method. An advantage of the effective recombination rate over previous approaches is that it integrates gene flow in both directions into a single index measuring the strength of isolation. This enables straightforward comparisons of speciation scenarios with the same or different geographic histories. The method also allows us to evaluate the relative contributions of F2 hybrid deficiency or linkage between multiple barriers in reproductive isolation.

KEY WORDS: Effective migration rate, gene flow, isolating barrier, linkage disequilibrium, reproductive value.

Speciation is one of the fundamental evolutionary puzzles that Darwin essentially failed to address in the *Origin of Species* despite the title of the book. Not to mention empirical researchers (Coyne and Orr 2004; Widmer et al. 2009), this challenging problem intrigued many theoreticians (Turelli et al. 2001; Gavrillets 2004). They contributed numerous mathematical and simulation models, which revealed how species can diverge through various evolutionary mechanisms (Gavrillets 2003, 2004; Dieckmann et al. 2004). Speciation models are still increasing in number, continuously bringing novel ideas and renewing our understanding (e.g., Proulx and Servodio 2009; Barton and de Cara 2009; van Doorn et al. 2009). A consequence of this growth is "balkaniza-

tion" of the subject (Kirkpatrick and Ravigne 2002), which makes synthetic and unifying work important. A major problem in synthesis is, however, that many of the modeling studies focus on conditions for speciation to occur. Given the inherent complexity of speciation, it is usually difficult to extract analytical conditions for speciation from realistic models. Therefore, modelers often use computer simulations with limited parameter values. This makes comparisons between different studies difficult or impossible. Thus, it is an important question what aspect of speciation, if not "occurrence," we can focus on to get a more synthetic view.

We would like to direct attention to consequences of, rather than conditions for, reproductive isolation and speciation, that is,

Speciation And The Recognition Concept Theory And Application

David H. Lane



Speciation And The Recognition Concept Theory And Application:

Speciation and the Recognition Concept David M. Lambert, Hamish G. Spencer, 1995 Developed by Hugh E H Paterson in the 1970s the Recognition Concept of Species stressed the importance of the Specific Mate Recognition System SMRS and offered a view of species which was radically different from the traditional Isolation Concept Paterson held that new species were formed through incidental changes in the SMRS rather than being directly promoted In the two decades since Paterson first advanced his theory evolutionary biologists around the world have had the opportunity to use this approach in their work Speciation and the Recognition Concept is the first book to bring together a group of leading researchers to examine the relevance of Paterson's ideas today for this important topic in evolutionary biology Representing a wide variety of viewpoints the contributors explore the consequences of applying the concept to areas as diverse as the fossil record insect taxonomy the structure of mate recognition systems speciation models and the concept function in biology The Recognition Concept of species write the editors is important to biology because it represents an innovative approach to the resolution of the problem of biological diversity The concept is based upon an analysis of the logic and language of species studies Consequently it offers significant implications for ideas about the origin of species **Evolutionary Genetics** R. S. Singh, Costas B. Krimbas, 2000-03-28 This book brings out the central role of evolutionary genetics in all aspects of its connection to evolutionary biology Molecular Biology and Genetics of the Lepidoptera Marian R. Goldsmith, Frantisek Marec, 2009-09-01 Numerous and charismatic the Lepidoptera is one of the most widely studied groups of invertebrates Advances in molecular tools and genomic techniques have reduced the need for large sizes and mass rearing and lepidopteran model systems are increasingly used to illuminate broad based experimental questions as well as those peculiar to butterflies Putting the spotlight on the second most numerous order of insects living today this book provides a summary of cutting edge studies of the Lepidoptera as an organism in and of itself and as model systems Leading researchers discuss symbiosis genomes sex determination natural products ecophysiology sensory systems pest control the sterile insect technique immunity and evolution development Understanding the biology and genetics of butterflies and moths may lead to new species selective methods of control saving billions of dollars in pesticide use and protecting environmental and human health making the sections on pest control and the sterile insect technique extremely important Vital Apologetic Issues Roy B. Zuck, 2012-12-01 Vital Apologetic Issues Vital pertaining to life essential of critical importance Apologetic a systematic defense of the authenticity and authority of Christian truth Issues a point or matter the decision of which is of special or public importance When it comes to giving a reasoned defense of one's faith just knowing definitions isn't enough It helps to have reliable guidance through the critical issues of apologetics such as philosophical questions regarding the Christian faith or biblical reliability Vital Apologetic Issues Examining Reason and Revelation in Biblical Perspective draws upon the insights and study of numerous evangelical scholars and writers to address crucial questions in the field of Christian apologetics

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Principles of Human Evolution Robert Andrew Foley, Roger Lewin, 2013-05-03 Principles of Human Evolution presents an in depth introduction to paleoanthropology and the study of human evolution Focusing on the fundamentals of evolutionary theory and how these apply to ecological molecular genetic paleontological and archeological approaches to important questions in the field this timely textbook will help students gain a perspective on human evolution in the context of modern biological thinking The second edition of this successful text features the addition of Robert Foley a leading researcher in Human Evolutionary Studies to the writing team Strong emphasis on evolutionary theory ecology and behavior and scores of new examples reflect the latest evolutionary theories and recent archaeological finds More than a simple update the new edition is organized by issue rather than chronology integrating behavior adaptation and anatomy A new design and new figure references make this edition more accessible for students and instructors New author Robert Foley leading figure in Human Evolutionary Studies joins the writing team Dedicated website www.blackwellpublishing.com/lewin provides study resources and artwork downloadable for Powerpoint presentations Beyond the Facts boxes explore key scientific debates in greater depth Margin Comments indicate the key points in each section Key Questions review and test students knowledge of central chapter concepts and help focus the way a student approaches reading the text New emphasis on ecological and behavioral evolution in keeping with modern research Fully up to date with recent fossil finds and interpretations integration of genetic and paleoanthropological approaches

Catalogue of the Cicadoidea (Hemiptera: Auchenorrhyncha) Allen F. Sanborn, 2013-10-31 This is the third in a series of catalogs and bibliographies of the Cicadoidea covering 1981 2010 The work summarizes the cicada literature providing a means for easy access to information previously published on a particular species or to allow researchers the ability to locate similar work that has been published on other species A total of 2 591 references are included in the bibliography The book is a source of biological and systematic information that could be used by zoologists entomologists individuals interested in crop protection and students studying entomology as well as anyone interested in cicadas or who require specific information on the insects Each genus species is identified with the reference the page number any figures if applicable the topics covered by the reference any synonymies and any biogeographic information mentioned for the species in the individual reference An added benefit to the catalog is that it is the first complete species list for the Cicadoidea including all synonymies and new combinations through 2012 Provides nearly four times the number of references of the previous catalog demonstrating the explosion of data since that time Contains all references found that mention a genus or species name in the work Includes more than 300 additional references that were not in the two previous works on this subject Features the first complete species list for the Cicadoidea

including all synonymies Evolution of the House Mouse Miloš Macholán, 2012-07-19 A detailed review of the evolutionary context necessary to interpret patterns and processes in the age of mouse genomics **The Phenomenon of Teilhard** David H. Lane, 1996 New Age writer of the popular Aquarian Conspiracy Marilyn Ferguson observed that many of the leading lights of the New Age movement claim Teilhard as one of the most influential persons in their lives Other influences acknowledged include C G Jung Aldous Huxley Swami Muktananda Thomas Merton Werner Erhard and Maharishi Yogi Indeed of the 185 New Age leaders surveyed Teilhard was the most frequently mentioned of any person who had most influenced their thinking If this is the case then if we are to understand the New Age movement properly it behooves us to take a careful and critical look at Teilhard de Chardin David Lane has done precisely this in a clear well documented and penetrating way In this crucial book David Lane lays bare the philosophical theological and scientific failures of Teilhard's New Age enterprise In a highly documented and insightful scrutiny of Teilhard's cosmic evolution Lane unveils the apostate Christian roots of one of the most important forerunners of the New Age movement This is one of the most significant and serious treatments of the modern roots of the New Age in print **Species, Species Concepts and Primate Evolution**

William H. Kimbel, Lawrence B. Martin, 2013-12-18 A world of categories devoid of spirit waits for life to return Saul Bellow Humboldt's Gift The stock in trade of communicating hypotheses about the historical path of evolution is a graphical representation called a phylogenetic tree In most such graphics pairs of branches diverge from other branches successively marching across abstract time toward the present To each branch is tied a tag with a name a binominal symbol that functions as does the name given to an individual human being On phylogenetic trees the names symbolize species What exactly do these names signify What kind of information is communicated when we claim to have knowledge of the following types *Tetodonius mathewzi* was ancestral to *Pseudotetodonius ambiguus* The sample of fossils attributed to *Homo habilis* is too variable to contain only one species Interbreeding populations of savanna baboons all belong to *Papio anubis* *Hylobates lar* and *H. pileatus* interbreed in zones of geographic overlap While there is nearly universal agreement that the notion of the species is fundamental to our understanding of how evolution works there is a very wide range of opinion on the conceptual content and meaning of such particular statements regarding species This is because oddly enough evolutionary biologists are quite far from agreement on what a species is how it attains this status and what role it plays in evolution over the long term

Darwin and the Nature of Species David N. Stamos, 2012-02-01 Since the 1859 publication of *On the Origin of Species* the concept of species in biology has been widely debated with its precise definition far from settled And yet amazingly there have been no books devoted to Charles Darwin's thinking on the term until now David N Stamos gives us a groundbreaking historical reconstruction of Darwin's detailed yet often misinterpreted thoughts on this complex concept Stamos provides a thorough and detailed analysis of Darwin's extensive writings both published and unpublished in order to reveal Darwin's actual species concept Stamos argues that Darwin had a unique evolutionary species concept in mind one that was not at all

a product of his time Challenging currently accepted views that believe Darwin was merely following the species ascriptions of his fellow naturalists Stamos works to prove that this prevailing nominalistic view should be overturned This book also addresses three issues pertinent to the philosophy of science the modern species problem the nature of concept change in scientific revolutions and the contextualist trend in professional history of science **Autecology** Gimme H. Walter,Rob Hengeveld,2014-04-24 This book spells out the theoretical structure methodology and philosophy of the science of autecology The autecological approach focuses on the interactions of individual organisms and their species specific adaptations with the spatio temporal dynamics of their environment as a basis for interpreting patterns of diversity and abundance in nat

The Handbook of Historical Linguistics Brian Joseph,Richard Janda,2008-04-15 The Handbook of Historical Linguistics provides a detailed account of the numerous issues methods and results that characterize current work in historical linguistics the area of linguistics most directly concerned with language change as well as past language states Contains an extensive introduction that places the study of historical linguistics in its proper context within linguistics and the historical sciences in general Covers the methodology of historical linguistics and presents sophisticated overviews of the principles governing phonological morphological syntactic and semantic change Includes contributions from the leading specialists in the field **Acoustic Communication in Insects and Anurans** H. Carl Gerhardt,Franz Huber,2002-07-15 Walk near woods or water on any spring or summer night and you will hear a bewildering and sometimes deafening chorus of frog toad and insect calls How are these calls produced What messages are encoded within the sounds and how do their intended recipients receive and decode these signals How does acoustic communication affect and reflect behavioral and evolutionary factors such as sexual selection and predator avoidance H Carl Gerhardt and Franz Huber address these questions among many others drawing on research from bioacoustics behavior neurobiology and evolutionary biology to present the first integrated approach to the study of acoustic communication in insects and anurans They highlight both the common solutions that these very different groups have evolved to shared challenges such as small size ectothermy cold bloodedness and noisy environments as well as the divergences that reflect the many differences in evolutionary history between the groups Throughout the book Gerhardt and Huber also provide helpful suggestions for future research

Defining Species John S. Wilkins,2009 This book was listed as a CHOICE Outstanding Academic Title in 2011 Defining Species A Sourcebook from Antiquity to Today provides excerpts and commentary on the definition of species from source material ranging from the Greeks through the middle ages to the modern era It demonstrates that the logical meaning of species is in direct contrast to the use of kind terms and concepts in natural history and biology and that the myth that biologists or natural historians were ever essentialists about kinds is mistaken *Insect Pheromone Research* R.T. Carde,A.K. Minks,2012-12-06 This book contains the proceedings of the First International Symposium on Insect Pheromones which was held at Wageningen The Netherlands from March 6 to March 11 1994 Eighty participants from 17 countries

attended the symposium which turned out to be a unique forum for the exchange of the latest worldwide findings on insect pheromones an opportunity to discuss and debate unsettled issues and a mechanism to define new directions in pheromone research and foster interdisciplinary collaborations The meeting comprised five sessions representing the breadth of disciplinary interest in pheromones a typical characteristic of this research area In the sessions the following topics were presented 1 control of pheromone production organized by W L Roelofs 2 sensory processing of pheromone signals T L Payne 3 neuroethology of pheromone mediated responses T C Baker 4 use of pheromones in direct control A K Minks and R T Card6 and 5 evolution of pheromone communication c LOfstedt All sessions started with a series of 30 minute lectures after which ample time was reserved for discussion In each session some participants were asked to serve as discussants and to initiate and stimulate discussion and a rapporteur was recruited to make notes of these discussions and to summarize the general trends emerging from the session The general program ming of the symposium was in the hands of R T Carde A K Minks and T L Payne

Insect Sounds and Communication Sakis Drosopoulos, Michael F. Claridge, 2005-11-02 While we may have always assumed that insects employ auditory communication our understanding of it has been impeded by various technical challenges In comparison to the study of an insect s visual and olfactory expression research in the area of acoustic communication has lagged behind Filling this void Insect Sounds and Communication is the **Species** John S.

Wilkins, 2009-09-08 The complex idea of species has evolved over time yet its meaning is far from resolved This comprehensive work takes a fresh look at an idea central to the field of biology by tracing its history from antiquity to today John S Wilkins explores the essentialist view a staple of logic from Plato and Aristotle through the Middle Ages to fairly recent times and considers the idea of species in natural history a concept often connected to reproduction Tracing generative conceptions of species back through Darwin to Epicurus Wilkins provides a new perspective on the relationship between philosophical and biological approaches to this concept He also reviews the array of current definitions Species is a benchmark exploration and clarification of a concept fundamental to the past present and future of the natural sciences

The Morphology and Physiology of Insect Chemosensory Systems - Its Origin and Evolution Rui Tang, Xin-Cheng Zhao, 2022-11-10 **Biology of Australian Butterflies** R. L. Kitching, 1999 Brings together exciting accounts of life history strategies of a range of species as well as background information on general butterfly behaviour taxonomy and evolutionary aspects

Pheromones and Animal Behaviour Tristram D. Wyatt, 2003-02-27 We are entering one of the most exciting periods in the study of chemical communication since the first pheromones were identified some 40 years ago This rapid progress is reflected in this book the first to cover the whole animal kingdom at this level for 25 years The importance of chemical communication is illustrated with examples from a diverse range of animals including humans marine copepods *Drosophila* *Caenorhabditis elegans* moths snakes goldfish elephants and mice It is designed to be advanced but at the same time accessible to readers whatever their scientific background For students of ecology evolution and behaviour this book

gives an introduction to the rapid progress in our understanding of olfaction at the molecular and neurological level In addition it offers chemists molecular and neurobiologists an insight into the ecological evolutionary and behavioural context of olfactory communication

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Table of Contents Speciation And The Recognition Concept Theory And Application

1. Understanding the eBook Speciation And The Recognition Concept Theory And Application
 - The Rise of Digital Reading Speciation And The Recognition Concept Theory And Application
 - Advantages of eBooks Over Traditional Books
2. Identifying Speciation And The Recognition Concept Theory And Application
 - 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 Speciation And The Recognition Concept Theory And Application
 - User-Friendly Interface

4. Exploring eBook Recommendations from Speciation And The Recognition Concept Theory And Application
 - Personalized Recommendations
 - Speciation And The Recognition Concept Theory And Application User Reviews and Ratings
 - Speciation And The Recognition Concept Theory And Application and Bestseller Lists
5. Accessing Speciation And The Recognition Concept Theory And Application Free and Paid eBooks
 - Speciation And The Recognition Concept Theory And Application Public Domain eBooks
 - Speciation And The Recognition Concept Theory And Application eBook Subscription Services
 - Speciation And The Recognition Concept Theory And Application Budget-Friendly Options
6. Navigating Speciation And The Recognition Concept Theory And Application eBook Formats
 - ePub, PDF, MOBI, and More
 - Speciation And The Recognition Concept Theory And Application Compatibility with Devices
 - Speciation And The Recognition Concept Theory And Application Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Speciation And The Recognition Concept Theory And Application
 - Highlighting and Note-Taking Speciation And The Recognition Concept Theory And Application
 - Interactive Elements Speciation And The Recognition Concept Theory And Application
8. Staying Engaged with Speciation And The Recognition Concept Theory And Application
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Speciation And The Recognition Concept Theory And Application
9. Balancing eBooks and Physical Books Speciation And The Recognition Concept Theory And Application
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Speciation And The Recognition Concept Theory And Application
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Speciation And The Recognition Concept Theory And Application
 - Setting Reading Goals Speciation And The Recognition Concept Theory And Application
 - Carving Out Dedicated Reading Time

12. Sourcing Reliable Information of Speciation And The Recognition Concept Theory And Application
 - Fact-Checking eBook Content of Speciation And The Recognition Concept Theory And Application
 - 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

Speciation And The Recognition Concept Theory And Application Introduction

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