

The Species Problem and Polar Bear Evolution

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Abstract

It has been more than 70 years since the Modern Evolutionary Synthesis (hereafter, the Modern Synthesis) updated Darwin's evolutionary principles with the addition of population genetics. The Modern Synthesis has faced numerous criticisms since then but one of the most serious and long-standing has been the "Species Problem": the fact that it still cannot explain the mechanism by which new species arise. Speciation is fundamental to evolution and one of the things we have learned in the last few decades is that developmental change in its various permutations are often pivotal to this process. However, it has also become apparent that the details of how developmental changes operate—especially the interplay between hormones, genes, and environmental cues—may be impossible to incorporate into population genetic models. It is not enough for biologists to acknowledge in theory that developmental changes are critical to evolution if in practice the mathematical models that underpin population genetics cannot assimilate the complex hormonal factors that drive them. Here I present a radically new paradigm, updated since its inception, that incorporates developmental effects into an explicit non-mathematical model of how speciation is initiated that assumes a pivotal role for thyroid hormone and its analogues, using the speciation event that produced the polar bear, *Ursus maritimus*, as an example. This theory and its testable hypotheses provide a solution to the Species Problem and have the potential to truly revolutionize evolutionary biology.

KEY WORDS

heterochrony; population genetics; embryology; speciation; thyroid hormone; origin of species; Extended Evolutionary Synthesis; paradigm; macroevolution

Species Problem The

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Species Problem The:

The Species Problem Igor Pavlinov, 2013-02-06 The book includes collection of theoretical papers dealing with the species problem which is among most fundamental issues in biology The principal topics are consideration of the species problem from the standpoint of modern non classical science paradigm with emphasis on its conceptual status presuming its analysis within certain conceptual framework evolutionary emergence of the species as discrete unit of certain level of generality epistemological consideration of the species as a particular explanatory hypotheses with respective revised concepts of biodiversity and conservation considerations of evolutionary and phylogenomic species concepts as candidates for the universal one re appraisal of the biological species concept based on the friend foe recognition system species delimitation approach using multi locus coalescent based method a re consideration of the Darwin s species concept

The Species Problem David N. Stamos, 2003-01-01 Stamos squarely confronts the problem of determining what a biological species is whether species are real and the nature of their reality He critically considers the evolution of the major contemporary views of species and also offers his own solution to the species problem

The Species Problem Igor Ya. Pavlinov, 2023-02-24 The general notion of species is one of the most fundamental in biology But an idea of species is also one of the most persistent unresolved obsessions of biologists philosophers and theoreticians This new book investigates the multifaceted problem species as a conceptual envelope of that notion Contemporary conceptualists and evolutionary epistemology allow for a fresh look by analyzing the framework of history viewed as changes ordered by changing philosophical scientific contexts In this analysis the species problem is characterized in a pluralistic non trivial manner in contrast to a more monistic accepted view

Key Features Provides new insights into the persistent species problem Focuses on conceptual history and identifies pivotal landmarks in the history of the concept of species Argues for a scientific consistency of species pluralism Discusses the evolving species hood in the context of new essentialism

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candidates for the universal one species delimitation approach employing multi locus coalescent based technique
epistemological view of the species as a specific explanatory hypotheses review of species concept proposed by Darwin

Species Problems and Beyond John S. Wilkins, Frank E. Zachos, Igor Ya. Pavlinov, 2022-06-14 *Species Problems and Beyond* offers a collection of up to date essays discussing from an interdisciplinary perspective the many ramifications of the Species Problem The authors represent experts in the philosophy of biology in species level evolutionary investigations and in biodiversity studies and conservation Some of the topics addressed concern the context sensitivity of the term species species as individuals processes natural kinds or as operative concepts species delimitation in the age of Big genomic Data and taxonomic inflation and its consequences for conservation strategies The carefully edited volume will be an invaluable resource for philosophers of biology and evolutionary biologists alike Olivier Rieppel Rowe Family Curator of Evolutionary Biology Negaunee Integrative Research Center Field Museum USA *Species or the Species Problem* is a topic in science in the philosophy of science and in general philosophy In fact it encompasses many aspects of the same problem and these are dealt with in this volume Species are often thought of as fundamental units of biological matter to be used in ecology conservation classification and biodiversity The chapters in this book present opposing views on the current philosophical and conceptual issues of the Species Problem in biology Divided into four sections Concepts and Theories Practice and Methods Ranks and Trees and Names and Metaphysics and Epistemologies the book is authored by biologists philosophers and historians many leaders in their fields Topics include ontology of species definitions of both species category and units species rank speciation issues nomenclature ecology and species conservation *Species Problems and Beyond* aims to clarify the contemporary issues of the Species Problem It is ideal for use in upper level seminars and courses in Evolutionary Biology Philosophy of Science Philosophy of Biology Systematics and Taxonomy and Phylogenetics Cladistics and for any scholar in these fields *The Species Problem* David N. Stamos, 2003-03-17 Stamos squarely confronts the problem of determining what a biological species is whether species are real and the nature of their reality He critically considers the evolution of the major contemporary views of species and also offers his own solution to the species problem *The Endangered Species Problem* Daniel R. Faust, 2021-07-15 In 2018 three species of birds went extinct These species are gone forever and many more species of plants and animals are in danger of going extinct every year Scientists estimate that almost half of the species on Earth could be extinct by 2050 This volume looks at the issue of endangered species and the impact that human activity has on the many plants and animals that share our planet Colorful photographs primary sources and helpful graphics illustrate the conservation efforts made by scientists and lawmakers around the world This book will encourage your young readers to take an active role in solving this problem **Great Lakes Restoration** United States. Congress. Senate. Committee on Environment and Public Works, 2004 *Biological Classification* Richard A. Richards, 2016-09-08 This book is a comprehensive introduction to the philosophical foundations and development of modern biological classification **The**

History of the Race Idea Eric Voegelin, 1998 By the middle of the eighteenth century the effort of philosophy was to place man with his variety of physical manifestations throughout the world within a systemic order of nature Voegelin perceives the problem of race as the epitome of the difficulties presented by this new theoretical approach

Biodiversity II A Joseph Henry Press book, 1996-10-16 The book before you carries the urgent warning that we are rapidly altering and destroying the environments that have fostered the diversity of life forms for more than a billion years With those words Edward O Wilson opened the landmark volume Biodiversity National Academy Press 1988 Despite this and other such alarms species continue to vanish at a rapid rate taking with them their genetic legacy and potential benefits Many disappear before they can even be identified Biodiversity II is a renewed call for urgency This volume updates readers on how much we already know and how much remains to be identified scientifically It explores new strategies for quantifying understanding and protecting biodiversity including New approaches to the integration of electronic data including a proposal for a U S National Biodiversity Information Center Application of techniques developed in the human genome project to species identification and classification The Gap Analysis Program of the National Biological Survey which uses layered satellite climatic and biological data to assess distribution and better manage biodiversity The significant contribution of museum collections to identifying and categorizing species which is essential for understanding ecological function and for targeting organisms and regions at risk The book describes our growing understanding of how megacenters of diversity e g rainforest insects coral reefs are formed maintained and lost what can be learned from mounting bird extinctions and how conservation efforts for neotropical primates have fared It also explores ecosystem restoration sustainable development and agricultural impact Biodiversity II reinforces the idea that the conservation of our biological resources is within reach as long as we pool resources better coordinate the efforts of existing institutions museums universities and government agencies already dedicated to this goal and enhance support for research collections and training This volume will be important to environmentalists biologists ecologists educators students and concerned individuals

Biological Systematics Igor Pavlinov, 2021-03-25 This volume reviews the historical roots and theoretical foundations of biological systematics in an approachable text The author outlines the structure and main tasks of systematics Conceptual history is characterized as a succession of scientific revolutions The philosophical foundations of systematic research are briefly reviewed as well as the structure and content of taxonomic theories Most important research programs in systematics are outlined The book includes analysis of the principal problematic issues as scientific puzzles in systematics This volume is intended for professional taxonomists biologists of various specialties students as well as all those interested in the history and theory of biology and natural sciences Key Features Considers the conceptual history of systematics as the framework of evolutionary epistemology Builds a hierarchically organized quasi axiomatic system of taxonomic theory Contends that more reductionist taxonomic concepts are less objective Supports taxonomic pluralism by non classic philosophy of science as a normal condition of

systematics Documents that taxonomic puzzles result from conflict between monistic and pluralistic attitudes Related Titles de Queiroz K et al eds Phylonyms A Companion to the PhyloCode ISBN 978 1 1383 3293 5 Sigwart J D What Species Mean A User s Guide to the Units of Biodiversity ISBN 978 1 4987 9937 9 Rieppel O Phylogenetic Systematics Haeckel to Hennig ISBN 978 1 4987 5488 0 Wilkins J S Species The Evolution of the Idea 2nd ed ISBN 978 1 1380 5574 2 Understanding Evolution in Darwin's "Origin" Maria Elice Brzezinski Prestes,2023-10-10 This book aims to encourage the reading of On the Origin of Species and to include it in the teaching of evolution With a comprehensive overview of the development of Darwin s theory the volume provides relevant aspects of Darwin s life and work in connection with the broader context of his time The historical and philosophical analysis mirrored in the socio cultural scope enables the diachronic reading of the text It is built on various sources of historians and philosophers of science and sheds fresh light on them Its uniqueness is the broad structure that covers four parts the pre Darwinian concepts of species changes some key elements of Darwin s pursuit of the causes of evolution from his voyage on Beagle to the publication of his groundbreaking work chapter by chapter analysis of the Origin and subsequent developments in evolutionary thought This book is of interest to undergraduate and graduate students scholars in history philosophy and sociology of science and science education as well as the general public

Floral Mimicry Steven D. Johnson, Florian P. Schiestl, 2016-11-03 Mimicry is a classic example of adaptation through natural selection The traditional focus of mimicry research has been on defence in animals but there is now also a highly developed and rapidly growing body of research on floral mimicry in plants This has coincided with a revolution in genomic tools making it possible to explore which genetic and developmental processes underlie the sometimes astonishing changes that give rise to floral mimicry Being literally rooted to one spot plants have to cajole animals into acting as couriers for their pollen Floral mimicry encompasses a set of evolutionary strategies whereby plants imitate the food sources oviposition sites or mating partners of animals in order to exploit them as pollinators This first definitive book on floral mimicry discusses the functions of visual olfactory and tactile signals integrating them into a broader theory of organismal mimicry that will help guide future research in the field It addresses the fundamental question of whether the evolutionary and ecological principles that were developed for protective mimicry in animals can also be applied to floral mimicry in plants The book also deals with the functions of floral rewardlessness a condition which often serves as a precursor to the evolution of mimicry in plant lineages The authors pay particular attention to the increasing body of research on chemical cues their molecular basis their role in cognitive misclassification of flowers by pollinators and their implications for plant speciation Comprehensive in scope and conceptual in focus Floral Mimicry is primarily aimed at senior undergraduates graduate students and researchers in plant science and evolutionary biology *A Theory of General Ethics* Warwick Fox, 2006-09-22 With A Theory of General Ethics Warwick Fox both defines the field of General Ethics and offers the first example of a truly general ethics Specifically he develops a single integrated approach to ethics that encompasses the realms of interhuman ethics the ethics of the

natural environment and the ethics of the built environment Thus Fox offers what is in effect the first example of an ethical Theory of Everything Fox refers to his own approach to General Ethics as the theory of responsive cohesion He argues that the best examples in any domain of interest from psychology to politics from conversations to theories exemplify the quality of responsive cohesion that is they hold together by virtue of the mutual responsiveness of the elements that constitute them Fox argues that the relational quality of responsive cohesion represents the most fundamental value there is He then develops the theory of responsive cohesion central features of which include the elaboration of a theory of contexts as well as a differentiated model of our obligations in respect of all beings In doing this he draws on cutting edge work in cognitive science in order to develop a powerful distinction between beings who use language and beings that do not Fox tests his theory against eighteen central problems in General Ethics including challenges raised by abortion euthanasia personal obligations politics animal welfare invasive species ecological management architecture and planning and shows that it offers sensible and defensible answers to the widest possible range of ethical problems

Proceedings of a Workshop on Statistics on Networks (CD-ROM) National Research Council, Division on Engineering and Physical Sciences, Board on Mathematical Sciences and Their Applications, Committee on Applied and Theoretical Statistics, 2007-12-18 A large number of biological physical and social systems contain complex networks Knowledge about how these networks operate is critical for advancing a more general understanding of network behavior To this end each of these disciplines has created different kinds of statistical theory for inference on network data To help stimulate further progress in the field of statistical inference on network data the NRC sponsored a workshop that brought together researchers who are dealing with network data in different contexts This book which is available on CD only contains the text of the 18 workshop presentations The presentations focused on five major areas of research network models dynamic networks data and measurement on networks robustness and fragility of networks and visualization and scalability of networks

From Groups to Individuals Frederic Bouchard, Philippe Huneman, 2013-03-22 The biological and philosophical implications of the emergence of new collective individuals from associations of living beings Our intuitive assumption that only organisms are the real individuals in the natural world is at odds with developments in cell biology ecology genetics evolutionary biology and other fields Although organisms have served for centuries as nature's paradigmatic individuals science suggests that organisms are only one of the many ways in which the natural world could be organized When living beings work together as in ant colonies beehives and bacteria metazoan symbiosis new collective individuals can emerge In this book leading scholars consider the biological and philosophical implications of the emergence of these new collective individuals from associations of living beings The topics they consider range from metaphysical issues to biological research on natural selection sociobiology and symbiosis The contributors investigate individuality and its relationship to evolution and the specific concept of organism the tension between group evolution and individual adaptation and the structure of collective individuals and the extent to which they

can be defined by the same concept of individuality These new perspectives on evolved individuality should trigger important revisions to both philosophical and biological conceptions of the individual Contributors Fr d ric Bouchard Ellen Clarke Jennifer Fewell Andrew Gardner Peter Godfrey Smith Charles J Goodnight Matt Haber Andrew Hamilton Philippe Huneman Samir Okasha Thomas Pradeu Scott Turner Minus van Baalen *This Is Biology* Ernst Mayr,1997 A lively book on how biologists study living things Its range is enormous This is an old fashioned book to be read slowly more than once and to be thought about afterward Ann Finkbeiner The New York Times Book Review Chart **Vision and Visual Perception** Duco A. Schreuder,2014-12-03 Vision is about insight and visual perception is about cognition and they form the foundation of how we see the world Duco A Schreuder a physicist and psychologist explores the finer details of each in this groundbreaking book that explores human consciousness and perception Sharing virtually everything he s learned over a varied career spanning more than sixty years he examines a wide array of topics including how we understand what we visually process how we store and retrieve information the role that neurons play in how what we see and much more While Schreuder isn t afraid to disagree with other leading thinkers he relies on science and focuses on the facts behind it so you can understand lighting visual perception engineering design and applied and experimental physics Looking is about insight whereas seeing is about knowledge and you need to know how each one works to truly understand how humanity views the world Whether you re an illuminating engineer considering the fundamentals of the trade or a student or professional in an allied discipline you ll be well served by taking a closer look at Vision and Visual Perception **The Theory of Evolution** Samuel M. Scheiner,David P. Mindell,2020-04-03 Darwin s nineteenth century writings laid the foundations for modern studies of evolution and theoretical developments in the mid twentieth century fostered the Modern Synthesis Since that time a great deal of new biological knowledge has been generated including details of the genetic code lateral gene transfer and developmental constraints Our improved understanding of these and many other phenomena have been working their way into evolutionary theory changing it and improving its correspondence with evolution in nature And while the study of evolution is thriving both as a basic science to understand the world and in its applications in agriculture medicine and public health the broad scope of evolution operating across genes whole organisms clades and ecosystems presents a significant challenge for researchers seeking to integrate abundant new data and content into a general theory of evolution This book gives us that framework and synthesis for the twenty first century The Theory of Evolution presents a series of chapters by experts seeking this integration by addressing the current state of affairs across numerous fields within evolutionary biology ranging from biogeography to multilevel selection speciation and macroevolutionary theory By presenting current syntheses of evolution s theoretical foundations and their growth in light of new datasets and analyses this collection will enhance future research and understanding

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