Creationism's Trojan Horse: The Wedge of Intelligent Design

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Intelligent Design's Empty but Explosive Black Box

Creationism's Trojan Horse: The Wedge of Intelligent Design. Barbara Carroll Forrest and Paul R. Gross. Oxford University Press, New York, 2004. 401 pp. $40.00 (ISBN 0195157427 cloth).

Biologists have been lulled into assuming that creationists are ignorant crackpots. That may have been a fair assessment 30 years ago, when the front lines were manned by people insisting that the Earth is only 6000 years old and the receding Noachian flood carved the Grand Canyon, but there's a new breed afoot. Aficionados of creationism's latest flavor, intelligent design (ID), are far more sophisticated, smarter, better organized, and more politically savvy than their predecessors.

Intelligent design is a throwback to William Paley's 19th-century "argument from design." Instead of claiming the improbability of organs such as eyes and bird wings, as the old school did (developmental biologists have rendered that view silly), ID supporters like Lehigh University biochemist Michael Behe (1996) adopt a modern facade by invoking the improbability of biochemical pathways and subcellular structures arising through natural selection. Instead of asking what function half a bird wing could serve, Behe belittles the utility of half a biochemical pathway. In other words, he argues that complex biochemical systems like the blood-clotting cascade could not have been selected stepwise by Darwinian mechanisms. In Behe's world, such pathways exhibit "irreducible complexity." Add mathematician William Dembski's statistical arguments about the impossibility of chance accounting for design in nature, and the ID creed is complete.

Today's evolution deniers try to avoid mentioning God, because the Supreme Court soundly trounced "scientific" creationism—the previous incarnation foisted on our school systems—as patently religious in nature and a clear violation of the separation of church and state. Intelligent design merely invokes some sort of master architect. He, she, or it could even have been (wink, wink) an extraterrestrial, adherents coyly offer.

Science or public relations?

Proponents of ID have a slick cybercathedral to sell their product: the Seattle-based Discovery Institute, whose public relations talents are awesome. The Discovery Institute has polished ID's patina of scientific validity by rounding up a bevy of true believers with PhDs. It also takes advantage of the press's obsession with "balance" in news stories. That evolutionary biology is supported by the vast majority of biologists, geologists, physicists, and other scientists matters little to reporters. Despite the huge disparity in numbers, evolution deniers end up equally represented with biologists in nightly news stories about the latest flap over science textbooks.

The tactics afford ID credibility and an equal place at the public-affairs table, whether at a school board meeting or a congressional hearing. The strategy is clever. Instead of trying to replace evolution with ID, which proponents know is probably impossible, they instead seek "fairness" and "academic freedom" by asking that teachers be allowed to cover both sides of the evolution "controversy." After all, isn't fairness the American way? Intelligent-design proponents don't recognize the concept that not all ideas in science are created equal—at least in biology—and they hope an uninformed public won't either. On the basis of ID-instigated press reports, many lay people assume that lots of credible scientists doubt evolution. Supporters of ID even promote the myth that hordes of scientists are jumping off a sinking evolution ship.

With ID proponents, it's the appearance of credibility that counts, not the substance. If facts were important, divine design would lose, hands down. After all, not a single article offering positive evidence in favor of the idea has ever been published in a peer-reviewed scientific journal. Despite a flurry of pro-ID books, the vast majority of biologists and geologists remain unconvinced. Where ID is concerned, though, science doesn't really count. All its shock troops have to do is fool a lot of people all of the time. They're off to a great start. In case you haven't noticed, school boards and state legislatures across the country are busily inserting antievolution or pro-ID statements in school curricula and science textbooks. Media like the *New York Times, Time* magazine, and National Public Radio have rung alarm bells.

Conspiracy mavens, take note

Does all this sound like a conspiracy theory to rival claims about NASA's "faked" lunar landing? Most of us tend to be skeptical about plots behind every door. In this case, though, think again: There's more substance than smoke here. And that's where a new round of books comes in, including Barbara Forrest and Paul Gross's *Creationism's Trojan Horse.*

A Trojan horse—the mother of all plots—is an apt description of the ID agenda, as Forrest and Gross meticulously document in their book. They ought to know what they're talking about. Forrest, a philosophy professor at Southeastern Louisiana University, has been tracking ID creationism for years. Gross, a world-class developmental biologist, has also tackled another bit of absurdity, academic postmodernism's attack on science (Gross and Levitt 1994).

It seems that all of the ID shenanigans follow a carefully scripted, elaborate plan, crafted by a relatively small group of people associated with Berkeley lawyer Phillip Johnson and the Discovery

Institute. Before 1999, many would have scoffed at the idea of an effective antievolution cabal. But that year, an internal Discovery Institute document called "The Wedge Strategy" was outed on the Internet. As Forrest and Gross show, this document sets out a strategy to dismantle the evolution edifice brick by brick. Although the Discovery Institute at first did not formally acknowledge the strategy as its own, Forrest and Gross leave little doubt about how and where the wedge strategy evolved. Intelligent design is Johnson's brainchild, the wedge its battle plan.

Using everything from anecdotal accounts of ID lectures to exhaustive literature searches and direct quotes of ID proponents, Forrest and Gross trace the history of the wedge strategy, mark its progress, and hold the feet of Behe, Dembski, and their ilk to the fire. They reveal the misrepresentations, out-of-context quotes, and outright falsehoods in ID critiques of evolution, showing that, despite their new look, neocreationists are up to the same old tricks. Forrest and Gross even explore a conspiracy within the conspiracy: ID proponents like to whine that scientists keep them out of journals, thereby preventing them from publishing their work. What work? counter Forrest and Gross.

The authors even adhere to the now-famous Watergate advice to "follow the money." After tracing where and how the Discovery Institute gets its funding, they move to its public relations strategies, its influence with politicians, its use of public-opinion polls, and the campaign to change school science standards. What ID supporters can't win with data they intend to achieve through politics, legislation, and legal decisions.

This exposé is as disturbing as it is enlightening. It's true that, when it comes to supporting data, the ID emperor has no clothes. It's also true that scientists have convincingly challenged ID's pseudoscientific claims with respect to probability and irreducible complexity. Unfortunately, none of that seems to matter. As far as ID believers like Johnson are concerned, the refutations are a plus, because they keep their agenda in the public eye and lend credence to the myth of a genuine debate between equal, competing camps. For scientists, that mentality is a lose–lose situation. We're damned if we keep quiet and let the lunacy proliferate, and damned if we speak out and, by doing so, lend authenticity to it. Aficionados of ID subscribe to Hollywood's view that there's no such thing as bad publicity.

Bigger fish to fry

It would be wrong to give the impression that evolution is the evil to end all evils in the minds of people like Johnson, Dembski, and Behe. Actually, the ID movement and the Discovery Institute have more lofty (dare I say heavenly?) goals. Evolution is just the tip of the iceberg—the edge of the wedge, if you like. Forrest and Gross point out that the institute and its followers rail against materialism and naturalism in contemporary society, blaming not only Darwin but Marx, Freud, and others for leading us to perdition.

Believers in ID make no distinction between methodological and philosophical materialism. Yes, many scientists may be atheists or philosophical materialists—that is, they may believe that what you see in this world is all that's there. The problem is, ID supporters can't or won't wrap their minds around the concept that scientific discovery and progress don't depend on an investigator's religion, politics, or personal philosophy. Scientists base their conclusions on material evidence drawn from the natural world. Results of an experiment done in Riyadh, Rome, Beijing, or Brooklyn should be the same, provided that the conditions are identical.

To ID supporters, though, scientists are instead foisting a materialist philosophy or worldview on impressionable children. To them, naturalism is about worshipping nature, not God. That's why, in their own words, ID proponents seek "nothing less than the overthrow of materialism and its cultural legacies." What will they replace it with? Why, a more "theistic science," of course—one that allows a miracle here and there.

And therein lies the real danger of ID. If its proponents succeed, science as we know it will change, for the worse. There's a reason why science gave up "God did it" as an explanation for natural phenomena 200 or so years ago. It threw a wet blanket on curiosity, didn't solve real problems like disease, and failed to make testable predictions. In other words, "God did it" was an intellectual brick wall. What better measure for this view than the progress made in our quality of life and understanding of nature ever since!

Yet the Discovery Institute and its allies want to revive this failed mantra. If you think that's hyperbole, read Forrest and Gross's book. The authors demonstrate convincingly that "this movement seeks nothing less than to overthrow the system of rules and procedures of modern science and those intellectual footings of our culture laid down in the Enlightenment and over some 300 years" (p. 10).

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SHOOTING FOR THE IMPOSSIBLE DREAM: A COMPREHENSIVE CATALOG OF FUNGAL DIVERSITY

Biodiversity of Fungi: Inventory and Monitoring Methods. Gregory M. Mueller, Gerald F. Bills, and Mercedes S. Foster, eds. Elsevier Academic Press, Burlington, MA, 2004. 777 pp., illus. $99.95 (ISBN: 0125095511 cloth).

Imagine trying to document the diversity of the world's fungi. You would have to look literally everywhere—from the microscopic fungi that parasitize the protozoa in animal rumens to the lichens that colonize the leaves of the highest trees. After you finished looking on and inside all of Earth's plants and animals, you could begin sampling soil, fresh water, estuaries, and oceans. It would be an immense task, but luckily you now have a guide: a one-stop reference book called *Biodiversity of Fungi: Inventory and Monitoring Methods.* This volume illustrates the enormous amount of work it would take to document fungal diversity, while simultaneously breaking the task into more manageable chunks.

Biodiversity of Fungi argues that fungi and their allies (slime molds and water molds) are critically important players in the world's ecosystems, yet science has documented relatively few of the species that are thought to exist. The book's purpose is to provide standardized methods for quantitative measures of fungal populations in almost any habitat. Perhaps equally important, the book encourages researchers not only to carefully record their discoveries—with annotated voucher specimens deposited in herbaria—but also to create computerized databases in a form that others can share. After all, they argue, no one benefits from poorly documented or inaccessible research.

Not surprisingly, *Biodiversity of Fungi* is a team effort, requiring three editors and about 10 years of work. Two of the editors have extensive experience in mycology. Gregory M. Mueller is curator of mycology and chair of botany at the Field Museum of Natural History in Chicago; Gerald F. Bills studies the systematics, diversity, life history, and ecology of filamentous fungi at Merck Research Laboratories. Mercedes S. Foster, of the US Geological Survey's Patuxent Wildlife Research Center at the Smithsonian Institution's National Museum of Natural History, has previously edited books on measuring and monitoring the biodiversity of mammals and amphibians. Together, the three editors coordinated the efforts of some 88 expert authors.

The book's content is divided into three units. Unit I consists of six chapters that cover general issues relevant to all fungal research. Serious researchers should take special note of the chapters on herbaria, database design, and statistical considerations. The 20 chapters of unit II, which occupy the bulk of the book, describe detection and isolation techniques. Unit III is a collection of useful resources, including recipes for culture media; lists of institutions, Web sites, and vendors; and a glossary.

Unit II is organized mostly by habitat. Chapters include guidelines for finding fungi on or in other fungi, living plants (both inside and out, for both shoots and roots), plant debris, wood, soil, arthropods and other invertebrates (both terrestrial and aquatic), vertebrates (both inside and out), dung, fresh water, estuaries, and oceans. Even "stressful" environments—those that are hot, cold, nutrient poor, salty, dry, or metal contaminated—are included. A few chapters depart from this habitat-based focus and instead discuss fungi by group, including lichens, sequestrate fungi, yeasts, and slime molds. Along the way, the book acknowledges the many difficulties that researchers face when inventorying fungi: the huge number of undescribed species, the ubiquity of fungi nearly everywhere on Earth (with scores of species colonizing the same tiny substrate), multiple correct binomial names for different stages in the same organism's life history, constantly changing names, and species that refuse to grow in pure culture.

Because it is so wide-ranging, this book will be useful for both beginners and experts. Many chapters are extremely user-friendly, giving easy-to-follow instructions for collecting fungi, preserving cultures, and keeping records. However, beginners may find other chapters difficult. For example, the first chapter introduces the current state of systematics for the fungi and their allies. It dives right into terminology such as *dolipore septa, plesiomorphies,* and *homoplasies.* A cladogram accompanies the discussion of each phylum, but this introductory chapter would have been more useful to beginners if illustrations of zygospores, asci, basidia, and other fundamental features of the fungi were included. Likewise, the unit I chapter on quantitative measures of species diversity was hard for me to follow. Without extensive training in this area, I found it hard to tell how the subtopics related to each other. Thankfully, the authors included several helpful summary tables, and the chapter is useful because it brings relevant references together in one place.

My favorite parts of the book were those that directly supported its mission to guide researchers in finding fungi. I enjoyed reading the parts that explained how to select sampling locations, how big the plots should be, where to look for fungi, what information to collect in the field, how much time to expect to spend in the field and in the lab, and how to store specimens and data. One chapter has wonderful examples of data sheets; another has an appendix that suggests the size, type, and format of fields one could incorporate into a computerized database. I also liked the practical discussions showing how statistical and logistical constraints make it difficult to calculate species richness in certain habitats.

The book has many other useful features as well. Most chapters contain at least one table. Especially useful are those that list some typical genera, organized by phylum, class, and order. Two chapters even include keys to genera. The 40-page, illustrated glossary was also helpful. As I read the book, I tested the glossary by looking up several words that I assumed a beginning reader would not know. Most were in the glossary, and many entries had simple line drawings that helped illustrate the concept.

Biodiversity of Fungi does have some shortcomings. A minor complaint is that some topics occur in odd places. For example, chapter 21 describes the life cycles of major groups of fungi and their allies, along with useful definitions of the specialized terminology in dichotomous keys. This information would have been better placed in the first chapter, where it could help nonspecialists decipher some basic fungal biology and vocabulary. Similarly, surface sterilization is described in the chapter on endophytic fungi, even though these techniques would also be useful for researchers who might want to "bait" for fungi in many habitats. The appendix would have been a more suitable place for this topic.

A more significant problem is that the chapters do not follow a standardized outline, so the contents vary widely from chapter to chapter. For example, some chapters have as many as 12 sections, while others have as few as 3; and the section titles are inconsistent from chapter to chapter. Some chapters include advice on designing sampling schemes or fixing material for DNA analysis; others do not. Some emphasize background over technique; others do the opposite. Some chapters include conclusions or recommendations for future research; others do not.

I have often wished for a book that combined fungal sampling methods in one place, and I am grateful that this enormous team of editors and authors has completed this heroic undertaking.

This nonstandardized approach means that each chapter discusses the issues that are most relevant to each habitat type, but it also leads to uneven coverage. The chapter on yeasts, for example, is just six pages long, with no illustrations and sparse detail on where to find yeasts, what features to look for, or diversity. The next chapter, which describes fungi that eat other fungi, totals 50 pages and illustrates the other extreme. It includes extensive detail on group-specific terminology, taxonomic groups (illustrated by color photos), distribution, identification, research methods, examples of fungi that colonize five different subgroups of fungi, and a description of the use of fungi as biological control agents.

The preface seems to acknowledge this lack of uniformity: "It will become apparent to the user...that the state of knowledge regarding fungal sampling is uneven from habitat to habitat and taxon to taxon and that few quantitative procedures have been developed" (pp. xi–xii). Even so, a uniform outline would have helped to highlight these gaps—and perhaps to guide future research—instead of obscuring them in a mix of different formats.

Just as the content coverage is uneven, so are the illustrations. Many chapters (notably those on fungi that eat other fungi, rotifers, and nematodes) have excellent art and abundant, beautiful, large photos. Other chapters, however, lack illustrations altogether. The chapters on voucher specimens, culture preservation, yeasts, and chytrids would be more useful if the procedures and important structures were not left to the reader's imagination.

Even with these limitations, *Biodiversity of Fungi* is a welcome addition to my reference bookshelf. I have often wished for a book that combined fungal sampling methods in one place, and I am grateful that this enormous team of editors and authors has completed this heroic undertaking. As a bonus, the book makes a strong case for the importance of systematically cataloging and quantifying fungal diversity. Realistically, science may never be able to complete the task of inventorying all of the world's fungi, slime molds, and water molds; but with this book, we can at least take a shot at it.

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PRIMING FOR GENETICS IN ECOLOGY

A Primer of Ecological Genetics. Jeffrey K. Conner and Daniel L. Hartl. Sinauer Associates, Sunderland, MA, 2004. 304 pp., illus. $34.95 (ISBN 087893202X paper).

The field of ecological genetics became firmly established 40 years ago with the publication of E. B. Ford's seminal book, *Ecological Genetics* (1964). The work Ford described in that book represented a quarter-century of studies in which the theoretical predictions of how natural genetic systems should act were tested empirically under real field conditions. This period defined the beginning of a discipline that combined field-based ecology with laboratory-based genetics; the strategy provided unique insight into natural population-level processes.

In its modern form, ecological genetics addresses two broad aspects of biology: (1) the genetic basis of ecologically important traits and (2) the ecological and evolutionary processes that influence patterns of genetic variation in and among natural populations. Ecological genetics therefore borrows heavily from the conceptual frameworks of population and quantitative genetics, and it represents a powerful and unifying approach for understanding ecological responses and evolution in natural populations. In the four decades since Ford's book was published, the field has grown tremendously, and as genetic and genomic resources continue to be developed and applied to ecological questions, the future of ecological genetics seems especially bright.

An excellent introduction to basic conceptual and practical aspects of ecological genetics now can be found in the popular *Primer* series, published by Sinauer Associates. *A Primer of Ecological Genetics,* by Jeff Conner (professor at the W. K. Kellogg Biological Station and the Department of Plant Biology, Michigan State University) and Daniel Hartl (Higgins Professor of Biology at the Department of Organismic and Evolutionary Biology, Harvard University), covers basic population and quantitative genetic principles and explains how these approaches are applied to study evolutionary dynamics in both natural and managed populations. Clearly and concisely written, the book is geared toward advanced undergraduates, graduate students, and professionals outside the field in search of a basic introduction.

The chapters in *A Primer of Ecological Genetics* are logically arranged, with the ideas that are introduced in earlier chapters frequently revisited and reinforced in later chapters. Following a brief introduction to fundamental genetic concepts and terms in chapter 1, the next two chapters address basic population genetic principles of natural populations. The reader is introduced to the concept of population genetic variation, its measurement with different types of molecular markers, and the basic statistical and mathematical foundations for quantifying genetic variation within and among populations. Ecologically and evolutionarily relevant forces that influence the extent and patterning of genetic variation are considered both individually and in combination. These forces include mutation, genetic drift, gene flow, and natural selection.

Chapters 4 and 5 introduce the reader to the analysis of quantitative traits, which are traits distributed continuously as a result of their polygenic basis and environmental sensitivity. (The majority of ecologically relevant traits are quantitative traits.) The concepts of genetic and environmental sources of phenotypic variance and covariance are explained, as are methods for estimating standard quantitative genetic parameters such as heritability and correlation. Also covered are phenotypic plasticity, artificial selection, and the more recent development of QTL (quantitative trait locus) mapping, in which the approximate genomic locations of loci underlying variation in quantitative traits are determined through an analysis of their linkage to polymorphic molecular markers.

Conner and Hartl reserve the final two chapters for addressing how natural selection on ecologically important phenotypes can be measured in populations (chapter 6) and how the principles of ecological genetics can be applied to societal issues ranging from biological conservation to the fitness effects of escaped crop transgenes and the evolution of resistance in pest species (chapter 7). These final chapters represent an integration of concepts and methods covered in chapters 2–5.

As in other books from the *Primer* series, discussions of all concepts and principles are accompanied by examples of real data taken from the primary literature. This practice is particularly effective here, given the wide range of subjects covered. The pen-and-ink illustrations of organisms accompanying the examples provide an especially nice touch. Although familiarity with some basic statistical techniques (e.g., analysis of variance and regression) is helpful, the authors provide short introductions to such methods in stand-alone boxes for the statistically uninitiated. Each chapter closes with a short problem set testing the reader's knowledge of material covered and a list of additional suggested reading for those willing to delve deeper.

I found the authors' examinations of the strengths and weaknesses of different experimental approaches especially useful. For example, following the discussion on heritability and how it can be measured (chapter 4), the authors summarize the pros and cons of the different experimental designs for estimating this important parameter. Similarly, in chapter 6, explanations of experimental methods for measuring selection on phenotypes in natural populations are followed by caveats regarding the limitations on interpretation of the various approaches. These additional discussions will make *A Primer of Ecological Genetics* a valuable reference for new graduate students as they consider experimental designs and approaches in their own work.

It will be interesting to see what future editions of this title will cover, given the current surge in genome science. As genomic approaches increasingly become applied to ecological studies (Feder and Mitchell-Olds 2003, Thomas and Klaper 2004), new avenues for ecological genetic research will undoubtedly be established. Genomic methods may well deserve inclusion in future editions.

In sum, *A Primer of Ecological Genetics* provides a lucid introduction to foundational principles in the field. In their preface, Conner and Hartl state, "The guiding principle of the book is to focus on clear explanations of the key concepts in the evolution of natural and managed populations." The first edition of *A Primer of Ecological Genetics* accomplishes this nicely. I recommend it with enthusiasm.

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CONSERVATION AND EVOLUTION REDUX

Evolutionary Conservation Biology. Régis Ferrière, Ulf Dieckmann, and Denis Couvet, eds. Cambridge Studies in Adaptive Dynamics, Cambridge University Press, United Kingdom, 2004. 428 pp., illus. $95.00 (ISBN 0521827000 cloth).

Evolutionary Conservation Biology is an ambitious attempt to integrate genetics, ecology, and demography in order to manage species from a conservation biology perspective. Written in the style of an advanced textbook, it provides a current review of key topics in conservation, population biology, and evolutionary ecology. The book consists of 19 chapters by 30 contributing authors, including some of the leading writers in their fields. It is divided into five parts dealing with the theory of extinction (part A), the pace of adaptive response to environmental change (part B), the genetic and ecological bases of adaptive responses (part C), spatial structure (part D), and community structure (part E).

Part A consists of three chapters that consider the theory of extinction at scales ranging from the individual to the metapopulation. The goal of this section is to introduce the theoretical tools needed to evaluate the risk of extinction. This part would have been stronger had it been possible to evaluate the theoretical considerations by comparing them to empirical studies. For example, the only genetic model incorporated into the theory is one based on thousands of loci that each have two alleles (a wild allele and a mutant allele); the mutant allele at each locus has a very small deleterious effect. The actual parameter values used in this model (mutation rates and selection coefficients at many individual loci) cannot be estimated empirically in real populations. Some effort to relate the amount of inbreeding depression expected with this model to estimated values of inbreeding depression (Keller and Waller 2002) would have been very helpful.

Part B is the strongest section of the book. Its four chapters do an excellent job of considering the theory and presenting empirical examples of adaptive response to environmental change. Dick Frankham and Joel Kingsolver are especially effective as they address the possible importance of adaptation for the long-term survival of species facing abiotic environmental change.

Part C is a mixture of three chapters that do not seem to present a coherent theme of the genetic and ecological bases of adaptive responses. Michael Whitlock and Reinhard Bürger offer a good discussion of the fixation of new mutations in small populations and the role it may play in extinction by "mutational meltdown." Also in this section, Ulf Dieckmann and Régis Ferrière argue that "evolutionary suicide" (the adaptive increase by individual selection of genotypes that may accelerate the probability of population extinction) "occurs for a rich variety of ecological settings." However, they do not present any empirical examples or discuss when conservation biologists should be particularly concerned about this possibility.

Part D consists of four chapters that deal with spatial structure. Unfortunately, there is little integration between the genetic chapter in this section, by Oscar Gaggiotti and Denis Couver, and its counterpart in part A on the spatial dimensions of population viability, by Mats Gyllenberg, Ilkka Hanski, and John Metz. Each of these two chapters is a valuable contribution to the literature; however, the editors make no apparent attempt to integrate them. For example, some consideration of how genetic data from natural populations can be used to construct and use more realistic models of population viability would have been useful.

Part E contains three chapters that deal with community structure, including coevolution, ecosystem dynamics, and the interaction between rare species and their close relatives. Michael Loreau, Claire de Mazancourt, and Robert Holt make the important point in their chapter on ecosystem evolution and conservation that the species-based approach and the ecosystem- or habitat-based approach to conservation are not in conflict with each other. They demonstrate the importance of considering both of these approaches in their consideration of plant–herbivore interactions.

Many of the individual chapters in this volume are excellent current reviews of a variety of relevant topics. Nevertheless, the book suffers from a problem common in such collections: The treatment is extremely uneven. For example, the primary chapter on population viability, by Wilfried Gabriel and Régis Ferrière, is extremely mathematically sophisticated. It jumps right into diffusion theory for stochastic models and bases many of its conclusions on the concept of quasi-stationary distribution. The chapter on spatial dimensions of population viability, by Mats Gyllenberg, Ilkka Hanski, and Johan Metz, continues in this vein. Consider the following conclusion about the extinction probability of a metapopulation: "The process can be described in terms of its quasi-stationary distribution, which is given by the left eigenvector (normalized to a probability distribution) that corresponds to the dominant eigenvalue of the transition matrix Q restricted to the transient class $\Xi \backslash O$" (p. 74). This contrasts starkly with the description of measuring genetic variation in Oscar Gaggiotti and Denis Couver's chapter on genetic structure in heterogeneous environments, which explains that the mean percentage of heterozygous loci per individual is estimated by dividing the number of heterozygous individuals by the total number of individuals (p. 230).

The editors' goal is laudable. Nevertheless, the ambitious integration of genetics and ecology that they aimed for will not be found in this book. The individual chapters are generally solid reviews of theory, but they contain very little consideration of how that theory relates to real populations or to empirical information from populations. There is also a complete absence of any consideration of molecular genetic data. For example, the term "microsatellite" does not even occur in the index.

Throughout the book, genetic considerations seem to be treated at a much more basic level than are ecological considerations. For example, the discussion of heterozygous advantage as a mechanism for maintaining genetic variation (p. 123) considers only loci with two alleles. Also in that chapter, the term "linkage disequilibrium" is defined incorrectly. Linkage disequilibrium is the nonrandom association between alleles at two loci in a population. The definition on page 125 states that "particular alleles are inherited together more often than expected under Mendel's laws on independent assortment." This is a definition of linkage, not of linkage disequilibrium. Close linkage is one common cause of linkage disequilibrium, but linkage disequilibrium can also occur in the absence of linkage (e.g., because of hybridization).

Perhaps the biggest weakness of this volume is that it does not recognize many of the previous efforts of conservation biologists to achieve the same goals as those of its authors. (For example, the 1981 book *Conservation and Evolution,* by Otto H. Frankel and Michael E. Soulé, is not cited.) Conservation biology had its roots in the very integration of evolution with genetics and ecology that this book attempts.

Evolutionary Conservation Biology contains a number of excellent reviews of a variety of current topics in conservation, and I am happy to have it on my bookshelf. Nevertheless, I cannot recommend it to a general audience. It does not achieve its goal of integrating genetics and ecology. In addition, the treatment is far too theoretical to be of value to practicing conservation biologists who are responsible for managing species.

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NEW TITLES

Biomaterials for Delivery and Targeting of Proteins and Nucleic Acids. Ram I. Mahato. CRC Press, Boca Raton, FL, 2005. 669 pp., illus. $189.95 (ISBN 0849323347 cloth).

Colonization of Mucosal Surfaces. James P. Nataro, Paul S. Choen, Harry L.T. Mobley, and Jeffrey N. Weiser, eds. ASM Press, Washington, DC, 2005. 478 pp., illus. $119.95 (ISBN 1555813232 cloth).

ALL NEW FROM SINAUER ASSOCIATES

Evolution

Douglas J. Futuyma

A readily recognized descendant of the author's previous textbook, *Evolution* is much shorter and exclusively directed toward an undergraduate audience. Readers will appreciate the list of important concepts and terms in each chapter, as well as the radically different dynamic figures and lively photographs. The content of all chapters has been updated, and material has been reorganized into new chapters. Contributors Scott V. Edwards and John R. True have provided authoritative chapters on, respectively, "Evolution of Genes and Genomes" and "Development and Evolution." A new final chapter treats such topics as the nature of science and the practical applications of evolutionary biology.

January 2005, 543 pages, 508 illustrations, ISBN 0-87893-187-2, casebound

Species Invasions: Insights into Ecology, Evolution, and Biogeography

Edited by Dov F. Sax, John J. Stachowicz, and Steven D. Gaines

Species invasions present significant conservation challenges, but they also provide invaluable information about the functioning of natural systems. In this edited book, experts from the fields of ecology, evolution, and biogeography explore the unique insights species invasions provide. Several key advances emerge in each discipline, and collectively they provide a template for new research that transforms invasion biology into a powerful tool for basic research in ecology, evolution, and biogeography.

June 2005, ISBN 0-87893-811-7, casebound

Bioethics and the New Embryology: Springboards for Debate

Edited by Scott F. Gilbert, Anna Tyler, and Emily Zackin

Copublished by Sinauer Associates, Inc. and W. H. Freeman and Company

Our ability through modern science to alter the course of human development has brought embryology into the public domain. In order to make informed judgments on when human life begins, sex selection, cloning, stem cell research, gene therapy, and what is "normal," one has to know both the science and the ethical considerations. This book presents enough science so that readers can both make an informed analysis of the issues and know what data are consistent (or not) with their views. The chapters are not meant to provide definitive answers but, rather, to be springboards for discussion. Each two-chapter unit addresses a question, juxtaposing the scientific "facts" (in the initial chapter) with the ethical questions (in the latter chapter). While the science has been simplified, it successfully conveys the essential information for useful discussions.

May 2005, ISBN 0-7167-7345-7, paper

Angiosperm Phylogeny and Evolution

Douglas E. Soltis, Pamela S. Soltis, Peter K. Endress, and Mark W. Chase

Our understanding of angiosperm relationships has changed dramatically during the past ten years. The big picture of angiosperm phylogeny emerged suddenly as a direct result of collaborative molecular analyses, and longstanding views of deep-level relationships required revision. Many major clades of angiosperms did not correspond to the classes, subclasses, and orders of modern classifications. Furthermore, a wealth of recent data coupled with current understanding of phylogeny permits reevaluation of many deep-rooted evolutionary hypotheses. Soltis et al. provide a comprehensive summary of current concepts of angiosperm phylogeny and illustrate the profound impact that this phylogenetic framework has had on concepts of character evolution. In so doing, they acknowledge inadequacies in both current understanding of phylogeny and knowledge of morphological characters, as well as the need for additional study.

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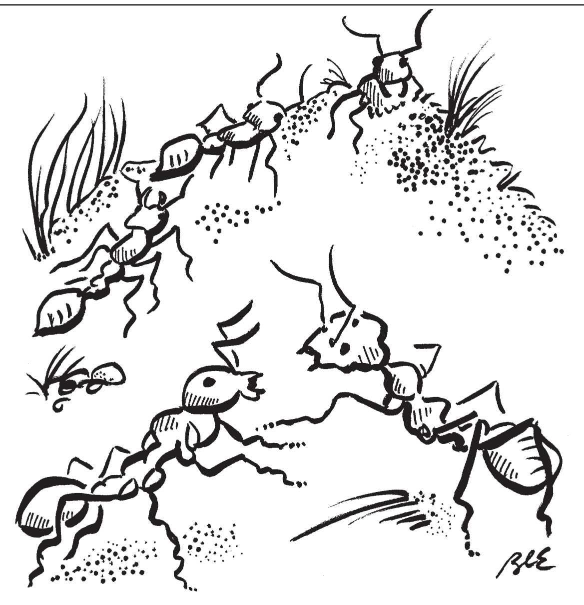

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