A Guinea Pig's History of Biology

Author: Hagen, Joel B.

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A History of Model Organisms

A Guinea Pig's History of Biology. Jim Endersby. Harvard University Press. 2009. 544 pp., illus. $18.95 (ISBN 9780674032279 paper).

Originally published as a hardcover edition in the United Kingdom (2007), *A Guinea Pig's History of Biology* won the Jerwood Prize from the Royal Society for Literature. Jim Endersby, senior lecturer in the Department of History at Sussex University and a specialist in the history of Victorian science, has written a compelling history of biology from the perspective of the organisms used to study phenomena related to inheritance and evolution. Each chapter focuses on a species that is either now a model organism or that was once a promising candidate but ultimately failed to gain long-term acceptance among researchers. Not surprisingly, Endersby pays considerable attention to familiar research organisms such as fruit flies, guinea pigs, corn, bacteriophages, and zebrafish. However, he also includes equally interesting chapters on species such as the evening primrose (*Oenothera lamarckiana*), which once appeared poised to provide critical insights into the mechanisms of evolution but later faded from the center stage. Endersby cautions that he has not tried to write a comprehensive account of model organisms. However, by shifting attention slightly away from great scientists and great ideas he broadens the scope of the history of biology. Endersby's focus on how scientists selected, modified, and experimented with model organisms in the development of modern genetics and evolutionary biology allows the reader to examine the importance of developing techniques for breeding, standardizing procedures, and building communities of researchers who share common problems, objectives, and methods. According to Endersby (p. 26), "In this story the *ideas* of science come second, in every sense, to the *work* of science."

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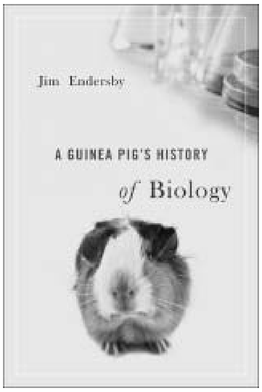
In retrospect, it may seem obvious why some species came to play such prominent roles in studies of inheritance and evolution. Small size, short generation times, and ease of breeding immediately come to mind as necessary characteristics for success. Endersby makes abundantly clear, however, that the advantages of using a particular new organism may be far from obvious at the start. For example, *Arabidopsis thaliana* has become one of the most common experimental organisms for plant geneticists, but initially it met strong opposition from plant scientists who had focused most of their attention on *Zea mays* and other commercially important species. From a perspective strongly shaped by the economics of agriculture, studying an insignificant weed seemed dubious, and using one as a model species met stiff resistance from established plant geneticists and the funding agencies that supported their research. Success came largely because an initially small group of enthusiasts self-consciously worked to build a community of *Arabidopsis* researchers who informally shared seeds, experimental techniques, and preliminary results.

This idea of networks or communities of researchers who promote and expand the use of particular research organisms is a major theme that runs through *A Guinea Pig's History of Biology*. Endersby recounts the particularly well-studied case of *Drosophila melanogaster,* which played a critical role in establishing the modern science of genetics. Thomas Hunt Morgan and his students exploited the large number of well-marked mutants that they discovered in the fruit fly to demonstrate that inheritance followed Mendelian laws and that genetic determinants were physically located on chromosomes. The fact that *Drosophila* has only four pairs of chromosomes greatly simplified the task of mapping the locations of various genes. But Endersby emphasizes that the success of *Drosophila* as a model organism for studying genetics also depended heavily on researchers creating standardized breeding lines, providing these manufactured flies to other researchers at no cost, and using an informal newsletter to publicize techniques for manipulating the flies. From Endersby's perspective, Morgan and his coworkers standardized their fruit flies using the same



production principles that Frederick Winslow Taylor was advocating for manufacturing. Thus, the standardized flies that Morgan's lab produced were comparable to the machines produced by Henry Ford and other industrialists of the period who used assembly line methods.

Endersby juxtaposes accounts of successful model organisms with cautionary stories of promising lines of research on species that rarely are included in today's textbooks on genetics and evolution. These episodes include Mendel's research on hybridization in hawkweeds (*Hieracium*), Francis Galton's eugenic studies on humans, and Hugo de Vries's evolutionary studies on evening primroses

(*Oenothera*). These cases highlight the contingency of scientific discovery. For example, de Vries believed that he had found the perfect species for demonstrating his mutation theory—the claim that new species arise in a single step by saltation. At the beginning of the 20th century, this theory was enormously influential and was widely accepted as a viable alternative to natural selection. The mutation theory avoided the two major criticisms that dogged Darwinian evolution: that the age of Earth was too young for natural selection to account for the great diversity of species, and that the small variations Darwin posited would be swamped before they could accumulate in a population. The mutation theory also appealed to many experimental biologists who rejected natural history and wanted to bring the study of evolution into the controlled environment of the laboratory. Impressed by de Vries's claims that he had found new species of *Oenothera* in his experimental gardens, many evolutionary biologists in both Europe and the United States turned to evening primroses as a promising experimental subject. Evolutionary biologists eventually rejected the mutation theory, and the "new" species that de Vries claimed to have discovered turned out to be the result of the unusual behavior of chromosomes of the evening primrose during meiosis. As Endersby aptly describes it, *Oenothera* started out as a botanical superstar, but ended up a freak of nature.

I strongly recommend this book to biologists who have an interest in history. For those too busy to delve deeply into the academic history of science, Endersby provides an engaging overview of recent research in the history of genetics and evolutionary theory. He freely acknowledges that much of his book is based on the earlier work of other historians, yet Endersby has done a wonderful job of synthesizing this work into a unified whole. Even readers well acquainted with the history of biology will find his historical observations enlightening. Endersby has a rare ability to tell an entertaining and engrossing story without sacrificing historical accuracy.

JOEL B. HAGEN

Joel B. Hagen (jhagen@radford.edu) is a professor of biology at Radford University in Radford, Virginia.

IN THIS TIME OF MYRIAD HUMAN NEEDS, YOU WANT TO SAVE *INSECTS*?

Insect Species Conservation. Tim R. New. Cambridge University Press, 2009. 272 pp., illus. $69.00 (ISBN 9780521732765 paper).

Professor Tim R. New, of La Trobe University, Australia, is an authoritative researcher and prolific writer on conservation, particularly insect conservation. *Insect Species Conservation*, one of his recent books, demonstrates that he is certainly serious about saving insects. Would that billions of people shared his well-informed and justified passion!

Current local and global changes make it imperative to conserve millions of beneficial species, including insects at all levels from populations through species and communities. These "little things that run the planet" perform significant ecosystem services, from aerating soil to pollinating to recycling nutrients; furthermore, they inspire and create jobs for *Homo sapiens sapiens*. In view of the many studies that have addressed conservation of special habitats and ecosystems, New focuses on insect species and subspecies. He and others have extensively covered insect-habitat and ecosystem conservation elsewhere. Many entomotaxa require immediate aid to prevent their extinction, and many are charismatic microfaunal and umbrella species—for instance, the sadly underappreciated *Rhaphiomidas terminatus abdominalis* (Delhi Sands flower-loving fly) in California. Unfortunately, there is little public support for endangered fly species, and this is the only fly on the US list of threatened and endangered species. Preserving this fly protects the last remaining remnant of an ancient dunes habitat and its other threatened species; nonetheless, some people wish to remove this fly's federal protection so that this habitat can be used for commercial or residential development. Conserving a focal insect taxon can, in turn, save many other species of concern that inhabit the same environment.

Throughout this book readers learn that each insect species differs, often in subtle ways, from other entomospecies, necessitating the development of individual management programs. Successful species programs can result from excellent biological knowledge of a focal species, as well as information gleaned from practical experience and

other conservation examples. Other essential elements of conservation programs include perspicacious planning, insightful legislation, and enduring public support coupled with continual adaptive management. Winning examples are the ant-associated *Paralucia pyrodiscus lucida* (Eltham copper butterfly) in Australia and Nabokov's *Lycaeides melissa samuelis* (Karner blue butterfly) in the United States.

New writes that the main goal of *Insect Species Conservation* is to help others design and implement effective insect-species management and restoration plans, and he aims to inform the many resource managers who are essentially unfamiliar with the special

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