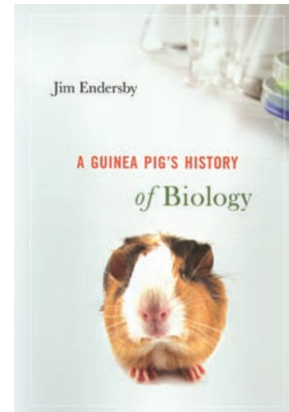
A guinea pig's history of biology



Jim Endersby
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Reviewed by Anne E. Kwitek
Department of Internal Medicine, University of Iowa, Iowa City, Iowa, USA.
E-mail: anne-kwitek@uiowa.edu

Scientific discovery typically does not happen overnight, or in a vacuum. The current understanding of the mystery of life is based upon historical discoveries, built upon in increments. Like the Ghost of Christmas Past in Dickens's *A Christmas carol*, Jim Endersby – a lecturer on the history of science at the University of Sussex – provides a glimpse into the history of critical discoveries in life science in *A guinea pig's history of biology*. The understanding of evolution, inheritance, and modern genetics has been made possible by the utilization of model organisms to answer various questions; Endersby describes these key discoveries through the experiences of scientists and their "pet" models. Major roles in this story were played by a diverse set of organisms: plants, flies, fish, phages, and, yes, the guinea pig.

Life sciences began with the "naturalists," whose goal was to explore, characterize, and categorize all the world's organisms. Darwin's voyage on the HMS *Beagle* provided him with material for a lifetime of study of the way species evolve through gradual changes established by selective advantages. He and other naturalists, such as Jean-Baptiste Lamarck and Hugo de Vries, studied visible traits in plants such as the passionflower (*Passiflora*), evening primrose (*Oenothera*), and hawkweed (*Hieracium*). Conflicting theories on speciation resulted in part from the unknown biological differences between their plants of study. For example, the polyploidy that is commonplace in *Oenothera* and *Hieracium* led great minds such as de Vries down a perplexing pathway.

Eventually, the school of experimentalists began to emerge. Scientists such as de Vries and Gregor Mendel found that meticulously designed and executed breeding experiments provided results not possible by the naturalist approach of simply observing population variation. Mendel's well-known pea plant studies, giving rise to the familiar Mendelian ratios, were only made possible by the careful and calculated experimental design Mendel learned through the teachings of Austrian botanist Franz Unger.

Another realization stemming from Endersby's book is that history's translation is sometimes not the same as its reality. For instance, although Mendel described the familiar 3:1 and 1:2:1 ratios of genetic inheritance taught in science classrooms, he did not describe his *Anlagen* (alleles) as coming in pairs, as we now know. Because chromosomes and genes had not yet been discovered, his interpretation described simple factors that parents passed to offspring. The AA, Aa, aa "genotypes" were simply depicted, with "A" representing a dominant trait that, if present, masked the effects of a recessive "a". It was not until the discovery of chromosomes and genes that the concept of diploidy was realized.

Endersby nicely introduces the guinea pig's role in our modern-day genetics, one that could easily go unrecognized. The guinea pig, with its pleasant disposition and prolific nature, captured the loyalty and mathematical mind of American geneticist Sewall Wright. When Wright joined the group of fellow American geneticist William Castle as a graduate student, Castle assigned him the guinea pig as his model to study genetics. It was the basis of their pivotal work on genetic linkage mapping in mammals in the early 1900s and remained his model of choice throughout his career.

A message that is clear from Endersby's tale is that the successful use of many model organisms was due to the community nature of those who studied them. Thomas Morgan, American geneticist and Nobel laureate for his work on *Drosophila*, and his "fly boys" shared their message in a bottle (their fruit flies, of course) with whoever asked, and the ensuing fly community has made a dramatic impact on our understanding of genetics. This trend continued for most successful model organism communities, such as the *Arabidopsis* community, spearheaded by Chris and Shauna Somerville, and the zebrafish (*Danio rerio*) community, which stills pays special tribute to the late George Streisinger, considered by many to be the founding father of zebrafish research. Their goal is to share data openly, to establish common resources, and to enable integration of multiple studies. A result is a close-knit community of scientists focused on a single organism, rather than a function or disease.

Endersby brings to life the scientists of the times – their passions, conflicts, successes, and quirks. The book's bibliography is rich: nearly 50 pages, including publications and personal journals to which he was allowed access. I found the book highly entertaining and enlightening for the geneticist, but it is also written in a fashion appropriate for the well-read lay audience having an interest in science. Endersby describes the origins of the many organisms' role in modern genetics and the coining of many of the terms we now take for granted, heard in educational settings from grade school classrooms to graduate courses. In the last chapter, "Oncomouse," brief mention is made of "humanizing" mice by introducing a human cancer transgene. However, the focus of this chapter is not on the mouse, as would have been expected (and rightly so). Rather, the genetically modified mouse serves as a segue into the use of genetic modification in our food supplies and the associated political issues and controversies. A fairly surprising end, but perhaps the mouse will star in the next century's history of modern genetics. Perhaps the guinea pig held a grudge.