Feature Book Review

Rebels with a (Biological) Cause

Review of: *Rebels, Mavericks, and Heretics in Biology*, edited by Oren Harman and Michael R. Dietrich; 2009; 400 pp.; Yale University Press (New Haven, CT); ISBN-13: 978-0-300-15845-8

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INTRODUCTION

History of biology is often presented and/or taught in the context of discoveries, with little or no emphasis placed on the scientists' personae. This book is a collection of essays, each about a scientist who made a significant impact on biology and who is considered by the editors to qualify as either a rebel, a maverick, or a heretic. Although I could not find much about these scientists to qualify them as either mavericks or heretics, there is plenty of material to demonstrate how rebellious those women and men were in challenging the existing paradigms of their particular fields of biology. One of the strengths of the book is the group of scientists included, some well-known and some others unknown to me before I read this book. The second and most notable strength is the diversity of biological fields exemplified in this collection of essays: subjects range from animal behavior to zoology. A third strength of the book is its narrative, something that a multi-authored collection often fails to achieve. The impressive editorial work of Harman and Dietrich makes them seem mavericks in biology themselves.

WHAT IS A REBEL?

The role of dissent and controversy is nothing new in science, but its significance in contemporary biology has been overlooked. The editors are quick to point out how many rebels they encountered, and how few of them could be included in this book (p. 2). The "Introduction" section attempts to give

a description of what constitutes a rebel for the purpose of this book, only to conclude "*rebel* is far from a well-defined term" (p. 9). It does not matter; the book does a terrific job at portraying scholars who challenged established views and

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became successful in one way or another by doing so. What becomes clear at the end is that all of the scientists showcased here had a genuine need to be innovative and nonconformist, which set them apart from other scientists in their field. The book never provides a clear answer as to whether some of the men and women discussed were rebellious, but what is clear is their passion for science and creativity.

The book consists of an “Introduction” written by the editors; 19 chapters, each featuring one of the “rebels”; and an “Epilogue” contributed by Richard Lewontin. Each chapter provides a brief introduction to a scientist and an in-depth description of his or her work in the context of the historical period, along with some conclusions on how this person’s work constituted an act of rebellion. Although the term “heretic” is in the title, there is little to no discussion about heretics. There are some other minor flaws, which, at least in my mind, do not detract from this volume’s merits.

Some notable essays include the chapters on Hans Driesch, Raymond Arthur Dart, Roger Sperry, Peter Mitchell, and Thelma Rowell. Driesch played a major role in making embryology a respected field. His holistic approach to the problem of embryonic development opened up experimental avenues by rejecting the notion that laws of chemistry and physics could not answer all the questions pertaining to morphogenesis (p. 58). His overall contribution lies in his rejection of the mosaic theory of Roux and Weismann in favor of “his own concept of the embryo as a nonmosaic, totipotent, and self-regulating system” (p. 59). Dart was truly a rebel in the sense of his unorthodox opinions about morphology of the nervous system. However, his life’s work was to “refashion thinking about human origins” (p. 88). In 1925, a great controversy erupted when he proposed classifying an *Australopithecus africanus* fossil as an intermediate form between apes and humans. For many years, there were serious arguments about Dart’s classification. Some of those controversies about our ancestor species still resonate in today’s ongoing arguments about the teaching of evolution in our schools. Contrary to the quiet disposition of scientists like the American bacteriologist Oswald Avery, Dart is portrayed as someone who “might have put colleagues off and militated against the ready acceptance of his writings and pronouncements” (p. 96). Nonetheless, he was a visionary and his work and “rebellion” shed much light onto our knowledge of hominid evolution.

Roger Sperry worked on the integration of the nervous system. His work addressed concepts “of fundamental significance: perception, memory, learning, control of behavior, and consciousness” (p. 174). He is considered a rebel for challenging the existing notion of modeling brain function without consciousness. Sperry’s name may not be familiar to many of us for several reasons. He did not keep up with rapid developments in the fields of physiological and neuroanatomical techniques. In addition, as Tim Horder points out, “Being a Nobel Prize winner is no guarantee of lasting fame within the annals of the scientific discipline” (p. 183). Although Sperry had a successful academic life, he never attained the stature

of other Nobel laureates in the field. Peter Mitchell, a pioneer in the field of bioenergetics, came up with a new approach during a period of crisis in cell bioenergetics, which occurred due to a dearth of experimental data. He proposed that a pH gradient across the membrane could drive the synthesis of ATP. His major published works further enhanced the role of ATP synthase in transporting protons across the membrane. His evidence for the chemiosmotic theory came from work using chloroplasts, even though most of his work was applied to mitochondria. He is seen as a rebel for a variety of reasons, among them that his work was self-published and his research was funded through his own foundation. His work contributed to other areas of research, such as the mechanism of flagellar motion and the origin of mitochondria. His work on chemiosmosis forever changed biochemistry.

Thelma Rowell’s work focused on female baboons acting as foci of their groups’ social activity. How was she a rebel? It is inferred that her observations were the result of being a female primatologist (p. 342), although the question of Rowell’s gender seemed irrelevant to her scientific contributions. This notion has been suggested by others. Primatologists like Jane Goodall and Rowell shifted the focus of research to include the behavior of individuals. One radical assumption Rowell made was that competition and hierarchy depend on the eyes of the observer (p. 346). She then expanded the concept of hierarchy under captivity conditions. In addition, she was the first primatologist to question the concept of dominance, which became a crucial factor in our understanding of the social organization of primates. Her influential work, which has had a long-lasting effect in terms of the questions being asked and the methodology used, has been called the “Thelma effect” (p. 351). She summarized her working method by saying: “That was my Cambridge training. We were always taught to question authority: the more authoritarian it is, the more you question it” (p. 351).

CONCLUDING REMARKS

Rebels, Mavericks, and Heretics in Biology is valuable in many respects. First, it introduces several scientists with whom some teachers and students might not be familiar. Second, it portrays a more human aspect of scientists, showing their strong tempers, personal insecurities, and other attributes rarely mentioned when discussing scientists’ work. Third, it shows that a scientist might need to challenge entrenched dogmas and paradigms in order to succeed. By the end of the book, it becomes obvious that so many fields of biology have been enriched by the work of unique personalities who had the common goal of trying to understand the world around us. Although I did not see anything heretical about the scientists portrayed here, the book offers some valuable lessons about challenging established scientific views—and succeeding by doing so. I look forward to reading a future edition featuring another group of interesting “rebellious” biologists.