

Lara V. Marks. *The Lock and Key of Medicine: Monoclonal Antibodies and the Transformation of Healthcare*. xxv + 316 pp., illus., figs., tables, bibl., index. New Haven, Conn./London: Yale University Press, 2015. \$40 (cloth).

Accounts of the biotechnology revolution are usually organized around the story of DNA: the pioneers who developed the recombinant DNA technology in the 1970s, the companies that led the way to exploit this new technology, the governments that came up with both promotional and regulatory policies, and the civic groups that expressed ethical and social concerns about the manipulation of genetic materials. In her fascinating book, *The Lock and Key of Medicine*, Lara V. Marks tells a similar story but from an entirely different angle—that of monoclonal antibodies (Mabs). Mabs can kill disease-causing microorganisms with high precision, illuminate pathological pathways of chronic diseases like cancer and neurological disorders, and serve as fast and accurate diagnostic tools for clinical testing like blood typing. No material is better suited for the title of “magic bullets”—the metaphor the German immunologist Paul Ehrlich had used in the late nineteenth century to denote the potentiality of antibodies as curative agents—than Mabs.

Monoclonal antibodies are now everywhere around us in various forms, such as home-testing kits for pregnancy and best-selling blockbuster drugs. Nevertheless, unlike DNA, Mabs are unfamiliar to most non-experts. Nor have they drawn much attention from historians. Marks aims to fill this gaping hole by tracing the history of monoclonal antibodies from Nobel Prize-winning research in the 1970s to the commercial success of Mab products in the 2000s. In between, she chronicles the emergence and disappearance of early start-up companies and explores the competitiveness of the biotech industry at the global scale. She also describes the roles played by funding organizations, patent offices, and regulatory agencies in shaping the pace of the commercialization of academic research. This is an original, well-researched, and compelling account of extraordinary materials in the history of biotechnology. Presented in a jargon-free, reader-friendly manner with full background information, this book will be a pleasant read for scientists, medical doctors, business strategists, journalists, museum curators, and historians.

Historiographically, *The Lock and Key of Medicine* touches on the important theme of the *materiality* of knowledge production. Mabs are not only final products of benchwork but also integral parts of the technique. In other words, the success of the Mab-producing technique, called “hybridoma technology,” did not hinge solely on the idea of fusing a myeloma cell with a normal spleen cell from immunized mice. That idea was in the air. More important was the material side of laboratory work: for example, what kind of target material should be used as an antigen, what myeloma cell line should be selected, how to prepare a cell-growing medium, how to detect the production of Mabs, and so on. This was the reason why the Mab-producing experiment was often so difficult to replicate in other laboratories.

Examining the materiality of Mabs, Marks focuses on César Milstein and Georges Köhler’s work, done within the Laboratory of Molecular Biology at the University of Cambridge, and on their way of responding to the requests for lab materials and techniques from other research groups in Europe and the United States. The important question of how to share or protect intellectual property ensued when the culture and process of securing patents in life sciences varied significantly from one country to another. Marks offers a picture of the changing moral economy and patent policy at this pivotal moment of the biotechnology revolution. However, she could have engaged the existing literature of laboratory studies, such as work on air pumps and fruit flies, in order to illuminate the unique feature of the materiality of Mabs in conjunction with the commercialization of academic research.

Marks intends to discuss the significance of Mabs not only in terms of scientific discovery and commercialization but also from the perspective of health care and affordability. The therapeutic benefits of Mabs are unquestionable, yet their costs are extremely high. Who should take the burden? Patients, companies, or the government? Perhaps this is the issue that many historians of medicine and public health will find most interesting and wanting in this book. Have Mabs led the way to a therapeutic revolution? Marks thinks so. But she has yet to describe the nature of that revolution. By what means is the therapeutic efficacy of Mabs constructed? How can we discern the therapeutic transformation from the marketing strategy of pharmaceutical

companies? How does Mab therapeutics affect public health policy? Marks eschews these questions. In the final chapter of the book, instead, she describes the whole event as “a quiet revolution” in order to emphasize that Mabs “have generally received less public fanfare than other forms of biotechnology such as genetic engineering and stem cells” (p. 236). Does she offer any good explanation for this lack of fanfare? Does it really matter to the therapeutic side of the story? Marks leaves us a wonderful research question about the extent to which breakthroughs in science can change medical practices in the twenty-first century.

Buhm Soon Park

Buhm Soon Park teaches history of science and policy at the Korea Advanced Institute of Science and Technology (KAIST). His research explores the issues at the intersection between science, law, and governance from a historical and comparative perspective. He has published on the history of the National Institutes of Health, the history of quantum chemistry, and science policy in East Asia.

Alan C. Love (Editor). *Conceptual Change in Biology: Scientific and Philosophical Perspectives on Evolution and Development*. (Boston Studies in the Philosophy and History of Science, 307.) xviii + 490 pp., figs., tables, bibls., index. Dordrecht: Springer, 2015. \$179 (cloth).

The title of this anthology expresses the depth of the love affair between contemporary philosophy of biology and the field of evolutionary developmental biology (evo-devo). Although nominally a book about conceptual change in *biology*, it is in fact a book about conceptual change in one recent and idiosyncratic *field* of biology that now looms large in our frame of view. At the same time, the title expresses something true about evo-devo itself: just as the proponents of the Modern Evolutionary Synthesis of the mid-twentieth century sought to provide a unifying framework for all of biology, the participants in the 1981 Dahlem conference on evolution and development—the *raison d'être* of this new volume—viewed the injection of developmental processes into evolutionary theory as similarly global in its disruption of the synthesis paradigm. That conference, and the resulting 1982 anthology of the same name (edited by J. T. Bonner), have for many philosophers of biology become symbols of a broader backlash against—or at least a correction of—the perceived epistemic and conceptual shortcomings of the Modern Evolutionary Synthesis.

In keeping with the general aims of the Boston Studies in the Philosophy and History of Science series, Alan Love has interspersed contributions from prominent scientists in the field—many of whom participated in the 1981 Dahlem conference—with offerings from philosophers of science. The anthology stems from a 2010 workshop at the Max Planck Institute for the History of Science centered on the impact of evo-devo on evolutionary theory over the intervening three decades. Scientific participants were asked to reflect on changes in the conceptual dimensions of their work since the mid-1980s and on how those changes have impacted their empirical research activities. Philosophical participants were asked to provide an outsider's view on the development of evo-devo and to evaluate models that could describe and explain conceptual changes in the field. The resulting papers are rich in biological detail and represent a wide range of research activities. Such variety evidently presented an organizational challenge, as several of the five parts into which the volume is divided have nearly as many concepts in their titles as constituent chapters (e.g., “Part III: Models, Larvae, Phyla, and Paleontology”). Several salient themes nevertheless emerge, including the timing of development, phenotypic plasticity, and developmental constraints on evolution.

Biologically literate philosophers and philosophically inclined biologists will find this book to be an invaluable primer, covering a wide range of scientific and epistemic concerns central to contemporary philosophical scholarship on evo-devo. The anthology features chapters from some of the most prominent philosophers in this field, including William Wimsatt, James Griesemer, Ingo Brigandt, and Love himself. Many of the scientific contributors were, as noted, participants in the 1981 Dahlem conference. Historians will value this book as a source for scientists' retrospective narrations. Although several chapters deal with