# BOOK REVIEWS

## Immunology Dichotomized

**Species and Specificity**. An Interpretation of the History of Immunology. PAULINE M. H. MAZUMDAR. Cambridge University Press, New York, 1995. xiv, 457 pp., illus. $64.95 or £40.

Do scientific thinkers (or, if you prefer a less anachronistic term for those living before the 19th century, natural philosophers) constitute a genus of two species, one of which seeks unity, continuity, and simplicity in nature, while the other seeks difference, discontinuity, and distinct categories? Can, say, Galileo, Buffon, and Matthias Schleiden be placed in the first, while Aristotle, Linnaeus, and Robert Koch are assigned to the second? Does this classification tell us something fundamental about the nature of scientific thought and the history of science? Pauline Mazumdar's answer is yes on all counts, and she finds in this dichotomy a master key to the history of immunology.

Mazumdar describes her book as a scientific biography of Karl Landsteiner. It is that, but her ambitions go much further. Landsteiner's scientific career is embedded in the larger framework of a series of debates in scientific and especially biological thought, debates that extend over at least five generations and two continents, from the mid-19th to the mid-20th century. In each generation the specific problems and research methods are different, but in Mazumdar's account each conflict expresses a constant set of underlying dichotomies. Whatever the particular issues at stake, one side may be seen to favor unity and continuity, the other plurality and sharply defined difference.

First in the series is Schleiden, who as cofounder of the cell theory was emphatically a unifier, militantly opposed to systematic botany's endless efforts at splitting and differentiation. In the next generation Schleiden's student Carl von Nägeli sought continuity and gradation everywhere in the natural world and denied the existence of distinct bacterial species. Nägeli was opposed by Ferdinand Cohn, a Linnean botanist who created a classification of bacteria based on a firm conviction of the reality and stability of their separate species. Cohn's project was taken up and powerfully extended by Koch. Koch's development and eminently successful application of the technical armamentarium of bacteriology reinforced concepts of sharply defined specific difference in the microbial world, and his institutional success and ability to train and place followers in German-language universities and medical institutions ensured the spread and establishment of pluralist views. Koch's triumph was rendered incomplete by opposition from Nägeli's student Max von Gruber, who attacked Koch's ideas on specificity. Gruber later attacked Koch's student Paul Ehrlich, who developed influential variants of pluralist views in his work on biological stains, immunology, and chemotherapy.

Paul Ehrlich; pencil drawing. [From *Species and Specificity*; National Library of Medicine]

Only after this genealogy of conflict has been established does Mazumdar introduce Landsteiner into the story. As Gruber's student, Landsteiner enters the fray on the side of the unifiers. By this time, however, the field of battle has shifted to immunochemistry. In his early work, Landsteiner advances the idea that blood immune reactions are due to continuous modification of a few substances, and not to the presence of a multiplicity of highly specific substances as Ehrlich maintained. Participating in biologists' enthusiasm for colloid chemistry, and for physical chemistry more generally, in the first decade of the 20th century, Landsteiner opposed his own explanation of toxin-antitoxin interaction on the basis of electrical charge to Ehrlich's approach emphasizing structural organic chemistry. In response to chemists who showed that chemical substitution in the serum protein molecule destroyed specificity (apparently confirming Ehrlich's side-chain theory), Landsteiner responded that the substitutions affected specificity only indirectly, by altering the molecule's physical properties, and that specificity could be made to vary continuously by varying substitutions.

Robert Koch with his second wife, on a visit to Tokyo, 1903. [From *Species and Specificity*; National Library of Medicine]

Although it was a 1901 paper of Landsteiner's that had described the human blood groups, he did not become involved in blood grouping again until the 1920s, after he had moved from Vienna to the Rockefeller Institute in New York. His avoidance of the subject may have been due to its association with Ehrlich's receptor theory and with Mendelian unit characters. He returned to it by making a distinction between protein specificity, which reflected the smooth transitions between biological species, and cellular antigens, which were part of a different system of specificities embodying discontinuities. By the 1930s he had moved away from this modus vivendi, partly in response to Linus Pauling's work on weak, short-range forces that seemed to offer a new way to interpret antigen-antibody relationships in physical terms and with renewed stress on gradual transitions.

Landsteiner died in 1943. The unifier–pluralist conflict was carried forward another generation, Mazumdar argues, in the controversy over the immunogenetical implications of the rhesus blood groups, discovered in the early 1940s. On one side were Ronald Fisher and the English serologist Robert Race, who based their theory of the rhesus system on the ideas of the receptor and the unit character, which blood group genetics had transmitted from Ehrlich and from early Mendelian genetics, respectively. On the other side was Alexander Wiener, an American follower of Landsteiner who rejected both the receptor and the unit character ideas, and who developed a theory of the rhesus system that emphasized gradual transitions among specificities. The theoretical conflict was never resolved, and Mazumdar points out that the related nomenclatural dispute was settled on the practical grounds of what terminology facilitated discussion of clinical problems or labeling of bottles.

## Vignettes: Popular Lecturing

I feel so strongly about the wrongness of reading a lecture that my language may seem immoderate. . . . The spoken word and the written word are quite different arts. . . . I feel that to collect an audience and then read one's material is like inviting a friend to go for a walk and asking him not to mind if you go alongside him in your car.

—*Lawrence Bragg*

The most prominent requisite to a lecturer, though perhaps not really the most important, is a good delivery; for though to all true philosophers science and nature will have charms innumerable in every dress, yet I am sorry to say that the generality of mankind cannot accompany us one short hour unless the path is strewed with flowers.

. . . With respect to the action of the lecturer, it is requisite that he have some, . . . for though I know of no other species of delivery that requires less motion, yet I would by no means have a lecturer glued to the table or screwed to the floor. He must by all means appear as a body distinct and separate from the things around him, and must have some motion apart from that which they possess.

—*Michael Faraday*

Quoted in David Crystal's *The Cambridge Encyclopedia of the English Language* (Cambridge University Press)

The book's argument is admirably clear and is never lost in the wealth of detail that flows from the author's obvious immersion in the sources. Mazumdar is attentive to the philosophical resonances of her themes of unity-simplicity and pluralism-specificity. She cites Kant and explores the vogue for Ernst Mach's philosophy in turn-of-the-century Vienna. But she never reduces the controversies to the philosophical predispositions of her protagonists. In each episode, in each generation, the dispute is embodied in the problems, issues, and scientific language of the day. The volume is generously illustrated, and the illustrations are well placed in relation to the text.

Karl Landsteiner at the age of about five (around 1873), "posing in a Hussar riding costume on the photographer's papier-maché rocks." [From *Species and Specificity*; George Mackenzie's collection, American Philosophical Society]

Mazumdar's thesis is an important and persuasive one that deserves serious attention from anyone interested in 19th- and 20th-century biology. This is not to say that questions will not arise for some readers. Mazumdar's emphasis on the role of teacher-pupil transmission in the continuation of the general form of controversy she identifies is credible, especially given the academic culture of the predominantly German-speaking scientists she examines. Whether it is sufficient is another matter, and discussion of other possible reasons for the persistence of the pattern seems called for. By positing two such distinct species of scientists, unifiers and pluralists, Mazumdar seems to betray her own inclinations as a pluralist. Fair enough, but the reader may wonder whether the separation is always so sharp, and whether individual scientists may not often incorporate both continuity and discontinuity, unifying and differentiating tendencies, into their work, as Landsteiner did in his thinking on the specificity of proteins and cellular antigens in the 1920s. Finally, we must ask to what extent the history of blood group immunology can represent the history of immunology in general. This is a question that Mazumdar does not explicitly address but that is evoked by the book's subtitle. Whatever the answers to these queries may be, there is no doubt that readers will come away from this book with a livelier sense of the controversies that have helped shape modern biology, and of their connections across the generations.

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## Reprints of Books Previously Reviewed

**Charles Darwin**. Voyaging. Janet Browne. Princeton University Press, Princeton, NJ, 1996. Paper, $18.95 or £12.95. ISBN 0-691-02606-8. *Reviewed* **268**, 1196 (1995).

**Hilbert**. Constance Reid. Copernicus (Springer), New York, 1996. Paper, $15. ISBN 0-387-94674-8. *Reviewed* **170**, 965 (1970).

**Learning to Heal**. The Development of American Medical Education. Kenneth M. Ludmerer. Johns Hopkins University Press, Baltimore, 1996. Paper, $16.95. ISBN 0-8018-5258-7. *Reviewed* **231**, 873 (1986).

**Marie Curie**. A Life. Susan Quinn. Addison-Wesley, Reading, MA, 1996. Paper, $16. ISBN 0-201-88794-0. *Reviewed* **267**, 1842 (1995).

**No Ordinary Genius**. The Illustrated Richard Feynman. Christopher Sykes, Ed. Norton, New York, 1996. Paper, $19.95. ISBN 0-393-31393-x. *Reviewed* **264**, 1617 (1994).

**Physical Chemistry from Ostwald to Pauling**. The Making of a Science in America. John W. Servos. Princeton University Press, Princeton, NJ, 1996. Paper, $19.95 or £16.50. ISBN 0-691-02614-9. *Reviewed* **252**, 863 (1991).

**Revolutions in Mathematics**. Donald Gillies, Ed. Clarendon (Oxford University Press), New York, 1995. Paper, $55. ISBN 0-19-851486-7. *Reviewed* **259**, 995 (1993).

**Scientific Elite**. Nobel Laureates in the United States. Harriet Zuckerman. Transaction, New Brunswick, NJ, 1996. Paper, $24.95. ISBN 1-56000-855-5. *Reviewed* **196**, 754 (1977).

**Stalin and the Bomb**. The Soviet Union and Atomic Energy, 1939-1956. David Holloway. Yale University Press, New Haven, CT, 1996. Paper, $18. ISBN 0-300-06664-3. *Reviewed* **266**, 466 (1994).

**Zipper**. An Exploration in Novelty. Robert Friedel. Norton, New York, 1996. Paper, $13 or C$16.99. ISBN 0-393-31365-4. *Reviewed* **264**, 994 (1994).

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## Books Received

**Anoxygenic Photosynthetic Bacteria**. Robert E. Blankenship, Michael T. Madigan, and Carl E. Bauer, Eds. Kluwer, Norwell, MA, 1995. xxiv, 1331 pp., illus. $492 or £303 or Dfl. 675. Advances in Photosynthesis, vol. 2.

**Biogéographie des Milieux Aquatiques**. Gabriel Rougerie. Colin, Paris, 1994. 252 pp., illus. Paper, 190 F. U Géographie.

**Corona- and Related Viruses**. Current Concepts in Molecular Biology and Pathogenesis. Pierre J. Talbot and Gary A. Levy, Ed. Plenum, New York, 1995. xx, 615 pp., illus. $139.50. Advances in Experimental Medicine and Biology, vol. 380. From a symposium, Québec City, Québec, Canada, Aug.-Sept. 1994.

**Human Identification**. The Use of DNA Markers. Bruce S. Weir, Eds. Kluwer, Norwell, MA, 1995. vi, 213 pp., illus. $122 or £76 or Dfl. 165. Contemporary Issues in Genetics and Evolution, vol. 4. Mostly reprinted from *Genetica*, vol. 96, no. 1-2 (1995).