Book Reviews

Joseph S Fruton, *Proteins, enzymes, genes: the interplay of chemistry and biology*, New Haven and London, Yale University Press, 1999, pp. xii, 783, £30.00 (0-300-07608).

Joseph Fruton (b. 1912) belongs to a generation of well-read biochemists who have found that historical understanding benefits their teaching and research. An outstanding protein chemist, his thousand-page biochemistry textbook, *General biochemistry* (1953; 2nd ed. 1958), which he co-authored with his wife Sofia Simmonds, was said by Gunter Stent to have brought intellectual substance and "grand coherence" to biochemistry. In 1972, at a time when few historians showed much interest in the development of biomedical and biochemical science, and while still practising biochemistry, Fruton published *Molecules and life: historical essays on the interplay of chemistry and biology.* As its sub-title indicated, this did not pretend to be an exhaustive history of biochemistry; nevertheless, like his biochemistry textbook, it brought out the intellectual substance and coherence of the discipline and did much to encourage a younger generation of historians to explore the history of molecular biology and its antecedents. This was, however, a period when many historians of science and medicine were agonizing over "internal" and "external" approaches to historiography. Some criticized Fruton for his emphasis upon the theories, experiments and methods used by chemists and biologists in exploring the phenomena of life, as opposed to an emphasis upon the effects of social, institutional and political events on the interplay of chemistry and biology.

Professor Fruton is more than able to hold his own in such debates and those that followed with the emergence of the sociology of science. Since his retirement in 1984 he has increased his standing as an historian of science with the outstandingly useful *Biobibliography for the history of the biochemical sciences since 1800* (2nd ed. 1992) and the fascinating *Contrasts in scientific style: research groups in the chemical and biochemical sciences* (1990), the latter especially demonstrating his ability to view history as an interpretative enterprise. Much has happened, both in biochemical science and in the historical interpretation of the interplay between chemistry and biology, in the 27 years since *Molecules and life* was published. The present huge volume is a reworking and enlargement of it, bringing forward the history of physiological chemistry from the 1950s to the 1990s. It pays particular attention to the emergence of molecular biology and the conceptual and methodological changes it has produced not only on biochemical genetics, but also in the more traditional research fields concerning enzymes, proteins, bioenergetics and metabolism.

Besides making rich additions to the printed literature surveyed in the chapters on these subjects (and adding a new, more philosophical, chapter on hormones and the issue of cell regulation), Fruton introduces comments on and criticisms of other historians' interpretations of these research areas. For example, had an "enzyme theory of life" emerged by the end of the nineteenth century? He doubts this, given the existing (and long-continuing) tensions between the different approaches of biologists who warmly embraced the physical chemistry of colloids and the traditional organic chemists (exemplified by Emil Fischer) who stressed analysis and synthesis of individual chemical substances found in animal and plant systems. As for molecular biology, he is certain that it was biologists, not biochemists, who adhered to the protein theory of the gene, and that in any case, research on photosynthesis has been equally significant to that on DNA

(and, as significantly, so far ignored by historians).

Historians of science and medicine who are not interested in the minutiae of the chemistry of life will, nevertheless, find the volume an extremely useful reference source. There are helpful names and subject indices and a generous 184 pages of bibliography. Such readers will particularly enjoy the three introductory chapters, partly drawn from the author's *A skeptical biochemist* (1992), that are new to this edition. Here Fruton offers helpful distinctions between the "research disciplines" created autonomously by the interplay of practising and publishing biologists and chemists, and "academic disciplines" that are promoted (or otherwise) by institutional, administrative or government policies. He also provides a wonderful worldwide survey and guide to the institutional settings in which the interplay of biology and chemistry has taken place, and an intriguing series of reflections on the way that biological and chemical issues (such as vitalism, teleology, reductionism and organization) have continued to fascinate philosophers, even if biochemists themselves have ceased to be directly influenced by philosophy. Fruton emerges as a happy-go-lucky realist and empiricist. To Paul Feyerabend's quip that scientists do not solve problems because they have a method or theory of rationality but "because they have studied it a long time", he forcibly adds "and by putting more women and men on the job".

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Martin J S Rudwick, *Georges Cuvier, fossil bones, and geological catastrophes: new translations & interpretations of the primary texts*, University of Chicago Press, 1997, pp. xvi, 301, illus., £27.95, $34.95 (0-226-73106-5).

Georges Cuvier, pioneer of vertebrate palaeontology and comparative anatomist at the Muséum national d'histoire naturelle in Paris from 1795 until his death in 1832, was arguably the leading scientist of France—and the most brilliant naturalist in Europe—during the first quarter of the nineteenth century. Modern biographers have produced excellent analyses of his careers as zoologist and scientific administrator, but his place in the history of geology has not been well preserved. Anglophone geologists of the later nineteenth century stressed his leadership of the losing side in two crucial debates: uniformitarianism versus catastrophism in the history of the earth, and evolutionism versus species fixity in the history of life. To make the victors' history as clear and simple as possible, Cuvier the catastrophist was cast as a miracle-monger anxious to find support for the Bible in the record of the rocks, and thus an obstructionist to proper geological theory. Twentieth-century geological textbooks perpetuated this flawed, positivist interpretation.

During the past three decades, however, Cuvier's geological beliefs and accomplishments have undergone re-examination by historians of science such as Reijer Hooykaas, Roy Porter, Stephen J Gould and, most importantly, Martin Rudwick. The rereading of Cuvier's publications has re-established his rigorously literal empiricism in analysing the Paris basin's discontinuous strata and their discontinuous fossil contents. Moreover, no one was more critical than Cuvier of the uncontrolled speculation that had typified the "theories of the earth" of his predecessors, speculation that produced only "a fruitless web of hypotheses and conjectures" (p. 103).

In the present volume, Rudwick completes this revision of Cuvierian science by presenting new translations of nineteen of Cuvier's most important geological writings and elaborating the details of their contexts. The writings span the period