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*Methods and Styles in the Development of Chemistry* by Joseph S. Fruton

Philadelphia: American Philosophical Society, 2002. Pp. xviii + 332.  
ISBN 0-87169-245-7. Cloth \$40.00

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Joseph Fruton is a prominent biochemist who late in life found a second career as a historian of science. He is best known for his Pfizer Prize-winning *Molecules and Life* [1972], and for his extensive studies of the research laboratories led by the 19th century organic chemists Justus von Liebig, Adolf von Baeyer, and Emil Fischer and by the physiologist Franz Hofmeister [Fruton 1972, 1985, 1988, 1990]. In these works, Fruton succeeded admirably in comparing pedagogical and research styles in various research laboratories. With *Methods and Styles*, Fruton offers his first general history of chemistry; and he has largely succeeded in preparing a short, well written, and accessible introduction to the major figures and theories of chemistry.

*Methods and Styles* is divided into nine chapters in a fairly standard manner. Of most importance to readers of *Aestimatio* are chapters 1–3. Chapter 1 offers a highly compressed tour of matter theory and alchemy from ancient Greece to the 17th century. Although this chapter manages to convey a large amount of material in a succinct manner, it is unavoidably superficial and takes slight notice of recent work on alchemy in the 17th century that has demonstrated far more continuity than discontinuity in chemistry before and after the Chemical Revolution [cf. Principe 1998, Newman 1994].<sup>1</sup> As a result, Fruton continues the (not entirely unreasonable) assumption long held by historians of chemistry that ‘real’ chemistry began in the

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<sup>1</sup> Two co-authored works, Newman and Principe 2001 and 2002, appeared at the same time as *Methods and Styles* and make more explicit the argument for continuities between alchemy and chemistry.

18th century; and he divides the 18th century into Lavoisier (chapter 3) and everyone else (chapter 2). Despite this emphasis given to Lavoisier, in the conclusion Fruton expresses more sympathy and admiration for Priestley than for Lavoisier.

The remaining chapters are organized around the emergence of Daltonian atomism, the development of radical and type theory in organic chemistry, the formulation of ideas of valence and molecular structure in the mid-19th century, and the appearance of stereochemistry and physical chemistry. The last chapter, 'Electrons, Reaction Mechanisms and Organic Synthesis', is somewhat unwieldy, as it seems to cover too much material in ranging from Faraday's study of electricity and the discovery of the electron to the emergence of electronic theories of bonding and quantum mechanics in the 20th century and to the Nobel prize winner in chemistry (1965) R. B. Woodward and his work in organic synthesis. Most of this chapter is a welcome summary of the major developments in chemistry during the 20th century, although it does not cover colloidal, inorganic, and polymer chemistry. In each chapter, Fruton's approach is primarily biographical, introducing the background and education of the relevant chemists before moving on to their ideas.

Although Fruton has written an admirable, short account of the history of modern chemistry, the principal drawback of the book is the lack of a central theme or themes organizing the actual material in the text, thus making the title somewhat misleading. In the foreword, Fruton does discuss several possible meanings of 'styles and methods in science'; and he is influenced by Alistair Crombie's recent categorization of six styles of scientific reasoning [see Crombie 1994, 1995], which Fruton says can be applied profitably to the history of chemistry. Unfortunately, however, these six styles are largely ignored in the rest of the text, leaving the reader to assign each chemist to one of the six styles. Fruton returns to the styles in the conclusion but only in a vague way, never specifying how particular chemists match each type of style. For example, on page 227, Fruton quotes James Bryant Conant at length from the preface to his famous case studies; yet Fruton fails to make the connection explicit by comparing this pedagogical statement to Conant's own chemistry. As a result, throughout the book, 'style' simply means what the reader draws from Fruton's presentation about each individual chemist. It does not signify anything that is common to chemists at any given

time or place. Similarly, there is no explicit discussion of ‘methods’ and what they might mean to chemists.

Despite this reservation, and although Fruton’s analysis does not go far beyond what historians of chemistry have said elsewhere, *Methods and Styles* is a clearly written, succinct account of basic personalities and issues in the history of chemistry for the non-specialist. Fruton has made extensive use of recent secondary literature and his notes will lead a novice in the history of chemistry to much of the most important literature on each topic.

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