

Book Review

Before Big Science - The Pursuit of Modern Chemistry and Physics, 1800-1940,

by Mary Jo Nye (Harvard University Press, 1996) 304 pp., ISBN 0-6740- 6382-1; \$18.50 (paperback)

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The most impressive and useful features of this relatively small book are its thematic organization and its ability to develop these chemical/physical themes in an integrated and comprehensive manner. As Nye states in the preface, there is little new information that is not available elsewhere. What is new and useful is its packaging. She has chosen several themes in chemistry and physics and examines their development within the title years. She does this in a concise, dense fashion. This book contains much information.

For example, one of the seven themes is chapter six "A New Chemistry, A New Physics: Radiations, Particles, and Wave Mechanics after 1895." In this chapter the advances in physics and chemistry that led to the modern understanding of the atom and chemical bonding are spelled out. The author deftly integrates the work of the many scientists who contributed to this progress, often explaining the influence of one on the others. In these forty-two pages the impact of Roentgen, Becquerel, the Braggs, Moseley, the Curies, Rutherford, Thomson, Nagaoka, Bohr, Geiger, Sommerfeld, Born, de Broglie, Heisenberg, Schrödinger, Langmuir, Lewis, Robinson, Ingold, Heitler, London, Pauling, and Mulliken on these topics are discussed. Although this treatment is necessarily abbreviated, it effectively and efficiently covers all these people, their ideas, and interactions. In this chapter, as in the others, the level of treatment is relatively high. I doubt if many lay readers would follow much of the discussion. On the other hand, this is an excellent summary for scientists who wish to review or study the theme in an integrated, holistic fashion. The level of presentation is appropriate for advanced undergraduate science majors, graduate students in science, and practicing scientists who wish a concise summary.

The other themes investigated in this book are the organization of science, atomic theory, the electromagnetic view of nature, thermodynamics and energy, organic chemistry, and the creation of nuclear science. The seven chapters range from 27 to 42 pages in length.

Chapter one outlines the internationalization of science from its beginnings in Britain, France and Germany. The roles of industry, academia, and government in scientific research and education are explored. Interwoven within all these discussions are the people who inspired and led these changes and advancements. Chapter one also delineates the role of the Nobel Prize in scientific progress and the evolution of the United States as a leader in international science.

Chapter two traces the development of the atom as a central concept in the development of chemical theory, symbolism, and experimental observations. Nye further draws a clear distinction between the competing physical and chemical atomic concepts, and suggests that this competition indeed inspired much of the research that led to a more complete understanding of the atom in the twentieth century.

Chapter three investigates the development of the theory of electro-magnetic radiation by Faraday, Hertz, and Maxwell. The author examines the studies which initially included, then refuted, the “ether” concept. The understanding of electricity and the origin of electromagnetic radiation set the stage for the advances in understanding atomic structure in the early 1900s,

Chapter four delves into the development of the laws of thermodynamics and concepts of energy and entropy by key figures as Helmholtz, Gibbs, Joule, and van't Hoff, It contains a treatment of the Planck hypothesis that matter exchanges energy with, its surroundings in discrete, quantized amounts. Einstein's use of this hypothesis to explain the photoelectric effect is also examined.

Chapter five examines the development of the structural theory of organic chemistry from Laurent's “nucleus theory”, through Fischer's elucidation of carbohydrate structure, to Pauling's contributions to protein structure. The main theme developed in this chapter is that the advances in structural chemistry made during this time came as a result of the search for knowledge about natural products such as plants and animals, and agricultural and physiological chemistry. Pages 179-181 provide an illustrative example of the ability of the author to weave together the research of several people toward a common scientific understanding. In this section she discusses the development of theory, nomenclature, and notation related to organic reactions mechanisms.

Chapter six was discussed in the second paragraph. Chapter seven traces the role of scientists in both WWI and WWII and in the years between these conflicts. The details of the discovery of nuclear fission are probed with consideration of the international impact of this discovery. These efforts gave rise to science on an international scope. They also gave rise to “big science”, as typified by the Manhattan Project.

The value of this book is enhanced by both the bibliographic essay and extensive name and subject indexes. Both collect a large amount of information into a minimum number of pages and are valuable for conducting historical research. The writing style, although generally understandable, is all too frequently hampered by lengthy, sometimes obtuse sentences. Often, the meaning of some of the sentences or paragraphs remains unclear even after several readings. The technical information is almost always accurate. There was only a single instance where an error was noted. On page 128 it states that “aldehydes and ketones... were ... derived from water by replacement of one or both hydrogen atoms ... by radicals or residues with explicit chemical function.” This is untrue; neither aldehydes nor ketones contain divalent oxygen in tetrahedral hybridization.

Overall this book is useful to scientists wanting a quick, but thorough, explanation of some themes in chemical history between 1800 and 1940. This treatment will help these readers “see the forest for the trees.” It will also be useful to anyone involved in chemical history research because of the bibliographic essay and extensive indexes. Lay readers will not find this book easy to understand or learn from. Finally, it should be considered for advanced undergraduate and graduate courses for science majors in the history of chemistry, where such courses still exist.