without any introduction, can only serve to puzzle the reader. Why the botanical garden? Perhaps it has a place, but can it be said to have played so important a role? Is it really a social institution in Armytage's sense, or is it, as I believe, a large-scale cooperative experiment? My own view is that this history ought to begin with the late medieval guild and the *quadrivium* of the medieval university. But there are more searching questions. A history that is so narrowly restricted to the empirical data does not really tell the story that we need to know. Without descriptive and interpretive generalizations, without an assessment or evaluation of the main events, we are never brought to the place where we can comprehend the role of the scientific institution, and hence the scientific enterprise itself, in the social and economic systems in which they play this role. The crucial event in the social history of science, for example, is the professionalization of science in the 19th century. What social factors were necessary for this to occur? The beginning, I think, is the succession of radical changes in the manufacturing process following the Industrial Revolution of the 18th century. Through complex developments in the physical sciences a new symbiotic interdependency grew up between science and technology, with the ultimate consequence that science reached a decisive economic importance. The point is that the historian cannot write meaningful social history without inquiring into that intricate pattern of relations existing among science, technology, industry, and economic and social organizations. Armytage has an overabundance of one kind of fact, but he does not present the larger issues, and he does not have a conceptual scheme by which all these elements can be united into a revealing totality.

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Fluorescent-Tracer Studies

Beaches represent one of the most complex natural environments on earth. Movement of beach sediment in response to waves and currents as analyzed by use of tracer particles is the subject of **The Movement of Beach Sand** (Elsevier, New York, 1966. 231 pp., illus. $14.50) by James C. Ingle, Jr. A great resurgence of interest in tracing the path of sediment movement both in rivers and on beaches has developed with the advent of methods for radioactive or fluorescent tagging of natural sediment. Because the field has grown so rapidly within the past ten years much of the basic literature is still in the inconvenient form of mimeographed internal laboratory reports, limited-circulation Department of Defense project reports, and unpublished graduate theses. Ingle has performed a valuable service by identifying these references in an exhaustive 8½-page bibliography.

The book is constructed primarily around the description and analysis of a series of fluorescent-tracer-particle experiments conducted by Ingle in shallow water at five beaches along the southern California coast. An introduction that gives appropriate terminology and history is followed by chapters on field and laboratory procedures, general patterns of foreshore-inshore tracer transport, sand movement seaward of the breaker zone, sand movement around man-made structures, analysis of tracer dispersion, and a summary chapter. Those interested in performing fluorescent-tracer experiments are directed to the first appendix, which lists components of the coating formulations currently being used by coastal investigators other than Ingle.

Even though Ingle has attempted to relate his conclusions to work of previous investigators, many aspects of basic data-collection procedures and methods of interpretation are presented somewhat esoterically, thereby causing potential hardship for many readers having only a general background in sedimentology. A broadened base of readership might have been achieved by deemphasizing the California tests and by adding an incisive examination of the applicable literature relating to statistics of beach-sediment sampling designs, sampling devices, and concepts of hydrodynamic interpretation. However, as presently constituted, the book holds many rewards for those concerned with understanding the dynamics of coastal erosion and accretion.

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Physical Chemistry for Students

Should a course in advanced physical chemistry be offered in a modern curriculum, and if so, what should the content be? Jeff C. Davis, Jr., the author of **Advanced Physical Chemistry: Molecules, Structure, and Spectra** (Ronald, New York, 1965. 642 pp., illus. $12), clearly believes in the need for such a course. His first few chapters, which cover elementary quantum mechanical principles, are followed by one on statistical mechanics. Chapters on the hydrogen atom, complex atoms, and simple molecules follow. The latter half of the book is devoted almost entirely to molecular spectroscopy, including microwave, infrared, electronic, and magnetic-resonance applications. Numerous problems are given at the end of each chapter, many of which appear to be of top quality.

The text is well written and clear, although I wished at times that it were more concise. The early chapters on quantum mechanical principles and applications are on the level of Pauling and Wilson's *Introduction to Quantum Chemistry* or Eyring, Water, and Kimball's *Quantum Chemistry*, and the treatment of many topics parallels the treatment given in these two texts. The one chapter on statistical mechanics is, in my opinion, not adequate for a course in advanced physical chemistry since only the microcanonical ensemble is considered. The latter half of the book offers an excellent introduction to the various branches of molecular spectroscopy.

A course based on this text could easily be incorporated into existing chemistry-department programs. Within this framework it is a decent text if one offers supplementary material in kinetic theory and statistical mechanics. Although there is no doubt that a graduating senior in chemistry ought to be familiar with the material presented, there is some question in my mind whether piling additional survey courses on top of the existing structure is worthwhile. It might be more to the point if the present undergraduate programs in chemistry departments, which have been for the most part frozen for about 20 years, were completely revamped with more emphasis on the general principles and more efficient use of students' time.

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