"Humboldtian science" comes close to explaining everything—and nothing. The varieties of science in London, then the commanding city of the Western world, deserve a fuller treatment. The uses and abuses of scientific knowledge in cities like Edinburgh, Glasgow, Dublin, and Manchester are not developed. On occasion Cannon's work threatens to become an entertaining rollick, as when she offers admirable rules of historical evidence but goes on to admit that "I have violated these rules often in this book, but here I have provided a standard whereby the reader can judge whether to believe what I say or only to become interested in it" (p. 173).

Because early Victorian Britain was a seedbed of our modern science, it deserves the historian's attention. We must hope that this bold, iconoclastic survey will encourage other scholars to undertake new analyses of the scientific institutions, ideologies, politics, and personalities of that era. A more disciplined technique than appears here will be needed to separate out, characterize, and display the rich variety of elements that constitute science in culture. The challenge to the historian is to develop that technique without sacrificing the interest or intelligence so vividly displayed in Cannon's idiosyncratic account.

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Chemistry in Britain

Chemists by Profession. The Origins and Rise of the Royal Institute of Chemistry. COLIN A. RUSSELL with Noel G. Coley and Gerrylynn K. Roberts. Open University Press, Milton Keynes, England, 1977 (U.S. distributor, Humanities Press, Atlantic Highlands, N.J.). x, 342 pp. + plates. $21.50.

Authors of commissioned institutional histories, even when trained historians, frequently are subject to subtle or overt pressures to illuminate an institution's best profile, to avoid discussion of controversial matters of policy and personality, to emphasize their subject's significance, and to refrain from pursuing topics or themes that might displace the institution itself from center stage. *Chemists by Profession*, a history commissioned to celebrate the Royal Institute of Chemistry's centenary in 1977, avoids most of these pitfalls.

Commencing with a valuable account of the growth of chemistry as a science in Britain, Russell, Coley, and Roberts proceed to examine the factors that contributed to the formation of a body of professional British chemists during the 19th century: the increasing importance of chemical analysis to municipal authorities and a variety of private firms, the expansion of British chemical industries, and the growth in the number and variety of educational institutions at which chemistry was taught. Several societies arose in response to the needs, interests, and ambitions of Britain's chemists. The Chemical Society of London, the Society for Analytical Chemistry, and the Society of Chemical Industry were all products of the Victorian era.

From its inception in 1877, the Institute of Chemistry was unique among these organizations. Its primary aims were to promote the economic and social standing of its members and to ensure that practicing analytical and consulting chemists possessed training suitable for their tasks. The promotion of chemistry as a profession was the Institute's central goal, not the advancement of chemistry as a branch of knowledge. Following its establishment, the Institute gradually evolved a system of examinations and qualifications for membership which, its leaders hoped, would serve as standards for practicing chemists. At a time when an array of colleges, universities, technical schools, mechanics' institutes, and hospitals were training chemists, this would have been no small accomplishment. The ambition, however, was never fully realized. A Royal Charter granted the Institute in 1885 conferred legal authority to award certificates of competence, but failed to give the Institute a monopoly on qualifying chemists for practice.

During the 20th century the Institute slowly expanded the scope of its activities. Although it has continued to administer examinations, during the years since World War I the Institute's leaders have given greater attention to surveys of remuneration, the development of a national appointments register, and lobbying efforts within government councils in behalf of chemists' professional interests in matters of legislation and national policy.

Russell and his collaborators provide a thorough account of the circumstances that led to the organization of the Royal Institute and a detailed discussion of subsequent changes in its structure and function. They are at their best in analyzing the Institute's qualifications as products of the conflicting interests of academic chemists, who provided much of the Institute's leadership, and practicing chemists, who constituted a majority of its members. They also succeed in demonstrating how an organization that embraced both employers and employees in its membership was forced to walk a fine line between acting as a trade union and acting as a professional society, especially during the years after World War I when British society became increasingly polarized between management and labor organizations.

As their title suggests, the authors of *Chemists by Profession* sought to do more than chronicle the Royal Institute of Chemistry's development. They also aimed to trace the evolution of chemistry as a profession in Britain. According to their criteria, a profession consists of a group sharing intellectual qualifications, standards of remuneration, a sense of corporate identity, and an awareness of social responsibility. Its accredited representatives should constitute a recognized source of authority in society. Russell and his associates see the Royal Institute's history as a vehicle for studying the formation of this professional group. Indeed, they claim that the story of the development of chemistry as a profession in Britain is largely the history of the Institute.

In this claim they are not entirely convincing. Certainly the Institute's foundation and continued existence should be read as an expression of chemists' professional yearnings, but has a profession defined according to the authors' criteria ever taken form in Britain? Despite recent efforts toward unification, the Royal Institute remains one among several organizations seeking to speak for chemists. Although it alone enjoys the right to certify practical chemists as being competent, many chemists who fall short of the Institute's standards continue to practice, and many others who possess the qualifications necessary for membership have not joined. The authors tell us that as late as 1971 only 60 percent of the chemists qualified to enroll had done so. Moreover, the same tensions among academic chemists, independent consultants, employees of industry, and managers that the authors use so effectively in analyzing the glacial development of Institute policies also speak tellingly for the enduring strength of particularist sentiments within the Institute's membership. Current attempts to unify chemists' organizations in Britain, the subject of the last chapter of this book, offer dim promise of resolving these conflicts.

The voluntary nature of membership in the Institute, the existence of rival organizations competing for members and a voice in government councils, and internal divisions within the Institute itself point to the conclusion that chemistry in Britain has never possessed the essential characteristics of a profession as Russell and his colleagues define it. In this sense, *Chemists by Profession* is an account of a development that has not occurred. It richly documents the difficulties, perhaps insurmountable, that confront those who would shape a unified profession from the diverse groups who call themselves chemists.

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Galactic Dynamics

Structure and Properties of Nearby Galaxies. Papers from a symposium, Bad Münstereifel, Germany, Aug. 1977. ELLY M. BERKHUIJSEN and RICHARD WIELEBINSKI, Eds. Reidel, Boston, 1978. xviii, 308 pp., illus. Cloth, $38; paper, $24.50. International Astronomical Union Symposium No. 77.

The Large Scale Structure of the Universe. Papers from a symposium, Tallinn, Estonia, U.S.S.R., Sept. 1977. M. S. LONGAIR and J. EINASTO, Eds. Reidel, Boston, 1978. xx, 464 pp., illus. Cloth, $46; paper, $29. International Astronomical Union Symposium No. 79.

Extragalactic astronomy advances simultaneously on two fronts. For nearby galaxies, high-resolution studies reveal a wealth of details concerning the optical, infrared, radio, and x-ray properties of their nuclei, their distribution of light and mass, their past history of star formation, and material in their vicinity. In contrast, observations to the outermost distance limits reveal the large-scale distribution of matter in small groups, in large clusters, and in superclusters, the dynamical evolution of clusters, the cosmical evolution of matter, and the formation of structure in the universe. In recognition of the rapid progress in both of these directions, the International Astronomical Union sponsored the two symposiums in 1977 whose proceedings are reviewed here. In a standard format of invited papers, short notes, and floor discussion, the volumes present a wealth of recent observations, accepted theories, novel ideas, and sheer conjecture, all of which lead to a model of the universe that is both exciting and beautiful, and that could not have been presented ten years ago.

Nearby, as *Structure and Properties of Nearby Galaxies* demonstrates, the surprises are few, but the breadth of facts is impressive. In the Andromeda galaxy (M31), for example, although the detailed form of the spiral pattern still cannot be deduced (Athanassoula), the kinematics is better understood. Neutral hydrogen can be traced beyond the optical image to a distance of 30 kiloparsecs, and the rotational velocities remain high (Roberts, Whitehurst, and Cram), implying a significant mass at large nuclear distance. Closer to the nucleus, motions are complex and may arise from an earlier nuclear explosion (Shane), a warped or corrugated disk (Emerson and Newton; Whitehurst, Roberts, and Cram), or high-velocity clouds surrounding M31. Dwarf spheroidal galaxies in the vicinity of M31 are shown to resemble those in our own Local Group of galaxies (Kinman). Radio continuum observations (Berkhuijsen) detect intense radio emission from the nucleus and from the optically bright arms, with the peak intensity of the radio continuum, of HI, and of HII generally coincident and often following the dust lanes. Many concepts concerning the dynamics and evolution of galaxies are now well understood (Tinsley; Strom and Strom), although whether a heavy halo exists is still uncertain (van den Bergh).

In *The Large Scale Structure of the Universe*, the picture that emerges from studies of distant groups of galaxies begins to be revealed through studies of nearby small groups of galaxies (Tully and Fisher): there is no evidence for significant numbers of isolated "field" galaxies. More striking, there are large voids in the galaxy distribution, encompassing about one-half of the region surveyed; the number density here is down by a factor of 10^3. DeVaucouleurs, who taught us that we live in a supercluster, now has a plethora of colleagues (Rudnicki and Zieba; Abell; Tarenghi *et al.*; Tifft and Gregory; Huchra) who report on the large-scale distribution of extragalactic objects. Their work, plus that of Jõeveer and Einasto ("Has the universe the cell structure?"), but especially that of Peebles and his school, is changing our picture of the large-scale clustering of galaxies. Peebles's analysis, which is based on galaxy counts by Shane and Wirtanen, shows that the galaxies distribute themselves in interlocking lace-like cells, cells with scale lengths of 50 to 100 megaparsecs. The voids are a significant feature of the arrangement and will have to be accounted for in any theory of matter distribution.

The dynamical evolution of clusters of galaxies, with emphasis on the roles of accretion, cannibalism, violent relaxation, and interactions with the intercluster gas (Ostriker) and observational evidence for cosmical evolution of quasars (Schmidt), radio sources (Longair), and galaxies (Tinsley) also now lend themselves to some measure of observational understanding.

Widely differing theories of the large-scale structure and evolution of the universe from the several Moscow groups (Zeldovich; Doroshkevich, Saar, and Shandarin; Ozernoy; Chernin) are imaginative and exciting. The points at which they mesh with observations must still be established; whether the physics of the very early universe can be understood is not yet clear.

Both of these volumes contain a wealth of information accumulated only in the last few years, and the index to the galaxies and clusters discussed in *Structure and Properties of Nearby Galaxies* deserves a special thanks. The proceedings make informative and interesting reading. The problems are far from solved, and these papers serve to illuminate the questions as well as to provide their present answers. Zeldovich, the optimist, concludes that at "the next symposium somewhere in the early eighties one can be pretty sure that the question of the formation of galaxies and clusters will be solved." We'll see.

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Cosmogony

The Origin of the Solar System. Papers from a NATO Advanced Study Institute, Newcastle upon Tyne, England, March 1976. S. F. DERMOTT, Ed. Wiley-Interscience, New York, 1978. xviii, 668 pp., illus. $69.

For much of its history, cosmogony was a field for the entrepreneur. The goal was to explain the large-scale structure of the solar system. With only dynamical constraints, this seemed within the powers of the individual; collaboration and specialization were rendered superfluous by the scarcity of data. Within the last two decades, new observational techniques, especially the use of spacecraft, the development of subtle chemical and isotopic analyses, and increases in computational capacity, have radically al-