Republics of Science

Solomon's House Revisited. The Organization and Institutionalization of Science. TORE FRÄNGSMYR, Ed. Science History (Watson), Canton, MA, 1990. xiv, 350 pp. $49.95. Nobel Symposium 75. From a symposium, Stockholm, Aug. 1989.

Published in 1627 in an age when the systematic study of nature was new, Francis Bacon's *New Atlantis* depicted a civilization that had learned to control and use natural philosophy and technology in beneficial ways. The intellectual center of this Christian civilization, located on the heavily forested island of Bensalem in the South Pacific, was Solomon's House. Named for a former king who was the island's lawgiver, Solomon's House was dedicated to the study of nature's laws, so as to appreciate the glory and craftsmanship of God, and the use to which these laws might be put, so as to improve the lot of the island's residents. The functions of Solomon's House were thus many. It managed the natural resources of the island and the technologies that made use of them; sought new knowledge in science and the mechanical arts; and codified craft knowledge so that it might be known publicly.

The historical significance of Bacon's fictional tale is at least twofold. First, the story is an example of a utopia in the definition of Karl Mannheim: an imagined state of affairs that seeks to legitimate new practices and beliefs by transcending existing conditions and bursting through the existing order. In short, the story depicted a republic of science. Bacon sought to legitimate science by showing how it and technology could better the human condition and by linking the study of natural philosophy and the practice of technology to a reigning ideology and seat of authority and power in his own day, Christianity. As others who came after him also argued, Bacon believed that the study of natural philosophy was prayerlike in that it glorified God by revealing the beauty and secrets of creation. This linkage to Christianity was more than rhetoric designed to associate the new study of nature with one of society's dominant institutions. It was, for Bacon and his contemporaries, essential to discuss religious miracles in the context of the study of nature's laws; for that some appearances were miracles offered one way to determine how regular an event or phenomenon had to be before it was designated a natural phenomenon or a true law of nature.

Second, the tightly knit organization of Solomon's House led many, then and now, to identify it as one of the earliest influential models of the organization and institutionalization of scientific practice, especially of a scientific academy. The House's tasks, which revolved around experimentation and the technologies that supported it, were strikingly similar to those of academies yet to be born. They included: collecting experiments from books; codifying practices from the crafts and mechanical arts; conducting new experiments; compiling and generalizing results; planning and executing new and more complicated experiments; and finally, interpreting results and determining their usefulness for life. Although Bacon sought to eliminate the secretive practices of many of those who had claimed to study nature, the knowledge of Solomon's House was not entirely public. This was a socially responsible body, itself sworn to secrecy, that determined what would be revealed to the state and what would not. The House's control over information made it authoritative in its own right, enjoying the same power that Christianity had over the people and, like Christianity, at times also holding power over the state.

Solomon's House Revisited is a highly readable and enjoyable examination of what several of these Baconian themes, or their implications, have meant in science's past and present. Twelve authors and nine commentators discuss how aspects of their own inquiries bear on the Baconian vision of science. The first two sections of the volume deal with the role of academies and universities in the growth of science. The state, the church, and secret societies are the theme of the third. The fourth section, on the laboratory and the workshop, addresses in novel ways the relation between technology and science. Two final sections address the more highly complex organizational features of modern science: competitive prize systems and big science. The commentaries to each of these six sections address, for the most part, historiographical or methodological issues. The volume concludes with a final set of commentaries, each of them excellent examples of scholarship, by Paolo Galluzzi, Mary Jo Nye, and J. L. Heilbron.

Diverse as its contents are, the volume as a whole can be read as a treatise on the ways in which science has achieved historically what Bacon could only express in utopian terms: legitimation. Roger Hahn's lucid discussion of early modern academies emphasizes how public ceremonies and ritual, such as the eulogy, were used to legitimate the new activity of science. In his detailed study of the Royal Society of London, Michael Hunter also emphasizes that although legitimation could take place through the acquisition of a formal institutional structure chartered by the state, that process was not necessarily one that sanctioned well-conceived activities. The early Royal Society, Hunter argues, had to find out just what being a scientific society meant, and so its early history can be viewed as one of trial and error in which the "proper" scientific behavior, and presumably the values appropriate to it, were achieved only gradually.

One route to legitimation is certainly through institutionalization. But the study of institutions, including their history, has never been a matter of examining only their bricks and mortar. As students of other human institutions—the family, religion, education, and marriage, to name a few—

Detail from a present-day artist's rendition of the New Atlantis: "Perspective houses to study light and color." [From *Solomon's House Revisited*]

have demonstrated, the study of institutions is inseparable from a study of the values that guide human action and decision-making; for values legitimate actions taken by individuals and societies alike. Robert Marc Friedman in his essay on the Nobel Prize and David Edge in his on competition in modern science discuss some of the values motivating scientific activity for the individual. Yet as the essays by Elisabeth Crawford and John Krige make clear, the system of values legitimating the scientific enterprise has become increasingly complex in the modern world. Crawford demonstrates how international science has become bound up with global economic and foreign policies, and Krige examines the intersection of scientific and state interests in the British decision to join CERN.

Values that justify activities are often expressed in ideologies, which according to Karl Mannheim are related to utopias. According to Mannheim, ideologies, like utopias, are situationally transcendent ways of achieving legitimation; but unlike utopias, ideologies do not seek to burst through the existing order but rather often use it for their own ends. The stability of most university systems, the subject of the contributions by Matti Kluge and J. B. Morrell, can be viewed in these terms. Most universities harbor ideologies compatible with the interests of higher powers, such as the state. As Morrell points out by invoking the ideas of Antonio Gramsci, institutions, including those of science, can be viewed as vehicles for achieving ideological control.

B. J. T. Dobbs considers alchemy to be strategic in the evolution of the social value of science; for alchemy's ideology seeking redemption and perfection of both matter and humanity melded with society's millennial expectations of reformation and salvation. This coalescence, Dobbs argues, was important not only for the growth of secret societies preceding the growth of scientific academies, but also for the evolution of a secretive millenarism into a public and social utilitarianism. Lorraine Daston follows through the transformation of another ideology, that of scientific cosmopolitanism, into scientific nationalism in France. Under Napoleon's guidance, French scientists' desire for honor and fame was satisfied by the creation of traditionally oriented rituals and protocols similar to those of France's now moribund aristocracy. Daston's story of French scientists, like that of Stendhal's Julian Sorel in *The Red and the Black*, demonstrates how value-laden symbols, especially of the aristocracy, could be manipulated and used to the point where they became signs lacking meaningful signification. One wonders if French scientists' obsession with

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honor and reputation, as described by Daston, was a factor in the decline of sectors of French science in the 19th century.

In their commentaries on the essays in this well-written volume, Giuliano Pancaldi and J. L. Heilbron both point to the need, when studying the various kinds of institutions associated with science, to examine more closely the science itself. Those wishing to study its practice might begin with the essays by Eda Kranakis and Svante Lindqvist and the commentary by Hans-Werner Schütt in the fourth section of this volume. Kranakis's excellent schematic overview of how technology and science interface and Lindqvist's discussion of the relation between industry and the scientific laboratory are superb examples of the historical craft. It is Schütt's belief that for some historians pure science no longer possesses what he calls a "metaphysical justification" as a "distinct phenomenon." His viewpoint is supported by the papers in this volume, which compel us to consider science as a social activity bound to cultural and social mores and values. The historical challenge, presented by Heilbron and Pancaldi, is to demonstrate precisely how scientific knowledge itself is a part of the contexts discussed in this volume.

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Sociological Explanations

Theories of Science in Society. SUSAN E. COZZENS and THOMAS F. GIERYN, Eds. Indiana University Press, Bloomington, 1990. viii, 264 pp., illus. $25. Science, Technology, and Society.

This book takes up a perennial debate over whether science is a special form of knowledge. The issue arose in its contemporary form just over 60 years ago when Karl Mannheim in *Ideology and Utopia* excluded science from the domain of the sociology of knowledge on the grounds that it was based on rational principles and thus was exempt from the dictum that knowledge is socially shaped.

The conclusion that science could be detached from the historical-social perspective of scientists paved the way for the development of a sociology of science independent of the sociology of knowledge. Indeed, the first phase of the sociology of science, originated by Robert K. Merton, was largely devoted to explaining how science, with its distinctive structure and norms, was bounded from the rest of society.

During the past 15 years, the sociology of science has taken a "constructivist" turn in which the production of scientific knowledge is viewed as the outcome of a negotiation among scientists in the laboratory. Jonas Salk in his introduction to Bruno Latour and Steve Woolgar's *Laboratory Life*, the exemplar work for the second phase of the sociology of science, commented that scientists would find some of what the authors said familiar but much else incomprehensible. It will be the same with this volume. The historical and ethnographic depictions of science will be familiar, but the theories used to explain them will appear abstruse unless the disciplinary context within which they arose is understood.

Readers of the news columns of *Science* are aware that scientists lobby for congressional appropriations, initiate contacts with the press, and reformulate the boundaries between basic and applied research. Such actions have led sociologists to raise the issue of whether science is indeed an activity apart from the rest of society. Thus, a projected third phase of the sociology of science would return to the sociology of knowledge as formulated by Mannheim, but without his exemption clause for the quantitative natural sciences. By implication the editors of *Theories of Science in Society* ask whether there is sufficient justification for a special sociology of science and, if so, how it should be formulated.

The basic theoretical issue of this book is relational. Is science best viewed as "science in society" or as "science and society"? This cryptic difference in connectives denotes a dispute over whether science is a distinctive institution in which truth claims are adjudicated independently of the exercise of power or whether science and society form a seamless web in which the principles for settling disputes within science are the same as in the larger society.

Three authors provide a counterpoint of thesis, antithesis, and synthesis on this issue. Thomas Gieryn argues that there are no essential boundaries between science and society, only ones imposed by those scientists or non-scientists who get their definition of the situation accepted at a given time. He uses the interaction between the physicist Richard Feynman and the press during the Challenger investigation to argue that science is a form of rhetoric through which scientific knowledge is created. Gieryn, following Latour, argues that Feynman succeeded not because his version of what had gone wrong corresponded more closely to a reality of nature but because he was able to lower the entrance requirements for participation in reality construction by making his version more accessible. It may be asked, however, whether Feynman's exposition of the properties of rubber was not merely a display of knowledge rather than a discovery of it or whether, if science, it is not best characterized as police or forensic science. Differences in media interpretation of the details of the display do not change the brittleness of a rubber ring under low-temperature conditions—that is unambiguous. The Challenger explosion can also be explained as a "corporate induced disaster" where the existence of a problem was known in advance by an organization but suppressed to protect bureaucratic interests.

At the other end of the spectrum Rob Hagendijk argues that science is a culturally distinct practice in which knowledge claims stand on their own without needing moral or political support. Allocation of resources can affect choice of research problems but not the answers. Drawing on his study of Dutch freshwater ecologists, he proposes a theory of crosscutting institutional spheres, with different combinations of rules and resources to explain overlap and distinction among them. In the case at hand, funding patterns were stable and so were the intellectual profiles of research groups. Hagendijk's interpretation would not likely hold under conditions of financial stringency such as currently obtain in the United States, where pressure to raise funds to maintain a group can lead to investigation of the applied aspects of a basic topic or to taking up of a new topic altogether.

Finally, Susan Cozzens argues that it is the ability of scientists and science to accumulate power along several dimensions, including the contribution to meeting the needs of sponsors, the ability to set individual research goals, and societal legitimation as an honored activity, that gives science its partly autonomous character. Cozzens discusses the Latour-Callon "actor network" approach in which scientists are viewed as building power bases for the sake of science, consisting of heterogeneous networks of researchers, sponsors, machines, and nature, all cooperating. Scientists need not be economic persons under this approach. Some can devote their time exclusively to extending knowledge while others work to enrol patrons. Cozzens recognizes that the patron-science-nature relationship captures only part of the interaction between scientists and society: how scientists serve others' goals. This model recognizes scientists' accumulation of resources from patrons and transfer of knowledge to meet the needs of sponsors, but it does not include scientists' setting their own goals in the larger society and using their knowledge and organizational skills to achieve them.

An alternative model of scientists as entre-