

give the analogue to nervous-system processing in the commonsense case. Thus single-observation judgments are themselves viewed by Rakitov as statistical summaries of "individuals" taken as statistical aggregates (for example, in the observation "This rose is red," or in a single measurement, say, of a man's height) and thus, such judgments always yield an indeterminacy. This is an extremely roundabout (albeit interesting) way of asserting the fallibility of empirical knowledge-claims. But it assigns fallibility (or the possibility of error) to the single observation on the grounds of the statistical indeterminacy of such an observation. The assumption is that repeated observation of independent instances yields greater confirmation approaching the limit of scientific "fact." The problem is that the fact "All swans are white" is no fact, and never was, albeit  $P_s$  approached  $P_t$  arbitrarily closely for a very long time. This essentially confirmationist (and hence subjectivist) theory of "fact" doesn't sit well with an objectivist theory of scientific knowledge, though it may be offered as a theory of rational belief.

The last comment concerns the unfortunate transliteration style, especially in the bibliographies following each article. The translator, after asserting in his prefatory note that "blatant errors [in the Russian bibliography] have been corrected," goes on to note such trivia as "H. Reichenbach for G. Reichenbach" (there is no "H" in Russian, and "G" is its standard substitute!), and *then* to list such entries as "Gusserl" (for Husserl), "Uorf" (for Whorf), "Gil'bert" (for Hilbert), but worst of all "Van Xao and Mak-Noton" (for Hao-Wang and McNaughton), Čerč (for Alonzo Church), and "N'juton" (for Newton). Some familiarity with the authors cited should have yielded normal spellings, instead of these barbarisms of transliteration. The bibliography, on the positive side, suggests a large number of technical-analytical works in Russian (many by the authors represented here) which ought to become known to American logicians and philosophers of science so that the discussion on these matters between Russian-speaking and English-speaking colleagues can be pursued intelligently and critically.

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## Prerevolutionary Scientists

**Science in the British Colonies of America.**  
RAYMOND PHINEAS STEARNS. University of Illinois Press, Urbana, 1970. xx, 762 pp. \$20.

When Raymond P. Stearns first turned from the study of European history to devote his scholarly efforts to early American science, he moved into a field that was very thinly populated. Aficionados can recall the names of Theodore Hornberger, Frederick Brasch, and a very few others. To my knowledge, the history of American science was not being taught at any college or university in the country. The surface of the subject had barely been scratched and most historians still did not realize that there was any significant scientific activity in America during the colonial period. Although a great many historians apparently still live in the same ignorant bliss, Stearns has played a major role in persuading the majority that scientific pursuits were important concerns for at least a part of the population. His pioneering studies of American fellows of the Royal Society, of that institution's role in promoting science in the colonies, and of various individuals involved in promotional effort on both sides of the Atlantic have been influential in restructuring our thought about that period.

The present volume, which I received only a few days after news of the death of the author, is a superb example of the type of work for which Stearns was known: careful, detailed, the result of meticulous scholarship. Its aim, in the author's words, is to provide "within a single cover, a comprehensive overview of the scientific interests and activities of American colonials . . . in the expectation that such a treatment would supply a basis for historical perspective, for comparison and contrast, and for the creation of a sense of growth and development of science in the colonial era."

The book delivers what the author promises. It is comprehensive—or at least as close to it as there is any need to be. Within the 686 pages of text, Stearns discusses virtually every scientist of any consequence who lived or worked in colonial America. He gives a clear account of their work and accurately assesses it, in most cases remaining true to his expressed belief that "the integrity of science at any moment of its history must be that of

its own time," that one must not judge earlier work in terms of its "rightness" or "wrongness" according to modern science but must be aware that many different views of nature have been "scientific" in their own day. The book is truly a mine of information that can safely be neglected by no one working in the field, and it will be useful for years to come.

But once this is said, one must also point out that not all the work on colonial American science has yet been done. As much as one must admire the comprehensive nature of the book, one should also be aware that—especially because it is a good book of its kind—it reveals all the limitations of the essentially descriptive, encyclopedic approach to history that Stearns took. It is a record of missed opportunities to make significant statements about the nature of colonial science. It suffers mostly because it has no analytical framework; instead, the framework is simply geographical and chronological. By this I mean that the author moves from an account of science in New England, through science in the West Indies and in the Southern mainland colonies, back to the West Indies at a later period, then once again to the Northern mainland colonies. Each is considered separately, almost in isolation from the others; the only thread that ties them together, at least in the early period, is the tenuous one of the activity of the Royal Society in promoting science in each area. Even within the areas, each scientist is considered under a separate heading. This organization means, of course, that there is some repetition that could have been avoided by a different framework. But most important, it means that promising lines of research simply cannot be followed. For example, in one place Stearns mentions that a circle of colonial scientists was beginning to develop, to carry on correspondence and exchange among themselves; in another he suggests that Paul Dudley, whom he correctly assesses as one of the most skillful of the colonial scientists, had discussed many scientific problems with a wide range of New England scientists. These are certainly important details, and Stearns was aware of them, but the organization he adopted made it impossible for him to give them more than a passing mention. It comes almost as an admission of failure, therefore, when he notes on the next-to-last page of text that "the triumph of colo-

nial science appears to have rested, in the long run, upon scientific organizations rather than upon the specific achievements of any particular colonial scientist."

Another opportunity for some kind of sociological relevance came in discussing the shift of leadership in science from the West Indies to the mainland colonies about 1750. Stearns notes that the West Indian scientists tended to be "birds of passage" who were ill-fitted socially to promote the new science among the more settled residents of the colonies. Once again, this suggests that some analysis of the society might be most enlightening—giving us valuable insights into the relation between social structure and the advancement of science—but here, too, the discussion is entirely in terms of individual scientists and their work.

There are other examples, but to cite them would be to belabor the obvious and, perhaps, to lose sight of the genuine merit of the work when taken on its own terms. And on its own terms, it is difficult to find fault with the book. There are a few errors, but they are not substantial. As a survey of the subject, and as a beginning point for further research, *Science in the British Colonies of America* is admirable.

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## New Legal Arena

**Law and the Environment.** A conference, Warrenton, Va., Sept. 1968. MALCOLM F. BALDWIN and JAMES K. PAGE, JR., Eds. Walker, New York, 1970. xviii, 432 pp. \$15. A Conservation Foundation Publication.

No science-based issue in modern times has been more underestimated and misunderstood than what Max Nicholson has called the "environmental revolution." The subversive potential of ecology had been unperceived even by ecologists, this nascent science having been focused largely upon manageable micro problems from which the human animal was usually excluded. The rapid maturing of ecological science, the advent of computers capable of coping with its extraordinary complexities, and the emergence of a public demand upon science to lessen the obviously worsening condition of

the environment have reinforced the already changing relationship of science to society. Not only were scientists among the first to perceive the specific problems that man was creating for himself in relation to his environment; they also took the lead in identifying, defining, and interpreting the macro problem of the expansion of human populations and technologies in a finite world. The "environmental revolution" was not intentionally perpetrated by scientists, nor have all scientists been a part of it; there can still be found dissenting voices questioning the reality of an environmental crisis. Nevertheless, a Pandora's box of public issues has been opened not only for North America and Western Europe but, through international action, for the world as a whole.

It rapidly becomes obvious to anyone who examines the evidence that science-based policies governing man's behavior in relation to his environment imply far-reaching changes in social, economic, and political thought; and these changes further imply equally drastic changes in social, economic, and political institutions. But institutional structure and behavior are legitimized and in various ways constrained and guided through law. For example, the effects of biomedical knowledge and technique upon legal prescriptions and procedures are widely recognized. The impact of the environmental quality movement and of environmental science and technology upon law is now a matter of common knowledge. Newly developing public-interest law firms have had a strongly environmentalist orientation. Environmental law groups have organized in a large number of law schools around the country, a National Environmental Law Society has been established, two environmental law reporter services are now being provided, a large number of articles and several major symposiums have appeared in law journals, and environmental law is becoming a standard course offering in law school curricula.

The Conference on Law and the Environment, which resulted in the book under review, marked the initiation of an active role for law in the environmental quality movement. Recognizing the novel implications of the emerging politics of the environment, the conference undertook to analyze the legal problems that this movement would produce, such problems, for example, as citizen-initiated environ-

mental law suits and the concept of environmental rights, and such basic changes in the law as were subsequently embodied in the National Environmental Policy Act of 1969. Ancillary to this purpose, the conference was intended to alert lawyers to the implications of the environmental movement, to explore theories that might be helpful in connection with environmental litigation, and to identify the kind of help needed to prepare lawyers for greater effectiveness in this field.

The resulting volume has three major divisions, dealing respectively with problems of litigation, needed developments in the law, and opportunities and mechanisms to meet the needs. A bibliography of reference works, government documents, and law review articles is appended, and it has the very great advantage of being accompanied by a finding index organized by topic. For the person not professionally concerned with law school curricula or with litigation, the articles of greatest interest would, in most cases, be those dealing with broader matters of public policy. Among these is the opening article by Malcolm F. Baldwin, a comprehensive case study of the Santa Barbara oil spill, with emphasis upon the political and legal aspects of that ecocatastrophe. Three other contributions of broad public interest are "Standing to sue in conservation suits" by Louis L. Jaffe, "The right to a decent environment: Progress along a constitutional avenue" by E. F. Roberts, and "The role of government in environmental conflict," by Harold P. Green.

An innovative consequence of the environment movement may well be a hybridization of scientific and legal training, comparable in the environmental field to what forensic medicine has been in the area of law and the biomedical sciences. In recent years a slowdown in the growth of opportunities for research, development, and teaching in the physical sciences together with an "urge to relevance" has led numbers of physical science graduates to seek outlets for their skills in environmental research and planning. Environmental law may well offer a valuable collateral field of competence. For a person whose interests may move in this direction, section 3 of the book would be especially useful. A. Dan Tarlock surveys "Current trends in the development of an environmental curriculum," James N. Corbridge, Jr.,