attempt to break a new path, I agree with not one jot of it, and I commend to the reader the works of philosophers, from the time of Mill and later, who have tried different paths through the wilderness: William Whewell, C. S. Peirce, Stephen Toulmin, P. K. Feyerabend, Michael Scriven, Hilary Putnam, the late Norwood Russell Hanson, and many, many others.

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Tools on a Grand Scale

Technological Change. Its Impact on Man and Society. EMMANUEL G. MESTHENE. Harvard University Press, Cambridge, Mass., 1970. 128 pp. $4.95. Harvard Studies in Technology and Society.

Mesthene is the director of the Harvard University Program on Technology and Society, a well-financed and ambitious enterprise which is presumably beginning to approach completion. One might expect, therefore, that this little volume would be a kind of interim report. It has a little of that quality. Mainly, however, it is a personal essay, reflective rather than empirical, on the impact of technical change on society, its possible evaluation, its impact on values and religion, and on economic and political organization. The essay indeed is short, comprising as it does only about 75 small pages, a considerable part of the volume being taken up by an excellent annotated bibliography. The word that most immediately comes to mind in describing it is "Emersonian." It has the judicious, rather lofty quality of Emerson's essays, and at the end of it one has the same slight feeling of emptiness. The great god Technology turns out to be neither all good nor all bad and indeed frequently overrated, so that he looks at the end a bit like a Boston-Unitarian Thor who hardly seems worth all the excitement. This, however, is a little unkind. There is a good deal of mature reflection in this book and it deflates gently a fair amount of popular nonsense on the subject. Technology is simply tools and ways of doing things. Social institutions are just "groups of people organized in certain ways to accomplish certain purposes" (p. vii), so there is no great mystery about all this and one wonders almost whether the question was worth studying.

By defining technology as tools, however, Mesthene in effect defines away what may be the real problem at issue, which is the life that human artifacts seem to possess almost independent of man himself. A tool is something always under the control of the tool user. The very thing which disturbs so many people about the burgeoning evolution of human artifacts is precisely that this process seems to be getting out of control and to be taking on an evolutionary life of its own, using the totality of human nervous systems as the field within which this evolutionary process proceeds. One sees this gap between the tool concept of technology and the social evolution concept most clearly perhaps in Mesthene's treatment—casual, it must be admitted—of military technology, which he looks upon with a surprisingly benign eye. Thus, he describes on page 32 "our most spectacular technological successes in America in the last quarter of a century" as "in national defense, in space exploration, and in the provision of consumer goods and services. These successes have provided protection for the nation, realization of an age-old human dream, and achievement of the highest standard of living ever enjoyed by man." There is not much feeling here for the appalling instability of a system of nuclear deterrence which makes the probability of almost total destruction in the next 25 or 50 years dangerously high. There is no sense that the space enterprise has diverted desperately needed resources from other things or that the higher standard of living goes hand in hand with desperate pockets of poverty, inadequate medical care, racial discrimination, and students burning down their own universities. There is no real discussion of the effect of technology on identity, or on those all too fragile integrative structures which hold society together. In its political theory the essay seems to rely on what is to my mind the rather naive assumption that improved collection or processing of information from the ruled will improve decisions of the rulers. This greatly underestimates the difficulty of the conflict-resolution tasks of political organization, especially as we move toward an age of declining growth.

This essay was clearly written before Earth Week and it does not reflect much of the anxieties about ecology and resource use which have been so prevalent this year. There is an implied expectation that technology will continue to increase human power and productivity almost indefinitely, without regard to the limited capacities of the planet. However, this is a very brief essay and one should not complain that it does not cover everything. The slightly querulous tone of this review indeed may be a tribute to the power of this essay to stimulate reflections which go far beyond its actual content.

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Interdisciplinary Earth Science

Hot Brines and Recent Heavy Metal Deposits in the Red Sea. A Geochemical and Geophysical Account. EGON T. DEGENS and DAVID A. ROSS, Eds. Springer-Verlag, New York, 1969. xii + 600 pp., illus. $32.

This book is a compilation of research papers from a variety of geological and oceanographic disciplines. Its approach is, therefore, problem-directed rather than subject-oriented. The purpose is to bring to bear, on a single problem, a diversified array of techniques and scientific backgrounds. The result is a coverage and a tone that is strongly reminiscent of the Apollo 11 conference in Houston, and the approach is one that probably will be applied more in the future in attempts to unravel complex interdisciplinary problems whose importance justifies the efforts involved. An advantage of such a treatment is that it may provide the only satisfactory insights into certain types of problems; a disadvantage lies in the great demands it makes on the reader's competence as a generalist. The present volume has these characteristics.

A proper framework is established from which to consider the origins and significance of the Red Sea brines. The regional stratigraphy, tectonics, and probable geologic history of the Red Sea and adjacent land areas are carefully documented and described, and a similar treatment is given to the physical, chemical, and biological oceanography of the Red Sea. It is likely that many readers will find the book valuable as a source and bibliography on these subjects, even if they are not interested in the hot brines per se. Similarly, the description of sampling and analytical techniques utilized in the various investigations is a useful summary of methodology for many areas of earth science.

The location of the brine basins and

the source of the heat are explained by sea-floor spreading and associated volcanic activity. Major- and minor-element and isotope geochemical data show that the brines are unlike Dead Sea or Red Sea water. The consensus is that the brines contain chemical components from bedded evaporites, shales, and juvenile igneous constituents. A particularly interesting analysis of the brine sediments shows that these deposits are not identical to any known ancient geological occurrences. Presumably, the present conditions represent either a unique set of geological and environmental circumstances or a transient phase that in other, similar, older deposits has always been modified or differentiated by diagenetic processes. The study may leave the reader with some doubts as to the accuracy of present views concerning some of the proposed origins of ancient marine metalliferous deposits. In any event, direct reasoning along uniformitarianistic lines may not be fruitful as a means of using the present to elucidate the past in this instance.

The book is well edited, and the individual papers are up to the standards of the best professional journals, with respect both to syntax and scientific excellence. Readers will find the summary paper at the end particularly useful, and some may prefer to read that first.

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Chemical Control Systems

Progress in Comparative Endocrinology. Proceedings of the Fifth International Symposium, Delhi, India, Nov. 1967. M. R. N. PRASAD, Ed. Academic Press, New York, 1969. xx + 604 pp., illus. $29.50. General and Comparative Endocrinology, Supplement 2, 1969.

In spite of the two-year delay in publication, this volume is a valuable addition to any library, surveying as it does most of the principal currents in modern comparative endocrinology. The book offers an excellent opportunity for teachers, students, and researchers to acquaint themselves with significant developments in the field since the previous symposium, held in Paris in 1964. There is a good balance between reviews of important fields incorporating new work by the authors up to the time of the conference (about a third of the 62 papers) and reports of original research oriented toward more specific problems. This allows readers to grasp quickly the current situation in areas of intense research activity (hypothalamic control mechanisms, comparative steroidogenesis, ionic control and water balance, hormone action at the cellular level, endocrine homologies, and neurosecretory phenomena) and to gain insight into some of the more recently opened avenues of research.

The papers treat a diversity of organisms, but research in fish (17 papers) and mammals (14 papers) is still favored. Nine investigations are concerned primarily with amphibians, five with birds, and only three with reptiles. A total of nine papers are concerned with invertebrates; these cover most of the phyla in which endocrine phenomena are currently receiving attention. Papers dealing with comparative aspects of parathyroid-thyroid action and calcium homeostasis and with islet cell function are noticeably absent. There is a good deal of research activity in both of these areas which ought to be reflected in an assessment of the status of comparative endocrinology. As far as the organization of the book is concerned, the papers within certain sections should have been more logically sequenced.

The location of the conference in Delhi focused attention on research in laboratories on the Indian subcontinent. The papers presented by Indian authors are uniformly of high caliber and cover subjects as diverse as the symposium itself. Contributions on primates are all from Indian authors.

Papers of particular note include the scholarly review of the role of prolactin in osmoregulation in teleost fishes by Ball. This paper and that by Olivereau present an excellent review of the subject. A trio of papers by Tata, Eaton and Frieden, and Weber serve to clarify in a thorough and concise manner current trends in research on thyroid hormone action. A provocative paper on the homologies and early evolution of chordate endocrine systems is given by Olsson, and this couples nicely with Jasinki's treatment of the early phylogeny of the pituitary portal system. The paper by Chan, Rankin, and Chester-Jones on ion regulation and osmoregulation in teleosts is notable for its skillful exposition and presentation of the complexities of the subject. The paper by Idler serves to remind those who are interested in comparative steroidogenesis that interesting variations on the mammalian theme remain to be uncovered in lower vertebrates. The paper by Dupé and Godet deserves special attention, using as it does electrophysiological and biochemical parameters to improve understanding of the role of environmental changes in the induction of the observed abrupt changes in the life cycle of the African lungfish. Also deserving of comment is the interesting paper by Fontaine, with its insight into the evolution of anterior pituitary hormones of basophil origin.

This volume serves to remind one not only of the intrinsic value of comparative studies but also of their importance in furthering our understanding of mammalian systems, which can be complete only when we know the modifications of chemical control mechanisms that have occurred in response to changing conditions throughout animal evolution.

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Secretion

Exocrine Glands. Proceedings of a satellite symposium of the 24th International Congress of Physiological Sciences, Philadelphia. STELLA Y. BOTELHO, FRANK P. BROOKS, and WALTER B. SHELLEY, Eds. University of Pennsylvania Press, Philadelphia, 1969. xxii + 282 pp., illus. $20.

The book focuses attention upon three exocrine-secreting glands, which serve as model systems: salivary glands, pancreas, and sweat glands. The papers are grouped logically under three headings: Secretion of Electrolytes and Water; Secretion of Organic Substances; and Neural, Hormonal and Pharmacological Control of Secretion. In addition to accounts of the organs mentioned above, the first section includes two modest reviews of the structure and function of avian and reptilian salt-excreting glands, and the third has chapters on the secretion of lacrimal glands and of bile.

The plan of the book is good; most of the articles are up to date and contain some new information, and most end in succinct summaries. The discussions following each chapter are better than most and as a rule tend to point up the material presented, but they add little to the substance of the book. Some of them ramble on aimlessly, a common fault with recorded discussions.