Book Reviews

Reflections on Public Affairs

Pieces of the Action. VANNEVAR BUSH. Morrow, New York, 1970. xiv, 366 pp. $8.95.

> I write also from a study of how technology and organization fit together in the modern scene, and there is much to be considered even from this limited standpoint. . . .
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> We are not the first to face problems, and as we face them we can hold our heads high. In such spirit was this book written.

Written without pretension, and consisting in large part of anecdotes, this volume will richly reward readers from a wide variety of fields—science, engineering, industry, education, the military, politics, and public and business administration. Much of it arises from Bush's experiences in the establishment and operation of the Office of Scientific Research and Development, an organization that was the brainchild of Bush, James B. Conant, and Frank B. Jewett, then president of the National Academy of Sciences. It was under the guiding genius of Bush that OSRD carried out the work that caused the Committee on Appropriations of the U.S. House of Representatives on 17 October 1945 to report: "The contribution that it has made to the winning of the war is inestimable. Without such contribution, it is safe to say that victory still would await achievement."

The volume serves a serious purpose: Interspersed among the items of history (some of them told here for the first time) there are bits of personal philosophy and comments on the current scene that could profitably be taken to heart by those now in positions of responsibility. It distills from the author's personal experience essentials that are highly relevant today.

Vannevar Bush was eminently prepared to fill the unique position he occupied. He was successful in engineering and academic careers, an inventor, president of a prestigious research institution, friend and confidant of leaders in the executive and legislative branches of the national government. He had a tremendous facility for drawing on the varied talents of his legion of friends in scientific, industrial, and academic circles. Around these he developed a highly flexible organization in which each individual had the freedom to operate at his greatest effectiveness, yet the whole was blended together to produce the results which contributed so largely to the winning of the war.

The poor job the Navy was doing in preparing for antisubmarine warfare was a substantial contributing factor in the establishment in 1940 of the National Defense Research Committee, around which OSRD was formed in 1941. Bush relates a number of incidents in the continuing struggle before the armed services finally came to realize the important contributions that persons out of uniform could make in areas that the services had marked out for their exclusive preserves. Two such incidents Bush describes involved marine torpedoes and tanks. In both cases the active cooperation of the services needed for effective civilian assistance was not forthcoming. Bush analyzes the characteristics of organizations which produce such an attitude. The story of the development of the Dukw, an amphibious army truck, has a happier outcome. Not only did the services not like the idea, it was emphatically stated that if the vehicle was developed it would not be used. Here, however, the services were not in a blocking position; not only was the Dukw developed, it made invaluable contributions to the landings in Sicily and Normandy.

Fortunately, these three incidents were not typical of OSRD-service relations; they may have been a reflection of the attitudes of particular individuals in strategic positions. For the most part those relations were cordial; and service personnel and civilian scientists worked closely together to produce results to which both groups were dedicated. Yet the circumstances out of which the difficulties arose are not transient. The great preponderance of scientific and technical skill in this country resides in the civilian sector. Finding the most effective way in which the needed skills can be put to the service of national defense is a continuing problem. In times of peace or half-war the civilians for the most part are not attracted to defense work. A wide-open approach to experimentation is difficult to harmonize with the military command system, in which one's chances of personal advancement seem best served by adherence to the views of the higher command. And that higher command is made up of persons who frequently have lost whatever feel they may have had for scientific and technical developments. The cliché that the military is always preparing for the last war has its nugget of truth. Bush's observation that "not all of us are satisfied that we are doing as well as we should" is buttressed by his suggestions for change.

Over half the volume is devoted to episodes arising from the OSRD experience, including the scientific interchange with our British allies. This part contributes valuable insight into some of the human aspects of the task of keeping scientists, contractors, and military services as well as executive and legislative leaders in step on a program which increased at a dramatic rate in both importance and cost. Throughout there are incisive comments that can be read with profit by anyone concerned with the operations of large organizations.

In the remainder of the volume, Bush draws upon his own experiences to lend point to pungent observations about specific policies of government, industry, and education. Of the automobile industry in this country he says that it is "half asleep and incapable of effective innovative cerebration." In his opinion, if significant improvement is to be made in American automobiles it will come as a result of government pressure, government orders, or foreign competition. With respect to government policies Bush is vigorous in his call for improvements in the patent system and a rethinking of the relation between the patent system and the antitrust laws. And he cites as evidence that we are still immature the fact that in the face of power blackouts power companies do not analyze the whole power network because of fear of prosecution under the antitrust laws. His observations on other matters are equally explicit.

The opening chapter of the book is devoted to a relaxed review of developments during the 60 years in which Bush was an active participant in public affairs. Subsequent chapters are headed "Of organizations"; "Of stumbling blocks"; "Of tyros"; "Of inventions and inventors"; "Of energies, engines, and hobbies"; "Of teachers and teaching"; and "Of leaders and leadership." The subjects and the treatment are far-ranging. Bush recognizes the serious prob-

lems confronting the country today; his call is not for optimism but for determination.

Altogether this volume is the witness of a remarkable man. One may hope that his counterpart is in the wings today should the times cry out for him.

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The North of Canada

Science, History and Hudson Bay. C. S. BEALS, Ed. Design and preparation by D. A. Shenstone. Department of Energy, Mines and Resources, Ottawa, Ontario, 1968 (available from the Queen's Printer, Ottawa). 2 vols. xxii, 1058 pp., illus., + maps. $16 Canadian.

The discovery of vast petroleum deposits on the north slope has once again focused attention on the arctic regions of North America. *Science, History and Hudson Bay* examines the nature of Canada's Hudson Bay region and asks what the future holds for its development. It is for this reason a timely work and should satisfy the curiosity of anyone, specialist or otherwise, interested in the north.

This monumental, and basically encyclopedic, work was prepared for the Centennial of Confederation (1967) and was conceived primarily as a point of departure for future studies. It contains the contributions of 56 scholars and scientists, including among others physicists, geologists, geographers, historians, and anthropologists. Volume 1 consists of eight chapters, subdivided into a number of subsections. It covers the prehistory and history of the region, its people, geography, climate, water and ice conditions, marine life, flora, and fauna. Among its contributors are members of the National Museum of Canada, the Meteorological Service, the Marine Sciences Branch, the Fisheries Research Board, the Canadian Wildlife Service, and several universities. Volume 2, with seven chapters and subsections, focuses on the geology, and summarizes geophysical studies, upper atmosphere research, transportation and communication, defense, economic possibilities, and theories of origin. Its contributors are drawn from the Geological Survey, the Dominion Observatory, the Hydrographic Service, and other Canadian institutions and organizations. Illustrations, which are profusely exhibited throughout the two volumes, are good, and there are some useful maps. Each chapter contains a fairly comprehensive bibliography, and the index is thorough.

Hudson Bay was discovered in the 17th century in the course of the search for the Northwest Passage. Although the grim experience of Henry Hudson is firmly implanted in the imagination of every Canadian schoolboy—at least it was a few generations ago—the region and its icy waters have not played a very positive role in Canadian life and development. Sending its chilly blasts of air southward into the lower Great Lakes region and St. Lawrence Valley, the Bay (and the sinister Greenland ice cap to the northeast) have pushed vegetation, soil, and agricultural belts to the south. Possibilities for agriculture in the Bay region itself—apart from the raising of caribou—are limited by the short frost-free period of from about 2 to 2½ months. Only in the southern part may potatoes be grown successfully.

Still, the resource potential of the region remains substantial. This is especially true of the fisheries, increased output of which apparently depends on the use of more and better boats. The extensive forest wealth could, if tapped, provide pulp and paper for Western Europe, conditioned of course by the navigation season, which extends over some three months or more. Other than low-grade nickel, exploration of the west shore of the Bay has not revealed any mineral deposits of economic significance. The east shore, however, is rather more promising. Considerable search has revealed a number of occurrences of low-grade iron ore; a number of industrial minerals, such as gypsum and asbestos; and a good possibility of petroleum or natural gas, or both, within the environs of the Bay.

Perhaps the most promising statement that may be made for the Bay region is that the arctic or subarctic environment has not been found to be a serious obstacle to economic development. It will simply be for the future to determine what path that development will take.

Though the topical organization of the work leaves something to be desired and one wishes that the editor had included a synthetic chapter, this remains an impressive assemblage of facts not readily found elsewhere.

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On Plant Morphogenesis

Cellular Differentiation in Plants and Other Essays. C. W. WARDLAW. Manchester University Press, Manchester, and Barnes and Noble, New York, 1970. vi, 162 pp. $6.50.

The development of the beautifully coordinated complexity of the higher plant body from the single cell of the fertilized egg has fascinated botanists for centuries. The earliest students of this process were the anatomists who carefully observed and completely chronicled the structure of the final body, as well as the innumerable stages that intervene between the one cell of fairly simple structure and the many cells of so many different structures and functions. Later came the experimental morphogeneticists who prodded, wounded, and dismembered plants, and especially their growing points, in order to see what unexpressed potentialities for the development of form and structure existed in plants, and to discover how versatile the plant could be in overcoming or circumventing obstacles placed in the path of normal development. Still later came the physiologists and biochemists and their chemical control of such processes as root initiation, bud formation, and the inception of floral primordia. The last to burst upon the scene have been the molecular biologists, with their emphasis on selective gene repression and derepression as an explanation of differentiation within the context of a demonstrated identical genome in all cells.

Claude Wardlaw, an emeritus professor of botany in the University of Manchester and a distinguished contributor to experimental plant morphogenesis, especially of fern apices, freed at last from the duties of his academic position and unrestrained by the necessity of pleasing colleagues or students, has written this book, as he has written others, to permit himself some freedom of expression, to muse aloud, and to share with readers his hopes, his misgivings, and his predictions concerning the future of his field. In a day when scientific writing, especially in journals, has become so stylized as to eradicate the personality of the author, it is a luxury and a distinct change of pace to read such a book. I found it relaxing, if at times a little precious. The book contains only a few new insights into plant developmental processes. Anyone at all acquainted with the field knows that there are many more unknowns and mysteries than there are knowns