Book Reviews

Achievement in Canada

The Mackenzie-McNaughton Wartime Letters. MEL THISTLE, Ed. University of Toronto Press, Buffalo, N.Y., 1975. xxiv, 178 pp. $12.50.

Canada declared war on Germany on 10 September 1939, a week after the United Kingdom and more than two years before the United States. Her deep commitment to the war was to strengthen profoundly her science, technology, and industry and thereby her power status. C. J. Mackenzie is convinced that if the United States had declared war in September 1939 the status of Canadian science would be very different today. For during the 28 months of United States neutrality, Canada was for the first time in the position of engaging in a research and development enterprise without the overpowering competition of American industrial and marketing resources. In these conditions Canada's scientists and engineers could and did produce highly sophisticated weaponry as efficiently as any other country. Without this head start Canada might have come out of World War II with little more capability in current science and industrial technology than she had after World War I and the current high standards and prestige of Canadian universities, research institutions, and industry would not have been achieved until much later (p. 151).

Between the two wars, Canada had been essentially a "scientific colony," having a good deal of modern technological knowledge available through branch factories of non-Canadian industries but having little competence in industrial research or innovation. Yet in these years the National Research Council of Canada (NRC), founded in 1916, laid the foundations for the post-1939 progress both by breeding researchers through scholarships and grants and by establishing its own laboratories to provide the long-term applied research on which industrial innovation must be based. In these years of preparation the NRC struck a good balance between basic and applied research, altering the balance from time to time to meet the changing needs of a changing society. Through the NRC industry, universities, and government cooperated at a working level, and the NRC had become "a supple and flexible institution capable of dealing resourcefully with any circumstance that history might offer."

Scientists of all disciplines, medical men, and engineers apparently mingled on equal terms. Indeed, much of the credit for the great success of the NRC goes to two engineers, Mackenzie and A. G. L. McNaughton. It is their wartime correspondence concerning this enterprise that makes up this book. General McNaughton left the army to become president of the NRC in 1935, and when he returned to command the Canadian forces in Europe Mackenzie took his place.

Both men were farsighted. McNaughton, convinced as early as 1937 of the inevitability of war, had encouraged research on certain war projects, and he had seen, as few people except Keynes did, that war planning must be in terms of man-hours, power, equipment, and supplies rather than dollars. Mackenzie had a strong grasp of the research strategy for war and for the postwar period.

At the outbreak of war, the total staff in NRC establishments was only 300, and at the end of the war it was less than 1300. With these small numbers the NRC achieved much. It did excellent work, for example, on radar, gauges, optical glass, gas, synthetic rubber, refrigeration, and medical aspects of aviation. It created crown corporations to manufacture some of the products of its research. At the beginning of the war the British had not concealed their belief that nothing at all intricate could be made in Canada, and the radar achievements of the Radio Section of NRC surprised them and the Americans. The chief engineer of Westinghouse could not believe that this section had done in nine months a job he thought would take at least two years. He considered the Canadian work to rate a $1-million building, whereas the NRC had two buildings which cost $50,000 and some tents and shacks.

Apart from the work in its own establishments, the NRC welded together the wartime research of the armed services, universities, and industry; the cooperation was often informal but remarkably effective and harmonious. From 1940 there was also excellent cooperation with the distinguished British scientists who became liaison officers in Ottawa.

Mackenzie was the linchpin of it all (including the complicated Anglo-Canadian atomic project, which scarcely figures in the book). He was, McNaughton wrote, the source and inspiration of the magnificent NRC record.

This correspondence across the oceans is marked by humanity and simple dignity. Its style is refreshingly clear and straightforward, albeit rather formal. Together with the foreword by Thistle, the introduction by Mackenzie, and the epilogue based on his journal, it makes a rewarding book.

MARGARET GOWING
Linacre College, University of Oxford, Oxford, England

Environmental Adaptations

Physiological Aspects of Deep Sea Biology. A. G. MACDONALD. Cambridge University Press, New York, 1975. xiv, 450 pp., illus. $49.50. Monographs of the Physiological Society, No. 31.

The organisms of the deep sea live as much as 11 kilometers beneath the surface layer of primary productivity, are shielded from sunlight, remain at a constant low temperature, and are compressed by several hundred bars. Each of these environmental attributes presents challenges which deep-sea creatures have met successfully. This book examines the deep-sea life-style by critically discussing and interpreting research in the field. Three-quarters of the monograph is an analysis of how organisms have adapted to exist at high pressures, to obtain food, to communicate, and to maintain their position in the water column. The remainder of the text is a chapter called "Deep sea bio-engineering" that illustrates how deep-sea conditions (especially high pressure) affect the experimenter himself, as in diving, and the design of gear to retrieve organisms and of experimental apparatus to simulate the deep-ocean environment.

The text is generously illustrated with graphs and tables presenting data from the literature. There are block and flow