

two of them. Graduate schools provide for a broader and deeper penetration and understanding in one field, supplemented perhaps with more general knowledge in related fields. Seminars, directed study, and individual research usually form a considerable part of advanced study. Most of these courses provide for practice in the research methods of the discipline—whether through experiment, questionnaire, logic or statistics—in order to prepare students capable of adding to present knowledge. This applies to the closely knit professional fields as well as to the more general branches.

For many years research in the universities was directed towards obtaining knowledge for its own sake and was considered pure research. Later it was recognized that the conclusions of such research provided the basic information for applied science and before long the universities, because of their unique position in having trained specialists and equipment, were involved in both basic and applied research. During World War II they were encouraged to undertake emergency and other contractual research and since then the trend towards broadening the field of research, increasing the capacity of universities to educate advanced students, and procuring large-scale costly equipment has shown rapid advance. This has created new problems but has provided even greater opportunities for undertaking sizable projects which could not have been attempted otherwise and has thereby tended to knit the university into the very warp of industry.

Research conducted in the universities falls into three broad categories: projects undertaken by the student under the guidance of a professor or committee to meet requirements for an advanced degree; research undertaken by the professor, which may be of a more or less continuous nature; and larger research projects undertaken co-operatively on a faculty or interfaculty basis in university laboratories or in such specialized institutions connected with the university as medical research laboratories, institutes of microbiology and hygiene, science service laboratories and faculties of agriculture.

Some idea of the increase in research undertaken by Canadian universities may be obtained from a comparison of the situation in 1919 with that in 1959. In the former year, two universities—Toronto and McGill—offered graduate courses beyond the master's degree and graduated 11 students; in 1959 Ontario had four, Quebec three and six other provinces each had one major university with graduate courses leading to the Ph.D. degree. They conferred 284 doctorates in course, distributed by fields as follows: biological sciences, including medical and agricultural sciences, 64; engineering and applied science, 19; humanities, 61; physical sciences, 101; and social sciences, 39. Subject matter covered in these courses and other research conducted by university professors and reported in professional journals is encyclopaedic and reflects specialization and variety. Outstanding research in particular fields has become associated with various universities, for example: nuclear research and geophysics in McGill, Queen's, McMaster and Saskatchewan; medical research in such institutions as the Connaught Laboratories and the Montreal Neurological Institute; agricultural research in the western universities; and fisheries research in British Columbia.

Outside financial support for university research comes primarily from four sources: agencies and departments of the Federal Government including the National Research Council and Defence Research Board which provide grants for approved and contracted government-sponsored research; industry which supports both basic and applied research; private foundations which provide grants for approved research, sometimes in selected fields; and provincial governments.

#### **Subsection 5.—Industrial Research**

Industrial research in Canada is changing very rapidly. In the past, industry in general was largely unaware of the value of research to its own development and to that of the country, partly because many Canadian companies were subsidiaries of companies in the United Kingdom and the United States and partly because small companies found it impossible to finance their own research. The problem was accentuated by the vast size of the country, the absence of concentration of similar industries and the proximity to the relatively large research facilities of the United States.