

mills, mines, and factories can be transformed into useful articles. Without scientific investigation Canada, instead of being one of the richest countries in the world as a result of the development of its natural resources, would be one of the poorest.

Research in industry in Canada is affected very largely by the parentage of many of our industries. Canadian industries draw on the results obtained by their respective American and British parent bodies. An American industry that employs hundreds of professional men to do research in its central organization is likely to have only a handful of people to do routine checking and perhaps an occasional piece of research in its Canadian subsidiary plant. Further, the companies that spend money on original research usually do not publish their findings and are reluctant to give information concerning this research work. It would be of tremendous value to Canada as a growing nation if the Canadian industries not only undertook original research but made the results known to all concerned.

Even to-day expenditures on industrial research in Canada are relatively small. This fact is illustrated by data showing the status of laboratories and laboratory equipment in Canadian industry in 1938. In that year there were in Canada approximately 1,000 industrial laboratories, employing 2,500 professional and 2,700 non-professional workers. The total investment in laboratory buildings and equipment was about \$10,500,000 and the total annual expenditure, including salaries and other expenses, was approximately \$9,000,000. While these figures may appear large, it must be noted that most of the laboratories are small, and that by far the greater proportion of them are engaged almost entirely in plant control and testing work, as opposed to research. Many of the staff members may and do conduct some research but this is incidental, their fundamental task being control of the uniformity and quality of the materials used or produced by the industry.

In Canada, one transportation system has established a laboratory as an adjunct to its medical department. This laboratory now handles not only medical and biochemical work but also general industrial and sanitary control and research, such as the sanitary analyses of water, ice, and milk products, purification of air, and the development of chemical methods for the examination and control of railway supplies, with the view not only of speeding up analysis, but also for the examination of compounds for which no established procedure exists. Methods of analysis for phosphates in soaps, for synthetic insecticides, volatile oils and perfumes, and phenols, and many other organic and inorganic tests have been developed. The method developed for phosphates in soap is an example of increased speed in determination. The railway laboratory has also succeeded very largely in overcoming the insect problems that were formerly incidental to transportation. In general, however, the value of the chemist has been overlooked by the railroads on this continent.

In England, France, and Germany large laboratories, employing research and analytical chemists in considerable numbers, have been maintained for years by the railway organizations. In other directions Canada has made progress in building up her chemical industries particularly those branches that have a solid foundation in the Dominion's natural resources of raw materials and energy.

A Few Outstanding Examples of Industrial Research in Canada.—One of the largest of the Canadian chemical process industries is the manufacture of pulp and paper. Radical changes in the methods of bleaching pulp that have been developed largely in Canada have greatly increased the efficiency of operation and