

today were invented 15 or more years ago and it has been argued that "most new drugs introduced recently offer fewer benefits over older drugs" than was the case in the past.¹⁵

Consequently, a range of patented and still widely prescribed drugs will be becoming available to generic manufacturers over the next few years. In response to this circumstance some of the multinationals engaged in the production of patented ethical products have begun to move into the production of generic substitutes. Third, the emphasis in the industry by therapeutic category is likely to shift. The aging population of rich countries means an increasing demand for cardiovascular and mental health products. The growing income in some parts of the developing world will produce increased sales of anti-infective drugs. Fourth, the most likely source of product innovations over the next several decades is biotechnology. The development of products through modifications to living organisms is accentuating pharmaceutical company involvement in basic research.¹⁶

1.4 Biotechnology

There are about 220 organizations involved in industrial biotechnology in Canada, spending in 1986 over \$359 million on R&D.¹⁷ Worldwide, the principal biotechnology sector is pharmaceuticals (68 per cent of the market). Food and agriculture account for another 24 per cent. Biotechnology is, of course, most relevant to agriculture as a source of livestock and plant improvements. But the range of its possible uses in this industry is wider. For example, developments in the biotechnology of fertilizers, especially soil incubants such as nitrogen-fixed bacteria and similar products are of potential commercial significance. Early work on this by the Saskatoon-based company, Microbio Rhizogen Corp., led

to its purchase by the U.K. company, Agricultural Genetic. Canada has some strength in both pharmaceutical and agricultural biotechnology.

However, its area of most probable relative advantage lies elsewhere. Biotechnology can be used in the natural resource-related industries in which Canada has great strength. It has applications in forestry (in particular, genetic improvements in trees and the development of biological pesticides), the extraction of minerals from ore (bioleaching), and pulp and paper manufacture (the use of bacteria as whitening agents, detoxification of waste water).¹⁸ It also has promise in other pollution-control uses, in which Canadian companies might have some experience and thus could have a relative advantage.

These, however, are areas in which the commercial applications of biotechnology have been generally modest. It is in medical applications and plant genetics that commercial application of biotechnology has been most frequent. Even in medical applications, biotechnology has been slower to generate new therapeutic products than was anticipated in the recent past.¹⁹ Interestingly, the area of medical biotechnology with the greatest commercial success is the development of novel diagnostic kits.²⁰ This is an area in which Canada has successful small companies (ADI Diagnostics, APO Diagnostics, IAF Biochem International, Biomira, Canadian Bioclinical) and some exports to Europe.

The other currently commercially viable sector of medical biotechnology is the manufacture of vaccines and immunostimulants. Canada has successful exporting firms in these areas for applications to both humans (Connaught Bioscience) and animals (Vetrepharm).