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# Opportunities for microbiologists in an emerging industry

Many industries are reshaping their business strategy with respect to research and development (R&D). Research laboratories are being shut down due to poor long-term cost-benefit ratios and are instead relying on university research projects to keep the innovation pipeline open in order to obtain new products and services. At the same time, lower labor costs are shifting production activities to Asian countries, where low salaries make product manufacturing attractive. Although European companies are no longer competitive regarding production costs, their R&D and innovation activities will keep them in the market. Thus, both R&D and innovation will form the basis of emerging industries, which will require a specialized workforce: scientists—some of whom will of course be microbiologists.

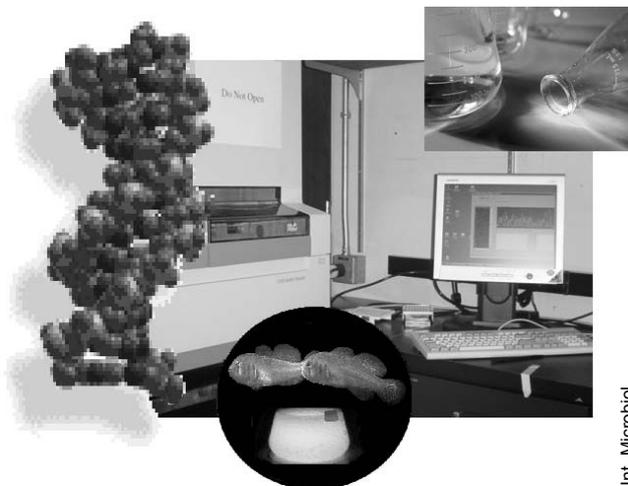
The European Commission has made great efforts towards the development and recognition of the researcher career [2]. The Barcelona European Council meeting (15–16 March, 2002) agreed that overall spending on R&D and innovation in the European Union should be increased, and set a target of 3% of gross domestic product (GDP) by 2010. This, together with actions to strengthen the European Research Area (ERA), generates tremendous possibilities for the near future of European research. Moreover, the move toward increased governmental research funding is occurring not only in Europe; after a decade of stagnation, many OECD (Organisation for Economic Co-operation and Development) countries are

reporting expected increases in their investments in R&D and innovation. These attempts to raise levels of R&D spending call for complementary efforts to increase the supply of science and technology graduates and research personnel.

The recent European Commission Communication “Investing in research: an action plan for Europe” [1] stresses that “[m]ore and more adequately skilled researchers will be

needed in Europe in order to fulfill the targeted increase of investment in research by 2010. Increased investment in research will raise the demand for researchers: about 1.2 million additional research personnel, including 700,000 additional researchers, are deemed necessary to attain the objective, on top of the expected replacement of the ageing workforce in research”. Although the expectation—finding 700,000 researchers with proper skills by 2010—is ambitious, from my point of view it is even

harder to find those other 500,000 research personnel. In addition to excellent researchers, excellent R&D needs proper and in-place research support, namely, lab technicians. Apparently, there are few initiatives to encourage young people to explore a science technician career. The challenge now is to be ready for the increased R&D funding. People and equipment have to be ready to respond to new opportunities that will be provided. The challenge, in my opinion, is of particular relevance to microbiologists. Major issues that have impacted the world recently, such as bioterrorism, anthrax, marine oil spills and



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the SARS outbreak, fall within the scope of microbiology. Health, defense and environmental protection will remain major areas for public funding of R&D. While specific attention has been devoted to the social and economic aspects of biotechnology, microbiology pervades the hot topics and major concerns of today's world. As a result, microbiologists will no doubt receive significant increases in the funding of their R&D activities, especially from governmental organizations.

Raising the current European average of 2% GDP investment in R&D towards the 3% expected to have been reached by 2010 will require both public and—mainly—private sources. Government-level initiatives will not be able to increase R&D funding alone. Private action is particularly needed to overcome the inertia that has afflicted academic European research in the last decade. Permanent faculty appointments in academia are no longer available in many countries, with more people than ever before chasing fewer and fewer of these positions.

Hopefully, the near future will also bring about increased R&D investment coming from private business. Strategic issues such as technological change, competition and globalization are driving changes in the business environment, which are motivating a restructuring of business R&D processes and strategies. Firms are linking their R&D programs more closely to their business needs and taking greater advantage of technologies developed in universities as well as public research institutes and laboratories. Governments should encourage business R&D financing by offering further tax incentives, grants and loans. Successful promotion of business R&D will be increasingly based on the development of a fertile environment for innovation. This entails promoting networking and interaction among firms and between the public and private sectors, ensuring adequate intellectual property agreements. Governments should also foster entrepreneurship to ensure the availability of risk capital.

In Europe, the size of the R&D workforce is relatively small, accounting for only 5.1 per 1000 workers, whereas this ratio is much higher in the USA (7.4) and Japan (8.9). The gap becomes even larger when we compare only researchers employed in industry: in Europe, the ratio falls to 2.5 per 1000 workers compared to 7.0 in the USA and 6.3 in Japan. These figures, together with the fact that higher funding will call for many more R&D workers, will lead to many European researchers, including microbiologists, joining private companies to try to fill this gap.

The concept of "researcher" should be slightly modified. Traditionally, a researcher was the practitioner of research as defined in the Frascati Manual [3]: "Research and experimental development (R&D) comprise creative work under-

taken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications". R&D in the public environment (universities, research institutes, etc.) has little in common with R&D in private business. Personal skills, organization management, evaluation criteria, and communication trends are issues that differ extremely depending on the specific environment. Since the final goal of business is obtaining profit from the market, all business activities, including R&D, must be aimed towards this mission. European researchers will find their best opportunities by means of versatility, that is, by rapidly adapting their abilities and attitudes towards the goals of business. Skills in managing scientific research, and the ability to understand the basic role of R&D activities in the success of the company will be essential when, in the near future, business assumes an essential role in scientific R&D.

Scientists as a collective are a valuable asset for business corporations. This asset, however, is not always necessarily recognized in the R&D departmental structure of companies. A microbiologist may be able to efficiently carry out many jobs within the business environment, including those related to intellectual property rights issues, quality control, technology and knowledge transfer, environmental monitoring, and communicating science and technology information to non-scientists. Scientists will also play a key role in bridging the increasing contacts between universities and companies. As an European Commission communication has stressed [2], "[c]ollaborative partnerships between academia and industry or between private and public funded research organizations have emerged as a critical imperative necessary to sustain transfer of knowledge and innovation but it is still unclear how to structure such relationships, let alone how to exchange personnel or to promote common training programs".

The recently expanded Europe provides many opportunities for microbiologists. In fact, microbiology is a traditionally well-rooted scientific discipline in many Eastern countries. The European Commission, through ERA and the 6th Framework Program, is launching a strong policy of scientists' mobility in order to ensure that opportunities exist all over the continent.

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## References

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