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Technology Roadmap for the 21st Century Environmental Biotechnology Program

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Environmental biotechnology is defined as the development, use and regulation of biological systems for remediation of contaminated environments (land, air, water), and for environment-friendly processes (green manufacturing technologies and sustainable development) (International Society for Environmental Biotechnology, 1992).

Recently several particular areas in environmental biotechnology have been substantially developed in Korea. These include (1) bioremediation of toxic and recalcitrant compounds, (2) biological detection of pollutant chemicals, (3) biological treatment of wastewater from solid waste dumping grounds, etc. When comparing the overall development of environmental biotechnology in Korea with advanced countries, on a five scale rating, Korea would rank second or third from the bottom. However, there are some core biotechnologies applicable to environmental biotechnology in Korea where the level of development is close to that in advanced countries. For example, the screening and preservation of microbial strains and cells, recombinant DNA technology, fermentation processes, mass cultivation in bioreactors, purification of substances and refining processes, and immobilization of microorganisms and enzymes. All of these areas are currently on a level of development that is equivalent to 80 or 90% of the technological levels of advanced countries.

Despite the ever-increasing demand for more advanced environmental technology in Korea, the financial support for research and development in this area is still smaller than for other areas of technology. Civil engineering has received more attention than biotechnology for developing environmental technology. In addition, there is currently insufficient data-based informatics for research on environmental pollution and biotechnology. Therefore, in some sense environmental biotechnology in Korea has not experienced much development compared with other areas of biotechnology, such as public health, medical biotechnology, and food and fermentation biotechnology.

Environmental biotechnology is not a new field; composting and wastewater treatment technologies are familiar examples of "old" environmental biotechnologies. However, recent developments in molecular biology, ecology, and environmental engineering now offer opportunities to modify organisms so that their basic biological processes are more efficient and can degrade more complex chemicals and higher volumes of waste materials. Notable accomplishments of the "new" environmental biotechnology include the cleanup of water and land areas polluted with petroleum products (DOE, 2001). Genomics is a rapidly growing industry that uses genomic information to develop novel methods, products, or services for a variety of applications. The field includes gene sequencing and mapping, functional genomics, and bioinformatics. Not only will genomics become a vital technology in the field of health and medicine, its application will lead to the development of new chemicals and high-performance materials.

Technology roadmaps serve as pathways to the future. The purpose of the environmental biotechnology roadmap is to identify, select and develop objectives that seems to be necessary for the biotechnology-based environmental industry, the sustainable development and the promotion of living quality.