

Bio-based Technology Development Plan

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Bioscience and biotechnology have grown to a big science in the 21st century. There are several backgrounds to this situation; i) As a result of expand of activity of mankind in the 20th century, cleanup function of overall living organisms on the earth cannot work and warming and environmental pollution in world-wide became serious problems. ii) Genome and post-genome era open the new field for treatment and prevention of human disease, increase of activity of microbes, plants and animals for foods and feeds, industrial materials, and biofuel production. iii) New technologies periphery of biotechnology, such as information science, nano-material science, are also rapidly growing. Japanese government released 3 strategies of biotechnology in 2001: improvement of health and medicine, increase of food supply, and improvement of environment and energy. Especially, Japan has to reduce CO₂ emission by 6% of 1990 or 14% of 2004 based on COP3.

As a result of civilization in the 20th century depend on fossil resources, CO₂ in the atmosphere increased 100 ppm, and 0.7^oC of temperature on the surface of earth from 1850 to 2002. Even now, biomass energy converted from solar energy by photosynthesis per year in the world is more than 10 times of fossil energy consumed per year. If we can increase 10% of productivity of plants by recombinant DNA technology and utilize the increase for industrial material and fuel, we can change the civilization depend on fossil resources to biomass resources. Productivity of plants is significantly reduced by multi-environmental stresses to plants. Genetically modified plants, such as herbicide-resistant, insect- and virus-resistant crops, increased productivity of foods. Recently we have succeeded to increase of growth of tobacco by 80% by the

introduction of the key gene in Calvin cycle into the chloroplast genome.

National project of production of industrial materials and fuel by plants has done from 1999 to 2003 by industries and academia with support of Ministry of Economy, Trade, and Industry (METI), Japan. The second project for 8 years is going on from 2002. We hope to create a new world independent to fossil energy in the early 21st century. I will discuss these projects as a leader of the project in this lecture.