The Japan’s Bioindustry Market

In 2003, the bioindustry market in Japan was worth Japanese Yen (JY) 1,660 billion (US$15 billion). It was a 15% increase over the previous year. If conventional biotechnology products such as beer and sake were to be included, the market size would be four times larger. The bioindustry market has grown approximately eight-fold over the past 14 years since 1989 (Fig. 1). Noteworthy is such a sustained growth that took place in the period during which Japan had been experiencing a prolonged economic recession.

In 2003, pharmaceuticals account for 33%, agro-products and foods for 26%, and chemicals (including enzymes) for 26% of the market. A number of the market segments that grew noticeably in 2003 include the following: biodegradable plastics (53%); functional foods (24%); and transgenic crops (23%); and R&D support services (13%).
**Pharmaceutical Industry**

The size of the Japanese pharmaceutical market in 2001 was US$46.2 billion — 13% of the world market, which is the second largest in the world after that of the US (45%). The value added by the pharmaceutical industry within Japan in 2002 was JY205.6 billion, which is 30% increase compared with the 1991 figure. The tax paid by the pharmaceutical industry within Japan accounted for 14% of the total tax paid by all the industry sectors in 2002. This is ranked second after the automobile industry.

In 2001, the Japanese pharmaceutical industry filed 2,749 patent applications domestically, and 3.5 times more internationally. This ratio of international to domestic filing by the pharmaceutical sector far exceeded that of the other industry sectors in Japan. Regarding the balance of technology trade in 2001 for Japanese pharmaceutical industry, technology export was JY111 billion, while technology import was JY63.5 billion. Furthermore, during the period from 1997 to 2002, the number of new active substances that were commercialized by the Japanese pharmaceutical companies was 35. This is 15.6% of the world total, and ranked second after the US. During the same period, “blockbuster” drugs (those drugs whose worldwide sales volume exceeded US$0.7 billion per year) were 19 in total. Four out of the 19 blockbuster drugs (21%) were originated from Japanese pharmaceutical companies.

Japanese pharmaceutical industry has been facing a number of challenges to their future development. To exemplify four of the main challenges; firstly, the Ministry of Health, Labor and Welfare (MHLW) has been continuing to lower official drug prices regularly to slow the increase of the medical budget deficit. Secondly, ICH guidelines that harmonize international pharmaceutical regulations have intensified competition within the Japanese market, because of intensified sales efforts by multinational pharmaceutical companies. Thirdly, new good clinical practice guidelines have made it more complicated to conduct clinical trials in Japan. And fourthly, pharmaceutical companies have been obliged to increase their R&D expenditures dramatically since the advent of genomics.

Pharmaceutical companies in Japan have been coping with these challenges. They have been strengthening their R&D and sales capability at home and abroad through merger, acquisition, and other type of partnerships. They are steadily increasing their R&D expenditures. In 2003, the ratio of foreign to domestic sales substantially increased for companies like Takeda, Eisai and Fujisawa. All these trends seem to reflect a current outcome of the efforts by Japanese pharmaceutical industry to increase its international competitiveness.

**Agro-Foods Industry**

In December 2002, Prime Minister Koizumi announced in Tokyo that the completion of the sequencing of the rice genome (japonica cultivar “Nipponbare” variety). This signifies that a high-quality sequencing of the rice genome was achieved as part of the International Rice Genome Sequencing Project. The ceremony commemorating this event was attended not only by the 10 countries/regions of the consortium, but also by representatives of private companies (Monsanto and Syngenta). Japan contributed to the Project by analyzing 55% of the main part of the genome.

Importation of recombinant crops (soybeans, corn, rapeseeds and cotton) to Japan has been increasing steadily. In 2003, JY298 billion (approx. US$2.7 billion) worth of these recombinant crops were imported mainly from North America.
Functional foods are items such as cooking oil that is less fattening, foods that activate the immune system, and foods that help prevent cancer. Biotechnology has a potential to revolutionize the food industry by contributing to R&D of functional foods. Japanese consumers have been getting increasingly health conscious, and, in the light of this trend, the functional foods sector seems to have a bright future in the Japanese market.

Bioprocesses and Environmentally Friendly Products

Japanese companies have strengths in commercializing microorganism- or enzyme-based bioprocesses for chemical, food and other industries. Noteworthy is that the market for industrial biodegradable plastics has recently started exponentially growing in Japan, particularly since 1998. Biodegradable Plastics Society (Tokyo, Japan) worked persistently for almost 15 years to lay the groundwork. The present market is mainly composed of poly (butylene succinate) (PBS), poly (lactic acid) (PLA), and starch blended with biodegradable plastics. Recently, Toyota Motor Co. started using PLA for the floor mat and the cover case for spare tires in their cars. Mitsubishi Chemical Co. and Ajinomoto Co., Inc. recently announced that they would synthesize their PBS from succinic acid derived from renewable resources.

In 2002, the Ministry of Agriculture, Forestry and Fisheries (MAFF) unveiled its BIOMAS JAPAN strategy outline. MAFF’s immediate goals are to:
1) develop a system for the efficient production and collection of various types of biomasses;
2) provide assistance to the construction of advanced facilities and infrastructure;
3) explore ways in which to boost demand through early implementation by government agencies and other public organizations;
4) prepare for a smooth implementation of the Japan’s Renewable Portfolio Standard Law;
5) standardize various types of biomasses, and consider methods for classification labeling; and
6) assess biomass risks and conduct demonstrations of model cases.

Biotechnology Start-ups

Biotechnology-related start-ups are called “bioventures” in Japan. The number of bioventures in Japan has been steadily increasing according to Japan Bioindustry Association (JBA) surveys. As of November 2003, 387 bioventures were operating in Japan. In regional distribution, the highest concentration (50.1% of the national total) was in Kanto district (Tokyo metropolitan area and the neighboring prefectures), followed by Kinki district (Osaka, Kyoto and Kobe and the vicinity) (14.2%) and Hokkaido (11.6%). Kanto is home to the nation’s highest concentration of companies. It is noteworthy that approximately one-third of all the bioventures are located in Tokyo.

In terms of business sector distribution of bioventures, the most prevailing sector was pharmaceuticals & healthcare (31.4%), followed by research support (customized research, instrument development, bioinformatics, etc.) (27.4%), environmental technologies (11.8%), and consulting & other services (11.5%).
Furthermore, law to corporatize all the national universities took effect in April 2004, and the involvement of faculty members in entrepreneurship became deregulated. Consequently, the creation of spin-off bioventures is expected to increase nationwide in the coming years. With the number of bioventures increasing, their contribution to strengthening of R&D capability of Japanese bioindustry is likely to become more significant in the coming years.

Government Initiatives

Due to a high longevity (the highest in the world) and a low birth rate, Japanese population is aging faster than other industrialized countries. The Japanese civil society has a tendency to respond sensitively to issues on safety and the environmental quality. Furthermore, Japan was experiencing a prolonged economic recession in the past decade. Under these circumstances, the Japanese Government decided to put priority on biotechnology as an enabling technology to reinvigorate the nation’s economy, as well as to emphasize the need for sharing enhanced common understanding of innovation processes with the civil society.

In July 2002, Japanese government launched the Biotechnology Strategy Council (BTSC). BTSC was presided over by Prime Minister Koizumi and consisted of seven Cabinet members and 12 experts from academia and industry. In December 2002, BTSC announced a comprehensive “National Strategy on Biotechnology” report containing 200-detailed action plans. The report specified responsible government agencies, implementation dates, and target deadlines.

While government’s previous policies on biotechnology focused on science and technology, BTSC’s plan addresses R&D, commercialization, and public understanding of biotechnology. Each of these three pillars of the strategy has its own action plans, which cover a wide range of issues. Under the auspices of the Life Sciences Executive Committee consisting of chairman of the Parliamentarians “Promotion Alliance for Life Sciences”, member of the Council for Science and Technology Policy — Cabinet Office, and chairman of the Japan Association of Bioindustries’ Executives, “Life Sciences Summit” has been convened every year since 2000 in order to discuss further the direction of Japan’s biotechnology strategy, and to follow up on the implementation of BTSC’s action plans. Around 500–600 participants comprised of parliamentarians, government officials, academics and industry leaders attended each summit meeting.

Future Trends of Bioindustry in Japan

The industrial landscape in Japan will be quietly but steadily kept transformed by the penetration of biotechnology into existing industries, as well as by the creation of new industries that will emerge as a result of interaction between biotechnology innovations and existing technologies.

Existing industries — such as chemical, food, pharmaceutical, energy, paper & pulp, textile, information, electronics, and machinery — will become more sophisticated and environmentally friendly by incorporating biotechnology innovations. For example, the chemical industry is likely to undergo transformation at three levels. Firstly, the industry will undergo raw material conversion from fossil feedstock to biological resources. Secondly, it will undergo process conversion from using chemical processes to using bioprocesses. Thirdly, it will undergo product conversion as it increasingly focuses on more knowledge-intensive and environmentally friendly products.
Biotechnology will revolutionize the healthcare industry. Firstly, biotechnology will help reduce the number of patients requiring acute care through advanced preventive medicine and functional foods. Secondly, personalized medicine will be able to improve health with fewer side effects and shorter hospital stays. As individuals’ genetic information will play such an important role in this changing industry, developing of rules and systems is essential to ensure security and privacy protection of individuals’ genetic information.

Japan has strengths in a number of areas of biotechnology, such as the sequencing of human full-length cDNAs (Japan contributed 60% of the cDNA data), single nucleotide polymorphisms (SNPs), glyco-chain technology and bioinformatics, in addition to industrial microbiology and enzyme engineering. Japan will have strengths in combining biotechnology with other advanced technologies, such as nanotechnology, robotics, and electronics to create a new generation of advanced technologies. 

Reference
4. Fujiwara, N., OPIR Views and Actions (Seisakukens News), November 2003 issue, No. 12, 12-13
5. Morishita, Y., OPIR Views and Actions (Seisakukens News), November 2003 issue, No. 12, 4-5

About JBA
Japan Bioindustry Association (JBA) is a non-profit organization dedicated to the promotion of bioscience, biotechnology and bioindustry in both Japan and the rest of the world. Established through the support and cooperation of industry, academia and government, JBA is the only organization of its kind in Japan. JBA’s roots date back 60 years to the establishment of the Japanese Association of Industrial Fermentation. Today, like its predecessor organizations, JBA functions as a think tank and platform for communication between scientists, technologists, policymakers and corporate managers.

About the Author — Seizo Sumida
Born in Tokushima, Japan, Seizo received his PhD in Biochemistry from University of California, Riverside (1969). His fields of specialization include Bioindustry in general, and policy study on conservation and sustainable use of biodiversity.

From 1969–1991, Dr. Sumida worked as a Manager of Corporate Planning Office, Manager of Biotechnology Research Laboratory, Sumitomo Chemical Co., Ltd. Later, he joined the Science and Technology Policy, Organization for Economic Cooperation and Development (OECD), Paris and served as the Principal Administrator from 1991–1994. Currently, Dr. Sumida served as the Managing Director, Japan Bioindustry Association (since 1999) and Director-General, JBA Research Institute (since 2001).