Session 4

Innovation in the Life Sciences

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Forging an ecosystem of innovation for the life sciences

The life sciences are the driving force for innovation in the twenty-first century. New discoveries and technological advances in the life sciences are expected to stimulate further innovations of science and technology and to lead to paradigm shifts that can change our social systems as we know them today. There are those who point out, however, that given contemporary pharmaceutical and medical equipment markets, the life sciences are unlikely to have an industrial impact comparable to that of IT and other such technologies, despite the strong demand from society. Nevertheless, new discoveries in the phenomenon of life inevitably lead to major changes in how we live today, and affect the public systems that are directly linked to people's health and safety and to the environment. By acting as a stimulus for change, innovations in the life sciences are likely to have a broad influence on a variety of industries and lead to the creation of whole new industries as well. The very fact that we cannot yet see how the new industrial map will evolve suggests that there are major innovations on the horizon.

Creating an ecosystem for innovation in the life sciences requires collaboration among industry, academia, and government that is more diverse and extensive than ever before. A major difference between innovation in the life sciences and that centered on industrial products is that innovation in the life sciences links directly to health and life, and is closely related to natural ecosystems and food. Because of this, issues of safety and ethics are paramount, and there is a need for greater sensitivity to regulation and society's capacity for accepting innovation. There will be numerous Valleys of Death and Darwinian Seas – perilous transitions from R&D to markets – in the process of creating an ecosystem for innovation in the life sciences.

Warm-up zones and baton zones

An ecosystem conducive to open innovation is one in which organizations and individuals from different sectors, working within their varied capacities, cooperate, collaborate, and compete, both within and outside their own sectors. In an effective environment for open innovation there is active interchange among different fields of science and technology that will give birth to the seeds of innovative technology and, further down the line, to active exchanges for transforming these technological seeds into useful applications. At RIKEN, this latter stage is referred to as the Baton Zone, that small window of opportunity when the relay runner hands over the baton to the next runner. There is no clear demarcation of function, no single point at which we declare that the creation of seeds stops here and the meeting of application needs starts there. Rather, both objectives are pursued in parallel at full speed, making it possible to share the risks of innovation and to cross a line, rather than converge at a single point, beyond which the seeds of innovation are

transformed into actual applications. In the Baton Zones, both sides, those working on innovative seeds and those working on applications, share the costs of personnel and funding. RIKEN is actively working to build the kind of infrastructure needed for this, by soliciting collaborations with industry and encouraging technology transfers.

There is as well, what I call a Warm-up Zone within which active exchange among different fields of science and technology gives birth to the seeds of innovative technology mentioned earlier. In this regard, Dr. James D. Watson, and many other great scientists, have been inspired by the great physicist Dr. Erwin Schrödinger's book, *What is Life*, first published in 1944. To create a Warm-up Zone that will give birth to high-quality seeds in the life sciences, it is necessary to build an ecosystem that will mobilize the combined knowledge of physics, chemistry, biology, engineering, and medicine for the exploration of life phenomena. This requires vigorous investment in research by the government.

Investing in the creation of technological seeds in the life sciences requires that a clear distinction be made between "small science" and "big science." Small science thrives in a competitive environment in which research is evaluated and selected on the basis of its impact over the long term. Rather than being curiosity-driven, small science research needs to be dream-driven or mission-driven. It should also be open to scientists from other countries as well as those in Japan.

Big science, on the other hand, requires investment in large-scale research infrastructure and sophisticated research facilities. For the life sciences, investment is needed in projects for building a comprehensive and searchable database of genome-related data and disease-related data, and for the operation of bioresource facilities. In this regard, RIKEN has already been making significant contribution to international endeavors, through its participation in the genome sequencing project within Japan and in the project for structural and functional analysis of proteins. Additionally, RIKEN has contributed to research inside and outside Japan by providing bioresources to laboratories around the world.

Our next undertaking is to create effective Baton Zones for the life sciences. At issue is how to ensure a seamless transfer of the large volume of knowledge acquired through basic research and big science so that it can be applied in clinical studies and the development of new drugs. There are numerous points at which the baton must be passed on before innovations become actual applications: From basic research to clinical studies; from venture business to large pharmaceutical corporation; from the government's ethical guidelines to the approval of new drugs and methods of treatment. It is to be hoped that the government and each affected sector will be proactive in their support and participation in preparing the groundwork for each of these Baton Zones. It is also to be hoped that there will be active support and cooperation among governments worldwide so that we can tackle the global concerns of infectious disease, environmental conservation, food, and energy.

The exchange of people and clusters for innovation

Mobility of people is as important as the collaboration of organizations in creating effective environments for open innovation and the Warm-up and Baton zones. Information exchange alone is not enough to

ascertain what kinds of technological seeds will lead to innovations that will meet society's needs. The physical presence and movement of people are needed as well, in what can be called clusters for innovation. There are already a number of such clusters in Japan, the product of cooperation between the national government and local administrative units. Support structures are needed to facilitate the required fluidity of human resources, and to ensure that these clusters of innovation are successful. This is an area in which universities and national and local governments can play a significant role.

As educational institutions, universities train the human resources needed at local research institutions and industries. What they also need to do is to provide forums that encourage intellectual exchange. Local governments can play a role as well by providing the necessary facilities and the foundations for community-building and enacting tax and social security provisions that will not put people at disadvantage when shifting from one job or position to another. To cite an example: RIKEN has been cooperating with the city of Kobe to implement its vision for a medical industry development project, and RIKEN's Center for Developmental Biology is one of the core facilities of the project. Located next to the Translational Research Center, the CDB will, in the future, also be linked to Kobe's city hospitals. Elsewhere in the project are the offices of venture businesses and pharmaceutical corporations. Kobe also has its own international airport. All that is needed now is a mechanism to encourage interaction and movement among the people who gather and work in this area.

International cooperation and partnership

Conventional industrial innovations have stimulated international competition, but the life sciences need to focus on promoting international cooperation. By providing innovative solutions to the problems of human health, food, environment, and energy, the life sciences have the potential to significantly improve global sustainability. And to achieve this, there needs to be a sharing of new knowledge and an exchange of the knowhow and materials that have been individually developed in different countries. When it comes to human health and life, there must be temperance in enforcing intellectual property policies, and limits on the priority placed on economic advantage, monopoly, and international competition. The passion for scientific inquiry will not fade away and is not something that can patented for economic gain. Likewise, a nation's insistence on clinging to its competitive edge can be detrimental to all of humankind.

It is hard to hold on to the conventional concept of industrial property rights when discussing the life sciences. The idea of industrial property rights does not sit well with new discoveries related to life, human and otherwise. Insisting on exclusive rights to drugs and methods of treatment raises an obstacle to the promotion of innovation in health care. Pro-patent policies are not needed now. Instead, the international community needs to formulate pro-innovation policies.