Speech by Guest of Honor

Basic science in atomic energy —For the 20th anniversary of ASRC—

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Prolusion

It is an honor for me, as the founding director, to speak at this memorable occasion to celebrate the 20th anniversary of Advanced Science Research Center (ASRC), JAEA, which was formerly Japan Atomic Energy Research Institute (JAERI). Looking back on the last 20 years, social landscape has been changed and involved people have totally been shifted while some of them have already passed away. It is, therefore, my mission was not to let views of the old days to fall into oblivion, with hope that the center would flourish by revising the founding philosophy and spirit. The center, with the new competent leader, is going further to grow. I would be much obliged if my massage could be a tip for the future advancement.

1. The situation in the early days of the ASRC

In comparison to the old days, what was different from today is an infestation of "free rider problem" of basic science. Japan, who was in the ascendant in semiconductor and auto manufacturing, was criticized of enjoying a free ride using knowledge discovered and developed in the West. Even the former British Prime Minister Margret Thatcher once accused Japan of making money out of electromagnetism developed by British scientists. This bitterness boosted investments to basic science within Japan. In the movement, the ASRC was founded with the aim of a promotion of basic science research. It was the time academic societies like Science Council of Japan heard talk that the mood should not last more than five years, and, in fact, the expectation appeared to be true.

At that time, JAERI was facing an issue of abolition and reconstruction of its physics and chemistry divisions. They had been dealing with basic science within JAERI but there was a need for reformation of the timeworn organization and personnel. There were, when viewed individually, capable personnel. Making utmost use of their skills and knowledge were the important task for the center. Although the administrative board insisted to hire competent personnel from outside to create more active research groups, I came to a decision that it is more efficient to cultivate and develop existing young man power. Therefore, appointments from outside were kept to the minimum necessary to leaders of few key groups and the main effort was taken for the reconstruction of existing flame works. I convinced the administrative board by saying "A top-class expert brings on another top-class whereas second ones bring third ones". I did not want recommendations from the second-class ones who tend to bring those who are unlikely to be better than them. Moreover, subsequent positions of external appointees were also considered problematic. This is how the original flame work was established.

Right from the beginning, let me explain the background of my appointment to the director. When the establishment of the center was approved at the administrative board, Executive Director, Hitoshi Iizumi was assigned to the ASRC. He, a well-known figure in the field of condensed matter physics for his work on neutron scattering, asked Professor Yasuo Endoh of Tohoku University for an advice. When I received the offer as a consequent, I was about to retire from my position in Osaka University in the coming March and my next position was not yet determined. Unlike Iizumi and Endoh, my field of expertise is not neutron scattering research. I accepted, however, the offer since I had once been a chair of the examination committee for special research funds on atomic energy science and was no stranger to JAERI. I must say that it was a fateful coincidence that the year of my retirement and the realization of the center which an approval of MEXT (The Ministry of Education, Culture, Sports, Science and Technology-Japan) was given a year later than that had originally been scheduled, accorded.

2. The framework and achievements at the beginning

Therefore, my first task as the director was to rearrange the framework of research activity. This was in another word for construction of the research philosophy. As a result of deliberation, the framework is done as shown at Fig. 1, and it has to demonstrate what the "basic science of atomic energy" is to be. Here are the three pillars of the new establishment; science of radiation field, science of heavy elements, and basic nuclear science. Ample facilities of JAERI including radiation fields, fields using gamma rays, neutron beams, electron beams, and ion beams are ideal tools for research of the radiation field science. The research on heavy elements is closely linked to atomic energy science. The research on basic nuclear science comprehends wider range of sciences other than those above. All of those are unique to JAERI, somewhat different from research themes which studied at universities. Each theme is to be re-examined and re-constructed every five years.

Let me mention three representative results came out of the new framework. A development of a neutron imaging plate was succeeded by Nobuo Niimura et al. a year and half after the founding of the center. With this novel

achievement, measurement of neutrons which traditionally had only been done in a counter became possible in films like of X-rays. This appeared on the cover of Nature (Fig. 2), and was taken up by every newspaper in the country. I used to call this imaging plate as the "image enhancement plate of the ASRC". In the following year, a successful uranium separation by carbon dioxide was achieved by Zenko Yoshida et al. Uranium can be recovered selectively by, with an organic catalyst as a set-upper, making carbon dioxide super critical. This was too appeared extensively on major newspapers. In the next year, Shigemitsu Tano and Atsushi Tanaka succeeded in a creation of ultraviolet-ray resistant plants. Most plant seeds died when irradiated by ion-beams, however, there are gene-transformed ones sprang up among some surviving seeds. This founding is one of them. The three smashing results elevated recognition of the center. In addition to those, discovery of hypervalent molecules by Hiroshi Kudo et al. is also notable. They found that CLi_6 becomes stable when changed hydrogen of methane CH_4 into lithium. Despite the great importance of this discovery, I did not count it here as it was more properly to be recognized as a result achieved by the chemistry division during the former system. Another remarkable result was a discovery of plutonium recovery bacteria by Takashi Sakaguchi et al. in 1996 when the ASRC began to conduct an open-offering project called Reimei Research Project. Their discovery at its first year had a significant impact which made the project take root and encourages involvement of young researchers.

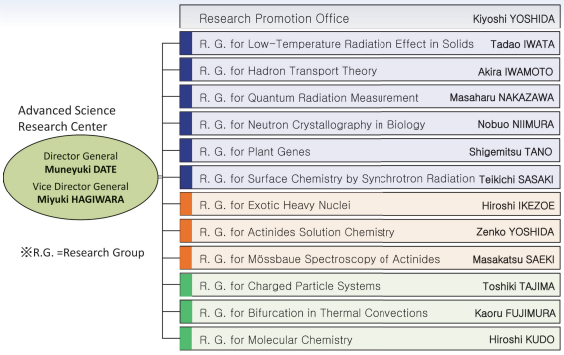

Fig.1. The original framework in the early days Radiation field science in blue, heavy elements science in red, and basic atomic nuclear science in green.

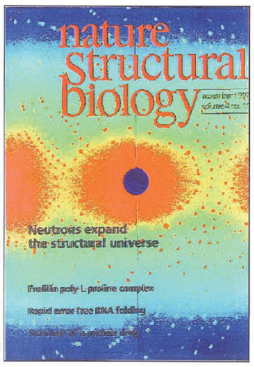

Fig. 2. The neutron imaging plate on the front cover of *Nature*

3. Basic science in atomic energy

Leaving immediate tasks aside for a moment, let me now give thought to what basic science is to be to atomic energy science. Is that merely a countermeasure to the "free rider" problem? Here is a historical evidence to confront the criticism. Figure 3 was drawn for the special issue to celebrate the 5th anniversary of the center. Major discoveries of the 20th century were listed and the arrows indicate how long it took applications of them became materialized. X-rays and semiconductors were applied quite soon while superconductivity and magnetic recording did not reach their application for several decades, and liquid crystal and relativity took almost a century.

Among them, neutron (N) and chain reaction of fission (A) witnessed their applications in incredibly a short term. As we all know, that is an atomic bomb. Based on this rapid progression and the subsequent tragedy became a standing point of the following development of nuclear energy research. Atomic energy is the second fire for mankind. Among all animals on the earth, which most of them were awed, only human being absorbed it. Mastering the technology took tens of thousands of years. On the other hand, for contemporary human being, it should not take such long time to handle its treatment technology, but still require few hundred years. Some people say, at the present, atomic technology has already attained a high degree of its development, but, as we look at the cases of JCO in 1999 and TEPCO (Tokyo Electric Power Company) today, it does not seem true.

As already mentioned in the 5th year anniversary issue, basic science research in terms of atomic energy science is a continuation of research in a sensible and a dispassionate manner with in-depth understanding of the present situation surrounding the ongoing issues on nuclear energy development. A broad vision, creativity and leadership are necessary elements for realization of it.

So to speak, the ASRC is more needed than ever before, even at the time when the "free rider" problem was widespread. I sincerely wish that the center will continue its growth and create outstanding achievements.

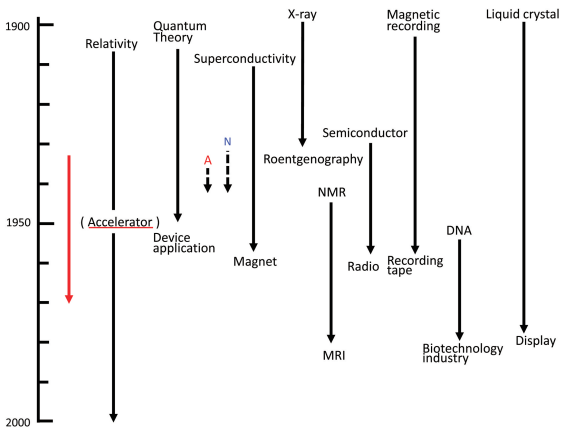

Fig. 3. Time taken for some of the greatest discoveries of the 20th century to reach their application