The History and Current Status of Space Life Sciences in Asia - A report of the 10th Asian Microgravity Symposium 2014 Seoul -

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Abstract

The 10th Asian Microgravity Symposium was successfully held in Seoul, South Korea. In all, 169 scientists participated from China, Japan, South Korea, Pakistan, Malaysia, and Saudi Arabia, as well as non-Asian countries (United States, Germany, and the Netherlands). This was the first symposium to which our society, the Japanese Society for Biological Sciences in Space joined as a co-organizer of the symposium; 10 members of our society participated in this symposium. Sessions for two different subgroups, life sciences and material sciences, were simultaneously conducted for three days. The various presentations documented the ongoing and future microgravity research and programs in each country, including the future research at the Chinese Space Station. This commentary summarized the historical overview of this symposium and the current status of space life sciences in Asia, and discussed the importance of this symposium. ©2015 Jpn. Soc. Biol. Sci. Space; doi: 10.2187/bss.29.8

Introduction

I recently participated in the 10th Asian Microgravity Symposium (AMS) 2014, which was held during Oct. 28–31, 2014, at Hotel President in Seoul, South Korea. AMS is held every two years. However, members of our society, the Japanese Society for Biological Sciences in Space (JSBSS), who are not affiliated to the Japan Society of Microgravity Application (JASMA), may not be familiar with this symposium. Moreover, since many past symposium participants from Japan have been from the field of material sciences, younger members of JSBSS may not be familiar with the AMS. This was also the first time I participated in the symposium. The history of AMS intrigues me. Upon my research on the establishment of AMS, I realized that it is important for our society to build a relationship with the symposium participants and the related Asian societies in the field of space life sciences. Herein, I report the findings of AMS 2014, as well as the current status of space life sciences in Asia, highlighting the importance of this symposium.

History of AMS and a stream of life sciences inside

This symposium started as a Joint Workshop on Microgravity Research between the Chinese Academy of Sciences and The University of Tokyo in 1992, and it focused on a joint project on semiconductor crystal growth using the Chinese recoverable satellite No. 14 (Nishinaga et al., 1997; Yoda, 2010). Since then, international exchanges within Asia have been conducted by JASMA through this symposium, mainly with regard to material sciences using microgravity environments (Yoda, 2010). Here, I examine the history and current state of international exchanges among Asian countries in the field of life sciences.

Historically, microgravity experiments in the field of life sciences have been performed by Chinese scientists using recoverable satellites (Sawaoka, 1994), some of which were reported at the second Japan-China Microgravity Workshop in 1994 (Hu, 1997). On the other hand, several life science experiments have been performed in space by Japanese scientists using the space shuttle Endeavor as a part of the First Material Processing Test conducted by the National Aeronautics and Space Administration of the United States and the National Space Development Agency of Japan in 1992. This project was called “Fuwatto 92” (Harada et al., 1998). Nevertheless, the exchange of information in the field of space life sciences has not yet been very active among research scientists in Asia. Meanwhile, with a perspective view of collaborative utilizations of the Japanese Experiment Module, “Kibo”, on the International Space Station (ISS), the Joint Japan-Korea Space Environment Utilization Research Seminar began in 2004 involving life scientists from both countries (Fujimori, 2005; JAXA, 2014). Kibo was installed in the ISS in 2008 and is utilized. The principals of the ISS program are the United States, Russia, Europe (11 countries), Canada, and Japan. Japan is the only participating country from Asia, and therefore, Japan is responsible for reporting on the results of this program to the space research community in Asia. In the context of this situation, the workshops between China and Japan were expanded with the participation of South Korea at the 8th AMS in 2010 (Sendai, Japan) (Choi, 2014). However, there was limited participation from Japanese scientists from the field of life sciences. Therefore, to facilitate information exchange and collaboration on space experiments among these countries in the field of microgravity sciences, including life sciences, Dr. Takao Ohnishi, former president of our society, joined the 9th Workshop in 2012, which was renamed the Asia Microgravity Pre-
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Symposium (Guilin, China). He proposed that related societies in the participating countries should sign a partnership agreement for space experiments. As a result, a partnership among Japan, China, and Korea for space experiments, was signed by the presidents of the Japan Society of Microgravity Application (JASMA), the National Society of Microgravity Science and Application (China), the Korean Microgravity Society, and JSBSS (Natsuisaka, 2013). JSBSS and JASMA were co-organizers of the symposium.

In addition to the specific history of the symposium and the research presented there, the activities initiated by the space agencies and national governments should also be mentioned. The Asia-Pacific Regional Space Agency Forum (APRSAF) started in 1993 to enhance space activities in the Asia-Pacific region (APRSAF, 2013). With regard to the activities of the working group within this forum, the Kibo Utilization Office for Asia (KUOA) was established by the Japan Aerospace Exploration Agency (JAXA) in 2010 (Kamigaichi et al., 2011). In addition, the Asian Beneficial Collaboration through Kibo utilization (Kibo-ABC) was initiated in 2012 at this forum. These activities, led by the Japanese government, aim to promote the utilization of Kibo by researchers from the Asia-Pacific region.

Summary of the meeting of the AMS 2014

The 2014 symposium, formally called the “10th AMS 2014,” was hosted by a local organizing committee chaired by Dr. Inho Choi, President of the Korean Microgravity Society. The 2014 symposium focused on research, including combustion and chemical physics, crystal, protein, and colloid growth and application, facilities and techniques for microgravity experiments, fundamental physics, heat and fluid flow in microgravity, ground-based microgravity research, life sciences and biotechnology in space, materials sciences and advanced functional materials, and thermophysical properties. From Japan, the following 10 members of JSBSS participated in AMS 2014: Drs. Makoto Asashima and Takeo Ohnishi as members of the international advisory board, Dr. Hideyuki Takahashi as symposium co-chair, Dr. Takeshi Nikawa as a member of the organizing committee, Drs. Atsushi Higashitani and Yoshiaki Kitaya as members of the scientific committee, and Drs. Masao Yamasaki, Jun Hidema and I as members of the research team of the Space Environment Utilization Scientific Committee of JAXA for the discussion and planning of life science experiments using Kibo, which is led by Dr. Ohnishi. The total number of participants was 169 (Table 1, Fig. 1). Approximately one-third of the presentations were in the field of life sciences. Five of the 14 plenary lectures (Japan, 2; China, 1; Korea, 1; Malaysia, 1), 18 of the 73 oral presentations (China, 8; Japan, 6; Korea, 3; Malaysia 1), and 18 of the 59 poster presentations (Korea, 9; Japan, 2; China, 1) represented research from life sciences.

Topics discussed by Japanese scientists tanged from animal sciences (radiation biology, muscle atrophy, and cardiovascular changes) and plant sciences (circumnutation, hydrotropism, sap flow, and vegetative growth), and results from both ground-based experiments and experiments in Kibo were presented. Topics discussed by Korean scientists included development of a three-dimensional (3D) clinostat and scientific results related to sustained torpidity, bone loss, autophagy, microalgae growth, and bacterial growth, with results obtained from ground-based experiments using Table 1. Number of the participants of AMS 2014 from each country

<table>
<thead>
<tr>
<th>Country</th>
<th>Number</th>
</tr>
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<tbody>
<tr>
<td>Korea</td>
<td>60</td>
</tr>
<tr>
<td>China</td>
<td>55</td>
</tr>
<tr>
<td>Japan</td>
<td>40</td>
</tr>
<tr>
<td>USA</td>
<td>3</td>
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<tr>
<td>Pakistan</td>
<td>3</td>
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<tr>
<td>Malaysia</td>
<td>3</td>
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<tr>
<td>Germany</td>
<td>3</td>
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<tr>
<td>Netherlands</td>
<td>1</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>169</td>
</tr>
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</table>

Fig. 1. A group photo of the participants of AMS 2014. Photo courtesy of the local organizing committee.
After attending both events, COSPAR 2014 and the AMS 2014, a scheduling conflict was noted. Some participants were concerned about participating in both. However, it is evident from the fact that the Center for Space Utilization of the Chinese Academy of Sciences participated in COSPAR 2014 as a co-organizer of the AMS 2014 symposium. Their interest in space life sciences is reflected in the programs they are involved in, which are often conducted within a framework of international cooperation.

The Chinese Space Station (CSS) is also an example of such cooperation. Its construction is scheduled for 2020, and its release into orbit will mark a significant milestone in Chinese space exploration. International scientific cooperation is expected to play a crucial role in the development of this facility. Moreover, the Chinese Cargo Ship Tianzhou-1 is planned for launch in 2015. Flight models of space experiments, such as seed-to-seed experiments, are planned for the Tiangong-2 Spacelab, which will launch in 2015 and dock with the first Chinese Cargo Ship Tianshou-1 in 2016. The Tianshou-1 will carry out experiments in space, including biological experiments and space biology experiments.

In conclusion, the future of space life sciences in Asia is promising. The AMS 2014 meeting highlighted the importance of international cooperation and the need for continued efforts to support space life sciences activities. The AMS 2014 meeting was a great success, and efforts will continue to make this symposium a great success. The science and life sciences in Asia are expected to continue to grow and develop in the future.
themes and collaborate if possible. I have looked into the history of AMS and found that AMS was founded on the basis of such a spirit. I pay my respect to the founder of AMS. Today, AMS includes space-related societies and space exploration agencies from the National Institute for Biotechnology and Genetic Engineering (NIBGE) of Pakistan, the National Microgravity Programme of India, the National Science and Technology Development Agency (NSTDA) of Thailand, and the National Space Agency (ANGKASA) of Malaysia in addition to the four societies mentioned above. Therefore, development of our society into one such as the European Low Gravity Research Association can be realistically achieved; which has already been proposed (Yoda, 2013). There are no domestic societies specific for space life sciences in China and Korea at present. In Japan, there is another society related to space life sciences besides our society. The Japanese Society of Aerospace and Environmental Medicine (JSASEM) should be encouraged to join AMS. Coincidentally, just a day before I left for Seoul to attend the AMS 2014, I spoke to JAXA astronaut Dr. Koichi Wakata. He was the first Japanese ISS commander, and I believe that he has a well-balanced, international sensibility. His experiences as an ISS commander will benefit space exploration in Asia. This discussion as well as his talk made me think that we, as scientists involved in space science studies, should have a particularly strong global sensibility.

Next “11th AMS 2016” will be held in Sapporo by Dr. Osamu Fujita, Hokkaido University on Oct. 26-28 as the president. See you again in Sapporo.

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References


