NIBB Center for the Interuniversity Bio-Backup Project (IBBP Center)

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In order to realize the vision of a life science community that can withstand natural disasters and calamities, the National Institutes for Natural Sciences (NINS) and Hokkaido University, Tohoku University, University of Tokyo, Nagoya University, Kyoto University, Osaka University, and Kyushu University finalized an agreement on June 1st 2012 to launch a system to 'back up' the biological resources essential to the work being done at universities and research institutions nationwide, called the 'Interuniversity Bio-Backup Project (IBBP)'.

The IBBP Center was established as a centralized backup and storage facility at NIBB, while IBBP member universities have set up satellite hubs and work closely with the IBBP center to put in place reciprocal systems for backing up important biological resources that have been developed by researchers residing in the area each university satellite hub is responsible for.

Figure 1. IBBP Center.

The IBBP Center includes:

- earthquake proof structures capable of withstanding even very large-scale quakes which are equipped with emergency backup power generators,
- cryopreservation facilities equipped with automatic liquid nitrogen feeding systems,
- deep freezers, and refrigerated storage (mainly for seed stocks),

as well as all manner of automated laboratory equipment, cell culture tools, and the latest equipment necessary to back up the genetic resources in a collaborative manner. The specific preservation methods used are the freezing of animal sperm and eggs, cultured plant and animal cells, proteins and gene libraries. Plant seeds are frozen or refrigerated.

When university satellite hubs receive preservation requests involving biological resources from researchers, they report to the Managing Project Committee of IBBP (which is comprised of NIBB faculty members and other satellite institutes), where the relevance of the request is reviewed. If the request is approved, the biological resources that are to be preserved will be sent to the IBBP Center by the requesting researcher, where they will be frozen (or refrigerated), and their particulars registered into a database. In the event of a disaster leading to the loss of a researcher's own biological resources, preserved samples will be promptly returned to the researcher so they can quickly resume their work.

Through the development of this backup system biological resources that had only been stored at individual research institutes can now be preserved at the IBBP Center's state of the art facilities. As a result of this, Japan's research infrastructure has been significantly strengthened.

Figure 2. Cryogenic storage system. Liquid nitrogen tanks are monitored 24 hours a day and are refilled automatically.

I. Current status of back up available for biological resources

In 2020, the IBBP Center stored 5,264 384-well and 112 96-well plates consisting of 2,244,864 clones as cDNA/BAC clones, 20,163 tubes for animal cells, plant and animal samples, proteins, genes and microorganisms, 5,114 133mm-straw tubes for sperm and 664 seed samples. In total 2.058,069 samples were stored.

Figure 3. Cryo tube with 2D barcode. Each sample is printed with a unique barcode and is managed using a database.

II. Collaborative Research Project for the development of new long-term storage technologies and cryo-biological study

As the IBBP Center can only accept biological resources which can be cryopreserved in liquid nitrogen, researchers cannot backup biological resources for which cryopreservation methods are not well established. In order to increase the usability of IBBP, we started a collaborative research project for the development of new long-term storage technologies and cryo-biological study in 2013. This collaborative research focuses on two goals: 1) The establishment of new storage technologies for biological resources for which long-term storage is unavailable. 2) Basic cryobiological research enabling us to improve low temperature storage for biological resources. In 2020, we have conducted 10 collaborative research projects aimed at achieving these goals. We also worked to establish a research center for cryo-biological study thorough this Collaborative Research Project. Accordingly, we organized the Cryopreservation Conference 2020 on November 26-27, 2020 online, because of the COVID-19 pandemic. We had 195 participants from several fields covering physics, chemistry, biology, and technology. In the special lecture, there was a presentation on the effect of polymeric compounds on cell cryopreservation and its mechanism of action, and other presentations related to the development of cryopreservation technology, such as methods for preserving insects, plants, and animal embryos.

Figure 4. Group photo of Cryopreservation conference 2020

Publication List on Cooperation:

〔Original papers〕

- Watanabe, H., and Akiyama, Y. (2020). Improved and reproducible cell viability in the superflash freezing method using an automatic thawing apparatus. Cryobiology, *96*, 12-18. DOI:10.1016/j.cryobiol.2020.09.003
- Kawasaki, Y., Kohaya, N., Shibao, Y., Suyama, A., Kageyama, A., Fujiwara, K., Kamoshita, M., Matsumura, K., Hyon, S-H., Ito J. and Kashiwazaki, N. (2020). Carboxylated ε-poly-L-lysine, a cryoprotective agent, is an effective partner of ethylene glycol for the vitrification of embryos at various preimplantation stages. Cryobiology, *97*, 245-249. DOI:10.1016/j.cryobiol.2020.10.004