

## Departmental Overview

Tasks and responsibility of processing and storing biosamples and managing biosample information at the ABCC and RERF had been mostly assigned to individual research departments until recent years. To preserve these precious biosamples, which include blood (serum, plasma, and cells), urine, pathological specimens, blood smears, and teeth, in good condition over the long term, and to promote utilization of such biosamples, it was crucial to centralize their management and to create a database for biosample information. In 2013, the Biosample Research Center (formerly Biosample Center) was established to undertake this work. With the goal of clarifying late effects of ionizing radiation on medical conditions and disease risks with A-bomb survivors and their children, and of elucidating their molecular mechanisms, the Center is arranging appropriate storage for quality control in order to ensure effective utilization of those invaluable materials, donated by A-bomb survivors, their spouses, and children. To achieve these objectives, biosamples and associated information previously collected by various departments are being moved to the Center, and most of the biosamples currently collected are processed and stored by the Center since 2015, with standardized preparation methods.

Because a freezer room in Unit G of Hiroshima Lab had been filled beyond the capacity with 51 upright deep freezers full of sample tubes, securing space for future biosamples became a task of the highest priority. In 2015, to solve this issue, a robotic deep-freezer biorepository system (Brooks BioStore II) was installed in Hiroshima Lab to accommodate 674,000 existing biosample tubes compatible with the system and to efficiently manage future blood and urine samples.

Development of the Biosample Research Center and the Research Resource Center (RRC) is one of the top priorities of the RERF to facilitate internal and external collaborative research. To take full advantage of the invaluable biosamples, the RRC will link the inventory and quality information of biosamples with epidemiological and clinical information to construct an RERF integrated database, with which internal and external researchers can search for biosamples necessary for their research on their own. Therefore, the Center must construct and constantly update a biosample database, and provide it to the RRC whenever needed. In order to construct such a biosample database, the Center must utilize a laboratory information management system (LIMS) that can record and manage all of the workflows and the biosample inventory and quality information. In 2019, after evaluating several commercial LIMSs, the RERF selected LabVantage® as a LIMS to be implemented in the Center. The Center is currently designing and constructing the LIMS specifically customized for the Center.

Quality evaluation of both aged preserved and newly collected biosamples is essential to ensure accuracy of data obtained by any analytical method. There is, however, no single measurement method for quality control that can be applied to various biosamples with different storage conditions and to different analytical methods. Therefore, protocols and methods of quality control will be established in consultation with an advisory committee.

## FY2019 Biosample Research Center Achievements

The RERF selected LabVantage® as a LIMS (Laboratory Information Management System)

to be implemented in the Center for the management of various workflows and the biosample inventory. Dr. Kajimura, an assistant technical director of the Center, was concurrently appointed to a vice director of the Center in Hiroshima Lab.

### Inventory Management and Storage of Biosamples

- During the past year (Dec. 1, 2018 – Nov. 30, 2019), the Center stored 70,221 tubes of blood samples (Hiroshima 47,320, Nagasaki 22,901) and 14,526 tubes of urine samples (Hiroshima 9,840, Nagasaki 4,686) provided by 1,407 AHS subjects (Hiroshima 873, Nagasaki 534) and by 2,320 FOCS subjects (Hiroshima 1,641, Nagasaki 679).
- The Center holds a cumulative total of 1,640,000 tubes of blood samples (Hiroshima 1,056,000, Nagasaki 584,000) and 227,000 tubes of urine samples (Hiroshima 147,000, Nagasaki 80,000) provided by 16,833 AHS subjects (Hiroshima 11,281, Nagasaki 5,552) since 1969, and provided by 12,787 FOCS subjects (Hiroshima 8,523, Nagasaki 4,264) since 2002, as of Nov. 30, 2019.
- In Hiroshima Lab, we inventoried 116,000 archived blood sample tubes in the past year, reaching a near (99.8%) finalization of the inventory of 972,000 tubes of blood and urine samples that had been transferred from Departments of Clinical Studies and Molecular Biosciences and mostly stored in conventional upright  $-80^{\circ}\text{C}$  freezers or in liquid nitrogen tanks.
- In Hiroshima Lab, we moved 282,000 tubes of the inventoried archived biosamples from conventional upright freezers to the robotic freezer in the past year, bringing the cumulative number of migrated tubes to 499,000 out of 667,000 tubes that are compatible with the robotic system (to 75% completion).
- In Nagasaki Lab, we inventoried 105,000 archived blood sample tubes in the past year, reaching a near (99.7%) finalization of the inventory of 492,000 tubes of blood and urine samples that had been transferred from Departments of Clinical Studies and Molecular Biosciences and stored mostly in conventional upright freezers or in liquid nitrogen.
- The Center extracted DNA from 1,158 preserved blood clots provided by 1,158 AHS subjects in the past year, bringing the cumulative number of DNA samples to 5,822, which were provided by 3,800 AHS subjects.
- Owing to the progress of the migration of the archived biosample tubes into the robotic freezer as mentioned above, we could reduce the number of upright  $-80^{\circ}\text{C}$  freezers in a freezer room in Unit G of Hiroshima Lab from 51 to 42. The reduction of freezers created enough space for an appropriate working condition and allowed us to fix the freezers to the floor for the better security of biosamples as well as for the safety of the staff in case of earthquake.
- The RERF selected LabVantage® as a LIMS to be implemented in the Center for the management of sample-processing workflows and the inventory and quality information of biosamples through open competitive bidding after evaluation of several commercial LIMSs. The Center and Mitsubishi Space Software, an official retailer of the LIMS in Japan, have been holding a weekly meeting since Nov. 2019 to design and construct the

LIMS fully customized and optimized specifically for the Center.

### Preparation for Usage of Biosamples

- As members of an advisory committee for the quality control of biosamples, we nominated four experts in omics studies with human biosamples, i.e., genomics, transcriptomics, proteomics, and metabolomics. We invited them as speakers for a workshop on “Biosample quality control” held in 2019 to exchange information and ideas.
- The Center established standard operational procedures (SOPs) for quality assurance and quality control (QA/QC) of DNA and RNA extracted from blood cells (including blood clots) by electrophoresis with 4200 TapeStation System and Fragment Analyzer, respectively, and drafted protocols for QA/QC of preserved blood plasma and serum with the assay methods endorsed by ISBER (International Society for Biological and Environmental Repositories).
- We continued collection of biosample quality information from RERF researchers who have used preserved blood samples for completed or ongoing research projects by using a specific questionnaire.
- We updated drafts of detailed regulations and procedures on sample usage and sample use request forms.