FY2018 Report of Activities

I. Report of Major Activities

Epidemiologic data on mortality and cancer incidence from the A-bomb survivors (the Life Span Study [LSS], the *in utero* study) and their children (the F_1 generation studies) have long been a primary basis for national and international estimates of the risks of cancer and other diseases from exposure to ionizing radiation. The unique importance of the LSS study stems from the combination of its large size, wide range of exposure levels, inclusion of all ages at exposure, and long, high-quality follow-up of mortality and cancer incidence. However, the LSS is only one facet of RERF's research activities. Clinical examinations and the collection of biosamples in the Adult Health Study (AHS, a subsample of the LSS) and the clinical, epidemiological and genetic studies of the children of A-bomb survivors provide more detailed information on health conditions of interest, including radiation-related non-cancer conditions, and the pathogenesis of those conditions in relation to radiation exposure, as well as the study of heritable mutations. Our basic science groups, in collaboration with the clinical studies and epidemiology departments, utilize the biosamples to further address the nature and extent of genetic (both heritable and somatic) effects, and molecular changes associated with health risks. These three components within the RERF research program provide an integrative approach into epidemiological, clinical, biological, and mechanistic aspects of human radiation risk. Such integrated opportunities are unique to RERF and demand the best possible science be conducted for the benefit of the survivors and the radiation research community. As we move forward, the primary focus of RERF studies will be on such integrated research programs through their development within the cancer, genetic and non-cancer research clusters. An additional and essential component of our research program development is the expansion of collaborations with institutions outside of RERF both in Japan and internationally.

1. Research Projects Examining A-bomb Survivors Health

1) Radiation and Cancer

- *Breast cancer:* Female breast cancer indicated a strong linear dose response with excess relative risk (ERR) of 1.12 per Gy at age 70 after exposure at age 30. Age at menarche was a strong modifier of the radiation effect: for a given dose. Also, independently, age-at-exposure effects on ERR and EAR differed before and after menarche with highest risks for exposures around menarche. A persistently increased risk of female breast cancer after radiation exposure and its modification pattern suggests heightened breast sensitivity during puberty. (Brenner AV et al., *Radiat Res* 2018; 190:433–444)
- *Uterine cancer:* Uterine corpus cancer indicated a significant association between radiation dose and risk of (ERR/Gray=0.73), but not for cervical cancer (ERR/Gy=0.00). Analyses of corpus cancer also indicated an elevated risk for women exposed to radiation between ages 11 and 15 (ERR/Gy=4.10) and no radiation effect for exposures before or after this exposure-age range. It was suggested that the uterine corpus is especially sensitive to the carcinogenic effect of radiation exposure occurring during the mid-pubertal period preceding menarche.

(Utada M et al., *JNCI Cancer Spectr* 2019/02/08 (Epub); 2(4):1-6)

- *Liver cancer:* Recent results from RERF showed that HBV and HCV infection and radiation exposure are associated independently with increased risk of HCC, and that radiation exposure was a significant risk factor for non-B, non-C HCC with no apparent confounding by alcohol consumption, smoking habit, or BMI. We are now conducting a study the objective of which is to examine whether chronic inflammation due to radiation exposure is involved in the development of HCC through insulin resistance or liver fibrosis, regardless of HBV/HCV infection and lifestyle-related factors. We have successfully fit a structural regression model for inferring the latent factors (inflammation, insulin resistance, liver fibrosis, etc.) based on values of biomarkers such as CRP, TNF-α, IL-6, adiponectin, leptin, resistin, type 4 collagen, and platelet count. Based on that model, we have estimated odds ratios for association between latent factors and HCC. We have also established, through methodological research, that standard mediation analysis can be applied to counter-matched, nested case-control data without modification.

- *Myelodysplastic Syndrome (MDS):* A project has been developed in collaboration with the Nagasaki University and the Kyoto University to examine the pathogenesis of Myelodysplastic Syndrome. Radiation is one of the causes of the development of hematological malignancies. A-bomb survivors have a high risk of hematological malignancies, even 50 years after exposure, such as acute myeloid leukemia (AML) and MDS. Recent genome analyses of these diseases have demonstrated that most samples contain several gene mutations, and that these mutations might be found before clinical diagnosis. We hypothesize that a hematopoietic progenitor or stem cell with a small number of gene mutations acquires additional gene mutations over time (more than several years) and causes hematological malignancies and that ionizing radiation increases the chance of such gene mutations occurring. We are determining the dynamics of mutated clones before clinical diagnosis of MDS and exploring how it differs by exposed radiation dose. Our study plan is to detect mutations in serially stored blood samples of AHS participants who developed MDS using next-generation genome analysis technology. This study will answer the very important question about how radiation-induced myeloid malignancies develop, which has never been tested. Furthermore, we will be able to obtain new knowledge of mechanisms of radiation-induced myeloid malignancies. To identify MDS cases, clinical information from hospitals and cancer registry data were obtained. As a preliminary experiment, blood samples serially collected before and after MDS diagnosis in a subject with unknown radiation dose were successfully analyzed by whole exome sequencing. We found that mutated clones were detected 13 years before diagnosis and that they gradually expanded with progression of cytopenia in peripheral blood cells. A strategy for genome analyses for the overall study was decided based on these preliminary results.

2) Radiation and Non-Cancer Effects

- *Cataract:* Radiation effects on posterior sub-capsular opacity have been well documented among A-bomb survivors and other exposed population. With regard to radiation effects on cortical/ nuclear opacities, however, evidence appears to be insufficient and study results are inconsistent. Therefore, we are conducting a new ophthalmological study to obtain lens images by 3 devices; slit-lamp, retro-

illumination camera, and Scheimpflug camera with standardized method. Posterior sub-capsular and cortical opacities are being scored with images obtained by retro-illumination camera, and nuclear opacities scored with images obtained by slit-lamp. Nuclear opacities are also being evaluated quantitatively with images obtained by Sceimpflug camera.

Ophthalmologic examinations for our cataract study using these devices were initiated in Hiroshima and Nagasaki in collaboration with ophthalmologists in Hiroshima and Nagasaki Universities in April 2016. Supervision for this study is made by a cataract specialist in Kanazawa Medical University. As of November 2018, 864 AHS participants have been examined by ophthalmologists and lens images of 814 participants were obtained, and these examinations among subjects who were <15 years of age at the time of bombings (except *in utero*-exposed subjects) will be finished by March 2019 in Hiroshima and Nagasaki. An ophthalmologist has started scoring cataract severity using photographed images and will finish by June 2019. Ophthalmological examinations among *in utero*-exposed subjects were initiated in April 2018 and will be continued until March 2020.

- *Cardiovascular disease:* Although the LSS study and other studies in the literature have recently identified radiation risks for CVD mortality or incidence at low-to-moderate doses, the etiological and pathogenic pathways are not well characterized. To better characterize these pathways, we have been examining physiological indices of arteriosclerosis and potential related biomarkers with radiation dose in the AHS. Pulse wave velocity, augmentation index, ankle-brachial blood pressure index (ABI), carotid intima-media wall thickness, and aortic calcification in thoracic and abdominal aorta were measured as physiological indices of arteriosclerosis. Pentraxin-3, osteopontin, osteoprotegerin, high mobility group box-1, VEGF, and apolipoprotein-J for about 1200 AHS participants have been measured as multi-functional cytokines involved in the "cytokine network" that are possibly related to radiation-induced atherogenesis. The complex pathways involving these indices and biomarkers are now being assessed using structural equation models. This study showed no clear association between prevalence of peripheral artery disease diagnosed by ABI and radiation exposure in the AHS.

- *Stroke:* To test the possible involvement of radiation exposure in the pathogenesis of stroke, experiments were conducted using hypertensive and stroke susceptible rat models. The onset of symptoms related to stroke was significantly earlier in spontaneously hypertensive and stroke prone rat (SHRSP) irradiated with 0.1 Gy than in unirradiated controls, but it was not evident with 0.075 Gy. This suggested a threshold in the radiation dose effect between 0.075 and 0.1 Gy. In addition, metabolome analyses demonstrated that the amounts of some metabolites including lithocholate (a kind of bile acid) biosynthesis system were altered with radiation doses. Various cytokines, such as IL-2 and IL6, were also altered. These data maybe useful to infer potential mechanisms underlying the radiation effect on circulatory disease.

- *Neurocognitive function:* The AHS and various studies of childhood radiotherapy have shown that the brain is susceptible to radiation damage *in utero* and in early childhood. ABCC/RERF and other studies have documented early-life cognitive deficits in relation to *in utero* and childhood radiation exposures. The objective is to

examine the prenatal and childhood effects of radiation exposure on cognitive function as it appears more than 65 years later by using the Cognitive Abilities Screening Instrument (CASI) and the Neurocognitive Questionnaire (NCQ). Regarding NCQ, latent factors related subjective neurocognitive complaints were identified by an exploratory factor analysis among non-exposed subjects. An article about effects of demographic variables on subjective neurocognitive complaints was submitted for journal publication. The results showed that older age and lower education were associated with more subjective neurocognitive complaints. We are also analyzing the radiation effect on subjective neurocognitive complaints based on NCQ.

3) Immunologic Effects of Radiation:

- *Vaccine response:* In a series of studies we tested the hypothesis that atomic bomb radiation has accelerated the aging of immune system. To accomplish this we evaluated the effects of whole body radiation exposure early in life on influenza vaccination immune responses much later in life. A total of 292 volunteers were recruited from the cohort members of our ongoing AHS of A-bomb survivors who participated in this observational study spanning two influenza seasons (2011–2012 and 2012–2013). Peripheral blood samples were collected prior to and three weeks after vaccination. Serum hemagglutination inhibition (HAI) antibody titers were measured. We found that influenza vaccination modestly enhanced serum HAI titers in this unique cohort of elderly subjects, with seroprotection ranging from 18 to 48% for specific antigen/season combinations. Twelve percent of subjects were seroprotected against all three vaccine antigens postvaccination. Males were generally more likely to be seroprotected for one or more antigens postvaccination, with no differences in vaccine responses based on age at vaccination or radiation exposure in early life. These results demonstrate that early life exposure to ionizing radiation does not prevent responses of elderly A-bomb survivors to seasonal influenza vaccine. (Hayashi, *Vaccine* 2018; 36:6650–6659)
- *High-dimensional data:* Future RERF research requires maximizing the potential of longitudinal biosamples collected among the clinical cohorts, along with the application of state-of-the-art technologies in genomics, proteomics, and metabolomics. We collaborated with the Biostatistics and Informatics Resource at the University of Hawaii Cancer Center to complete and publish an analysis of SNP sets (pathways) in colon cancer demonstrating a practical approach to pathway analysis. We applied that methodology to analysis of immune-genome related SNPs in the Immunogenome Cohort Study, and we began work on comparing methods of integrated analysis of multi-omics data using R and Bioconductor software.

2. Research Projects on the Health of A-bomb Survivors Children (F_1)

- *FOCS:* The initial examination of the longitudinal F_1 clinical cohort from 2002 to 2006 (the first round examination) provided no evidence for an increased prevalence of adult-onset multifactorial diseases due to parental radiation exposure, but the study subjects were still quite young. Definitive human data can only be obtained if a high-quality clinical study is continued until the subjects become elderly, when many multifactorial diseases develop. The objective of this study is to elucidate the effects of parental exposure to A-bomb radiation on the development of polygenic,

multifactorial diseases such as diabetes, hypertension, dyslipidemia, ischemic heart disease, and stroke, and subclinical conditions among the F_1 offspring. Self-selection bias also tends to be minimized when prospective longitudinal data are obtained, because such data allow estimates of disease incidence. Thus far we have:

Almost completed the third round examination of the F_1 offspring clinical study (FOCS) that was initiated in November 2014 on a four-year cycle. 9,525 subjects participated and participation rate during this cycle was 72.7%. Continued conducting the third round examination and started the fourth round in November 2018.

- *Trans-generational mutations:* Radiation-induced small-size indels (insertions and deletions) and complex mutations were identified in F_1 mice born to exposed spermatogonia or mature oocytes. To evaluate genetic effects of radiation exposure to spermatogonia or mature oocytes, WGS examination was conducted in a mouse system. We compared WGS data between F_1 mice from parents before and after exposure to 4 Gy of gamma-ray. The frequency of small-size indels increased in F_1 mice born to either exposed spermatogonia or oocytes. Furthermore, multiple mutations within 10 bp appeared to be induced in these mice. The frequency of such complex mutations increased in those born after mature oocyte exposure and born after spermatogonia exposure. These data demonstrate that radiation can induce small-size indels in spermatogonia and mature oocytes that were heritable. Complex mutations in mature oocytes and spermatogonia were also induced following γ-ray exposure. These results will provide useful information for planning WGS analysis in A-bomb survivor families.

3. Research to Elucidate Individual Doses and Effects from the A-bomb

- *New organ doses:* Over the past year, the Statistics Department has supported and collaborated with an extramural working group that was formed to evaluate the effect of new computational models of the human body and new radiation transport calculations on the dose estimates for specific organs and tissues of the body, including the 15 organs calculated by the current DS02 system and a larger set, as well as a pregnant-woman model and a complete pediatric series reflecting growth and development for survivors who were exposed *in utero* or at ages ranging from newborn to adult (under a contract with H Cullings). The working group has prepared two manuscripts. The first compares a new pediatric series of phantoms to the three (infant, child, adult) DS86/02 phantoms. The second compares a series of pregnant woman phantoms to the DS86/02 surrogate of the dose to the uterine wall of a non-pregnant adult DS86/02 phantom. A third paper for radiation transport computation is under preparation.

4. Projects to Release Research Results and to Collaborate with Other Scientific Organizations

Crucial to the mission of RERF is the dissemination of results of our studies to survivors and their children and to the international community. Toward that end we interact with local liaison councils representing the communities of Hiroshima and Nagasaki and provide information via public lectures and other activities. These will be described later in another section of this report. With respect to the international

community there are a number of activities. These include seminars, workshops, participation at international scientific conferences, and international publication of results. This year 5 workshops and 13 seminars were held at RERF presented by national and international visitors to RERF, and published about 40 scientific papers.

1) Collaborative Research Projects

- Ongoing international collaborative research projects

In addition to the above activities the development of national and international collaborations is essential to help disseminate results and to enhance RERF research programs. A list of current collaborations is provided below:

a. Partnership with the University of Washington
b. Partnership with Kurume University
c. Collaborations with the US National Cancer Institute
d. Collaborations with the University of Florida
e. Collaborations with Outside Investigators:
   39 Japanese Institutions
   18 North American Institutions
   14 European Institutions
   3 Asian, Oceanian Institutions
   Nuclear Emergency Workers Study (NEWS): 11 Japanese Institutions

2) Workshops

a. Exchange Seminar of ICRP Members with RERF Scientists
b. ICRP-QST-RERF Workshop on Individual Response to Ionising Radiation
c. International Workshop: Clonal Hematopoiesis and Radiation-associated Diseases
d. Final Review Meeting for the Organ Dosimetry Working Group: New RERF Organ Dose Calculations for Atomic Bomb Survivors
e. Workshops on Preservation and Utilization of Biosample
   i. Genomics, Transcriptomics
   ii. Proteomics
   iii. Integrated Database
   iv. Metabolomics

5. Training Programs for Domestic and Overseas Specialists

1) A “Training course for biologists: Let us learn more about epidemiology” was held to deepen biologists’ understanding of RERF’s epidemiological studies and to also promote exchanges among researchers working for radiation-related organizations (August 20–21, 2018; 68 participants in total—38 from outside and 30 from RERF).

2) RERF accepted overseas research trainees, either on their own initiative or in support of the activities of such organizations as the Hiroshima International Council for Health Care of the Radiation-exposed (HICARE), the Nagasaki Association for Hibakushas’ Medical Care (NASHIM), and the Nagoya University Graduate School of Medicine (64 trainees in total). A trainee, who was accepted by HICARE, received lectures on research methods and the results of past studies and

took part in experiments and analyses to deepen their understanding of the health effects of radiation at RERF for about four weeks.

3) RERF will cooperate in the international training course jointly held by the International Atomic Energy Agency (IAEA) and HICARE (February 18–22, 2019; approximately 44 participants in total), and provided lecturers and offered a venue for the training course on February 21, 2019.

4) RERF accepted visits by trainees from universities and other educational organizations in Japan for tours including research lectures (21 trainees in total).

5) RERF further reviewed future directions for its training activities, including an approach of publicly inviting overseas trainees in the International Exchange Research Program, and called for applications from researchers and others from abroad to receive training at RERF by posting an invitation and the guidelines for application on the RERF website. In FY2018, RERF received nine applications and accepted five trainees including a person recommended by WHO.

6) Following FY2017, the Department of Molecular Biosciences in Hiroshima and the Department of Epidemiology in Nagasaki each accepted one visiting student fellow.

6. Public Information Programs

1) RERF Open House events

In fiscal year 2018, RERF held its 24th Open House on August 3–4 at the Hiroshima Laboratory and its 22nd Open House on August 8–9 in Nagasaki. The Open House event in Hiroshima featured the presentation "Lecture on genes: Why do some children resemble their parents while others do not?" on August 3. On August 4, the Hiroshima Open House also included the lecture titled "School Visit Program: What's Radiation?," with one of the Public Relations and Publication Office's staff providing a lecture designed to model RERF's school lecture series, which provides an understandable explanation about radiation for children at their schools.

The Open House at the Nagasaki Laboratory featured the presentation "Special Summer-break Lecture," which explained radiation in easy-to-understand terms for children on August 8. In addition, in Hiroshima, several science corners were established: "Liquid nitrogen: What is the world of -196°C like?" and "Extract DNA," among others, at which science experiments were conducted, with hands-on learning opportunities also provided. As usual, a "Quiz stamp rally" was featured, in which young visitors moved throughout the facilities to complete the quiz. In Nagasaki, several science corners were set up, including bone density testing, liquid nitrogen experiments, body fat measurement, and more.

The two-day Open House events attracted 953 and 581 visitors in Hiroshima and Nagasaki, respectively.

2) Enhanced RERF website

- The comprehensive overhaul of the RERF public website was completed in June 2018, when the homepage was released to the public. During the remainder of the fiscal year, the new homepage was regularly updated with revised information, when new information became available, and whenever necessary.

- When papers were published in scientific journals, starting in the fall of 2018, new easy-to-follow synopses of papers are being posted in the "What's New" section on the public website; it is planned that video interviews with main authors will be included when the information is deemed of interest to the public, along with an abstract when available, with the aim of enriching such content.
- The total number of RERF website hits, or page views, between June 1, 2018, and March 31, 2019, was 288,420, with the daily average being 949. The total number of website visitors for the same period was 99,823, with the daily average about 328.*

  * These numbers are the result of a new system of assessment that we started using in June 2018 called Google Analytics. The old system of calculating hits and visitors was seemingly unreliable, with even hacks being incorrectly included in the numbers. For that reason, the figures from April and May 2018 using the old system of calculation have not been included in this report, given their uncertainty and unreliability. Thus, starting with FY2018 (from June) using the Google Analytics system, we will be able to gain more accurate understanding of, and report on, the true communicative power of our homepage, even though the new system makes our numbers appear lower than in previous years.

- The RERF Facebook page continues to convey information to readers and now has close to 770 followers.

3) Media gatherings

RERF held a new round of media gatherings in Hiroshima starting on January 11, 2019, for the broadcast media, and on January 18 for the print media. The first event gathered seven media representatives, and the latter gathering hosted 10 reporters. The purpose of this new media gathering initiative is to both present new research achievements and increase understanding among media representatives about RERF studies, and we are scheduled to continue this series of informal events going forward.

4) School Visit Program

The RERF School Visit Program, which is an attempt to teach radiation health effects to school children in readily understandable language, involved 12 lectures in Hiroshima in FY2018: one elementary school class, nine junior high and high school classes, one public lecture at our Open House event, and one peace club class.

5) Updating of public relations materials

The printed version of the RERF *Update* newsletter was discontinued at the end of 2016. However, plans for a new electronic subscriber list email magazine were initiated in FY2018 for posting on the new homepage in FY2019. The subscriber list email magazine will give the Public Relations and Publications Office access to user information and a method for achieving "buy-in" among a group of the general public that is interested in our research results and related news.

In addition, the Annual Report had previously been discontinued in its previous hard-copy format, with the FY2016 and FY2017 versions of the new Report of Annual Activities posted exclusively online.

6) Other public relations activities

- With the hiring of a PR expert from a leading advertising firm, progress was attained during FY2018 on RERF's public relations strategies from multiple dimensions. RERF was able to carry out various planning strategies for its public relations activities utilizing this advisor's professional experience and know-how.
- As part of its public relations activities through the media, RERF held press conferences at the time of important functions and newsworthy events, as well as publication of topical papers. RERF also responded to inquiries and requests for interviews from many domestic and overseas media organizations.
- In addition to the Open House events, visitors are welcome to tour RERF's facilities upon request. In FY2018, as of the end of March 2019, 1,083 individuals from Japan, including students on school excursions, and 118 individuals from overseas toured the RERF facilities in Hiroshima and Nagasaki.
- Continued from the previous year, RERF welcomed in February 2019 marketing and other students from Think Global School, an international high school that travels the world to learn about different societies, to work with the school on a marketing project involving the development of a social media strategy at RERF.

（Attachment 1）

FY2018 RERF International Collaborative Activities

I. Participation in international collaborative activities by RERF directors and staff members		II. Acceptance of visitors from overseas for briefing and training	
WHO-related activity	2 people	(Hiroshima)	
UNSCEAR-related activity	4 people	Visitors related to HICARE	28 people
ICRP-related activity	6 people	Visitors related to RERF (International Exchange Research Program)	5 people
IAEA-related activity	3 people	Visitors related to MEXT	12 people
Medical checkup for A-bomb survivors residing in South Korea-related activity	1 person	Fulbright exchange program	1 person
Others	11 people	(Nagasaki)	
		Visitors related to NASHIM	24 people
	Total: 27 people		**Total: 70 people (Hiroshima 46 people, Nagasaki 24 people)**

I. Participation in international collaborative activities by RERF directors and staff members (excluding participation in international scientific meetings)

In italics: Funding Organization

1. World Health Organization (WHO)-related activity (2 people)

   1) *RERF (MHLW International Exchange Research Program)* (hereinafter, all titles represent those at time of participation)

   Kazunori Kodama, Executive Director and Misa Imaizumi, Assistant Department Chief of Clinical Studies (Nagasaki), visited WHO headquarters to discuss collaboration between RERF and WHO. (Geneva, Switzerland, March 8, 2019)

2. United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) -related collaborative activity (4 people)

   1) *National Institute of Radiological Sciences*

   Kazunori Kodama, Executive Director, and Kotaro Ozasa, Department Chief of Epidemiology, attended the UNSCEAR domestic committee meeting. (Tokyo, August 30, 2018 and March 28, 2019)

   2) *RERF*

   Kazunori Kodama, Executive Director, and Kotaro Ozasa, Department Chief of Epidemiology, attended the 65th UNSCEAR meeting. (Vienna, Austria, June 8-16, 2018)

3. *ICRP (International Commission on Radiological Protection)*-related activity (6 people)

   (1) Kotaro Ozasa, Department Chief of Epidemiology, attended the ICRP Liaison Committee “Discussion meeting with outside invited experts”. (Tokyo, August 1, 2018)

(2) Kotaro Ozasa, Department Chief of Epidemiology, participated as a member of the ICRP C1 in its meeting to discuss radiation effects. (Chicago, USA, September 19-21, 2018)

(3) Ohtsura Niwa, Chairman, Robert Ullrich, Vice Chairman, Kotaro Ozasa, Department Chief, and Alina V. Brenner, Senior Scientist, Department of Epidemiology, attended an ICRP-QST-RERF Workshop on Individual Response to Ionising Radiation. (National Cancer Center, Research Institute, Tokyo, December 12, 2018)

4. International Atomic Energy Agency (IAEA)-related activity (3 people)

1) *IAEA*

Kazunori Kodama, Executive Director gave a lecture at IAEA/HICARE International Training Course on Advanced Radiation Therapy. (Hiroshima, February 21, 2019)

2) *RERF (MHLW International Exchange Research Program)*

Kazunori Kodama, Executive Director, and Misa Imaizumi, Assistant Department Chief of Clinical Studies, Nagasaki, visited IAEA headquarters to discuss collaboration between RERF and IAEA. (Vienna, Austria, March 4, 2019)

5. Medical checkup for A-bomb survivors residing in South Korea-related activity (1 person)

Nagasaki Prefectural Government's medical checkup project for A-bomb survivors residing in South Korea

Ayumi Hida, Acting Department Chief of Clinical Studies, Nagasaki, together with the physicians and others from Nagasaki University Hospital and the Nagasaki Genbaku Hospital participated in the medical checkup project for A-bomb survivors residing in South Korea sponsored by the Nagasaki Prefectural Government and provided health consultations for the A-bomb survivors in South Korea. (Hapjeong, South Korea, July 9–12, 2018)

6. Others (11 people)

(1) John Cologne, Senior Scientist, Department of Statistics, visited the University of Hawaii Cancer Center unofficially to discuss potential future research topics related to integrated analyses of multiple molecular (omic) endpoints with a researcher—Dr. Gordon Okimoto—in bioinformatics at the center. (Hawaii, USA, May 16, 2018)

(2) Robert Ullrich, Vice Chairman, chaired session for Center for High-Throughput Minimally-Invasive Radiation Biodosimetry and gave a presentation. (New York, USA, May 21–22, 2018)

(3) Benjamin French, Acting Department Chief of Statistics, visited the University of Washington as a lecturer in a short course on longitudinal data analysis at the 2018 Summer Institute in Statistics for Clinical Research. (Seattle, USA, July 24, 2018)

(4) Benjamin French, Acting Department Chief of Statistics, gave a lecture on statistical methods for quantifying radiation health effects at the Radiation Research Society's Scholars in Training program. (Chicago, USA, September 22, 2018)

(5) Robert Ullrich, Vice Chairman, attended the 24th International Meeting of the Conference on Radiation & Health. (Chicago, USA, September 23–25, 2018)

(6) Ohtsura Niwa, Chairman, gave a lecture at the Joint Conference on Applicability of Radiation Response Models to Low Dose Protection Standards. (Tri-Cities, USA, September 30 – October 3, 2018)

(7) Ohtsura Niwa, Chairman, gave a lecture at the International Symposium on Ion Therapy 2018. (Saga, November 11, 2018)

(8) Ohtsura Niwa, Chairman, gave a lecture at the International Symposium on Radiopharmaceutical Therapy. (Helsinki, Finland, November 18-20, 2018)

(9) Kotaro Ozasa, Department Chief of Epidemiology, visited Korea University, study group of Korean radiation epidemiology and Korean Association of Radiation Protection to give a talk on long-term health effects of atomic bomb radiation and recent ICRP activities. (Seoul and Jeju, Korea, November 20-22, 2018)

(10) Ohtsura Niwa, Chairman, participated in a banquet with the Chinese People's Association for Peace and Disarmament delegation. The delegation was hosted by Hiroshima Peace Culture Foundation (Hiroshima, November 26, 2018)

(11) Ohtsura Niwa, Chairman, gave a lecture at the 3rd International Symposium of the Network-type Joint Usage/Research Center for Radiation Disaster medical Science. (Fukushima, January 13-14, 2019)

II. Acceptance of visitors from overseas for briefing and training (Total: 72 people)

[Hiroshima: 46 people] *In italics: Funding Organization*

1. Visitors related to *Hiroshima International Council for Health Care of the Radiation Exposed (HICARE)* (28 people)

1) South Korea (17 people)

(1) June 26, 2018: 1 trainee for the "A-bomb survivors residing in South Korea."

(2) September 14, 2018: 8 trainees for the "A-bomb survivors residing in South Korea."

(3) October 17, 2018: 6 trainees for the "A-bomb survivors residing in South Korea."

(4) December 4, 2018: 2 trainees for the "A-bomb survivors residing in South Korea."

2) United States (6 people)

(1) July 26, 2018: 2 trainees

(2) December 4, 2018: 4 trainees

3) Others (5 people)

(1) November 12–December 8, 2018: 1 trainee from Latvia

(2) February 13, 2019: 4 trainees from Brazil

2. *RERF (MHLW International Exchange Research Program)* (5 people)

Training period:November 13-22, 2018

(1) National Cancer Center, South Korea

(2) Biotechnology Department, Dalat Nuclear Research Institute, Vietnam

(3) Henri Mondor University Hospital, Mondor Institute of Biomedical Research, France

(4) Singapore Nuclear Research and Safety Initiative, Singapore,

(5) National Radiation Emergency Medical Center, Korea Institute of Radiological and Medical Science, South Korea

3. *Ministry of Education, Culture, Sports, Science and Technology, MEXT* (12 people)

November 14, 2018: Mongolia, Malaysia, Myanmar, Cambodia, Afghanistan, Thailand, Bangladesh, and Laos for Nagoya University Graduate School of Medicine, Young Leaders' Program

4. *Fulbright* exchange program (1 person)

September 11, 2017–July 25, 2018: 1 visiting student (scholarship student) from the United States for the Fulbright exchange program, in continuation from FY2017.

[Nagasaki: 24 people]

Visitors related to *the Nagasaki Association for Hibakushas' Medical Care (NASHIM)* (24 people)

1) Chernobyl and Kazakhstan

July 26, 2018: 6 trainees

2) Korea

(1) October 23, 2018: 8 trainees

(2) January 30, 2019: 8 trainees

3) Brazil

January 30, 2019: 2 trainees

（Attachment 2）

FY2018 Joint programs between RERF and overseas researchers/ research organizations

In italics: Funding Organization

1. Collaborative studies between *RERF and US National Cancer Institute (NCI)*

(1) Under the research contract entered into by and between RERF and the US National Cancer Institute (NCI), in which Kotaro Ozasa, Department Chief of Epidemiology, serves as a responsible person of the RERF side, he is working on analysis of solid cancer incidence risks in the LSS cohort, site-specific cancer studies based on histopathological diagnoses, and preliminary reviews for genomic analysis of thyroid cancer.

The following papers have been published (RERF authors underlined):

Grant EJ, Cologne JB, Sharp GB, Eguchi H, Stevens RG, Izumi S, Kim YM, Berrington de González A, Ohishi W, Nakachi K. Bioavailable serum estradiol may alter radiation risk of postmenopausal breast cancer: a nested case-control study. Int J Radiat Biol 2018;94(2):97-105.

Utada M, Brenner AV, Preston DL, Cologne JB, Sakata R, Sugiyama H, Sadakane A, Grant EJ, Cahoon EK, Ozasa K, Mabuchi K. Radiation risks of uterine cancer in atomic bomb survivors: 1958-2009 Journal of National Cancer Institute, Cancer Spectrum 2019/02/08 (Epub); 2(4):1-6

Sugiyama H, Misumi M, Brenner A, Grant EJ, Sakata R, Sadakane A, Utada M, Preston DL, Mabuchi K and Ozasa K, "Radiation risk of incident colorectal cancer by anatomical site among atomic bomb survivors: 1958–2009", International Journal of Cancer, 2019, in press.

(2) Arikuni Uchimura, Laboratory Chief, Molecular Genetics, Department of Molecular Biosciences, visited NCI to discuss sequencing and future collaborations on genetic research in the offspring of the atomic bomb survivors with Robert Ullrich, Vice Chairman. (April 9–13, 2018)

(3) Dr. Dale Preston, Principal Scientist from Hirosoft International Corporation, visited RERF to conduct collaborative studies including a solid cancer incidence risks study of A-bomb survivors. (May 5–17, 2018 and December 6–22, 2018)

(4) Dr. Kiyohiko Mabuchi and Dr. Elizabeth K. Cahoon of Radiation Epidemiology Branch, NCI, visited RERF to conduct NCI-funded collaborative studies including a site-specific cancer study. (May 13–19, 2018)

(5) Dr. Meredith Yeager, Scientific Director from Cancer Genomics Research Laboratory, Division of Cancer Epidemiology and Genetics, NCI, visited RERF to discuss collaborative genetic studies. (July 5–6, 2018)

(6) Ritsu Sakata, Assistant Chief, and Alina Brenner, Senior Scientist, Department of Epidemiology, are joining with the data of tumor of the central nervous system from RERF as a part of the pooled analysis conducted by the scientists of Radiation Epidemiology Branch, NCI.

(7) Ritsu Sakata, Assistant Department Chief of Epidemiology, is joining with the data of radiation-associated thyroid cancers from RERF as a part of the pooled analysis conducted by the scientists of Radiation Epidemiology Branch, NCI.

(8) Benjamin French, Acting Chief, John Cologne, Senior Scientist, and Munechika Misumi, Research Scientist, Department of Statistics, collaborated with the RERF Department of Epidemiology and the US NCI in preparation of data and methods for a series of upcoming papers on improved analyses of solid cancer incidence and

mortality. (Published papers listed in (1))

(9) John Cologne, Senior Scientist, Department of Statistics, collaborated with the RERF Department of Epidemiology and the US NCI in the preparation of a paper dealing with methodological aspects of Life Span Study cancer incidence risk analyses: “Effect of heterogeneity in background incidence on inference about the solid-cancer radiation dose response in atomic-bomb survivors” (under review at the journal Radiation Research).

2. Research exchange between *RERF and ICRP*

RERF-ICRP Exchange Seminar was held to coincide with an ICRP Task Group Meeting at RERF. (Hiroshima, December 10, 2018)

3. Collaboration between *RERF and the/Asia Cohort Consortium (ACC)*

Atsuko Sadakane, Senior Scientist, Department of Epidemiology, is joining the collaborative project with the ACC entitled: *Tobacco smoking, alcohol drinking, body mass index and risk of rare cancers*.

4. Collaboration between *RERF and Institute of Cancer Research, UK and US National Institute of Environmental*

Atsuko Sadakane, Senior Scientist, Department of Epidemiology, is joining with premenopausal breast cancer data from RERF as a part of the pooled analysis conducted by Dr. Anthony Swerdlow of Institute of Cancer Research, UK, and Dr. Hazel Nichols of US National Institute of Environmental.

The following paper has been published (RERF authors underlined):

Premenopausal Breast Cancer Collaborative Group, Schoemaker MJ, Nichols HB, Wright LB, Brook MN, Jones ME, O'Brien KM, Adami HO, Baglietto L, Bernstein L, Bertrand KA, Boutron-Ruault MC, Braaten T, Chen Y, Connor AE, Dorronsoro M, Dossus L, Eliassen AH, Giles GG, Hankinson SE, Kaaks R, Key TJ, Kirsh VA, Kitahara CM, Koh WP, Larsson SC, Linet MS, Ma H, Masala G, Merritt MA, Milne RL, Overvad K, Ozasa K, Palmer JR, Peeters PH, Riboli E, Rohan TE, Sadakane A, Sund M, Tamimi RM, Trichopoulou A, Ursin G, Vatten L, Visvanathan K,Weiderpass E, Willett WC, Wolk A, Yuan JM, Zeleniuch-Jacquotte A, Sandler DP, Swerdlow AJ. Body-mass index, age and premenopausal breast cancer risk: A prospective analysis of 758,592 women. JAMA Oncol. 2018 Nov 1;4(11):e181771.

5. Collaboration between *RERF* and University of Washington

RERF entered into a research contract with the University of Washington (Department of Epidemiology and Department of Biostatistics), for which Benjamin French, Acting Department Chief of Statistics serves as coordinator. Under this contract, RERF supports the training and education of MS and PhD students in epidemiology and biostatistics, and conducts collaborative research with students and their advisors. Research projects focus on analyses of cancer incidence and mortality outcomes in the LSS, as well as the development of new statistical methods for analyzing LSS cohort data. Research is ongoing and several papers are expected.

6. *RERF* international collaborative studies on statistical analysis

(1) Munechika Misumi, Research Scientist, Department of Statistics, visited the Institute of Radiation Protection, Helmholtz Zentrum in Germany to discuss collaborated projects with researchers from Helmholtz Zentrum on mechanistic modelling of radiation-induced cancer and gave a seminar to share a latest result of RERF research with the collaborators. (Munich, Germany, Dec 5–7, 2018).

(2) Benjamin French, Acting Department Chief of Statistics, collaborated with

researchers at the University of Pennsylvania, Philadelphia, Pennsylvania, US, on statistical methods for conducting sensitivity analyses of multiple dependent comparisons in a single observational study. The following paper has been published:

Karmakar B, French B, Small DS. Integrating the Evidence from Evidence Factors in Observational Studies. Biometrika, 2019, in press.

7. *WHO-REMPAN (Radiation Emergency Medical Preparedness And Assistance Network)*

The presentations by Hiroko Kitamura, Associate Senior Scientist of Emergency Workers Health Study Office of Department of Clinical Studies and Misa Imaizumi, Assistant Department Chief of Clinical Studies (Nagasaki), in the WHO/REMPAN meeting (Geneva, Switzerland, July 3–6, 2017) have been published as the proceedings (RERF authors underlined):

Kitamura H, Okubo T, Kodama K, on behalf of the Nuclear Emergency Workers Study Group. Epidemiological study of health effects in Fukushima nuclear emergency workers –study design and progress report. *Radiation Prot Dosimetry*, 2018; 182(1): 62-6

Imaizumi M, Furukawa K, Ohishi W, Hida A. Thyroid diseases among atomic bomb survivors. *Radiation Prot Dosimetry*, 2018; 182(1): 62-6

8. *RERF* international collaborative studies on thyroid

Misa Imaizumi, Assistant Department Chief of Clinical Studies (Nagasaki), Waka Ohishi, Department Chief of Clinical Studies and Michiko Yamada, Division Chief of Radiology of Department of Clinical Studies are joining with Adult Health Study data from RERF as a part of the pooled analysis of thyroid conducted by Dr. Rodondi of University of Bern, Switzerland (Thyroid Studies Collaboration). The following papers have been published (RERF authors underlined):

Meuwese CL et al. (RERF: Imaizumi M, Ohishi W); Thyroid Studies Collaboration. Low thyroid function is not associated with an accelerated deterioration in renal function. *Nephrol Dial Transplant* [Epub ahead of print]

Wopereis DM et al. (RERF: Imaizumi M); Thyroid Studies Collaboration. The relation between thyroid function and anemia: A pooled analysis of individual participant data. *J Clin Endocrinol Metab,* 2018;103(10):3658-67

平成30年度 外部資金研究一覧表
FY2018 External Research Funds

外部機関名称 Name of Outside Organization	件数 Number of Grants	研究資金 (資金拠出機関からの入金額) Research funds (amount of funds from funding organizations)
厚生労働省 Ministry of Health, Labour and Welfare (MHLW)	2	\2,270,000
独立行政法人 日本学術振興会 (文部科学省所管の独立行政法人) Japan Society for the Promotion of Science (JSPS) [Independent administrative entity under the jurisdiction of the Ministry of Education, Culture, Sports, Science and Technology (MEXT)]	7	\10,955,000
一般社団法人 日本血液学会 The Japanese Society of Hematology	1	\300,000
国立研究開発法人 国立がん研究センター National Cancer Center	1	\0*
総合計 Grand total	11	\13,525,000

注)
・間接費を含む。
・研究分担者の配分額を含む。
* 研究協力者として研究参画のため、配分資金の配分なし。

Notes)
・These amounts include indirect cost.
・These amounts may include subsidies allocated to collaborators.
* No research fund is allocated because the RERF researcher takes part in the research as a cooperative investigator.

平成30年度 外部資金研究一覧表
FY2018 External Research Funds

	研究のタイトル Title of Research	委託組織の名前と場所及び研究グループのチーフ又は担当の主任研究者 Name and location of entrusting outside organization Chief of research group or principal investigator in charge	放影研における研究者の名前 Investigator(s) at RERF	研究資金（資金拠出機関からの入金額） Research funds (amount of funds from funding organizations)	開始日 Initiation Date	終了日 Termination Date	関連RP Related RPs	関連性 Relationship to RERF's mission
疫学部 Department of Epidemiology								
1	都道府県がん登録の全国集計データと診療情報等との併用･突合によるがん統計整備及び活用促進の研究 Study to promote the usage and the maintenance of the cancer statistics by merging data of prefecture-based cancer registries and national cancer registry	厚生労働省・厚生労働科学研究費補助金 「がん対策推進総合研究事業」 研究代表者　松田　智大 国立研究開発法人国立がん研究センター がん対策情報センターがん登録センター 全国がん登録室長 Health and Labour Sciences Research Grants (MHLW) Promotion of Comprehensive Research Project for Cancer Control Tomohiro Matsuda Section Head, Registry Section, National Cancer Registry, Center for Cancer Registries, Center for Cancer Control and Information Services, National Cancer Center	**研究分担者** (Collaborator) 杉山　裕美 Hiromi Sugiyama	¥650,000	April 1, 2018	March 31, 2019	RP 18-61	被爆者のがん罹患調査 Study of cancer incidence among A-bomb survivors
2	国内外研究連携基盤の積極的活用によるがんリスク評価及び予防ガイドライン提言に関する研究 Study of evaluation of carcinogenetic effects based on active utilization of domestic and international research consortia and proposal of cancer prevention guidelines	国立がん研究センター・国立がん研究センター研究開発費 研究代表者　井上　真奈美 国立研究開発法人国立がん研究センター 社会と健康研究センター 予防研究部 部長 National Cancer Center Funds for Cancer Research and Related Technology Development Manami Inoue Chief, Division of Cohort Consortium Research, Epidemiology and Prevention Group, Center for Public Health Sciences, National Cancer Center	**研究協力者** (Cooperative Investigator) 定金　敦子 Atsuko Sadakane	研究協力者のため、研究資金の配分なし Since this person is a cooperative investigator, research funds were not allocated to her.	April 1, 2018	March 31, 2019	RP-A2-15	日本人のがんの疫学研究 Epidemiological study of cancer in Japanese population

平成30年度 外部資金研究一覧表
FY2018 External Research Funds

	研究のタイトル Title of Research	委託組織の名前と場所及び研究グループのチーフ又は担当の主任研究者 Name and location of entrusting outside organization Chief of research group or principal investigator in charge	放影研における研究者の名前 Investigator(s) at RERF	研究資金（資金拠出機関からの入金額） Research funds (amount of funds from funding organizations)	開始日 Initiation Date	終了日 Termination Date	関連RP Related RPs	関連性 Relationship to RERF's mission
臨床研究部 Department of Clinical Studies								
1	生涯にわたる循環器疾患の個人リスクおよび集団のリスク評価ツールの開発を目的とした大規模コホートの統合研究 A large-scale integrated cohort study to develop tools to assess life-long individual/group risk of circulatory diseases	厚生労働省・厚生労働科学研究費補助金 「循環器疾患・糖尿病等生活習慣病対策総合研究事業」 研究代表者　岡村　智教 慶應義塾大学医学部　教授 Health and Labour Sciences Research Grants (MHLW) Comprehensive Research on Life-Style Related Diseases including Cardiovascular Diseases and Diabetes Mellitus Tomonori Okamura Professor, School of Medicine, Keio University	**研究分担者** (Collaborator) 山田　美智子 Michiko Yamada	¥1,620,000	April 1, 2018	March 31, 2019	RP 2-75	広範囲な医学的調査 （生活習慣病） Broad-based medical research (Lifestyle disease)
2	現代の後期高齢者における循環器疾患リスク要因の検証 Inspection of the circulatory disease risk factors in the modern old-old	日本学術振興会・科学研究費助成事業 「基盤研究(B)」 研究代表者　大久保　孝義 帝京大学医学部　教授 JSPS Grant-in-Aid for Scientific Research Scientific Research (B) Takayoshi Okubo Professor, School of Medicine, Teikyo University	**研究分担者** (Collaborator) 山田　美智子 Michiko Yamada	直接経費 (Direct cost) ¥250,000 間接経費 (Indirect cost) ¥75,000	April 1, 2018	March 31, 2019	RP 2-75 RP 5-92	広範囲な医学的調査 （生活習慣病） Broad-based medical research (Lifestyle disease)
3	末梢性T細胞性リンパ腫における融合遺伝子検索方法の確立 Identification of efficient discovery strategy for fusion genes assays in peripheral T-cell lymphoma	一般社団法人 日本血液学会研究助成 研究代表者　吉田　稚明 Research Grant for Japanese Society of Hematology Noriaki Yoshida	**研究代表者** (P.I.) 吉田　稚明 Noriaki Yoshida	\300,000	April 1, 2018	March 31, 2019	No RP	がん研究 （被爆者がん研究への応用） Cancer research (Application to cancer research among A-bomb survivors)

平成30年度 外部資金研究一覧表
FY2018 External Research Funds

研究のタイトル Title of Research	委託組織の名前と場所及び研究グループのチーフ又は担当の主任研究者 Name and location of entrusting outside organization Chief of research group or principal investigator in charge	放影研における研究者の名前 Investigator(s) at RERF	研究資金（資金拠出機関からの入金額） Research funds (amount of funds from funding organizations)	開始日 Initiation Date	終了日 Termination Date	関連RP Related RPs	関連性 Relationship to RERF's mission
統計部 Department of Statistics							
1 測定誤差を考慮した低線量被曝影響の統計的評価 Project to investigate effects of measurement errors in low dose range	日本学術振興会・科学研究費助成事業 「若手研究」 研究代表者　三角　宗近 JSPS Grant-in-Aid for Scientific Research Early-Career Scientists Munechika Misumi	**研究代表者** (P.I.) 三角　宗近 Munechika Misumi	直接経費 (Direct cost) ¥1,300,000 間接経費 (Indirect cost) ¥390,000	April 1, 2018	March 31, 2019	RP 1-75 RP 18-59	LSS、遮蔽調査、線量調査 LSS, Shielding survey and dosimetry study

平成30年度 外部資金研究一覧表
FY2018 External Research Funds

研究のタイトル Title of Research	委託組織の名前と場所及び研究グループのチーフ又は担当の主任研究者 Name and location of entrusting outside organization Chief of research group or principal investigator in charge	放影研における研究者の名前 Investigator(s) at RERF	研究資金（資金拠出機関からの入金額） Research funds (amount of funds from funding organizations)	開始日 Initiation Date	終了日 Termination Date	関連RP Related RPs	関連性 Relationship to RERF's mission
分子生物科学部 Department of Molecular Biosciences							
1 胎生期に被ばくしたマウス造血幹細胞の放射線感受性に関する研究 A study for radiation-sensitivity in hematopoietic stem cells (HSCs) following fetal irradiation mice	日本学術振興会・科学研究費助成事業 「基盤研究(C)」 研究代表者　濱崎　幹也 JSPS Grant-in-Aid for Scientific Research Scientific Research (C) Kanya Hamasaki	**研究代表者** (P.I.) 濱崎　幹也 Kanya Hamasaki	直接経費 (Direct cost) \800,000 間接経費 (Indirect cost) \240,000	April 1, 2018	March 31, 2019	RP 6-11	生物学的線量推定 Biodosimetry
2 生殖細胞変異の1分子解析と後世代影響のリスク評価 Single molecular analysis of germline mutagenesis and risk assessment for future generation	日本学術振興会・科学研究費助成事業 「若手研究(A)」 研究代表者　内村　有邦 JSPS Grant-in-Aid for Scientific Research Young Scientist (A) Arikuni Uchimura	**研究代表者** (P.I.) 内村　有邦 Arikuni Uchimura	直接経費 (Direct cost) ¥5,300,000 間接経費 (Indirect cost) ¥0 大阪大学の招へい教員として阪大で研究を継続。 Dr. Uchimura continues this research project as a visiting researcher at Osaka University.	April 1, 2018	March 31, 2019	RP 2-13	放射線被曝の遺伝的影響 Genetic effects of radiation exposure
3 極微量変異原評価のための全ゲノム解読に基づく網羅的自然発生突然変異検出系と標準化 New detection system of spontaneous mutations with whole genome sequencing for evaluation of infinitesimal mutagens	日本学術振興会・科学研究費助成事業 「基盤研究(A)」 研究代表者　権藤　洋一 東海大学 医学部基礎医学系 分子生命科学 教授 JSPS Grant-in-Aid for Scientific Research Scientific Research (A) Yoichi Gondo Professor, Department of Molecular Life Sciences, Tokai University School of Medicine	**研究協力者** (Cooperative Investigator) 内村　有邦 Arikuni Uchimura	研究協力者のため、研究資金の配分なし Since this person is a cooperative investigator, research funds were not allocated to him.	April 1, 2018	March 31, 2019		**なし** None
4 胚発生期の自然発生変異に注目した高解像度な細胞系譜の解析 High resolution analysis of cell lineage by using post-zygotic spontaneous mutations	日本学術振興会・科学研究費助成事業 「挑戦的研究（萌芽）」 研究代表者　内村　有邦 JSPS Grant-in-Aid for Scientific Research Grant-in-Aid for Challenging Research (Exploratory) Arikuni Uchimura	**研究代表者** (P.I.) 内村　有邦 Arikuni Uchimura	直接経費 (Direct cost) ¥2,600,000 間接経費 (Indirect cost) ¥0 大阪大学の招へい教員の立場で研究代表者として研究全体に従事。当該科研費の管理および係る交付申請、実績報告書等の提出事務はすべて大阪大学が行う。 Engage whole work as PI and perform in Osaka University, and all management of this funds and submission of reports, etc. are done by Osaka University.	June 29, 2018	March 31, 2019	RP 2-13	放射線被曝の遺伝的影響 Genetic effects of radiation exposure

平成30年度 外部資金研究一覧表
FY2018 External Research Funds

研究のタイトル Title of Research	委託組織の名前と場所及び研究グループのチーフ又は担当の主任研究者 Name and location of entrusting outside organization Chief of research group or principal investigator in charge	放影研における研究者の名前 Investigator(s) at RERF	研究資金（資金拠出機関からの入金額） Research funds (amount of funds from funding organizations)	開始日 Initiation Date	終了日 Termination Date	関連RP Related RPs	関連性 Relationship to RERF's mission
その他 Other Office							
1 どの程度低い放射線被曝、どの程度低い線量率被曝が循環器疾患と相関するか？ How lower radiation dose and how lower radiation dose rate associate with circulatory diseases?	日本学術振興会・科学研究費助成事業 「基盤研究(C)」 研究代表者　高橋　規郎 JSPS Grant-in-Aid for Scientific Research Scientific Research (C) Norio Takahashi	**研究代表者** (P.I.) 高橋　規郎 Norio Takahashi **研究分担者** (Collaborator) 三角　宗近（統計部） Munechika Misumi (Dept. Statistics) **研究協力者** (Cooperative Investigator) 大石　和佳（臨床研究部） Waka Ohishi (Dept. Clinical Studies)	直接経費 (Direct cost) ¥0 間接経費 (Indirect cost) ¥0	April 1, 2018	March 31, 2019	RP 1-11 RP 2-12	循環器疾患研究 RERF Circulatory Disease Study
				補助事業期間延長により、平成29年度の未執行額（1,606,666円）を使用。 平成30年度に新たな助成金の交付はなし。 With extension of the funded term, the unexecuted amount for FY2017 (1,606,666yen) was used. No grant was provided for FY2018.			

平成30年度 特別会計一覧表
FY2018 Special Funds

資金拠出機関名称 Name of Funding Agency	件数 Number of Funds	資金合計 Amount of Funding Total
厚生労働省 Ministry of Health, Labour and Welfare (MHLW)	3	¥548,157,000
米国国立がん研究所(NCI)契約 U.S. National Cancer Institute (NCI) Contract	1	¥16,204,996
広島県 Hiroshima Prefecture	1	¥14,228,282
長崎県 Nagasaki Prefecture	1	¥8,528,000
公益財団法人 原子力安全研究協会(環境省委託事業の受託機関) Nuclear Safety Research Association [Contract project organization commissioned by the Ministry of the Environment (MOE)]	1	¥4,680,654
国立大学法人 京都大学(国立研究開発法人 日本医療研究開発機構委託事業の受託機関) Kyoto University [Contract project organization commissioned by the Japan Agency for Medical Research and Development (AMED)]	1	¥950,000
総合計 Grand total	8	¥592,748,932

注)
・間接費を含む。
・研究分担者の配分額を含む。

Notes)
・These amounts include indirect cost.
・These amounts may include subsidies allocated to collaborators.

平成30年度　特別会計一覧表
FY2018 Special Funds

	研究のタイトル Title of Research	委託組織の名前と場所及び研究グループのチーフ又は担当の主任研究者 Name and location of entrusting outside organization/Chief of research group or principal investigator in charge	放影研における契約者/研究者の名前 Investigator(s) at RERF	資金拠出機関からの入金額 Amount of Funds from Funding Agencies	開始日 Initiation Date	終了日 Termination Date	関連RP Related RPs	関連性 Relationship to RERF's mission
1	東電福島第一原発緊急作業従事者に対する疫学的研究 Epidemiological Study of Health Effects in Fukushima Emergency Workers	厚生労働省・労災疾病臨床研究事業費補助金 研究代表者　大久保　利晃 Research Grant for Clinical Studies of Work-Related Illness (MHLW) Toshiteru Okubo	研究代表者 (Principle Investigator) 大久保　利晃 Toshiteru Okubo 研究分担者 (Collaborative Investigators) 小笹　晃太郎 Kotaro Ozasa 大石　和佳 Waka Ohishi 喜多村　紘子 Hiroko Kitamura	直接経費 (Direct cost) ¥468,551,000 間接経費 (Indirect cost) ¥74,002,000	April 1, 2018	March 31, 2019	RP 6-15 RP 2-17 RP 1-18 RP 2-18	東電福島第一原発事故処理緊急作業従事者の長期疫学調査 Long term follow-up epidemiological study on emergency workers of TEPCO, Fukushima 1F Nuclear Power Plant accident.
2	原爆放射線による健康影響に関する国際交流調査研究業務 International Exchange Program on Health Effects of the Atomic Bomb Radiation	厚生労働省・委託事業 丹羽　太貫 MHLW Entrustment Ohtsura Niwa	受託者 (Contractor) 丹羽　太貫 Ohtsura Niwa	¥3,730,000	July 20, 2018	March 29, 2019		放射線の人に及ぼす影響及びこれによる疾病に関する調査研究の成果の管理、報告及び公表並びに研修を行うこと To report and publicize the results of research and studies, and to provide training on the effects of radiation and associated diseases in humans
3	原爆被爆者の生物試料の保管及び活用に関する研究事業 Research Program on preservation and use of the A-bomb survivors' biosamples	厚生労働省・委託事業 丹羽　太貫 MHLW Entrustment Ohtsura Niwa	受託者 (Contractor) 丹羽　太貫 Ohtsura Niwa	¥1,874,000	February 13, 2019	March 29, 2019		原爆被爆者の生物試料の保管及び活用 Preservation and use of the A-bomb survivors' biosamples
4	原爆被爆者におけるがんの疫学的研究支援 Support for Epidemiological studies of cancer among atomic bomb survivors	米国国立がん研究所（NCI）契約 米国メリーランド州ベセスダ、 米国国立がん研究所 NCI契約　HHSN261201400009C 主任研究者　小笹　晃太郎 U.S. National Cancer Institute (NCI) Contract National Cancer Institute, Bethesda, Maryland, USA NCI Contract HHSN261201400009C Kotaro Ozasa	主任研究者 (Program Director) 小笹　晃太郎 Kotaro Ozasa 研究管理者 (Project Managers) エリック　グラント Eric J. Grant ハリー　カリングス Harry M. Cullings	直接経費 (Direct cost) ¥10,803,334 間接経費 (Indirect cost) ¥5,401,662	April 1, 2014	July 31, 2019	RP 1-75 RP 18-61 RP 3-94 RP 6-02 RP 1-06 RP 4-07 RP 5-08 RP 6-10 RP-S2-15 RP-S2-16 RP-P1-16	がんの疫学研究、 LSS、胎内被爆者、 F_1集団 Epidemiological study of cancer, LSS, *in utero*, and F_1 populations

平成30年度　特別会計一覧表
FY2018 Special Funds

	研究のタイトル Title of Research	委託組織の名前と場所及び研究グループのチーフ又は担当の主任研究者 Name and location of entrusting outside organization/Chief of research group or principal investigator in charge	放影研における契約者/研究者の名前 Investigator(s) at RERF	資金拠出機関からの入金額 Amount of Funds from Funding Agencies	開始日 Initiation Date	終了日 Termination Date	関連RP Related RPs	関連性 Relationship to RERF's mission
5	がん登録推進事業 Cancer Registry Promotional Project	広島県・委託事業 丹羽　太貫 Hiroshima Prefecture Ohtsura Niwa	受託者 (Contractor) 丹羽　太貫 Ohtsura Niwa	¥14,228,282	April 1, 2018	March 31, 2019	RP18-61 RP29-60 RPs18-61& 29-60附属書	がんの疫学研究、 LSS、胎内被爆者、 F1集団 Epidemiological study of cancer, LSS, in utero, and F1 populations
6	長崎県がん登録・評価事業 Nagasaki Prefecture Cancer Registry Program	長崎県・委託事業 丹羽　太貫 Nagasaki Prefecture Ohtsura Niwa	受託者 (Contractor) 丹羽　太貫 Ohtsura Niwa	¥8,528,000	April 1, 2018	March 31, 2019	RP18-61 RP29-60 RPs18-61& 29-60附属書	がんの疫学研究、 LSS、胎内被爆者、 F1集団 Epidemiological study of cancer, LSS, in utero, and F1 populations
7	低線量放射線は循環器疾患のリスクを上げるか？低線量率放射線は？放射線関連循環器疾患の機序の解明 Can low-dose radiation exposure increase the risk of circulatory diseases? How about low-dose rate radiation? Inferring potential mechanisms underlying the radiation associated circulatory diseases.	公益財団法人 原子力安全研究協会 環境省「平成30年度放射線健康管理・健康不安対策事業（放射線の健康影響に係る研究調査事業）」 研究代表者　高橋規郎 Nuclear Safety Research Association MOE Research on the Health Effects of Radiation in FY2018 (Study of the Health Effects of Radiation) Norio Takahashi	主任研究者 (P.I.) 高橋　規郎 Norio Takahashi 研究協力者 (Cooperative Investigators) 大石　和佳 Waka Ohishi 三角　宗近 Munechika Misumi 村上　秀子 Hideko Murakami	¥4,680,654	April 2, 2018	March 8, 2019	RP 1-11 RP 2-12 RP-S1-15	循環器疾患研究 RERF Circulatory Disease Study
8	骨髄異形成症候群（MDS）のオミックス解析による治療反応性および病型進展の新たなバイオマーカーの同定とその実用化に関する研究 Study for identification of new biomarkers for predicting therapeutic responsiveness and disease type progression of myelodysplastic syndrome (MDS) by omics analyses and the practical use	日本医療研究開発機構（AMED）研究費 「革新的がん医療実用化研究事業」 研究代表者 小川　誠司 京都大学大学院医学研究科　教授 Japan Agency for Medical Research and Development (AMED) Grants Practical Research for Innovative Cancer Control Seishi Ogawa Professor, Kyoto University Graduate School of Medicine	研究分担者 (Collaborator) 今泉　美彩 Misa Imaizumi 研究協力者 (Cooperative Investigators) 飛田　あゆみ Ayumi Hida ベンジャミン フレンチ Benjamin French 三角　宗近 Munechika Misumi 吉田　稚明 Noriaki Yoshida	直接経費 (Direct cost) ¥730,770 間接経費 (Indirect cost) ¥219,230	April 1, 2018	March 31, 2019	RP 1-17	被爆者のがん研究 Cancer research in atomic bomb survivors

II. Activities necessary for the above projects

1. Multi-year personnel plan for the Secretariat

The majority of management-level personnel in the Secretariat will reach mandatory retirement age within five years. Some sections will find it challenging to put capable successors in place due to mandatory retirements and a shrinking personnel cap. In the future, the Secretariat needs to select competent management-level personnel from a limited number of employees and also establish a system in which a limited number of employees can perform current duties. As part of this effort, part of the Accounting Section of Nagasaki's duties was transferred to the Accounting Section of Hiroshima in December 2018—before personnel numbers are due to decrease following mandatory retirements at the Nagasaki Accounting Section at the end of March 2019. This integration of duties enabled the Nagasaki Accounting Section to establish a system where tasks are smoothly executed without hiring new employees—even in and after FY2019. We continue to make a multi-year plan to establish an effective system to execute business with a limited number of employees. Based on business needs, our financial situation, and work content and specialties, we hired one fixed-term general employee (special status) and one fixed-term general employee.

2. Long term leadership training

To motivate staff to aspire to be management-level positions with high awareness and strong willingness, we will hold six leadership training sessions for assistant section chief or lower positions over the next four years starting from FY2017. The second and third sessions were held in July and November, respectively, at the laboratories of Hiroshima and Nagasaki in FY2018. We invite different lecturers with different professional backgrounds such as company sales representatives or those who have rich experience in a managerial positions. In FY2018, training attendees received training in problem-solving (investigating a situation and analyzing it, and planning a solution) and basic management training (acknowledging managerial roles, supervising staff, and managing goals). We received much proactive feedback from the participants such as, "I acquired knowledge concerning leadership I can utilize not only for my future, when I actually have subordinates, but also for my current duties." or "I will put into practice what I learned immediately." We find leadership training to be effective.

3. Continuation of internal audit process

A contract with Deloitte Touche Tohmatsu LLC was signed on August 1, 2018, to perform an internal audit of RERF. The internal audit has been conducted from the date of the contract and will continue through June 30, 2019. The specifics of the internal audit, as of the end of March 2019, are as follows:

- First-round audit, August 7, 10, 20 and 21, 2018
  Re: external research grants
- Second-round audit, October 10–11 and November 14, 2018
  Re: personal information protection
- Third-round audit, December 3–5, 2018

Re: trial calculation of pension liability to comprehend calculation procedures, management of purchase and payment, contract, follow-up of findings in the past fiscal year.

- Fourth-round audit, January 10, 2019
  Re: Computation of project-specific expenses, Payment procedures of payroll
- Fifth-round audit, March 29, 2019

Re: Observation of inventory taking, Payment procedures of payroll, Accounting transaction

Regarding the results of the internal audit, the interim report was sent to the Auditors on January 9, 2019. Upon completion of the internal audit, the final report will be submitted to the Auditors by the regular meeting of the Board of Directors in June 2019.

4. Facility upgrades

(1) Facility upgrades to the Hiroshima Laboratory

i. The Animal Facility was relocated to the first floor of Unit B. (Construction costs for this fiscal year: 100,440,000 yen)
ii. Replaced air conditioners on the first and second floors of Unit H set for renewal. (Renewal cost: 16,200,000 yen)
iii. Replacement of LED lights was canceled due to budget cuts.
iv. Completed painting of roofs and exterior walls of Units A, C, and F. (Painting cost: 16,308,000 yen)
v. Painted the walls of the relevant offices at time of the internal office shuffle.

5. Revision of the rules and regulations

The following regulations were revised with the aim of enhancing RERF's operational framework as a Public Interest Incorporated Foundation (PIIF):

- Safety Management Regulations Concerning Chemical Substances (Effective date: April 1, 2018)

  Due to revisions made to the Industrial Safety and Health Law, risk assessments of chemical substances were mandated. RERF established a management system for the maintenance, use, and storage of chemical substances.

- Procedures for Computation of Project-Specific Expenses (Effective date: April 1, 2018)

  RERF established new procedures to properly compute project-specific expenses.

- Supplementary Regulations for Administering Contracts, Guidelines for Purchase of Goods, Guidelines for Handling Competitive Bidding for Construction Work, and Guidelines for Entrustment Contracts (Effective date: August 1, 2018)

  RERF revised procedures for competitive bidding, and provisions concerning the determination of estimated cost and vendor selection to comply with Japanese government rules. We also clarified the rules concerning procurement.

- Detailed Regulations Concerning Performance of Internal Audit of External Research Funds (Effective date: September 1, 2018)

  As internal audits of external research funds have been conducted based on the regulations concerning the performance of internal audits since FY2017, detailed regulations were established to specify matters related to the internal audits of external research funds.

- Procedures for Management and Operation of Security Camera (Effective date: September 1, 2018)

  These procedures were established to properly operate security cameras, including a management system of information obtained by security cameras and handling of recorded data.

- Regulations Concerning Management of Safety and Health (Effective date: January 1, 2019)

  Existing regulations were repealed, and new regulations concerning the management of safety and health were established to include work environment maintenance, stress checks and protecting personal information; which are the purpose of the revision of the Industrial Safety and Health Law in 2014.

6. Investigation as to relocation of RERF

RERF openly invited proposals to investigate the facility's relocation, as 10,000,000 yen was included for the investigation in the FY2018 budget. An internal review committee of six members evaluated applicants based on their project proposals and presentations. As a result, Shimadzu Rika Corporation's Osaka Branch Office was selected, and an agreement with the company was signed for 5,940,000 yen.

Contractor-selection timeline:

・Tender notice on:	May 22, 2018
・Application deadline:	June 8, 2018
・Explanatory meeting for vendors on:	June 14, 2018
・Written proposal deadline:	June 29, 2018
・Presentation and Q & A on:	July 4, 2018
・Notification of results on:	July 17, 2018
・Agreement signed on:	August 10, 2018

Specific items of investigation included: the current status of facility, a detailed study of the Hiroshima Comprehensive Health Center (the candidate relocation site) and whether or not there were other sites available for rent, relocation of specialized fixings such as precision equipment, and work related to dismantling RERF's current buildings, disposal of waste, and restoration work including leveling the grounds.

The main investigation began after the conclusion of the agreement in August 2018 and was completed by the end of December, and a report was submitted at the end of March 2019.

The report says that seismic strengthening, asbestos removal, and repair work will be necessary to meet the present Building Standards Act in order to continue use of the current buildings that were constructed about 70 years ago and have become decrepit.

It concludes that, in view of the buildings' life and repair costs, it is desirable to relocate or demolish the current buildings to build new ones.

The investigation on relocation was conducted assuming relocation to the current candidate site, the Hiroshima Comprehensive Health Center.

Calculated costs for relocation:

1. Calculated cost for demolishing current buildings	912,208,165 yen
2. Calculated cost for surveying current soil	78,480,000 yen
3. Cost for disposing of waste	12,130,000 yen
4. Calculated cost for abolishing current RI control area	6,004,000 yen
5. Estimated cost for adjusting and transporting goods/equipment	956,000,000 yen
6. Estimated cost for renovating the relocation site	4,146,605,479 yen
Total	6,111,427,644 yen

Appended documents to FY2018 report of activities

There were no items considered to be important matters for supplementing the contents of the FY2018 report of activities.