The 13th International Congress of Radiation Research was held in San Francisco, California, U.S.A., from July 8 to 12, 2007, and 18 RERF research scientists participated. At the RERF special booth, which received many visitors, RERF research activities were displayed along with RERF’s renewed website, Update newsletter, and brochures. Two RERF-sponsored symposia were also held during the congress as described below:

Symposium on Studies of In Utero Radiation Effects

Nori Nakamura, Chief Scientist

The above symposium was held during the 13th International Congress of Radiation Research. The following are the lecture titles with the names of speakers.

Chair: Roy E. Shore, RERF Vice Chairman and Chief of Research

Lecture 1: Cancer incidence and mortality after in utero atomic-bomb exposures (Dale L. Preston, HiroSoft International Corporation, U.S.A.)

Lecture 2: Chromosome aberration induction following fetal radiation exposure in mice and humans (Nori Nakamura, RERF, Japan)

Lecture 3: Early molecular radiation events in embryogenesis (Ohtsura Niwa, National Institute of Radiological Sciences, Japan)

Lecture 4: Fetal irradiation effects on the developing brain (Louis de Saint-Georges, Nuclear Research Center, Belgium)

Based on an epidemiological survey (Oxford Survey of Childhood Cancer: OSCC) conducted in the United Kingdom in the 1950s among others, it has been thought that the fetus is highly radiosensitive. This survey was conducted in the form of a “case-control study” with the purpose of elucidating the causes of this radiosensitivity, by making comparisons to identify differences between children who died of childhood leukemia (cases) and children born at the same hospitals during the same periods of time but did not develop the disease (controls). As a result of the interviews with their mothers, it was learned that more mothers in the case group underwent X-ray pelviscopy during pregnancy, and was thus assumed that radiation exposure to about 10 mSv (estimated dose of one X-ray test at that time; current dose is much lower) increased the risk of children dying of childhood leukemia or childhood cancer about 1.5 times compared with the spontaneous rate. Assuming a direct proportional relationship between radiation dose and the effects, this means the relative risk per Gy is as large as 50. Given that the sex-/age-averaged cancer risk per Gy among A-bomb survivors is on the order of 1.5, the relative risk derived from such in utero exposure research is extremely high, although some researchers express disagreement about such conclusions. Their dissenting argument is that the fact that the pregnant mothers had to undergo X-ray testing cannot rule out the possibility that those in the case group may have had congenital problems to begin with. Unfortunately, the case-control study in the U.K. involving the in utero exposed was carried out only until the participants reached adulthood; therefore, it is unclear whether the risk of malignant tumors continues to be high even into adulthood and beyond.

Although there was in the past heated discussion internationally over the absence of childhood leukemia among the in utero survivors in Hiroshima and Nagasaki, it is now understood that the results of the A-bomb survivors study and the OSCC are not contradictory. The absence was due to limited statistical power resulting from the small number of in utero survivors (about 3,600) and the T65D-based dose estimates of about twice those based on the current DS02 (thus resulting in the greater predicted number of patients).

The following is a summary of the presentations. Dr. Preston, in his presentation, reported that although in utero survivors had slightly higher cancer risk compared with those exposed to atomic-bomb radiation at the ages of 0–10 years,
the latest study (through 1999) showed the reverse results, in other words, that risk for in utero survivors was smaller. This result is understandable since there are many animal studies reporting smaller cancer risk in in utero exposure compared with childhood exposure. However, in that case, inconsistencies with the results of the OSCC and others (high radiosensitivity of the fetus) remain. In my presentation, I explained that when chromosomes were examined 20 weeks after X-ray irradiation of fetal mice and neonatal mice, almost no effects of radiation exposure were observed in frequency of blood cell abnormality as seen among in utero survivors (examined at the age of 40), whereas frequency of chromosome aberration remaining in the body increased with increasing age of mice at the time of X-ray irradiation. A possible reason may be that behavior of bone marrow stem cells recovering from radiation injuries differs between fetuses and adults. Due to space limitations, the presentations by Drs. Niwa and Saint-Georges will not be mentioned here.

It was truly regrettable that Dr. William J. Schull (together with Dr. James V. Neel, he led the neonatal health examinations for the children of A-bomb survivors in the early days of ABCC), who was originally going to co-chair the session with Dr. Shore, was suddenly unable to attend the meeting.

Symposium on Cardiovascular Late Effects of Radiation

Kazunori Kodama, Chief Scientist

The above symposium was held during the 13th International Congress of Radiation Research. Four speakers made presentations on radiation and cardiovascular diseases from their respective perspectives. The following are the lecture titles, the names of the speakers, and the name of the chairman.

Chair: Kei Nakachi, Chief, Department of Radiobiology/Molecular Epidemiology, RERF

Lecture 1: Cardiovascular disease in the atomic-bomb survivors: Mortality, morbidity and laboratory findings and its association with atomic-bomb radiation (Kazunori Kodama, RERF, Japan)

Lecture 2: Radiation exposure and cardiovascular disease risks (Sarah C. Darby, Oxford University, U.K.)

Lecture 3: Radiotherapy and cardiovascular outcomes (Steven E. Lipshultz, University of Miami, U.S.A.)

Lecture 4: Biology of cerebrovascular effects (Fiona Stewart, Netherlands Cancer Institute, the Netherlands)

It has long been known that myocardial infarction and stroke develop after radiation therapy possibly because radiotherapy in the past involved very large radiation doses, which caused direct damage to blood vessels of the heart and the brain. It is still unclear whether low-dose exposure including atomic-bomb radiation exposure involving lower radiation doses than that used in radiation therapy can give rise to cardiovascular diseases, about which continued discussion takes place in the field of radiation risk. Recent radiation therapy involves lower-dose exposure of the cardiac vessels, and cardiovascular disease risk after radiation therapy is also drawing renewed attention.

This symposium was organized to exchange recent research results and discuss important propositions.

In my presentation, I explained the course of events for atomic-bomb radiation exposure and cardiovascular diseases over time observed in the Life Span Study (LSS) and the Adult Health Study (AHS), and reported based on the recent analysis results of LSS that increase in ischemic heart disease death rates is pronounced at the relatively high doses of 2 Gy or more, that dose-dependent increase in incidence of not only myocardial infarction but also hypertension was observed in AHS, that risk factor levels (such as total cholesterol in serum) also tended to increase dose-dependently, and that similar dose dependency was observed for inflammatory marker levels. Also noted, however, was the fact that it is still unclear whether a causal relationship exists between radiation exposure and increased cardiovascular disease incidence.

Dr. Darby of Oxford University reported on a “collaborative study of radiation exposure and cardiovascular disease risks,” which has been carried out in the U.K. According to a follow-up study involving about 11,000 breast cancer patients since 1961, relative risk of cardiovascular disease death in a group that underwent radiation therapy significantly increased to 1.26, and this trend was predominant in the group with a heart dose of 5 Gy or more.

Dr. Lipshultz of University of Miami reported that people
who had radiation therapy for Hodgkin’s disease during childhood had higher risk of developing cardiomyopathy, valvular disease, arrhythmia, and myocardial infarction 10 or more years later. The risk increased with dose. It was suggested that a heart dose of as low as 1.5 Gy may increase risk. Dr. Lipshultz participated in the “Radiation and Cardiovascular Disease” workshop, which was held in February 2006 at RERF.

Dr. Stewart of the Netherlands Cancer Institute reported on a condition of vascular damage associated with irradiation of 14 Gy based on a mouse experiment. Irradiated mice formed numerous plaques in the vascular intima and showed inflammatory changes. Although experiments are being conducted to explore possible treatment for such changes, a conclusion is yet to be reached. Dr. Stewart also participated in the “Radiation and Cardiovascular Disease” workshop, which was held in February 2006 at RERF.

Although general discussion was not had in the interest of time, at this time there seems little doubt about a causal relationship between exposure to high radiation dose and development of cardiovascular diseases. However, there is still no evidence that exposure to 1 Gy or less causes cardiovascular diseases. I look forward to further developments in this field.