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## Atomic Bomb Radiation Studies in Japan

The Atomic Bomb Casualty Commission (ABCC) in Japan was organized in 1947 under the supervision of the U.S. National Academy of Sciences (NAS) for the purpose of detecting late radiation effects in the people of Hiroshima and Nagasaki who were exposed to the atomic bombs in 1945. The ABCC was funded almost entirely by the U.S. Atomic Energy Commission, although major research projects were under the joint sponsorship of the Japanese National Institute of Health and the NAS.

In 1975, 30 years after the war and after 28 years of continuous operation, ABCC was reorganized as the Radiation Effects Research Foundation (RERF), a private nonprofit foundation funded equally by Japan and the United States. American support is through the NAS under contracts with the Energy Research and Development Administration (ERDA), the National Cancer Institute, and the National Heart and Lung Institute; the responsibility for American staffing and supervision rests with the NAS. Japanese support and direction are provided by the Ministry of Health and Welfare.

The RERF offices, laboratories, and examination facilities are maintained in both Hiroshima and Nagasaki, where adult health examinations, autopsies, clinical research, and epidemiologic studies are conducted. Of the 576 RERF employees, most of the 46 professional members of the staff are Japanese. At present five physicians and three statisticians are Americans.

A number of important radiation-related clinical disorders and abnormalities have been detected in the atomic bomb survivors. The most notable of these have been increased occurrences of lenticular opacities, thyroid tumors, leukemia, chromosome aberrations in the peripheral blood lymphocytes, and a slight impairment of growth and development of those exposed early in life. Microcephaly and mental retardation have been noted in some of those exposed in utero, especially if significant exposure occurred during the early period of gestation. Recent findings indicate an increased incidence of solid tumors among the more heavily irradiated survivors. This increase has been most apparent for breast and lung cancers, but it may extend to cancer of the stomach and several other specific sites.

Extensive clinical observation of newborn children in both cities during the early years of ABCC did not demonstrate any evidence of hereditary abnormalities attributable to parental exposure. Other major studies have shown no evidence of diminution of fertility, acceleration of aging, or progression of the minimal lenticular lesions. No new or unusual clinical disorders have been observed that could be characterized as specifically and solely due to atomic bomb exposure.

The RERF plans to continue its health examination and autopsy surveillance. Particular attention now is being focused on the immunologic competence of the exposed survivors through studies of lymphocyte function. In addition, the first-generation offspring are being reexamined for evidence of possible genetic effects by using cytogenetic techniques and through a comprehensive biochemical search for serum and erythrocyte protein variants. The development of active Tumor and Tissue Registry programs in Hiroshima and Nagasaki has greatly increased the epidemiologic capabilities for detecting radiation-induced cancers in the exposed populations.

The failure to detect genetic effects thus far has been reassuring to the exposed survivors and their children, although early studies dealt only with gross structural defects. The current search for mutations at the molecular level represents a more definitive approach to the identification of radiation-induced genetic effects in the survivors' children. The persistence of an increased risk of cancer 30 years after exposure clearly indicates that the Foundation must continue its study of delayed radiation effects among the atomic bomb survivors.—STUART C. FINCH and HOWARD B. HAMILTON, *Radiation Effects Research Foundation, 5-2 Hijiyama Park, Hiroshima 730, Japan*