Meeting the Moment: Ending Cancer As We Know It

ORAU'S PIONEERING CANCER HISTORY

In 1950, the Oak Ridge Institute for Nuclear Studies (now ORAU), opened a 30-bed cancer hospital. It was one of three facilities across the country developed by the Atomic Energy Commission after the end of World War II and the Manhattan Project to explore the use of radiation in cancer treatment. The other hospitals were located near Argonne National Laboratory in Chicago and Brookhaven National Laboratory in Upton, New York.

During the 24 years during which the ORINS Medical Division cancer hospital admitted patients, 3,500 people were treated. All had been diagnosed with cancer and nearly all of them were considered terminal.

The ORINS cancer hospital is credited with laying the foundations for nuclear medicine research, pioneering the use of chemotherapy, immunotherapy, teletherapy and brachytherapy, and the development of machines that were precursors to today's linear accelerators and positive emission tomography scanners.

ORAU Medical Division

Leading the way in nuclear medicine

- **Development of mock iodine.** Radioactive iodine has long been used to detect and diagnose thyroid cancer but has an extremely short half-life. The mock iodine source developed in 1955 had a much longer half-life and was helpful in calibrating counting machines before they were used on patients.
- **Development of thyroid phantoms.** Thyroid phantoms simulated the human neck and thyroid and were used for equipment calibration in thyroid uptake studies. These studies were crucial in evaluating thyroid function. Dr. Marshall Brucer, director of the cancer hospital, sent the phantoms were sent around the world to train personnel in their use for equipment calibration.
- **Creation of an early linear scanner.** Similar to the radioisotope device developed by scientists at Oak Ridge National Laboratory, the ORINS linear scanner was used to determine how radioisotopes were distributed and how they behaved in patients receiving diagnostic or therapeutic doses of radioisotopes.
- **Advancement of bone marrow transplantation.** ORINS Dr. Gould Andrews studied the effectiveness of bone marrow transplantation in the treatment of victims of radiation accidents.
- **Development of gallium-67 as a radiopharmaceutical.** ORINS medical staff first developed gallium-67 as a scanning agent for locating soft-tissue tumors. Then, in the early 80s, ORAU staff determined how it could be used in a diagnostic procedure for finding postoperative infections. Gallium-67 has wide use in nuclear medicine to this day.
- **Development of carbon-11-labeled amino acids as radiopharmaceuticals.** ORAU staff synthesized and purified carbon-11-labeled amino acids for use in positron emission computerized tomography (what we call PET Scans today). These amino acids could be used for differential diagnosis of pancreatic diseases and detection of solid tumors.

Leading the way in radiation therapy

- **Development of cobalt teletherapy.** Dr. Marshall Brucer was a major contributor to the development of teletherapy using cobalt-60. Cobalt-60 became the most widely used teletherapy source across the world.
- **Development of cesium teletherapy.** Brucer was also a key contributor to the development of cesium teletherapy, in which cesium was used in place of cobalt.
- **Creation of cesium teletherapy machines.** Brucer helped develop machines like the 1540 curie cesium-137 unit, which targeted diseased tissue and reduced impact on healthy tissue. Dr. Leonard G. Grimmett at MD Anderson Cancer Center in Houston was co-developer.
- **Development of total body irradiation.** Drs. Brucer and Andrews developed an approach for delivering a uniform whole-body dose of radiation and used it to treat some forms of cancer. Employing whole body irradiation with significantly higher doses than those used at ORAU became established medical practice for treatment of leukemia and other cancers.

The cancer hospital was closed in 1974 after U.S. Department of Energy determined that the fields of nuclear medicine, oncology, and others were thriving in world outside of the government department. While the cancer research hospital no longer exists, ORAU has built on its legacy by continuing research in the cancer space. This includes epidemiology and exposure studies, radiation-related research, and health communications work related to prevention and early detection of cancer.

KEY CANCER STATISTICS

1.9M
Estimated new cases of cancer in the U.S. in 2023 (American Cancer Society)

$7.3B
FY2023 funding for National Cancer Institute (including $216M for Cancer Moonshot)

↓50%
Cancer Moonshot goal to reduce cancer deaths over 25 year

$1.1B
CDC 5-year investment in Cancer Moonshot prevention priorities

18.1M
Number of cancer survivors alive in the U.S.

ORAU University Consortium Research Opportunities: White House Cancer Moonshot and Federal Agenda

On July 22, 2022, the White House released a memorandum for the heads of executive departments and agencies outlining the Administration's research and development priorities for the FY2024 budget. "Reducing the death rate from cancer by half" is among the research priorities, with particular focus on closing the screening gap, understanding and addressing environmental and toxic exposures, decreasing the impact of preventable cancers, bringing cutting edge research through the pipeline to patients and communities, and supporting patients and caregivers.

Among the areas where ORAU's capabilities intersect with these priorities include:

Closing the screening gap/decreasing the impact of preventable cancers.

These priorities require delivering health messaging to underserved populations. Black and Hispanic individuals are at higher risk for the diagnosis of later-stage cancers. Interventions designed to encourage age-appropriate screenings for normal risk individuals and earlier screenings for high-risk individuals will be critical. ORAU has a long history of delivering health messages to underrepresented groups, including people experiencing homelessness, people of color, people experiencing substance use disorders, and others.

Understanding and addressing environmental and toxic exposures.

ORAU has decades of experience screening and monitoring the health of thousands of current and former energy workers through the National Supplemental Screening Program (NSSP) and the National Institute for Occupational Safety and Health (NIOSH) Dose Reconstruction Program. The NSSP screens for and regularly monitors the health of current and former energy workers, while the NIOSH Dose Reconstruction Program reconstructs the radiation doses current and former energy workers may have been exposed to on the job.

Bringing cutting edge research through the pipeline.

Adayabalam Balajee, Ph.D., director of the Cytogenetic Biodosimetry Laboratory at the Radiation Emergency Assistance Center/Training Site, a U.S. Department of Energy asset managed by the Oak Ridge Institute for Science and Education, is conducting research with Columbia University Medical into the effectiveness of FLASH radiation, the use of ultrahigh-dose radiation as a therapeutic for some forms of cancer. FLASH radiation therapy would treat some cancers with a single dose of radiation. FLASH radiation therapy can improve patient care through precision treatment that targets diseased tissue and preserves healthy tissue. This treatment holds the promise of improving health equity by improving access to care and reducing transportation, employment and childcare barriers that may exist for some patients.

Scan to learn more about FLASH Radiation