

OAK RIDGE ASSOCIATED UNIVERSITIES CARRIES ON RADIATION TRAINING AND RESEARCH

Technology often advances before society becomes equipped to handle it. Fortunately for the nuclear research community, the Oak Ridge scientists in Tennessee who were pioneering peaceful applications for atomic energy in the 1940s recognized this tendency and did something about it.

"It became apparent that we could *make* most of the radioactive nuclides that were needed, but it also became apparent that there were not enough physicians and scientists trained to *use* radioactive materials safely and to interpret the results of their measurements correctly," noted Ralph T. Overman, PhD, who organized the first short courses in radioactivity given in 1948 at the Oak Ridge Institute of Nuclear Studies (1).

Known today as the Oak Ridge Associated Universities (ORAU), this consortium of 49 colleges and universities with a staff of over 400 serves as a focal point for radiation research and training programs.

The ORAU Medical and Health Sciences Division encompasses an extensive array of research groups, including the Radiopharmaceutical Development Group, the Nuclear Medicine Group, and the Center for Epidemiologic Research. Animal facilities at ORAU can handle burros, cattle, marmoset monkeys, and swine, as well as the typical laboratory rodents and rabbits.

The division also includes the Radiation Emergency Assistance Center/Training Site (REAC/TS), and provides technical assistance to the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC). [This committee, which reports to the White House Office of Science and Technology Policy, de-

termines research needs and coordinates radiation safety policy among 18 federal agencies in the United States.]

Under the ORAU Manpower Education, Research, and Training Division, the courses started almost 40 years ago continue today. The Radiopharmaceutical Internal Dose Information Center also occupies a prominent space in this division.

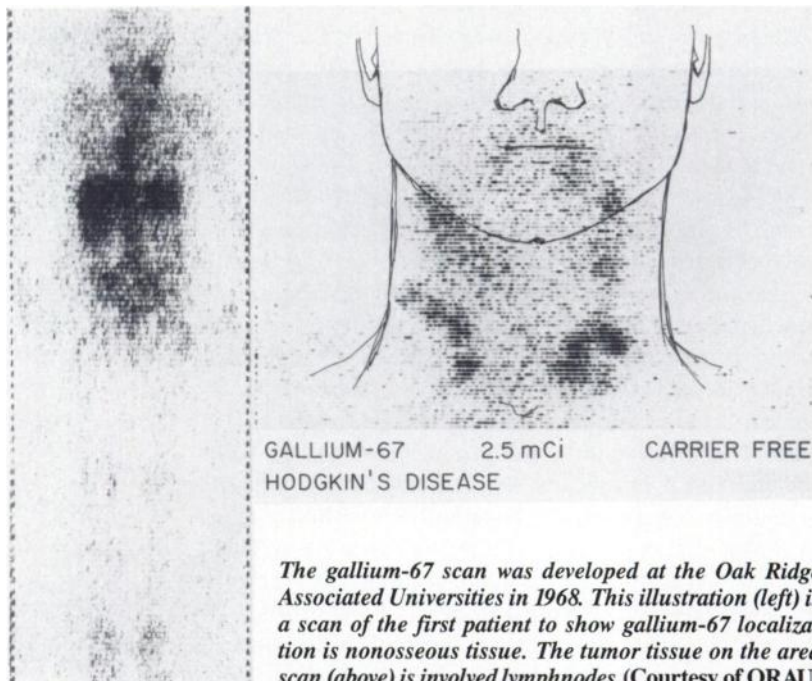
Biomedical Research

The Medical Division, established in 1948 under the directorship of Marshall H. Brucer, MD, aimed its first research efforts toward cancer treatment, and ORAU had once operated an inpatient clinical facility which closed in 1974. Today, the Radiopharmaceutical Development Group works closely with the Nuclear Medicine Group, both directed by

James E. Crook, MD, PhD, on basic and preclinical research while outside institutions conduct clinical trials in cooperation with ORAU.

Medical research at ORAU leans strongly toward positron emission computed tomography (PET), said Dr. Crook. Although the ORAU group is still employing carbon-11-labeled amino acids to evaluate pancreatic cancer, the recent shutdown of the Oak Ridge National Laboratory's (ORNL) 86-inch cyclotron has motivated the research team to identify positron emitters that can replace carbon-11. The group is now evaluating, for example, copper-64 citrate to detect soft-tissue tumors.

The ORAU group is also developing methods to make and purify a monofluorinated derivative of fluorine-18 [alpha]-aminoisobutyric acid for tumor detection. This work will



The gallium-67 scan was developed at the Oak Ridge Associated Universities in 1968. This illustration (left) is a scan of the first patient to show gallium-67 localization is nonosseous tissue. The tumor tissue on the area scan (above) is involved lymphnodes. (Courtesy of ORAU)

depend upon the production of clinically useful quantities of fluorine-18 by the ORNL tandem van de Graaff accelerator.

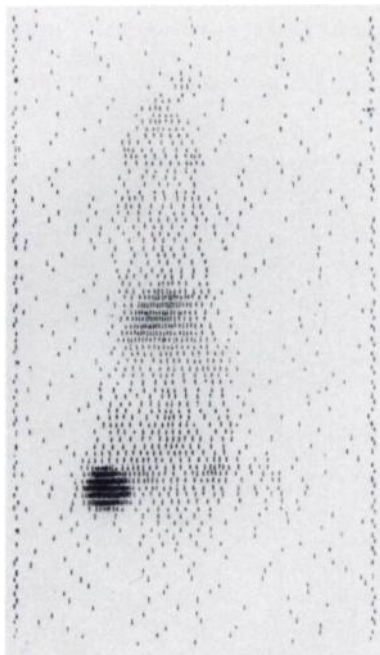
"The research consortium enables institutions without PET facilities to study positron emitters in cooperation with ORAU," noted Dr. Crook.

With a new grant from the National Cancer Institute, ORAU plans to expand its research in therapeutic monoclonal antibodies labeled with yttrium-90, fermium-255, and einsteinium-253.

Dr. Crook's group continues to evaluate and improve drugs that remove radioactive transuranic elements from the body, and now works with REAC/TS to coordinate the national use of diethylenetriaminepentaacetic acid (DTPA) for this purpose.

Radiation Accident Management

Established in 1976, REAC/TS provides an emergency treatment area,



Scan of a rat bearing a tumor transplant three days after gallium-67 administration. The tumor comprised approximately 1% of the body weight, but showed 30% of the administered gallium-67 activity. (Courtesy of ORAU)

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serving the entire Western Hemisphere, for radiation accident victims. The facility, which includes a surgical decontamination unit with a lead-shielded operating table, has treated one patient on an emergency basis since it opened. REAC/TS receives over 50 calls a year for assistance, however, and provides hands-on follow-up care or consultation as needed. (Only one other such facility exists, located in Paris, France, at the Curie Institute.)

Although serious radiation accidents rarely occur, the REAC/TS facility serves an invaluable role in helping nuclear workers handle minor accidents and in establishing guidelines (see *Newsline*, May 1985, p. 455) for accident management, explained Robert C. Ricks, PhD, director of REAC/TS. "We get two or three phone calls a week from people who need assistance with real or presumed radiation accidents," he said.

Through the Pan American Health Organization, REAC/TS helped the Mexican government in 1983 investigate the effects of radiation on five citizens of Ciudad Juarez who were exposed to radiation from a cobalt-60 teletherapy unit sent to a junkyard. REAC/TS maintains a radiation accident registry of serious incidents worldwide.

In addition to these services, REAC/TS offers courses on medical planning and care in radiation accidents, health physics in radiation accidents, and the handling of radiation

accidents by emergency personnel. "More than 1,500 people, including physicians, nurses, and occupational health personnel, have gone through the accident training program," said Dr. Ricks.

Epidemiology Studies

The Center for Epidemiologic Research, directed by Shirley Fry, MB, BCh, MPH, is responsible for several parts of the DOE Health and Mortality Study, an investigation of about 600,000 nuclear workers employed at government facilities since 1942. The center's studies evaluate health effects of exposure to chemical toxicants as well as ionizing radiation.

Epidemiology is a new field in terms of specific training, and newer practitioners get training from such schools as the University of North Carolina, a subcontractor to ORAU on the Health and Mortality Study, said Dr. Fry. The older epidemiologists have come in through other fields, she added, such as medicine, statistics, and sociology.

A recently published collaborative study of 8,375 workers at Oak Ridge National Laboratory by ORAU and the University of North Carolina's Department of Epidemiology showed that "the observed number of 966 deaths from all causes was 73% of the number expected," indicative of the healthy worker effect (2). "There were no significant increases in the number of deaths due to specific can-

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cers, and in fact, there were significantly fewer lung cancer deaths than expected,” said Dr. Fry. The study also showed an unexplained association of leukemia with long-term engineering employment, which entailed potential exposures to chemicals and toxic metals as well as radiation.

Professional Training Programs

Thousands of people who handle radioactive materials have passed through ORAU training courses, such as Medical Uses of Radionuclides, Radiopharmaceutical Internal Dose Calculation, Safe Use of Radionuclides in Research and Development Techniques, and Radiation Protection Engineering. The ORAU courses offered in 1986 include Applied Health Physics, Safe Use of Radionuclides, Internal Dosimetry for Fixed Nuclear Facilities, and Air Sampling.

In addition to training college students, professors, radiation safety officers, health physicists, emergency planning personnel, physicians, industrial hygienists, and medical technologists, the ORAU courses reach government regulators. Since 1960, ORAU has trained more than 400 members of the US Nuclear Regulatory Commission (NRC), and its predecessor agencies, in health physics and radiation protection, and several energy-related companies have arranged special courses.

Internal Dose Information

At the Radiopharmaceutical Internal Dose Information Center, established in 1971, staff members calculate the radiation dose from administered radiopharmaceuticals and collect, interpret, and correlate information about internal dosimetry.

“The primary aim of the center is to improve radiation dose estimation through the development of new and better mathematical models, more accurate assumptions used for estimating the dose, and more refined radiation dose equations,” said Evelyn E. Watson, the center’s program manager.

Supported principally by the US Food and Drug Administration (FDA) and the DOE, the center also maintains a computer database of bibliographic references concerning the characteristics of radiopharmaceuticals, including distribution patterns, uptakes, disappearance times, and retention, as well as data on metabolic variations according to age, sex, disease, and patient’s condition. The database contains more than 27,000 references on radiopharmaceuticals,

decay schemes, calculation techniques, physiologic behavior, phantoms, and mathematical models, explained Ms. Watson.

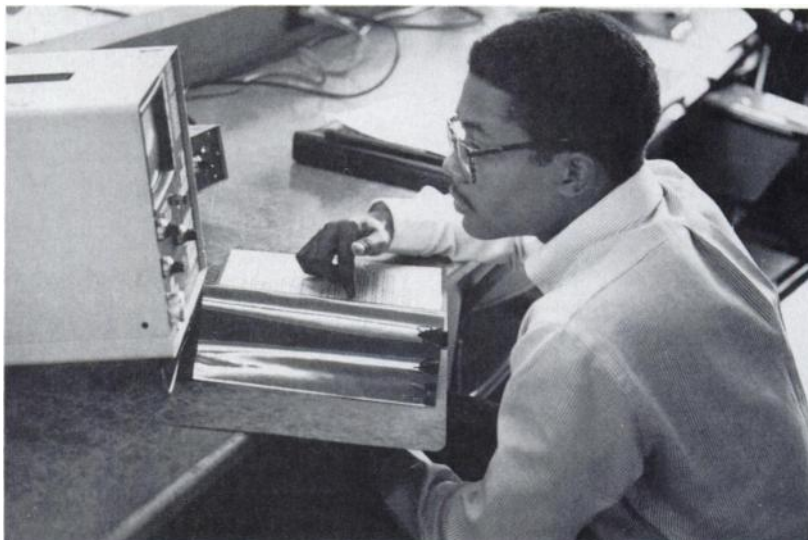
“Researchers, physicians, health physicists, and others interested in dose estimates may receive information from the center upon request,” said Ms. Watson. The center also provides reference information useful for radiopharmaceutical development, comparing radiopharmaceuticals used for similar procedures, analyzing results from nuclear medicine procedures, and radiation accidents.

For more information on any of the ORAU services, contact: Sandra W. Plant, Office of Information Services, Oak Ridge Associated Universities, PO Box 117, Oak Ridge, TN 37830 (615) 576-3353.

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References

1. Overman RT: Oak Ridge remembered: 1944-1949. *J Nucl Med* 18:759-763, 1977
2. Checkoway H, Mathew RM, Shy CM, et. al: Radiation, work experience, and cause-specific mortality among workers at an energy research laboratory, *Br J Indust Med* 42:525-533, 1985



The Oak Ridge Associated Universities Professional Training Programs offers special courses to science students and faculty that allow hands-on experience with equipment—such as high-purity germanium detectors for gamma spectroscopy and surface barrier detectors for alpha and beta spectroscopy—not available on most college campuses.
(Courtesy of ORAU)