

HISTORY CORNER

Pioneering Nuclear Medicine in Buffalo, NY

For many years, Buffalo, NY, has been a nexus of activity in the development of nuclear medicine, and practitioners working there have played unique historical roles in the evolution of the field. Drs. Merrill A. Bender and Monte Blau were both affiliated with the Roswell Park Memorial Institute in Buffalo. Their original and innovative work led to the development of a high-contrast photoscanning system for diagnostic doses (1956) and an autofluoroscopic imaging device (1960) and to the introduction of ^{203}Hg -chlormerodrin for brain tumor localization (1960), ^{75}Se -selenomethionine for pancreatic tumor imaging (1961), and ^{18}F for bone imaging (1962). The nuclear medicine community that first grew around their activities has continued to thrive, with numerous contributions to the field coming from Buffalo area specialists.

Merrill A. Bender, MD

Bender was a native of Cleveland, OH. He attended Goddard and Middlebury Colleges in Vermont and received his medical degree in 1948 from Harvard University Medical School. His transitional year of rotating internship was at the National Naval Medical Center in Bethesda, MD, where he also began his residency.



Merrill A. Bender, MD

His residency was interrupted by service in Korea with the 1st Marine Division Hospital. He returned to the Naval Hospital in Bethesda to join the radiation therapy residency training program and went on to advanced training at Francis Belafield Hospital in New York. He returned to Bethesda in 1952 as a radiation therapist and head of the radioisotope laboratory.

Bender went to Roswell Park Memorial Institute in September of 1953 as a cancer research radiologist. He was certified in radiation therapy by the American Board of Radiology in 1954. In 1955, he was appointed chief of the Department of Radioisotope Research at Roswell, where he also served as a chief of nuclear medicine from 1959 to 1985. The first departmental meeting of the faculty of the Department of Nuclear Medicine of the State University of New York (SUNY) Buffalo was held at Roswell Park Memorial Institute on June 7, 1973. The following January, Bender was appointed acting chair of the department.

As the SNM has celebrated its 50th anniversary over the past year, I have encouraged many individuals from across the United States and beyond to think about preserving the history of nuclear medicine as it pertains to their hospitals, cities, and regions. The first to respond was Dr. Husain, who contributes a look at the rich history of nuclear medicine at his institution in Buffalo, NY.

*Henry N. Wagner, Jr., MD
SNM Historian*

Bender was an early and active member of the SNM, joining as one of only a few East Coast members in the mid-1950s. He was a trustee of the Society from 1957 to 1960 and again from 1963 to 1966. He served as chair of the Radiopharmaceutical Committee and, in 1967, as president of the Society. He also served on a number of Atomic Energy Commission panels and committees and as a member of the commission's Byproduct Materials Licensing Review Panel. In 1958, he was appointed technical advisor at the second International Conference on the Peaceful Uses of Atomic Energy at Geneva, Switzerland, and in 1961 was appointed a United Nations technical assistance expert for the Atomic Energy Establishment. Among many other rewards and recognitions, he was a recipient of the first William H. Wehr Award for his outstanding work in cancer research, treatment, and education in Buffalo.

Monte Blau, PhD

Blau arrived at Roswell Park Memorial Institute in 1954 and was the first PhD chemist to work full time in nuclear medicine. He had received his doctorate in chemistry from the University of Wisconsin in 1952, with a major in radiochemistry and a minor in biochemistry. After work at Yale on radioisotope dating in archaeology and geology, he spent a year at Montefiore Hospital in New York City working with ^{45}Ca kinetics in humans. After working at Roswell Park for 3 years, he joined Bender in 1957 for what would prove to be a long and productive creative partnership.



Monte Blau, PhD

Blau joined the SNM in 1956 and served as a trustee for 2 terms (beginning in 1960 and 1972), as vice-

president and president in 1964 and 1965, as chair of the Finance and Scientific Exhibits Committees, and as a member of numerous other committees. He also served as president of the Eastern Great Lakes Chapter. He was professor and chair of the Department of Nuclear Medicine at SUNY Buffalo.

He was a founding member and cochair of the SNM's Medical Internal Radiation Dose (MIRD) Committee. He held advisory positions in various national and international organizations, including the World Health Organization, and served as chair of the Los Alamos Scientific Laboratory Medical Isotopes Advisory Committee and of the New York State Bureau of Radiological Health Medical Advisory Committee.

A Complementary Partnership

The research team put together at Roswell Park Memorial Institute was an ideal combination of these 2 individual's distinct areas of expertise and featured a multidisciplinary approach that blended clinical and basic sciences. They focused simultaneously on the development of ideal radioisotopes for specific localization of various tumors and on addressing instrumentation needs for the detection and localization of organ-specific radioisotopes.

Development of Radioisotopes. In 1960, Bender and Blau were the first to use ^{203}Hg -labeled chlormerodrin for localizing brain tumor, capitalizing on the physical and biological properties of an imaging agent (1). This achievement provided a solid foundation for further development of nuclear medicine as a diagnostic imaging modality.

^{75}Se -selenomethionine (a selenium analog of methionine labeled with ^{75}Se) was the first amino acid labeled with a γ -emitting isotope and was helpful in studying the pathophysiology of amino acid metabolism. Bender and Blau successfully used ^{75}Se -selenomethionine in the localization of carcinoma of pancreas (2).

A groundbreaking and much-cited paper published in 1962 introduced ^{18}F as a bone-scanning agent to much of the nuclear medicine community (3).

The pair also used ^{137}Ba (with a half-life of 2.6 minutes) for dynamic studies. The radioisotope was ideal for measurement of circulation times and visualization of blood pool in vascular compartments. When used with the autofluoroscope, ^{137}Ba made it possible to quantitate such abnormal cardiac processes as valvular regurgitation, ejection fraction, and wall motion abnormalities.

Bender and Blau were among the first to obtain a brain scan using ^{131}I -labeled serum albumin. Dynamic studies of kidneys and heart were performed with ^{131}I and ^{137}Ba , respectively.

Other notable contributions in the field of radiopharmaceuticals included an evaluation of the efficacy of intravenously administered ^{32}P -chromic phosphate in the treatment of chronic lymphocytic leukemia; tumor localization with ^{51}Cr ion; validation of the efficacy of ^{131}I -iodocholesterol for the visualization of the adrenal glands; measurement of

American Board of Nuclear Medicine

In 1967 Bender was approached as SNM president by the American Board of Radiology to initiate the process of establishing a specialty certifying board in nuclear medicine. A proposal for establishing a conjoint ABNM was submitted to the Liaison Committee for Specialty Boards in 1969 and approved in May 1971 (1). The American Board of Medical Specialties (ABMS) and Council on Medical Education (CME) of the American Medical Association (AMA) approved the application of the American Board of Nuclear Medicine (ABNM) in June 1971. The ABNM was formally incorporated the next month.

It was Bender who resolved disputes between competing disciplines with interests in nuclear medicine by coming up with the concept of a "conjoint" board. Although the idea was not universally popular with nuclear medicine practitioners, it was widely agreed that the solution was the only one that would convince the AMA to add a new specialty board. Opposition was most evident at what Bender would later refer to as "The Battle of New Orleans," an AMA meeting in 1969. Unable to speak on the floor of the meeting because he was not a member, Bender called in last-minute, fly-in support from interested practitioners across the country who arrived to provide much-needed votes. A year and a half later, Bender was elected as the first chair of the new board. He went on to spearhead the effort to recognize nuclear medicine as an independent specialty within the ABMS, a goal achieved in 1976. In 1985, the ABNM was designated as a primary board. At the time of his death on March 1, 1988, more than 4,000 nuclear medicine physicians were certified as specialists in this newly recognized specialty (2-4).

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myocardial perfusion after injection of ^{131}I and $^{99\text{m}}\text{Tc}$ macroaggregates into coronary arteries; the use of ^{201}Tl to differentiate between benign and malignant thyroid nodules; definitive description of the kinetics and distribution of granulocytes in humans using ^{111}In -labeled granulocytes; evaluation of the efficacy of ^{67}Ga -citrate for the detection of occult mediastinal metastasis from bronchogenic carcinoma; and development of a simple and inexpensive manual system for the rapid, efficient production of $^{99\text{m}}\text{Tc}$ -sodium pertechnetate from ^{99}Mo -sodium molybdate by the methylethyl ketone extraction technique.

In 1964 Monte Blau and Merrill Bender published a summary paper, "Biology of Scanning Agents," emphasizing that, in addition to the essential requirement of organ or tissue specificity, other biological properties, such as blood and whole-body clearance and localization in nontarget organs, are important (4). They were the first to introduce the concept of target-to-nontarget localization of radiotracers.

Development of Instrumentation. The development of the autofluoroscope led to the evaluation of renal and cardiac dynamic imaging, which helped to propel routine nuclear scanning from static to dynamic imaging (5,6). The autofluoroscope was a stationary camera with a large array of 293 sodium iodide crystals, each measuring $\frac{3}{8}$ inch in diameter. The crystals were 2 inches thick and



The "light pipes" from the original autofluoroscope were made into a presentation piece to commemorate the contributions of Bender and Blau.

ideally suited for the detection of high-energy γ rays. A complex "light piping" system was used to conduct the photoscintillation events from the crystals to the corresponding photomultiplier tubes. The photoelectric event could be stored in a digital memory matrix or displayed on the oscilloscope tube for viewing and scanning.

The autofluoroscope reduced the static brain and liver scanning time to approximately $\frac{1}{10}$ the time required with a conventional scanner. Moreover, the apparatus could visualize dynamic processes, so that, for the first time, nuclear medicine practitioners could measure qualitatively as well as quantitatively the rapid transport of radioactive substances from one compartment to another within an organ. A technique was also devised to use the digital autofluoroscope to obtain a linear profile scan of the distribution of a radionuclide in a patient.

The first autofluoroscope (System 77) was manufactured by Baird-Atomic. This multicrystal, computerized scintigraphic camera provided an effective means of measuring cardiac function, including ventricular ejection fraction, pulmonary transit time, cardiac wall motion, and cardiac output. This apparatus was the workhorse for cardiac first-pass studies at Roswell Park Cancer Institute until the early 1990s and was used for detecting incipient cardiomyopathy resulting from cardiotoxic chemotherapeutic drugs.

It is interesting to note that the current concept of combined functional and anatomical imaging by a hybrid CT/PET scanner can be traced back to 1958 and the second International Conference on Peaceful Uses of Atomic Energy, at which David Pressman, E.D. Day, and Blau presented their work on localizing rat tumor by superimposing radioisotope photoscans of radiolabeled antitumor antibody over X-ray images of the animal (7).

Training, Education, and Development of Nuclear Medicine at Roswell

The Department of Nuclear Medicine at Roswell Park Memorial Institute was one of the first to provide regular training in nuclear medicine for radiology residents. The formal nuclear medicine residency training program began at SUNY Buffalo in the 1960s. The first residents in the program were Laila Moussa-Mahmoud, MD (1967–68); Jehuda Steinbach, MD (1969–1970); and Suraj Bakshi, MD. Bakshi and Steinbach were subsequently involved in various research projects with Bender and Blau. Bakshi succeeded Bender as chief of nuclear medicine at Roswell, and Steinbach became chief of nuclear medicine at the Veterans Affairs (VA) Medical Center in Buffalo. Dr. Bender also trained Dr. Hussein Abdel-Dayem, who was among the first recipients of ABNM certification in 1972. Dr. Abdel-Dayem later became chief of nuclear medicine at the Erie County Medical Center in Buffalo, where he made significant contributions to nuclear medicine. In 1973, K.L. Parthasarathy, MD, joined Roswell as senior cancer research internist and later became associate chief of nuclear medi-

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Sally Bender with the author.

He worked with Bender on a number of projects, including significant work on gallium imaging.

Difficulties in recruiting qualified technologists in Buffalo led to plans in the early 1970s for the establishment of a baccalaureate program in nuclear medicine technology. A formal program was established in 1976 under the School of Health-Related Programs at the University of Buffalo. The Buffalo VA Hospital provided space for the instrumentation laboratory. Robert Ackerhalt, PhD, was instrumental in implementing the program, and Steinbach and Ann Steves, CNMT, served as the first program directors. In 1986, Elpida Crawford, CNMT, assumed the position of program director. Since 1977, the program has trained more than 200 technologists.

Central Radiopharmacy, a unit within the Department of Nuclear Medicine at the University of Buffalo, was founded in 1970. Since its inception under the directorships of Florian Zielinski, Jerry Robinson, and Ackerhalt, it has played a pivotal role in providing much-needed economic support to the department of nuclear medicine. Central Radiopharmacy is a major supplier of radiopharmaceuticals to hospitals in Buffalo and other areas of western New York and Pennsylvania. In 1973, a Joint Radioisotope Committee was formed with Bender as chair.

A Continuing Tradition of Excellence

Buffalo continues to work at the leading edge of nuclear medicine innovation. In 1991, a joint venture was

undertaken between the VA Western New York Healthcare System and SUNY to set up a PET center. This was one of the few centers in the early 1990s to have an onsite cyclotron. Joseph Prezio, MD, the dynamic and gifted leader who succeeded Bender as chair of the Department of Nuclear Medicine, was the main force behind this major accomplishment.

The Center for PET has made significant contributions in neurolinguistic research (8), functional neuroanatomy of tinnitus (9), myocardial function (10), and staging and evaluation of cancers (11,12).

Buffalo is unusual in that at almost every major hospital, the nuclear medicine department has maintained an identity separate from other imaging and therapeutic disciplines. The cultural milieu created by the local pioneers in nuclear medicine may account for the discipline's success and survival as an independent field, even in this era of merger and consolidation of clinical imaging services.

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