Dennis D. Patton, MD SNM Historian

History Corner

How Cesium-137 Was Discovered by an Undergraduate Student

As a follow-up on the story of how the element technetium was discovered (*1*), here's another on the discovery of one of the most widely used radionuclides, cesium-137 (*2*). The story really starts (as so many do) with the late Glenn Seaborg, who was identifying the myriad new radionuclides that were being produced by Lawrence's revolutionary cyclotron at Berkeley. There were radionuclides produced by charged-particle interactions (protons, deuterons, alphas) and also others produced by neutron-induced fission of uranium, the neutrons originating in d,n reactions.

Seaborg noticed something interesting. In all the fission products identified by 1940, a year after the discovery of fission by Hahn et al., there were no long-lived radioisotopes of any Group I elements (Na, K, Rb, Cs, Fr), although there seemed to be no reason why they should not occur. Seaborg began to look for one.

Meanwhile, an undergraduate chemistry student named Margaret Melhase was considering a career in chemistry and was looking for an honors research project. She applied to Seaborg. He put two and two together and started Melhase on the search for a Group I element among the fission products.In March 1941 Melhase was given 100 grams of a neutron-irradiated uranium compound to work with. She spent the next several months extracting the elements of other groups and analyzing what was left. Most of the residual activity precipitated out with silicotungstate, identifying it as cesium. The activity was intense enough to measure with a simple electroscope. Over the next two weeks, the activity did not diminish measurably, and Melhase could only conclude that whatever isotope of cesium it was, it had a very long half-life. It was soon identified as 30-year Cs-137; over two weeks the decay would have been less than 1%, far too small to measure with an electroscope.

Although Melhase was in the right place at the right time for discovering Cs-137, the times were not right for receiving recognition for the discovery; wartime security quickly put a tight lid on all publications having to do with fission. Much classified research was done with cesium-137, but the results were not released until after the war, and by then the trail of discovery was cold.

It is rather surprising that radiocesium had not been found before 1941; its yield from uranium fission is about 6%, as high as any yields get. At any rate, Seaborg himself did give credit to Melhase for her role in the discovery of this radionuclide (*3*), which has found widespread application in radiotherapy, in nuclear medicine (as a calibration source), and in industry (industrial radiography, equipment sterilization, food irradiation).

Seaborg went on to become chancellor of the University of California at Berkeley and later chairman of the Atomic Energy Commission. He shared the 1951 Nobel Prize in Chemistry for his discovery of plutonium. His many contributions to nuclear medicine will be the subject of a future History Corner.

Margaret Melhase as an **undergraduate at UC Berkeley, circa 1941.**

Margaret Melhase applied to graduate school in chemistry but was turned down because at Berkeley in those years no women were admitted. She worked in industry and on the Manhattan Project for a while, but lacking an advanced degree she did not pursue a career in chemistry. Margaret Melhase Fuchs is a Southern California housewife, mother of three, active in her church, co-discoverer of cesium-137.

On October 25, 1969, Seaborg wrote to Melhase asking her for some details regarding her separation of cesium-137. In her reply she wrote, "My kids will never get over the thought that Glenn Seaborg had to ask anybody anything about radioisotopes - least of all their mother!" (M. M. Fuchs, letter to G. Seaborg, Nov. 5, 1969). Seaborg wrote in reply, "I hope you have succeeded in convincing your kids that you made an important contribution to the radioisotope field (resulting in many practical applications) during those days at Berkeley" (Nov. 8, 1969).

Who should get the credit? Melhase, the undergrad, actually found the treasure, but Seaborg knew it had to have been there, and supplied the map, the materials, and the means. The discovery should be credited jointly to one of the greatest chemists of our age and to a capable undergraduate student who happened to be in the right place at the right time.

A personal note: The history of Cs-137 had not been told before 1994 (*2*). I got Melhase's name from a 1941 University of California Radiation Laboratory reference and her where-

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the expendable source is included in the TC RVUs), or

• Therapeutic nuclear medicine procedures.

Therefore, a separate payment for a radiopharmaceutical can be made only when the supply is billed in connection with one of the above procedures. In order to pay for a radiopharmaceutical, Medicare contractors must associate a procedure code with the contrast agent code. Both the procedure and supply can have different dates of service, since a radiopharmaceutical may have been administered several days ahead of the test. If both services are billed on the same claim, Medicare contractors can more easily associate these two services to each other even though the services may have been done several days apart. If these services are billed on separate claims with different dates of service, some Medicare contractors may not be able to associate the two services in their payment system

SNM PROCEDURE GUIDELINES REAPPROVED BY HOD

The Guidelines and Communications Committee of the Commission on Health Care Policy and Practice presented 22 revised procedure guidelines and 3 new guidelines to the SNM House of Delegates at the Society's Mid-Winter Meeting in Fort Lauderdale, Florida. The House approved all guidelines.

The revision process consisted of a review of the SNM procedure guidelines by their original authors for revisions and updates. Changes in procedures were noted. New references were added or old references deleted, where appropriate. The comments were collated and sent to the primary author of the guideline for determination as to which comments would be implemented in the new version of the guideline.

Three new guidelines were developed by expert task forces and were reviewed and revised by members of the Guideline Development Subcommittee. These guidelines were sent to the SNM Random Sample Review Group, a cross-section of more than 100 physicians across the country representing all areas of specialization within nuclear medicine. The new guidelines deal with breast scintigraphy, gastric emptying and motility, and gastrointestinal bleeding and Meckel's diverticulum scintigraphy.

Before being presented to the House of Delegates, the revised guidelines were discussed and passed unanimously by the Guidelines and Communications Reference Committee. Procedure guidelines may be downloaded free of charge from the Society's home page at www.snm.org. The 1999 edition of the *Procedure Guidelines Manual*, which will contain new and revised guidelines, will be available for sale at the SNM Annual Meeting in June.

—Wendy Smith, MPH, is the SNM director of health care policy

Lines from the President

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tive clinical "effectiveness" studies. New clinical study designs must incorporate the measurement of diagnostic thinking and therapeutic efficacy and capture the impact of the imaging test result on the clinician's decision process. While many effectiveness studies are observational, retrospective and filled with selection bias, collaborative, prospective, clinical effectiveness studies can help remove concerns about the ability of the diagnostic intervention to work adequately in a broader range of patients or in usual practice settings in which both patients and providers face natural barriers to care. These types of trials differ from typical clinical trials in that they enroll heterogeneous participants, use providers more similar to those who manage/treat the disease, and incorporate outcomes mesaures relevant to the disease and delivery systems.

As many have noted, the measurement of outcomes associated with diagnostic interventions is much more difficult than with therapeutic interventions. As there is often no direct linkage between the diagnostic test and a measured outcome, it is difficult to attribute the outcome to the intervention. However, by looking at more short-term, intermediate outcomes, by using physiologic measurements as surrogates for hard clinical events/outcomes and by learning how to incorporate measures of patient satisfaction and quality of life, we will be up to meeting the challenge. The Society of Nuclear Medicine is poised with its strategic plan to play a major role in this effort.

Cesium-137

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abouts from the Alumni Office. I was the first to interview her about her work, in her home. It was a rare privilege for an amateur historian to be the first to interview someone who shared in such an important discovery, especially when it occurred 50 years earlier.

Finally, this is another example of how support for student research can lead to significant advances that benefit medicine. Please support SNM's Education and Research Foundation!

(1) Patton DD: How technetium was discovered in a pile of junk. *J Nucl Med* 1998; 39:26N.

(2) For a more complete account see Patton DD: The discovery of cesium-137: The untold story. *Acad Radiol.* 1994; 1:51-58.

(3) Seaborg GT: Reminiscences on the development of some medically useful radionuclides. Address delivered at the 17th Annual Meeting of the Society of Nuclear Medicine, Washington, DC, July 10, 1970.

—Dennis D. Patton MD, is the SNM historian and professor of radiology and optical sciences at University Medical Center, Tucson, Arizona.