What are some of these radioisotopes, and how are they used? In terms of both the variety of applications and total doses administered, iodine-131, the isotope first synthesized back in 1938, seems to be the most useful by far. Iodine-131 is used to diagnose various thyroid disorders, treat hyperthyroidism and functional metastatic thyroid cancer, diagnose kidney and liver disorders and make function tests of these organs, screen for pulmonary emboli by lung scans, locate brain tumors, and make blood volume and cardiac output studies. Reciting such a list makes iodine-131 sound like the radioactive equivalent of one of those old-fashioned all-purpose remedies. In some respects it is just as easy to administer. For the thyroid function test, iodine-131 is simply given in a glass of water in the form of a clear, odorless, tasteless drink. More than a million such "atomic cocktails"—which produce no "hangover," by the way—are served annually in the United States.

Another very useful isotope—which I had the good fortune to co-discover with my colleague and friend of many years, Emilio Segre—is technetium-99*m*. As developed at Brookhaven National Laboratory and Argonne Cancer Research Hospital, this radioisotope has in recent years proved to be such a versatile tool that I feel it is worth some special attention as an example of recent progress in nuclear medicine.

Technetium-99*m*, used in different physical and chemical states in the diagnosis of thyroid, liver, brain, and kidney disease, is obtained from a radioisotope generator or "cow." This cow is a laboratory device in which technetium-99*m* is formed by the decay of molybdenum-99 and can be readily "milked off" by the appropriate chemical process whenever there is need for it (Figure 1). At least 2,000 diagnostic procedures are being carried out daily in the United States with this radioisotope, and it is now being used on a worldwide basis because of its nearly ideal properties as a diagnostic tracer.

The list of other radioisotopes used extensively in medicine includes carbon-14, gallium-68, strontium-85, fluorine-18, calcium-47, arsenic-74, mercury-197, gold-198, sodium-22, zinc-65, iron-59, phosphorus-32, cesium-137, and cobalt-60. This is only a partial list at best. Reciting all of them and explaining their many applications is another talk in itself, one I have given recently.

Most of the radioisotopes I have just mentioned are produced today in reactors in large quantities even though, as you may recall, some of them were created initially with the cyclotron. In recent years we have been returning to the cyclotron for certain radioisotopes for medicine.