radioactivity in a microscopic volume of bone. Quantitative microradiography was developed to address the first requirement (Rowland et al. 1959a), while several different types of quantitative autoradiography addressed the second (Marshall et al. 1959b; Rowland and Marshall 1959).

These studies provided an understanding of the mechanism by which radium and other alkaline earth elements are lost from bone. That the radium body content of an individual decreased with time was well known. The loss was thought to be due to resorption of bone, a process that removed discreet volumes of bone by an active cellular process. However, the results showed that resorption accounted for only a small portion of radium loss from the skeleton; the major loss at early times after uptake was the consequence of an exchange process by which radium was slowly but steadily removed from the entire volume of bone. That is, uptake of radium causes the entire bone volume to be labeled with radium; years later, all the bone that remains is still labeled, but at a lower concentration (Rowland 1961).

The loss of radium from bone by exchange processes was first demonstrated by an experiment in which bone from a dog given weekly injections of equal quantities of radium was examined at two different times. Such an injection schedule provides a uniform diffuse distribution and broad "hot spots" in locations of new bone growth, both of which are areas of radium-labeled bone ideal for quantitative alpha-track analysis. An amputation, shortly after the series of radium injections, provided the first bone sample for an evaluation of the hot-spot and diffuse levels. At sacrifice, a year later, the remaining bones were obtained for comparison. A definite loss of activity was observed from both distributions in regions where no bone resorption had taken place. These early bone studies were summarized, in part, by Marshall et al. (1959a-d) and Rowland et al. (1959a).

In an attempt to verify that the same kind of radium loss took place in humans, bones were examined from some of the Elgin State Hospital patients, each of whom was considered to have received identical radium injections at weekly intervals for various periods of time. This type of administration causes wide bands of newly formed bone to be uniformly labeled with radium, just as in the dog experiment described above. Samples from several deceased individuals had been obtained and examined, but the variation in survival times was too small to verify the concept. What was needed was a bone sample from an individual suffering an early death. An exhumation of a patient who had died early would provide the necessary sample, and such exhumations might in addition provide data on early radium cases for the radium toxicity program.