

among those listed; he died at the age of 64 of a carcinoma of the bladder. After an exhumation in 1970, his body content was found to be 1.1  $\mu\text{Ci}$ , and his systemic intake was calculated as 159  $\mu\text{Ci}$  of  $^{226}\text{Ra}$  and 140  $\mu\text{Ci}$  of  $^{228}\text{Ra}$ .

In addition to the use of radium by individual physicians and others, this radioactive material was also used in certain medical institutions. An account of treatments for hypertension and pain at a midwestern clinic published by Allen et al. (1927) described eight patients treated with radium water in 1922 and another series treated with intravenous injections starting in 1925. A total of 116 subjects were found to have been treated with radium during this short period. Unfortunately, these patients were not identified until the early 1970s, and by that time most of the few survivors were difficult to locate.

One study of the effects of intravenously administered radium has provided researchers with invaluable evidence regarding the retention of radium within the human body. A series of four papers, Schlundt et al. (1929), Barker and Schlundt (1930), Schlundt and Failla (1931), and Schlundt et al. (1933), discussed the measurement of radium in the body and the elimination of radium from the body. The last paper described the intravenous injection of radium into 32 patients, primarily classified as having dementia praecox (now called schizophrenia), at the Elgin (Illinois) State Hospital.

Schlundt et al. (1929) reported body content measurements for seven radium-containing individuals, with no mention of how the subjects obtained their radium. Barker and Schlundt (1930) reported body content measurements for ten cases, with the route of administration (oral or intravenous) and the dates of multiple administrations. These ten individuals, who received 80-1,455  $\mu\text{Ci}$  of  $^{226}\text{Ra}$ , were identified. Three were subsequently located by Argonne staff, and body burden determinations were made on two of them. One of these individuals was both a dental surgeon and physician. He received 330  $\mu\text{Ci}$  of  $^{226}\text{Ra}$ , all intravenously. His body content was reported to have been 9-14  $\mu\text{Ci}$  in 1929. When he was measured at Argonne in 1951, his body burden was 10.7  $\mu\text{Ci}$ , and his initial systemic intake was calculated to have been 1,180  $\mu\text{Ci}$ . He probably received radium at times other than those listed by Barker and Schlundt (1930). He and his family are also known to have received radium from John. His son, measured in 1951, contained 5.6  $\mu\text{Ci}$  (systemic intake 720  $\mu\text{Ci}$ ), and his wife, measured in 1952, contained 1.0  $\mu\text{Ci}$  (systemic intake 193  $\mu\text{Ci}$ ). The dentist died of aplastic anemia in 1953 at the age of 79; his wife died of a bone cancer in 1952, at age 74. The son died of a heart problem at age 55.