

## RELATIVE $^{238}\text{Pu}$ CONTENT OF BONE AND BONE MARROW

Investigator: B. J. McClanahan

Selected bones from a dog that inhaled  $^{238}\text{PuO}_2$  were subjected to ultrasonic cell disruption to separate the marrow elements from bone, in order to determine the plutonium content of the two components of the skeleton.

After inhalation of  $^{238}\text{PuO}_2$  a significant fraction of plutonium is translocated to the skeleton. An effective separation of marrow from bone would permit estimation of the distribution of the total skeletal content of plutonium between bone and marrow. In this study, selected bones were obtained from a dog which was euthanized because of an osteosarcoma of the pelvis 51 mo after inhalation of  $^{238}\text{PuO}_2$ . The bones were subjected to ultrasonic cell disruption to remove marrow cells and each skeletal component was assayed for its  $^{238}\text{Pu}$  content (Table 3.5). Among the bones examined, an average of approximately 2% of the total plutonium was in the marrow. The remaining 98% was in bone, demonstrating that skeletal  $^{238}\text{Pu}$  assays primarily determine plutonium deposits in bone.

The concentration of  $^{238}\text{Pu}$  in the marrow was approximately one-tenth that in bone. Among the bones examined, the Pu concentra-

tions were highest in marrow from lumbar vertebral bodies, ribs, and sternbrae. The lowest concentrations were found in radius, ulna, tibia, processes from cervical vertebrae and distal portions of humerus and femur. In general, marrow specimens from bones with the highest  $^{238}\text{Pu}$  concentrations tended to be higher than marrow from bones with low concentrations. However, there were exceptions: marrow samples from proximal femur and proximal humerus, both of which exhibited a relatively high plutonium concentration, were intermediate in plutonium concentration.

These data indicate that whole-bone assays should not be used to estimate the amount or concentration of  $^{238}\text{Pu}$  in marrow. It is necessary to achieve an effective separation of marrow from bone in order to estimate the average dose from deposited  $^{238}\text{Pu}$  to each of the two major skeletal components.

TABLE 3.5. Distribution of <sup>238</sup>Pu Between Bone and Marrow.

Tissue	<sup>238</sup> Pu, nCi/g			<sup>238</sup> Pu, nCi		
	Bone	Marrow	Mar/Bone	Bone	Marrow	Bone Mar/+ Mar
Proximal Humerus	5.1	0.35	0.069	56.1	1.05	0.019
Shaft Humerus	1.5	0.23	0.15	10.0	0.26	0.026
Distal Humerus	1.8	0.12	0.066	15.4	0.21	0.014
Proximal Femur	4.3	0.50	0.12	37.4	0.59	0.016
Shaft Femur	1.5	0.27	0.180	9.3	0.35	0.036
Distal Femur	2.4	0.09	0.038	30.7	0.26	0.0084
Proximal Radius	1.6	0.15	0.093	7.8	0.16	0.021
Shaft Radius	0.71	0.16	0.225	3.1	0.10	0.033
Distal Radius	1.2	0.14	0.12	3.7	0.059	0.016
Proximal Ulna	1.1	0.10	0.091	7.0	0.065	0.0092
Shaft Ulna	1.4	0.16	0.11	1.6	0.10	0.058
Distal Ulna	0.88	0.17	0.19	3.9	0.052	0.013
Proximal Tibia	1.4	0.16	0.11	15.6	0.18	0.012
Cervical Vertebrae A - Body	2.1	0.08	0.038	10.7	0.025	0.0024
Cervical Vertebrae A - Process	1.4	0.05	0.036	6.2	0.0098	0.0016
Cervical Vertebrae B - Body	3.5	0.74	0.21	7.5	0.18	0.024
Cervical Vertebrae B - Process	1.9	0.08	0.094	10.2	0.018	0.0018
Thoracic Vertebrae A - Body	6.1	0.56	0.092	18.3	0.34	0.018
Thoracic Vertebrae A - Process	3.3	0.19	0.058	9.7	0.11	0.012
Thoracic Vertebrae B - Body	6.3	0.54	0.086	16.1	0.27	0.017
Thoracic Vertebrae B - Process	3.0	0.29	0.097	7.9	0.18	0.023
Lumbar Vertebrae A - Body	6.1	0.99	0.16	20.8	0.70	0.033
Lumbar Vertebrae A - Process	2.6	0.62	0.24	16.0	0.17	0.011
Lumbar Vertebrae B - Body	5.4	0.63	0.117	22.7	0.56	0.024
Lumbar Vertebrae B - Process	2.9	0.30	0.10	12.5	0.15	0.012
Sacrum	3.5	0.28	0.08	6.6	0.20	0.030
Rib A Segment 1	1.9	0.10	0.053	0.8	0.018	0.020
Rib A Segment 2	5.7	0.86	0.15	3.4	0.14	0.040
Rib A Segment 3	5.5	0.96	0.18	4.7	0.12	0.026
Rib A Segment 4	3.8	0.81	0.21	3.8	0.17	0.044
Rib B Segment 1	7.6	0.79	0.10	5.7	0.16	0.027
Rib B Segment 2	4.2	0.62	0.15	3.7	0.10	0.042
Rib B Segment 3	2.9	0.42	0.14	3.0	0.070	0.022
Sternebra A	7.2	2.0	0.28	4.6	0.31	0.063
Sternebra B	4.0	0.96	0.24	6.6	0.26	0.039
Iliac Crest	3.6	0.54	0.15	15.0	0.31	0.021
Pelvis	4.9	0.34	0.069	19.6	0.17	0.0089
Scapula 1	2.4	0.35	0.15	4.9	0.031	0.0063
Scapula 2	2.7	0.38	0.15	9.2	0.14	0.016