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Ann ICRP 1975 os-23: 273

DOI: 10.1016/S0074-2740(75)80022-5

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CHAPTER 2

GROSS AND ELEMENTAL CONTENT OF REFERENCE MAN

I. INTRODUCTION

This section presents in tables the values for the physical properties (weight, specific gravity), gross content (water, ash, fat, protein), blood content and elemental content of the total body and of the various organs, tissues, and components of Reference Man. Table 105 contains values for the physical properties and gross content. Tables 106–108 contain values for elemental content; Table 106 the major elemental composition of the body components, water, fat, protein, carbohydrate and bone mineral; Table 107 the elemental content of body fat and body water; and Table 108 the elemental content of organs and tissues. Table 108 summarizes the weights of organs and tissues, and Table 109 summarizes the elemental content of the total body.

The single values for the physical properties in Table 105 have been chosen and the values for gross content and blood content have been calculated from the middle of the range of values given and discussed in Chapter 1, and this table is cross-referenced to that chapter.

As far as possible, only values reported for “normal” (that is, not diseased) human tissue have been used to calculate elemental content contained in Table 108. Values for the more common trace elements are based on analyses of the tissues and organs of 150 adult victims of accidental death. For the content of most other elements, no consistent body of data exists, and values have been inferred from a number of sources.

Most authors report concentrations rather than contents, and these concentrations are expressed in a variety of ways: on the basis of wet, dry, fat-free or dry fat-free tissue; as meq. %, mg %, $\mu\text{g/g}$; etc. For this report all concentrations have been converted to g/g of wet tissue, and the content has been calculated by multiplying the concentration in g/g of wet tissue by the weight in grams of the organ or tissue.

In general, values for the gross and elemental content of the total body have been calculated as the sum of the values for the various organs and tissues. For those elements like sodium and potassium for which an estimate of total body content has been made in living individuals, the sum of the contents of the various organs and tissues has been found to be compatible with the estimates in the living body with very little adjustment. All values have been rounded to two significant figures with four exceptions: specific gravity, which is usually measured to at least three figures and often to four or five, and contents of gastrointestinal (GI) tract, body fat, and central nervous system (CNS), which are all sums of component parts of disparate magnitude. Many apparent dis-

crepancies throughout this chapter are due to rounding. The notes for Table 108 contain a more detailed discussion of discrepancies in elemental content of total body.

The bibliography which accompanies this section includes only the references from which a value used in calculating content was actually taken. The list by no means indicates the extent of the literature search. For many elements, no values for concentration or content were found. For some, only single values in one or more tissues of an undescribed set of individuals were reported. When there was a choice, those values for concentration of an element in a tissue were chosen for which the author described the sample of individuals on which the determination was made. Except when more recent data could be found, values from compendia of data like the biological handbooks edited by Altman and Dittmer, the compilation of data on blood by Bowen, *Documenta Geigy*, Spector, etc., were freely used, and in many cases the original references were also consulted.

II. PHYSICAL PROPERTIES, BLOOD CONTENT, AND GROSS AND ELEMENTAL CONTENT OF REFERENCE MAN

In general the values for physical properties shown in Table 105 have been transferred directly from Chapter 1. The values for content of blood and gross components have been calculated on the basis of concentrations given in that section. Each column of Table 105 contains a value and information about how the value was chosen or calculated. This is most often the page of Chapter 1 on which the value or the concentration from which the value was calculated appears, but occasionally a value has been estimated (est.) or based on another value. For example, values of gross content for cerebrum, cerebellum, and brain stem have been based on the values for brain; the weight of aorta has been estimated from its dimensions.

Column 1. An alphabetical listing of organs (such as kidney, liver, skeleton), tissues (such as adipose tissue, blood), and body components (such as body water, body fat) is included in this column. *The asterisked tissues and organs are considered to make up the totality of Reference Man and to contain within them the components.*

Column 2. Weight in situ. The weight of each organ, tissue, and component is given in this column. The sum of the asterisked weights is 70 kg. The value for the weight of fluids such as blood, cerebrospinal fluid, etc., has been obtained by multiplying the volume by the density (see notes for column 9). The weight of each organ or tissue is assumed to include the blood vessels which the organ or tissue carries in the living body and such blood or other fluids as would not be lost when the tissue or organ is dissected at autopsy. Interstitial adipose tissue, nerves, lymphatic tissue except for dissectible lymph nodes, and connective tissues except for dissectible portions like tendons are also included in the weight of the organs.

Column 3. Total blood. The values in this column represent an estimation of the total quantity of blood in an organ or tissue in the living body. Since the information was obtained almost completely from animal studies, as reported in the *Biological Handbook of Blood and Other Body Fluids*, it is not necessarily reliable for human beings.

Column 4. Residual blood. The values for the quantity of blood which remains in a tissue or organ after it has been allowed to bleed freely are given in this column. This is assumed to be equivalent to "capillary blood." The few available values were obtained from animal data.

Column 5. Water. The quantity (in grams) of water in each organ and tissue is given in this column. The sum total of the quantities of water in the starred tissues approximates the total body water.

Column 6. Ash. The mineral content of tissues is given in this column.

Column 7. Fat. This column contains the values for the quantity of the body component fat in the various tissues and organs. The sum of the values for the starred organs and tissues makes up the total body fat.

Column 8. Protein. The values for the protein content of tissues and organs are given in this column, and the sum of the starred values approximates the total protein.

Column 9. Specific Gravity. Wherever available, a value for specific gravity of a tissue, organ, or component has been included. This value is multiplied by the density of water (1 g/ml) to give the value for density used in calculating the weight of fluids (see notes for column 2).

Adipose tissue is considered to be a kind of connective tissue made of closely packed fat cells with collagenous and elastic fibers, lymphoid tissue, fibroblasts, and capillaries. The general term adipose tissue includes the hypodermis or subcutaneous adipose, the adipose that surrounds organs like the kidney and intestines which may be readily separated from the organ at dissection, the adipose (interstitial) which occurs interspersed among the cells of an organ so intimately that it would be included with the organ at dissection, and yellow marrow. Of these four categories of adipose tissue, the weight of the yellow marrow is included in this table as part of the skeleton, and the interstitial is included as part of the weight of each organ. Thus the categories of adipose for which the weight is not accounted elsewhere are the subcutaneous and the "other separable," and these are starred to show that they should be included when calculating the totality of the weight of Reference Man.

Adrenals (2). All quantities are for two adrenals.

Aorta is the only blood vessel for which considerable specific information on elemental composition is available. It is usually not included with the heart or lungs at dissection and so has been considered separately. The blood that the aorta ordinarily contains in the living body is included here as contents of aorta.

Blood. The weight and volume of total blood in the body is given, as well as the same information for plasma and red cells. The weight of total blood is not starred for addition in the totality of Reference Man because residual blood is included in the weight of each organ.

Blood vessels. Except for the aorta (considered separately above) and those portions of the vena cava and the hepatic, renal, and mesenteric arteries and veins which would be removed when the liver, kidneys, and GI tract were dissected at autopsy and so must be accounted for separately, blood vessels are considered to be included in organs when they are weighed at dissection. The contents of all of the larger vessels, however, are lost at dissection. The blood which is lost at dissection is therefore indicated here as contents of blood vessels and is starred for inclusion in the totality of Reference Man.

Body fat is a component, not a tissue or an organ. It is considered to be the ether-soluble extract of tissue. As such, its weight is included with the weights given for the various tissues. Essential fat includes the lipid constituents of cells; nonessential fat represents the fat contained in adipose tissue.

Body water is also a component, not a tissue, and its weight is included with the weights given for the various tissues. Extracellular water is associated with plasma, lymph, cartilage, connective tissue, bone, and secretory cells; intracellular water is within the cells of the body.

Cartilage and connective tissue. Cartilage is considered as part of the skeletal system, and its weight is included with the skeleton. Of the different kinds of connective tissue, about 500 g of tendons and fascia, 600 g of periarticular tissue, and 500 g of other connective tissue—making a total of 1600 g—is considered to be separable at autopsy, and this quantity is starred for inclusion in the totality of Reference Man. The rest of the connective tissue is included in the weights of the various tissues with which it is associated.

Central nervous system includes the brain with its separate subdivisions and the spinal cord. All of these tissues are bathed with the cerebrospinal fluid which must also be included in the weight of Reference Man. The gross composition of the subdivisions of the brain has been assumed to be the same as for the brain as a whole, and the quantities of each component have been based on the composition of brain.

Eyes (2). All quantities have been given for two eyes.

Gall bladder and its contents (bile) have been considered separately from liver and from GI tract and thus are included separately in the totality of Reference Man.

GI tract is considered to include the esophagus, stomach, and small and large intestines. The values for the weight of each portion are consistent with the recommendations made by Eve, (ref. 19a) and the value for weight of the contents is the value he recommends.

Hair includes all the hair on the surface of the human body.

Heart. The weight of the heart itself and of the blood contained within its cavity is included in the totality of Reference Man.

Kidneys (2). All quantities are for two kidneys.

Larynx is included in the totality of Reference Man.

Liver is included in the totality of Reference Man.

Lung. The weight of the lung includes all of the pulmonary tissue below the bifurcation of the trachea plus the pulmonary blood. The "lung tissue" includes the bronchial tree, pulmonary lymph nodes, and capillary blood as well as the lung parenchyma. This is essentially the tissue that makes up lungs removed at autopsy since the venous and arterial blood would be lost on dissection. This blood (venous and arterial) has been included separately.

Lymphocytes and lymphatic tissue. The weight of these tissues is included with other tissues.

Lymph nodes (dissectible). Some lymph nodes may be removed at autopsy. The weight of these has been estimated to be 250 g and starred for inclusion in total body.

Muscle (skeletal). The weight of this tissue includes the connective tissue, blood vessels, blood, lymph, etc., which is normally associated with skeletal (striated) muscle.

Nails. The weight includes the nails on both hands and both feet.

Pancreas is included in the totality of Reference Man.

Parathyroid. The weight, and thus all quantities, are for all parathyroid tissue, usually distributed among four glands.

Pineal is included in the totality of Reference Man.

Pituitary. The weight of the pituitary does not include the stalk, capsule, or surrounding connective tissue.

Prostate. The weight of the prostate is for the adult 20–30 years old.

Salivary glands (parotid, submaxillary, sublingual). All data for each type of these glands refer to a pair; values for "salivary glands" are for all six.

Skeleton. The skeleton is considered as an anatomical structure, including cortical and trabecular bone, cartilage, some periarticular tissue, and marrow.

Cortical bone is solid, hard bone tissue where spaces appear only on microscopic examination, whereas *trabecular bone* is a spongy network of plates and bars. The density of the bony material which makes up trabecular bone, however, is almost the same as that for cortical bone, as indicated in column 9, although the density of trabecular bone *in situ* is only a little more than half as great since it contains marrow and other light materials.

Red marrow is that fraction of the contents of marrow spaces which is hematopoietically active.

Yellow marrow is an adipose tissue which replaces red marrow when the latter recedes.

Periarticular tissue. The periarticular tissue included in the weight of the skeleton is that connective tissue which is so closely associated with bones, especially at their joints, that it would not be removed from the skeleton at autopsy.

Skin. The weight of the skin, which is part of the totality of Reference Man, includes the epidermis and the dermis. The weight of the hypodermis or subcutaneous adipose tissue which underlies the skin is also included in the section on "adipose tissue" where it is starred for inclusion in the totality of Reference Man.

Spleen is included in the totality of Reference Man.

Teeth. Reference man is considered to have a full complement of teeth, including third molars, made up of enamel, dentin, and pulp.

Testes (2). All quantities are for two.

Thymus is included in the totality of Reference Man.

Thyroid. The weight of the thyroid given here is typical for a nonendemic-goitrous area. There is evidence that the weight is related to the amount of iodine in the diet. (See Chapter 1.)

Tongue. The weight of the tongue is included in the totality of Reference Man.

Tonsils. These are the palatine tonsils.

Trachea. The weight of the trachea has been roughly estimated from its dimensions.

Ureters (2). All quantities are for two ureters. The weight has been estimated.

Urethra. The weight of the male urethra has been estimated from its dimensions.

Urinary bladder and contents. The weight of the bladder is fairly constant, although its dimensions are variable. Reference Man is considered to have a moderately distended bladder containing 100 ml of urine.

The elemental composition (percent carbon, hydrogen, oxygen, nitrogen) of the body components water, fat, protein, and carbohydrate is given in Table 106 which also includes the percent of carbon and oxygen in bone mineral. The values in this table were used to calculate the total content of these elements in body fat and body water which are presented in Table 107.

Table 108 contains the values for the elemental content in grams of the total body, of the total soft tissue, and of the tissues and organs of Reference Man. Since these values range in magnitude from 10^4 to 10^{-15} g, they are expressed in the "E-converted" notation, that is, as a number with the appropriate power of 10 indicated. For example, 26,000 is $2.6E + 4$ and 0.000026 is $2.6E - 5$. The single value which represents Reference Man is given in the first column under each element heading, and the last column contains the reference, the number of subjects, and the analytical method on which this value was based. For those elements for which the information was available, the middle column gives the 80% range (10th and 90th percentiles) of a statistical sample of grossly normal individuals in which the concentration of the element in the organ or tissue was measured. The middle column has been omitted when this information was not available.

All values were calculated by multiplying a concentration in grams per gram of wet tissue by the weight in grams of the tissue, organ, or component. The values for the more common elements are based on the analyses of 150 adult victims of accidental death from the United States performed at the University of Tennessee and Oak Ridge National Laboratory (refs. 43; 44; 78-89). In general these values were compatible with values reported by various observers. The values from the 150-adult study have the advantage of having been obtained by the same method from the same group of individuals. They are thus more consistent than values obtained from a number of different laboratories performing analyses on various groups by a variety of methods and lend themselves more readily to comparisons between different organs and tissues. The concentrations which were originally obtained on the basis of ash were recalculated on the basis of wet tissue. That is, concentration in grams per gram of ash was multiplied by the fraction of ash in wet tissue for each individual specimen of an organ or tissue. When the concentration in ash was below the lower limit of detection for an individual specimen of an organ or tissue, this lower limit was used to convert the concentration to the wet basis and the resulting value considered as "less than the lower detection limit."

For statistical samples of organs or tissues, the median value was chosen as the representative value for Reference Man and the 10th and 90th percentiles (80% range)

TABLE 105. PHYSICAL PROPERTIES, BLOOD CONTENT, AND GROSS CONTENT OF REFERENCE MAN

1 Organ, tissue, or component	2 Weight <i>in situ</i>		3 Total blood		4 Residual blood	
	g	Page	ml	Page	ml	Page
1 Total body	70,000	13	5,200	33	..	..
1a Total soft tissue	60,000	Diff.	..	..	..	..
2 Adipose tissue	15,000	44	270	44	270	44
3 Subcutaneous (hypodermis)*	7,500	44	140	Based on adip.	140	Based on adip.
4 Other separable*	5,000*	44	90	Based on adip.	90	Based on adip.
5 Interstitial	1,000	44	..	..	..	..
6 Yellow marrow (see skeleton)	1,500	79	20	74	..	..
7 Adrenals (2)*	14*	204	3.3	206	0.6	206
8 Aorta*	100*	Est.	..	..	..	..
9 Contents*	190*	Est.	180	Definition	..	..
10 Blood	5,500	33	5,200	33	..	..
11 Plasma	3,100	39	..	..	..	..
12 Erythrocytes	2,400	36	..	..	..	..
13 Blood vessels* (see notes for Table 105)	200*	Est.	..	..	..	..
14 Contents* (except aorta and pulmonary)	3,000*	Est.	2,900	Definition	..	..
15 Body fat	13,500	43	..	..	..	..
16 Essential	1,500	43	..	..	..	..
17 Nonessential	12,000	43	..	..	..	..
18 Body water	42,000	29	..	..	..	..
19 Extracellular	18,000	32	..	..	..	..
20 Intracellular	24,000	32	..	..	..	..
21 Cartilage (see skeleton)	1,100	80	..	..	..	..
22 Connective tissue	3,400	Sum; 81	..	..	..	..
23 Tendons and fascia	1,400	81	..	..	..	..
24 Periarticular tissue	1,500	81	..	..	..	..
25 Other connective tissue	500	81	..	..	..	..
26 Separable connective tissue*	1,600*	276	..	..	..	..
27 Central nervous system*	1,430*	Sum of brain and spinal cord	32	Sum	..	..
28 Brain	1,400	213	31	215	..	..
29 Cerebrum	1,200	213	..	..	..	..
30 Cerebellum	150	213	..	..	..	..
31 Brain stem	30	213	..	..	..	..
32 Spinal cord	30	217	..	..	..	..
33 Contents (cerebrospinal fluid)*	120*	219	..	..	..	..

(Asterisked quantities make up the totality of Reference Man—see notes for Table 105)

5 Water		6 Ash		7 Fat		8 Protein		9 Specific gravity	
g	Page	g	Page	g	Page	g	Page	g	Page
42,000	24	3,700	24	13,300	24	10,600	24	1.07	26
38,700	Diff.	400	Diff.	11,400	Diff.	8,700	Diff.	..	..
2,300	44	30	Est.	12,000	44	750	44	0.92	44
1,100*	Based on adip.	15*	Based on adip.	6,000*	Based on adip.	380*	Based on adip.	0.92	Based on adip.
750*	Based on adip.	10*	Based on adip.	4,000*	Based on adip.	250*	Based on adip.	0.92	Based on adip.
150	Based on adip.	2.0	Based on adip.	800	Based on adip.	50	Based on adip.	0.92	Based on adip.
230	79	3	79	1,200	79	60	79	0.98	97
8*	205	0.06*	206	3.6*	205	2.2*	Diff.	1.02	205
70*	121	1.4*	121	1.5*	121	27*	121	..	..
150*	Based on blood	1.9*	Based on blood	1.2*	Based on blood	34*	Based on blood	1.06	34
4,400	34	55	34	36	34	990	34	1.06	34
2,900	40	29	40	23	40	210	40	1.03	39
1,500	37	26	Diff.	13	Diff.	780	Diff.	1.09	36
150*	121	1.2*	122	..	122	48*	122	..	..
2,400*	Based on blood	30*	Based on blood	20*	Based on blood	540*	Based on blood	1.06	Based on blood
..	..	..	..	13,500	43	..	..	0.92	Based on adip.
..	..	..	..	1,500	43	..	..	0.92	Based on adip.
..	..	..	..	12,000	43	..	..	0.92	Based on adip.
42,000	29	..	..	..	..	..	..	1.0	Def.
18,000	32	..	..	..	..	..	..	1.0	Def.
24,000	32	..	..	..	..	..	..	1.0	Def.
860	80	45	80	14	80	180	80	1.1	80
2,100	81	140	Based on cart.	44	Based on cart.	1,200	Based on cart.	1.2	81
880	Based on con. tis.	57	Based on cart.	14	Based on con. tis.	520	Based on con. tis.	1.2	81
950	Based on con. tis.	62	Based on cart.	15	Based on con. tis.	560	Based on con. tis.	1.2	81
320	Based on con. tis.	21	Based on cart.	5	Based on con. tis.	180	Based on con. tis.	1.2	81
1,000*	Based on con. tis.	66*	Based on cart.	21*	Based on con. tis.	580*	Based on con. tis.	1.2	81
1,100*	Based on brain	21*	Based on brain	160*	Based on brain	110*	Based on brain	..	..
1,100	214	21	214	150	214	110	214	1.03	215
930	Based on brain	18	Based on brain	130	Based on brain	96	Based on brain	..	..
120	Based on brain	2.3	Based on brain	13	Based on brain	12	Based on brain	..	..
23	Based on brain	0.45	Based on brain	3.3	Based on brain	2.4	Based on brain	1.04	218
..
120*	219	0.8*	Est.	..	..	0.03*	219	1.01	219
								1.03	219

TABLE 105. PHYSICAL PROPERTIES, BLOOD CONTENT, AND GROSS CONTENT OF REFERENCE MAN (*continued*)

1 Organ, tissue or component	2 Weight <i>in situ</i>		3 Total blood		4 Residual blood	
	g	Page	ml	Page	ml	Page
34 Eyes (2)*	15*	219	..	..	..	..
35 Lenses (2)	0.4	229	..	..	..	..
36 Gall bladder*	10*	148	..	..	..	..
37 Contents (bile)*	62*	Vol. x, dens est.	..	..	..	..
38 GI tract*	1,200*	136	..	..	..	..
39 Contents (food plus digestive fluids)*	1,005*	137	..	..	..	..
40 Esophagus	40	129	..	..	..	..
41 Stomach	150	131	6.0	134	..	..
42 Contents	250	137	..	..	..	..
43 Intestine	1,000	136	..	..	..	..
44 Contents	750	137	..	..	..	..
45 Small intestine	640	136	..	..	..	..
46 Contents	400	137	..	..	..	..
47 Duodenum	60	136	..	..	..	..
48 Jejunum	280	136	..	..	..	..
49 Ileum	300	136	..	..	..	..
50 Large intestine	370	136	..	..	..	..
51 Contents	355	137	..	..	..	..
52 Upper large intestine	210	136	..	..	..	..
53 Contents	220	137	..	..	..	..
54 Ascending colon and cecum	90	136	..	..	..	..
55 Transverse colon	120	136	..	..	..	..
56 Lower large intestine	160	136	..	..	..	..
57 Contents	135	137	..	..	..	..
58 Descending colon	90	136	..	..	..	..
59 Sigmoid colon	50	136	..	..	..	..
60 Rectum	20	136	..	..	..	..
61 Hair*	20*	58	..	..	..	..
62 Heart*	330*	115	53	117	13	117
63 Contents* (av.)	500*	115	500	..	..	..
64 Kidneys (2)*	310*	175	70	177	25	177
65 Larynx*	28*	154	..	..	..	..
66 Liver*	1,800*	146	250	147	..	..
67 Lung*	1,000*	173	530	173	100	173
68 Parenchyma (includes bronchial tree plus capillary blood)	570	173	..	..	100	173
69 Blood (arterial and venous)	430	173	400	Def.	..	..

(Asterisked quantities make up the totality of Reference Man—see notes for table 105)

5 Water		6 Ash		7 Fat		8 Protein		9 Specific gravity	
g	Page	g	Page	g	Page	g	Page	g	Page
..	..	..	..	..	..	..	..	1.1	..
0.27	225	0.0016	225	0.008	225	0.14	225	1.1	225
7.3*	149	0.07*	149	..	..	..	..	1.03	..
53*	149	0.6*	149	1.2*	149	0.26*	149	1.03	149
			Based on inorg. matter						
950*	Based on intest.	10*	Based on intest.	74*	Based on intest.	160*	Based on intest.	1.04	..
900*	Est.	..	..	..	..	..	..	..	..
30	130	0.36	130	..	..	..	..	1.04	130
110	134	1.2	134	9.3	134	20	134	1.05	134
790	143	8.0	143	62	143	130	143	1.04	144
510	Based on intest.	5.1	Based on intest.	40	Based on intest.	83	Based on intest.	1.04	144
47	Based on intest.	0.48	Based on intest.	3.7	Based on intest.	7.8	Based on intest.	1.05	144
220	Based on intest.	2.2	Based on intest.	17	Based on intest.	36	Based on intest.	1.04	144
240	Based on intest.	2.4	Based on intest.	19	Based on intest.	39	Based on intest.	1.04	144
290	Based on intest.	2.3	Based on intest.	23	Based on intest.	48	Based on intest.	1.04	144
170	Based on intest.	1.4	Based on intest.	13	Based on intest.	27	Based on intest.	1.04	Based on LI
71	Based on intest.	0.72	Based on intest.	5.6	Based on intest.	12	Based on intest.	1.04	Based on LI
95	Based on intest.	0.96	Based on intest.	7.4	Based on intest.	16	Based on intest.	1.04	Based on LI
130	Based on intest.	1.3	Based on intest.	9.9	Based on intest.	21	Based on intest.	1.04	Based on LI
71	Based on intest.	0.72	Based on intest.	5.6	Based on intest.	3.8	Based on intest.	1.04	Based on LI
40	Based on intest.	0.40	Based on intest.	3.1	Based on intest.	6.5	Based on intest.	1.04	Based on LI
16	Based on intest.	0.16	Based on intest.	1.2	Based on intest.	2.6	Based on intest.	1.04	Based on LI
1.7*	59	0.10*	59	0.5*	Diff.	18*	59	1.3	59
240*	116	3.6*	117	33*	117	55*	116	1.03	117
400*	Based on blood	5*	Based on blood	3.3*	Based on blood	90*	Based on blood	1.06	Based on blood
240*	176	3.4*	176	16*	176	53*	176	1.05	176
19*	155	0.84*	155					1.08	155
1,300*	146	23*	147	120*	147	320*	147		
780*	Sum	11*	Sum	9.9*	Sum	177*	Sum	1.05 deflated	163
								0.26 inflated	163
430	164	6.3	Based on lung;	7.1	Based on lung;	100	Based on lung;	1.00	164
350	Based on blood	4.3	Based on blood	2.8	Based on blood	77	Based on blood	1.06	Based on blood

TABLE 105. PHYSICAL PROPERTIES, BLOOD CONTENT, AND GROSS CONTENT OF REFERENCE MAN (*continued*)

1 Organ, tissue or component	2 Weight <i>in situ</i>		3 Total blood		4 Residual blood	
	g	Page	ml	Page	ml	Page
70 Bronchial tree	30	173	..	..	..	..
71 Lymphocytes	1,500	98	..	..	..	..
72 Lymphatic tissue	700	101	..	..	..	..
73 Lymph nodes (dissectible)*	250*	Est.	..	..	9.4	101
74 Miscellaneous*	2,956*	By difference				
75 Solid soft tissue (nasopharynx, etc.)	2,600	Estimated	..	..	..	..
76 Fluid (synovial, pleural, etc.)	350	Estimated	..	..	..	..
77 Muscle (skeletal)*	28,000*	109	700	111	250	111
78 Nails (20)*	3*	59	..	..	..	..
79 Pancreas*	100*	150	..	..	3.0	151
80 Parathyroid (4)*	0.12*	201	..	..	..	..
81 Pineal*	0.18*	206	..	..	..	..
82 Pituitary	0.6*	208	0.056	209	..	..
83 Prostate*	16*	185	..	..	..	..
84 Salivary glands (6)*	85*	125	8.2	125	..	..
85 Parotid (2)	50	125	4.8	125	..	..
86 Submaxillary (2)	25	125	2.4	125	..	..
87 Sublingual (2)	10	125	0.96	125	..	..
88 Skeleton*	10,000*	79	350	74	..	..
89 Bone	5,000	79	250	74	..	..
90 Cortical	4,000	79	..	..	..	..
91 Trabecular	1,000	79	..	..	..	..
92 Red marrow	1,500	79	80	74	..	..
93 Yellow marrow	1,500	79	20	74	..	..
94 Cartilage	1,100	79	..	..	..	..
95 Periarticular tissue (skeletal)	900	79	..	..	..	..
96 Skin*	2,600*	54	65	55	..	..
97 Epidermis	100	54	..	..	..	..
98 Dermis	2,500	54	..	..	..	..
99 Hypodermis (see adipose tissue)	7,500	54	..	..	..	..
100 Spleen*	180*	102	90	104	40	105
101 Teeth (32)*	46*	83	..	..	..	..
102 Enamel	10	Estimated	..	..	..	..
103 Dentin	35	Estimated	..	..	..	..
104 Pulp	1	Estimated	..	..	..	..
105 Testes (2)*	35*	182	1.3	184	..	..
106 Thymus*	20*	106	6.0	107	..	..
107 Thyroid*	20*	199	3.6	200	..	..
108 Tongue*	70*	123	..	..	..	..
109 Tonsils (2 palatine)*	4*	127	..	..	..	..
110 Trachea*	10*	157	..	..	..	..
111 Ureters (2)*	16*	177	..	..	..	..
112 Urethra*	10*	181	..	..	..	..
113 Urinary bladder*	45*	179	..	..	..	..
114 Contents (urine)*	102*	Vol. x dens. estimated	..	..	..	..

(Asterisked quantities make up the totality of Reference Man—see notes for Table 105)

5 Water		6 Ash		7 Fat		8 Protein		9 Specific gravity	
g	Page	g	Page	g	Page	g	Page	g	Page
..
..
..
..
1,770*	Based on	..	..	..	..	..	..	..	..
350	TB 29	..	..	..	..	..	..	..	..
	Est.	..	..	..	..	..	..	..	..
22,000*	110	340*	110	620*	110	4,800*	110	1.04	112
0.2*	62	..	..	..	..	..	..	1.3	62
71*	150	1.2*	151	8*	150	13*	150	1.05	151
0.5*	209	..	..	..	..	..	..	1.05	207
..	..	..	..	..	..	..	..	1.07	209
13*	186	0.2*	186	0.2*	186	2.4*	Diff.	1.05	186
64*	Est.	..	..	..	..	..	..	1.05	125
..	..	..	..	..	..	..	..	1.05	125
..	..	..	..	..	..	..	..	1.05	125
..	..	..	..	..	..	..	..	1.05	125
3,300*	79	2,800	79	1,900*	79	1,900*	79	1.4	65
850	79	2,700	79	50	79	1,300	79	2.2	65
600	79	2,200	79	40	79	1,000	79	1.85	71
230	79	500	79	10	79	240	79	1.08	71
600	79	9	79	600	79	300	79	1.03	97
230	79	3	79	1,200	79	60	79	0.98	97
860	79	45	79	14	79	180	79	1.1	80
570	79	37	79	12	79	140	79	1.1	65
1,600*	55	18*	55	260*	55	750*	55	1.10	56
..	..	..	..	..	..	..	..	1.15	56
..	..	..	..	..	..	..	..	1.12	56
..	..	..	..	..	..	..	..	0.97	56
140*	104	2.5*	104	2.9*	104	35*	104	1.06	104
4.2*	85	34*	85	..	..	8.3*	85	2.10	85
0.28	85	9.6	85	..	..	0.12	85	..	..
3.9	85	25	85	..	..	(insol.)	..	..	..
0.7	Est.	0.1	Est.	0.01	85	0.16	85	..	..
28*	184	0.39*	184	1.1*	184	0.6	85	..	..
16*	107	0.15*	107	..	..	4.2*	184	1.04	183
15*	200	0.22*	200	2.0*	diff.;	..	..	1.03	107
46*	124	0.70*	124	14*	124	2.8*	200	1.05	200
3*	Est.	..	..	..	..	12*	124	..	..
6*	158	0.16*	158	..	..	..	..	1.08	158
11*	178	..	..	..	..	..	..	..	..
7.5*	182	..	..	..	..	..	..	..	..
29*	180	0.36*	180	..	..	..	..	..	..
95*	354	1.1*	Est.	..	..	6.2*	355	1.02	354

were chosen to indicate the variability. In Table 108 when the median value for content (that is, the value which represents Reference Man) is preceded by a "less than" sign, this means that the element was below the detection limit in more than half of the individual specimens of an organ or tissue which were analyzed. When the lower limit of the 80% range is preceded by a "less than" sign, this means that the element was below the detection limit in more than 10% of the individual specimens, and when the upper limit of the range is preceded by "less than," this means that the element was below the detection limit in more than 90% of the samples. When an element was not observed in a single specimen of an organ or tissue, the value which represents Reference Man in Table 108 has been expressed as "less than the limit of detection" and enclosed in parentheses.

When values are taken from literature sources, it frequently happens that no information permitting calculation of an 80% range is given; indeed, sometimes only a single value has been found. In such cases a value was chosen from the middle of the range reported by various observers, and this value (even when it was the result of a single determination) was used to calculate organ content. In such cases no 80% range is indicated in the table.

In calculating the quantity of an element in the *total body*, the sum of the quantities of the element in the various tissues and organs has been taken as the quantity in the total body. Although information on all tissues and organs was not available for every element, values were found or inferred for the quantities of most of the commonly occurring elements in over 90% of the total body and an estimation of the quantity in the balance could be made, depending on the nature of the tissues or organs in which the quantities were unknown. If the concentration was approximately the same in all tissues for which information was available, i.e., "known" tissues, the concentration in those tissues for which no information was available, i.e., "unknown" tissues, was assumed to be the same as for the known. If the concentration of an element in one or more tissues was much higher than the average of the other known tissues, the concentration in the remaining unknowns was assumed to have this average value. For example, magnesium has an exceptionally high concentration in bone, so in calculating the quantity of magnesium in the total body, the unknown tissues, being for the most part soft tissues, were assumed to have the average concentration of the known soft tissues. That is, since the "known" soft tissues contain 7.2 g of magnesium and the sum of the weights of these tissues is 55.5 kg or 92% of 60 kg, the total soft tissue weight, then the extrapolated value for magnesium in soft tissues is $7.2 \div 0.92 = 7.8$ g. The value for total body is then the sum of soft tissue (7.8 g) and skeleton (11 g) or 19 g. In general, when a value for the concentration of an element in skeleton was not known, no value for total body has been included for this element.

In Table 108 the reference column for soft tissue contains the fraction (in %) of the soft tissue for which the content was actually known and from which the value for total soft tissue was calculated. When this fraction was less than 50% the value for soft tissue and for total body have been followed by a question mark.

Those elements for which available values represented less than 20% of the body are included at the end of Table 108.

In calculating the elemental content of "other separable adipose tissue" the values for concentration in omentum were used. The elemental content of all other adipose was calculated on the basis of the concentration in subcutaneous adipose (hypodermis).

In calculating the elemental content of the *skeleton*, the values for concentration in whole wet rib were used. Therefore in Table 108 the content of an element in the skeleton is not necessarily the sum of the contents of the various portions of the skeleton.

Where the only available concentrations of naturally radioactive elements were expressed in microcuries per gram or microcuries per liter, the content has been calculated in curies rather than grams. This is clearly indicated in the heading of the appropriate columns.

The contents of *carbon*, *hydrogen*, *oxygen*, and *nitrogen* for all tissues, organs, and components were calculated from their gross content of water, fat, protein, and carbohydrate, using the values in Table 106 as the concentrations of these elements in the gross components of tissue. In calculating the quantity of oxygen in skeleton, the amount in bone mineral was included.

Sodium, *potassium*, *chlorine*, and *iodine* in total body, may be estimated in other ways than as the sum of chemically determined quantities in the various tissues and organs.

Sodium. On the basis of isotopic dilution studies by various laboratories, Edelman and Leibman (ref. 18) suggest a value of 42 meq./kg for exchangeable sodium and 58 meq./kg for total sodium or 93 g of sodium in a 70-kg man. Moore *et al.* (ref. 53) give the value 40 meq./kg for exchangeable sodium (p. 76) and 6 meq./kg of residual sodium (p. 97) or about 75 g in a 70 kg man. On the same basis Forbes (ref. 24, p. 61) predicts the total body content of sodium of a 70-kg man to be about 70 g. A recent study of total body sodium by whole body neutron activation (ref. 12) indicates a value of about 50 meq./kg or 80 g in a 70-kg man. In general, estimations based on chemical analyses seem to be higher than estimations by other methods (refs. 12; 25).

Potassium. On the basis of isotopic dilution, Moore *et al.* (ref. 53) find the total exchangeable potassium to be about 130 g in a 70-kg man. Their estimated bone value of about 6 g brings the total potassium to 136 g. Wilde (ref. 93) quotes an estimated 133 g of exchangeable potassium. The natural potassium content estimated from measurements of ^{40}K in whole body counters (refs. 73; 3a; 58a) is about 145 g, which is approximately the value obtained by carcass analysis.

Chlorine. Moore *et al.* (ref. 53) estimate the exchangeable chloride in a 70-kg man at 98 g which is approximately the same value as the sum of the chlorine content of individual organs. Cotlove and Hogben (ref. 14, p. 116) suggest values from 84 g to 94 g in a 70-kg man.

Iodine. For this element the amount in total body has not been calculated as the sum of the amounts in the various organs and tissues but as the sum of thyroïdal and extra-thyroidal iodine. Although reported values for the concentration of iodine in thyroid vary widely, a value of 0.6 mg/g, or a total content of 12 mg in a normal 20-g thyroid, is a reasonable value for Reference Man. The value is also supported by recent studies employing x-ray spectrometry and direct activation analysis of living individuals. Values for concentration of iodine in other organs and tissues of the body are scarce and often unreliable.

Metabolic studies yielding information about the spaces in which iodine is distributed make possible an estimate of extrathyroidal iodine. These dynamic studies are usually based on a single injection or ingestion, and the application of the results to equilibrium conditions can be made only by extrapolation. Plasma protein bound iodine concentrations of 0.04–0.08 $\mu\text{g/ml}$ (ref. 21) are considered within the normal range. The value 0.06 $\mu\text{g/ml}$ has been chosen for Reference Man. Protein bound iodine in this concentration is distributed in a space of about 20 l (ref. 55), thus contributing about 1.2 mg to the body pool. Other plasma components with a concentration of about 0.002 $\mu\text{g/ml}$ and a distribution space of about 40 l contribute about 0.1 mg to the body pool. The total content of iodine associated with thyroid protein iodine and circulating iodine is therefore about 13 mg. This value is consistent with Berman's multi-compartmental model (ref. 5a).

There is some evidence by whole body counting that the half period of radioiodine in plasma differs from the half period of radioiodine in the body as a whole, suggesting that there may be sites of iodine retention which are not in rapid equilibrium with plasma components (ref. 58a). The total body content of iodine may exceed the 13 mg associated with thyroid protein and iodide. Determinations of iodine in tissues other than thyroid are necessary before a firm value for total body iodine can be established. Values of concentration suggested by Salter (ref. 60) and by Everett (ref. 20) for extrathyroidal organs and tissues appear to be high since, on the basis of these values, only about 20% of the total body iodine would appear in the thyroid.

Calcium. On the basis of Widdowson and Dickerson's published values (ref. 92, p. 39) a 70-kg man would contain 1265 g of calcium, of which the soft tissues would contribute about 5 g or 0.4%. In this report the value for total body calcium is 1014 g of which 3 g or 0.3% is in soft tissue. The values for the content of individual organs are generally lower in this report than those quoted by Widdowson and Dickerson from various authors. The discrepancies are probably due to the different methods of analysis employed by these authors.

Cobalt. Published values for the concentration of cobalt in supposedly normal human tissues vary widely—as much as a thousand fold (ref. 56). Thiers (ref. 77) pointed out that, since all glassware contains cobalt, all analyses which involve the use of glassware are suspect. When he analyzed blood serum under carefully controlled conditions he obtained values for cobalt that were a thousandth of the values previously reported. Tipton and her co-workers, whose material never touched glass, observed cobalt above the limit of detection of their method in fewer than half of the tissues analyzed. Parr and Taylor (ref. 56) measured cobalt by neutron activation and found values of the same order of magnitude as Tipton's and Thiers's. Both of these sets of values for soft tissue (Tipton's and Parr's) are lower by a factor of 10 to 200 than Butt's (ref. 10) or Koch's (ref. 42), for instance. In this report values have been arbitrarily based on the results of Tipton's and of Parr's analyses, since they agree and in neither method was glassware used. (Parr and Taylor's values for copper, iron, and zinc also agree with those of Tipton *et al.*)

Values for *cesium* were based on Yamagata's study of Japanese subjects (ref. 97). Since Tipton *et al.* (ref. 87) found few significant differences in the concentrations of many common elements in Japanese and Western subjects and since no values for cesium were available for Western subjects, Yamagata's values were used to establish the content of this element in Reference Man.

TABLE 106. ELEMENTAL COMPOSITION OF BODY COMPONENTS
(used in calculation of concentrations of these elements in tissue)

Component	Carbon		Hydrogen		Nitrogen		Oxygen	
	%	Ref.	%	Ref.	%	Ref.	%	Ref.
Water								
Fat	77	33, p. 87	11	33, p. 87			89	33, p. 87
Protein	52	27, p. 27	12	27, p. 27			11	27, p. 27
Carbohydrate	42	33, p. 47	7	33, p. 47	16	27, p. 27	23	27, p. 47
Bone ash			6				52	9, p. 385
							40	

TABLE 107. ELEMENTAL CONTENT OF BODY FAT AND BODY WATER

Component	Mass (g)	Carbon		Hydrogen		Oxygen	
		Quantity (g)	Ref.	Quantity (g)	Ref.	Quantity (g)	Ref.
Body fat	13,500	1.0E + 4	Table 106	1.6E + 3	Table 106	1.5E + 3	Table 106
Essential	1,500	1.2E + 3	Based on fat	1.8E + 2	Based on fat	1.7E + 2	Based on fat
Nonessential	12,000	9.2E + 3	Based on fat	1.4E + 3	Based on fat	1.3E + 3	Based on fat
Body water	42,000			4.6E + 3	Table 106	3.7E + 4	Table 106
Extracellular	18,000			2.0E + 3	Based on water	1.6E + 4	Based on water
Intracellular	24,000			2.6E + 3	Based on water	2.1E + 4	Based on water

TABLE 108. ELEMENTAL CONTENT OF ORGANS AND TISSUES OF REFERENCE MAN

(Analytical methods: AA, atomic absorption; C, chemistry; CO, colorimetry; F, fluorimetry; FS, flame spectroscopy; MS, mass spectrometry; NA, neutron activation; RC, radiochemistry; S, emission spectroscopy; SP, spectrophotometry; XF, x-ray fluorescence.)
(Asterisked quantities make up the totality of Reference Man)

Organ and tissue	Weight (g)	1 Aluminium		Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method
		Quantity in tissue or organ (g)	80% range (g)			
1 Total body	70,000	6.1E-2		Sum = soft tis. + skel. + teeth	??9E-3?	
1a Total soft tissue (does not include skeleton and teeth)	60,000	4.0E-2		Extrap. from 97% of soft tis.	??59E-3?	Extrap. from 11%
2 Adipose tissue (see skeleton for marrow)	15,000	5.2E-3	1.5E-3 - 1.9E-2	Sum		
3 Subcutaneous (hypodermis)*	7,500*	2.5E-3*	7.4E-4 - 5.9E-3	43, 84 (34) S		
4 Other separable*	5,000*	1.9E-3*	5.5E-4 - 1.1E-2	85 (oment.) (75) S		
5 Interstitial	1,000	3.2E-4	1.0E-4 - 7.7E-4	Based on subcut. adip.		
7 Adrenals (2)*	14*	1.1E-5*	3.8E-6 - 4.3E-5	85 (13) S		
8 Aorta*	100*	4.7E-5*	1.7E-5 - 2.0E-4	85 (104) S		
9 Contents (blood)*	190*	6.7E-5*		Based on blood	8.5E-7*	Based on blood
10 Blood (whole) (5200 ml × 1.06 g/ml)	5,500	1.9E-3		7	2.4E-5	7
11 Plasma (3000 ml × 1.03 g/ml)	3,100	1.3E-3		7	<4.6E-4	
12 Erythrocytes (2200 ml × 1.09 g/ml)	2,400	1.4E-4				
13 Blood vessels (dissectible)*	200*					
14 Contents (blood) (2900 ml)*	3,000*	1.0E-3*		Based on blood	1.3E-5*	Based on blood
21 Cartilage (see skeleton)	1,100	7.7E-4	3.5E-4 - 2.6E-3	43, 84 (68) S		
22 Connective tissue	3,400	2.4E-3		Based on cartilage		
26 Separable connective tissue*	1,600*	1.1E-3*		Based on cartilage		
27 Central nervous system (includes spinal cord)*				Sum		
28 Brain	1,430*	3.4E-4*	1.4E-4 - 8.3E-4	85 (127) S		
29 Cerebrum	1,400	3.4E-4	1.2E-4 - 7.2E-4	Based on brain		
30 Cerebellum	1,200	2.9E-4	1.5E-5 - 8.9E-5	Based on brain		
31 Brain stem	140	3.6E-5	2.9E-6 - 1.8E-5	Based on brain		
33 Contents (cerebrospinal fluid)*	30	7.2E-6				
35 Eye lenses (2)	120*					
36 Gall bladder*	0.4	3.9E-6*	1.7E-6 - 9.3E-6	84 (36) S		
38 GI tract*	10*	6.3E-4*	1.6E-4 - 1.6E-3	Sum		
40 Esophagus	1,200*	2.3E-5	8.0E-6 - 9.6E-5	85 (66) S		
41 Stomach	150	4.6E-5	1.9E-5 - 1.2E-4	85 (130) S		
43 Intestine	1,000	5.5E-4	1.3E-4 - 1.4E-3	Sum		
45 Small intestine	640	3.1E-4	1.1E-4 - 9.3E-4	Sum		
47 Duodenum	60	2.2E-5	8.4E-6 - 9.6E-5	85 (67) S		

48	Jejunum	280	9.8E-5	4.3E-5-3.4E-4	85 (101) S			
49	Ileum	300	1.7E-4	5.7E-5-4.8E-4	85 (82) S			
50	Large intestine	370	2.3E-4	6.4E-5-5.1E-4	Sum			
52	Upper large intestine	210	1.7E-4	4.2E-5-9.2E-5	Sum			
54	Ascending colon and cecum	90	7.3E-5	1.8E-5-3.9E-4	85 (31) S			
55	Transverse colon	120	9.6E-5	2.4E-5-5.2E-4	Based on cecum			
56	Lower large intestine	160	7.0E-5	2.3E-5-3.7E-4	Sum			
58	Descending colon	90	4.5E-5	1.4E-5-2.2E-4	Based on sigmoid colon			
59	Sigmoid colon	50	2.5E-5	7.5E-6-1.2E-4	85 (107) S			
60	Rectum	20	9.3E-6	2.6E-6-3.0E-5	85 (42) S			
61	Hair*	20*	9.3E-5*	7.0E-5*	72, p. 77		1.3E-4*	4 NA
62	Heart*	330*	7.0E-5*	3.2E-5-2.5E-4	85 (140) S			
63	Contents (blood)*	500*	1.8E-4*	4.3E-5-2.8E-4	Based on blood		2.2E-6*	Based on blood
64	Kidneys (2)*	310*	8.4E-5*	5.4E-6-3.2E-5	85 (141) S		9.3E-5*	46 (1) NA
65	Larynx*	28*	1.3E-5*	3.8E-4-2.5E-3	85 (50) S			
66	Liver*	1,800*	1.2E-3*	4.6E-3-3.4E-2	85 (148) S		3.6E-4*	46 (1) NA
67	Lung*	1,000*	1.2E-2*	1.9E-3-2.4E-2	Sum		6.0E-5*	Sum
68	Parenchyma plus capillary blood and bronchus	570	1.2E-2	1.4E-5-1.1E-4	85 (141) S		3.2E-5	52 (45) NA
69	Blood (arterial and venous)	430	1.5E-4	2.4E-6-5.0E-5	Based on blood		1.9E-6	Based on blood
73	Lymph nodes (dissectible)*	250*	3.7E-3*	<1.1E-2-5.0E-2	43, 84 S			
77	Muscle (skeletal)*	28,000*	5.6E-3*	8.3E-6*	85 (136) S			
79	Pancreas*	100*	2.9E-5*	2.1E-2*	85 (138) S			
82	Pituitary*	0.6*			85 (50) S			
83	Prostate*	16*			44, 86 (91) S		2.0E-3*	46 (1) NA
88	Skeleton*	10,000*			(see notes)			
89	Bone	5,000						
90	Cortical	4,000						
91	Trabecular	1,000						
92	Red marrow	1,500						
93	Yellow marrow	1,500						
94	Cartilage	1,100	4.9E-4	1.5E-4-1.1E-3	Based on subcut. adip.			
95	Periarticular tissue (skeletal)	900	7.7E-4	3.5E-4-2.6E-3	43, 84 (68) S			
96	Skin*	2,600*	6.3E-4	1.7E-3-2.4E-2	Based on cart.			
97	Epidermis	100	5.2E-3*		85 (22) S			
98	Dermis	2,500						
100	Spleen*	180*	6.3E-5*	2.5E-5-2.9E-4	85 (143) S		1.8E-5*	46 (1) NA
101	Teeth (32)*	46*						
102	Enamel	35						
103	Dentin	10						
105	Testes (2)*	35*	1.2E-5*	5.2E-6-3E-5	85 (72) S		1.7E-6*	46 (1) NA
106	Thymus*	20*	6.6E-6*		84 (9) S			
107	Thyroid*	20*	1.7E-4*	8.2E-6-7.7E-5	85 (21) S			
108	Tongue*	70*	6.0E-5*	2.5E-6-1.1E-4	84 (2) S			
110	Trachea*	10*	1.0E-5*	6.3E-6-5.0E-5	85 (60) S			
113	Urinary bladder*	45*	1.8E-5*		85 (110) S			
114	Contents (urine)*	102*	7.6E-5*		88, 89 S			

Organ and tissue	3 Arsenic		4 Barium		5 Beryllium	
	Quantity in tissue or organ (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method
1 Total body	71.8E-2?					
1a Total soft tissue	71.8E-2?					
2 Adipose tissue						
3 Subcutaneous*						
4 Other separable*						
5 Intestinal						
7 Adrenals (2)*						
8 Aorta*						
9 Contents (blood)*						
10 Blood (whole)	8.8E-5*					
11 Plasma	2.5E-3					
12 Erythrocytes	<9.3E-5					
13 Blood vessels*	5.9E-4					
14 Contents (blood)*						
21 Cartilage	1.4E-3*					
22 Connective tissue						
26 Separable connective tissue*						
27 Central nervous system*						
28 Brain						
29 Cerebrum						
30 Cerebellum						
31 Brain stem						
33 Contents* (CenSpFl)						
35 Eye lenses (2)						
36 Gall bladder*						
38 GI tract*						
40 Esophagus						
41 Stomach						
43 Intestine						
45 Small intestine						
47 Duodenum						
48 Jejunum						
49 Ileum						
50 Large intestine						
52 Upper large intestine						
54 Ascending colon and cecum						

55	Transverse colon			1.0E-5	4.6E-6	Based on cecum	
56	Lower large intestine			6.0E-6	1.7E-6	Sum	
58	Descending colon			3.2E-6	9.0E-7	Based on sigmoid colon	
59	Sigmoid colon			1.8E-6	5.0E-7	85 (108) S	
60	Rectum			9.3E-7	3.2E-7	85 (42) S	
61	Hair*	4.0E-5*	5 NA	1.0E-4*		59 p. 642	
62	Heart*			2.5E-6*	<6.6E-7	85 (140) S	1.4E-7*
63	Contents (blood)*			<9.5E-5*		Based on blood	<4.7E-8*
64	Kidney*	2.3E-4*	Based on blood	4.7E-6*	<6.8E-7	85 (142) S	2.4E-7*
65	Larynx*	9.3E-6*	46 (1) NA	4.9E-6*	1.3E-6	85 (50) S	
66	Liver*			<5.8E-6*	<4.3E-6	85 (146) S	
67	Lung*	1.8E-4*	8 CO	1.6E-4*		Sum	7.9E-7*
68	Parenchyma	2.5E-4*	Sum	8.6E-5	2.5E-5	85 (140) S	7.3E-6*
69	Blood	5.2E-5	46 (1) NA	<8.0E-5		Based on blood	7.3E-6
73	Lymph nodes (dissectible)*	2.0E-4	Based on blood	9.2E-5*		43, 84 S	<4.0E-8
77	Muscle (skeletal)*			1.4E-4*	<6.2E-5	85 (136) S	
79	Pancreas*			1.7E-6*	<2.4E-7	85 (139) S	
82	Pituitary*						4.5E-6*
83	Prostate*			3.7E-7*	<4.2E-8	85 (50) S	
88	Skeleton*	1.0E-4*	46 (1) NA	2.0E-2*		79, 80, 81, 82 S	9.5E-6*
89	Bone						bone
90	Cortical						50 (6) F
91	Trabecular						
92	Red marrow						
93	Yellow marrow						
94	Cartilage			1.9E-5	9.7E-6	Based on subcut. adip.	
95	Periarticular tissue			4.4E-5	3.1E-5	43, 84 (68) S	
96	Skin*			3.6E-5		Based on cart.	<2.8E-8
97	Epidermis			1.5E-4*	5.1E-5	85 (22) S	
98	Dermis						
100	Spleen*			1.3E-6*	<4.7E-7	85 (143) S	1.3E-7*
101	Teeth*	3.6E-6*	46 (1) NA				
102	Enamel						
103	Dentin						
105	Testes*	1.4E-6*	46 (1) NA	3.8E-7*	<7E-8	85 (72) S	
106	Thymus*			3.4E-7*		84 (9) S	
107	Thyroid*			1.6E-6*	4.2E-7	85 (21) S	
108	Tongue*			1.5E-6*		84 (2) S	
110	Trachea*			7.3E-7*	1.8E-7	85 (60) S	
113	Urinary bladder*			1.1E-6*	2.2E-7	85 (110) S	
114	Contents (urine)*			1.2E-5*		88, 89 S	

Organ and tissue	6 Bismuth		7 Boron		8 Bromine	
	Quantity in tissue or organ (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method
1 Total body						
1a Total soft tissue	<2.3E-4	Extrap. from 96% Sum 43, 84	<2.0E-2 1.4E-2	Extrap. from 92% Sum	2.0E-1 1.7E-1	Extrap. from 72% Sum
2 Adipose tissue	<6.0E-5	<3.8E-5 - <2.6E-4	1.1E-3	Based on oment.	6.4E-3	
3 Subcutaneous*	<3.0E-5*	<2.3E-5 - <1.2E-4	7.5E-4*	85 (105) S		
4 Other separable*	<2.0E-5*	<8.0E-6 - <1.0E-4	<1.0E-4*	85 (oment.) (74) S		
5 Interstitial	<4.0E-6	<3.0E-6 - <1.6E-5	1.0E-4	Based on subcut. adip.		
7 Adrenals (2)*	<1.4E-7*	<5.6E-8 - 2.8E-7	9.8E.7*	85 (15) S	3.1E-5*	54 (1) C
8 Aorta*	<3.0E-6*	<2.0E-6 - 2.0E-5	<1.4E-5*	85 (105) S	8.2E-4*	Based on blood
9 Contents (blood)*	<2.2E-6*		1.8E-5*	Based on blood	2.6E-2	31b (1800) XF
10 Blood (whole)	<6.2E-5	57 (animal) S	5.2E-4	37 SC	1.7E-2	7
11 Plasma	<3.1E-4	30 (3) XF			7.5E-3	7
12 Erythrocytes						
13 Blood vessels*						
14 Contents (blood)*						
21 Cartilage	<1.4E-4	44, 86 (68) S	2.8E-4*	Based on blood	1.1E-2*	Based on blood
22 Connective tissue	<4.3E-4	Based on cart.			5.5E-4	15
26 Separable connective tissue*	<2.0E-4*	Based on cart.			1.7E-3	Based on cart.
27 Central nervous system*	<4.5E-5*	Sum	<2.2E-4*	Sum	8.0E-4*	
28 Brain	<4.5E-5	85 (129) S	<2.2E-4	85 (129) S	1.3E-3	Sum
29 Cerebrum	<3.9E-5	<3.9E-5 - <5.9E-5	<2.0E-4	Based on brain	8.5E-4	54 (3) C
30 Cerebellum	<4.8E-6	<4.2E-6 - <6.3E-6	<2.4E-5	Based on brain	3.4E-4	54 (3) C
31 Brain stem	<9.6E-7	<8.4E-7 - <1.3E-6	<4.8E-6	Based on brain	5.1E-5	54 (2) C
33 Contents* (CerSpFlu)						
35 Eye lenses (2)*						
36 Gall bladder*	<3.1E-7*	<1.6E-7 - <6.0E-7	<9.4E-5*	Sum	2.2E-5*	54 (1) C
38 GI tract*	<1.9E-5*	<1.0E-5 - 2.0E-4	<3.6E-6	85 (68) S	6.0E-3*	Sum
40 Esophagus	<8.0E-7	<5.2E-7 - <1.4E-6	<2.6E-6	85 (131) S	9.0E-4	54 (3) C
41 Stomach	<2.4E-6	<1.6E-6 - <3.0E-6	<1.2E-5	Sum	5.1E-3	Sum
43 Intestine	<1.6E-5	<9.6E-6 - 1.9E-4	<7.7E-5	Sum	2.9E-3	54 (2) C
45 Small intestine	<1.1E-5	<7.7E-6 - 4.8E-5	<5.2E-5	85 (68) S	2.8E-4	Based on sm. intest.
47 Duodenum	<9.6E-7	<7.2E-7 - 4.4E-6	<4.8E-6	85 (104) S	1.2E-3	Based on sm. intest.
48 Jejunum	<5.0E-6	<4.0E-6 - 2.5E-5	<2.5E-5			

49	Ileum	<4.8E-6	<3.0E-6-2.0E-5	85 (84) S	<2.4E-5	<1.5E-5-3.9E-5	85 (84) S	1.4E-3	Based on sm. intest.
50	Large intestine	<5.3E-6	<2.7E-6-1.1E-4	Sum	<2.7E-5	<1.6E-5-3.4E-5	Sum	2.1E-3	54 (1) C
52	Upper large intestine	<2.9E-6	<1.7E-6-4.5E-5	Sum	<1.5E-5	<8.4E-6-2.2E-5	Sum	1.2E-3	Based on large intest.
54	Ascending colon and cecum	<1.3E-6	<7.2E-7-1.9E-5	85 (31) S	<6.3E-6	<3.6E-6-8.9E-6	85 (31) S	5.0E-4	Based on large intest.
55	Transverse colon	<1.7E-6	<9.6E-7-2.6E-5	Based on cecum	<8.8E-6	<4.8E-6-1.2E-5	Based on cecum	6.7E-4	Based on large intest.
56	Lower large intestine	<2.3E-6	<9.6E-7-5.9E-6	Sum	<1.2E-5	<7.0E-6-1.7E-5	Sum	8.9E-4	Based on large intest.
58	Descending colon	<1.3E-6	<2.7E-7-2.7E-6	Based on sig. colon	<6.3E-6	<3.6E-6-9.0E-6	Based on sig. colon	5.0E-4	Based on large intest.
59	Sigmoid colon	<7.1E-7	<4.0E-7-1.5E-6	85 (109) S	<3.5E-6	<2.0E-6-5.0E-6	85 (109) S	2.7E-4	Based on large intest.
60	Rectum	<3.2E-7	<2.0E-7-1.8E-6	85 (42) S	<1.4E-6	<1.2E-6-3.2E-6	85 (42) S	1.1E-4	Based on large intest.
61	Hair*				1.0E-4*			2.5E-4*	72, p. 77 C
62	Heart*	<6.6E-6*	<5.4E-6-7.2E-6	85 (140) S	6.0E-4*		59, p. 642	1.9E-4*	54 (5) C
63	Contents (blood)*	<4.4E-6*		Based on blood	3.7E-5*	2.2E-5-6.7E-5	Based on blood	1.7E-3*	Based on blood
64	Kidney*	<7.4E-6*	<6.2E-6-1.5E-4	85 (145) S	9.9E-5*	<3.9E-6-1.6E-5	23	1.7E-3*	54 (3) C
65	Larynx*	<1.8E-6*	<7.8E-7-2.1E-6	85 (50) S	<8.4E-6*		85 (50) S	4.7E-3*	54 (5) C
66	Liver*	<4.7E-5*	<4.0E-5-2.0E-4	85 (150) S	1.6E-4*		23 (2) CO	4.7E-3*	Sum
67	Lung*	<1.8E-5*		Sum	1.3E-4*		Sum	2.9E-3	54 (5) C
68	Parenchyma	<1.3E-5	<1.2E-5-1.5E-5	85 (141) S	9.2E-5		23 (2) CO	1.8E-3	Based on blood
69	Blood	<4.8E-6		Based on blood	4.0E-5	2.4E-5-7.2E-5	Based on blood		
73	Lymph nodes (dissectible)*	<1.4E-4*		43, 84 S					
77	Muscle (skeletal)*	<6.7E-4*	<5.6E-4-8.4E-4	85 (136) S	8.1E-3*		23 (2) CO	1.2E-1*	54 (2) C
79	Pancreas*	<2.4E-6*	<1.4E-6-3.4E-6	85 (139) S	<1.2E-5*	<7.0E-6-1.6E-5	85 (139) S	4.7E-4*	54 (2) C
82	Pituitary*							3.0E-7*	54 (2) C
83	Prostate*	<3.5E-7*	<2.6E-7-5.8E-7	85 (50) S	<1.8E-6*	<1.3E-6-2.2E-6	85 (50) S	4.5E-5*	54 (1) C
88	Skeleton*				7.4E-3*		23 (2) CO	2.8E-2*	54 (2) C
89	Bone								
90	Cortical								
91	Trabecular								
92	Red marrow								
93	Yellow marrow	<5.3E-6	<4E-6-2.1E-5	Based on subcut. adip.	1.3E-4		Based on subcut. adip.		
94	Cartilage	<1.4E-4		44, 86 (68) S				5.5E-4	15
95	Parietal tissue	<1.1E-4		Based on cart.				4.5E-4	Based on cart.
96	Skin*	<3.9E-5*	<2.5E-5-1E-4	85 (22) S	1 E-3*		23 (2) CO		
97	Epidermis								
98	Dermis	<5.0E-6*	<4.0E-6-6.1E-6	85 (143) S	1.4E-5*		23 (2) CO	7.9E-4*	54 (5) C
100	Spleen*								
101	Teeth*								
102	Enamel								
103	Dentin								
105	Testes (2)*	<7.6E-7*	<6.4E-7-7.6E-6	85 (72) S	<3.8E-6*	<3.1E-6-4.5E-6	85 (72) S	8.7E-5*	54 (1) C
106	Thymus*	<1.9E-7*		84 (9) S	8.0E-7*		84 (5) S	2.8E-5*	54 (1) C
107	Thyroid*	<4.7E-7*	<3.6E-7-2.7E-6	85 (21) S	<2.2E-6*	<1.7E-6-3.6E-6	85 (21) S	4.0E-4*	54 (2) C
108	Tongue*	4.6E-4*		84 (2) S	<8.4E-6*		84 (2) S		
110	Trachea*	<3.3E-7*	<2.4E-7-8.0E-7	85 (60) S	<1.7E-6*	<1.3E-6-3.4E-6	85 (60) S		
113	Urinary bladder*	<7.2E-7*	<4.5E-7-1.1E-6	85 (110) S	<3.6E-6*	<2.5E-6-6.3E-6	85 (112) S		
114	Contents (urine)*				8.7E-5*		88, 89 S		

Organ and tissue	9 Cadmium			10 Calcium			11 Carbon	
	Quantity in tissue or organ (g)	80% range (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	80% range (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method
1 Total body	5.0E-2			1.0E-3			1.6E+4	2-20
1a Total soft tissue	3.8E-2			1.4E+1			1.4E+4	Difference
2 Adipose tissue	7.0E-4	3.2E-4 - 2.9E-3	Extrap. from 97%	3.4E-1		Extrap. from 93%	9.6E+3	2-20
3 Subcutaneous*	1.5E-4*	6.8E-5 - 6.6E-4	Sum 43, 84 (34) S	1.7E-1*		Sum Based on oment.	4.8E+3*	Based on adip.
4 Other separable*	<5.0E-4*	<2.3E-4 - 2.0E-3	85 (oment.) (74) S	1.1E-1*	2.8E-2 - 3.3E-1	85 (oment.) (72) S	3.2E+3*	Based on adip.
5 Interstitial	2.0E-5	9.0E-6 - 8.8E-5	Based on subcut. adip.	2.2E-2		Based on subcut. adip.	6.4E+2	Based on adip.
7 Adrenals (2)*	4.9E-6*	<1.4E-6 - 9.8E-6	85 (15) S	5.7E-4*	1.8E-4 - 1.1E-3	85 (10) S	4.0*	2-20
8 Aorta*	<7.5E-5*	<4.5E-5 - 1.6E-7	85 (105) S	7.8E-2*	2.9E-2 - 1.7E-1	85 (94) S	1.5E+1*	2-20
9 Contents (blood)*	1.3E-6*	7.2E-7 - 2.3E-6	Based on blood	1.1E-2*		Based on blood	1.9E+1*	Based on blood
10 Blood (whole)	3.6E-5	2.1E-5 - 6.8E-5	37 SC	3.1E-1		7	5.4E+2	2-20
11 Plasma	<3.1E-4		30 XF	2.9E-1		7	1.3E+2	2-20
12 Erythrocytes				1.2E-2		7	4.1E+2	Difference
13 Blood vessels*								
14 Contents (blood)*	2.0E-5*		Based on blood	1.7E-1*		Based on blood	3.0E+2*	Based on blood
21 Cartilage	<1.4E-4	<1.0E-4 - <3.9E-4	44, 86 (68) S			Based on blood	1.1E+2	2-20
22 Connective tissue	<4.3E-4		Based on cart.				6.5E+2	Based on cart.
26 Separable connective tissue*	<2.0E-4*		Based on cart.				3.2E+2*	Based on cart.
27 Central nervous system*	(<1.1E-3)*			1.2E-1*			1.8E+2*	Based on brain
28 Brain	(<1.1E-3)		85 (129) S	1.2E-1	7.3E-2 - 2.1E-1	85 (108) S	1.7E+2	2-20
29 Cerebrum	(<9.8E-4)		Based on brain	1.1E-1	6.3E-2 - 1.8E-1	Based on brain	1.6E+2	Based on brain
30 Cerebellum	(<1.2E-4)		Based on brain	1.3E-2	7.8E-3 - 2.3E-2	Based on brain	1.9E+1	Based on brain
31 Brain stem	(<2.4E-5)		Based on brain	2.6E-3	1.6E-3 - 4.5E-3	Based on brain	4.0	Based on brain
33 Contents* (CerSpFl)				5.5E-3*		3	1.6E-2*	2-20
35 Eye lenses (2)	2.7E-6*	9.7E-7 - 5.8E-6	84 (36) S			Sum	8.0E-2	2-20
36 Gall bladder*	<4.7E-4*	<3.0E-4 - 1.0E-3	Sum	1.2E-1*	5.8E-2 - 2.5E-1	Sum	1.4E+2*	Based on intest.
38 GI tract*								
40 Esophagus	<1.8E-5	<1.3E-5 - <2.9E-5	85 (68) S	3.8E-3	2.6E-3 - 9.6E-3	85 (57) S		2-20
41 Stomach	<6.0E-5	<4.1E-5 - 1.1E-4	85 (131) S	1.0E-2	5.7E-3 - 2.2E-2	85 (110) S	1.8E+1	2-20
43 Intestine	<3.9E-4	<2.4E-4 - 5.8E-4	Sum	9.9E-2	4.9E-2 - 2.2E-1	Sum	9.4E+1	Based on
45 Small intestine	2.7E-4	<1.8E-4 - 4.4E-4	Sum	5.4E-2	2.4E-2 - 1.2E-1	Sum	7.4E+1	Based on intest.
47 Duodenum	2.8E-5	<1.9E-5 - 4.4E-5	85 (68) S	4.0E-3	2.2E-3 - 4.2E-3	85 (60) S	6.9	Based on intest.
48 Jejunum	1.4E-4	<9.9E-5 - 2.5E-4	85 (104) S	1.9E-2	1.0E-2 - 2.5E-2	85 (83) S	3.2E+1	Based on intest.
49 Ileum	<1.2E-4	<7.5E-5 - 1.6E-4	85 (84)	2.9E-2	1.2E-2 - 7.2E-2	85 (77)	3.5E+1	Based on intest.

50	Large intestine	<1.3E-4	<7.4E-5 - 1.8E-4	Sum	4.2E-2	2.2E-2 - 8.9E-2	Sum	4.3E+1	Based on intest.
52	Upper large intestine	<7.5E-5	<4.2E-5 - 9.2E-5	Sum	2.8E-2	1.5E-2 - 5.5E-2	Sum	2.4E+1	Based on intest.
54	Ascending colon and cecum	<3.2E-5	<1.8E-5 - 4.4E-5	85 (31) S	1.2E-2	6.4E-3 - 2.3E-2	85 (31) S	1.1E+1	Based on intest.
55	Transverse colon	<4.2E-5	<2.4E-5 - 5.8E-5	Based on cecum	1.6E-2	8.8E-3 - 3.1E-2	Based on cecum	1.4E+1	Based on intest.
56	Lower large intestine	<5.6E-5	<3.3E-5 - 8.3E-5	Sum	1.5E-2	7.7E-3 - 3.2E-2	Sum	1.9E+1	Based on intest.
58	Descending colon	<3.2E-5	<1.8E-5 - 1.0E-5	Based on sig. colon	8.4E-3	3.3E-3 - 1.7E-2	Based on sig. colon	1.1E+1	Based on intest.
59	Sigmoid colon	<1.8E-5	<1.0E-5 - 2.5E-5	85 (109) S	4.6E-3	1.8E-3 - 9.6E-3	85 (88) S	5.8	Based on intest.
60	Rectum	<7.3E-6	<5.0E-6 - 1.3E-5	85 (42) S	2.2E-3	1.6E-3 - 5.2E-3	85 (41) S	2.3	Based on intest.
61	Hair*	<1.6E-4*	<1.4E-4 - 1.8E-4	85 (140) S	6.4E-2*	7.0E-3 - 2.5E-2	13	9.8*	2-20
62	Heart*	2.6E-6*	1.5E-6 - 4.8E-6	Based on blood	1.2E-2*	2.9E-2*	85 (120) S	5.4E+1*	2-20
63	Contents (blood)*	9.9E-3*	<5.5E-3 - 1.7E-2	85 (145) S	2.2E-2*	1.8E-2 - 5.3E-2	Based on blood	4.9E+1*	Based on blood
64	Kidney*	<4.3E-5*	<1.9E-5 - <7.8E-5	85 (50) S	6.2E-2*	9.9E-3 - 1.2E-1	85 (121) S	4.0E+1*	2-20
65	Larynx*	4.0E-3*	1.5E-3 - 7.9E-3	85 (150) S	9.0E-2*	4.3E-2 - 1.7E-1	85 (49) S	2.6E+2*	2-20
66	Liver*	3.5E-4*	<2.8E-5 - 6.9E-4	Sum	8.7E-2*	4.0E-2 - 1.2E-1	85 (126) S	1.0E+2*	Sum
67	Lung*	3.5E-4*		85 (141) S	6.3E-2		Sum	5.8E+1	Based on lung, 2-20
68	Parenchyma			Based on blood	2.4E-2		85 (119) S	4.3E+1	Based on blood
69	Blood	2.8E-6		43, 84 S			Based on blood		
73	Lymph nodes (dissectible)*	4.5E-5*							
77	Muscle (skeletal)*	<1.7E-2*	<1.4E-2 - <2.1E-2	85 (137) S	8.7E-1*	5.3E-1 - 1.8	85 (119) S	3.0E+3*	2-20
79	Pancreas*	9.6E-5*	<4.8E-5 - 2.1E-4	85 (139) S	9.1E-3*	3.7E-3 - 1.7E-2	85 (119) S	1.3E+1*	2-20
82	Pituitary*								
83	Prostate*	<9.6E-6*	<6.4E-6 - 1.9E-5	85 (50) S	3.5E-3*	1.9E-3 - 1.0E-2	85 (40) S	1.4*	2-20
88	Skeleton*	<1.2E-2*	<7.5E-3 - <1.8E-2	44, 86 (91) S	1.0E+3*	6.3E+2 - 1.6E+3	44, 86 (91) S	2.5E+3*	2-20
89	Bone				8.0E+2		95	7.4E+2	2-20
90	Cortical							5.5E+2	2-20
91	Trabecular							1.3E+2	2-20
92	Red marrow							6.2E+2	2-20
93	Yellow marrow	2.6E-5	1.1E-5 - 1.1E-4	Based on subcut. adip.	2.9E-2		Based on subcut. adip.	9.5E+2	2-20
94	Cartilage	<1.4E-4	<1.0E-4 - <3.9E-4	44, 86 (68) S				1.1E+2	2-20
95	Periarticular tissue	<1.1E-1		Based on cart.			85 (19) S	8.2E+1	2-20
96	Skin*	<9E-4*		85 (22) S	3.9E-1*	1.8E-1 - 4.7E-1	75	5.9E+2*	2-20
97	Epidermis				2E-2		By difference		
98	Dermis				4.1E-1		85 (122) S	2.0E+1*	2-20
100	Spleen*	<1.3E-4*	<1.1E-4 - 1.6E-4	85 (143) S	1.2E-2*	6.8E-3 - 2.0E-2	Sum	4.3*	2-20
101	Teeth*				1.3E+1*		4	6E-2	2-20
102	Enamel				3.5		4	8.3E-1	2-20
103	Dentin				9.2		3.1*		2-20
105	Testes*	<1.9E-5*	<9.6E-5 - 2.4E-5	85 (72) S	3.3E-3*	2.2E-3 - 5.2E-3	85 (68) S		
106	Thymus*	3.4E-6*	<9.0E-6 - 6.7E-5	43, 84 (9) S	1.7E-3*	4.2E-3 - 1.1E-2	84 (4) S	2.1*	2-20
107	Thyroid*	1.1E-5*	<4.7E-6 - 1.4E-5	85 (21)	7.0E-3*	2.4E-3 - 2.8E-2	85 (14) S	1.7E+1*	2-20
108	Tongue*	<1.8E-5*	<1.3E-5 - 2.7E-5	52 (8) NA	1.5E-2*		84 (2) S		
110	Trachea*	<8.0E-6*		85 (60) S	5.5E-3*		85 (57) S		
113	Urinary bladder*	<1.8E-5*		85 (112) S	4.5E-3*		85 (98) S		
114	Contents (urine)*	1.6E-7*		37, 57	1.3E-2*		88, 89 S	3.4E-1*	3-34

50	Large intestine	1.6E-6	7.8E-7 - 3.6E-6	97 (13) NA	5.0E-1	Based on GI tract	1.0E-5	3.3E-6 - 4.8E-5	Sum
52	Upper large intestine	8.4E-7	4.5E-7 - 7.8E-6	Based on large intest.	2.9E-1	Based on GI tract	6.3E-6	2.9E-6 - 3.2E-5	Sum
54	Ascending colon and cecum	4.1E-7	1.9E-7 - 3.3E-6	Based on large intest.	1.3E-1	Based on GI tract	2.7E-6	1.3E-6 - 7.7E-6	85 (31) S
55	Transverse colon	5.5E-7	2.6E-7 - 4.5E-6	Based on large intest.	1.7E-1	Based on GI tract	3.6E-6	1.7E-6 - 1.4E-5	Based on cecum
56	Lower large intestine	9.0E-7	< 7.9E-7 - < 5.1E-6	Based on large intest.	2.0E-1	Based on GI tract	3.9E-6	5.9E-7 - 1.7E-5	Sum
56	Intestine	4.1E-7	1.9E-7 - 3.3E-6	Based on large intest.	1.3E-1	Based on GI tract	2.2E-6	2.7E-7 - 9.9E-6	Based on
58	Descending colon	2.3E-7	1.0E-7 - 1.8E-6	Based on large intest.	7.1E-2	Based on GI tract	1.2E-6	1.5E-7 - 5.4E-6	sig. colon 85 (108) S
59	Sigmoid colon	2.4E-7		97 (2) NA	2.8E-2	Based on GI tract	5.4E-7	1.8E-7 - 2.0E-6	85 (42) S
60	Rectum								
61	Hair*	2.8E-3*			2.8E-3*	15 C	7.6E-5*		59, p. 642
62	Heart*	1.1E-6*			5.4E-1*	26 (2) C	5.2E-6*		85 (140) S
63	Contents (blood)*	2.3E-6*			1.1*	Based on blood	1.0E-5*		Based on blood
64	Kidney*		1.7E-6 - 3.7E-6	97 (13) NA	7.4E-1*	26 (2) C	3.1E-6*		85 (142) S
65	Larynx*						1.3E-8*		85 (49) S
66	Liver*	2.0E-5*	1.2E-5 - 6.3E-5	97 (14) NA	3.6*	26 (2) C	1.6E-5*		85 (146) S
67	Lung*	6.2E-6*		Sum	2.6*	Sum	9.2E-5*		Sum
68	Parenchyma	5.1E-6	2.6E-5 - 3.5E-4	97 (16) NA	1.4	26 (2) C	8.1E-5		85 (139) S
69	Blood	1.1E-6		Based on blood	1.2	Based on blood	1.1E-5		Based on blood
73	Lymph nodes (dissectible)*						7.0E-5*		43, 84 S
77	Muscle (skeletal)*	5.7E-4*	4.2E-4 - 8.4E-4	97 (12) NA	2.2E+1*	26 (2) C	3.4E-4*		85 (136) S
79	Pancreas*	8.9E-7*	4.7E-7 - 5.1E-6	97 (13) NA	1.6E-1*	17, p. 282	1.8E-6*		85 (139) S
82	Pituitary*								
83	Prostate*	1.2E-7*		97 (6) NA	1.4E+1*	26 (2) C	1.6E-7*		85 (50) S
88	Skeleton*	1.6E-4*	8.8E-5 - 5.4E-4	(8) NA			< 4.8E-3*		44, 86 (91) S
89	Bone						4.4E-3		70
90	Cortical								
91	Trabecular								
92	Red Marrow								
93	Yellow marrow								
94	Cartilage								
95	Periarticular tissue								
96	Skin*								
97	Epidermis								
98	Dermis								
100	Spleen*	1.7E-6*	9.9E-7 - 5.0E-6	97 (13) NA	2.9E-1*	17, p. 282	1.3E-6*		85 (143) S
101	Teeth*								
102	Enamel								
103	Dentin								
105	Testes (2)*	4.0E-7*	3.1E-7 - 1.1E-6	97 (12) NA	8.2E-2*	17, p. 282	5.8E-7*		85 (72) S
106	Thymus*	4.6E-8*		97 (3) NA	1.8E-7*		1.8E-7*		43, 84 (9) S
107	Thyroid*	1.5E-7*	9.0E-8 - 4.7E-7	97 (14) NA	3.4E-2*	17, p. 282	2.7E-7*		85 (21) S
108	Tongue*						2.0E-6*		84 (2) S
110	Trachea*						4.8E-7*		85 (60) S
113	Urinary bladder*	5.2E-7*	1.8E-7 - 1.8E-6	97 (16) NA			1.0E-6*		85 (110) S
114	Contents (urine)*						8.7E-6*		88, 89 S

Organ and tissue	15 Cobalt			16 Copper		17 Fluorine	
	Quantity in tissue or organ (g)	80% range (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	80% range (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)
1 Total body	<1.5E-3			7.2E-2			2.6
1a Total soft tissue	<1.2E-3		Extrap. from 97%	6.5E-2			2.9E-2
2 Adipose tissue	3.6E-4		Sum	3.6E-3	1.1E-3 - 6.8E-3		
3 Subcutaneous*	2.5E-4*		Based on oment.	1.4E-3*	9.8E-5 - 4.1E-4		
4 Other separable*	<3.0E-5*	<9.0E-6 - 1.5E-4	85 (oment.) (75) S	1.7E-3*	7.0E-4 - 5.0E-3		
5 Interstitial	3.2E-5		Based on subcut. adip.	1.9E-4	1.2E-4 - 5.4E-4		
7 Adrenals (2)*	<2.0E-7*	<5.6E-8 - 9.1E-7	85 (14) S	1.5E-5*	5.3E-6 - 2.1E-5		
8 Aorta*	<3.0E-6*	<1.8E-6 - 9.0E-6	85 (104) S	1.3E-4*	8.1E-5 - 2.2E-4		
9 Contents (blood)*	5.9E-8*		Based on blood	2.0E-4*			2.8E-3*
10 Blood (whole)	1.7E-6		7	5.6E-3			3.3E-5*
11 Plasma	1.4E-6		7	3.5E-3			9.5E-4
12 Erythrocytes	3.4E-7		7	2.2E-3			8.7E-4
13 Blood vessels*							1.7E-4
14 Contents (blood)*	9.3E-7*		Based on blood	3.1E-3*			5.2E-4*
21 Cartilage	<6.6E-5	<4.3E-5 - 3.4E-4	44, 86 (68) S	7.7E-4	4.2E-4 - 1.3E-3		
22 Connective tissue	<2.0E-4		Based on cart.	2.4E-3			
26 Separable connective tissue*	<9.6E-5*		Based on cart.	1.1E-3*			
27 Central nervous system*							
28 Brain	<4.5E-5*		Based on brain	8.1E-3*			
29 Cerebrum	<4.5E-5	<3.9E-5 - <5.9E-5	85 (129) S	8.1E-3	5.5E-3 - 1.2E-2		2.1E-3*
30 Cerebellum	<3.9E-5	<3.4E-5 - <5.1E-5	Based on brain	7.1E-3	4.8E-3 - 1.0E-2		2.1E-3
31 Brain stem	<4.8E-6	<4.2E-6 - <6.3E-6	Based on brain	8.7E-4	5.9E-4 - 1.3E-3		1.8E-3
33 Contents* (CerSpFl)	<9.6E-7	<8.4E-7 - <1.3E-6	Based on brain	1.7E-4	1.2E-4 - 2.6E-4		2.3E-4
35 Eye lenses (2)				1.6E-5*			4.5E-5
36 Gall bladder*	1.8E-7*	<1.1E-7 - 8.1E-7	84 (36) S	2.0E-5*	8.6E-6 - 5.2E-5		
38 GI tract*	<1.9E-5*	<1.2E-5 - <6.2E-5	Sum	2.0E-3*	1.2E-3 - 3.3E-3		
40 Esophagus	<7.2E-7	<6.2E-7 - <1.3E-6	85 (67) S	4.8E-5	3.8E-5 - 8.8E-5		
41 Stomach	<2.4E-6	<1.6E-6 - 3.5E-6	85 (131) S	2.5E-4	1.6E-4 - 3.5E-4		
43 Intestine	<1.6E-5	<9.6E-6 - 5.6E-5	Sum	1.7E-3	9.7E-4 - 2.8E-3		
45 Small intestine	<1.1E-5	<7.0E-6 - <2.0E-5	Sum	1.0E-3	7.6E-4 - 2.0E-3		
47 Duodenum	<9.6E-7	<7.2E-7 - <1.3E-6	85 (67) S	1.3E-4	7.2E-4 - 2.2E-4		
48 Jejunum	<5.0E-6	<3.4E-6 - 7.2E-6	85 (102) S	5.9E-4	3.7E-4 - 8.4E-4		
49 Ileum	<4.8E-6	<3.0E-6 - 1.7E-5	85 (83) S	5.4E-4	3.6E-4 - 9.3E-4		
50 Large intestine	<5.3E-6	<3.0E-6 - 2.5E-5	Sum	4.8E-4	2.8E-4 - 8.0E-4		

52	Upper large intestine	<2.9E-6	Sum	2.5E-4	1.6E-4 - 4.4E-4	Sum		
54	Ascending colon and cecum	<1.3E-6	85 (31) S	1.1E-4	6.8E-5 - 1.9E-4	85 (31) S		
55	Transverse colon	<1.7E-6	Based on cecum	1.4E-4	8.8E-5 - 2.6E-4	Based on cecum		
56	Lower large intestine	<2.3E-6	Sum	2.2E-4	1.2E-4 - 4.0E-4	Sum		
58	Descending colon	<1.3E-6	Based on sig. colon	1.3E-4	6.8E-5 - 2.4E-4	Based on sig. colon		
59	Sigmoid colon	<7.1E-6	85 (108) S	7.1E-5	3.8E-5 - 1.3E-4	85 (108) S		
60	Rectum	3.2E-7	85 (42) S	2.4E-5	1.6E-5 - 4.8E-5	85 (42) S		
61	Hair*	3.1E-4*	72 p. 77	3.1E-4*		13		
62	Heart*	1.0E-5*	20 p. 533	1.0E-3*	7.8E-4 - 1.5E-3	85 (140) S	5.8E-4*	11 SP
63	Contents (blood)*	1.2E-7*	Based on blood	4.0E-4*		Based on blood	6.4E-5*	Based on blood
64	Kidney*	4.0E-6*	56 (6) NA	9.0E-4*	6.5E-4 - 1.2E-3	85 (143) S	7.1E-4*	11 SP
65	Larynx*	<1.7E-7*	85 (50) S	2.8E-5*	1.6E-5 - 1.5E-4	85 (50) S		
66	Liver*	1.1E-4*	56 (6) NA	1.2E-2*	7.6E-3 - 3.1E-2	85 (148) S	2.5E-3*	11 SP
67	Lung*	2.0E-5*	Sum	1.2E-3*		Sum	2.1E-3*	Sum
68	Parenchyma	1.9E-5	23 (2) C	8.1E-4	5.8E-4 - 1.2E-3	85 (141) S	2.0E-3	11 SP
69	Blood	1.3E-6	Based on blood	4.4E-4		Based on blood	7.0E-5	Based on blood
73	Lymph nodes (dissectible)*	(<2.7E-6)*	43, 84	2.2E-4*		43, 84		
77	Muscle (skeletal)*	2.0E-4*	23 (2) C	2.5E-2*	1.7E-2 - 3.9E-2	85 (136) S	1.5E-2*	69, p. 92
79	Pancreas*	2.4E-6*	85 (139) S	1.5E-4*	1.0E-4 - 2.3E-4	85 (138) S	1.7E-4*	11 SP
82	Pituitary*							
83	Prostate*	<3.5E-7*	85 (50) S	1.8E-5*	1.2E-5 - 2.7E-5	85 (50) S		
88	Skeleton*	2.8E-4*	23 (2) C	7.2E-3*	4.3E-3 - 1.2E-2	44, 86 (91) S	2.5*	69, p. 93
89	Bone					70		
90	Cortical			3.2E-3				
91	Trabecular							
92	Red marrow							
93	Yellow marrow	4.3E-5	Based on subcut. adip.	2.5E-4	1.7E-4 - 7.1E-4	Based on subcut. adip.		
94	Cartilage	<6.6E-5	44, 86 (68) S	7.7E-4	4.2E-4 - 1.3E-3	44, 86 (68) S		
95	Periarticular tissue	<5.4E-5	Based on cart.	6.3E-4		Based on cart.		
96	Skin*	4.9E-5*	23 (2) C	2E-3*	1.2E-3 - 3.6E-3	85 (22) S	1.6E-3*	69, p. 92
97	Epidermis							
98	Dermis							
100	Spleen*	6.3E-6*	23 (2) C	2.2E-4*	1.6E-4 - 3.1E-4	85 (143) S	3.2E-4*	11 SP
101	Teeth*						3.5E-3*	69, p. 92 P
102	Enamel							
103	Dentin							
105	Testes (2)*	<7.6E-7*	85 (72) S	2.9E-5*	2.1E-5 - 4.2E-5	85 (71) S		
106	Thymus*	<1.7E-7*	43, 84 (8) S	1.4E-5*		43, 84 (9) S		
107	Thyroid*	<2.2E-7*	85 (21) S	2.2E-5*	1.2E-5 - 4.7E-5	85 (20) S		
108	Tongue*	(<1.7E-6)*	43, 84 (2) S	9.8E-5*		43, 84 (2) S	8.0E-5*	11 SP
110	Trachea*	<1.9E-7*	85 (60) S	9.3E-6*	5.7E-6 - 1.6E-5	85 (60) S		
113	Urinary bladder*	<3.4E-7*	85 (110) S	3.8E-5*	2.5E-5 - 5.9E-5	85 (110) S		
114	Contents (urine)*	2.1E-5*	88, 89 S	1.1E-5*		88, 89 S		

I.C.R.P. 23-1

Organ and tissue	18 Gold			19 Hydrogen		20 Iodine	
	Quantity in tissue or organ (g)	80% range (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method
1 Total body	<9.8E-3			7.0E+3	2-20	1.3E-2	See notes for table 108
1a Total soft tissue	<5.0E-3			6.3E+3	Difference		
2 Adipose tissue	1.7E-4			1.8E+3	2-20		
3 Subcutaneous*	<3.0E-5*		Sum	8.7E+2*	Based on adip.		
4 Other separable*	<1.3E-4*	<5.0E-5 - 4.2E-4	43, 84 (34) S 85 (oment.) (74) S	5.8E+2*	Based on adip.		
5 Interstitial	<4.0E-6		Based on subcut. adip.	1.2E+2	Based on adip.		
7 Adrenals (2)*	<8.3E-7*		85 (15) S	1.5*	2-20		
8 Aorta*	<1.6E-5*	2.8E-7 - 5.7E-6	85 (105) S	9.8*	2-20		
9 Contents (blood)*	7.2E-9*	<9.8E-6 - 6.3E-5	Based on blood	2.0E+1*	Based on blood	1.0E-5*	Based on blood
10 Blood (whole)	2.1E-7		7	5.5E+2	2-20	2.2E-4	7, 31c
11 Plasma	<3.1E-4		85 S	3.4E+2	2-20	2.6E-4	7
12 Erythrocytes				2.1E+2	Difference	3.5E-5	7
13 Blood vessels*							
14 Contents (blood)*	1.1E-7*		Based on blood	3.0E+2*	Based on blood	1.6E-4*	Based on blood
21 Cartilage	<1.4E-4		44, 86 (68) S	1.1E+2	2-20		
22 Connective tissue	<4.3E-4		Based on cart.	3.2E+2	Based on lig. and cart.		
26 Separable connective tissue*	<2.0E-4*		Based on cart.	1.5E+2*	Based on con. tis.		
27 Central nervous system*							
28 Brain	<2.2E-4*		Based on brain	1.5E+2*	Based on brain	1.7E-4*	
29 Cerebrum	<2.2E-4	<2.0E-4 - <2.9E-4	85 (129) S	1.5E+2	2-20		
30 Cerebellum	<2.0E-4	<1.7E-4 - <2.6E-4	Based on brain	1.3E+2	Based on brain		
31 Brain stem	<2.4E-5	<2.1E-5 - <3.2E-5	Based on brain	1.6E+1	Based on brain		
33 Contents* (CerSpFl)	<4.8E-6	<4.2E-6 - <6.3E-6	Based on brain	3.1	Based on brain		
35 Eye lenses (2)				1.3E+1*	2-20	1.2E-6*	3
36 Gall bladder*	<3.1E-7*		84 (36) S	4.1E+2	2-20		
38 GI tract*	<9.1E-5*	<6.1E-5 - 2.3E-4	Sum	7.0E-1*	2-20		
40 Esophagus				1.3E+2*	Based on intest.		
41 Stomach	<3.9E-6	<3.1E-6 - 7.8E-6	85 (68) S	3.3	2-20		
43 Intestine	<1.2E-5	<8.1E-6 - 1.8E-5	85 (131) S	1.5E+1	2-20		
45 Small intestine	<7.4E-5	<4.9E-5 - 2.0E-4	Sum	1.0E+2	2-20		
	<5.2E-5	<3.7E-5 - 1.7E-4	Sum	6.7E+1	Based on intest.		
47 Duodenum	<4.8E-6	<3.6E-6 - 9.6E-6	85 (68) S	6.2	Based on intest.		
48 Jejunum	<2.5E-5	<1.9E-5 - 5.0E-5	85 (104) S	2.9E+1	Based on intest.		
49 Ileum	<2.4E-5	<1.5E-5 - 9.3E-5	85 (84) S	3.1E+1	Based on intest.		

Organ and Tissue	21 Iron		22 Lead		23 Lithium	
	Quantity in tissue or organ (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method
1 Total body	4.2					
1a Total soft tissue	3.3					
2 Adipose tissue	3.6E-1	Extrap. from 92%				Extrap. from 64%
3 Subcutaneous*	1.8E-1*	Sum	2.2E-4-3.6E-3	Sum		
4 Other separable*	1.2E-1*	Based on S	1.2E-4-9.0E-4	43, 84 (34) S		
5 Interstitial	2.4E-2	85 (cont.) (73) S	6.5E-5-2.4E-3	85 (cont.) (74) S		
7 Adrenals (2)*	5.2E-4*	Based on subcut. adip.	1.6E-5-1.2E-4	Based on subcut. adip.		
8 Aorta*	4.2E-3*	83 (10) S 85 (93) S	5.0E-7-1.2E-5 3.8E-5-5.5E-4	85 (15) S 85 (105) S		
9 Contents (blood)*	8.6E-2*	Based on blood	4.9E-5*	Based on blood		
10 Blood (whole)	2.5	7	1.7E-6*	7		96 (1) S
11 Plasma	3.6E-3	7	1.4E-3	7		79, 80 (40 comp.) S
12 Erythrocytes	2.4	7	1.2E-3	7		Based on blood 7 S
13 Blood vessels						7 S
14 Contents (blood)*	1.4*	Based on blood	7.6E-4*	Based on blood		Based on blood
21 Cartilage			5.2E-4	44, 86 (68) S		
22 Connective tissue			1.6E-3	Based on cart.		
26 Separable connective tissue*			1.6E-4*	Based on cart.		
27 Central nervous system*			1.4E-4*	Based on brain		
28 Brain	7.4E-2*	Based on brain	1.4E-4*	85 (129) S		Based on brain 46 (14) S
29 Cerebrum	6.5E-2	Based on brain	<9.8E-5-9.0E-4	Based on brain		Based on brain
30 Cerebellum	8.0E-3	Based on brain	<8.3E-5-8.7E-4	Based on brain		Based on brain
31 Brain stem	1.6E-3	Based on brain	<1.1E-5-1.1E-4	Based on brain		Based on brain
32 Contents (CisSpFl)	4.2E-3*	Based on brain	<2.1E-6-2.1E-5	Based on brain		Based on brain
33 Eyes (2)			3.0E-6			
36 Gall bladder*	2.8E-2*	Sum	2.5E-6*	84 (36) S		Sum
38 GI tract*	1.5E-3	85 (57) S	1.5E-4*	Sum		79, 80 (20 comp.) S
40 Esophagus			3.6E-6	85 (68) S		79, 80 (40 comp.) S
41 Stomach	4.3E-3	85 (110) S	1.4E-5	85 (131) S		Sum of SI and LI
43 Intestine	2.3E-2	Sum	1.3E-4	Sum		Based on jejunum
45 Small intestine	1.7E-2	Sum	8.4E-5	Sum		Based on jejunum
47 Duodenum	2.2E-3	85 (60) S	1.3E-5	85 (68) S		jejunum
48 Jejunum	8.1E-3	85 (84) S	3.0E-5	85 (104) S		79, 80 (44 comp.) S
49 Ileum	6.8E-3	85 (78) S	4.2E-5	85 (84) S		Based on jejunum
50 Large intestine	7.4E-3	Sum	4.6E-5	Sum		Based on sig. colon

52	Upper large intestine	4.5E-3	2.5E-3-3-7.0E-3	Sum	3.4E-5	8.4E-6-1.2E-4	Sum	2.3E-6	Based on sig. colon
54	Ascending colon and cecum	1.9E-3	1.1E-3-3-3.0E-3	85 (31) S	1.4E-5	4.1E-6-4.9E-5	85 (31) S	9.9E-7	Based on sig. colon
55	Transverse colon	2.6E-3	1.4E-3-4-4.0E-3	Based on cecum	1.9E-5	5.4E-6-6.5E-5	Based on cecum	1.3E-6	Based on sig. colon
56	Lower large intestine	3.0E-3	1.5E-3-3-6.0E-3	Sum	1.4E-5	4.9E-6-5.4E-5	Sum	1.8E-6	Based on sig. colon
58	Descending colon	1.6E-3	8.3E-4-3-2E-3	Based on sig. colon	6.8E-6	2.7E-6-2.8E-5	Based on sig. colon	9.9E-7	Based on sig. colon
59	Sigmoid colon	9.2E-4	4.6E-4-1.8E-3	85 (88) S	3.8E-6	1.5E-6-1.5E-5	85 (109) S	5.5E-7	79, 80 (30 comp.) S
60	Rectum	4.4E-4	2.4E-4-9.5E-4	85 (41) S	2.8E-6	7.3E-7-1.7E-5	85 (42) S	2.2E-7	Based on sig. colon
61	Hair*	6.0E-4*	1.1E-2-2.2E-2	13	1.0E-3*	<1.2E-5-6.0E-5	59, p. 642	9.0E-7*	96 (12) S
62	Heart*	1.8E-2*	1.2E-2-3.7E-2	85 (123) S	1.8E-5*	1.4E-5-7.4E-4	85 (140) S	1.4E-5*	Based on blood
63	Contents (blood)*	2.3E-2*	5.4E-4-1.5E-3	85 (123) S	3.4E-4*	5.0E-6-2.1E-4	85 (145) S	3.0E-6*	96 (13) S
64	Kidney*	9.4E-4*	1.3E-1-5.8E-1	85 (49) S	3.1E-3*	1.3E-3-6.3E-3	85 (150) S	5.1E-5*	96 (14) S
65	Larynx*	3.2E-1*	6.9E-2-3.4E-1	Sum	3.9E-4*	9.2E-5-8.6E-4	Sum	5.0E-5*	Sum
66	Liver*	3.6E-1*	7.0E-1-1.8	85 (120) S	2.8E-4	1.1E-4	85 (141) S	3.9E-5	96 (14) S
67	Long*	1.7E-1		Based on blood	1.1E-4		Based on blood	1.1E-5	Based on blood
68	Parenchyma	1.9E-1			7.5E-5*		43, 84		79, 80 based on diaphragm (20 comp.) S
69	Blood	1.1*		85 (120) S	1.7E-3*		85 (136) S	1.7E-4*	96 (12) S
70	Muscle (skeletal)*								96 (13) S
71	Pancreas*	3.9E-3*	2.0E-3-7.7E-3	85 (119) S	5.5E-5*	1.6E-5-1.7E-4	85 (139) S	2.0E-6*	4E-7-3.6E-5
72	Pituitary*	4.2E-4*	2.7E-4-7.7E-4	85 (39) S	1.9E-6*	<6.4E-7-2.1E-5	85 (50) S	2.7E-7*	79, 80 (15 comp.) S
73	Prostate*	8.1E-1*	4.2E-1-1.6	44, 86 (91) S	1.1E-1*	4.8E-2-1.7E-1	44, 86 (91) S	1.2E-4	90, p. 223
74	Bone								
75	Cortical								
76	Trabecular								
77	Red marrow								
78	Yellow marrow								
79	Cartilage								
80	Periarticular tissue								
81	Skin*	3.4E-2*	<1.5E-2-1E-1	Based on subcut. adip.	4.2E-5	2.1E-5-1.6E-4	Based on subcut. adip.		
82	Epidermis								
83	Dermis								
84	Spleen*	4.9E-2*	2.2E-2-1.2E-1	85 (19) S	5.2E-4	<1.3E-4-2.6E-3	44, 86 (68) S		
85	Teeth*								
86	Enamel								
87	Dentin								
88	Testes (2)*	8.2E-4*	4.9E-4-1.5E-3	85 (68) S	8E-4*	2.1E-4-2.5E-3	85 (22) S	3.0E-6*	96 (14) S
89	Thymus*	2.2E-4*	5.2E-4-1.4E-3	43, 84 (5) S	4.5E-6*	1.7E-6-1.1E-5	85 (72) S	3.2E-7*	79, 80 (32 comp.) S
90	Thyroid*	1.1E-3*	2.5E-4-7.8E-4	85 (14) S	1.0E-6*	1.6E-6-1.0E-5	43, 84 (9) S		
91	Tongue*	2.5E-3*	5.4E-4-2.5E-3	85 (14) S	2.4E-6*	2.1E-6-2.7E-5	85 (21) S	3.2E-7*	96 (1) S
92	Trachea*	4.3E-4*	5.4E-4-2.5E-3	85 (56) S	3.5E-6*	1.8E-6-1.3E-5	43, 84 (2) S	3.2E-7*	79, 80 (16 comp.) S
93	Urinary bladder*	9.9E-4*		85 (99) S	4.1E-6*		85 (112) S	7.2E-7*	79, 80 (39 comp.) S
94	Contents (urine)*	9.8E-5*		88, 89 S	3.0E-6*		88, 89 S		

Organ and tissue	24 Magnesium		25 Manganese		26 Mercury
	Quantity in tissue or organ (g)	80% range (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method
1 Total body	1.9E+1 7.8		Extrap. from 92%	1.3E-2	Extrap. from 81%
1a Total soft tissue			Sum	4.5E-3	Sum
2 Adipose tissue	3.0E-1		Based on oment.	2.2E-3*	39 (1) C
3 Subcutaneous*	1.5E-1*		85 (oment.) (72) S	1.7E-3*	Based on subcut. adip.
4 Other separable*	1.0E-1*	4.2E-2 - 3.0E-1	Based on subcut. adip.	3.4E-4	Based on subcut. adip.
5 Interstitial	2.0E-2		85 (10) S		
7 Adrenals (2)*	6.2E-4*		85 (94) S		
8 Aorta*	2.0E-2*	1.1E-4 - 1.5E-3	Based on blood		
9 Contents (blood)*	7.4E-3*	1.0E-2 - 4.2E-2	7		
10 Blood (whole)	2.1E-1		7		
11 Plasma	6.8E-2		7		
12 Erythrocytes	1.3E-1		Based on blood		
13 Blood vessels*					
14 Contents (blood)*	1.1E-1*				
21 Cartilage					
22 Connective tissue					
26 Separable connective tissue*					
27 Central nervous system*					
28 Brain	2.1E-J*		Based on blood		
29 Cerebrum	2.1E-1		44, 86 (68) S		
30 Cerebellum	1.8E-1	1.3E-1 - 2.8E-1	Based on cart.		
31 Brain stem	2.3E-2	1.2E-1 - 2.4E-1	Based on brain		
33 Contents* (CerSpFl)	4.5E-3	1.4E-2 - 3.0E-2	Based on brain		
35 Eye lenses (2)	3.3E-3*	2.9E-3 - 6.0E-3	Based on brain		
36 Gall bladder*					
38 GI tract*	1.5E-1*		Based on brain		
40 Esophagus	4.8E-3	9.3E-2 - 3.1E-1	85 (108) S		
41 Stomach	1.6E-2	3.8E-3 - 1.0E-2	Sum		
43 Intestine	1.3E-1	8.9E-3 - 2.3E-2	85 (57) S		
45 Small intestine	7.7E-2	8.0E-2 - 2.7E-1	85 (110) S		
47 Duodenum	6.0E-3	5.0E-2 - 1.4E-1	Sum		
		3.6E-3 - 8.4E-3	85 (60) S		
48 Jejunum	3.1E-2	2.1E-2 - 5.0E-2	85 (83) S		
49 Ileum	3.9E-2	2.5E-2 - 7.5E-2	85 (77) S		

50	Large intestine	5.5E-2	3.0E-2-1.2E-1	Sum	2.2E-4	6.3E-5-7.4E-4	Sum	1.9E-5	39 (14) C
52	Upper large intestine	3.4E-2	1.9E-2-7.6E-2	Sum	1.9E-4	4.9E-5-5.0E-4	Sum	1.1E-5	Based on large intest.
54	Ascending colon and cecum	1.4E-2	8.2E-3-3.2E-2	85 (31) S	7.7E-5	1.7E-5-2.2E-4	85 (31) S	4.5E-6	Based on large intest.
55	Transverse colon	1.9E-2	1.1E-2-4.3E-2	Based on cecum	1.0E-4	2.3E-5-2.9E-4	Based on cecum	6.0E-6	Based on large intest.
56	Lower Large intestine	2.2E-2	1.2E-2-4.4E-2	Sum	4.5E-5	1.7E-5-1.9E-4	Sum	7.7E-6	Based on large intest.
58	Descending colon	1.2E-2	6.1E-3-2.4E-2	Based on sig. colon	2.5E-5	9.9E-6-9.9E-5	Based on sig. colon	4.5E-6	Based on large intest.
59	Sigmoid colon	6.7E-3	3.4E-3-1.3E-2	85 (88) S	1.4E-5	5.4E-6-5.4E-5	85 (107) S	2.5E-6	Based on large intest.
60	Rectum	3.4E-3	2.0E-3-6.6E-3	85 (41) S	5.4E-6	1.8E-6-4.2E-5	85 (42) S	1.0E-6	Based on large intest.
61	Hair*	1.0E-3*		59, p. 642	2.5E-5*		13	1.2E-4*	13 (800) NA
62	Heart*	5.4E-2*	.4E-2-7.6E-2	85 (122) S	6.6E-5*	3.6E-5-1.3E-4	85 (139) S	4.5E-5*	39 (25) C
63	Contents (blood)*	1.5E-2*		Based on blood	1.0E-5*		Based on blood	2.4E-6*	Based on blood
64	Kidney*	4.0E-2*	2.9E-2-5.9E-2	85 (121) S	2.8E-4*	1.5E-4-5.0E-4	85 (143) S	8.7E-4*	39 (39)
65	Larynx*	9.0E-3*	4.5E-3-2.1E-2	85 (49) S	4.5E-6*	2.6E-6-8.8E-6	85 (35) S		
66	Liver*	3.1E-1*	2.0E-1-4.5E-1	85 (126) S	2.5E-3*	1.3E-3-4.9E-3	85 (148) S	5.4E-4*	39 (29) C
67	Lung*	7.1E-2*		Sum	1.2E-4*		Sum	5.8E-4*	Sum
68	Parenchyma	5.5E-2	4.0E-2-8.1E-2	85 (119) S	1.1E-4	5.0E-5-3.2E-4	85 (141) S	5.8E-4	39 (23) C
69	Blood	1.6E-2		Based on blood	1.0E-5		Based on blood	2.6E-6	Based on blood
73	Lymph nodes (dissectible)*				7.7E-5*		43, 84		
77	Muscle (skeletal)*	5.3*	3.4-8.1	85 (119) S	1.5E-3*	6.7E-4-4.5E-3	85 (133) S	4.2E-3*	39 (22) C
79	Pancreas*	1.6E-2*	7.5E-3-2.4E-2	85 (119) S	1.1E-4*	5.2E-5-2.2E-4	85 (138) S	5.0E-6*	39
82	Pituitary*								
83	Prostate*	2.9E-3*	1.6E-3-4.0E-3	85 (40) S	2.4E-6*	1.4E-6-5.1E-6	85 (50) S		
88	Skeleton*	1.1E+1*	7.2-1.5E+1	44, 86 (91) S	5.2E-3*	3.2E-3-9.8E-3	44, 86 (91) S		
89	Bone			95					
90	Cortical	8.4							
91	Trabecular								
92	Red marrow								
93	Yellow marrow	2.6E-2							
94	Cartilage								
95	Periarticular tissue								
96	Skin*	1.5E-1*	9.0E-2-2.5E-1	Based on subcut. adip.	3.5E-5	1.6E-5-9.7E-5	Based on subcut. adip.		
97	Epidermis	1.8E-2		85 (19) S	2.2E-4	1.1E-4-6.0E-4	44, 86 (68) S		
98	Dermis	1.1E-1		48, 74	1.8		Based on cart.		
99	Spleen*	2.3E-2*		38 (adi.)	2.1E-4*	1.1E-4-4.8E-6	85 (22) S		
100	Spleen*	3.2E-1*		Sum					
101	Teeth*	3.0E-2	1.5E-2-3.4E-2	85 (123) S	2.3E-5*	1.1E-5-4.5E-5	85 (143) S	9.0E-6*	39 (22) C
102	Enamel	2.9E-1		4					
103	Dentin	2.9E-1		4					
105	Testes*	3.8E-3*	2.6E-3-5.6E-3	85 (68) S	4.5E-6*	2.9E-6-8.2E-6	85 (72) S		
106	Thymus*	6.0E-4*	8.2E-4-3.2E-3	43, 84 (4) S	1.8E-6*		43, 84 (9) S		
107	Thyroid*	2.0E-3*		40E-1*	4.0E-6*	2.4E-6-6.6E-6	85 (21) S		
108	Tongue*	1.5E-2*		43, 84 (2) S	1.1E-5*		52, 84 (4) NA		
110	Tongue*	1.8E-3*	1.0E-3-4.3E-3	85 (57) S	2.0E-6*	1.2E-6-3.4E-6	85 (54) S	3.7E-6*	52 (4) NA
113	Urinary bladder*	4.5E-3*	2.7E-3-7.7E-3	85 (98) S	4.4E-6*	2.2E-6-6.1E-5	85 (109) S		
114	Contents (urine)*	1.0E-2*		88, 89 S	3.3E-6*		88, 89 S		

Organ and tissue	27 Molybdenum		28 Nickel		29 Niobium	
	Quantity in tissue or organ (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method
1 Total body	<9.5E-3					
1a Total soft tissue	<4.5E-3	Based on 85% soft tis.		Extrap. from 96% Sum	2.1E-1?	Extrap. from 28% Sum
2 Adipose tissue	8.8E-5	Sum	1.4E-4 - 1.5E-3	43, 84 (34) S	2.6E-2	63
3 Subcutaneous*	3.6E-5*	43, 84 (34) S	6.0E-5 - 6.4E-4	85 (oment.)	1.3E-2*	Based on subcut. adip.
4 Other separable*	<4.0E-5*	85 (oment.) (75) S	6.0E-5 - 7.0E-4	Based on subcut. adip.	8.5E-3*	Based on subcut. adip.
5 Interstitial	4.7E-6	Based on subcut. adip.	8.0E-6 - 8.5E-5	85 (13) S	1.7E-3	Based on subcut. adip.
7 Adrenals (2)*	9.7E-7*	85 (13) S	<3.6E-7 - 5.2E-6	85 (104) S		63 (2) CO
8 Aorta*	<5.6E-6*	85 (104) S	<5.5E-6 - 3.3E-5	Based on blood	6.2E-4*	Based on blood
9 Contents (blood)*	2.9E-6*	7	1.8E-6 - 1.3E-5	37	7.2E-7*	31b (31) MS
10 Blood (whole)	8.3E-5	30 (39) XF	5.2E-5 - 3.6E-4	7	2.1E-5	63 CO
11 Plasma	<6.2E-4		9.0E-5			
12 Erythrocytes			7.0E-5		1.3E-2	
13 Blood vessels*						
14 Contents (blood)*	4.5E-5*	Based on blood	8.7E-5*	Based on blood	1.1E-5*	Based on blood
21 Cartilage	(<6.0E-5)	44, 86 (68) S	2.3E-4	44, 86 (68) S		
22 Connective tissue			7.1E-4	Based on cart.		
26 Separable connective tissue*			3.3E-4*			
27 Central nervous system*	<9.0E-5*	Based on brain	<1.1E-4*	Based on brain	9.5E-4*	Based on brain
28 Brain						
29 Cerebrum	<9.0E-5	85 (129) S	<1.1E-4	85 (129) S	9.5E-4	63 (2) CO
30 Cerebellum	<7.8E-5	Based on brain	<8.5E-5 - <1.5E-4	Based on brain	8.3E-4	Based on brain
31 Brain stem	<9.6E-6	Based on brain	<1.2E-5	Based on brain	1.0E-4	Based on brain
33 Contents* (CerSpFl)	<1.9E-6	Based on brain	<2.4E-6	Based on brain	2.0E-5	Based on brain
35 Eye lenses (2)*						
36 Gall bladder*	6.0E-7*	84 (36) S	8.2E-7*	84 (36) S		
38 GI tract*	<4.6E-5*	Sum	9.4E-5*	Sum		
40 Esophagus	<1.4E-6	85 (66) S	<2.2E-6	85 (66) S		
41 Stomach	<4.7E-6	85 (130) S	<6.1E-6	85 (130) S		
43 Intestine	<3.9E-5	Sum	8.5E-5	Sum		
45 Small intestine	<3.2E-5	Sum	3.5E-5	Sum		
47 Duodenum	<1.9E-6	85 (67) S	2.8E-6	85 (67) S		
48 Jejunum	<1.0E-5	85 (102) S	<1.4E-5	85 (102) S		
49 Ileum	<9.6E-6	85 (83) S	1.7E-5	85 (83) S		
50 Large intestine	<1.0E-5	Sum	4.1E-5	Sum		

52	Upper large intestine	<5.9E-6	<3.4E-6 - 9.2E-6	Sum	2.5E-5	8.4E-6 - 1.2E-4	Sum		
54	Ascending colon and cecum	<2.6E-6	<1.4E-6 - 4.4E-6	85 (31) S	1.1E-5	3.6E-6 - 5.0E-5	85 (31) S		
55	Transverse colon	<3.4E-6	<1.9E-6 - 5.8E-6	Based on cecum	1.4E-5	4.8E-6 - 6.7E-5	Based on cecum		
56	Lower large intestine	<4.5E-6	<2.6E-6 - <7.0E-7	Sum	1.6E-5	<5.1E-6 - 5.4E-5	Sum		
58	Descending colon	<2.5E-6	<1.4E-6 - <3.6E-6	Based on sig. colon	8.7E-6	<2.7E-6 - 3.0E-5	Based on sig. colon		
59	Sigmoid colon	<1.4E-6	<7.9E-7 - <2.0E-6	85 (108) S	5.0E-6	<1.5E-6 - 1.7E-5	85 (108) S		
60	Rectum	<5.6E-7	<4.0E-7 - <1.1E-6	85 (42) S	2.2E-6	9.3E-7 - 8.0E-6	85 (42) S		
61	Hair*				1.5E-4*			4.3E-5*	63 CO
62	Heart*	<1.3E-5*	<1.1E-5 - <1.5E-5	85 (140) S	<1.6E-5*	<1.4E-5 - <0.9E-4	85 (140) S	1.9E-4*	63 (2) CO
63	Contents (blood)*	6.0E-6*		Based on blood	1.1E-5*	3.7E-6 - 2.6E-5	Based on blood	1.9E-6*	Based on blood
64	Kidney*	1.1E-5*	6.5E-5 - 1.8E-4	85 (144) S	<1.7E-5*	<1.6E-5 - 4.3E-5	85 (144) S	1.5E-4*	63 (2) CO
65	Larynx*	<3.4E-6*	<1.6E-6 - <2.2E-5	85 (50) S	<5.4E-6*	<2.2E-6 - 1.2E-5	85 (50) S		
66	Liver*	1.8E-3*	7.2E-4 - 3.2E-3	85 (148) S	<1.2E-4*	<9.9E-5 - 3.1E-4	85 (148) S		
67	Lung*	<3.1E-5*	<2.3E-5 - <3.0E-5	Sum	4.7E-5*	4.5E-5 - 2.3E-4	Sum	8.3E-3*	63 (2) CO
68	Paracymbria	<2.5E-5		85 (141) S	<3.5E-5	<2.9E-5 - 2.0E-4	85 (141) S	9.2E-4	63 (2) CO
69	Blood	6.4E-6		Based on blood	1.2E-5	4.0E-6 - 2.8E-6	Based on blood	1.6E-6	Based on blood
73	Lymph nodes (dissectible)*	<3.3E-6*		43, 84 S	5.0E-5*		43, 84 S		
77	Muscle (skeletal)*	<1.3E-3*	<1.1E-3 - <1.7E-3	85 (136) S	<1.7E-3*	<1.4E-3 - 4.8E-3	85 (136) S		
79	Pancreas*	<4.8E-6*	<2.8E-6 - <6.0E-6	85 (139) S	<6.0E-6*	<4.0E-6 - 1.3E-5	85 (139) S	1.0E-4*	63 (2) CO
82	Pituitary								
83	Prostate*	<7.0E-7*	<5.1E-7 - <1.1E-6	85 (50) S	<8.8E-7*	<6.4E-7 - 1.6E-6	85 (50) S		
88	Skeleton*	<4.8E-3*	<3.0E-3 - <7.2E-3	44, 86 (91) S	<5.0E-3*	<3.1E-3 - 1.1E-2	44, 86 (91) S		
89	Bone								
90	Cortical								
91	Trabecular								
92	Red marrow								
93	Yellow marrow	6.4E-6	2.1E-6 - 2.5E-5	Based on subcut. adip.	4.0E-5	1.1E-5 - 1.1E-4	Based on subcut. adip.	1.8E-3	Based on subcut. adip.
94	Cartilage	(<6.0E-5)		44, 86 (68) S	2.3E-4	<5.5E-5 - 8.2E-4	44, 86 (68) S		
95	Pariarticular tissue	(<4.9E-5)		Based on cart.	1.9E-4		Based on cart.		
96	Skin*	<7.4E-5*	<5.1E-5 - <1.4E-4	85 (22) S	9.5E-4*	1.9E-4 - 3.3E-3	85 (22) S		
97	Epidermis								
98	Dermis								
100	Spleen*	<1.0E-5*	<7.9E-6 - <1.2E-5	85 (143) S	<1.3E-5*	<9.9E-6 - 1.5E-5	85 (143) S	2.5E-4*	63 (2) CO
101	Teeth*								
102	Enamel								
103	Dentin								
105	Testes*	<1.5E-6*	<1.3E-6 - <2E-6	85 (72) S	<1.9E-6*	<1.6E-6 - 6.4E-6	85 (72) S	2.2E-5*	63 (2) CO
106	Thymus*	(<2.2E-7)*		43, 84 (9) S	4.4E-7*		43, 84 (8) S		
107	Thyroid*	<9.0E-7*	<7.2E-7 - <1.2E-6	85 (21) S	<1.2E-6	<9.0E-7 - 3.6E-6	85 (21) S		
108	Tongue*	(<3.4E-6)*		43, 84 (2) S	2.2E-6*		43, 84 (2) S		
110	Trachea*	<6.4E-7*	<4.8E-7 - <1.2E-6	85 (60) S	1.0E-6*	<8.4E-7 - 3.3E-6	85 (60) S		
113	Urinary bladder*	<1.4E-6*	<9.0E-7 - <2.2E-6	85 (110) S	<2.0E-6*	<1.4E-6 - 7.7E-6	85 (110) S		
114	Contents (urine)*	1.4E-5*		88, 89 S	8.5E-6*		88, 89 S		

Organ and tissue	30 Nitrogen		31 Oxygen		32 Phosphorus	
	Quantity in tissue or organ (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method
1 Total body	1.8E+3	2-20	4.3E+4	2-20	7.8E+2	Extrap. from
1a Total soft tissue	1.5E+3	Difference	3.8E+4	Difference	8.0E+1	93%
2 Adipose tissue	1.2E+2	2-20	3.5E+3	2-20	2.4	Sum
3 Subcutaneous*	6.1E+1*	Based on adip.	1.7E+3*	Based on adip.	1.2*	Based on
4 Other separable*	4.0E+1*	Based on adip.	1.2E+3*	Based on adip.	8.0E-1*	oment.
5 Interstitial	8.0	Based on adip.	2.3E+2	Based on adip.	1.6E-1	(71) S
7 Adrenals (2)*	0.4*	2-20	8.2*	2-20	1.5E-2*	Based on
8 Aorta*	4.3*	2-20	6.9E+1*	2-20	9.8E-2*	subcut. adip.
9 Contents (blood)*	5.4*	Based on blood	1.4E+2*	Based on blood	85 (8) S	85 (91)
10 Blood	1.6E+2	2-20	4.1E+3	2-20	6.6E-2*	Based on blood
11 Plasma	3.4E+1	2-20	2.7E+3	2-20	1.9	7
12 Erythrocytes	1.3E+2	Difference	1.4E+3	Difference	3.4E-1	7
13 Blood vessels*	8.6E+1*	Based on blood	2.2E+3*	Based on blood	1.0*	Based on blood
14 Contents (blood)*	2.9E+1	2-20	8.0E+2	2-20		
21 Cartilage	1.9E+2	Based on cart.	2.2E+3	Based on lig. and cart.		
22 Connective tissue	9.3E+1*	Based on con. tis.	1.0E+3*	Based on con. tis.		
26 Separable connective tissue*	1.8E+1*	Based on brain	1.0E+3*	Based on brain	4.8*	
27 Central nervous system*	1.8E+1	2-20	1.0E+3	2-20	4.8	
28 Brain	1.5E+1	Based on brain	8.7E+2	Based on brain	4.2	
29 Cerebrum	1.9	Based on brain	1.1E+2	Based on brain	5.1E-1	85 (102) S
30 Cerebellum	3.8E-1	Based on brain	2.2E+1	Based on brain	3.8E-1 - 6.3E-1	Based on brain
31 Brain stem	5.4E-3*	2-20	1.1E+2*	2-20	1.0E-1	Based on brain
33 Contents* (CerSpFl)	2.2E-2	2-20	2.7E-1	2-20	1.8E-3*	3
35 Eye lenses (2)*	2.6E+1*	Based on intest.	8.9E+2*	Based on intest.	1.1*	Sum
36 Gall bladder*						
38 GI tract*						
40 Esophagus						
41 Stomach	3.2	2-20	2.7E+1	2-20	3.4E-2	85 (65) S
43 Intestine	2.1E+1	2-20	1.0E+2	2-20	1.8E-1	85 (105) S
45 Small intestine	1.3E+1	Based on intest.	7.7E+2	2-20	8.5E-1	Sum
			4.8E+2	Based on intest.	7.4E-1	Sum
47 Duodenum	1.2	Based on intest.	4.4E+1	Based on intest.	7.2E-2	85 (57) S
48 Jejunum	5.8	Based on intest.	2.1E+2	Based on intest.	4.0E-1	85 (80) S
49 Ileum	6.2	Based on intest.	2.3E+2	Based on intest.	2.9E-1	85 (75) S

50	Large intestine	7.7	Based on intest.	2.7E+2	Based on intest.	2.0E-1	1.5E-1 - 4.9E-1	Sum
52	Upper large intestine	4.3	Based on intest.	1.6E+2	Based on intest.	1.5E-1	8.4E-2 - 2.2E-1	Sum
54	Ascending colon and cecum	1.9	Based on intest.	6.6E+1	Based on intest.	6.3E-2	3.6E-2 - 8.9E-2	85 (31) S
55	Transverse colon	2.6	Based on intest.	8.9E+1	Based on intest.	8.8E-2	4.8E-2 - 1.2E-1	Based on cecum
56	Lower large intestine	3.4	Based on intest.	1.2E+2	Based on intest.	1.2E-1	6.4E-2 - 2.6E-1	Sum
58	Descending colon	1.9	Based on intest.	6.7E+1	Based on intest.	6.9E-2	3.5E-2 - 1.1E-1	Based on sig. colon
59	Sigmoid colon	1.0	Based on intest.	3.7E+1	Based on intest.	3.8E-2	2.0E-2 - 1.4E-1	85 (84) S
60	Rectum	4.2E-1	Based on intest.	1.5E+1	Based on intest.	1.5E-2	1.1E-2 - 2.4E-2	85 (41) S
61	Hair*	2.9*	2-20	6.0*	2-20	4.8E-1*	4.0E-1 - 6.6E-1	85 (115) S
62	Heart*	8.8*	2-20	2.3E+2*	2-20	1.4E-1*	3.1E-1 - 6.2E-1	Based on blood
63	Contents (blood)*	1.4E+1*	Based on blood	2.3E+2*	2-20	5.0E-1*	2.1E-2 - 1.2E-1	85 (116) S
64	Kidney*	8.5*	2-20	1.7E+1*	2-20	5.0E-2*	3.4 - 6.1	85 (49) S
65	Larynx*	5.1E+1*	2-20	1.2E+3*	2-20	4.7*	4.4E-1 - 8.6E-1	85 (118) S
66	Liver*	2.8E+1*	Sum	7.4E+2*	Sum	7.8E-1*		Sum
67	Lung*	1.6E+1	Based on lung;	4.1E+2	Based on lung;	6.3E-1		85 (111) S
68	Parenchyma	1.2E+1	2-20	3.3E+2	2-20	1.5E-1		Based on blood
69	Blood	7.7E+2*	Based on blood	2.1E+4*	2-20	5.0E+1*	3.4E+1 - 6.4E+1	85 (112) S
73	Lymph nodes (dissectible)*	2.1*	2-20	6.7E+1*	2-20	2.3E-1*	1.0E-1 - 3.2E-1	85 (114) S
77	Muscle (skeletal)*	3.8E-1*	2-20	1.2E+1*	2-20	1.6E-2*	1.0E-2 - 2.6E-2	85 (36) S
79	Pancreas*	3.0E+2*	2-20	4.7E+3*	2-20	7.0E+2*		95
82	Pituitary*	2.1E+2	2-20	2.1E+3	2-20	4.0E+2		95
83	Prostate*	1.6E+2	2-20	1.7E+3	2-20	2.1E-1		Based on subcut. adip.
88	Skeleton*	3.8E+1	2-20	2.6E+2	2-20			
89	Bone	4.8E+1	2-20	6.2E+2	2-20			
90	Cortical	9.6	2-20	3.4E+2	2-20			
91	Trabecular							
92	Red marrow							
93	Yellow marrow							
94	Cartilage	2.9E+1	2-20	8.0E+2	2-20			
95	Periarticular tissue	2.2E+1	2-20	6.6E+2	2-20			
96	Skin*	1.2E+2*	2-20	1.6E+3*	2-20	8.5E-1*	5.1E-1 - 2	85 (19) S
97	Epidermis							
98	Dermis							
100	Spleen*	5.6*	2-20	1.3E+2*	2-20	4.0E-1*	2.7E-1 - 5.0E-1	85 (115) S
101	Teeth*	1.3*	2-20	1.9E+1*	2-20	6.2		Sum
102	Enamel	1.9E-2	2-20	4.1	2-20	1.7		4
103	Dentin	2.6E-1	2-20	1.4E+1	2-20	4.5		85 (65) S
105	Testes*	6.7E-1*	2-20	2.6E+1*	2-20	4.2E-2*	2.3E-2 - 6.4E-2	84 (4) S
106	Thymus*			1.4E+1*	2-20	8.2E-3*		85 (10) S
107	Thyroid*	4.4E-1*	2-20	1.4E+1*	2-20	1.5E-2*	6.7E-3 - 5.4E-2	84 (2) S
108	Tongue*	1.9*	2-20	4.5E+1*	2-20	8.4E-2*	5.4E-3 - 2.6E-2	85 (55) S
110	Trachea*			5.3*	2-20	8.7E-3*	1.9E-3 - 5.0E-2	85 (96) S
113	Urinary bladder*			2.6E+1*		3.0E-2*		
114	Contents (urine)*	1.0*	3-34	9.0E+1*	3-34	1.1E-1*		88, 89 S

Organ and tissue	33 Potassium			34 Radium		35 Rubidium	
	Quantity in tissue or organ (g)	80% range (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	80% range (g)
1 Total body	1.4E+2						
1a Total soft tissue	1.2E+2						
2 Adipose tissue	4.8						
3 Subcutaneous*	2.4*						
4 Other separable*	1.6*	7.0E-1-4.5	Extrap. from 92% Sum Based on oment. 85 (oment.) (71) S Based on subcut. adip. 85 (8) S 85 (91) Based on blood 7 7 7	3.1E-11 4.7E-12 1.5E-12 7.5E-13*	Extrap. from 82% 29 XF Based on adip. Based on adip. Based on adip.	6.8E-1 4.7E-1	
5 Interstitial	2.6E-1			5.0E-13*			
7 Adrenals (2)*	1.4E-2*	2.7E-3-2.0E-2		8.0E-14			
8 Aorta*	1.2E-1*	7.2E-2-2.1E-1					
9 Contents (blood)*	3.1E-1*						
10 Blood (whole)	8.8			<6.2E-16	(Animal)	1.4E-5* 2.9E-4* 4.7E-4* 1.4E-2 2.0E-3 1.2E-2	96 (1) S 97, p. 17 (4) FS Based on blood 7 Difference 7
11 Plasma	5.0E-1						
12 Erythrocytes	8.3						
13 Blood vessels*							
14 Contents (blood)*	4.8*					7.5E-3*	Based on blood
21 Cartilage							
22 Connective tissue							
26 Separable connective tissue*							
27 Central nervous system*							
28 Brain	4.2*						
29 Cerebrum	4.2	2.9-5.7	Based on brain 85 (102) S			3.6E-2*	Based on brain
30 Cerebellum	3.7	2.6-5.0	Based on brain			3.5E-2	96 (14) S
31 Brain stem	4.5E-5	3.2E-1-6.2E-1	Based on brain			3.0E-2	Based on brain
33 Contents* (CerSpFl)	9.0E-2	6.3E-2-1.2E-1	Based on brain 3			3.5E-3	Based on brain
35 Eye lenses (2)*	1.2E-2*					7.5E-4	Based on brain
36 Gall bladder*							
38 GI tract*	1.5*	7.3E-1-2.5	Sum	>2.4E-13*	Based on intest.	5.6E-3*	Sum
40 Esophagus	6.4E-2	4.7E-2-1.3E-1	85 (55) S			4.4E-5	79, 80 (20 comp.) S
41 Stomach	2.1E-1	1.2E-1-3.0E-1	85 (104) S			5.4E-4	97 (3) FS
43 Intestine	1.2	5.5E-1-2.0	Sum	2.4E-13	36 RC	5.0E-3	Sum
45 Small intestine	8.7E-1	3.8E-1-1.4	Sum	1.5E-13	Based on intest.	2.8E-3	97 (3) FS
47 Duodenum	8.4E-2	5.0E-2-1.3E-1	85 (57) S	1.4E-14	Based on intest.	2.6E-4	Based on SI
48 Jejunum	4.4E-1	2.5E-1-7.1E-1	85 (79) S	6.8E-14	Based on intest.	1.2E-3	Based on SI
49 Ileum	3.6E-1	1.2E-1-6.0E-1	85 (75) S	7.2E-14	Based on intest.	1.3E-3	Based on SI
50 Large intestine	4.1E-1	1.9E-1-7.0E-1	Sum	8.9E-14	Based on intest.	2.2E-3	Based on sig. colon

52	Upper large intestine	2.1E-1	8.4E-2 - 3.4E-1	Sum	5.0E-14	Based on intest.	1.3E-3	Based on sig. colon	3E-4 - 1.2E-1
54	Ascending colon and cecum	8.9E-2	3.6E-2 - 1.4E-1	85 (31) S	2.1E-14	Based on intest.	5.4E-4	Based on	1.4E-3 - 5.7E
55	Transverse colon	1.2E-1	4.8E-2 - 2.9E-1	Based on cecum	3.9E-14	Based on intest.	7.2E-4	Based on	3.3E-2 - 1.7E
56	Lower large intestine	1.9E-1	9.6E-2 - 3.4E-1	Sum	3.8E-14	Based on intest.	9.6E-4	Based on	5E-3 - 1.8E
58	Descending colon	1.1E-1	5.0E-2 - 1.9E-1	Based on sig. colon	2.2E-14	Based on intest.	5.4E-4	Based on	1.8E-3 - 2.3E
59	Sigmoid colon	5.8E-2	2.8E-2 - 1.0E-1	85 (82) S	1.2E-14	Based on intest.	3.0E-4	Based on	
60	Rectum	2.8E-2	1.9E-2 - 5.6E-2	85 (41) S	4.8E-15	Based on intest.	1.2E-4	Based on	
61	Hair*	7.2E-1*	5.4E-1 - 1.2	85 (115) S	2.2E-14*	36 (11) RC	4.9E-4*	96 (12) S	
62	Heart*	6.3E-1*	4.0E-1 - 7.8E-1	Based on blood	3.7E-14*	36 (11) RC	1.3E-3*	Based on blood	
63	Contents (blood)*	5.9E-1*	2.6E-2 - 6.5E-2	85 (114) S	3.2E-13*	36 (11) RC	2.7E-3*	96 (13) S	
64	Kidney*	3.9E-2*	3.1 - 6.5	85 (48) S			5.5E-2*	96 (14) S	
65	Larynx*	4.5*	8.1E-1 - 1.7	85 (116) S			9.2E-3*	Sum	
66	Liver*	1.9*		Sum			8.2E-3	96 (14) S	
67	Lung*	1.2		85 (110) S			1.0E-3	Based on blood	
68	Parenchyma	6.8E-1		Based on blood					
69	Blood								
73	Lymph nodes (dissectible)*								
77	Muscle (skeletal)*	8.4E+1*	5.9E+1 - 1.2E+2	85 (112) S	1.4E-12*	36 (11) RC	1.7E-1*	97 (4) FS	
79	Pancreas*	2.3E-1*	1.1E-1 - 3.5E-1	85 (113) S			4.4E-3*	96 (12) S	
82	Pituitary*	3.0E-2*	2.1E-2 - 4.8E-2	85 (36) S			1.3E-4*	79, 80 (15 comp.) S	
83	Prostate*	1.5E+1*	1.0E+1 - 1.9E+1	44, 86 (91) S	2.7E-11*	36, 91 RC	2.1E-1*	97 (4) based on rib FS	
88	Skeleton*								
89	Bone								
90	Cortical								
91	Trabecular								
92	Red marrow								
93	Yellow marrow								
94	Cartilage								
95	Periarticular tissue								
96	Skin*	2.2*	1.2 - 3.1	85 (19) S	3.1E-13*	36 (11) RC			
97	Epidermis	4.6E-1		74					
98	Dermis	1.1		By difference					
100	Spleen*	5.6E-1*	4.0E-1 - 8.3E-1	85 (114) S	1.8E-14*	36 (11) RA	3.5E-3*	96 (14) S	1.4E-3 - 5.7E
101	Teeth*								
102	Enamel								
103	Dentin								
105	Testes*	7E-2*	4.2E-2 - 9.9E-2	85 (67) S	4.2E-15*	36 (11) RA	7.0E-4*	79, 80 (32 comp.) S	
106	Thymus*	1.2E-2*	1.4E-2 - 3.4E-2	43, 84 (4) S		4	1.2E-4*	96 (1) S	
107	Thyroid*	2.4E-2*	9.3E-3 - 3.3E-2	85 (10) S			2.4E-4*	79, 80 (16 comp.) S	
108	Tongue*	2.0E-1*	3.8E-2 - 9.9E-2	43, 84 (2) S			1.0E-4*	97 (1) FS	
110	Trachea*	1.7E-2*		85 (55) S					
113	Urinary bladder*	6.3E-2*		85 (95) S					
114	Contents (urine)*	2.0E-1*		88, 89 S					

Organ and tissue	36 Selenium			37 Silver		38 Sodium	
	Quantity in tissue or organ (g)	80% range (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	80% range (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)
1 Total body							
1a Total soft tissue	1.3E-2		Extrap. from 63%	7.9E-4		Extrap. from 93%	1.0E+2 6.8E+1
2 Adipose tissue				2.0E-5	5.0E-6 - 1.5E-4	Sum	7.6
3 Subcutaneous*				1.2E-5*	<3.0E-6 - 5.5E-5	43, 84 (34) S	3.8*
4 Other separable*				3.8E-6*	1.0E-6 - 2.1E-5	85 (oment.) (74) S	2.5*
5 Interstitial				1.6E-6	<4.0E-7 - 5.8E-6	Based on subcut. adip.	5.0E-1
7 Adrenals (2)*				4.2E-8*	<4.6E-9 - 1.7E-7	85 (13) S	
8 Aorta*				1.8E-7*	<1.0E-7 - 1.8E-6	85 (105) S	2.4E-1*
9 Contents (blood)*	3.8E-5*		Based on blood	3.4E-5*		Based on blood	3.6E-1*
10 Blood (whole)	1.1E-3		2 (210) F	9.9E-4		7	1.0E+1
11 Plasma				<6.2E-4		7	1.0E+1
12 Erythrocytes				3.7E-4		By difference	5.7E-1
13 Blood vessels*							
14 Contents (blood)*	6.0E-4*		Based on blood	5.4E-4*		Based on blood	5.5*
21 Cartilage						20, p. 533	6.0
22 Connective tissue						Based on cart.	1.9E+1
26 Separable connective tissue*						Based on cart.	8.7*
27 Central nervous system*						Based on brain	2.5*
28 Brain	2.9E-4*		Sum	1.3E-5*	<2.2E-6 - 4.1E-5	85 (128) S	2.5
29 Cerebrum	2.9E-4		68 (1) ?	1.3E-5	<2.0E-6 - 3.5E-5	Based on brain	2.2
30 Cerebellum				1.1E-5	<2.4E-7 - 4.4E-5	Based on brain	2.7E-1
31 Brain stem				1.4E-6	<4.8E-8 - 8.7E-7	Based on brain	5.4E-2
33 Contents* (CerSpFl)				2.7E-7		Based on brain	6.0E-1*
35 Eye lenses (2)*	2.1E-7		75	7.5E-8*	<2.7E-8 - 2.2E-8	84 (36) S	
36 Gall bladder*	2.2E-4*		Based on sm. intest.	1.3E-6*	<6.7E-7 - 1.9E-5	Sum	1.3*
38 GI tract*				<5.0E-8	<4.2E-8 - 5.0E-7	85 (68) S	
40 Esophagus				<1.2E-7	<8.1E-8 - 1.2E-6	85 (130) S	8.0E-2
41 Stomach				1.1E-6	<5.4E-7 - 1.1E-5	Sum	1.5E-1
43 Intestine	1.8E-4		Based on sm. intest. 68 (3) ?	6.8E-7	<3.7E-7 - 7.6E-6	Sum	1.0
45 Small intestine	1.1E-4			5.4E-8	<4.2E-8 - 6.0E-7	85 (68) S	6.4E-1
47 Duodenum				2.8E-7	<1.9E-7 - 3.7E-6	85 (104) S	6.0E-2
48 Jejunum				3.3E-7	<1.5E-7 - 3.3E-6	85 (84)	2.8E-1
49 Ileum							3.0E-1

50	Large intestine	6.7E-5			4.2E-7	<1.9E-7 - 3.9E-6	Sum	3.7E-1	Based on GI tract
52	Upper large intestine				2.9E-7	<1.0E-7 - 1.9E-6	Sum	2.1E-1	Based on GI tract
54	Ascending colon and cecum				1.2E-7	<4.5E-8 - 8.2E-7	85 (31) S	9.0E-2	Based on GI tract
55	Transverse colon				1.6E-7	<6.0E-8 - 1.1E-6	Based on cecum	1.2E-1	Based on GI tract
56	Lower large intestine				1.5E-7	<8.3E-8 - 1.9E-6	Sum	1.6E-1	Based on GI tract
58	Descending colon				8.1E-8	<4.5E-8 - 1.1E-6	Based on sig. colon	9.9E-2	Based on GI tract
59	Sigmoid colon				4.6E-8	<2.5E-8 - 5.8E-7	85 (109) S	5.0E-2	Based on GI tract
60	Rectum				<1.8E-8	<1.2E-8 - 2.2E-7	85 (42) S	2.0E-2	Based on GI tract
61	Hair*				6.9E-5*		13 (800) NA	1.3E-2*	Based on GI tract
62	Heart*	7.5E-5*			<3.4E-7*	<2.8E-7 - 1.5E-6	85 (138) S	4.0E-*	13 (800) NA
63	Contents (blood)*	1.0E-4*			7.0E-5*		Based on blood	7.4E-1*	26 (2) FS
64	Kidney*	2.9E-5*		68 (5) ?	<3.4E-7*	<3.1E-7 - 3.4E-6	85 (143) S	6.2E-1*	Based on blood
65	Larynx*			68 (6) ?	<9.3E-8*	<3.9E-8 - 6.7E-7	85 (50) S	7.7E-2*	26 (2) FS
66	Liver*	1.2E-3*		68 (7) ?	2.0E-5*	2.7E-6 - 6.8E-5	85 (148) S	1.8 E*	38
67	Lung*	1.8E-4*		Sum	7.6E-7*		Sum	1.8*	26 (2) FS
68	Parenchyma	8.1E-5		68 (7)	<6.3E-7	<5.8E-7 - 3.7E-6	85 (139) S	1.0	Sum
69	Blood	9.6E-5		Based on blood	7.6E-5		Based on blood	8.0E-1	26, 38
73	Lymph nodes (dissectible)*								Based on blood
77	Muscle (skeletal)*	5.0E-3*			<3.4E-5*	<2.8E-5 - 1.5E-4	85 (135) S	2.1E-1*	26 (2) FS
79	Pancreas*	2.9E-5*		68 (3) ?	1.3E-7*	<8.0E-8 - 9.6E-7	85 (137) S	1.4E-1*	38
82	Pituitary*								
83	Prostate*				2.1E-8*	<1.3E-8 - 1.9E-7	85 (48) S	3.2E-2*	38
88	Skeleton*							3.2E-1*	20, 34, 45, 66
89	Bone*								
90	Cortical								
91	Trabecular								
92	Red marrow				2.1E-6	<5.3E-7 - 1.1E-5	Based on subcut. adip.	6.6E-1	Based on subcut. adip.
93	Yellow marrow							6.0	20, p. 533
94	Cartilage							4.9	Based on cart.
95	Periarticular tissue				2.3E-5*	5.1E-6 - 8.5E-5	85 (22) S	4.7*	26 (2) FS
96	Skin*							1.8E-1	74
97	Epidermis							4.5	By difference
98	Dermis				<2.5E-7*	<2.2E-7 - 1.2E-6	85 (141) S	2.2E-1*	38
100	Spleen*	5.6E-5*		68 (5) ?					
101	Teeth*								
102	Enamel								
103	Dentin								
105	Testes (2)*	1.3E-5*		68, p. 235 (1)	<3.8E-8*	<3.1E-8 - 2.5E-7	85 (71) S	7.6E-2*	38
106	Thymus*				3.6E-8*		84 (9) S		
107	Thyroid*				2.7E-8*	<1.6E-8 - 2.4E-6	85 (20) S	4.4E-2*	38
108	Tongue*				(<8.4 - 8)*		84 (2) S		
110	Trachea*				3.1E-8*	<9.4E-9 - 2.2E-7	85 (60) S	3.0E-2*	38
113	Urinary bladder*				<4.1E-8*	<2.7E-8 - 2.0E-7	85 (112) S	7.2E-2*	38
114	Contents (urine)*				6.6E-7*		83, 89 S	4.4E-1*	75 S

Organ and tissue	39 Strontium		40 Sulfur		41 Tellurium	
	Quantity in tissue or organ (g)	80% range (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method	
1 Total body	3.2E-1					
1a Total soft tissue	3.3E-3					
2 Adipose tissue	3.7E-4	1.8E-4 - 9.0E-4	Extrap. from 97%	1.4E+2	Extrap. from	
3 Subcutaneous*	2.2E-4*	7.2E-5 - 4.1E-4	Sum 43, 84 (34) S	1.2E+2	54%	
4 Other separable*	1.0E-4*	1.8E-5 - 3.3E-4	85 (oment.) (74) S	1.1E+1	67, p. 149	
5 Interstitial	2.9E-6	9.6E-6 - 5.4E-5	Based on subcut. adip.	5.5*		
7 Adrenals (2)*	2.2E-7*	4.9E-8 - 7.7E-7	85 (13) S	3.7*		
8 Aorta*	5.0E-5*	1.8E-5 - 1.2E-4	85 (103) S	7.2E-1		
9 Contents (blood)*	6.2E-6*		Based on blood			
10 Blood (whole)	1.8E-4		7, 49	3.6E-1*		
11 Plasma	1.7E-4		7	1.0E+1		
12 Erythrocytes	8.0E-6		7	2.7		
13 Blood vessels*				7.9		
14 Contents (blood)*	9.8E-5*		Based on blood			
21 Cartilage	7.2E-4	3.1E-4 - 7.7E-4	44, 86 (68) S	5.5*		
22 Connective tissue	2.2E-3		Based on cart.	6.6		
26 Separable connective tissue*	1.0E-3*		Based on cart.	2.0E+1		
27 Central nervous system*	3.4E-5*		Based on brain	9.6*		
28 Brain	3.4E-5	1.4E-5 - 9.0E-5	85 (127) S	2.4*	3.5E-4*	
29 Cerebrum	2.9E-5	1.2E-5 - 7.8E-5	Based on brain	2.4	47 (1) NA	
30 Cerebellum	3.6E-6	1.5E-6 - 9.6E-6	Based on brain	2.1	Based on brain	
31 Brain stem	7.2E-7	2.9E-7 - 1.9E-6	Based on brain	2.6E-1	Based on brain	
33 Contents* (CerSpFl)			Based on brain	5.1E-2	Based on brain	
35 Eye lenses (2)*	7.5E-8		71	6.5E-4*	Based on brain	
36 Gall bladder*	1.2E-6*	6.0E-7 - 2.2E-6	84 (36) S			
38 GI tract*	1.9E-4*	5.2E-5 - 4.8E-4	Sum	1.3*		
40 Esophagus	2.7E-6	1.8E-6 - 8.0E-6	85 (65) S		54 (4) AA	
41 Stomach	1.2E-5	3.6E-6 - 2.8E-5	85 (130) S	1.7E-1		
43 Intestine	1.7E-4	4.6E-5 - 4.4E-4	Sum	1.1	67 (4) AA	
45 Small intestine	9.2E-5	2.0E-5 - 2.3E-4	Sum	7.0E-1		
47 Duodenum	5.2E-6	1.1E-6 - 1.1E-5	85 (67) S	6.6E-2	Based on sm. intest.	
48 Jejunum	2.8E-5	7.5E-6 - 7.5E-5	85 (100) S	3.1E-1	Based on sm. intest.	
49 Ileum	5.4E-5	1.1E-5 - 1.3E-4	85 (81) S	3.3E-1	Based on sm. intest.	
50 Large intestine	7.3E-5	2.2E-5 - 1.9E-4	Sum	4.1E-1	Based on sm. intest.	

52	Upper large intestine	5.0E-5	1.7E-5 - 1.5E-4	Sum	2.4E-1	Based on intest.	3.4E-5	Based on sm. intest.
54	Ascending colon and cecum	2.2E-5	7.3E-6 - 5.4E-5	85 (31) S	9.9E-2	Based on intest.	1.5E-5	Based on sm. intest.
55	Transverse colon	4.3E-5	9.6E-6 - 7.2E-5	Based on cecum	1.4E-1	Based on intest.	2.1E-5	Based on sm. intest.
56	Lower large intestine	2.4E-5	6.3E-6 - 7.0E-5	Sum	1.7E-1	Based on intest.	2.8E-5	Based on sm. intest.
58	Descending colon	1.4E-5	3.3E-6 - 4.1E-5	Based on sig. colon	9.9E-2	Based on intest.	1.5E-5	Based on sm. intest.
59	Sigmoid colon	7.5E-6	1.8E-6 - 2.3E-5	85 (107) S	5.4E-2	Based on intest.	2.5E-5	Based on sm. intest.
60	Rectum	3.4E-6	1.2E-6 - 7.3E-6	85 (42) S	2.2E-2	Based on intest.	1.0E-5	Based on sm. intest.
61	Hair*	1.0E-6*		59, p. 642	8.8E-1*			
62	Heart*	8.4E-6*	3.6E-6 - 2.3E-5	85 (140) S	5.4E-1*	72, p. 77	7.8E-5*	67 (4) AA
63	Contents (blood)*	3.5E-6*		Based on blood	7.1E-1*	51 C		
64	Kidney*	1.8E-5*	9.3E-6 - 4.0E-5	85 (143) S		Based on blood	1.2E-4*	47 (1) NA
65	Larynx*	2.4E-5*	4.5E-6 - 7.7E-5	85 (50) S				
66	Liver*	3.2E-5*	1.6E-5 - 9.4E-5	85 (146) S	5.2*	(2) C	5.9E-4*	47 (1) NA
67	Lung*	5.7E-5*		Sum	2.2*	Sum	5.2E-5*	47 (1) NA
68	Parenchyma	5.3E-5	2.8E-5 - 1.1E-4	85 (141) S	1.4	51 (1) C		
69	Blood	3.8E-6		Based on blood	8.0E-1	Based on blood		
73	Lymph nodes (dissectible)*							
77	Muscle (skeletal)*	4.2E-4*	9.2E-5 - 1.5E-3	85 (135) S	6.7E-1*	17, p. 282	2.7E-5*	47 (1) NA
79	Pancreas*	3.5E-6*	1.7E-6 - 1.0E-5	85 (139) S			2.6E-5*	67 (4) AA
82	Pituitary*							
83	Prostate*	2.2E-6*	8.0E-7 - 6.7E-6	85 (48) S				
88	Skeleton*	3.2E-1*	1.7E-1 - 5.6E-1	44, 86 (91) S	1.7E-1*	54 (sternu.) (1) C		
89	Bone							
90	Cortical				1.2E-1	95		
91	Trabecular							
92	Red marrow							
93	Yellow marrow							
94	Cartilage	3.8E-5	1.2E-5 - 7.1E-5	Based on subcut. adip.	1.1	51, p. 839	2.2E-3	67, p. 149
95	Periarticular tissue	7.2E-4	3.1E-4 - 7.7E-4	44, 86 (68) S	6.6			
96	Skin*	5.9E-4		Based on cart.	5.4	Based on cart.		
97	Epidermis	1.8E-4*	7.4E-5 - 2.8E-4	85 (21) S	4.1*	51 (1) C		
98	Dermis							
100	Spleen*	5.2*	2.7E-6 - 1.4E-5	85 (143) S	2.9E-1*	17, p. 282	5.0E-6*	47 (1) NA
101	Teeth*							
102	Enamel							
103	Dentin							
105	Testes (2)*	1.6E-6*	8.2E-7 - 4.5E-6	85 (69) S	4.9E-2*		1.7E-6*	47 (1) NA
106	Thymus*	1.4E-6*		43, 84 (9) S				
107	Thyroid*	2.6E-6*	1.1E-6 - 4.4E-6	85 (21) S				
108	Tongue*	5.5E-6*		43, 84 (2) S	1.4E-1*			
110	Trachea*	3.1E-6*	1.5E-6 - 1.3E-5	85 (60) S				
113	Urinary bladder*	3.9E-6*	2.0E-6 - 8.6E-6	85 (110) S				
114	Contents (urine)*	1.5E-5*		88, 89 S				

Organ and tissue	42 Tin			43 Titanium			44 Uranium	
	Quantity in tissue or organ (g)	80% range (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	80% range (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method
1 Total body	<1.7E-2							
1a Total soft tissue	5.8E-3							
2 Adipose tissue	7.0E-4	1.5E-5 - 3.8E-3	Extrap. from 97% Sum	9.0E-3		Extrap. from 95% Sum	9.0E-5	Extrap. from 80% 31a (2) RC
3 Subcutaneous*	4.1E-4*	7.5E-5 - 2.0E-3	43, 84 (34) S	4.7E-4	1.4E-4 - 2.4E-3	Sum	9.0E-6	Based on adip. 31a (2) RC
4 Other separable*	1.5E-4*	4.5E-5 - 1.1E-3	85 (omient.) (74) S	2.0E-4*	6.8E-5 - 7.5E-4	43, 84 (34) S	4.5E-6*	Based on adip. 31a (2) RC
5 Interstitial	5.4E-5	1.0E-5 - 2.6E-4	Based on subcut. adip. 85 (15) S	2.7E-5	5.0E-5 - 1.4E-3	85 (omient.) (75) S	3.0E-6*	Based on adip. 31a (2) RC
7 Adrenals (2)*	1.4E-6*	1.4E-7 - 3.8E-6	Based on subcut. adip. 85 (15) S	7.0E-7*	9.0E-6 - 1.0E-4	subcut. adip. 85 (13) S	6.0E-7	Based on adip. 31a (2) RC
8 Aorta*	1.8E-5*	8.5E-6 - 7.5E-5	85 (105) S	<9.2E-6*	<2.2E-7 - 2.9E-6	85 (104) S		
9 Contents (blood)*	2.3E-5*		Based on blood 7	4.7E-6*	<5.0E-6 - 3.5E-5	Based on blood 7	1.6E-7*	Based on blood 31a (21) RC
10 Blood (whole)	6.8E-4		29 (43) XF	1.4E-4		By difference	4.6E-6	
11 Plasma	1.0E-4		By difference	1.2E-4				
12 Erythrocytes	5.5E-4			8.0E-5				
13 Blood vessels*								
14 Contents (blood)*	3.7E-4*		Based on blood 44, 86 (68) S	7.6E-5*		Based on blood 44, 86 (68) S		
21 Cartilage	<1.5E-4	<8.4E-5 - 6.1E-4	Based on cart. 2.0E-4	2.0E-4	<1.1E-4 - 5.3E-4	Based on cart. 2.0E-4		
22 Connective tissue	<4.7E-4		Based on cart. 2.9E-4*	6.2E-4		Based on cart. 2.9E-4*		
26 Separable connective tissue*	<2.2E-4*							
27 Central nervous system*	<1.1E-4*		Based on brain	<1.1E-4*		Sum	2.1E-6*	Based on blood 31a (21) RC
28 Brain	<1.1E-4	<9.8E-5 - <1.7E-4	85 (129) S	<1.1E-4	<9.8E-5 - <1.4E-4	85 (129) S		
29 Cerebrum	<9.8E-5	<8.5E-5 - <1.5E-4	Based on brain	<9.8E-5	<8.5E-5 - <1.2E-4	Based on brain		
30 Cerebellum	<1.2E-5	<1.1E-5 - <1.8E-5	Based on brain	<1.2E-5	<1.1E-5 - <1.5E-5	Based on brain		
31 Brain stem	<2.4E-6	<2.1E-6 - <3.6E-6	Based on brain	<2.4E-6	<2.1E-6 - <3.0E-6	Based on brain		
33 Contents* (CerSpFl)								
35 Eye lenses (2)*	2.0E-6*	3.5E-7 - 9.2E-6	84 (36) S	5.5E-7*	2.7E-7 - 2.5E-6	84 (36) S		
36 Gall bladder*	4.8E-4*	2.0E-5 - 3.2E-3	Sum	<5.2E-5*	<3.3E-5 - 1.6E-4	Sum		
38 GI tract*	6.4E-6	<2.3E-6 - 3.3E-5	85 (68) S	<2.5E-6	<2.1E-6 - 1.8E-5	85 (66) S		
40 Esophagus	1.8E-5	<5.4E-6 - 7.8E-5	85 (131) S	<6.6E-6	<4.1E-6 - 8.0E-6	85 (130) S		
41 Stomach	4.5E-4	1.2E-5 - 3.1E-3	Sum	<4.3E-5	<2.7E-5 - 1.3E-4	Sum		
43 Intest	2.4E-4	5.8E-5 - 1.2E-3	Sum	<2.9E-5	<1.8E-5 - 7.4E-5	Sum		
45 Small intestine	1.2E-5	2.4E-6 - 6.6E-5	85 (68) S	<2.8E-6	<2.2E-6 - 7.8E-6	85 (67) S		
47 Duodenum	1.9E-5	1.9E-5 - 2.8E-4	85 (104) S	<1.3E-5	<8.4E-6 - 2.2E-5	85 (102) S		
48 Jejunum	1.4E-4	3.3E-5 - 7.6E-4	85 (84) S	<1.4E-5	<7.5E-6 - 4.2E-5	85 (84) S		
49 Ileum	1.9E-4	5.3E-5 - 1.6E-3	Sum	<1.5E-5	<9.6E-6 - 5.3E-5	Sum		
50 Large intestine	1.5E-4	4.9E-5 - 1.3E-3	Sum	8.4E-6	<5.4E-6 - 1.8E-5	Sum		

54	Ascending colon and cecum	6.3E-5	2.1E-5-5.8E-4	85 (31) S Based on cecum	3.6E-6	<2.3E-6-7.7E-6	85 (31) S		
55	Transverse colon	1.1E-4	3.5E-5-9.6E-4	Based on cecum	4.8E-6	<3.0E-6-1.0E-5	Based on cecum		
56	Lower large intestine	5.0E-5	8.3E-6-3.6E-4	Sum	6.4E-6	<4.2E-5-3.2E-5	Sum		
58	Descending colon	2.7E-5	4.9E-6-2.1E-4	Based on sig. colon	<3.6E-6	<2.2E-6-2.1E-5	Based on sig. colon		
59	Sigmoid colon	1.5E-5	2.7E-6-1.0E-4	85 (109) S	<2.0E-6	<1.3E-6-1.0E-5	85 (108) S		
60	Rectum	8.0E-6	9.3E-7-6.7E-5	85 (42) S	9.3E-7	<6.0E-7-2.4E-6	85 (42) S		
61	Hair*	1.8E-5*	<1.1E-5-7.6E-5	85 (140) S	1.0E-6*	<1.4E-5-2.2E-5	85 (140) S	5.3E-8*	31a (1) RC
62	Heart*	4.8E-5*	1.9E-5-1.6E-4	Based on blood	9.6E-6*	<1.6E-5*	Based on blood	4.2E-7*	Based on blood
63	Contents (blood)*	5.9E-5*	<3.4E-6-1.3E-5	85 (145) S	<1.7E-5*	<1.6E-5-2.2E-5	85 (144) S	7.0E-6*	31a (21) RC
64	Kidney*	6.2E-6*	1.5E-4-1.7E-3	85 (50) S	<4.9E-6*	<1.9E-6-7.8E-6	85 (50) S	4.3E-7*	31a (2) RC
65	Larynx*	5.8E-4*	6.9E-5-6.9E-4	85 (150) S	<1.2E-4*	<9.0E-5-4.0E-4	85 (148) S	1.0E-6*	31a (10) RC
66	Liver*	2.8E-4*	<1.4E-3-3.1E-3	Sum	2.4E-3*	3.4E-4-4.4E-3	Sum	3.6E-7	Based on blood
67	Lung*	2.3E-4	<1.7E-3*	85 (140) S	1.4E-3	<1.7E-3*	85 (141) S	5.3E-6*	31a (8) RC
68	Parenchyma	5.2E-5	<4.5E-6-2.8E-5	Based on blood	1.0E-3	<3.5E-6-1.7E-5	Based on blood	5.9E-5*	31a (63) RC
69	Blood	2.3E-4*	<7.0E-7-1.1E-5	43, 84 S	2.0E-3*	<9.9E-7*	43, 84 S		
70	Lymph nodes	<1.7E-3*	<7.5E-3-1.8E-2	85 (137) S	<1.7E-3*	<7.2E-7-6.2E-6	85 (136) S		
71	Muscle (skeletal)*	7.0E-6*	<1.4E-3-3.1E-3	85 (139) S	<6.0E-6*		85 (139) S		
72	Pancreas*	2.6E-6*	<1.4E-3-3.1E-3	85 (50) S	<9.9E-7*		85 (50) S		
73	Pituitary*	<1.2E-2*	<7.0E-7-1.1E-5	44, 86 (91)					
74	Prostate*								
75	Skeleton*								
76	Bone								
77	Cortical								
78	Trabecular								
79	Red marrow								
80	Yellow marrow								
81									
82									
83									
84									
85									
86									
87									
88									
89									
90									
91									
92									
93									
94	Cartilage	7.1E-5	1.3E-5-3.4E-4	Based on subcut. adip.	3.5E-5	1.1E-5-1.5E-4	Based on subcut. adip.	7.9E-7	Based on adip.
95	Pariarticular tissue	<1.5E-4	<8.4E-5-6.1E-4	44, 86 (68) S	2.0E-4	<1.1E-4-5.3E-4	44, 86 (68) S		
96	Skin*	<1.2E-4	1.3E-4-1.5E-3	Based on cart.	1.6E-4	2.5E-4-2.5E-3	Based on cart.		
97	Epidermis	4.1E-4*		85 (22) S	6.4E-4*		85 (22) S		
98	Dermis								
99									
100	Spleen*	2.7E-5*	1.2E-5-8.6E-5	85 (143) S	<1.3E-5*	<1.1E-5-3.1E-5	85 (143) S	1.5E-7*	Based on blood
101	Teeth*								
102	Enamel								
103	Dentin								
104	Testes (2)*	3.8E-6*	<1.7E-6-1.2E-5	85 (72) S	<1.9E-6*	<1.6E-6-3.8E-6	85 (72) S		
105	Thymus*	1.0E-6*	<9.6E-7-1.1E-5	43, 84 (9) S	<5.0E-7*	<9.0E-7-2.0E-5	43, 84 (9) S		
106	Thyroid*	3.4E-6*		85 (21) S	1.4E-6*		85 (21) S		
107	Tongue*	8.4E-6*		43, 84 (2) S	<4.2E-6*		43, 84 (2) S		
108	Trachea*	2.2E-6*	1.0E-6-9.4E-6	85 (60) S	<1.2E-6*	<5.1E-7-1.0E-5	85 (60) S		
109	Urinary bladder*	5.4E-6*	<1.8E-6-2.1E-5	85 (112) S	<2.0E-6*	<1.4E-6-9.5E-6	85 (110) S		
110	Contents (urine)*	8.8E-6*		88, 89 S	2.9E-5*		88, 74, 75, 89		

Organ and tissue	45 Vanadium		Reference (number of subject) analytical method	46 Yttrium		Reference (number of subject) analytical method
	Quantity in tissue or organ (g)	80% range (g)		Quantity in tissue or organ (g)	80% range (g)	
1 Total body						
1a Total soft tissue	<1.8E-2					
2 Adipose tissue	2.2E-2					
3 Subcutaneous*	1.6E-2*					
4 Other separable*	1.6E-3*					
5 Interstitial	1.6E-3					
7 Adrenals (2)*	<8.3E-8*					
8 Aorta*	(<1.4E-6)*	<2.8E-8 - <1.1E-7	Extrap. from 83% Sum	5.2E-6*		19 (2) XF
9 Contents (blood)*	3.1E-6*		61 AA Based on subcut. adip.	8.4E-7*		Based on blood
10 Blood (whole)	8.8E-5		Based on subcut.	2.6E-5		31b (39) MS
11 Plasma	3.1E-5		Based on subcut. adip.			
12 Erythrocytes	5.7E-5		85 (13) S			
13 Blood vessels*			85 (104) S			
14 Contents (blood)*	4.8E-5*		Based on blood	1.3E-5*		Based on blood
21 Cartilage	<1.2E-4	<8.2E-5 - <3.1E-4	44, 86 (68) S			
22 Connective tissue	<3.7E-4		Based on cart.			
26 Separable connective tissue*	<1.7E-4*		Based on cart.			
27 Central nervous system*	(<2.2E-5)*		Sum	1.3E-3*		Sum
28 Brain	(<2.2E-5)		85 (129) S	1.3E-3	<1.3E-3 - 2.1E-3	19 (13) XF
29 Cerebrum	(<2.0E-5)		Based on brain			
30 Cerebellum	(<2.4E-6)		Based on brain			
31 Brain stem	(<4.8E-7)		Based on brain			
33 Contents* (CerSpFl)						
35 Eye lenses (2)*	<2.5E-7*	<1.3E-7 - <4.8E-7	84 (36) S			
36 Gall bladder*	<9.6E-6*	<6.2E-6 - 2.9E-5	Sum			
38 GI tract*	<3.8E-7	<3.7E-7 - <6.2E-7	85 (66) S			
40 Esophagus	<1.2E-6	<8.1E-7 - <1.3E-6	85 (130) S			
41 Stomach	<7.9E-6	<4.9E-6 - 2.7E-5	Sum			
43 Intestine	<5.2E-6	<3.5E-6 - <1.0E-5	Sum			
45 Small intestine	<4.8E-7	<3.6E-7 - <6.0E-7	84 (67) S			
47 Duodenum	<2.5E-6	<1.6E-6 - <3.4E-6	84 (102) S			
48 Jejunum	<2.4E-6	<1.5E-6 - 8.1E-6	84 (84) S			
49 Ileum	<2.8E-6	<1.6E-6 - 1.3E-5	Sum			
50 Large intestine						

52	Upper large intestine	<1.7E-6	<1.0E-6 - 7.3E-6	Sum 85 (31) S			
54	Ascending colon and cecum	<7.2E-7	<4.5E-7 - 2.6E-6	Based on cecum			
55	Transverse colon	<9.6E-7	<6.0E-7 - 3.5E-6	Sum			
56	Lower large intestine	<1.2E-6	<6.4E-7 - 5.9E-6	Based on sig. colon			
58	Descending colon	<6.3E-7	<3.6E-7 - 1.9E-6	Sum			
59	Sigmoid colon	<3.5E-7	<2.0E-7 - 1.0E-6	85 (108) S			
60	Rectum	<1.4E-7	<1.0E-7 - 4.6E-6	85 (42) S			
61	Hair*						19 (3) XF Based on blood
62	Heart*	($<3.4E-6$)*		85 (140) S	<9.9E-5*		19 (3) XF
63	Contents (blood)*	6.3E-6*		Based on blood	2.2E-6*		19 (3) XF
64	Kidney*	($<3.4E-6$)*		71 (144) S	<1.0E-4*		
65	Larynx*	($<8.8E-7$)*		71 (50) S			19 (5) XF
66	Liver*	<2.3E-5*	<1.8E-5 - <3.2E-5	71 (148) S	1.6E-3*		
67	Lung*	1.3E-5*		Sum			
68	Parenchyma	6.9E-6	<5.8E-6 - 8.6E-5	85 (141) S			
69	Blood	6.8E-6		Based on blood	1.9E-6		Based on blood
73	Lymph nodes (dissectible)*	4.3E-5*		43, 84 S	5.6E-4*		19 (5) XF
77	Muscle (skeletal)*	($<3.4E-6$)*	<7.0E-7 - <1.5E-6	85 (136) S			19 (3) XF
79	Pancreas*	<1.2E-6*		85 (139) S	7.2E-5*		
82	Pituitary*						19 (33) XF
83	Prostate*	<1.8E-7*	<1.3E-7 - <2.9E-7	85 (50) S	<5.3E-6*	<5.3E-6 - 1.1E-5	
88	Skeleton*						
89	Bone						
90	Cortical						
91	Trabecular						19 (4) XF
92	Red marrow						
93	Yellow marrow	2.1E-3		Based on subcut. adip.	<4.5E-3		
94	Cartilage						
95	Periarticular tissue	<1.2E-4	<8.2E-5 - 3.1E-4	44, 86 (68) S			
96	Skin*	<9.8E-5	<1.5E-5 - 5.1E-5	Based on cart.			
97	Epidermis	<2.1E-5*		85 (21) S			19 (5) XF
98	Dermis						
100	Spleen*						
101	Teeth*						
102	Enamel	<2.5E-6*	<2.0E-6 - <2.9E-6	85 (143) S			
103	Dentin						
105	Testes (2)	($<3.8E-7$)*					19 (5) XF
106	Thymus*	($<9.8E-8$)*		85 (72) S	1.5E-5*		
107	Thyroid*	<2.2E-7*	<1.7E-7 - 3.2E-7	43, 84 (9) S			19 (4) XF
108	Tongue*	($<8.4E-7$)*		85 (21) S	8.7E-5*		19 (3) XF
110	Tongue*	($<8.4E-7$)*		43, 84 (2) S	<2.1E-5*		
110	Trachea*	($<1.6E-7$)*		85 (60) S			
113	Urinary bladder*	<3.6E-7*	<2.3E-7 - <5.0E-7	85 (110) S			
114	Contents (urine)*	2.9E-6*		88, 89			

Organ and tissue	47 Zinc		48 Zirconium		
	Quantity in tissue or organ (g)	80% range (g)	Reference (number of subject) analytical method	Quantity in tissue or organ (g)	Reference (number of subject) analytical method
1 Total body	2.3				
1a Total soft tissue	1.8				
2 Adipose tissue	2.7E-2	1.4E-2 - 1.3E-1	Extrap. from 97% Sum	4.2E-1	Extrap. from 79% Sum
3 Subcutaneous*	9.8E-3*	5.6E-3 - 2.4E-2	43, 84 (34) S	2.8E-1	65 (3) CO
4 Other separable*	1.4E-2*	6.0E-3 - 5.0E-2	85 (73) S	1.4E-1*	Based on subcut. adip.
5 Interstitial	1.2E-3	7.5E-4 - 3.2E-3	Based on subcut. adip.	9.5E-2*	Based on subcut. adip.
7 Adrenals (2)*	1.1E-4*	4.8E-5 - 1.5E-4	85 (15) S	1.9E-2	
8 Aorta*	2.6E-3*	1.4E-3 - 4.8E-3	85 (104)	9.5E-4*	65 (1) CO
9 Contents (blood)*	1.2E-3*		Based on blood	4.9E-4*	Based on blood
10 Blood (whole)	3.4E-2		7	1.3E-2	Sum
11 Plasma	5.6E-3		7	1.2E-3	65 (3) CO
12 Erythrocytes	2.8E-2		7	1.3E-2	65
13 Blood vessels*					
14 Contents (blood)*	1.7E-2*		Based on blood	7.0E-3*	Based on blood
21 Cartilage	1.1E-2	6.0E-3 - 4.1E-2	44, 86 (68) S		
22 Connective tissue	3.4E-2		Based on cart.		
26 Separable connective tissue*	1.6E-2*		Based on cart.		
27 Central nervous system*	1.7E-2*		Based on brain	3.6E-3*	Based on brain
28 Brain	1.7E-2	1.2E-2 - 2.7E-2	85 (129) S	3.6E-3	65 (4) CO
29 Cerebrum	1.5E-2	1.1E-2 - 2.3E-2	Based on brain	3.2E-3	Based on brain
30 Cerebellum	1.8E-3	1.3E-3 - 2.9E-3	Based on brain	3.9E-4	Based on brain
31 Brain stem	3.6E-4	2.6E-4 - 5.7E-4	Based on brain	7.8E-5	Based on brain
33 Contents* (CetSpFl)					
35 Eye lenses (2)*	8.2E-5*	4.6E-5 - 1.5E-4	84 (36) S		
36 Gall bladder*	2.3E-2*	6.9E-3 - 3.7E-2	Sum	1.8E-3*	Sum
38 GI tract*	9.6E-4	7.8E-4 - 2.1E-3	85 (67) S		
40 Esophagus	2.8E-3	1.8E-3 - 3.6E-3	85 (130) S	2.4E-4	65 (2) CO
41 Stomach	1.9E-2	6.6E-3 - 3.1E-2	Sum	1.6E-3	Based on jejun.
43 Intestine	1.2E-2	7.7E-3 - 2.0E-2	85 (68) S	1.0E-3	Based on jejun.
45 Small intestine	1.1E-3	7.6E-4 - 8.1E-4	Sum	9.6E-5	Based on jejun.
47 Duodenum	5.3E-3	3.7E-3 - 7.5E-3	85 (103) S	3.5E-4	65 (2) CO
48 Jejunum	5.7E-3	3.3E-3 - 1.0E-2	85 (84) S	4.8E-4	Based on jejun.
49 Ileum	7.2E-3	4.1E-4 - 1.1E-3	Sum	5.9E-4	Based on jejun.
50 Large intestine					

52	Upper large intestine	4.2E-3	2.5E-4-8.0E-3	Sum	3.4E-4	Based on jejum.
54	Ascending colon and cecum	1.8E-3	1.1E-3-2.8E-3	85 (31) S	1.4E-4	Based on jejum.
55	Transverse colon	2.4E-3	1.4E-3-3.8E-3	Based on cecum	1.9E-4	Based on jejum.
56	Lower large intestine	3.0E-4	1.7E-4-4.5E-3	Sum	2.6E-4	Based on jejum.
58	Descending colon	1.6E-3	8.6E-4-2.6E-3	Based on sig. colon	1.4E-4	Based on jejum.
59	Sigmoid colon	9.2E-4	5.0E-4-1.3E-3	85 (108) S	7.9E-5	Based on jejum.
60	Rectum	4.6E-4	2.8E-4-8.7E-4	85 (42) S	3.2E-5	Based on jejum.
61	Hair*	5.2E-3*		13	5.4E-4*	65 (4) CO
62	Heart*	8.4E-3*	6.0E-3-1.3E-2	85 (140) S	8.4E-4*	65 (4) CO
63	Contents (blood)*	2.4E-3*		Based on blood	1.1E-2*	65 (3) CO
64	Kidney*	1.5E-2*	1.1E-2-2.5E-2	85 (145) S	2.0E-3	65 (4) CO
65	Larynx*	5.4E-4*	4.3E-4-2.8E-3	85 (48) S	7.3E-2*	65 (1) CO
66	Liver*	8.5E-2*	4.9E-2-1.4E-1	85 (150) S	2.1E-4*	65 (3) CO
67	Lung*	1.1E-2*		Sum		
68	Parenchyma	8.1E-3	5.7E-3-1.2E-2	85 (141) S		
69	Blood	2.6E-3		Based on blood		
73	Lymph nodes (dissectible)*	2.7E-3*		43, 84 S		
77	Muscle (skeletal)*	1.5*	9.8E-1-2.2	85 (137) S		
79	Pancreas*	2.5E-3*	1.6E-3-3.6E-3	85 (138) S		
82	Pituitary*					
83	Prostate*	1.3E-3*	4.6E-4-3.4E-3	85 (50) S		
88	Skeleton*	4.8E-1*	<3.3E-1-6.1E-1	44, 86 (91) S		
89	Bone			70		
90	Cortical	3.8E-1				
91	Trabecular					
92	Red marrow					
93	Yellow marrow					
94	Cartilage	1.7E-3	9.7E-4-4.1E-3	Based on subcut. adip.	2.5E-2	Based on subcut. adip.
95	Periarticular tissue	1.1E-2	6.0E-3-4.1E-2	44, 86 (68) S		
96	Skin*	9.0E-3		Based on cart.		
97	Epidermis	1.5E-2*	9.5E-3-2.2E-2	85 (21) S		
98	Dermis					
100	Spleen*	3.2E-3*	2.5E-3-4.9E-3	85 (142) S		
101	Teeth*					
102	Enamel					
103	Dentin					
105	Testes (2)*	5.2E-4*	3.2E-4-8.2E-4	85 (71) S	4.9E-5*	65 (4) CO
106	Thymus*	1.3E-4*		43, 84 (9) S		
107	Thyroid*	6.2E-4*	3.7E-4-9.7E-4	85 (21) S		
108	Tongue*	2.2E-3*		43, 84 (2) S		
110	Trachea*	1.5E-4*	9.3E-5-3.3E-4	85 (60) S		
113	Urinary bladder*	1.0E-3*	5.4E-4-1.5E-3	85 (112) S		
114	Contents (urine)*	1.8E-4*		88, 89 S	1.2E-5*	85, 89 S

Organ and tissue	49 Gallium		50 Polonium		51 Silicon	
	Quantity in tissue or organ (g)	Reference (number of subjects) analytical method	Quantity in tissue or organ (Curie)	Reference (number of subjects) analytical method	Quantity in tissue or organ (g)	Reference (number of subjects) analytical method
10 Blood	1.6E-5	31b (48) MS			1.4E-1	31b (50) MS
11 Plasma	<1.6E-4	30			9.0E-3	7
12 Erythrocytes						
35 Eye lenses (2)*						
61 Hair*			2.7E-11*	34 (6) RC		
64 Kidney*			2.7E-11*	34 (6)		
66 Liver*			1.9E-12	34 (6) RC		
67 Lung*	2.6E-7	45				
68 Parenchyma	5.0E-8	78 (24) S				
69 Blood	<1.2E-6	Based on blood				
88 Skeleton*						
114 Contents (urine)*					1.1E-2	Based on blood

CHAPTER 2

ADDENDUM I

WEIGHTS OF ORGANS AND TISSUES OF REFERENCE MAN

The values in Table 109 have been transferred from column 2 of Table 105. (A detailed explanation of each tissue and organ is given in the notes for Table 105.) The weight of each organ or tissue is assumed to include the blood vessels, lymphoid, adipose, and connective tissue that the organ or tissue contains in the living man, and such blood and other fluids as would not be lost when the tissue or organ is dissected from the body at autopsy. The organs and tissues indicated with an asterisk are considered to make up the totality of Reference Man, and the sum of their weights is 70 kg.

The mass of the item "miscellaneous" was determined by difference. This includes miscellaneous fluids which would be lost on dissection and so would not be included in the masses of organs weighed at autopsy and soft tissues like the pharynx which have not been included elsewhere.

TABLE 109. WEIGHTS OF ORGANS AND TISSUES OF REFERENCE MAN

Tissue or organ	Weight (g)	% of total body
Adipose tissue	15000	21
Subcutaneous*	7500*	11*
Other separable*	5000*	7.1*
Interstitial	1000	1.4
Yellow marrow (included with skeleton)	1500	2.1
Adrenals (2)*	14*	0.02*
Aorta*	100*	0.14*
Contents (blood)*	190* (180 ml)	0.27*
Blood—total	5500 g (5200 ml)	7.8
Plasma	3100 g (3000 ml)	4.4
Erythrocytes	2400 g (2200 ml)	3.4
Blood vessels* (not including aorta and pulmonary)	200*	0.29*
Contents (blood)*	3000* (2900 ml)	4.3*

Continued

TABLE 109—*Continued*

Tissue or organ	Weight (g)	% of total body
Cartilage (included with skeleton)	1100	1.6
Connective tissue	3400	4.8
Tendons and fascia	1400	2.0
Periarticular tissue	1500	2.1
Other connective tissue	500	0.7
Separable connective tissue*	1600*	2.3*
Central Nervous System*	1430*	2.04*
Brain	1400	2.0
Spinal cord	30	0.04
Contents—cerebrospinal fluid*	120*	0.17*
	(120 ml)	
Eyes (2)*	15*	0.02*
Lenses (2)	0.4	
Gall bladder*	10*	0.01*
Contents (bile)*	62*	0.09*
	(60 ml)	
GI tract*	1200*	1.7*
Esophagus	40	0.06
Stomach	150	0.21
Intestine	1000	1.4
Small	640	0.91
Upper large	210	0.30
Lower large	160	0.23
Contents of GI tract* (food plus digestive fluids)	1005*	1.4*
Hair*	20*	0.03*
Heart*	330*	0.47*
Contents (blood)*	500*	0.71*
	(470 ml)	
Kidneys (2)*	310*	0.44*
Larynx*	28*	0.04*
Liver*	1800*	2.6*
Lungs (2)*	1000*	1.4*
Parenchyma (includes bronchial tree, capillary blood, and associated lymph nodes)	570	0.81
Pulmonary blood	430	0.61
	(400 ml)	
Lymphocytes	1500	2.1
Lymphatic tissue	700	1.0
Lymph nodes (dissectible)*	250*	0.36*
Miscellaneous* (by difference)	2953.1*	4.2*
Soft tissue (nasopharynx, etc.)	300	0.43
Fluids (synovial, pleural, etc.)	350	0.50
Muscle (skeletal)*	28,000*	40.0*
Nails*	3*	
Pancreas*	100*	0.14*
Parathyroids (4)*	0.12*	
Pineal*	0.18*	
Pituitary*	0.6*	
Prostate*	16*	0.023*
Salivary glands (6)*	85*	0.12*
Skeleton*	10,000*	14*
Bone	5000	7.2
Cortical	4000	5.7
Trabecular	1000	1.4

Continued

TABLE 109—Continued

Tissue or organ	Weight (g)	% of total body
Skeleton*—Continued		
Red marrow	1500	2.1
Yellow marrow	1500	2.1
Cartilage	1100	1.6
Periarticular tissue (skeletal)	900	1.3
Skin*	2600*	3.7*
Epidermis	100	0.14
Dermis	2500	3.6
Hypodermis	7500	11
Spleen*	180*	0.26*
Teeth*	46*	0.066*
Testes (2)*	35*	0.05*
Thymus*	20*	0.029*
Thyroid*	20*	0.029*
Tongue*	70*	0.10*
Tonsils (2)*	4*	0.006*
Trachea*	10*	0.014*
Ureters (2)*	16*	0.023*
Urethra*	10*	0.014*
Urinary bladder*	45*	0.064*
Contents (urine)*	102* (100 ml)	0.15*
Total body*	70,000*	100*

The values in Table 110 have been transferred from the first row of Table 108. The details of how the values were determined are described in the notes for Table 108. Table 110 includes only those elements for which the concentration was known in at least 50% of the total body, including the skeleton.

TABLE 110. REFERENCE MAN: TOTAL BODY CONTENT FOR SOME ELEMENTS

Element	Amount (g)	Percent of total body weight
1. Oxygen	43,000	61
2. Carbon	16,000	23
3. Hydrogen	7000	10
4. Nitrogen	1800	2.6
5. Calcium	1000	1.4
6. Phosphorus	780	1.1
7. Sulfur	140	0.20
8. Potassium	140	0.20
9. Sodium	100	0.14
10. Chlorine	95	0.12
11. Magnesium	19	0.027
12. Silicon ^(a)	18	0.026
13. Iron	4.2	0.006
14. Fluorine	2.6	0.0037
15. Zinc	2.3	0.0033
16. Rubidium	0.32	0.00046

Continued

TABLE 110—*Continued*

Element	Amount (g)	Percent of total body weight
17. Strontium	0.32	0.00046
18. Bromine	0.20	0.00029
19. Lead	0.12	0.00017
20. Copper	0.072	0.00010
21. Aluminium	0.061	0.00009
22. Cadmium	0.050	0.00007
23. Boron	< 0.048	0.00007
24. Barium	0.022	0.00003
25. Tin	< 0.017	0.00002
26. Manganese	0.012	0.00002
27. Iodine	0.013	0.00002
28. Nickel	0.010	0.00001
29. Gold	< 0.010	0.00001
30. Molybdenum	< 0.0093	0.00001
31. Chromium	< 0.0018	0.000003
32. Cesium	0.0015	0.000002
33. Cobalt	0.0015	0.000002
34. Uranium	0.00009	0.0000001
35. Beryllium	0.000036	
36. Radium	3.1×10^{-11}	

(a) From Chapter 3.

CHAPTER 2

ADDENDUM II

VARIATION OF ELEMENTAL CONCENTRATION WITH AGE

The concentrations of elements in the total body and in the various organs and tissues do not necessarily remain constant throughout the life of an individual. Although precise data are scarce for most elements, the variation of potassium with age is a striking example of such age dependence.

The variation of total body potassium with age has been investigated by several groups, for the most part by whole body counting but also by isotopic dilution and direct chemical analysis. At Los Alamos during the period 1956–61, total body potassium was determined in a whole body counter in some 2960 subjects who ranged from less than 1 year to 79 years of age. The results of this study are shown in Fig. 65 which shows values for the concentration in grams of potassium per kilogram of total body as a function of age.

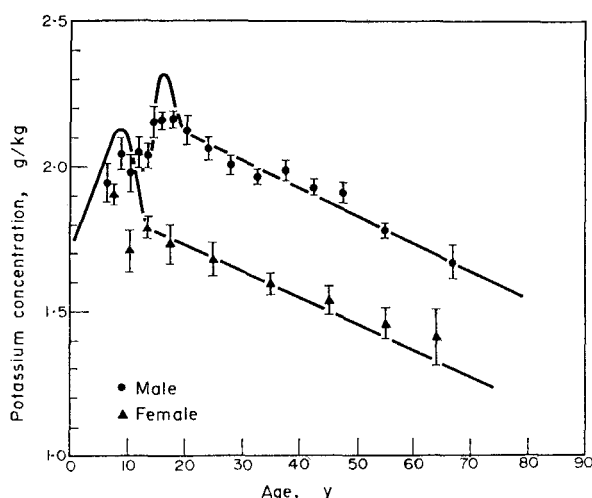


FIG. 65. Potassium concentration (g/kg) as a function of age for two large population samples. The solid curves are drawn for the 1956–8 sample, displaced downward by 2%, and the points are the 1959–60 repetition. (See Anderson, ref. 3a, p. 192.)

In a group of normal children, 18 boys and 16 girls between the ages of 5 and 16 years (ref. 58b), total body potassium was found to be highly correlated with age, and the relation for boys was different from that for girls. The regression equations for the two groups were:

For boys: total body-K (g) = 8.0 (age) - 13.5; SD 10.7 g; correl. coeff. = 0.92.

For girls: total body K (g) = 4.7 (age) + 10.2; SD 6.2 g; correl. coeff. = 0.94.

(Adapted from Reba *et al.*, 58a, p. 168).

Very little information about potassium is available for infants and children under 5 years of age.

Actually the variation with age and sex of the concentration of potassium in the total body as shown here reflects the amount of relatively potassium-free adipose tissue which is present with the "lean body mass" in the total body at different ages. It does not necessarily indicate equivalent changes in tissue or organ concentration, since adipose tissue is not distributed uniformly throughout the body. The available data on concentration of potassium in skeletal muscle show much less variation with age than does the average concentration in the total body.

TABLE 111. CORRELATION OF CONCENTRATION OF TRACE ELEMENT IN WET TISSUE WITH AGE IN YEARS

(correlation coefficients different from zero $p \leq 0.001$)
(concentrations in micrograms per gram of wet tissue)

Element	Tissue	Number of subjects	Age range (y)	Correlation coefficient	Equation of regression line
Aluminium	Lung	153	2-82	0.34	log conc. Al = 0.654 + 0.014 (age)
Calcium	Aorta	94	8-85	0.53	log conc. Ca = 2.337 + 0.012 (age)
	Bone (rib)	91	0.1-85	-0.47	conc. Ca = 113,500 - 608 (age)
	Kidney	129	0-85	0.39	log conc. Ca = 1.717 + 0.005 (age)
	Testis	71	12-80	0.37	log conc. Ca = 1.784 + 0.003 (age)
Copper	Liver	157	0-85	-0.35	log conc. Cu = 1.033 - 0.004 (age)
Magnesium	Aorta	94	8-85	0.47	log conc. Mg = 1.962 + 0.008 (age)
	Bone (rib)	92	0.1-85	-0.64	log conc. Mg = 3.173 - 0.004 (age)
Manganese	Bone (rib)	92	0.1-85	-0.41	log conc. Mn = -0.141 - 0.003 (age)
	Liver	157	0-85	-0.33	log conc. Mn = 0.226 - 0.002 (age)
Molybdenum	Liver	157	0-85	-0.33	log conc. Mo = 0.039 - 0.002 (age)
Phosphorus	Aorta	91	8-85	0.46	log conc. P = 2.700 + 0.007 (age)
Tin	Lung	152	0-85	0.42	log conc. Sn = -0.958 + 0.013 (age)

The group of 150 adults on which many of the values for Reference Man were based, plus 23 children from the United States, showed significant variation with age of a number of elements in several tissues. The results of this study are given in Table 111 (ref. 89a, p. 767). The correlation coefficients were not very large, but all were significantly

different from zero at the 99.9% level ($p \leq 0.001$). Except for calcium in bone, values of concentration in the wet tissue were not normally distributed about a central value. The log of the values for these elements did, however, follow a normal distribution, and the statistical treatment was carried out on the log of the concentration for these elements. The regression equations, therefore, are based on the log of the concentration for all elements except calcium in rib.

Other elements—for example, cadmium (refs. 60a; 67a) and lead (ref. 67b)—show a variation with age, but no quantitative relations have been expressed for such elements.

REFERENCES

1. AGNA, J. W., H. C. KNOWLES, JR., and G. ALVERSON, The mineral content of normal human bone, *J. Clin. Invest.* **37**, 1357 (1958).
2. ALLAWAY, W. H., JKUBOTA, F. LOSEE, and M. ROTH, Selenium, molybdenum and vanadium in blood, *Arch. Environ. Health* **16**, 342 (1968).
3. ALTMAN, P. L., and D. S. DITTMER, *Blood and Other Body Fluids*, Federation of American Societies for Experimental Biology, Washington, DC, 1961.
- 3a. ANDERSON, E. C., Three-component body composition analysis based on potassium and water determinations, *Ann. NY Acad. Sci.* **110**, 189 (1963).
4. ARMSTRONG, W. D., and P. J. BREKHUS, Chemical constitution of enamel and dentin: 1. Principal components, *J. Biol. Chem.* **120**, 677 (1937).
5. BATES, L. C. and F. F. DYER, Trace elements in human hair, *Nucleonics* **23**, 74 (1965).
- 5a. BERMAN, M., The iodine pool, 349, *Compartments, Pools and Spaces in Medical Physiology*, USAEC-TID, 1967 (ed. Bergner and Lushbaugh).
6. BODDY, K., R. MCG. HARDEN, and W. D. ALEXANDER, *In vivo* measurement of the intrathyroidal iodine concentration in man by activation analysis, *J. Clin. Endocr.* **28**, 294 (1968).
7. BOWEN, H. J. M., The elementary composition of mammalian blood, UKAEA Research Group, Isotope Research Division (AERE) Wantage Research Laboratory, Berkshire, AERE-R4196, February 1963.
8. BOYLEN, G. W., JR., and H. L. HARDY, Distribution of arsenic in nonexposed persons, *J. Am. Indust. Hyg. Assoc.* **28**, 148 (1967).
9. BRONNER, F., Dynamics and function of calcium, *Mineral Metabolism*, Chap. 20, Vol. II, Part A, p. 385, Academic Press, 1964 (ed. F. L. Comar and F. Bronner).
10. BUTT, E. M., R. E. NUSBAUM, T. C. GILMOUR, and L. DiDio, Trace metal patterns in disease states, *Metal Binding in Medicine*, Chap. 4, 43, J. B. Lippincott, Philadelphia, 1960 (ed. Marvin Seven).
11. CALL, R. A., D. A. GREENWOOD, W. H. CHEMINANT, J. L. SHUPE, H. M. NIELSEN, L. E. OLSON, R. E. LAMBORN, F. M. MANGELSON, and R. V. DAVIS, Histological and Chemical Studies in Man on Effects of Flouride, *Public Health Reports* **80**, USPHS, 529, (1965).
12. CHAMBERLAIN, M. J., J. H. FREMLIN, D. K. PETERS, and H. PHILIP, Total body sodium by whole body neutron activation in the living subject: further evidence for non-exchangeable sodium pool, *Br. Med. J.* **2**, 583 (1968).
13. COLEMAN, R. F., F. H. CRIPPS, A. STIMSON, and H. D. SCOTT, The trace element content of human hair in England and Wales and the application to forensic science, *Atom* **123**, 12 (1967).
14. COTLOVE, E., and C. A. M. HOGGEN, Chloride, *Mineral Metabolism*, Chap. 27, Vol. II, Part B, p. 109, Academic Press, 1962 (ed. C. L. Comar and F. Bronner).
15. DAMIENS, M. A., Sur le brome et le chlore existant normalement dans les tissus animaux, *C. R. Acad. Sci.* **171**, 931 (1920).
16. DECKER, C. F., T. FIELD, E. KAPLAN, and Y. T. OESTER, Manganese and copper concentrations in human serum and cerebrospinal fluid, *Proceedings of the Sixth International Congress of Nutrition*, p. 524, E. & S. Livingston, Edinburgh, 1964.
17. *Documenta Geigy Scientific Tables*, Basle, Switzerland, 1959.
18. EDELMAN, I. S., and M. D. LIEBMAN, Anatomy of body water and electrolytes, *Am. J. Med.* **27**, 256 (1959).
19. ERAMETSA, O., M. L. SIHVONEN, and A. FORSSEN, Rare earths in the human body: I. Yttrium, *Am. Med. Exp. Fenn.* **16**, 179 (1968).
- 19a. EVE, I. S., A review of the physiology of the gastrointestinal tract in relation to doses from radioactive materials, *Health Phys.* **12**, 131 (1966).

20. EVERETT, M. R., *Medical Biochemistry*, Paul B. Hoeber, Medical Book Dept. of Harper & Bros., 1942.
21. FISHER, D. A. and T. H. ODDIE, Comparison of thyroidal iodine accumulation and thyroxine secretion in euthyroid subjects, *J. Clin. Endocr.* **24**, 1143 (1964).
22. FORBES, R. M., A. R. COOPER, and H. H. MITCHELL, The composition of the adult human body as determined by chemical analysis, *J. Biol. Chem.* **203**, 359 (1953).
23. FORBES, R. M., H. H. MITCHELL, and A. R. COOPER, Further studies on the gross composition and mineral elements of the adult human body, *J. Biol. Chem.* **223**, 969 (1956).
24. FORBES, G. B., Chemical growth in man, *Pediatrics* **9**, 58 (1952).
25. FORBES, G. B., Sodium, *Mineral Metabolism*, Chap. 25, Vol. II, Part B, Academic Press, 1962 (ed. C. L. Comar and F. Bronner).
26. FORBES, G. B., and A. M. LEWIS, Total sodium, potassium, and chloride in adult man, *J. Clin. Invest.* **35**, 596 (1956).
27. FRUTON, J. S. and S. SIMMONS, *General Biochemistry*, 2nd edition, John Wiley, New York, 1959.
28. GEILMANN, W., K. BEYERMANN, KARL-HEINZ NEEB, and R. NEEB, Thallium ein regelmässig vorhandenes Spurenelement in tierischen und pflanzlichen Organismus, *Biochem. Z.* **333**, 62 (1960).
29. GOFMAN, J. W., Chemical elements of the blood of man in health, *Adv. Biol. Med. Phys.* **8**, 1 (1962).
30. GOFMAN, J. W., O. F. DELALLA, E. L. KOVICH, O. LOWE, W. MARTIN, D. L. PILUSO, R. K. TANDY, and F. UPHAM, Chemical elements of the blood of man, *Arch. Envir. Health* **8**, 113 (1964).
31. GROSS, JACK, Iodine and Bromine, *Mineral Metabolism*, Chap. 29, Vol. II, Part B, p. 221, Academic Press, 1962 (ed. C. L. Comar and F. Bronner).
- 31a. HAMILTON, E. I., The concentration of uranium in man and his diet, Abst. 242, Rad. Prot. Serv. Ministry of Health and Med. Res. Council, England, 1970.
- 31b. HAMILTON, E. I., personal communication, September 1970.
- 31c. HAMILTON, E. I., M. J. MINSKI, and J. J. CLEARY, The concentration and distribution of some stable elements in healthy human tissues from the United Kingdom—an environmental study, *The Science of the Total Environment* **1**, 341 (1972-3).
32. *Handbook of Clinical Laboratory Data*, Chemical Rubber Company 1965.
33. HAWK, P. B., B. LOSER, and W. H. SUMMERSON, *Practical Physiological Chemistry*, 12th edition, The Blakiston Co., 1947.
34. HILL, C. R., Polonium-210 in Man, *Nature* **208**, 423 (1965).
35. HEEDMAN, P. A., and B. JACOBSON, Thyroid iodine by X-ray spectrophotometry, *J. Clin. Endocr.* **24**, 246 (1964).
36. HURSH, J. B., and A. LOVAAS, Radium-226 in bone and soft tissues of man, *Nature* **198**, 265 (1963).
37. IMBUS, H. R., J. CHOLAK, L. H. MILLER, and T. STERLING, Boron, cadmium, chromium, and nickel in blood and urine, *Arch. Envir. Health* **6**, 286 (1963).
38. ICRP Publication 2, Report of Committee II on Permissible Dose of Internal Radiation, *Recommendations of the International Commission on Radiological Protection*, p. 147, Pergamon Press, 1959.
39. JOSELOW, M. M., L. J. GOLDWATER, and S. B. WEINBERG, Absorption and excretion of mercury in man: XI. Mercury content of "normal" human tissues, *Arch. Envir. Health* **15**, 64 (1967).
40. KEHOE, R. A., The metabolism of lead in man in health and disease, The Harben Lectures, 1960.
41. KELLERSHOHN, C., D. COMAR, and C. LEPOEC, Determination of the mercury content of human blood by activation analyses, *J. Lab. Clin. Med.* **66**, 168 (1965).
42. KOCH, H. J., E. R. SMITH, N. F. SHIMP, and J. CONNOR, The analysis of trace elements in human tissue: I. Normal values, *Cancer* **9**, 499, (1956).
43. KOIRTYOHANN, S. R., unpublished data, 1961-3.
44. KOIRTYOHANN, S. R. and C. FELDMAN, *Tissues Analysis Laboratory Progress Report*, Health Physics Annual Report ORNL-3492, 178, 1963.
45. LEDDICOTTE, G. W., Determination of trace elements by neutron activation analysis, memo. to I. H. Tipton, unpublished data, June 8, 1953.
46. LEDDICOTTE, G. W., Use of neutron activation analysis to determine trace elements in human tissue, memos. to M. J. Cook, Oak Ridge National Laboratory, unpublished data, March 5, 1958, and April 22, 1958.
47. LEDDICOTTE, G. W., personal communication, 1968.
48. LIPKIN, G., C. MARCH, and J. GOWDEY, Magnesium in epidermis, dermis, and whole skin of normal and atopic subjects, *J. Invest. Dermatol.* **43**, 293 (1964).
49. MAGNO, P. J., E. J. BARATTA, and I. E. LEONARD, Strontium-90 in human hair and blood, *Health Phys.* **12**, 1493 (1966).
50. MEEHAN, W. R., and L. E. SMYTHE, Occurrence of beryllium as a trace element in environmental materials, *Envir. Sci. Tech.* **1**, 839 (1967).

51. MINSKI, M. M., and J. J. CLEARY, Estimation of stable sulfur in human tissue, *Health Phys.* **12**, 837 (1966).
52. MOLOKHIA, M. M., and H. SMITH, Trace elements in the lung, *Arch. Envir. Health.* **15**, 745 (1967).
53. MOORE, F. D., K. H. OLESEN, J. D. MCMURREY, H. V. PARKER, M. R. BALL, and C. M. BOYDEN, *The Body Cell Mass and its Supporting Environment*, Saunders, 1963.
54. NEUFELD, A. H., Contributions to the biochemistry of bromine: II. The bromine content of human tissue, *Can. J. Res.* **15B**, 132 (1937).
55. ODDIE, T. H., D. A. FISHER, J. C. WAIT, and B. NEWTON, Radioiodide space in human subjects without edema, *J. Clin. Endocr.* **24**, 54 (1964).
56. PARR, R. M., and D. M. TAYLOR, The concentration of cobalt, copper, iron, and zinc in some normal human tissue as determined by neutron-activation analysis, *Biochem. J.* **91**, 424 (1964).
57. PELLEGRINO, E. D., and S. J. FARBER, Mineral composition of human bone in various clinical disorders, *J. Lab. Clin. Med.* **56**, 520 (1961).
58. PERRY, H. M., JR., and E. F. PERRY, Normal concentrations of transition and related elements in human urine: changes produced by ethylenediaminetetraacetic acid, *J. Clin. Invest.* **38**, 1452 (1959).
- 58a. POCHIN, E. E., personal communication, 1970.
- 58b. REBA, R. C., D. B. CHEEK, and F. C. LEITNAKER, Body potassium and lean body mass, *Human Growth*, Chap. II, 165, Lea & Febiger, 1968 (ed. D. B. Cheek).
59. ROTHMAN, S., *Physiology and Biochemistry of the Skin*, The University of Chicago Press, Chicago, 1954.
60. SALTER, W. T., *The Endocrine Function*, Harvard University Press, Cambridge, 1940.
- 60a. SCHROEDER, H. A., and J. J. BALASSA, Abnormal trace metals in man: cadmium, *J. Chron. Dis.* **14**, 236 (1961).
61. SCHROEDER, H. A., J. J. BALASSA, and I. H. TIPTON, Abnormal trace metals in man—vanadium, *J. Chron. Dis.* **16**, 1047 (1963).
62. SCHROEDER, H. A., J. J. BALASSA, and I. H. TIPTON, Abnormal trace metals in man—titanium, *J. Chron. Dis.* **16**, 55 (1963).
63. SCHROEDER, H. A., and J. J. BALASSA, Abnormal trace metals in man—niobium, *J. Chron. Dis.* **18**, 229 (1965).
64. SCHROEDER, H. A., and J. J. BALASSA, Abnormal trace metals in man—arsenic, *J. Chron. Dis.* **19**, 85 (1966).
65. SCHROEDER, H. A., and J. J. BALASSA, Abnormal trace metals in man—zirconium, *J. Chron. Dis.* **19**, 573 (1966).
66. SCHROEDER, H. A., and J. J. BALASSA, Abnormal trace metals in man—germanium, *J. Chron. Dis.* **20**, 211 (1967).
67. SCHROEDER, H. A., J. BUCKMAN, and J. J. BALASSA, Abnormal trace metals in man—Tellurium, *J. Chron. Dis.* **20**, 147 (1967).
- 67a. SCHROEDER, H. A., A. P. NASON, I. H. TIPTON, and J. J. BALASSA, Essential trace metals in man: zinc. Relation to Environmental Cadmium, *J. Chron. Dis.* **20**, 179 (1967).
- 67b. SCHROEDER, H. A., and I. H. TIPTON, The human body burden of lead, *Arch. Environ. Health* **17**, 965 (1968).
68. SCHROEDER, H. A., D. V. FROST, and J. J. BALASSA, Essential trace metals in man: selenium, *J. Chron. Dis.* **23**, 227 (1970).
69. SMITH, F. A., *Pharmacology of Fluoride*, *Handbuch der experimentellen Pharmakologie*, Vol. XXII, 93, Springer, New York, 1966.
70. SOREMARK, R., and B. BERGMAN, Gamma-ray spectrometric analysis of some micro-elements in human mandibular compact bone, *Acta Isotopica* **2**, 5 (1962).
71. SOWDEN, E. and A. PIRIE, Barium and strontium concentration in eye tissue, *Biochem. J.* **70**, 716 (1958).
72. SPECTOR, W. S., *Handbook of Biological Data*, W. B. Saunders, 1956.
73. SPEIGHT, R. G., A note on the potassium content of a group of 154 people in normal health, *AEEW-M*, 391, 1964.
74. SUNTZEFF, V. and C. CARRUTHERS, The mineral composition of human epidermis, *J. Biol. Chem.* **160**, 567 (1945).
75. TAUSSKY, H. H., A. WASHINGTON, E. ZUBILLAGA, A. T. MILHORAT, Distribution of selenium in the tissues of eye, *Nature* **210**, 949 (1966).
76. TAVES, D. R. Normal human serum fluoride concentrations, *Nature* **211**, 192 (1966).
77. THIERS, RALPH E., Separation, concentration and contamination, *Trace Analysis*, Chap. 24, John Wiley, 1957 (ed. Yoe and Koch).
78. TIPTON, I. H., R. L. STEINER, W. D. FOLAND, J. MUELLER, and M. STANLEY, Spectrographic analysis, of the tissues from autopsies of twenty-four instantaneous deaths, ORNL Central Files No. 54-12-66, 1954.

79. TIPTON, I. H., M. J. COOK, R. L. STEINER, J. M. FOLAND, K. K. MCDANIEL, and S. D. FENTRESS, Spectrographic analysis of normal human tissue from Dallas, Texas, ORNL Central Files No. 57-2-3, 1957.
80. TIPTON, I. H., M. J. COOK, R. L. STEINER, J. M. FOLAND, K. K. MCDANIEL, and S. D. FENTRESS, Spectrographic analysis of normal human tissue from Miami, Florida, ORNL Central Files No. 57-2-4, 1957.
81. TIPTON, I. H., M. J. COOK, R. L. STEINER, J. M. FOLAND, K. K. MCDANIEL, and S. D. FENTRESS, Spectrographic analysis of normal human tissue from Baltimore, Maryland, ORNL Central Files No. 57-11-33, 1957.
82. TIPTON, I. H., M. J. COOK, J. M. FOLAND, J. RITTNER, M. HARDWICK, and K. K. MCDANIEL, Spectrographic analysis of normal human tissue from Seattle and Tacoma, Washington, ORNL Central Files No. 68-10-15, 1958.
83. TIPTON, I. H., M. J. COOK, J. M. FOLAND, J. RITTNER, M. HARDWICK and K. K. MCDANIEL, Spectrographic analysis of normal human tissues from Richmond, Virginia, ORNL Central Files No. 59-8-106, 1959.
84. TIPTON, I. H., unpublished data, 1952-63.
85. TIPTON, I. H. and M. J. COOK, Trace elements in human tissue: Part II. Adult subjects from the United States, *Health Phys.* **9**, 103 (1963).
86. TIPTON, I. H., and J. J. SHAFER, *Trace Elements in Human Tissue: Rib and Vertebra*, Health Physics Division Annual Report ORNL-3697, 179, 1964.
87. TIPTON, I. H., H. A. SCHROEDER, H. M. PERRY, JR., and M. J. COOK, Trace elements in human tissue: III. Subjects from Africa, the Near and Far East, and Europe, *Health Phys.* **11**, 403 (1965).
88. TIPTON, I. H., P. L. STEWART, and P. G. MARTIN, Trace elements in diets and excreta, *Health Phys.* **12**, 1683 (1966).
89. TIPTON, I. H., and P. L. STEWART, *Long Term Study of Intake and Excretion of Stable Elements*, Health Physics Annual Report ORNL-4168, 283, 1967.
- 89a. TIPTON, I. H., J. C. JOHNS, and M. BOYD, The variation with age of elemental concentrations in human tissue, *Proceedings of the First International Congress of Radiation Protection*, p. 759, Pergamon, 1968.
90. USSING, H. H., P. KRUIHOFFER, J. H. THAYSEN, and N. A. THORN, *The Alkali Metal Ions in Biology, Handbuch der experimentellen Pharmakologie*, Springer, Berlin, 1960.
91. WALTON, A., R. KOLOGRIVOV, and J. L. KULP, The Concentration and distribution of radium in the normal human skeleton, *Health Phys.* **1**, 409 (1956).
92. WIDDOWSON, E. M., and J. W. T. DICKERSON, Chemical composition of the body, *Mineral Metabolism*, Chap. 17, Vol. II, Part A, Academic Press, 1964, (ed. C. L. Comar and F. Bronner).
93. WILDE, W. S., Potassium, *Mineral Metabolism*, Chap. 26, Vol. II, Part B, Academic Press, 1962, (ed. C. L. Comar and F. Bronner).
94. WING, J. F., Background urinary uranium levels in humans, *Health Phys.* **11**, 731 (1965).
95. WOODARD, H. Q., The elementary composition of human cortical bone, *Health Phys.* **8**, 513 (1962).
96. HARDING-BARLOW, I., Studies on the Trace Element Content of Human Tissues, Dept. of Chemistry, University of Cape Town, April 1961, a thesis for the degree of doctor of philosophy.
97. YAMAGATA, N., The concentration of cesium and rubidium in the human body, *J. Radiation Res.* **3**, 9 (1962).