URANIUM TRANSFER FROM AN ANIMAL DIET TO ITS ORGANS.

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From the pathways of entry of radionuclides in the human (or animal) body, ingestion is the most effective one because it is closely related to alimentary (or dietary) habits. Those radionuclides which are able to enter the living cells by either metabolic or other processes give rise to localized doses that could be very high. The calculations of these internally localized doses are of paramount importance for the assesment of radiobiological risks and radiological protection. However, the main inputs for these calculations are the transfer coefficients of radionuclides from the diet of animals, or humans, to their tissues, organs, bones, blood, etc. The motivation to study uranium, in particular, is the following.

Uranium is a trace constituent in rock phosphate, which is extensively used as source of phosphorus for fertilizers and livestock feed supplements. Di-calcium phosphate (DCP), for example, a source of calcium used as animal feeding supplement, can present concentrations of uranium as high as 200 ppm. In fact, DCP can be produced by mixing phosphoric acid with calcareous rocks, while the phosphoric acid is frequently obtained from rock phosphate by the sulfuric acid process.

On the other hand, the transfer of radioisotopes from food to humans is still a well debated issue, because experimental results are scarce. As a contribution to this issue we decided to carry out experiments with animals, aiming the study of transfer and incorporation of uranium. A pilot experiment is described below, while experiments with superior animals are in progress.

The experiment was performed with 15 Wistar rats, all males and 15 days old, assembled in 6 groups with 2 animals each, and a control group with 3 animals. The animals were fed during 10 days with ration doped with Uranil Nitrate (except for the control group), at the following ppm concentrations per group: 0.5,2,10,20,50 and 100. Next, the animals were sacrificed and dissected. From the ashes of the organs, biological samples were prepared and deposited on foils of Makrofol E. These foils, together with standard samples, were irradiated with neutrons from the IPEN IEA-R1 2 MW reactor. The concentrations of uranium in the organs were determined by means of the neutron induced fission technique with track detectors (Makrofol). The transfer coefficient of U was determined by: $f = k/pc$, where k is the amount of U measured in an organ, p is its weight, and c is the amount of U daily intaken by the animal.. Table 1 shows preliminary results for f, obtained from animals fed with 100 ppm of U. With kidney we had, quite probably, the interference of U residues trapped in the renal tubules, which explains the very high U concentration comparatively to the other organs. Apart from kidney, the organs so far investigated exhibit transfer coefficients ranging from 1 to 30 (d kg^{-1}), where the biggest values were found for liver and heart. This is compatible with the fact that in these organs the flux of blood is higher.

Table 1

organ	p [kg]	k [g]	c [g d^{-1}]	f [d kg^{-1}]
kidney	$1.63(5)\cdot10^{-3}$	$16(6)\cdot10^{-4}$	$5.19(8)\cdot10^{-3}$	188(73)
liver	$21.79(5)\cdot10^{-3}$	$35.8(41)\cdot10^{-4}$	$5.19(8)\cdot10^{-3}$	31.6(47)
intestine	$20.12(5)\cdot10^{-3}$	$3.3(6)\cdot10^{-4}$	$5.19(8)\cdot10^{-3}$	3.2(6)
heart	$1.76(5)\cdot10^{-3}$	$1.5(3)\cdot10^{-4}$	$5.19(8)\cdot10^{-3}$	16(4)
skin	$31.04(5)\cdot10^{-3}$	$5.2(8)\cdot10^{-4}$	$5.19(8)\cdot10^{-3}$	3.2(5)
testicle	$8.33(5)\cdot10^{-3}$	$0.42(11)\cdot10^{-4}$	$5.19(8)\cdot10^{-3}$	0.93(25)
brain	$1.37(5)\cdot10^{-3}$	$0.22(3)\cdot10^{-4}$	$5.19(8)\cdot10^{-3}$	3.2(5)