

## RADIONUCLIDE TRANSFER FROM MOTHER TO EMBRYO

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### 1. Introduction

The transfer of radionuclides from mother to the embryo is still a matter of high interest for the radiological protection, as the kinetics of the transfer is not yet fully described. The content of the embryo depends on the radioactive content of the mother, which is given mainly by the dietary intake. A clear dependence between the amount of radionuclides in the embryo and the dietary intake of the mother, taking into account all the other data (age, weight and height of the mother, age of the embryo or foetus), would be of great help in determining the doses received in utero to the transfer of the radionuclides ingested by the mother.

The present paper presents some results concerning these dependencies, for two particular cases: a recurrent intake of variable amount of radionuclides, and a recurrent intake of relatively constant amounts of radionuclides.

### 2. Materials and method

<sup>137</sup>Cs content in the embryos was determined during April 1986 - September 1989, while the <sup>226</sup>Ra and <sup>210</sup>Po content was determined for embryos prelevated in 1995. To obtain the data for <sup>137</sup>Cs we have prelevated 96 human embryos from different hospitals in Bucharest, where the mother were having the abortion. The embryos prelevated for natural radionuclides determination were taken from Bucharest hospitals, but also from hospitals situated in an uranium mining area. At the moment of prelevation, the embryos were aged between 5 and 11 weeks. After the prelevation, <sup>137</sup>Cs, <sup>226</sup>Ra and <sup>210</sup>Po were radiochemically separated, then measured using low-level, high efficiency beta (for <sup>137</sup>Cs), respectively alpha (for <sup>226</sup>Ra and <sup>210</sup>Po) systems.

### 3. Results and discussion

We had taken into account two cases: a prolonged intake in the mother, with variable amounts of radionuclides (the case of <sup>137</sup>Cs, in the present paper), and a recurrent, constant intake of radionuclides in the mother (the case of natural radionuclides).

<sup>137</sup>Cs content in the embryos was studied soon after the Chernobyl accident. During April 1986 - September 1989 we have determined the caesium content in 96 human embryos, aged between 5 and 11 weeks at the moment of prelevation. All the subject mothers were living in Bucharest, and were aged between 17 and 44 years at the moment of the abortion. At the moment of the abortion, we took for every mother the data concerning their age, weight and height.

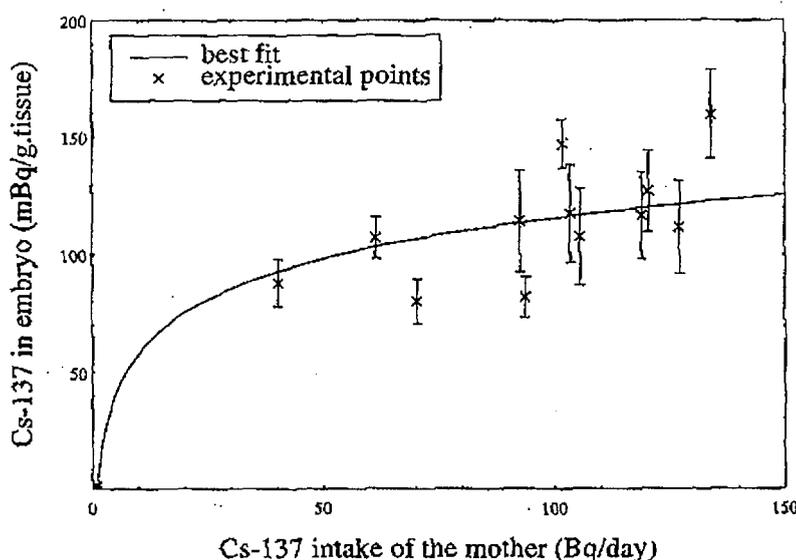
Within the period of study, <sup>137</sup>Cs content in the embryos increased from an average of 97.3 mBq/g.tissue in 1986 to an average of 137.9 mBq/g.tissue in 1987, then it decreased to 10.3 mBq/g.tissue in 1988. In 1989, the caesium content in the embryos was very small, in many cases below the minimum detectable activity. If we consider the average caesium content as a reference value for a certain year, than we can divide the embryos in two groups: a "group with high caesium content" and a "group with low caesium content". Table 1 summarizes the age distribution of high and low caesium content embryos, for every year.

**Table 1. Age distribution of caesium content in embryos**

Year	Caesium content of the embryos (mBq/g.tissue)	Percentage of the total number of embryos, as a function of age (in weeks)						
		5	6	7	8	9	10	11
1986	> 97.3	-	45.45%	56.25%	60%	0	66.66%	100%
	< 97.3	-	54.55%	43.75%	40%	100%	33.34%	0
1987	> 137.9	-	25%	83.3%	50%	100%	100%	-
	< 137.9	-	75%	16.7%	50%	0	0	-
1988	> 10.3	50%	50%	66.66%	66.66%	33.34%	100%	-
	< 10.3	50%	50%	33.34%	33.34%	66.66%	0	-

As it can be seen, the data points out towards an increase of caesium content with the age of the embryo. However, this dependence tends to be more obvious at higher caesium contents (in 1988, for instance), than for lower caesium content (in 1988). In previous paper [1], we have shown also that the  $^{137}\text{Cs}$  content of the embryos depends on the intake of the mother, the dependence being logarithmic, according to the data available until now (Fig. 1). We could not find any correlation between the amount of  $^{137}\text{Cs}$  in the embryo and the age, weight and height of the mother. Further data will clarify if there is any dependence of this kind, and the actual type of dependence between the intake of the mother and the amount transmitted to the embryo.

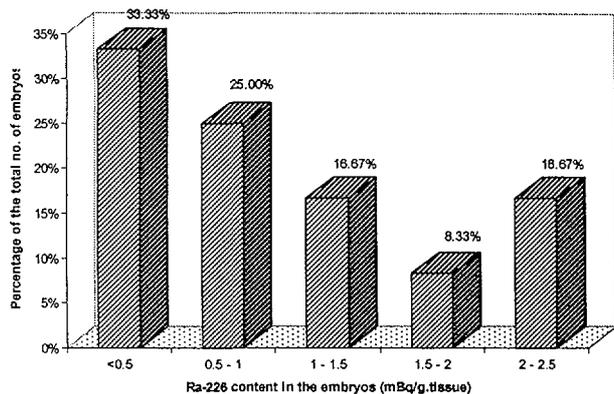
**Fig. 1. Plot of the amount of  $^{137}\text{Cs}$  in the embryo as a function of mother dietary intake**



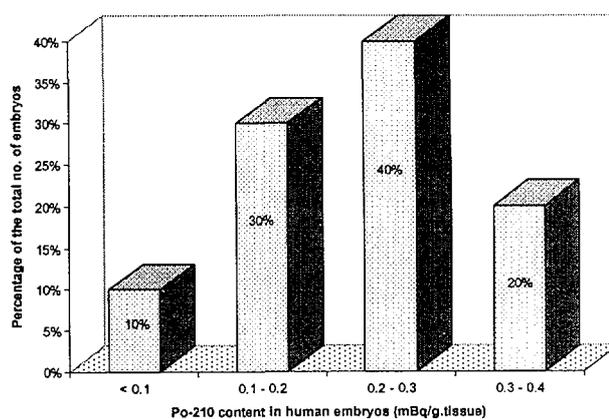
The transfer from mother to embryo, when the mother is subjected to a recurrent intake of constant amounts of radionuclides has been studied only for the case of natural radionuclides. The nuclides selected for this study were  $^{226}\text{Ra}$  and  $^{210}\text{Po}$ , both due to their high radiotoxicity and to their relative constant concentration in the aliments forming the population diet. (A survey of the environmental factors in the areas of interest led us to the conclusion that the variation of  $^{226}\text{Ra}$  and  $^{210}\text{Po}$  concentrations in different foods is no higher than 20% [2]). The embryos, as well as the dietary samples were prelevated directly from the hospitals where the mothers were having the abortion.

We have determined the  $^{226}\text{Ra}$  content in 23 embryos, prelevated during February 1995 - June 1995. All of those embryos were aged between 6 and 7 weeks, and the amount of  $^{226}\text{Ra}$  ranged between 0.3 and 2.22 mBq/g.tissue. The distribution of embryos with higher and lower amounts of radium was quite random, as it can be seen from Fig. 2. We could not find any correlation neither between the age of the embryo and their  $^{226}\text{Ra}$  content, nor between the physical data of the mother (age, weight, height) and the radium content of the embryo. The lack of dependence between the age of the embryo and its radium content may be due to the low radium intake of the mother (and average of  $74.74 \pm 14.5$  mBq/day)

**Fig. 2. Percentage distribution of high and low  $^{226}\text{Ra}$  content in embryos**



**Fig. 3. Percentage distribution of high and low  $^{210}\text{Po}$  content in embryos**



$^{210}\text{Po}$  content was determined in 10 embryos, prelevated in March 1995, and it ranged between 0.09 and 3.74 mBq/g.tissue, as it can be seen in Fig.3. The embryos were aged between 5 and 9 weeks, and we could not find any correlation between their age and their polonium content and the same can be said about the correlation between the physical data of the mother (age, weight, height) and the  $^{210}\text{Po}$  content of the embryo. The amount of  $^{210}\text{Po}$  ingested was approximately for all mothers ( $52.91 \pm 13.86$  mBq/day).

In both the cases of  $^{226}\text{Ra}$  and  $^{210}\text{Po}$ , a lower dietary intake was leading to a lower amount of radionuclides in the embryo. Therefore, it seems right to assume that, in this case too, the radionuclide content of the embryo increases with the dietary intake.

The experiments will continue, in order to obtain sufficient data to allow us to correlate the radioactive content of the embryo with the age, weight and height of the mother, for the same level of intake.

#### 4. Conclusions

In the case of a recurrent intake of variable amounts of radionuclides ( $^{137}\text{Cs}$ ), the amount of radionuclides present in the embryo increases with the age of the embryo and with the intake of the mother.

In the case of a prolonged intake of constant amounts of radionuclides we could not find any correlation between the age of the embryo and its radioactive content, but the correlation between the intake of the mother and the radionuclide content of the embryo remains.

#### 5. References

1. Maria Toader, R. A. Vasilache, Mirela Lucia Toader, Monica Ioana Vasilache, "Cs-137 transfer from mother to embryos, in the first year after the Chernobyl accident", Proceedings of the IRPA9 - International Congress on Radiation Protection, Vienna, 14-19 April 1996, P31-31
2. Maria Toader, R. A. Vasilache, M. Sutu, F. Isacu, "The Quantity of Cs-137, Sr-90 and Ra-226 Ingested by the Population from Bucharest, during 1986 - 1996", Proceedings of the XXXIIth Scientific Symposium of the IISP, Bucharest, May 1997