tomy in this study was due partly to an increase in the size of the renal cells as well as to an increased number of cells as evidenced by a higher content of DNA in all cases. In the irradiated female, the concentration of DNA fell less after operation than it did in the control. Since the increase in the total DNA was the same in both groups, it seems possible, therefore, that while prior irradiation of the female did not affect the increase in the number of cells in the remaining kidney, the increase in cell size was somewhat reduced. The reason for the sex difference in the growth of the kidney after unilateral nephrectomy of irradiated animals is not yet apparent. It seems unlikely that the irradiation could have any direct, permanent effect on the increase in cell size in the female kidney. It may be that the rapid growth induced by the operation revealed some degree of hormone imbalance in the irradiated females which might have been responsible for a diminished rate of synthesis of extra-nuclear material in the renal cells of these animals. However, the full explanation of this effect of radiation awaits further investigation as must the now well-established sex difference in the weights of the kidneys of intact exposed and control animals.

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Radioactivity in Snail Shells due to Fall-out

The snail, *Helix pomatia*, concentrates more calcium per unit body-weight in lesser time than most terrestrial animals, that is, 20–40 gm. calcium per kgm., about 50 per cent of which is deposited in the last summer season of the snail's life and 25 per cent in the last but one. Eating mostly green parts of the higher plants of low calcium content, and moving about only on wet days, the snail is much exposed to radioactive fall-out and apt to build in along with the calcium any strontium present. Assuming that the shells would yield useful information about contamination due to strontium-90, specimens kindly supplied by P. Agócsy, Hungarian National Museum, Budapest, were investigated.

Shells of adult animals collected alive, weighing 2–5 gm., had an ash content (ashing at 600° C. for 5 hr.) of 96–98 per cent containing 95–98 per cent calcium carbonate. 5 gm. of the ash along with 100 mgm. strontium carbonate carrier was dissolved in nitric acid and the separation of strontium nitrate carried out by Kooi's method[1]. The strontium carbonate obtained was quantitatively transferred to a planchet and assessed with a Geiger counter. The amount of strontium-90 was calculated from the growth curve of yttrium-90 and expressed as strontium-90–yttrium-90 μμc. per gm. calcium.

The results given in Table 1 are compatible with the values given for plants by many authors and especially by the report *Strontium-90 in Milk and Agricultural Materials in the United Kingdom, 1958–1959*[2], and the findings of Hawthorn and Duckworth on deer's antlers[3]. The correlation between the type of soil and the strontium-90 activity of the shells is evident.

Table 1. Strontium-90 – Yttrium-90 Activity in Shells of *Helix pomatia*

Year of collection	Site	Type of soil	Activity (μμc./gm. calcium)
1900	Mostar (Yugoslavia)	Limestone	0
1960	Mt. Bükk (Hungary)	Brown forest soil on limestone, high calcium	< 5
1961	Mt. Mátra (Hungary)	Pale forest soil on granite – andesite low calcium	39
1961	Szeged (Hungary)	Sand, low calcium	23
1960	Gyula (Hungary)	Acidic sand, very low calcium	63
1960	Zala district (Hungary)	Brown neutral soil, low calcium	24
1955	Zala district (Hungary)	Brown neutral soil, low calcium	< 5

The mean rainfall in Hungary is 30–35 in./year.

It is hoped to extend this work on samples from different latitudes and climates and perhaps on shells of other species, as this material seems to be of special value for indication of the contamination by strontium-90 not only because of its high calcium content but also for the ease of its collection, conservation, and transport.

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Repair of Radiation Damage in a Nucleoprotein by Cysteamine

Cysteamine has been shown by Bacq *et al.*[1] to be a most effective substance for the protection of living matter against X- and related radiations. *In vitro* experiments have shown that cysteamine can protect macromolecules by a variety of different chemical reactions[2,3]: by transfer of energy in the case of direct action[4,5], by competitive removal of OH· radicals in dilute aqueous solution[6] or by a repair mechanism[2,7]. In the last reaction it is visualized that the initial radical formed in the macromolecule (RH)—either by direct or indirect action—is restored to its original state by hydrogen transfer from the SH group, thus:

$$RH \xrightarrow[\text{indirect}]{\text{direct or}} R^{\bullet} \xrightarrow{+\ -\text{SH}} RH \text{ (repaired macromolecule)}$$

$$R^{\bullet} \downarrow \text{ undergoes further irreversible changes}$$

While such a repair reaction is, strictly speaking, a post-irradiation phenomenon and therefore not true protection, the lifetime of $R^{\bullet}$ is in most systems very short so that the repairing substance must be present during irradiation.

Electron spin resonance has made it possible to determine in solid systems (that is, where the action of the radiation is direct) whether transfer of energy or repair is involved in protection. At the temperature of liquid nitrogen (– 195° C.) certain energy-transfer processes still occur, but the bimolecular chemical reaction required for repair cannot occur. If, therefore, the presence of cysteamine reduces the number of radicals seen in the electron spin resonance spectrum, when both the irradiation and the measurement is made at – 195° C., then transfer of energy can be deduced, as was found to be the case with bovine serum albumin[5], in the solid state. In dilute solutions there are indications that cysteamine protects by a repair mechanism[7].