total effect of the rays, without manifest change. When a culture irradiated in the cold is transferred to the incubator, it develops to a degree exactly corresponding to the dose of rays applied. We are thus enabled to establish a numerical relation between the amount of growth inhibition and the dose of rays applied.

The cultures are irradiated immediately after explantation and are then transferred to the incubator. A parallel non-irradiated control culture is set up under identical conditions.

In our experiments, the cell cultures react to dosages ranging from 0·3 mgh. to 206·5 mgh. (3 minutes to 35 hours exposure) as observed in a period of 3×24 hours. The effects can be divided into three groups :

(1) Growth inhibition without complete stoppage of growth within the period of observation. The doses employed ranged from 0·3 mgh. to 70·8 mgh.

(2) Marked inhibition of growth with subsequent cell degeneration and stoppage of growth of the culture within the period of observation. Doses : 70·8–177 mgh.

(3) Immediate death of the irradiated culture. Doses 188·8–206·5 mgh.

With doses of less than 47 mgh. the retardation of growth in the irradiated cultures is observed after a latent period of 24 hours. With doses greater than 47 mgh. this latent period is no longer apparent.

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Radioactivity induced by Fast Neutrons according to the $(n, 2n)$ Reaction

IN a letter to NATURE[1], we reported some time ago that we had obtained evidence for the expulsion of two neutrons from the nucleus when copper and zinc were bombarded with the fast neutrons from a $(Li + {}^2H)$ source. In the case of copper, our assumption was confirmed by the experiments of Bothe and Gentner[2], who obtained the same radioactive copper nucleus by irradiating this element with gamma rays, this giving rise to the expulsion of a neutron. According to the latter process the same investigators produced some new radioactive bodies. We attempted to get the same active isotopes with the fast neutrons from our $(Li + H^2)$ source according to the process $(n, 2n)$, the results being as follows.

Molybdenum. A strong activity is observed with a period of 21 minutes. Bothe and Gentner found a period of 17 minutes, whilst a 25-minute period is observed with slow neutrons[3]. With slow neutrons $(Be + {}^2H + paraffin$; intensity equivalent to 3 grams Ra + Be) we also find a 25-minute period, which indicates that these activities are not identical.

Silver. A sheet of silver with a filter of 0·4 mm. silver and 0·2 mm. cadmium in front of it was irradiated. In accordance with Bothe and Gentner, we found a period of 24 minutes. The 2·4-minute period is also present.

Bromine. The activity induced in bromine shows two periods, one of 18 minutes and one of about 5 minutes. The former has been observed also by Bothe and Gentner. For the short period they give 3·5 minutes however.

Antimony. A strong activity with a period of 17 ± 1 minutes is observed, whilst Bothe and Gentner give 13 minutes.

Tantalum. A sheet of pure metallic tantalum was irradiated several times for half an hour. Only a very poor activity was obtained. We could not establish the period. Bothe and Gentner found a 14-minute period.

Tellurium. A strong activity with a 60-minute period is observed. The same period was found by Bothe and Gentner.

It may be mentioned that our apparatus works at a tension of 250 kV., whilst almost pure deuterium is used. Hence the creation of gamma rays is excluded.

Continuing our experiments, we observed some more examples of this type of reaction and found some new radioactive isotopes :

Selenium becomes strongly active when bombarded with fast neutrons. The period is 56 minutes. With slow neutrons (source as mentioned above) we find a period of 22 minutes, whilst Fermi and his co-workers[4] give 35 minutes.

Cadmium bombarded with fast neutrons yields two periods, one of 200 minutes and one of about 20 minutes. These activities may be due to ^{109}Cd and ^{115}Cd. A very low activity with a period of 70–200 minutes has already been observed when cadmium is bombarded with slow neutrons.

Mercury gives a period of 43 ± 1 minutes when bombarded with fast neutrons. With slow neutrons this period was not observed. A chemical separation was attempted by R. W. P. de Vries. It was ascertained that the active nucleus is an isotope of mercury.

Thallium. With fast neutrons we obtained a period of 4·1 minutes. As a period of 4 minutes has been observed already with slow neutrons[5], we may ascribe this activity to ^{204}Tl.

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Absorption Spectra, Optical Activity and Isotopic Exchange

WE have made a systematic examination[1] of the absorption spectra of cobaltammines which undergo isotopic exchange of hydrogen atoms in constituent NH_3 or NH_2 radicals, and more especially of those which are mixtures of optical isomers. Cobaltammines almost invariably give rise to two broad absorption bands[2] in the visible (I) and near ultraviolet (II) spectrum. Substitution of ${}^2H$ for ${}^1H$ produces an effect upon band (I) illustrated in Fig. 1 ; it is generally more pronounced the larger the number of exchangeable hydrogen atoms in the molecular ion. Absorption band (II) is scarcely affected, but differences occur in the farther ultra-violet. The full line is representative of protium-containing cobaltammines, the broken line of corresponding deuterium compounds.