with a special solution are being used as electrodes. Under a stereo-microscope these electrodes are introduced into a single cell by means of a special manipulator. In this way we can measure the electrical potentials existing between the interior of a cell and its surroundings. These potentials, representing a characteristic phenomenon of life, especially of the cell membranes, are sustained by complicated metabolic and diffusion processes. In the resting cell the potential is almost constant (resting potential). In cases of spontaneous actions or stimulations typical spikes occur (action potentials).

So far changes of potentials had been observed only during irradiation with very high doses. Under the research project we are examining whether or not low doses of irradiation may also change the resting or action potentials. The irradiation is being carried out with an X-ray apparatus as used for therapeutic superficial irradiation of the skin.

At the same time, we are trying by another method to approach the same goal, namely the detection of biological instantaneous reactions. The clinically observed actions of radiation on the intestine are being experimentally investigated by a special technique for testing drugs. When a piece of rabbit intestine is preserved under conditions as physiological as possible, the muscles of the intestinal wall keep their tension for a long time and show rhythmic contractions corresponding to the natural peristalsis in the living animal. Tension and motion can easily be registered. Two scientists had previously discovered by means of this technique that X-irradiation raises the tension of the intestine. It is now our aim to find the minimum necessary dose and dose rate for this effect and to analyze quantitatively the dependence of this effect on both these values.

During our investigations we developed another useful test for small radiation doses; we measured the through-flow of an artificial blood solution through the blood vessels of an intestinal loop. It was observed that a few seconds after irradiation the flow rate diminishes, and returns to its normal level only when irradiation ends. This phenomenon can also be registered with a Kymograph.

Our observations so far lead us to believe that also the instantaneous radiation reactions of the mammalian intestine are reflex-like stimulus responses and that the same rules are valid as those governing the reactions to mechanical, chemical, optical and electrical stimuli.

As usual, many new problems which await clarification have arisen in the course of our work and on the basis of the results so far achieved: Whether these highly sensitive reactions are produced by direct stimulation of the nerves, or receptors in the intestinal wall, or by substances freed or produced, under irradiation in other cells? Can these substances be isolated and determined? Could these instantaneous radiation effects be diminished or suppressed by certain substances, such as those already known for their radiation protective properties? All these questions are not merely theoretical, but have a direct bearing on protection against radiation.

DISTRIBUTION OF FISSION PRODUCTS IN THE BIOSPHERE

by Dr. Thomas Schönfeld

Protection against ionizing radiation given off in nuclear transformations is one of the foremost safety problems in all atomic energy operations. While every effort is being made to prevent reactors, processing plants and all other installations from releasing radioactive materials into the biosphere - air, water and earth - under any foreseeable conditions, small amounts of it are actually released into man's living space. Undoubtedly, this will continue to be so, at least for the time being. For example, low activity liquid wastes from some chemical processing plants are decontaminated in special processes, but traces of fission products remain in the liquids finally discharged on the ground or to nearby waterways. In some installations low and medium activity liquid wastes are even released on the ground or into swamps without prior decontamination. It is also to be expected that in accidents larger amounts of fission products may occasionally be released.

To make the routine release of small amounts of fission products safe and to be able to estimate the possible effect of larger releases in accidents, a considerable amount of information is required.

Special problems arise from the fact that enrichment processes operate in the biosphere. Even if the concentration of a certain radio-element at the point of release, e.g. into a stream, is below the tolerance concentration, high concentrations in food for humans may arise by absorption processes in aquatic organisms which are in some way part of the food chain. Strong enrichment in aquatic organisms has, for example, been observed for radioactive phosphorus, itself not a fission product. Hazards due to enrichment processes might also occur where weakly contaminated water is used for irrigation. Obviously, processes of this kind must be studied carefully to make certain that a release of radioactive products in a given set of circumstances is not harmful.

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might wish to have assistance in re-evaluating the whole question of heavy water production in the U.A.R. It is suggested that the matter of such assistance be left to the judgment of the U.A.R. people.

Quite aside from the problem of producing heavy water, it is suggested that the Egyptian Atomic Energy Authority could use assistance from the Agency in training people in the analysis, handling, and general research technology of heavy water. Specifically, it is suggested that assistance could be given in placing one or more technical people at research institutions where this technology is available.

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Useful knowledge about various aspects of fission product behaviour in the biosphere has already been obtained, but many important questions remain unanswered.

Considering the large increase in the construction of reactors planned for the near future, which will lead to a corresponding increase in the amount of fission products to be handled, it is necessary to intensify the efforts in this direction. In May 1958 a research project on "the factors controlling the distribution of fission products in the biosphere" was started at the First Chemical Institute of the University of Vienna under a contract with the International Atomic Energy Agency. The First Chemical Institute is headed by Professor Hans Nowotny. The project is carried out within the Department of Radiochemistry headed by Professor Engelbert Broda.

The project will contribute to one of the objectives of the IAEA - the establishment of standards of safety for protection of health and minimization of danger to life and property. Various methods of investigation are already being applied or are in preparation as part of this research project. The distribution of some fission products, present throughout the biosphere from nuclear test explosions, is being determined to elucidate the factors governing this transport and enrichment. Further data on the uptake of fission products by certain organisms or mineral substances may later be obtained by experiments on a laboratory scale or by release of small amounts of fission products into a certain ecological environment under controlled conditions.

Detection methods of high sensitivity are required for determining the fission products in the biosphere. At the First Chemical Institute in Vienna gamma-spectrometry has been employed since the beginning of the investigation and a low-level beta-counter will soon be completed. With a gamma-spectrometer (supplied by IAEA) samples from the biosphere, such as plant ashes or residues from the evaporation of river water are measured directly. Since gamma-rays of different energies are registered separately with this instrument, gamma-emitting radioisotopes are detected individually through the characteristic energies of their radiations.

The essential feature of a low-level beta-counter is that the background count due to cosmic rays and to the radioactivity of the surroundings is a low one. This is achieved by heavy shielding against radiation coming from the outside and by cosmic ray counters arranged around the beta-counting tube itself. With the help of these counters and a so-called "anti-coincidence" circuit, some counts in the beta-counter are automatically recognized as due to cosmic rays and are not registered. The low background value obtained in this manner permits the detection of very small activities in the material under investigation. The sensitivity of such a counter surpasses that of a gamma-spectrometer considerably. However, measurements are more difficult, since each radioelement to be determined must first be isolated by chemical techniques. Radiochemical separation methods suitable for the samples to be investigated by the research project are now being selected and checked.

In the project under way at the First Chemical Institute in Vienna particular attention is being paid to fission products with half-lives of several months. These have so far been investigated much less thoroughly than the long-lived isotopes caesium 137 and strontium 90. First results about the distribution of some of these fission products - zirconium, ruthenium and rare earths - in rivers and lakes and in vegetation have been obtained.

WASTE DISPOSAL EXPERTS MEET

Problems connected with the disposal into the sea of radioactive wastes from peaceful uses of atomic energy are being examined by a panel of experts, convened by the International Atomic Energy Agency. These experts from eight different countries held a first meeting at IAEA headquarters in Vienna from 4 - 9 December 1958, under the chairmanship of Dr. Harry Brynielsson, Director General of the Swedish Atomic Energy Company (seated at head of table). The countries represented are: Canada, Czechoslovakia, France, Japan, Netherlands, United Kingdom, and United States. The group will meet again in 1959.