

PHYSICS—MEDICINE

Artificial Radioelements for Medicine

Discoverers of Artificial Radioactivity Now Hint At New Substance That Can be Introduced Into Body

NOTE: The articles on this and the following page were received by cable from the Science Service correspondent at the International Conference of Physics in London.

ARTIFICIAL production of radioactive elements useful in medicine and superior in intensity to radium was predicted by the famous husband-and-wife scientific team, Prof. F. Joliot and Irene Curie of Paris, who discovered artificial radioactivity less than a year ago.

Speaking before the International Conference of Physics, at London, the Joliot expressed their hope of producing superior radioactive elements with useful properties not possessed by the radioactive substances in the development of which the famous parents of Mme. Joliot played such an important part.

These powerful radioelements that the Joliot foresee when introduced into the living body must, they declared, behave very differently because of their chemical properties and the fact that they will disintegrate without leaving a radioactive residue.

This has great possibilities in medicine. It may mean a new kind of cancer treatment in which artificial radioactive substances produced cheaply can be introduced directly into the cancerous tissue to do their work, and then become harmless.

"Internal Materialization"

The Joliot speculated upon just what happens within the central portion of the atom when it becomes artificially radioactive. They attributed the emission of electrons and positrons to what they called an "internal materialization" of gamma radiation, radiation of the same kind as light and X-rays. The gamma radiation, they suggest, is transformed into a positive and a negative electron in the process of leaving the central portion or nucleus of the atom which gave rise to it. In this manner neutron radiation and gamma radiation are emitted when beryllium is bombarded with the cores of helium atoms, called alpha particles, which are shot off from the naturally radioactive substance polonium.

But the Joliot found it difficult to

imagine what happens within the atom's heart when neutrons are the bombarding particles. A possible interpretation is that the entrance of a neutron is followed by an expulsion of a negative proton, a particle that has not yet been discovered.

This expulsion of a negative proton might explain the formation of a substance heavier than any hitherto known, chemical element 93. Such an element has been reported by Prof. Enrico Fermi of Italy but doubt has been cast upon its actual existence.

Certain experiments, the Joliot reported, suggest that neutrons bombarding phosphorus could produce radioelements themselves emitting protons.

Natural radioelements, like radium and uranium, are pronounced by the Joliot to be apparently rare survivors of numerous elements which existed under conditions of temperature, pressure and radiation different from those existing now on earth. This must have been millions of years ago.

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Study Region Where Atoms Unite to Determine Forms

PROBING into the region of the extremely minute, where atoms come together to determine the character of larger aggregations of matter, world-famous physicists attending the joint conference of the International Union of Pure and Applied Physics and the Physical Society heard Sir William Bragg keynote the inquiry:

"We must look into the region of crystals composed of atoms for explanation of the quality of a steel or bronze, a glass, a textile fiber, a living nerve and other substances. And somewhere there enters the breath of life to control atomic composition which enters into living mechanisms."

All investigations of solid bodies of every form, whether animal, vegetable or mineral, have as their primary aim, Sir William said, the connection between the properties of the body on

one hand and its composition and architecture on the other hand.

Some of these properties are directly dependent, he explained, on the few atoms and crystals of the unit cell. The arrangement of the unit cells determines the behavior of the body as a whole. Some other properties depend on the action of atomic forces in groups of hundreds, thousands or even tens of thousands of atoms.

Dr. R. A. Millikan, American physicist, presiding at the discussions upon solids, remarked that most of the knowledge of the subject has been gained by pure empiricism.

"Only in the last two or three years," Dr. Millikan said, "had the mind of man been able to get inside this body of knowledge in a theoretically satisfactory way."

It is pleasant, Sir William told the physicists, that a crystal responds to every effort to improve the accuracy of the measurements that scientists make upon it.

He called attention to the distinction made by Prof. Adolf Smekkal of Halle, Germany, between "insensitive" effects which are functions of the composition of the crystal itself and the "sensitive" effects which depend upon the crystal's treatment and previous history.

Large discrepancies have appeared in the investigations upon solids and the physicists are searching for the cause. For example, the cohesive force of rock salt calculated from the knowledge of its structure and its ionic composition is about 200 kilograms per millimeter, whereas the experimental value is usually less than a single kilogram per millimeter.

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Tweddledee, Tweddledum—But One Lives Longer

THE strange fact that two varieties of a radioactive element, exactly the same in mass and in charge, have very different periods of life excited discussion at the International Conference on Physics.

One of the newly discovered artificial radioactive elements, the mass thirteen isotope of nitrogen, has different peri-

ods of decay depending upon how it is produced. Dr. J. D. Cockcroft of Cambridge's Cavendish Laboratory described the making of nitrogen thirteen both by bombarding carbons with protons and with deuterons. In both these cases the "half life period," or the time that it takes for half of the newly manufactured nitrogen to disintegrate, is ten and a half minutes. But if this nitrogen isotope is made by the method discovered by the Joliot of Paris, bombarding boron with alpha particles, it has a decay period of fourteen minutes.

"This proves that some nuclear component or condition as yet unknown

must exist," Dr. Cockcroft said in an interview.

Wide support was given in the conference for the existence of two particles of matter, the neutrino and the negative proton, which physicists have not yet discovered, although their existence has been suspected.

Experiments looking toward the use of neutrons in medicine, somewhat in the same way as radium rays and X-rays are now used, are being made by Prof. J. C. McLennan, emeritus professor of physics of Toronto University now resident in England, it was revealed at the conference.

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are responsible for most of the cosmic ray effect or ionization found at sea level or underneath the sea. This is in accord with Dr. Millikan's previous findings and is opposed to the ideas of some other cosmic ray observers.

The resistance of the atmosphere to incoming electrons, suggested by some as composing the cosmic radiation, would require energies of a billion electron volts on the basis of encounters outside the nucleus of the atoms and five billions of electron volts on account of the encounters within the nuclei of atoms, Dr. Millikan told the conference. Nuclear electron encounters were seen as producing only very soft secondaries consisting of both photons and electrons.

Dr. Millikan also reported that:

Nearly all the non-field sensitive part of the ionization of the atmosphere above sea level is due to photons of energy below 500 million electron volts.

In the equatorial belt of the earth a small part of the ionization is due to incoming secondary electrons of energies as high as ten billion volts.

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Annihilation of Matter Seen As Cause of Cosmic Rays

MATTER being annihilated in the heated interiors of the stars and flashing "new star" novae as the origin of the cosmic rays was suggested by Dr. R. A. Millikan when he reported to the International Conference on Physics the first details of the very high altitude survey of cosmic rays made by the California Institute of Technology research team consisting of Dr. I. S. Bowen, Dr. Millikan and Dr. H. Victor Neher.

"The only source of the observed cosmic ray energies now in sight," Dr. Millikan reported, "is the annihilation of matter. But the softest components of the cosmic rays have energies corresponding to the partial annihilation or atom building hypothesis, while the energies of the hardest correspond to the complete annihilation of atoms."

Thus, in his latest interpretations, Dr. Millikan sees the cosmic rays as both the "death cries" and "birth cries" of matter. These mysterious penetrating radiations are seen as the signals of both tearing down and rebuilding of the stuff of the universe.

The process of annihilation and atom building conceivably take place, Dr. Millikan suggested, because of the ease with which hydrogen particles cluster at the extreme heat of interstellar temperature. Or they may happen because of the extremely high temperatures found in novae as suggested by Dr. Fritz Zwicky, one of Dr. Millikan's colleagues at California Institute of Technology.

Another outstanding conclusion by Dr. Millikan is that photons or radiation of the same kind as ordinary light



FOUND NEAR "FOUNTAIN OF YOUTH"

Florida's "Fountain of Youth" at St. Augustine failed to bring eternal youthfulness to these Indians of Ponce de Leon's day. But archaeologist J. R. Dickson, formerly with the University of Illinois, has found that this Indian graveyard he is unearthing contains an array of strong-framed skeletons with remarkably good teeth. The graveyard, discovered recently, has revealed over 90 burials. Mr. Dickson calls them some of the earliest Christianized Indians in the United States, because many lie with arms crossed as in prayer, and because the graves lack the offerings and equipment for a future world that the prehistoric Indians placed with the dead.