

a plant springing into maturity and blossoming, as the action of days is telescoped into a few minutes. Previously, this has been done only by elaborate studio

methods, but by using Mr. Casson's equipment any amateur gardener can record plant growth in his own garden.

*Science News Letter, July 20, 1940*

## PHYSICS

# Radium-Like Substances Produced Inexpensively

## Patent Granted Italian Physicists Covers Bombardment by Neutrons From Cyclotron

**A**RTIFICIAL production of substances like radium, which can probably be produced much less expensively than the natural material, yet have the same qualities that make it useful in medicine, is covered in United States Patent 2,206,634. This has just been granted to a quintet of Italian physicists, who were at the University of Rome when application was made for the patent, October 3, 1935. They are now widely scattered.

Chief of the group is Dr. Enrico Fermi, winner of the Nobel prize in physics in 1938. At the end of that year he came to the United States to join the faculty of Columbia University, New York City. His co-patentees are Edoardo Amaldi, still in Rome; Emilio Segre, University of California, Berkeley; Franco Rasetti, Quebec, and Bruno Pontecorvo, now in South America. The patent is assigned to G. M. Giannini and Co., Inc., New York City.

Most chemical elements consist of several isotopes, which have similar properties except that they differ in atomic weight. In radium, and other substances naturally radioactive, there is a disintegration into various isotopes of other elements. This is accompanied by the emis-

sion of the alpha, beta and gamma rays, which produce the effects of radium.

In 1934 the French physicists, F. Joliot and his wife, Irene Curie-Joliot, daughter of the Curies, discoverers of radium, found that radioactivity could be started artificially. They bombarded light elements, like boron, with alpha particles from radium. After the bombardment ceased, the boron itself gave off some of the radium rays.

Later, other ways were found of producing the same effect. By bombarding with other rays or particles of high energy, isotopes of different elements can be converted into other isotopes. These may be of the same or of other elements. Some of them are so unstable that they quickly decompose. In doing so, they show radioactivity.

The first efforts were to get bombarding particles or rays with energies as high as possible, but Dr. Fermi found this desirable only when the particles were electrically charged. Then high energy was needed to break through the barrier surrounding the nucleus of the atom. With neutrons, electrically neutral particles, the greatest efficiency is obtained with low energies.

Neutrons can be produced in various ways, chiefly by the use of the cyclotron, invention of Dr. E. O. Lawrence, of the University of California, who was awarded the Nobel prize last year. These neutrons, however, have very high energy, so Dr. Fermi's problem was to slow them down, and reduce their energy.

"We have found it possible to achieve the desired results by passing the neutron radiation against or through a screen of a suitable material," states the patent. "The materials which have been found best suited to this purpose are those containing hydrogen (including all its isotopes, but the light isotope which predominates in natural occurrence being most efficient) and especially water and

the hydro-carbons, such as paraffin for example."

In use, the screen may be either solid or liquid. In the latter event, the material to be treated can be dissolved or suspended in the liquid itself. The new patent covers the use of neutrons, with such an energy reducing screen and the production of radioactive isotopes thereby. Since this is so far the only satisfactory method of producing artificial radioactive substances, and these have begun to find medical use, the patent seems to be quite basic.

Sodium has been one of the most widely used elements, but many others show the effect. The patent specifications list all those that have been tried, including most of the 92 known. Platinum, gold, iodine, potassium, copper and chlorine, among others, can be made more or less radioactive. Certain elements, including hydrogen, carbon, tin, thallium, lead, bismuth and mercury, showed no activity. With these, it is supposed, the neutrons produce a change to a stable isotope.

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## MEDICINE

## Protein Migrations May Aid in Diagnosis

**T**HE WAY protein molecules of the human body migrate in solutions under the influence of electric current may make possible a rapid and accurate diagnosis of disease.

Dr. D. A. MacInnes of the Rockefeller Institute for Medical Research, New York City, told of the new method in his lecture at Western Reserve University sponsored by the Society of the Sigma Xi, national honor fraternity for the promotion of research in science.

Dr. MacInnes described the new robot "moving boundary apparatus" which makes it possible to get patterns created by normal blood plasma, and the plasma and serum patterns in different diseases.

The black and white diagnostic outlines are called schlieren patterns and consist of a series of peaks. In normal blood one peak, the largest, is caused by albumin A found in the blood plasma. Other and smaller peaks are caused by other proteins in the blood, three globulins—alpha, beta and gamma—and by the fibrinogen. The height of these peaks and their relationships to one another appear characteristic of different condi-

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tions of the blood. Normal blood, for example, gives a standard schlieren pattern.

It is found in many diseases which have the common characteristic of fever—pneumonia, peritonitis, rheumatic fever and lymphatic leukemia—that in every case the peak representing alpha globulin was greatly enlarged. It may be possible that when scientists have extended the new method they will be able to “read” schlieren patterns of blood plasma as readily as a spectroscopist can look at spectrum plates and distinguish the bands and lines of molecules and atoms.

Dr. MacInnes credited the Swedish scientist Arne Tiselius with improvement in the moving boundary apparatus which has made possible the new advance. For the development of the au-

tomatic recording apparatus to obtain the schlieren patterns he praised the work of Dr. Lewis G. Longworth of the Rockefeller Institute.

The schlieren patterns of blood are obtained by passing a beam of light through a composite solution of blood proteins. This beam, eventually, falls on a photographic plate. As an electric current is applied to the protein solutions they start to move—some faster than others—so that soon a series of boundaries between the different proteins originate. The light, shining through these boundaries, encounters materials with different refractive indices (light bending power).

By optical means these boundaries show up at the peaks of the schlieren patterns.

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GENERAL SCIENCE

## Only by Continuous Effort Can Disorder be Prevented

### British Nobelist Warns Against Optimistic Assumption Of Automatic Progress, Fashionable in Last Century

**I**N DAYS like these each succeeding headline reinforces the scientific rule that in any material system the most probable condition is one of chaos.

These are days when scientists in common with the rest of us look at the world critically, fearful that we are engaged in a crucial, final experiment.

Prof. A. V. Hill, Nobelist in medicine and secretary of Britain's Royal Society, in delivering the commencement address at the California Institute of Technology recently emphasized that the most certain of all scientific rules is that contained in the Second Law of Thermodynamics. In a system, once chaotic,

order can be set up only by the expenditure of energy from without.

“Left to itself an ordered system gradually reverts to chaos,” Prof. Hill said. “So it is in human affairs: it is only by the continual expenditure of effort that disorder can be avoided.

“For many years it was the fashion—based as little upon fact as most other fashions are—to write and speak, and finally to think and act, as though progress was inevitable. Those who doubted this creed were thought to be backward and reactionary.

“Such baseless optimism has done inestimable damage. It may have been due

in part to a reaction from the hard idea of sacrifice inherent in Christianity. It found bogus scientific authority from the theory of evolution. The bitter fact was disregarded that, just as a house of cards carefully erected can be blown down in a second, so the decency and orderly freedom, the art and knowledge and beauty, the simple and kindly customs, which men have slowly and laboriously built up, can be quickly and easily destroyed. Such destruction was long regarded, is still regarded by many, as unthinkable.

“It is not unthinkable, it is just what is happening now to many millions of people in various parts of the world: it is what may happen everywhere if mankind goes on worshipping a false god.”

Many civilizations have perished before, Prof. Hill observed, many races of animals have become extinct. Because—in pseudo-scientific jargon—of the survival of the fittest? The only evidence for that theory is that in fact they did not survive. Can we be sure that man and his present civilization are fitted to survive? or mercy, tolerance and honesty for that matter? Or may we look forward, not to extinction, but to a completely orderly arrangement like that of the ant-hill or the hive, in which freedom is impossible, spiritual things are forbidden, and unrealities like kindness, mercy and tolerance are eliminated?

Such questions may sound like bitter cynicism, Prof. Hill admitted. He continued:

“A false god, some will say, may be better than none. Not always. False gods take people, and their unfortunate neighbours, to strange destinies sometimes, as we see in Europe and Asia today, as we may very well see in other continents before long. Why not look for an alternative to the illusion of inevitable progress which has let us down so badly? For there is one, but it is harder to accept.

“The idea of progress is a generous one: it has moved high minds and warm hearts to do many of the things worth doing: I do not say that the idea of progress is false. The mistake has been to suppose that progress is inevitable: Whereas, in fact, even what we have of decency and orderly freedom can be held only by continual effort, continual sacrifice, continual watchfulness. No system which man can create will even maintain the very moderate estate he has achieved, far less advance him beyond it, without the conscious and willing service and the coordinated effort of the majority of the people.”

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