CHEMISTRY

Chemistry Nobelist

The 1945 award goes to Prof. Artturi Virtanen of Finland who has done practical work in cattle nutrition as well as research on capture of nitrogen by plants.

➤ PRACTICAL barnyard science and highly important basic investigations on how plants turn air into food have been combined in the research career of Prof. Artturi I. Virtanen, director of the Biochemical Institute at Helsinki, Finland, to whom the Nobel Prize in Chemistry for 1945 has been awarded.

Probably more people in the highly cow-conscious lands around the Baltic would recognize his name as the originator of the A. I. V. method of making silage than would know him as the discoverer of several important steps in the nitrogen synthesis by legumes. Yet the two are linked together, just as some of Pasteur's fundamental researches had practical tie-ups with such practical matters as brewing and silkworm culture.

Being interested in how proteins were made out of nitrogen captured from the air by bacteria on pea and clover roots, Prof. Virtanen was also interested in how the same proteins were broken down and destroyed by other bacteria. This led to a study of how silage spoiled when it was permitted to become alkaline, with the eventual loss of protein in the form of ammonia. He stopped such spoilage by wetting down the fresh fodder, as it was packed into the silo, with a weak solution of hydrochloric acid. Silage thus treated kept very well, and the physiological effects of the residual acid were offset by adding a little ground limestone and soda at feeding time. This is the foundation of the A. I. V. method. It is widely used in the dairy regions of Europe, though it has not been adopted to any great extent in the United States.

Prof. Virtanen's researches on the capture and utilization of nitrogen from the air in food formation in plants have led to some interesting discoveries. He found that the root-nodule bacteria sheltered by legumes do not necessarily feed their captured nitrogen directly to their hosts, but excrete into the soil considerable quantities of one of the essential building-blocks of the proteins, aspartic acid, which the host-plant is able to use. He found also that the bacteria could live without the support of a higher plant, but that they throve better and captured more nitrogen if they had it. He also uncovered evidence that higher plants can capture nitrogen directly themselves, without the aid of root bacteria.

In other researches Prof. Virtanen proved that higher plants could take up and utilize relatively complex organic compounds from solution in the soil. This ran counter to the doctrine, quite generally accepted for a hundred years or more, that such organic compounds have to be decomposed by soil microorganisms into simpler substances, which are then taken up by the plants and rebuilt into complex compounds.

In experiments with Dr. Synnove von Hausen, Prof. Virtanen found that plants' growth could be greatly stimulated, and their flowering and fruiting made earlier and more abundant, by feeding their roots with a yeast extract.

Science News Letter, December 1, 1945

PHYSICS—CHEMISTRY

Atom Bomb Nobelists

The 1944 chemistry award goes to Prof. Otto Hahn of Berlin; Prof. Wolfgang Pauli gets 1945 physics award for theoretical studies on atomic structure.

➤ AWARD of Nobel prizes to two European atomic scientists, one of them a German, emphasizes the importance to scientific progress of free interchange and publication of scientific information.

Prof. Otto Hahn of Berlin, who has been given the 1944 chemistry Nobel prize, may be, as rumored, in the United States among the German scientists brought to this country in the custody of the U. S. Army.

His researches reported in January, 1939, on the fission of the uranium atom with energy release, were actually the beginnings of the gigantic research project that resulted in the atomic bomb. His scientific reports, along with those of Dr. F. Strassmann, co-author with Prof. Hahn of the famous Die Naturwissenschaften paper, and observations of Dr. O. R. Frisch and Dr. Liese Meitner, both then refugees from Germany, caused the nuclear physicists of the world to start striving for the practical release of atomic energy.

Prof. Hahn's researches were published in the leading scientific journal of Germany, despite the fact that Nazi Germany was then only a few months away from war.

Prof. Wolfgang Pauli, now visiting professor at the Institute of Advanced Studies at Princeton, N. J., who has been awarded the 1945 physics Nobel prize, was born in Vienna, studied at Munich and until 1940 was at the Technical College in Zurich, Switzerland. His theoretical studies on atomic structure have contributed to advances in physics, among them the release of atomic energy.

He is best known for the exclusive principle that bears his name. In a story issued in 1933, Science Service explained this principle as "rugged individuality of electrons."

This article said:

Smith, Jones, Brown, White: these are the Anglo-Saxon world's commonest names. They all contain five letters.

The five letters in the name are not sufficient to classify them, but physicists can distinguish between the 92 identical electrons in the uranium atom family by having five labels for each little mite of electricity, and no two of these little fellows have the same five letters attached to them.

These tiny particles of electricity or matter, the electrons, are very standard uniform fellows and always have the same weight and quantity of electricity when they are alone, but if they are attached together to make up an atom they begin to exhibit individuality. The tags placed on any one of them by the scientist give his address within the atom and tell how far he lives from the center of the community.

The name given to the statement of this individuality is the Pauli exclusion or equivalence principle, which was formulated by the eminent physicist, Prof. W. Pauli, early in the development of the new wave mechanics. This states that there are never two or more equivalent electrons in the same atom, such that the values of all five of their quantum numbers will be identical when a strong magnetic field is applied.

The Pauli exclusion principle is essentially a statement of the rugged individuality of electrons and the impossibility of promoting a merger between them.

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GEOLOGY—BACTERIOLOGY

Bacteria and Petroleum

Bacteria may have played many important roles in the formation of deposits as well as have had something to do with the relative scarcity today.

➤ BACTERIA may have had a number of important roles in the formation and development of the earth's petroleum deposits, Dr. Claude E. ZoBell of the Scripps Institution of Oceanography stated in a lecture before a Washington scientific audience. They may also have had something to do with the relative scarcity of petroleum today, he added, for it seems likely that much more oil has been formed in the long course of geologic history than is now present in the rocks, and it is known that some species of bacteria can feed on petroleum and related compounds, unlikely though they may seem as food materials.

There is little direct evidence that bacteria helped to make oil, Dr. ZoBell admitted. However, laboratory experiments have given a number of very interesting clues, some of which are being followed intensively in the hope of throwing more light on this most difficult and baffling geologic riddle.

If bacteria did aid in producing oil, it was probably a highly complex process as well as a very long one. As many as 40 or 50 different kinds of bacteria may have been involved.

Most geologists now believe that petroleum formation started with the dead plant or animal materials. These, of course, are always subject to bacterial action. One of the things that happens to such organic remains is the bacterial removal of elements other than carbon and hydrogen, especially sulfur, phosphorus and nitrogen. The nearer organic remains come to consist of carbon and hydrogen alone, of course, the nearer they are to being hydrocarbons, which are the constituents of petroleum and natural gas. This general observation receives some backing from the known fact that bacteria can convert dead organic remains into the simplest of hydrocarbons (methane), and also some of the most complex of hydrocarbons (bacterial pigments), as well as a few other compounds of intermediate complexity.

Another thing that certain bacteria may have done toward oil formation is hinted at in the activity of some species in releasing quantities of hydrogen from organic compounds. Addition of hydrogen to carbon under heat and pressure (hydrogenation) is a standard method for manufacturing synthetic oil out of coal or lignite. Bacteria-freed hydrogen, under the heat and pressure conditions in the earth's crust, may have been added to buried carbonaceous deposits in a similar manner, Dr. ZoBell suggested.

The role of bacteria was not necessarily limited to the formation of oil, Dr. ZoBell continued. Other bacteria may have had a good deal to do with the loosening of oil from films coating soil and rock particles and its accumulation into pools. If the particles are of limestone, acid-forming bacteria can dissolve them altogether, leaving pores and channels through which the released oil can flow. Production of carbon dioxide, both through the dissolving of limestone and as a result of the microorganisms' own life processes can do several things: it makes the oil less viscous, so that it will flow more freely; it directly pries the oil films loose from the particles to which they cling; it can form pressure-bubbles in dead-end pockets and drive out the oil that has accumulated in them.

Bacteria are known to be able to feed on various kinds of hydrocarbons, ranging from the simple methane to the highly complex paraffin waxes, and including all varieties of petroleum products. They require water and certain mineral salts, but use the hydrocarbons as their sole energy foods. It is for this reason that Dr. ZoBell suggested that bacteria may have in the course of geologic ages destroyed vast oil pools that other bacteria had vital parts in forming.

Present-day bacterial appetities for oil and related compounds work both beneficially and harmfully, from the human point of view. Oil pollutions of the soil, near oil wells and where oil has spilled from broken pipe lines or wrecked tanks, do not last long, Dr. ZoBell pointed out. Bacteria clean them up, and as a rule leave the soil more fertile than it was before the pollution occurred. Similarly, but more slowly, bacteria clear up oil pollution on bodies of water.

Bacteria have been known to attack kerosene, releasing explosive gas mixtures. Deterioration of high-octane gasoline during the North African campaign was traced to bacteria present in the water at the bottoms of the tanks. Bacteria also made a lot of trouble, for a time, in non-leak gasoline tanks of airplanes by attacking the synthetic rubber linings, which are made from hydrocarbons derived from petroleum or natural gas.

Finally, bacterial fondness for petroleum constituents has been used as a sure-nosed means in oil prospecting. Several of the lighter, more volatile petroleum constituents, especially ethane, propane and butane, diffuse upward toward the earth's surface, and where they do, the special kinds of bacteria that feed on them will accumulate in the soil. By hunting for them, and especially by hunting for fossil evidences of their long-continued presence, new oil pools may be found.

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CHEMISTRY

Insoluble Soap Useful as Lubricant

➤ A MIXTURE of three kinds of soap which most people would never recognize as soaps at all is the basis for patent 2,389,523, issued to Dr. Frank A. Leyda of Berkeley, Calif. The ordinary sudsy soaps of bathroom and kitchen are compounds of either potassium or sodium with fatty acids, usually stearic or palmitic acids. When used with too-hard water, a flocculent precipitate, slippery but insoluble, sometimes comes out. This also is a soap—a calcium stearate.

To the housekeeper, such an insoluble soap is a plain nuisance, making troublesome rings in the bathtub or washbowl, but to the mechanical engineer metallic soaps of this kind are often very valuable greases. The grease on which Dr. Leyda has obtained his patent is a mixture: barium, calcium and magnesium compounded with stearic and palmitic acids.

Patent rights have been assigned to the California Research Corporation.

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