CHEMISTRY

Nobel Prize in Chemistry Is Awarded Dr. Langmuir

Gas Filled Lamps, "tron" Tubes and Atomic Welding Are Merely By-Products of His Experiments in Pure Science

See Front Cover

THE AWARD of the 1932 Nobel prize in chemistry to Dr. Irving Langmuir, the General Electric Research Laboratory chemist, adds laurels to a system of investigation of nature's secrets as it recognizes a great scientist.

Langmuir has never been a mere inventor or applier of knowledge to pressing technical problems. He is a searcher after scientific truth. His fruitful technical developments, such as the gas-filled lamp, the "tron" tribe of vacuum tubes, and atomic hydrogen welding have been by-products of his "pure science" experiments. He aimed at understanding the stuff that matter is made of. One practical result alone, gas-filled incandescent lamps, is estimated to save America a million dollars a night on its light bill of over a billion dollars a year.

This tackling of fundamental problems in science and letting the results fall where they may is a notable and effective method of research that finds particular expression in great American industrial research laboratories. To Dr. Willis R. Whitney, who retired as director of the General Electric Research Laboratory a few days since and who picked Dr. Langmuir for his staff over twenty years ago, to Dr. W. D. Coolidge, a great physicist whose name is familiar on X-ray tubes and who is now director of the G. E. Laboratories, the award to Dr. Langmuir will give nearly as much satisfaction as though they had received it themselves.

Both Chemistry and Physics

If the Nobel prize award to Dr. Langmuir had been in physics instead of chemistry it would have occasioned little surprise, for although he is a chemist by terminology his work is in that borderland that is both physics and chemistry.

All of his achievements have resulted from his study of the fundamental nature of electricity, of atomic hydrogen, and of atomic structure.

Those more efficient electric lamps filled with nitrogen and argon gas instead of vacuum that we all use every day came nearly as a direct result of Langmuir's experiments made for the purpose of studying atomic hydrogen. It was for that reason that he first heated tungsten filaments in the gases at atmospheric pressure.

Atomic hydrogen welding, which produces the hottest industrial temperatures, came as the harvest of fifteen years of theoretical research on the dissociation of the hydrogen molecule.

Most Perfect Vacuum Pump

The electron tubes fathered by Dr. Langmuir and known by the names of pliotron, kenotron, magnetron, thyratron, dynatron, etc., were greatly aided by his development of the most perfect vacuum pump in existence. In the front cover illustration Dr. Langmuir is holding an historical experimental electron tube used in 1914 for radio telephone conversations between Schenectady, N. Y., and Pittsfield, Mass.

No book on physics or physical chemistry is complete without reference to Dr. Langmuir's work on atom structure, the adsorption of gases, the orientation of molecules, valence and isomorphism.

Since Dr. Langmuir is only 51 years old his pure science achievements will multiply. New industrial achievements will also continue to result from his older industrially unoriented experiments.

Dr. Langmuir is the seventh American scientist to be honored with a Nobel prize. Only one other American, the late Prof. T. W. Richards of Harvard, has been awarded the chemistry (1914) laureate.

The late Prof. A. A. Michelson, University of Chicago physicist, was the first American recipient of a Nobel award in science, when in 1907 he was honored for his work. The other American Nobelists, all living, are: Dr. Alexis Carrel of the Rockefeller Institute for Medical Research, medicine, 1912; Dr. R. A. Millikan, of the California Institute of Technology, physics, 1923; Dr. Arthur H. Compton of the University of Chicago, physics, 1927; Dr. Karl Landsteiner of the Rockefeller Institute for Medical Research, medicine, 1930.

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CHEMISTRY

New Laureate Explains His Present Work

By DR. IRVING LANGMUIR, winner of the Nobel prize in chemistry for 1932, in a special statement to Science Service.

EVERY scientific research man, to reach the greatest achievement, must have a deep curiosity and an intense enthusiasm for discovering new important facts or new relations between known phenomena. During the course of his work he derives great pleasure from the progress he makes in these directions. His greatest satisfaction, however, is to see that his results are willingly used by others and is derived particularly from the recognition that his work receives from his fellow investigators.

My own work has been in the field of both chemistry and physics. I have been especially interested in the mechanism of chemical reactions which take place on solid surfaces.

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GENERAL SCIENCE

Award Should Stimulate Industry to Foster Science

By DR. W. D. COOLIDGE, director of the General Electric Research Laboratory, in a special statement to Science Service.

THE FOUNDERS of the research laboratory of the General Electric Company had seen a new industry grow up around the fundamental scientific work of Faraday and others, and, men of vision that they were, they saw that they should not be content merely to apply the principles discovered by others, but should themselves support such fundamental research and so aid in the discovery of new principles for the further development of the art.

This led to the establishment by Dr. W. R. Whitney of a new type of industrial research laboratory, devoted largely to fundamental research. From the beginning Dr. Whitney insisted that each research worker should be free to publish his results in (*Turn to Page* 331)

ANATOMY

Rat Brains Cannot Explain Man's Cerebral Functions

Rat's Cerebral Cortex is Primitive, Developed Mainly From Olfactory Centers; Man's Involves Other Senses

RATS, which have served in laboratories to test drugs, vitamins and other substances, can not help the neurologists to solve the old problem of where in the human brain vision and touch and other complicated functions are localized.

Prof. C. Judson Herrick, University of Chicago anatomist, so concluded in a paper read on his behalf before the National Academy of Sciences. The reason is that the cerebral cortex of rats is made on a different plan from the human brain.

"Cerebral cortex is the gray matter of the brain that carries on the complicated associational processes," Dr. Herrick's summary explained. "Fishes and frogs have no well formed cortex and reptiles have a perfect, though small and simple cortex, whose forerunners can be found in fishes and frogs. This true cortex of reptiles was developed from reflex centers for smell. It is not a part of the primitive brain, but was slowly developed when in the course of evolution land animals had to use their wits more than fishes do.

"The first cortex was an olfactory cortex, concerned with associations of odors with other sensory experiences. In lower mammals, like opossums and rats, about half the cortex is also olfactory, but the rest is concerned with associations of other senses. As we pass up the scale toward man, the olfactory cortex gets no bigger, but the non-olfactory cortex gets enormously larger and more complicated. We wonder why this is.

"The fact is, we cannot locate the source of an odor by smell alone, but vision and touch are our localizing senses. The primitive olfactory cortex, accordingly, could be of no use in finding food and avoiding enemies except when working in cooperation with the senses of sight and touch. Its chief function is probably to activate and facilitate the action of the visual and other parts of the cerebral cortex in which each sense has a separate location or center.

"The olfactory cortex acts as a whole; the rest of the cortex does not. If in low mammals, like rats, the non-olfactory cortex is seriously damaged or almost wholly destroyed, the olfactory cortex still is able to facilitate those simple learning processes that can be carried on by the more primitive subcortical parts of the brain-stem. But in man, where the olfactory cortex is only a very small fraction of the whole cortex, severe cortical injury causes more serious disturbance of associational processes. This is because the kinds of learning that we can do are functions of our larger non-olfactory cortex, not merely of the more primitive brain-stem.

"Experiments on learning by rats deprived of part of their cortex show that the loss of most of the non-olfactory cortex does not seriously interfere with learning simple tricks, but it does impair their ability to solve more complicated problems. Most human problems are of still more complicated sorts that cannot be done by the stem part of the brain, not even with the help of general activation or facilitation by the olfactory cortex.

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am engaged in working out the laws according to which atoms and molecules distribute themselves over surfaces forming single layers of atoms. These laws are of importance in understanding many simple phenomena such as those of lubrication and of the spreading of oil films on water.

The forces that hold atoms or molecules on the surfaces of solids or liquids are just as varied in their nature as those forces which determine the chemical and physical properties of substances in bulk. In other words we must recognize that the chemistry and physics of surface phenomena are subjects almost as broad and as complex as the whole field of chemistry and physics. It has too often been thought that a single equation such as a so-called "adsorption isotherm" could be devised to cover all surface phenomena.

The importance of this field of surface chemistry is really just beginning to be realized. There is much pioneer experimental and theoretical work to be done to establish even the fundamental principles which should guide investigations of these phenomena. What we need particularly is to study in great detail and with high accuracy a few typical simple examples of adsorption.

Dr. John Bradshaw Taylor and I are attempting to do this through an exhaustive study of the electrical and chemical properties of monatomic films produced on the surface of tungsten filaments when they are brought into contact with vapors of the alkali metal such as caesium or potassium. The effect of adding minute amounts of oxygen is of particular interest. Oxygen and caesium represent substances of two extreme types and so by working with surfaces that contain both kinds of atoms in varying proportions a very wide range of surface phenomena can be investigated.

The delicacy of the methods that can be evolved to detect caesium or oxygen atoms on surfaces is quite extraordinary. For example, it should be quite possible, if desired, to detect the presence of caesium atoms inside a vacuum bulb even if the average concentration of atoms in the space is only about one atom per cubic meter.

We intend to continue such investigations until we have obtained far more fundamental knowledge of surface phenomena than we have at present.

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CHEMISTRY

Huge Tanks of Curious Alcohol Go Begging For Worthy Use

WANTED: A practical use for tertiary butyl alcohol.

This is not an advertisement of surplus depression stocks, nor yet a bid for relief from the Volstead act. Tertiary butyl alcohol is not in the beverage class, though to be sure the chemist has tagged it with a suspicious name.

Following the post-war practice of cracking heavy petroleum to yield gasoline, certain leading oil refiners discovered that several kinds of alcohol could be made economically from the more volatile parts of the cracked oil. These alcohols have proved to be of great value, especially in the lacquer industry.

Unfortunately the oil refiner has to take what Nature gives him when he demolishes the large molecules of cheap, heavy petroleum. An appreciable fraction of one peculiar alcohol, the so-called tertiary butyl variety, turns up regularly by the thousands of gallons, and the present customers do not welcome it. It has eccentric chemical habits which do not fit the solvent industry.

Tertiary butyl alcohol is normally regarded by chemists as an academic curiosity. Its full industrial virtues have undoubtedly not been tested. Like grain alcohol, but unlike most of the newer alcohols, it mixes freely with water. It is readily frozen, more easily than water itself. It evaporates almost as freely as grain alcohol. The partial likeness of tertiary butyl alcohol to the ordinary alcohol suggests that it might be substituted for the latter in some of the host of industries using the older product. Such substitution would be a godsend to manufacturers who at present regard grain alcohol as indispensable, but are seriously hampered by the government prohibition restrictions.

For more than half a century chemists have known the structure of the molecule of the tertiary alcohol to be like a compact bunch of grapes rather than the more slender chains characteristic of its alcoholic brethren. The bunch-like molecular structure has suggested value as an anti-knock motor fuel. It is known that the more compact molecules in petroleum treat high powered motors more kindly than do the snake-like type of gasoline particles. Tertiary butyl alcohol seems to follow the rule.

Thus it might land in the gas tank, inasmuch as it dissolves freely in motor fuel as well as water. Knowing the more elegant applications of alcohols, however, the chemist hates to run his product into so ignominious a channel at a few cents per gallon. He probably will find a more profitable use for it.

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ARCHAEOLOGY

Tunnel at Monte Alban Yields Skeletons and Jewels

A TOMB-LIKE entrance leading to a long underground passage, two skeletons lying far in the depths of this secret passage—these are the latest discoveries announced by Dr. Alfonso Caso, noted Mexican archaeologist who is exploring ruins of ancient Monte Alban, in the state of Oaxaca, Mexico.

The tunnel, which dates from prehistoric times, is only 20 inches high and 24 inches wide, and follows an irregular course up and down. The archaeologists pushed their way 320 feet by crawling on their backs, propelling themselves by elbows and toes. At times they found themselves moving downward head first.

The first skeleton lay 195 feet from the tunnel entrance. In the dust, beside the bones was a necklace of jade, pearls, and red and white onyx beads. The second skeleton was encountered 320 feet from the entrance, and at a blocked end of the passage. This skeleton was broken and incomplete, Dr. Caso reported. With it lay pottery, also broken. Theories have already been advanced to account for Monte Alban's tunnels, of which there are a number. Their discovery recalls old Indian history, which says that armies of Zapotecan Indians had a way of vanishing into secret passages. One theory is that not only troops but supplies might have been transported underground. Finding two burials in one tunnel is considered rather strong evidence that tunnels were tombs in the ancient city.

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