PHYSICS—PHYSIOLOGY

Aid Study of Thin Films Important in Lubrication

NEW experiments, that are the outgrowth of the research for which the 1937 Nobel Prize in Physics was awarded, were revealed to have important significance for industry in studying the little-known but vital facts of lubrication.

In a report to the meeting of the American Physical Society in Indianapolis, Dr. L. H. Germer of the Bell Telephone Laboratories, New York City, described his researches on the nature of very thin films only a single molecule thick.

Dr. Germer was the colleague of Dr. C. J. Davisson in the epoch-making experiments on the diffraction of electrons for which Dr. Davisson — jointly with Prof. G. P. Thomson of England—was awarded the 1937 Nobel Prize.

Dr. Germer's current work, reported jointly with K. H. Storks, describes the bombardment of films of stearic acid with swift electrons and an analysis of the resulting diffraction patterns.

When a number of molecular layers of this acid were placed on a metal surface it was found that the long molecules were inclined at an angle. Significant, however, was the finding that the first layer of these molecules stood up at straight right angles to the plane of the metal surface even though subsequent layers were inclined.

"These experiments," said Dr. Germer, "seem to us to be significant in two ways; in the first place, they reveal the arrangement and structure of organic molecules upon surfaces, in the second place, we believe that they reveal chemical combination between a surface and the first layer of acid molecules. These particular results have interesting bearing upon theories of lubrication, in particular the nature of 'oiliness' and boundary lubrication."

The current Nobel awards to Dr. Davisson and Prof. Thomson were made for electron diffraction experiments which showed, at first, only matters of theoretical significance; that material particles of matter (the electrons) could exhibit the properties associated with waves under the proper conditions.

The experiments of Drs. Davisson and Germer, and of Prof. Thomson, were made independently and formed the clinching evidence on which is built up the new theory of wave mechanics that is now used widely to interpret the structure and behavior of matter. It is a tribute to the breadth of these researches that potential commercial applications of the work are now becoming apparent.

New facts about the performances of very thin layers of substances were revealed by Dr. Irving Langmuir, Nobelist and General Electric chemist, when he told of his latest experiments with one-molecule-thick layers.

Finding that films stand on their heads, as it were, with great ease, he has devised a way of "conditioning" the surface upon which they are captured so as to anchor them. A film laid on water and transferred to a plate dipped into it should wear its hydrophilic or water-loving side outside, while a layer picked up by a plate raised to the surface through the water should have its hydrophobic or water-fearing side up.

Dr. Langmuir reasoned that such films should have different properties promising interesting uses in research. But many monolayers were able to turn over and exchange their hydrophilic and hydrophobic parts. So Dr. Langmuir by devising ways of anchoring the layers has made films of a single substance that have a wide range of properties.

The inner surface areas of the human and animal body are the battleground of disease toxins and antitoxins, declared Dr. Harry Sobotka, chief chemist of Mount Sinai Hospital, New York.

"Most people know their height in inches or their weight in pounds," said Dr. Sobotka, "but nobody bothers with measuring his or her surface area." Yet these areas—in the lungs, the stomach, the intestine, and even the surface area of the red corpuscles in the blood—are vital to living.

New knowledge of chemistry, gleaned from such "thin film" researches as those of Dr. Irving Langmuir, has important bearing on the role played by the enzymes, vitamins, hormones and toxins and antitoxins, declared Dr. Sobotka.

Few people realize, he indicated, that the surface area of the human lungs is nearly 2,000 square feet; or that the intestines contain a total area of nearly 50 square feet; or that the area of the red corpuscles in the blood stream of the body have an area equal to nearly three-quarters of an acre!

The role of viruses, hormones and enzymes, he added, rests on their ability to distribute themselves over large surfaces in very thin films which may be only a molecule or two in thickness. Thus tiny amounts of these crucial chemicals affect tremendous surface areas in the body.

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A child should have all 20 of its temporary teeth by the time it is two and one-half years old.