SCIENCE NEWS

Science Service, Washington, D. C.

THEORY CONCERNING THE EFFECTS OF DEUTERON "BULLETS"

MODERN alchemy, the transmutation of one chemical element into another by bombardment with high-speed subatomic "bullets," is made possible by an electrical sorting arrangement inside each atom. How the subatomic sorter helps weed out parts of the incoming atom bullets and allows others to enter the nucleus and create a different, heavier atom, is explained in a new theory just announced at the University of California at Berkeley.

Drs. J. R. Oppenheimer and M. Phillips, in the *Physical Review*, described how their explanation of the sorter's operation clears up a mystery of certain puzzling experiments performed by their colleagues, Professor E. O. Lawrence, Dr. Edwin McMillan and Dr. R. L. Thornton.

Professor Lawrence's research had found many cases where an element, bombarded with deuterons from his giant sling-shot accelerator, was increased in mass by a unit of one. Thus, aluminum of mass 27, when struck by a deuteron of mass two, turned into aluminum of mass 28 and released a hydrogen particle of mass one, a proton.

Similarly sodium, whose chemical symbol is Na, entered into bombardment reactions of the type:

$$Na^{23} \text{ plus } H^2 \text{ produces } Na^{24} \text{ plus } H^1.$$

In each case part of the deuteron (H^2) was captured and went to form a heavier atom, while the rest of the deuteron turned into a proton (H^1).

As explanation, Drs. Oppenheimer and Phillips suggest that the deuteron is not really a single particle but a composite unit containing a neutron and a proton; the proton having electrical charge and the neutron being without one. Don't think of the deuteron, however, as a round, hard particle; for its wavelike nature means it is not confined to a sharply limited volume. As a matter of fact, there is a good chance that both, or either, the neutron or proton, of which the deuteron is composed, may be some distance away from the deuteron's center of mass.

Coming up to an atom in the target, say an aluminum atom, the neutron and proton in the deuteron particle behave quite differently. The strong electrical barrier of the atom nucleus stops the charged particle, the proton; but it has no effect on the non-electrical neutron. The latter goes right through the barrier, enters the aluminum nucleus, is captured, and in joining creates a new and heavier kind of aluminum.

One way to think of the atomic happening is to conceive an army half of which consists of men with gas masks and half without. The army is attacking an enemy whose sole defense is a cloud of poison gas thrown up around it. The attacking force comes to the gas cloud. Those parts of the deuteron army with gas masks (the neutrons) can go through the gas (electrical barrier). Those parts without masks (protons) must stay outside and retreat. The analogy falls down in that one deuteron does not consist of many neutrons and protons but only of a single pair. A stream of deuteron particles, however, might be likened to the attacking army pictured.

RECENT INCREASE IN MENTAL DISEASE NOT DUE TO THE DEPRESSION

THE number of new cases of mental disease admitted to the hospitals in New York State has increased from 6,300 in 1912 to about 12,000 in 1934, a 27 per cent. increase in the rate per 100,000 of population.

The increase in mental disease is not due to the mental strain and stress of the depression, however, Dr. Carney Landis, research associate in psychology for the New York Psychiatric Institute and Hospital, said in an address—broadcast over the Columbia System—under the auspices of Science Service.

Only one type of mental disease has increased materially in this period: a disease which affects only persons past middle age and is due to the hardening of the blood vessels in the brain. The rate for patients sent to mental hospitals on account of this disease has skyrocketed from less than 2 per 100,000 in 1912 to over 14 per 100,000 in 1934, a jump of almost 700 per cent. in 22 years.

Why are more people suffering from hardening of the arteries in the brain? We can not blame that on the depression, Dr. Landis said. It is explained by the simple fact that the United States now has many more people old enough to be subject to this disease than were living in 1912. In 1912 about one fifth of the population was 45 years old or older. In 1934 practically one quarter of the population was in this age group.

We have more old people now because public health work and preventive medicine have added more than 10 years to the life span of the average American since 1900, Dr. Landis indicated. "After all, a man must die of something, and if typhoid does not take him at 30, hardening of the arteries in the brain may at 60," he said.

"Depression, financial insecurity, unemployment, and general unrest have not led to any increase in hospitalized insanity," Dr. Landis concluded. "This does not mean that there has not been plenty of mental stress and anguish, plenty of ragged nerves and unhappiness, but these psychological stresses and tensions have not led to an increased rate of hospitalized mental disease."

NOISE CAUSES DEAFNESS BY DAMAGE TO NERVE

CONTINUOUS exposure to constant noise of sufficient loudness will cause deafness due to nerve damage, Dr. M. H. Lurie, of Harvard University, told members of the American Academy of Ophthalmology and Otolaryngology at their meeting in Cincinnati.

By listening in with a special kind of radio hook-up on the hearing apparatus of cats' ears, Dr. Lurie and associates were able to learn much about the causes of different kinds of deafness. Some of their conclusions are: (1) Deafness of adult life can be caused by the neglect of mild ear trouble of childhood. (2) Exposure of peo-

ple to loud noises for long periods of time will cause a dying of the sensitive hearing cells in the ear, followed by deafness. (3) Certain diseases and drugs, typhoid fever, mumps, influenza, quinine and alcohol, cause actual destruction of the nerve endings of the inner ear. (4) Explosions can dislocate these special hearing cells, throwing them off from the vibrating membrane on which they rest. (5) Unregulated noise over long periods may seriously injure the nerves by which we hear.

In the course of the experiments the investigators found in the animals tested all the different types of deafness that human beings have. These included the inherited type of deafness; deafness caused by disease of the drum and bones of the ear that bring the sound to the inner ear; the chronic deafness caused by repeated colds; deafness in which the nerve of hearing itself is involved; and loss of hearing as a result of the animal hearing loud noises for a long period of time.

Besides studying these various kinds of deafness with the super-radio apparatus, the investigators examined the animals' ears microscopically in order to find, if possible, the exact causes of the conditions.

HEIGHT OF THE FOREHEAD

DR. ALEŠ HRDLIČKA, anthropologist of the U. S. National Museum, in the annual report of the Smithsonian Institution, states that measurements on many hundreds of skulls in the museum collections, as well as on the heads of living men and women, show that the average forehead height of "Old Americans" of the white race is $2\frac{5}{8}$ inches. American Indians have foreheads hardly a thumbnail-thickness higher. But American Negroes have foreheads averaging $2\frac{3}{4}$ inches high, and Eskimos $2\frac{7}{8}$ inches.

Averages among various white races show Armenians to be the lowest-browed, with $2\frac{3}{8}$ inch foreheads. Irishmen have the highest foreheads, $2\frac{5}{8}$ inches. Hungarians and Frenchmen rank next to Armenians as "lowbrows"; Old Americans and Germans next to the Irish as "highbrows."

But lest any one take undue credit to himself for racial superiority in forehead height, Dr. Hrdlička makes it clear that this measurement has nothing to do with intellectuality. He measured four groups: Old Americans at large, representing the "average citizen" of native stock; Tennessee highlanders, a group much retarded educationally; Old American members of the National Academy of Sciences, and academy members without regard to race. The latter two groups, of course, may be presumed to be the very cream of American intellectual life.

Their foreheads were all of almost exactly the same average height. There wasn't a twelfth of an inch difference in the forehead heights of the four groups. And the averages for the Old Americans in the Academy and the Old Americans from the Tennessee mountains were precisely the same!

IMPROVEMENT IN RUST-RESISTING QUALITIES OF MOTOR CAR FINISHES

LIKE the owner of the one-horse shay who built his vehicle so well that it finally all wore out at the same instant, manufacturers of modern automobiles are gradually solving the problems of wear and weathering and making the journey from the assembly line to the automobile graveyard a longer and more beautiful one.

F. P. Spruance, of the American Chemical Paint Co., speaking at the meeting, in Cleveland, of the Society of Automotive Engineers, described advances in making motor car paint and accessories long-wearing and rust-resistant.

Automobile bodies rust because paint is sufficiently porous to permit moisture to get through to the metal surface. Once the moisture reaches the steel beneath, rust-creating conditions are at hand.

Electrolysis sets in and the iron in the steel dissolves out at innumerable anodic, or positive, electrical points and plates out, even under paint and lacquer at the cathodic, or negative, electrical points. This battery-like action of rusting goes on continually and is stopped only by the removal of the moisture.

The newest way of attacking this sub-paint rusting process is to coat the steel in some fashion with a protecting non-rusting metal coating.

An electrolytic process known as the Granode method is particularly successful. In the Granode process the protecting coating is developed electrolytically from a solution of zinc phosphate. The parts to be coated are hung on hooks in this solution and an alternating current passed through the zinc phosphate electrolyte.

A direct current would deposit zinc directly on the parts; the alternating current coats the metal with a continuous cover of the zinc phosphate. This cover is as rust-resistant as zinc itself but, unlike zinc, will take a coat of paint.

Cheaper than the Granode process and almost as satisfactory, is the Cromodine process, wherein the steel is dipped or sprayed with a solution of iron chromate and becomes coated with a thin layer which is little more than a slight discoloration.

Especially advantageous to the user is the flexibility of the chromium-treated surfaces. It is as pliable as the steel beneath it. A mudguard just tipped on the front end, which may buckle in the middle, will have no spreading paint crack at the bend.

DIESEL-POWERED MOTOR CARS

ADD to your vocabulary—cetene number! You've heard of octane number in rating the bumpiness, or knocking power, of your gasoline. Cetene number is the same thing for the fuel oil in Diesel engines. You'll hear more of cetene number as the gasoline resources of the nation diminish and transportation turns more and more to Diesel-propelled vehicles. Already fuel engineers of Pennsylvania State College are studying Diesel fuels and their characteristics. They are preparing for a condition now nearly at hand in truck and bus transportation, and which will some day come to pleasure cars.

Professor P. H. Schweitzer and his research associate, Theodore B. Hetzel, of the School of Engineering, explain that bumpiness in Diesel fuel is caused by an almost opposite happening from that which causes the comparable knock in gasoline. Gasoline knock—and the ac-

companying octane rating—comes about because the gasoline starts to burn evenly in the automobile cylinder, and then suddenly the unburned part explodes all at once with the resulting knock.

For smooth combustion with a knocking gasoline, the burning of the gas must be retarded. Tetra ethyl lead will bring about this deceleration and is widely used for the purpose. With Diesel fuel, combustion is not set off by spark plugs—there is none—but by the spontaneous ignition due to compression of the fuel which raises its temperature above that needed to make it explode.

If too much fuel spontaneously explodes at once, there is the knock. The way to stop it is to have the fuel burn as soon after it enters the cylinder as possible; speed up combustion instead of slowing it down as is the case for gasoline. To test the comparative values of Diesel fuel, the important point is to measure the ignition lag, the time between the injection of the fuel and its ignition, and make it as small as possible.

The contribution of Professor Schweitzer and Mr. Hetzel is the development of an ignition lag indicator which employs the principles of a phonograph pick-up device used with a radio loudspeaker. One pick-up is connected to the fuel injection nozzle and gives a surge of current when the fuel first enters; the other is connected to a small diaphragm on the walls of the firing cylinder and indicates when the fuel ignites. Standard Diesel fuels and special laboratory test fuels are compared for performance over a wide range of compression values within the testing engine.

ITEMS

CORN has gained a lap in its end-of-the-season sprint with frost, the weekly summary of crop-weather of the U. S. Weather Bureau shows. The situation this season was made more than ordinarily critical because of the persistent cold, wet weather that greatly delayed planting last spring. In spite of the generally optimistic outlook, the lateness of the crop in some areas leaves it still very backward. Thus, in southern Iowa very little corn is yet within sight of safety, while in the northern part of the state the crop is in quite satisfactory condition. The warm weather has been favorable for fall preparation for next spring's crop in most of the major agricultural sections, and farm work is going ahead fast. In the Southeast, however, there has been some delay in cotton operations because of wet weather.

THREE Texas farmers are each $5 richer because two physicists of the California Institute of Technology released six stratosphere balloons, each carrying cosmic ray recording apparatus, at Fort Sam Houston during August. Dr. Robert A. Millikan and Dr. H. Victor Neher had notes attached to self-recording electroscopes offering a reward of $5 for their return to Pasadena. B. I. Klein, of Mountain Home, Texas, recovered the first instrument returned. Records made by the device on motion picture film showed that it soared to an altitude of 63,000 feet, the highest reached of the three instruments returned. This instrument was found on August 7, the day it was released. Names of the other finders were not revealed. The second instrument returned reached an altitude of 48,000, and the third went to 42,000 feet.

AN electric light bulb which is said to provide the rickets-preventing vitamin D without burning, tanning or in any way changing the appearance or texture of the skin made its first public appearance at the convention of the Illuminating Engineering Society at Cincinnati. The new bulb was developed by Dr. George S. Sperti, working at the laboratories of the General Foods Corporation. The bulb can be used in any electric lamp socket without additional fixtures and the full value of the ultra-violet rays can be obtained, it is claimed, while using the bulb in an ordinary reading lamp. The bulb is the result of ten years of experiments on selective radiation. A special corex glass envelope or bulb filters out the light rays below 2,800 Ångstrom units. It is these lower wave-lengths, according to Dr. Sperti, that cause damage to human tissue. The new bulb really consists of two bulbs. An inner tube of corex glass operates as a mercury vapor ultra-violet lamp which radiates very little visible light. Within the large outside bulb, also made of corex glass, is a tungsten filament which provides the visible rays.

FLYING-FISH do have movement in their fins while they are in the air, but it does not aid them in their flight. Definite answer to this old and long-disputed argument about flying-fish was given by Dr. G. S. Carter and J. A. H. Mander. The often-observed movement of the flying-fish's fins, they found, is transmitted to them by the tail, which continues to lash the water hard even after most of the fish is clear of the surface. Once in the air, the fins are held rigid, and the "flight" is really a glide. Dissection of a number of specimens confirms these observations. There is nothing about the fin muscles that could give them the necessary movements to make them function as wings.

DUTCH elm disease, which is causing serious alarm and provoking heroic eradication effort in the United States, is not being so earnestly fought in England, where it has been present a longer time. A policy of "let it alone" was approved by T. R. Peach, of the Imperial Forestry Institute, Oxford, speaking before the British Association for the Advancement of Science. The disease, Mr. Peach said, is most serious in the southeast of England. It decreases in severity towards the north and west, and is not known to exist in north England and in Scotland. "In a few limited areas it has done severe damage, but over the bulk of its range, though common, it has as yet killed few trees," the speaker continued. "Prophecy of the future of the disease is complicated by the very varied rate of progress of the attack in different trees, and by the recovery, temporary or permanent, of many. In view of these recoveries and of the difficulties of eradication, a policy of *laissez faire* in this country is probably justified."