SCIENCE NEWS

Science Service, Washington, D. C.

VITAL SUBSTANCES AND OPTICAL ACTIVITY

LIFE may have its mysteries, but scientific investigators have one method of prying open, a bit, the door that guards the secrets of the atoms which compose living tissue. The wedge is the fortunate fact that those substances most essential to life—the enzymes, hormones and vitamins—are optically active.

Thus by noting whether they rotate a beam of polarized light clockwise or counter-clockwise, and to what degree, new facts on the most fundamental problems of man's existence can be found. The outstanding experimenter in this field is Dr. Phoebus A. Levene, of the Rockefeller Institute for Medical Research, who recently received the William H. Nichols gold medal of the New York section of the American Chemical Society for his discoveries.

The ability of many vital substances to rotate polarized light, said Dr. Levene in his address of response in accepting the medal, arises because their molecules are characteristically lop-sided or dissymmetrical. "To-day organic catalysts, by virtue of their specific dissymmetry, have become the most effective tools in researches on structural problems in the field of natural products—carbohydrates, proteins, hormones. Enzymes and substrates, the substances upon which enzymes act, are structurally dissymmetric substances, and the action of enzymes upon substrates depends upon the fitting together of the two dissymmetries, as a key fits into a lock."

The job of the organic chemists, Dr. Levene continued, has been to alter chemical molecules, one step at a time, and rearrange them to see how they fit. The job chemically resembles the efforts of a jig-saw puzzle fan, except that the parts are so tiny that they can not be seen. As the shapes of the molecules are altered the changes can be studied by the shifts in their ability to rotate polarized light.

Dr. Levene showed tables indicating that in some cases the direction of optical rotation depends entirely upon the arrangement in a molecule of the groups, or atoms, around the asymmetric atom in a clockwise or counter-clockwise order, according to size or volume. Another new finding is that in many cases substances which rotate polarized light to the right (substances having dextro-rotary properties) seem to have their inner-molecular groups arranged in clockwise order and in diminishing volume. This rough empirical rule is obeyed when the molecules are viewed with the heaviest groups toward the observer and the light passing toward the observer. Dr. Levene indicated that this discovery developed from a mathematical formula originated by the British mathematical physicist Boys. While Boys's rule is not applicable in general, it has been found valid for such organic chemical groups as the primary and secondary carbinols and the corresponding amines.

COSMIC RAYS

UNDERSTANDING of the cosmic ray has beeen furthered by the discovery at Harvard University that many of the strange new particles found in the rays last year are destroyed in a split-second cataclysm which, without leaving a shred of evidence, explodes their million-volt energies. The particles, found independently by Professor Jabez C. Street and Dr. Edward C. Stevenson, of Harvard, and Drs. Carl Anderson and Seth Neddermeyer, of the California Institute of Technology, are unlike any other fundamental bits of matter. They are the most penetrating projectiles known to man. Tearing earthward from outer space at energies ranging up to hundreds of billions of volts, they can easily blast through several inches of dense, solid lead.

According to Professor Street and Dr. Stevenson, however, many of these particles dribble off energy as they collide with atoms in the atmosphere, apparently reaching a critical stage at which one single collision will stop them in their tracks and completely dissipate their great store of remaining energy. Just when this stage is reached, why one smash-up should wreck these pile-driver projectiles, they are not prepared to say, nor are they certain exactly how these catastrophes occur. The cataclysms follow no known physical laws and are entirely unpredictable. To answer these and other puzzling questions a new type of cosmic ray "telescope" and atomic "speed trap" has been designed which will soon be put into operation for better observation of the cataclysm. An automatic recording device is already photographing the paths of some fifty cosmic-ray particles daily for them.

Preliminary experiments indicate that the new-found particle has an electric charge about equal to that of the ordinary atomic building blocks, the proton and the electron. Its mass, however, is about 130 times as great as that of the electron and just about one fourteenth that of the proton. Its tremendous penetrating power, of course, also marks it off from other particles of matter. Indeed it was this stupendous force which led to its original discovery. As Professor Street and Dr. Stevenson visualize the cosmic ray bombardment, one of the small particles might start from outer space with an energy of billions of electron-volts. Small amounts of this energy are probably lost through collisions with air molecules or even solid material as the particle shoots toward earth. A head-on smash-up with a lead plate might cost it a few million volts of energy per centimeter, a noticeable but by no means large loss.

Down to a certain critical energy value—possibly at several hundred million volts—the particle's energy loss apparently proceeds with fair regularity. At some as yet not accurately determined critical energy range, however, the chances are that one single collision may stop the particle altogether, exploding all its remaining energy in one lightning holocaust. This range probably extends from zero up to about four hundred million electron volts. Thus a particle which has easily smashed through several inches of lead plate may, in this critical energy range, succumb to a sheet of lead only a third of an inch thick or even less. This has been the most puzzling aspect of the discovery, for this energy loss is entirely out of pro-

portion to other earlier energy losses by the particle. In attempting to unravel the mystery, the two investigators have been looking for possible products of the catastrophe but thus far have been unable to find any.

HERMES

THE best estimates now indicate that Hermes, or the Reinmuth Object as it was tentatively known after its discoverer, Dr. Karl Reinmuth, of the Königstuhl Observatory, came 16,000 miles closer to the earth than first computations indicated. This is based on a 4 per cent. revision of an approximate approach within 400,000 miles. The recomputation of Hermes's orbit, announced by Professor Harlow Shapley, director of Harvard College Observatory, is based on work done by D. M. Beard, a senior student of the University of California at Berkeley.

When discovered last October, Hermes, having a size estimated at about one mile in diameter, broke all records for close approach to the earth by an object greater than the mere specks which are recognized as meteorites, or shooting stars. It came within less than 400,000 miles of the earth and for a brief time was closer than any other astronomical object except the moon.

To astronomers the new calculations are interesting, not because they lessen the distance between nearest approach of Hermes and the earth, but rather because the calculation of the orbit of this asteroid has been one of considerable difficulty.

In the February issue of the *Journal* of the British Astronomical Association, Dr. A. C. D. Crommelin, fellow of the Royal Astronomical Society, comments on this point, saying: "The orbit of this little body offered great difficulty to computers, who found the distance from the earth was not indicated very definitely from the observations at first available; at length two positions from a plate taken by C. Jackson at the Union Observatory, Johannesburg, gave the means of getting the asteroid's parallax by a combination with the European positions." Dr. Crommelin estimates that the closest possible distance, for the most favorable positions of the orbits of the earth and Hermes, is about 220,000 miles. This assumes that the present orbit of Hermes will remain unchanged; a condition—it should be added—which few seriously believe will persist because of the perturbations produced by the earth and the sun at each near approach of the asteroid. Based on calculations of the orbit the next appearance of Hermes within the range of telescopic visibility will be in 1940, but the approach then is not expected to be as close as the last one of October, 1937.

In the last six years several asteroids which approach very closely to the earth have been located. Eros, one about twenty miles in diameter, which was found in 1898, long had the record as the closest, as it came within 14,000,000 miles. But in March, 1932, Dr. E. Delporte, of the Belgian National Observatory, found one that comes within 10,000,000 miles. This he named Amor. The following month Dr. Reinmuth found one, which he later named Apollo, and which can come within three million miles. Then Delporte scored again, for on February 5, 1936, he found one that came within 1,376,000 miles. This was named Adonis. Astronomers do not believe that these objects are really getting closer to earth than they have been before. It is merely that a much closer watch, with more efficient telescopes, is being kept. Some years ago, all of them would probably have escaped scrutiny.

A NEW BLIND LANDING SYSTEM

A NEW blind landing system which gives the airplane pilot a "picture" of the unseen airport runway he is approaching was described by Irving R. Metcalf, veteran pilot and radio engineer of the Bureau of Air Commerce before the meeting of the Society of Automotive Engineers held recently in Washington.

Still under development, the device combines ultra-short radio waves, the plane's "artificial" horizon and a cathode ray tube to bring before the pilot's eyes the equivalent of the fog-bound airport landing lights. Highly valuable too is the fact that the new system combines into one instrument the duties now performed by nine separate devices. This simplification is a major advance in flying technique.

Three electron "guns" inside the cathode ray tube shoot electrons against the tube's fluorescent screen and produce three brilliant spots. When these spots are lined up horizontally the pilot knows that he is going down the correct glide path to his landing. The radio signals and the artificial horizon aim the "guns" so that the spots give the relative position of the plane at any instant and the pilot swings his plane until the dots line up properly. The three dots reproduce the behavior of three reference landing lights on the landing field in a system suggested by Mr. Metcalf a few years ago and installed at eighteen airports.

In the light system, which is now reproduced in the plane by radio means, a light sunk in the center of the runway, and a light on each side of the runway are used to tell the pilot whether he is making a proper approach. Squinting at the lights through cross-hairs, the pilot knows he is on course if the three lights appear in a horizontal straight line and the center light is at the intersection of the hairs. If the center light is to one side, the pilot knows his plane is off course on the same side. If the center light is above the other two, the plane is above its proper approach path; if below, the plane is below the proper approach path. In the radio system four antennae, fed by one radio transmitter, send out signals, one of which moves the dots in the cathode ray tube up, one down, one to the left and one to the right. When the pilot is on course the signals neutralize each other and the dots are in their proper position. If he is off course, the dots move in the direction in which the plane has veered.

Under the new system the plane approaches the field in a straight line, ready to land at any moment, instead of approaching in a steep glide and then leveling off near the ground. The advantages cited for the straight glide approach are this readiness to land, should the pilot be nearer the ground than he imagines, and the slower approach speed.—LEONARD H. ENGEL.

ITEMS

DR. R. W. BROWN, paleontologist of the U. S. Geological Survey, in a report given before the Geological Society of Washington stated that the Hell Creek beds of Montana and North Dakota, long a puzzle to paleontologists because they seemingly contained dinosaur bones and plant remains which belong to an age when dinosaurs were extinct, should be classified as two separate formations. Now, with the fossil-containing beds reclassified, Dr. Brown puts the Hell Creek formation in the Cretaceous age, along with the other dinosaur-containing beds of North America, and the overlaying beds, formerly such a puzzle, in a new age, the Paleocene, a period of transition from the age of reptiles to the age of mammals.

NATURAL color slow motion pictures of the electric arc, which appears to the naked eye as sputtering brilliant sparks, reveal one of the least understood of natural phenomena to consist of brilliantly colored flames, slowly pushing out tiny flashing globules of molten metal. Taken by Dr. C. G. Suits, of the General Electric Company, the film shows differently colored flames for different gases. The flames wander gracefully around the edges of the electrodes for an interval before becoming more or less stable at the electrode tips. One thousand frames per second, with exposures of 1/10,000 of a second for each frame, were taken by Dr. Suits to show what goes on in the arc.

A NEW device for measuring the thickness of coatings, like tin-plate, on iron or steel surfaces, has been developed at the National Bureau of Standards. The merit of the method is that the surface or sample is unharmed by the magnetic apparatus. Developed by Abner Brenner, of the electrochemistry section, the method depends on the decrease in attraction of a permanent magnet by steel when the two are separated by a non-magnetic coating. Coatings only fifteen thousandths of an inch thick can be measured by the method. Accuracy within an error of ten per cent. is claimed. In 1936 a patent was granted to three Pittsburgh inventors for a somewhat similar device which utilized a small electromagnet, contained in a pencil like device, as the source of the magnetism. Mr. Brenner's newer apparatus uses a permanent magnet. In the patented article the "pencil" was moved over the coated surface and changes in electric current, induced by the changing degree of magnetic attraction, were calibrated with coating thickness.

RADIOACTIVE minerals in a rare ore sample from Jimtown, Colo., were recently determined without destroying the mineral by Dr. E. N. Goddard, U. S. Geological Survey mineral expert, by a new use of the test by which radioactivity was discovered. Placing a polished face of the ore sample on a sheet of film, and leaving it untouched for some time, Dr. Goddard was able to determine, after the film was developed, the presence of pitchblende, a strongly radioactive ore of uranium, by its intense black markings on the film, and cerite, a weakly radioactive ore of cerium, from its gray markings. Substances that were not radioactive left no marks on the film. Later analyses of this ore sample showed that it was about 940,000,000 years old, placing it among the oldest rocks known, formed during the long eras before life appeared on earth.