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THE COMPOSITION OF MATTER

DECLARING that the most solid matter on earth is made up of openwork filigree atoms composed of nothing more firm than charges of electricity and spread out so thinly that they resemble more nearly the starry heavens where thousands of light years separate the stars, Dr. Willis R. Whitney, of the General Electric Company, reviewed some of the modern disclosures on the make-up of matter before the American Chemical Society meeting at Los Angeles recently.

"There is nothing more interesting than the continual change in fundamental theories regarding matter," Dr. Whitney said. "We still stand about where the metaphysician did when he questioned the independent existence of energy and matter."

The atom of the past generation was by definition indivisible. For many years it had been evident that the character of all chemical elements varied in a regular or periodic way with increasing atomic weight. Attempts at explanation were made by assuming that all the different elements were merely different multiples of the very simplest one, hydrogen. But this theory was never justified by its results because the atomic weights were not multiples of a whole number.

Sir Ernest Rutherford, the British physicist, showed that two lighter elements, hydrogen and helium, can be literally knocked out of some of the simpler elements while heavier elements such as uranium, radium and thorium give off of their own accord helium particles, electrons and electro-magnetic radiations. The indivisible atom of by-gone days had therefore to go, and give place to divisible atoms of complicated internal arrangements.

We have now reached a stage where the actual picture of the structure of the atom is more intricate than any earthly geometrical figure, and more perfect than any known celestial system. The laws of astronomy have been called into play, and the super-celestial orientations are needed to explain the complicated, but not bewildering, the novel, but not embarrassing, internals of the atoms.

The electron has now taken the place of the elemental atom of our fathers. We can not claim that ours is simpler than theirs. Theirs was harder to pierce, but ours is harder to understand. Roughly speaking, the atom of to-day is a positive electrical charge with the equivalent number of negative charges spaced in and around it.

Crookes called the electron the fourth state of matter, as it was neither solid, liquid nor gaseous. Matter is at least not merely dry and hard, nor yet soft and wet. It is electrotonic and even celestial, whatever that may mean, and the most we know about it is that it is almost entirely space. It is as empty as the sky. It is almost as empty as a perfect vacuum although it usually contains a lot of energy. Matter is like a vacuum in which there are an enormous number of positive and negative electric charges, which, however, fill only an incredibly small portion of the space attributed to the matter. We may now say that every gram of all matter contains 600,000,000,000,000,000,000,000 electrons and an equal amount of positive electricity. The lightest atom has one electron outside of the positive center or nucleus, the second heavier has two, the third three, and so on, throughout the whole list of elements.

The actual smallness of the atom is impossible to realize, Dr. Whitney said. There are two hydrogen atoms to one oxygen atom in one molecule of water, and there are so many atoms of hydrogen in one small drop that if the atom were as big as a drop, they could cover the whole world with a foot of water; or if they fell as in the heaviest rainfall it would rain all over the United States for nearly two weeks.

X-RAYS AND LABORATORY ANALYSES

RAPID analyses of materials in the laboratory by the use of X-rays in a much shorter time than required by the older chemical methods is promised by Professor Urbain, of the Minero-Chemical Laboratory at the Sorbonne. With the assistance of Eugene Delaunay, he has just completed a series of tests of the X-ray method.

The apparatus used is composed of an X-ray tube; a lead screen in which a small slot has been pierced; a "selector" or tantalum, as a filter for the rays; a stand to hold the piece to be studied and a detecter to measure the intensity of the radiation received—the intensity being indicated by the displacement of an illuminated spot.

The material to be analyzed is placed in the beam, and when it is in good condition, the spot of light remains stationary; but if a fault in the material appears, the electrometer registers promptly. By recognized laws of physics, the deviation is proportionate to the amount of the fault in the matter. By this method, the smallest faults can be detected.

For actual quantitative work, the movable holder for the material is replaced by a small basin. By using, for example, distilled water as a base, and placing this first in the basin to set the "zero starting point," other solutions containing salts can be analyzed by straight calculations. For more than one salt in solution, more than one wavelength can be used.

The great advantages of this would be first for the speed of analysis, and second that a constant watch and check can be kept on the material used in manufacturing. M. Delaunay, who did the actual work, also says that there is no risk of error, which greater accuracy should prove invaluable.

TESTS FOR AVIATORS

THAT more work needs to be done on tests to determine a man's fitness to become an aviator is shown by a

report of work done by George Brammer, of the Laboratory of Psychology at Stanford University. A certain degree of steadiness in muscular control is assumed to be a necessary qualification for a man who would become an aviator. During the war a number of tests were developed which were calculated to determine the nerve and muscle coordination of the would-be flyer before he was finally accepted for training in the art of flying.

In order to determine the value of this factor of steadiness, tests were made upon men in the Air Service of the U. S. Army at Crissy Feld, San Francisco. There were eighteen men and officers in the test group with from 110 to 1,775 hours of actual flying to their credit. The same tests were given to eighteen students of the University of California who had qualified for the Air Service of the R. O. T. C., but none of whom had had any flying experience.

The test subject stood in a comfortable standing position and by means of an apparatus known as the ataxiameter the amount of body sway in one minute of time was recorded automatically. Tests were first made with the eyes open and then with the eyes closed.

Results showed that this steadiness test is not a reliable criterion of a man's ability to become a flyer. Some men who had a creditable flying record showed a poor score in the steadiness test. It was also found that with a little practice a man might make a good score in the test, but that men with flying experience did not make a better average score than those without any experience in flying.

AN INTERNATIONAL PSYCHOANALYTICAL FOUNDATION

THE establishment of an international psychoanalytical foundation to be headed by Professor Sigmund Freud would be highly desirable, is the opinion expressed by Dr. William A. White, well known psychopathologist and superintendent of St. Elizabeth's Hospital in Washington, D. C.

The foundation, which is planned by the followers of Professor Freud in New York City, would bring the activities of the Freudian analysts under a central organization. It would have charge of the maintenance of the present psychoanalytic clinics and educational institutions in Berlin and Vienna, and is expected to lead to the establishment of such institutions in the United States. The foundation would also publish psychoanalytic literature and conduct a publicity campaign to dispel misconceptions of the Freudian theory and to combat the activities of "fake" practitioners.

Dr. White suggests that inexpert analysis of dreams and mental states in this country has not been due so much to deliberate quackery as to the lack of opportunity for psychoanalytic training.

"I have not met with many analysts to whom the term 'quack' could be properly be applied," says Dr. White. "There are undoubtedly a good many people who are making analyses who have not been technically trained, but who are doing the best they can with such information as they have and such technique as they can develop. I am constantly being asked where one can get training in psychoanalysis and having to reply that there is no place in this country. There has never been any opportunity here for systematic instruction and the method can not be learned successfully by the average person from the literature.

"Because of this fact, and the added fact that physicians in the United States have been mainly out of personal touch with the Europeans, especially during the war, undoubtedly errors of technique are numerous, and of course among a large number of readers all sorts of misunderstandings exist. An international foundation would do much towards improving the understanding of psychoanalysis and towards offering opportunities for training—both very highly desirable aims."

ITEMS

HOT summers are shown by a Swedish geologist, Professor Gerard de Geer, of the University of Stockholm, to have occurred occasionally even in the glacial ages when all the northern continents, including the North American, were covered by a thick ice blanket. Such variations in temperature from one year to another are read by him in the many thousands of clay samples which he and his pupils have collected in different parts of the world, including the United States. By their differences in thickness and color the layers of clay show exactly how much ice was melted by the sun's heat during the year they were formed and thus record not only the earth's age, but also its past temperatures as clearly as the rings of a tree show by differences in thickness which seasons have been wet and which dry. Upon retiring from his professorship in the University of Stockholm, Baron de Geer has now been enabled, through the generosity of some of his Swedish friends, to found a separate institute in Stockholm as part of the university and devoted wholly to research work in his particular branch of geology, that of geo-chronology, or the study of the earth's age. He has been in the United States twice to collect clay specimens.

THE ether which is believed to pervade space and carry light may be compressible, according to the ideas of Dr. Ludwik Silberstein, of the Eastman Kodak Company's research laboratory. In a recent statement to Science Service, Professor Albert Einstein differed with Dr. Silberstein's views, saying that the Stokes theory of the ether, on which Dr. Silberstein's is based, would not explain the astronomical aberrations. It was, he said, based on a mistaken idea that the velocity of the ether movement was deducible from a potential. "Against Professor Einstein's contention," says Dr. Silberstein, "a velocity potential of the ether motion as required for the Stokes theory of aberration becomes possible at once if the ether is assumed to be compressible. This was originally suggested by Planck, and was adopted by H. A. Lorentz, who based on it a perfectly satisfactory theory of aberration. All other phenomena then known were also covered by this theory. Whether the new experimental findings by Professor Miller will necessitate a further modification remains to be seen."