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these catatonic patients are unable to get their necessary ration of that life-sustaining gas under our ordinary atmospheric conditions. They may breathe just as much as you do, but do not make the same use of it.

At St. Elizabeth's hospital, the government hospital for the insane in Washington, Dr. Walter Freeman set to work in his laboratory to discover what this defect might be.

A careful microscopic and chemical examination of the brain cells of persons who had died with schizophrenia, or dementia praecox, revealed the fact that these cells contained decidedly less iron than the brain cells of others. Iron is a part of every living cell and is necessary to the process of oxygen metabolism. The reason that cyanide is such a deadly poison to cells is probably because it combines the iron in the cell to form an inert compound.

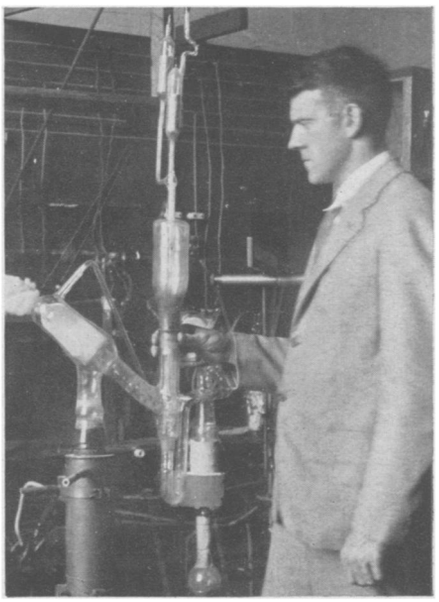
Dr. Freeman's discovery of the deficiency of iron in the brain cells of dementia praecox patients may therefore be an explanation of why these persons cannot make use of the oxygen they breathe. He, himself, regards his find only in the light of a very promising lead for further research, however, and is very careful to warn against the raising of false hopes of a dementia praecox "cure."

Science News Letter, July 25, 1931

PHYSICS

Nothing Solid Left as Atoms Dissolve in Nebulous Waves

Philadelphia Scientist Performs Experiments Which Adds New Proof to the Latest Theory Concerning Matter



DR. THOMAS H. JOHNSON

Of the Franklin Institute, Philadelphia, whose recent experiments have given weight to the revolutionary ideas of the new wave mechanics. He has been able to determine the wave length of atoms and has shown how networks of atoms on a crystal surface are fitted together.

SOLID MATTER was actually solid—until about 100 years ago. Then it was decided that most of a solid is empty space with solid atoms scattered about like bees in a swarm.

Now the bees may not even be solid.

Latest news from the atomic research front shows that even the atom has lost its solidity. At the Bartol Research Foundation at Swarthmore, Pa., a stream of atoms has been made to behave like immaterial waves scattered in many directions.

Dr. Thomas H. Johnson of the Franklin Institute, Philadelphia, has fired a stream of hydrogen atoms at the surface of a crystal of lithium fluoride and by observing the spread of the reflected atoms has found the wave length of the atoms and has learned how the network of atoms on the crystal surface is fitted together.

This discovery is the latest development in the great new branch of physics inaugurated in 1924 by the French nobleman and scientist, Prince Louis de Broglie, who first proposed to give matter the properties of waves. The revolutionary new wave mechanics, which threw many of the cherished notions of the nineteenth century overboard, has grown with amazing speed since its birth at the hands of de Broglie and now is the main weapon of scientists in attacking the intricate problems of the structure of the atom.

The present experiments confirm these new theories of the wave-like behavior of all matter. The beam of atoms reacts with the surface in much the same way as would a beam of light waves. It is, in scientists' language, "diffracted."

Based on Quantum Theory

This sort of thing was never suspected until the arrival of the quantum theory in physics on which, for instance, television and the talking movies depend. A beam of light was supposed to consist of waves. On the other hand, atoms or electrons in motion seemed to be like bullets.

This simplicity is all confused now. Light entering a photoelectric cell seems to act like a stream of particles, and it has been shown by two physicists of the Bell Telephone Laboratories, Drs. C. J. Davisson and L. H. Germer, that even electrons, those lumps of negative electricity that make the electric current, might, under special circumstances, behave like waves. These inconsistencies have led physicists to think that the distinction between lumpy particles and smooth tenuous waves was not so clear as they had thought.

Dr. Johnson's present experiments supply the last link in this chain of contradictions. He found that even atoms of hydrogen, apparently the most material of things, may become immaterial enough to act like waves breaking on a rocky shore when they are fired at the regular lattice work of a crystal. The atom waves are very short: that is, the distance from crest to crest of the waves is only about the diameter of an atom, one hundred millionth of an inch.

X-rays have been used for some time to explore the interior of crystals. The shortness of the new atom waves enables them to do still more and disclose even the small irregularities of the surface.

Before this work a crystal was regarded as made up like a super-chessboard with some four thousand million million squares on the square inch. Dr. Johnson's work shows that minute cracks break up the large board into a multitude of small ones having some four hundred squares on each. Enough atomic chessboards to take care of a gigantic chess match in which every member of the human race engaged are to be found on an area of about one ten-thousandth of a square inch of crystal.

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