

PSYCHIATRY

Artificial Insanity

By Controlling Oxygen of the Air Scientists Have Induced Temporary Insanity and Revived Dementia Praecox Patients

By MARJORIE VAN DE WATER

THE AVIATOR soaring high above the clouds, and becoming lightheaded and weak-willed. The mountain climber toiling up the steep slopes of Pike's Peak, and suffering from mountain sickness. A group of volunteers in a psychology laboratory in New York City, breathing air in which the oxygen proportion has been reduced, and becoming temporarily unbalanced mentally and emotionally. Patients with a mental disease which has reduced them to a stuporous state breathing a mixture of carbon dioxide and oxygen, and miraculously becoming active.

All these may have provided scientists with a new approach to the age-old and vexing problem of the cause and possible cure of that mental disease which afflicts about one-fifth of all hospital patients—dementia praecox.

For the characteristic effects which come from breathing air containing too little oxygen have recently been found to be very much like those which come from taking too much alcohol. And, except for the fact that they are temporary, they are significantly similar to the symptoms of that type of insanity known to physicians as dementia praecox.

Like the drunken man, the person starving for oxygen seems to lay bare his true self. All the brakes that he has learned to put on his impulses as a result of training are released, and he responds in a manner characteristic of his innate nature. One man will become unreasonably angry, will try to break things to pieces. Another may become sentimental even to a silly extent. One becomes happy and starts to sing, another may go to the other extreme of moroseness.

Like the drunken man, too, the person deprived of oxygen is usually completely unaware that anything is wrong with him. For this reason the U. S. Navy now equips the oxygen apparatus used by high-altitude flyers with an automatic valve which feeds him the amount of oxygen which he should have at the altitude at which he is flying. If

it were left to the flyer to decide when and how much to turn on the oxygen, he might go on thinking he was doing well without it until he was unable to turn it on. The Army Air Service requires the use of oxygen by all flyers going above 15,000 feet.

Each person has his "ceiling" beyond which he cannot go and retain his normal mental ability. The U. S. Navy Air Service therefore classifies aviators according to the altitude in which they can fly in safety. This is done on the ground before the candidate makes even his first flight with the aid of a "re-breather."

Same Air Breathed Again and Again

The "rebreather" holds a tank filled with ordinary air. This air is inhaled by the person being tested. The exhaled air passes through a container over a chemical, sodium hydroxide, which removes the carbon dioxide produced by breathing and then it goes back into the original tank to be breathed again. After each return, the air is perfectly free from poisonous elements, but has a smaller percentage of oxygen. The effect of breathing this oxygen-deficient air is practically the same as that of breathing ordinary air at greatly reduced atmospheric pressure.

When the candidate begins to fail on the simple mental tests given him while breathing oxygen-deficient air he is immediately removed from the apparatus. The air in the tank is tested to find out what percentage of oxygen remains, that is what "altitude" has been reached. That marks that man's ceiling.

In the psychology laboratory at Columbia University, under the direction of Dr. R. A. McFarland, 18 persons volunteered to "go up" in a similar apparatus. Starting at 16,000 feet they went up in steps of two to three thousand feet until the individual ceiling was reached. At each level they took a number of tests of simple and complex mental functions which would bring out emotional reactions and temperamental differences, such as irritability and persistency.

Dr. McFarland found that the higher

centers of the brain were the first affected by the lack of oxygen. Simple muscular reactions, and actions that were purely a matter of habit could be continued. In the test which involved discrimination and choice between a number of colored lights, however, he found a marked deterioration with increase in altitude. Even at 18,000 feet, the subjects were slow in choosing and often made mistakes of which they were quite unaware.

One of the first effects noticed was a narrowing of the field of attention. The person who is feeling the lack of oxygen will be able to notice only one thing that he is concentrating on. Of everything else that is going on about him he is unconscious.

Memory and the sense of relationships was greatly impaired in those persons who were able to go above the 20,000 foot level. Vision and the other senses, one by one, became impaired, hearing being the last to succumb.



FOR PROTECTION

From lack of sufficient oxygen in the rare atmosphere far above the earth Lieut. Apollo Soucek, altitude record holder, is wearing an apparatus to supply the deficiency artificially. Should he go up high enough without this apparatus he would develop symptoms similar to those of dementia praecox patients.

And quite as important as the changes in mental ability and physical coordination were the changes in character and temperament. The person who makes the most crude blunders will continue to bask in the sublime confidence that he is doing very well. And then, too, the person who still retains a knowledge of what should be done to pass the test will lack the will power to make even the simplest move toward it.

Self-Control Breaks Down

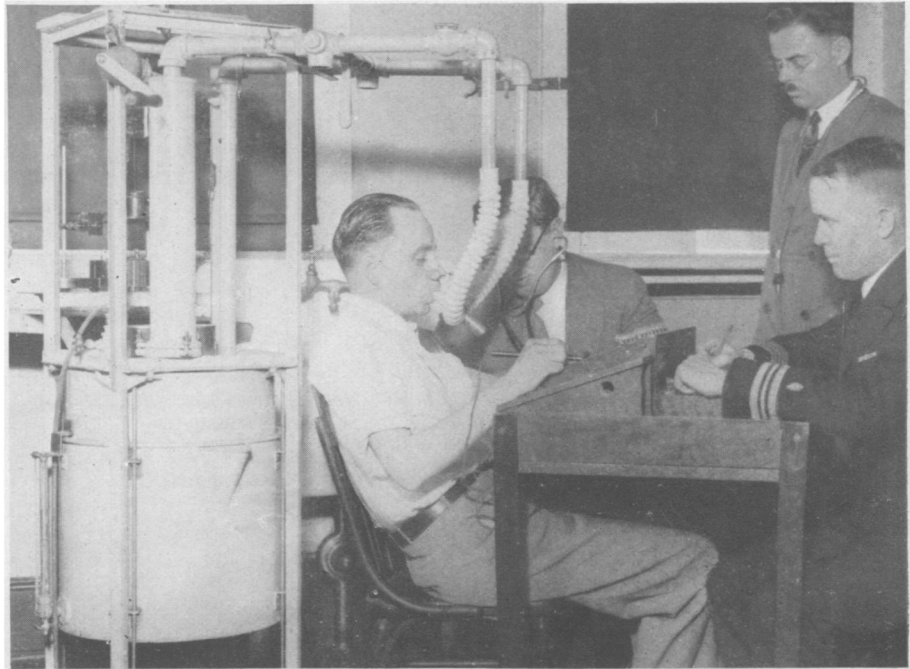
Dr. McFarland's last test, although designed primarily to measure muscular coordination, served admirably to show how the spirit of persistency and also all self-control are broken down when the system is deprived of enough oxygen. This test involved the rolling of a steel ball-bearing up an inclined plane perforated with small holes into which the ball-bearing could easily fall. The guiding of the ball-bearing was done with a knitting needle. Dr. McFarland reported:

"There were great individual differences in the emotional outbursts and breaking down of inhibitions. Some individuals reacted by marked irascibility of temper, or by trying to break the apparatus to pieces; others by uncontrollable laughter, or silliness, or flirting with the experimenter and apparatus. There seemed also to be some consistency in these reactions suggesting that the basic and uninhibited temperament of the individual had been exposed. The emotional behavior and the breaking down of inhibitions, as well as the changes in neuro-muscular control seem to be very similar to the effects of alcohol."

While psychologists have been studying the peculiar manner in which oxygen deprivation produces a condition like nervous breakdown, or mental or emotional disease, other scientists have been approaching the same problem from the opposite angle.

Three pioneers, Drs. A. S. Loevenhart, W. F. Lorenz, and R. M. Waters, experimenting at the University of Wisconsin, undertook to see what could be done to relieve patients with the mental disease dementia praecox who had sunk into stuporous catatonic state—that condition which so strongly resembles the final stages of oxygen deprivation. The patients were allowed to inhale for a few moments a mixture of oxygen and carbon dioxide.

The results were startling! From being stuporous and mute and mentally inactive, they became active and com-



"GOING UP"

While sitting in the laboratory taking the "rebreather" examination given applicants for the Navy's Air Service. The amount of oxygen in the air is reduced until the applicant's mind no longer functions normally or he shows signs of failing physically. Dr. Joel J. White, of the U. S. Navy Medical Corps, is giving the test.

municative. One of them who had been unable to speak or even eat for more than six years, at last was able to break her long silence. For about two minutes she uttered only a jumble of unintelligible but speech-like sounds, but after that the words became distinct, and she successfully held a conversation with those about her. To quote the experimenters themselves:

Inaccessibility Disappeared

"The most favorable and striking reactions occurred in those patients who had been mute and mentally inaccessible for a long period of time. In these cases after a short period of respiratory stimulation, this inaccessibility disappeared and the catatonia passed off.

"A number of patients have carried on conversation. A few mentioned depressive thoughts. One patient was markedly facetious, making responses typical of talkative hebephrenic praecox. Another patient, the least reactive of those so far observed, showed only a disappearance of muscular tension and a voluntary looking about the room at those standing near.

"A number of patients appeared frightened when the cerebral stimulation developed; they looked about apprehensively but became calm and at ease quite

promptly when efforts were made to reassure them. In other words, they seemed to comprehend the situation correctly, and following this almost immediately they made coherent and relevant replies to questions."

This return to the world of living lasted for some patients for as long as 25 minutes. Others began to lapse after only two minutes. Dr. Loevenhart and his associates describe "one notable case where there was a prolonged period of from ten to twelve minutes during which the patient maintained a comprehensive conversation without any evidence of psychosis."

Then begins the tragic return to the former condition of muteness and complete inaccessibility.

"It is especially striking to note how completely the former muscular state is resumed," the scientists report. "This reproduction is faithful to the minutest degree; the same posture, the same facial grimace, and apparently the same mental state. In some cases the lapse to the original state is remarkably sudden, so that a sentence begun is left unfinished."

These experiments point to the conclusion that a certain amount of oxygen absorbed by the body is essential to the proper functioning of the mind. For some reason, (Turn to page 58)

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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.

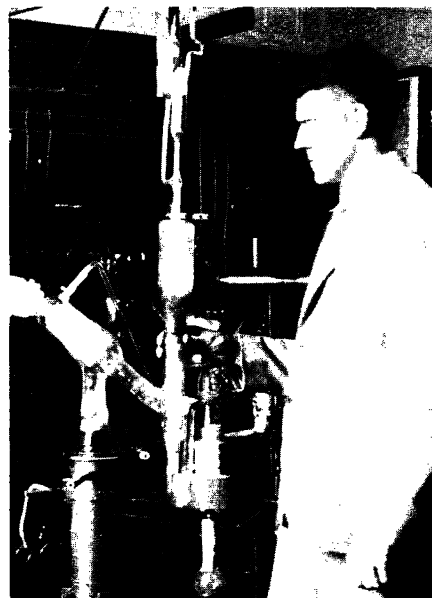
A careful microscopic and chemical examination of the brain cells of persons who had died with schizophrenia, or dementia praecox, revealed the fact that these cells contained decidedly less iron than the brain cells of others. Iron is a part of every living cell and is

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."

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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.

PHYSICS

Nothing Solid Left as Atoms Dissolve in Nebulous Waves

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

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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