SCIENCE NEWS

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SCIENCE AND AMERICAN CULTURE

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DR. ARTHUR H. COMPTON, professor of physics at the University of Chicago, speaking before the meeting of the American Philosophical Society in Philadelphia, pointed out that science is a decisive shaping influence in American culture, not only in material things but also in our intellectual life, our amusements, our art and our religion. He said: "At no previous time in history has life been so greatly influenced by science as in the United States to-day. Throughout history man's cultural growth has followed the gradual growth of his scientific knowledge. Even before the outbreak of the present wars, America had become the leader in most fields of scientific endeavor. The tradition of the pioneer has made it relatively easy for the American to alter his habits as required by the introduction of new techniques, with the result that in this country social changes have gone ahead with the speed not found elsewhere.

"As long as such rapid changes are occurring, we can not hope to adapt the art of living as completely to our technological surroundings as was done in the case of the classical culture initiated by the Greeks and refined through the centuries to fit an essentially stable world. Yet we are shaping our lives on a more heroic scale."

Professor Compton laid special stress on the necessity for cooperation in making the fruits of scientific endeavor available to mankind. He said:

"Without cooperation, scientific knowledge can not be made effective. If men divide into antagonistic groups it becomes terribly destructive. Thus in the technological society of which American culture is the supreme example, science emphasizes as never before the need of a will toward cooperation, that is, of the love of our neighbors.

"Science thus plays a threefold rôle in American culture. First, it supplies a direct outlet for man's creative instinct in building the permanent structure of scientific knowledge. Second, it supplies the means of living a life richer in health and in its variety of experience. And third, it creates a world setting in which man must rapidly adapt himself to live as a part of a more extensive and more highly coordinated society."

THE "PIPES OF PAN"

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PROFESSOR DAYTON C. MILLER, of the Case School of Applied Science, in a lecture before the American Philosophical Society in Philadelphia, pointed out that the first of all musical instruments was the flute, and the number of notes in the various musical scales the world has known was fixed by the number of fingers used in playing various types of this instrument.

Primitive flutes made of hollow bones have been found in cave dwellings of the Stone Age, and primitive peoples still use flutes of the same kind made out of bamboo or hollow reed. The simplest flute plays only one note. To get a series of tones it is necessary to use a number of them bound together—the "pipes of Pan" kind of instrument.

Then it was discovered (probably by accident) that a pipe or flute with a hole in its side could be made to produce two notes, as the hole was stopped or left open. By boring more holes, up to the total number of fingers available, a whole series of notes—the musical scale—could be played on the single tube.

Flutes have always been of three general types. The earliest ones were sounded by blowing across the open end: classic Greek flutes were of this variety. Later, a blow-hole was made in the side near one end; this "cross flute" was the ancestor of the modern orchestral instrument. The third flute type added a sort of artificial mouth in the shape of a whistle; of this type were the "recorders" mentioned by Shakespeare and Milton.

Having been the deciding influence in molding the musical scale, the flute itself came in for some revolutionary changes when Johann Sebastian Bach fixed that scale in essentially its present form, filling it up with half-tones. The simple tube with seven finger-holes could no longer meet the demands upon it—human hands lacked the necessary additional fingers. The problem was solved in 1832, when Theobald Boehm, of Munich, invented the modern keyed flute, which permits eight fingers to do the work of a dozen or more.

Professor Miller, who owns one of the most notable collections of flutes in the world, illustrated his lecture with an exhibit of fifty of his instruments, playing selections on some of them.

URANIUM FISSION

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FROM Stockholm comes the latest news on uranium fission—the amazing splitting of this heavy element by weak neutrons with the release of enormous amounts of atomic energy.

Nature prints a report of this work by Dr. Lise Meitner, an exile from Germany, who first suggested to Professor Otto Hahn, in Berlin, that his pioneer experiments really showed that uranium was split by neutron bombardment.

At the Research Institute for Physics in Stockholm, Dr. Meitner has been carrying out experiments on the capture "cross-sections" of atoms of lead, thorium and uranium exposed to the neutrons. The problem of cross-sections is a vital one in nuclear physics, for it helps to determine whether a bombarding particle like a neutron will be scattered by the nucleus or captured.

One may visualize "a capture cross-section" by a base-ball analogy. The area over which a player, standing still, can catch a baseball thrown at him would be his "capture cross-section." All players would have different capture cross-sections for baseballs, just as the nuclei of atoms have different capture cross-sections for neutrons. This is a rough picture intended only to give a partial idea of the meaning of a cross-section as physicists use it.

Dr. Meitner says that the nucleus of lead atoms has a

cross-section of 2.5 units of atomic cross-section area. By comparison thorium has a cross-section over twice as large, or 6.0 units. Finally, uranium with mass 238 (the kind that releases atomic energy) has a cross-section of 1.5 and is thus small by comparison, so that having neutrons hit uranium atoms and split them is no easy task. The unit of atomic cross-section used is equal to 10^{-24} square centimeters, or 0.000,000,000,000,000,000,001 square centimeters.

SYNTHETIC ORGANIC CHEMICALS

THE manufacture of useful synthetic substances from common minerals in the crust of the earth promises to be among the most useful technologic accomplishments of the future.

The synthetic organic chemical industry has poured out in recent years drugs, dyes, perfumes and other chemical products by the thousands, made largely from the complexity of coal's molecules. Far less complex substances, such as clay, graphite, etc., are due to come into the technologic limelight.

Most exciting, perhaps, is the possibility of making artificial diamonds of industrial usefulness from graphite by the use of high pressures combined with high temperatures. Both the diamond and graphite consist of the single element, carbon. Found only in unusual localities in the earth's crust where in past ages conditions of heat and pressure have been right to result in their formation, diamonds are potentially much more useful technologically than as jewelry.

The extreme hardness of diamonds causes them to be used in drills and for cutting operations, despite their cost. Diamonds used for these purposes are usually black or dark in color.

If diamonds could be made synthetically at a reasonable cost, they would find wider use than they do in working metals, drilling and other such tasks. As a matter of fact, years ago artificial diamonds were made, but they were much too small for practical use.

The new hope for artificial diamonds comes as a result of extremely high pressures achieved at both Harvard University and the Geophysical Laboratory of the Carnegie Institution, in the neighborhood of 3,000,000 pounds per square inch. One of the experiments made at Harvard was the application of this pressure to graphite in the hope that pressure alone would make the change from graphite to diamond. The attempt was not successful. When high temperature is combined with high pressure, the result may be different.

From clay there has been made through research at the Massachusetts Institute of Technology a synthetic mica that potentially makes America independent of the supplies of mica from Madagascar that might be interrupted by war conditions. Clay and mica are closely related in chemical composition, silicon, aluminum and oxygen being their chief constituents. Clay is pressed out into a sheet, which is hard and brittle. If this untreated sheet is placed in water, it swells as clay will. But if it is first treated with a lead salt, the lead enters into combination with the atoms of the clay sheet in such a way that it keeps out any other substances, such as water, that come along. A synthetic mica is formed. This substance, called Alsifilm, is being manufactured by five companies already and is finding extensive use as an insulator in all sorts of products.

Research may be expected to find similar ways of treating other common inorganic minerals in order to produce substitutes for existing materials or substances with new combinations of properties fit for new uses. As in the case of the synthetic mica, many of these new developments will be worked out from the theoretical chemistry of the substances involved. By learning how the atoms are arranged, science is able to design new substances and then attempt to build them in the laboratory.—WATSON DAVIS.

SUPER-SPEED PICTURE OF A SNEEZE

LATEST aid in the war against the common cold, influenza and other respiratory infections is a super-speed picture of a sneeze which was taken by special technique for high-speed photography by Professor M. W. Jennison and H. E. Edgerton at the Massachusetts Institute of Technology. It is the first picture that shows what really happens when you sneeze. The droplets given off in the sneeze travel at the rate of 100 feet per second, for the fastest of them, according to a report made to the Society for Experimental Biology and Medicine. Photographic enlargements show that the droplets have an apparent diameter of six hundredths of an inch or less.

The size and speed of these droplets and other knowledge that it is expected to gain from further study is important in the fight against air-borne germs such as those that cause colds, influenza, measles and the like. When a person with one of these ailments coughs or sneezes, some of the infected droplets immediately fall to the ground, but the smaller ones never reach the floor at all. Evaporating almost instantaneously, they leave behind tiny nuclei, so small they are easily carried about by the lightest air currents. Some of these nuclei are believed to carry with them disease germs. This, according to Professor William F. Wells, of the University of Pennsylvania, explains the very wide and rapid spread of colds, influenza and the like.

The speed of the droplets as determined by the sneeze picture would result, in dry air, in nearly instantaneous evaporation, producing droplet nuclei. The speed of the droplets in relation to evaporation may be much more significant than has been realized, and appears to be a more important factor than settling velocity.

The sneeze picture showed that the involuntary closing of the mouth near the end of a sneeze tends to produce more and smaller droplets, and that the number of droplets from the nose is usually insignificant compared with the number expelled from the mouth. This may have an important bearing on the problem of germ infection because of the differences in the germs found in mouth and nose.

THE BLACK STEM RUST OF WHEAT

UNCEASING warfare goes on between wheat breeders and the most destructive of wheat's fungus foes, black stem rust. Although this fungus is known under only one

specific name, *Puccinia graminis Tritici*, it is an exceedingly variable species, and is constantly evolving new strains, principally by natural hybridization. So it has come to pass that many a hopeful immune strain of wheat has been developed, only to be overtaken in a few years by a new strain of the rust fungus.

The newest recruits to the army of immune wheats are announced from the Dominion Rust Research Laboratory at Winnipeg, Canada, by R. F. Peterson, T. Johnson and Margaret Newton. There are six new wheat strains, five from seed imported from Kenya Colony in Africa, the sixth a native Canadian product. All six have thus far shown very high resistance to 20 strains of rust, to which they were purposely exposed.

The one all-Canadian wheat variety in the group owes its existence to an observant farmer, M. S. J. McMurachy, of Strathclair, Manitoba. Mr. McMurachy noticed one rust-free plant in a field of rusty wheat, one day ten years ago. He kept the seed and increased it. When his planting of the new variety came triumphantly through the bad rust season of 1935 he brought it to the attention of the Winnipeg laboratory.

Quite properly, the new variety has been given the name McMurachy's Selection.—FRANK THONE.

RADIO AND SUN-CAUSED DISTURBANCES

IN the sun-caused electrical and magnetic disturbances that bring "black-outs" or interruptions to radio programs and telegraph lines, there is a calm before the storm.

About four days before brilliant auroral displays, caused by the magnetic storm, the strengths of distant broadcasting station signals are abnormally high, usually about double, and radio communication is at its best. The least disturbance in the magnetism of the earth precedes an aurora by about four days.

A ten-year study of radio waves and aurorae, conducted by Dr. Harlan T. Stetson, of the Massachusetts Institute of Technology, has disclosed this relationship.

A lag of about 1½ days from the time of the display of the northern lights to the night when broadcast reception is most interrupted indicates to Dr. Stetson that there is an accumulation of electrified atmospheric atoms in the radio ceiling, about 80 miles up, from which broadcast waves are reflected back to earth.

The sun's effect is more prompt on radio communication conducted by means of waves of shorter length and higher frequency. The greatest disturbances of the earth's magnetic field follow very shortly after the electrical disturbances producing the aurora have taken place.

Auroral displays, radio disturbances and magnetic storms are associated with sun-spots. A day or two, on the average, elapses after the occurrences of these great solar storms and the auroral displays. This strengthens the idea that electrified particles emitted from the sun, rather than ultra-violet light, cause the aurora and prolonged magnetic storms. The electrified particles travel much more slowly, requiring a day or more to make the journey covered by light in about eight minutes.

Such studies as those by Dr. Stetson may allow the prediction of magnetic and radio disturbances sufficiently in advance to allow communications engineers to be ready for them.—WATSON DAVIS.

ITEMS

THE sudden freeze that recently swept over practically all the country east of the Rockies did a lot of harm, according to reports received by the U. S. Weather Bureau. Southern strawberries and early vegetables, just getting ready for market, were ruined over a large area. Peach blossoms shriveled in orchards all the way from Virginia to Georgia. Only apples escaped, being still in bud for the most part. In the North, little damage resulted because the spring has been so chilly that nothing much was in flower or far advanced in leaf when the freeze struck. Continued wetness, however, seriously retarded farm work and continues to do so. Corn and cotton planting alike are being held back.

A MICROSCOPE that "sees" by electrons, or particles of electricity, instead of light, and that can reach so far into the depths of matter that eventually it is expected that it will be possible to "see" atoms themselves was demonstrated to members of the American Philosophical Society by Dr. V. K. Zworykin, of the RCA's Electronic Research Laboratories. This latest electron microscope achieves magnifications of 25,000 to 30,000, instead of about 5,000 maximum with even ultra-violet light optical microscopes. The first research application of the perfected electron microscope is expected to be in biological fields. It is considered possible that the new microscope may help solve the problem of the nature of the viruses that cause certain unconquered diseases. Already in preliminary work unidentified particles, evidently associated with disease germs, but hitherto unsuspected, have been seen. Extremely fine particles in materials of industrial importance, such as rubber latex, are shown to have shapes different from those they were believed to have.

A RECORD distance for clear television reception was achieved when programs from New York City, 250 miles away by air line, were recently received on Whiteface Mountain, at Lake Placid, N. Y., by relay from the General Electric Company.

IN ordinary transport planes a descent which occurs more rapidly than 300 feet per minute has been found to be objectionable to passengers. With the new supercharged cabins on modern transports it is possible for a pilot to descend 900 feet per minute, if need be, without passenger discomfort, according to Walter Forster, of the Curtiss-Wright Corporation, in a report to the Society of Automotive Engineers.

HAVE you ever wondered how the amazing convolutions of band instruments—where the music goes round and round—are made? At a band instrument factory, at Grand Rapids, melted lead is poured into the instrument tubing. When it has cooled the tube is bent properly and hammered into proper shape and the wrinkles taken out. Finally the lead is melted away and the instrument buffed and polished, without injury.