SCIENCE NEWS

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THE ACTION OF ROCKS UNDER PRESSURE

NEW clues to the underground mechanism causing earthquakes, mountain formation and other geological phenomena have been found in the action of rocks under tremendous laboratory pressures.

David Griggs, junior fellow in geophysics at Harvard University, has utilized the high-pressure equipment of Professor P. W. Bridgman to duplicate the pressure conditions in the earth's outer crust—a granitic layer extending down 30 to 50 miles. Under the high confining pressures, which reached a maximum of about 300,000 pounds per square inch, it was found that limestone could be made to flow. A small block of it was compressed 35 per cent. in length without shattering. Contrary to past geologic beliefs it was found that, under high pressure, rocks will not flow indefinitely, but will break if deformation is carried far enough; and it was found that sudden differential stress is not required to produce fracture under high confining pressure, but that a strong steady differential pressure will cause fracture if applied long enough.

In the tests a specimen of rock is placed in a thick steel cylinder. Hydraulic confining pressure is applied through a liquid, or at very high pressures through lead. In addition a direct differential pressure is exerted on the specimen by a steel piston. Differential pressure used attains more than 1,500,000 pounds per square inch. The tests are made, it was said, under the highest one-directional stress ever controlled and measured in laboratory research. Quartz, which is geologically important as one of the commonest minerals, remained brittle under the very highest pressures. The only change in quartz, aside from fracture, was an alteration of optical quality known as "undulatory extinction." Prior to these tests it was thought that quartz might become plastic under the high pressures.

Mr. Griggs's tests show that the flow of rocks under pressure is mathematically similar to the flow of metals. Rock substances beside limestone in which flow has been observed in the laboratory include glass, rock salt, calcite crystals, talc, shale and marble.

The research has been supported by the Geological Society of America and Harvard University.

SPIN OF ATOMIC PARTICLES

THE spin of atomic particles, the same kind of whirling which makes a top stand up on a table-top when properly spun, is now enabling scientists to find a new simplicity in nature.

All the many atomic particles—the electrons, positrons, neutrons, neutrinos, deuterons, mesotrons and all the rest—are now known to fall into one of two simple categories. Either their nuclear spin falls into half integral or into whole integral differences.

In a reply to a query of Science Service, Professor J. Frenkel, theoretical physicist at the Industrial Institute in Leningrad, points out that all the atomic particles conform to either Fermi-Dirac or Einstein-Bose statistics, special advanced kinds of mathematics developed to interpret their properties. Electrons, positrons, protons, neutrons and neutrinos conform to Fermi-Dirac statistics, Professor Frenkel says, and he suggests that they be called "odd" particles. The second kind of particles have whole integral spins, conform to the Einstein-Bose statistics and include photons, deuterons and mesotrons. These particles would be known as "even" particles.

In treating the particles by mathematics it turns out that Fermi-Dirac class particles can combine their half integrals of spin and thus turn over into the second kind of Einstein-Bose particles. Thus where two, four, six or any even number of them combine the result is that the Fermi-Dirac particles show properties closely like the Einstein-Bose particles. Where three, five, seven or any odd number of Fermi-Dirac particles combine they keep their original properties. Einstein-Bose type particles can not, of course, ever combine into the Fermi-Dirac type because of their whole integral spin values.

Professor Frenkel is the well-known physicist who also named excitons and phonons as new concepts in mathematical physics. Exciton is a term used to designate a state of excitation moving from one atom to another in a material body, as where light would be absorbed in passing through a material like glass.

The phonon is a fictitious particle bearing the same relation to a sound wave as a photon does to a light wave. The latter is defined as a packet, or bundle, of radiant energy whose magnitude is equivalent to Planck's constant "h" times the frequency of the wave of light. By analogy a phonon would correspond to some constant times the frequency of the wave of sound under consideration.

Professor E. Teller, of the George Washington University, who has been credited by Science Service with the introduction of the terms exciton and phonon, wishes to acknowledge Professor Frenkel's clear priority for the use of these terms.—ROBERT D. POTTER.

INFLUENZA AND COLDS

A NEW line of attack on the common cold and influenza is being made in the laboratories of the International Health Division of the Rockefeller Foundation. The attack is centering on changes occurring in the nasal lining membranes during a cold or an attack of influenza—changes which may give you resistance or immunity to colds and 'flu and similar infections of nose, throat and other respiratory organs.

Drs. Thomas Francis, Jr., and C. H. Stuart-Harris have found such changes in nasal membranes of ferrets which received repeated inoculations of influenza virus. If they could find a way to induce such changes by permanent alteration of human nasal linings, it might be possible to confer resistance to influenza and the common cold in man.

The changes in the ferret nasal membranes, described in the current issue of the *Journal of Experimental Medicine*, are changes not so much in the structure of the

membranes as in their functioning. In the ferrets the changes result in complete resistance not only to the influenza virus itself but also to chemicals. The immunity or resistance thus induced is entirely a matter of cell resistance and has nothing to do with immunity in the usual sense. The latter immunity depends on the existence in the blood of germ-fighting substances called antibodies. Both mechanisms, antibody formation in the blood and changes in cells, probably interact to produce complete immunity to infection.

When the change in the nasal linings has once been induced, even after the resulting resistance has worn off and the animal is again susceptible to influenza, the nasal linings go through the change very rapidly when the next infection comes. These changes after the first one are so rapid that there are scarcely any symptoms of the infection that could be recognized as sickness.

Turning from ferrets to human beings, the Rockefeller scientists want first to find out whether such changes occur naturally in human nasal linings during colds or influenza. Two other important questions to be answered are :(1) Can these changes be induced artificially, so as to give immunity to these ailments? (2) Would it be good from the physiological standpoint to induce such changes or would they interfere too much with the normal function of the nose?

AGRICULTURAL AND FORESTRY RESEARCH IN LATIN-AMERICAN REPUBLICS

SCIENTIFIC research is being recruited to the aid of the U. S. Government's program of advancing its announced "good neighbor" policy in its relations with the other republics of this hemisphere to the status of mutual helpfulness among them, in the fields of agriculture and forestry.

Of the approximate million dollars designated for the promotion of closer cultural relations with our neighbors to the south, more than a third, or $350,000, has been allotted to the Department of Agriculture, for the purpose of a long-range research program looking toward increasing the production in tropical America of raw materials needed in this country and now obtained principally from the Old World tropics. Some of the most important of these, notably rubber and quinine, actually originated in South America, but their present production is controlled by other countries in southeastern Asia and the East Indies.

Preliminary steps will be discussed at the Lima conference and in the meantime Department of Agriculture scientists are developing an agenda of projects to be undertaken. Expenditure of the $350,000 breaks down into support of several lines of activity, all regarded as highly important:

For four new Department of Agriculture attachés, $120,000 a year will be needed. At present this country has only one agricultural attaché in the entire Latin-American area, with an office in Buenos Aires. The new men will be located in Mexico City, Havana, Rio de Janeiro and Panama.

A survey of hardwood forest products of tropical American republics calls for $65,000 a year. At present virtually nothing is known about the economic possibilities of tropical American forests. A similar survey of soils, vegetation, climate and other factors affecting agriculture will take another $65,000 a year. Rubber and quinine will receive special attention under this project. The sum of $75,000 is set aside for the development of a tropical forest experiment station in Puerto Rico to work out problems and serve as a research center for the Caribbean region. The U. S. Weather Bureau will be given $15,000 to make possible the training of meteorologists from American republics interested in special lines of weather forecasting technique. Particular attention to problems connected with hurricanes will be called for in this work. Finally, $10,000 is made available for the printing of scientific bulletins and other publications after translation into the three languages of Latin America—Spanish, Portuguese and French.

Other lines of activity for which additional appropriations are not at present needed are the loan of agricultural officials to the American republics, cooperation with radio companies for the transmission of information and promotion of the early completion of the Inter-American Highway as far as Panama.

Although the whole subject is only now being formally broached, informal inquiries by representatives of certain other American republics indicate their keen interest, and even eagerness to cooperate by placing their scientific facilities and tracts of land at the disposal of the scientists, both American and from among their own nationals, who will take part in the work.—FRANK THONE.

ITEMS

CHEMISTS from seven Virginia colleges and universities have completed 180,000 tests on organic chemicals. The objective of the project is to find organic chemical reactions which are suitable for research in inorganic chemistry. More than 1,200 compounds have already been studied with 150 tests performed on each one. For each case a relationship is being sought between the molecular structure of the organic compound and its reaction. The project is under the supervision of Dr. John H. Yoe, professor of chemistry at the University of Virginia. Cooperating with him are: Drs. Llye G. Overholser and Alfred Burger, of the university, and also A. R. Armstrong, of the College of William and Mary; Professor I. A. Updike, of Randolph-Macon College; Professor W. E. Trout, of Mary Baldwin College; Professor J. W. Watson and Professor F. H. Fish, of the Virginia Polytechnic Institute; L. J. Sesha and J. R. Taylor, of Washington and Lee University, and Professor W. J. Frierson, of Hampden-Sydney College.

WALLS filled with mineral wool can withstand flames and retard the spread of fire with considerably greater effectiveness than walls not so filled, according to tests conducted at the National Bureau of Standards. Walls filled with mineral wool resisted the penetration of test flames 10 to 30 minutes longer than walls without insulation of this kind. Rock, slag and glass wool were all tried. "The filling apparently retards the transmission of heat to the unexposed facing and decreases the rate of burning of the wood supports."