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THE REMOTE NEBULAE

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THE distant nebulae are closer together than the ones in our part of the universe, according to the latest measures of Dr. Edwin Hubble, of the Mount Wilson Observatory of the Carnegie Institution, who uses the world's largest telescope for his observations.

However, Dr. Hubble is not ready to accept the most obvious interpretation of his results. The measurements involve nebulae so far away that it takes several hundred million years for their light to reach us and various things have to be taken into consideration.

Dr. Hubble took the temperatures of the nebulae to be 6,000 degrees Centigrade and assumed that the farther a nebula is from us the redder its light appears. This so-called red shift has been observed for the nearer nebulae, but the more distant ones are so faint that they can not be examined even with the 100-inch telescope he used.

According to recent theories, the universe is best regarded as a uniform space constantly expanding, and Dr. Hubble's results raise a difficulty with the concept of uniform space. This difficulty has been examined theoretically by Professors R. C. Tolman and P. S. Epstein, of the California Institute of Technology. Working independently, they showed that even a homogeneous expanding universe could behave in accordance with the measurements of Dr. Hubble.

This is possible only if the matter in the universe is many times more dense than has been regarded as possible in the past. On the average there would have to be one atom in every quart of space. This would mean that 99.9 per cent. of the matter in the universe is nonluminous and that the stars and nebulae which we can see are only a minute fraction of the whole.

Astronomers raise the question as to how it is possible to hide such vast quantities of matter in space from all their observations.

When the 200-inch telescope is finished, the question will most likely be decided. Until then there are too many uncertainties involved to take any single theory too seriously. If the theory of Professor Tolman is correct, it would mean that we can see one quarter of all the nebulae in space with the 100-inch telescope and probably the 200-inch telescope will see out as far as there is any space.

ARTIFICIAL RADIOACTIVITY IN MEDICINE

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MEDICINE, including the treatment of cancer, and other sciences, may soon be able to benefit from useful quantities of many elements made artificially radioactive. The technique for producing such elements is rapidly developing, as is instanced by their production by a combination of neutron bombardment and paraffin bath, which acts like a neutron reflector and has raised the yield by 20 to 100 times. This statement is made by Professor Enrico Fermi, the Italian physicist, who discovered the unknown element numbered 93. Dr. Fermi is taking part this summer in the symposium on physics at the University of Michigan.

About two thirds of the known elements can be made temporarily radioactive by bombardment with neutrons, which are particles of matter weighing the same as a hydrogen nucleus, but without any electrical charge. The neutron, however, must strike the nuclei of the atoms of the element being bombarded and be retained, to produce radioactivity. Because of the "vast" space, relatively speaking, between atoms, the great majority of the intended projectiles never find marks, with the result that infinitesimal amounts of the changed, radioactive elements are produced.

In the neutron reflector process used by Professor Fermi, the source of the neutron "bullets" is surrounded by a cylinder of the element to be bombarded, and the whole apparatus is surrounded with water or paraffin. The secret of the increased production of an activated element is found in the fact that both water and paraffin contain much hydrogen and that hydrogen nuclei and neutrons have the same weight. Neutrons which do not hit their intended targets shoot on beyond, into the water or paraffin. Here they are very likely to strike a hydrogen nucleus. Being without electrical attraction, the neutrons may then bounce back into the cylinder of the element being attacked and thus get a second chance at their mark, after the reflecting collision.

Not all of the neutrons get this repeat chance or chances, Professor Fermi points out, but enough do to raise the production of the activated element by 20 to 100 times. An added advantage of the method is the fact that after having bumped into a hydrogen nucleus the speed of the neutron is so slowed down that if it does bounce back and strike one of the desired atom targets it is more likely to be held.

Since the radioactivity of the artificially excited elements is essentially similar to that given by radium, but temporary in duration, medical men are watching developments with interest. There is definite possibility that in the future some cancers and other conditions may be treated by radioactive chemicals which will surround the diseased spot with a temporary field of curative activity and which can be closely controlled, both as to time and strength, by the physician. While some such treatment now seems likely, when radioactive elements are available in quantity and variety, a long period of experiment must precede practical application.

Uranium, of atomic number 92, is the heaviest radioactive element existing in nature, but it is unstable, slowly breaking down. By neutron bombardment, some uranium atoms can be transformed into new elements which lie beyond uranium and are therefore numbers 93 and 94. These are, however, extremely short lived. While there is a chance that some elements of even higher atomic number might be formed by bombardment, in Professor Fermi's opinion they are essentially so very unstable that

they could not possibly last for a reasonable time. This is the reason why such elements are not found under natural conditions.

DINITROPHENOL AND CATARACT

REPORTS of cataracts following use of the drug dinitrophenol as an anti-fat remedy in California focuses attention upon the dangers of using this method of reducing.

Only a few days ago the Council on Pharmacy and Chemistry of the American Medical Association refused to accept dinitrophenol and preparations containing it as a "new and non-official remedy," pointing out its dangers and urging that its use be restricted to selected patients under observation of properly trained physicians.

Repeatedly the official journal of the association has warned against wide-spread use of the drug and protested against sale of the drug except on physician's prescriptions. Now this drug can be obtained by any one at any corner drug store.

Moreover, about twenty commercial concerns are merchandising dinitrophenol or preparations in which it is an active principle. Some of these preparations are sold under trade names for reducing purposes, so that those who use them may be endangered by the drug without knowing of their danger. It is estimated that about 100,000 persons in America alone have used the drug for the treatment of obesity since its introduction for this purpose.

For the past fifty years investigators have studied the action of dinitrophenol and similar chemical compounds in accelerating metabolism, that is, the burning of tissues within the body. In 1933 its possible usefulness in treating obesity was shown by American studies, but its dangers were also soon shown by the experiences of some of those treated.

Useful in the making of dyes and explosives, dinitrophenol was known to be poisonous through its toxic effects on munitions and other industrial workers.

THE MANUFACTURE OF CARBOHYDRATES BY PLANTS

IT'S just a simple leaf inhaling carbon dioxide, but if it ever stops breathing in what man breathes out, all life as it exists to-day would cease in a short time.

Dr. Dean Burk, U. S. Department of Agriculture scientist, and Hans Lineweaver, working in the Bureau of Chemistry and Soils in Washington, report that they have come five steps nearer in understanding the baffling chemical processes by which the leaf manufactures carbohydrates. His report was given to the biological conference now in progress at Cold Spring Harbor.

It is now only a matter of time, Dr. Burk said, until several more leaf reactions will be discovered. Then, chemists believe, man will be able to adopt and even improve on the method used in the green leaf chemical factory.

The process is known as basic photosynthesis. Chemists have long known that the wood in trees is created by the leaf. Its green coloring matter, chlorophyll, acts as a catalyst helping the carbon dioxide of the air to unite with water to form a primitive carbohydrate which, in turn, becomes cellulose.

Dr. Burk compared the reaction of photosynthesis to an endless chain-bucket pump in which the sun furnishes the power, the chlorophyll and another catalyst acting as buckets in pumping the carbon products to a higher energy level. The chemical equations he discovered are not of the simple type familiar to students of elementary chemistry, but depend upon changes of energy content.

The experiments were carried out with a green alga, *Chlorella*, in the life of which little happens except the change of carbon dioxide to protoplasmic carbohydrates. The importance of the work lies in the fact that when chemists can exactly duplicate the process, they will be able to improve and find short cuts. They may be able to do what Germany did in the war, her nitrogen supply having run low, due to blockades, when she reached into the air and "fixed" nitrogen, taking the plentiful gas and converting it into explosives. In the same way, chemists may eventually be able to create their own carbohydrates by taking carbon dioxide from the air or elsewhere.

It is also reported that those plants which are able to "fix" nitrogen do so by burning up the carbohydrates which their leaves created. It takes about as much energy to "fix" a pound of nitrogen as it does to "fix" a pound of carbon dioxide gas.

LACK OF SPECIMENS IN MUSEUMS OF NORTH AMERICAN ANIMALS NOW THREATENED WITH EXTINCTION

"EXPLORATION, like charity, begins at home." That is the pertinent comment of Dr. Roy Chapman Andrews, director of the American Museum of Natural History. Dr. Andrews, who has headed expeditions into the farthest corners of the earth in search of rare animals for museum groups, realizes that it's high time to hunt for specimens nearer home.

Recent droughts, dust-storms, floods and erosion, bringing many small rodents of the western prairies close to extinction, called attention to the fact that specimens of these and other native animals are entirely lacking in several cases. In the American Museum there is only one state—Connecticut—represented by a one hundred per cent. collection of its animal life. There are no collections whatever in the museum from the following states: Louisiana, Mississippi, Oklahoma, Alabama, Tennessee, Kentucky, Illinois, Ohio, Indiana, South Carolina, West Virginia, Pennsylvania, Maryland, Delaware and Rhode Island.

Sponsors of museum expeditions are usually interested in the fauna of far-away places, according to Dr. Harold E. Anthony, curator of mammals at the museum, in explanation of the situation. "We have now come to realize," he said, "that various forms of mammals in our country are in danger of extinction and have been going for some time. The great herds of antelope and bison which once roamed the plains have disappeared before the advance of civilization. Now the small burrowing rodents of the western states are being buried under drifts of dust, or drowned by floods."

Pre-historic horses and camels inhabiting the western part of America during fairly recent geological times suddenly became extinct for reasons not entirely understood, so that the horses brought over by the Spaniards under Cortes were the first that the Aztecs had ever seen.

Plans have been made for obtaining a complete collection from each state. Dr. Anthony hopes to secure a mobile laboratory with living quarters, to travel through various parts of the country, picking up specimens with the seasons. Meanwhile the museum is already extending its North American Mammal Collection with the aid of a number of persons who have opened their ranches in the West to staff-members of the museum. Several expeditions have already or soon will set out to collect deer, elk, bear and small animals.

PROPOSED APPROPRIATIONS FOR UNDERGROUND WATER RESOURCES

A SCIENTIFIC attack on the drought problem, by the U. S. Bureau of Mines, is provided for in a plan for exploring, measuring and charting the underground water resources of the nation, especially in the drought-stricken areas. Application for $1,619,100 of Public Works funds has been made by the bureau for this purpose.

During the drought, wells disappeared, surface water was scarce, and definite knowledge was lacking as to where water was located deep underground. Underground water supplies are now greatly needed in many parts of the United States, bureau officials explain. A systematic survey of hidden water resources has been recommended by the National Resources Board.

Electrical methods of geophysical exploration, modern scientific successor of the discredited "water witch," will be used for finding water. When an electric current is passed through the ground, the resistance it encounters gives the observer a clue to what lies hidden beneath the surface, because different rocks and ores offer varying amounts of resistance to the passage of the current.

The prospector for water starts by placing his electrodes close together on the surface and then gradually increases their distance apart and thus increases the effective depth measured. If the ground at that depth contains a resistant body, such as oil, then the resistance recorded will be high. If it contains one which conducts electricity readily, such as copper ore, then the readings will be low.

Water, curiously enough, may have either low resistance or very high resistance, depending upon its chemical content. A person familiar with the geology and water character of the region can detect the presence and depth of water by this method. Preliminary work has already been done successfully in the Humboldt Valley of Nevada and in other localities by this method.

ITEMS

UNUSUAL atmospheric stagnation preventing the normal movement of heavy rain clouds accounted for the freak cloudburst and floods which swept over western and central New York State on July 8, leaving more than a score known dead and many missing in their wake. A high moisture content in the air, probably three times normal, plus a severe local thunderstorm which failed to move onward in normal fashion, caused the catastrophe, according to Charles L. Mitchell, principal meteorologist of the U. S. Weather Bureau. Centering about Ithaca, which was the only government station to report unusual conditions, the heavy rainfall swelled creeks and rivers over their banks, and flooded the region. Had the storm clouds blown on, scattering rain over a larger area, the storm might have passed for nothing more than a local thundershower.

ABNORMALLY warm but good crop-growing weather characterized the past week in most parts of the nation, according to the U. S. Weather Bureau's weekly weather and crop summary. While a few localities particularly east and north of the Appalachians had abnormal rains, particularly New York State now struggling out of unusual floods, the south and interior valleys had much fair weather, with a high percentage of sunshine that was good for crops. Most states west of the Rockies could have used some of the excess rain of the east because vegetation west of the Rockies is feeling the effects of accumulated deficiencies of rainfall.

DISCOVERY of a new disease and progress already made toward its prevention are announced simultaneously by Dr. Charles Armstrong, of the U. S. Public Health Service, and Lieutenant-Commander Paul F. Dickens, of the Navy Medical Corps. The malady, which has appeared in isolated instances in a number of states, has features resembling meningitis, infantile paralysis and epidemic encephalitis, or sleeping sickness. The name "acute lymphocytic choriomeningitis" is suggested for it. The agent causing the disease is found to be a filterable virus. Cases have been reported in California, Maryland, District of Columbia, Illinois, Ohio and Virginia. It runs its course in ten days to two weeks, and recovery is complete without paralysis or other after-effects.

POTATOES have been stimulated into earlier sprouting and blossoming, and larger tuber yield at maturity, by treating the seed pieces with "supersonic" waves—sound waves of such high frequency that they are far beyond the range of audibility. The experiments were performed at the high-frequency laboratory of the State X-Ray Institute at Moscow. The waves were produced by an electrically excited quartz crystal, operating in an oil bath, at a frequency stated to be about 400 million cycles a second. The uppermost limit of audible sound waves is only about 20,000 cycles a second. Small numbers of potato tubers were exposed, in water, to these waves, and then planted after a short period in storage. The "sonized" plants sprouted and blossomed several days earlier than "control" specimens grown from untreated tubers, and their yield was increased by from 64 to 69 per cent. The experiments were performed under laboratory conditions only. Larger-scale tests under field conditions have not yet been undertaken. The first investigation of the biological effects of supersonic waves was carried on in the United States by Professor R. W. Wood, of the Johns Hopkins University, and A. L. Loomis, in the latter's private laboratory at Tuxedo Park, N. Y.