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HYDROGEN AND HELIUM

PROFESSOR HENRY NORRIS RUSSELL, of Princeton University, at the meeting sponsored by the American Philosophical Society and the Franklin Institute summarizing current knowledge of the stars and the planets, pointed out that hydrogen is the fuel and helium is the ash of the stellar engine which produces the vast amounts of energy liberated by the stars and the sun through the ages.

Speeding bits of hydrogen atoms are now believed to bring about spontaneous disintegration of chemical elements and release vast amounts of energy. Crediting Professor H. A. Bethe, of Cornell University, with having developed current concepts on the source of stellar energy, Professor Russell said that as the various elements were broken up they gave off helium as the end product. Thus helium—the light stable gas—is the "ash" of stellar energy production.

From purely mathematical theories on the behavior of atomic nuclei when they are smashed by other atomic particles inside the sun and star, it is possible to explain why many of the lighter elements—lithium, beryllium and boron—appear not to be present in the sun to any great extent. Long since they have been transmuted into helium, giving off radiation.

It is only when carbon in the sun is considered that the destruction of the elements changes. For carbon, explained Professor Russell, a whole series of transmutations occur which release large amounts of gamma radiation and which end up by recreating the carbon again along with more helium. Carbon, in effect, acts as the catalyst.

The sun will keep on shining for another 10,000,000,000 years, Professor Russell estimated, and each 100,000,000 years it will grow enough hotter to raise the earth's temperature by one degree Fahrenheit.

Thus if nothing happens to the earth in the meantime it is going to be about 168 degrees on the earth in the year 100,001,938 A.D. instead of 68 degrees average as it is now. These supertropical temperatures would probably melt all the ice caps at the earth's poles, raise the level of the ocean many feet and have other equally intriguing implications.—ROBERT D. POTTER.

THE ATMOSPHERES OF STARS

NEW stellar studies have revealed that some of the bright stars in the sky have atmospheres which extend far beyond the shining surface ordinarily seen, according to a paper given in the symposium on "Progress in Astrophysics" by Professor Otto Struve, of the Yerkes Observatory.

The eclipsing variable star, known as Zeta Aurigae, has a tenuous atmosphere extending more than 62,000,000 miles about the gleaming surface of the star. For Epsilon Aurigae the height of absorbing atmosphere is estimated at more than 180,000,000 miles. Several other stars, known astronomically as the B type, have atmospheres whose height is about five times the radius of the star itself.

An explanation of the physical nature of these stellar atmospheres is one of the puzzles of modern astronomy. It is necessary to take into account the unusual behavior of the energy levels of individual atoms in the stellar atmosphere. Transition of electrons between energy levels in atoms is the mechanism that produces the emission and absorption of light, Professor Struve explained. In some cases it is necessary to assume that the radiation is produced by atoms having so-called "metastable" energy levels which produce different kinds of spectrum lines than do the ordinary stable energy levels.

Using new methods, which Professor Struve outlined, astronomers have now made analyses of the atmospheric properties of such famous stars as Nova Herculis, P Cygni and Beta Lyrae.—ROBERT D. POTTER.

FUNGUS DISEASE OF AMERICAN TREES

FOREIGN enemies are entrenched in America on a dozen fronts. Their destructive activities are directed not at cities and the people who dwell therein but at our wealth of trees. Their havoc has already run into the hundreds of millions, and the end is not yet in sight. Against some of the worst attacks no adequate defense has been found.

Newest outbreaks are of diseases that threaten two favorite street trees, the American elm and the London plane or sycamore. Elms, already losers from the fungus-caused Dutch elm disease in the region around New York, are now suffering from a killing virus in the Ohio Valley. At first thought to be a "town" ailment, the disease has now been found in forest elms in West Virginia.

The London plane tree, a hybrid between European and American sycamores, is particularly valued for street plantings because it can endure city smoke. The fungus that is killing it in Philadelphia and Baltimore, and that threatens to spread to other cities, is therefore a particular foe of city foresters and park commissioners.

Two other new diseases are menacing forest trees that are valuable alike for their wood and as sources of food for wildlife, according to G. F. Gravatt, plant pathologist in the U. S. Department of Agriculture. One is a virus that has been found attacking oaks in Wisconsin. Although its distribution is limited as yet, foresters and wildlife administrators are alarmed over the possibility of its spread.

The other disease threatens to wipe out the American persimmon, valued as a source of hard wood for golf clubs and of food for wild birds and mammals, as well as a soil-binder in erosion control. It first appeared near Nashville, Tenn., in the summer of 1937. Last summer, R. Kent Beattie, of the U. S. Department of Agriculture, found it all the way from South Carolina to Mississippi. It kills the trees in a few weeks, and spreads with explosive rapidity.

As if the plague of chestnut blight that started something over a generation ago and has practically wiped out the American chestnut were not enough, a new enemy is attacking the few remaining chestnut trees in the South that the wilt has not yet reached. It is a root-rot fungus,

and it kills not only the chestnut trees but their smaller-fruited relatives, the chinquapins, which are an even more important source of food for game, especially wild turkeys.

A deadly combination of a scale insect and a fungus is killing the beech trees in New England. It got started in Nova Scotia or New Brunswick, and presently crossed the Maine boundary. Beechnuts are an important wildlife food, and the probable replacement of dead beeches by maples will make the forest a decidedly leaner larder for game.

A double invasion, one disease from Europe and one from Asia, has converged upon certain species of willow, and is killing the trees in great numbers. Willows are irreplaceable in certain types of soil conservation plantings, and they are also favored browse for deer and other game animals.

Against all these enemies of our trees, scientists are struggling valiantly, though it is an uphill fight all along the line. The persimmon blight has spread so rapidly that there is no use trying to get rid of it by destroying infected trees, as is being done in the battle against the Dutch elm disease. The attack on the chestnut ended in disaster long ago. Whether the new root rot that is killing chinquapins will wipe them out also is still uncertain, but the prospects are not bright.

In some cases, doomed native species can be replaced with resistant trees brought from other countries. Mr. Beattie spent several years in the Orient, seeking suitable chestnuts, and brought back a number of promising varieties. The same may be done in the case of the persimmon, for Chinese and Japanese persimmons have been found to be immune to the fungus. Hybrids between susceptible native trees and resistant foreign species are sometimes resistant.

No possible replacement tree has yet been found for the American elm, however. European elms are as susceptible as our own; indeed, it was from imported European logs that the fungus got its start in this country, Chinese elms appear to be resistant, but they are not really equivalent to the American elms. So the fight on that front will have to continue as an effort at absolute elimination.—FRANK THONE.

FOSSIL TOOTH FROM CREATURE LINKING MAN AND APE FOUND

A FOSSIL tooth, exceedingly well preserved, has been found in the Sterkfontein district of South Africa. It promises to furnish another important link between man and the ape. This is reported by Professor Middleton Shaw, head of the dental department of Witwatersrand University, and serves to strengthen the researches of Dr. Robert Broom.

"A single tooth may appear to be very inadequate evidence upon which to base conclusions," Professor Shaw said, "but many important extinct forms are known only from a single tooth. Moreover, the present specimen is beautifully preserved and its characters are so distinctive that there is adequate evidence that it belongs either to a man or a man-like ape closely allied to, if not identical with, the man-ape of which remains have recently been discovered at Sterkfontein by Dr. Robert Broom.

"A detailed report on the tooth will appear in due course, but in the meantime I am prepared to state that the discovery confirms the view that the man-apes which once inhabited the Sterkfontein district were closely related to the ancestors of modern man, and in fact, so far as their teeth are concerned, were hardly distinguishable from primitive modern man.

"The age of the new Sterkfontein specimen is probably between 50,000 and 100,000 years. The rock in which the specimen was discovered was found near the Sterkfontein caves by Dr. Julius Statz and given by him to Professor Shaw."

ITEMS

A DIFFERENCE of 110 degrees Fahrenheit between the lowest and highest minimum temperatures in the United States is the unusual record reported by the U. S. Weather Bureau. Lowest temperature at Havre, Mont., was 40 degrees below zero. At the same time, the thermometer in extreme southern Florida did not drop below 70 degrees above zero all week.

DR. PAUL YU-PIN, Catholic bishop of Nanking, has predicted the outbreak of pestilence throughout China during the coming summer. Diseases of several kinds, including typhus, plague and others endemic to the Far East, will break out as the result of the privations which the Chinese people have suffered in their war against the Japanese invaders. Bishop Yu-Pin said, in appealing for American aid, that the epidemics would strike both the areas still under Chinese control and those occupied by Japan. In asking for assistance, he suggested that American medicines be sent, because drug and surgical supply factories in China have all been destroyed.

THE number of deaf adults could be reduced by 50 per cent. if the ears of school children in the primary grades were periodically examined and, when necessary, treated. This is the opinion expressed by Drs. S. J. Crowe and John W. Baylor, of the Johns Hopkins University School of Medicine, in the leading article in the forthcoming issue of the *Journal* of the American Medical Association. The most common type of middle ear deafness in adults begins during childhood. Often it progresses so gradually and insidiously that it may not become evident until it is too late to correct the primary trouble and to restore the hearing.

A SIMPLE new blood test aiding in recognizing malaria has been announced by the U. S. Public Health Service. The new test was devised by H. O. Proske, chief medical technician, and Dr. Robert B. Watson, senior malariologist of the Tennessee Valley Authority. The test is based on the fact that a certain fraction of the proteins in blood, the euglobulins, is increased in most cases of malaria, and this increase can be shown by a chemical color test. Malaria can not always be diagnosed from the symptoms, it is explained, because many of these are similar to those of other diseases. Clinching the diagnosis by searching for the malaria germs in the blood is also sometimes difficult, especially if the number of these germs in the blood is small. The new test, which is easy to perform in any clinical laboratory, gave 97.4 per cent. positive reactions in a series of known malaria cases as compared with 81.9 per cent. found by microscopic examination.