

## SCIENCE NEWS

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## ATOMIC PHYSICS AND BIG TELESCOPES

By furnishing an explanation of how stars are fueled, atomic physics has been responsible for one of the greatest advances in astronomy during the past decade. Big telescopes are not the only means by which the science advances, was stated by Dr. Harlow Shapley, director of the Harvard College Observatory, in a lecture given under the auspices of Sigma Xi, at St. Louis.

He credited Dr. Hans Bethe and his colleagues at Cornell University with the proposal of a plausible method by which, it can be presumed, the stars turn the matter of which they are made into energy, and broadcast it into space.

"It has long been a serious problem," he stated, "to explain why the sun exists at present, and why it radiates at apparently the same rate as it did in Paleozoic times. The ancient plants and animals apparently lived under conditions similar to our own—two hundred million years ago.

"We have long known that if the machinery for transforming matter at the appropriate rate, and at the temperatures existing in the stars, could be found, we could account for the energy source of radiation. The deuterium process, which burns the ever-present hydrogen into helium ash by way of heavy hydrogen; and the carbon stove mechanism, by which the hydrogen goes into the helium ash by way of the transformation of carbon atoms—these two mechanisms appear to be the chief agents in supplying energy for running the universe."

However, the problem is not yet fully solved.

"A great advance has been made," he continued, "but some problems are left over. Where, for example, did the hydrogen come from?" He did not give the answer.

To explain astronomical puzzles of the star clouds, systematic star motions and the bunching of peculiar types of stars and of stellar systems, Dr. Shapley suggested that there is, even in the vicinity of the sun, some controlling "arm structure." This also seems to be manifested in the dominance of a spiral shape in other galaxies, or milky systems. Perhaps our milky way has such spiral arms.

"Progress toward unraveling the mysteries of the structure of our galaxy is made through studies of star colors, star counts, the distribution of obscuring matter, the spectral classification of faint stars and, indirectly, through the distribution of the external galaxies. Their presence or absence in a field of stars is a rough measure of the amount of absorbing material. Such material, if present, may affect measures of star colors, distances and numbers.

"Something like half a million external galactic systems have now been photographed in the Harvard survey of that part of the universe within reach of the large telescopes. Most of them are more distant than twenty million light years and nearer than two hundred million light years. The detailed studies of the distribution of external galaxies is leading slowly to knowledge of the

general 'metagalactic structure,' and bears therefore upon the problems of the expanding universe, age of the stellar systems and the theory of relativity as it applies to the structure of the universe."

## BOTANICAL DRUGS

THE only drugs of which supplies in this country may run short if war in Europe is prolonged are those drugs obtained from certain plants, according to the report of Dr. S. De Witt Clough, president of the Abbott Laboratories, in the current issue of *War Medicine*, the new medical journal published by the American Medical Association in Chicago. The first issue was mailed to physicians and others interested on January 28.

Of vitamins, including cod-liver oil, vaccines and other biologics, hormone remedies such as insulin for diabetes, sulfanilamide and the other sulfa remedies, anesthetics of all types, antiseptics, disinfectants, bandages and surgical dressings, the United States has plentiful supplies. "The drug industry," he says, "is in a much better position to supply the medical profession, hospitals, the Red Cross, the War Department and governmental agencies with pharmaceuticals and medicinal chemicals than it was during the World War.

"There is already a growing scarcity of such items as belladonna root and hyoscyamus, a source of scopalamine," Mr. Clough reports. "While these botanicals have been coming from foreign countries, it is reasonable to believe that sufficient supplies of belladonna can be cultivated in this country to take care of civilian and military requirements.

"This was the case in the World War, when not only belladonna but digitalis and other medicinal plants were grown in Washington, Oregon, California, Minnesota, Michigan, Indiana, New Jersey, Pennsylvania, Virginia and Florida. Digitalis of excellent quality is still grown in the United States but not in sufficient quantity, as yet, to supply domestic, export and military needs. It is hoped that domestic cultivation will be increased.

"Atropine sulfate can be obtained from jimson weed, which can be grown on almost any farm land. It may also come about that the alkaloid, atropine sulfate, can be synthesized. When the World War was over, the cultivation of belladonna and some other medicinal plants was practically abandoned in the United States, owing to the lower cost of labor in other countries."

Mr. Clough urges that agricultural departments of state universities and colleges grow such medicinal plants in this country as are adapted to the soil and climate of the various states and experiment with others not yet cultivated in this country. He states that we are in excellent condition to produce large quantities of biologic items such as vaccines and antitoxins; that we could take care of a large part of the world requirements for bandages and dressings; that we are in "an advantageous position" to produce enough vitamin oils to take care of the entire Western Hemisphere; and that we lead the world in

the production of anesthetics. There is no fear of shortage of minerals used in medicines such as mercury, arsenic or bismuth, since these are either available here or may be obtained from South America. We can make sulfanilamide, sulfapyridine and sulfathiazole from materials produced in this country.

### ELECTRICAL SHOCK

AFTER a person has repeatedly been subjected to electrical shock, he tends to develop immunity, was reported at the Philadelphia meeting of the American Institute of Electrical Engineers, by Professor Charles F. Dalziel, of the College of Engineering of the University of California; Dr. John B. Lagen, of the School of Medicine, and Joe L. Thurston, a senior electrical engineering student.

The immunity is not enough, however, to permit a person to reach the stage where he could sit in comfort in an electric chair. Part of the ability to withstand increasing shock, it was suggested, is due to a psychological factor, as the subject gets used to it.

Measurements were made on 120 men in order to find the greatest current at which the subject could let go of the electrode carrying the current. The voltages ranged from 20 to 75 and the current, which is measured in amperes, was increased to the point where the person tested could no longer release his grip. One subject was able to let go at about a fiftieth of an ampere, but the mean value was about three quarters as much. The experiments did not use heavy enough currents to cause unconsciousness.

The effects on the subjects were described as follows:

"If the electrodes are held in the hands, the threshold of perception is about one thousandth of an ampere. As the current is gradually increased, the sensation of tingling in the fingers, hands and wrists is intensified. At the same time the muscles of the fingers and hands, and later also of the arms, tighten involuntarily. At the higher currents (6-8 thousandths of an ampere and above) the discomfort from severe muscle contraction is more evident than the sensation of tingling, and may even be painful.

"For currents of this magnitude the individual may still be able to release his grip of the electrode by a determined muscular effort. As the current increases, the involvement reaches the shoulder girdle and extends to the external muscles of the chest so that respiration becomes somewhat difficult. The higher currents cause a sensation of mental discomfort which may even amount to a nameless fear, although the individual knows that at any indication from him, such as a nod or a cry, the current would be shut off."

### PAPERS READ AT THE PHILADELPHIA MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

(Continued from issue of February 7, p. 46)

Alcoholic mental disorders cost \$178,191,272 to the people of the United States each year, according to an estimate made by Dr. Horatio M. Pollock, director of

mental hygiene statistics, New York State Department of Mental Hygiene. Patients suffering from alcoholic mental disease or alcoholism in mental hospitals throughout the United States number about 31,220. Since the cost of maintaining these patients averages about \$500 a year, the total cost would be \$15,610,000. To this sum must be added the economic loss which results when a man or a woman suffers mental breakdown. Figured only for those patients first entering a mental hospital during a single year, this would amount to \$86,154,712. But this sum does not include the loss of earnings and the money spent on alcohol during all the years of alcoholic excesses that went before the victims finally landed in the mental hospital. This amount is estimated to be about \$76,426,560. These three amounts make up the striking total of \$178,191,272, which does not count losses due to physical illness, crime connected with intoxication, pay of policemen or cost of courts and jails.

A theory that anesthesia consists in the "jelling" of protoplasm was offered before a symposium on protoplasmic streaming by Professor William Seifriz, of the University of Pennsylvania. He has devoted a quarter-century of research to the properties of protoplasm, principally as evinced in the lowly organisms known as slime-molds, whose bodies consist merely of blobs of naked protoplasm. Treating these primitive forms of life with various anesthetics, he found that the streaming movement that goes on almost incessantly in its protoplasm stopped for some of the drugs, but apparently was immune to the effects of others. In every case where the streaming stopped the protoplasm had set into a jelly-like consistency, instead of the viscous fluid which is its usual state. "The gelatinization of protoplasm reduces all physiological activities, including irritability, to a minimum, and this is anesthesia."

Very high pressure, such as is found in the deepest parts of the sea, has a paralyzing effect on protoplasm, was reported by Professor Douglas A. Marsland, of New York University. The pressure apparatus with which he worked was rebuilt out of a hydraulic jack such as is used in commercial garages for lifting heavy trucks. The effect of extreme pressure is most evident in stopping the streaming movement that is characteristic of all protoplasm. This streaming can be observed readily in the leaf cells of certain plants, in moving amoeboid cells, in dividing animal cells, and in the expansion and contraction of the color bodies in the skins of fishes. All these varied forms of protoplasmic streaming were retarded as the pressure went up, and stopped altogether at the same high pressure—5,000 pounds per square inch. The stopping occurred when non-streaming parts of the protoplasm became unable to change from fluid to a firmer, jelly-like substance, which appears to be a necessary prelude to the streaming activity.

Colechicine, the drug that produces giant plants and causes great speed-up in evolutionary changes, has been used successfully for the first time in producing apparently similar changes in animals by Dr. Edna Higgins,

of the University of Pittsburgh. Earlier experiments with colchicine on animals have uniformly resulted in the early death of the animals, when the drug was used in sufficient concentration to obtain any results at all. However, by injecting very small amounts of highly dilute colchicine solutions into the eggs of chickens at various stages of incubation, Dr. Higgins has succeeded in obtaining six healthy birds that have survived to maturity. In one group of four chickens, injected after seventy-two hours of incubation, now seventeen months old, the combs and wattles of both males and females are twice the normal size, and the males also have two abnormally long tail-feathers apiece. Two others, out of a group injected during the thirteenth day of incubation, show less effect. Further work is now being conducted to determine whether colchicine produced the effects directly, or whether it worked through the sex glands.

Manganese is needed by oysters no less than by higher animals if they are to function as mothers, Dr. Paul S. Galtsoff of the U. S. Fish and Wildlife Service reported to the zoologists. He found a marked rise in the amount of manganese present in oysters when their eggs were developing and ripening. This manganese content, moreover, was concentrated principally in the ovaries. Concentration was relatively low in other tissues, as it was also in the reproductive organs of oysters in the male phase of their existence.

Dr. Gregory Thoennes of St. Mary's College of Winona, Minn., suggested that seventeen-year cicadas, usually called "locusts" when their shrilling swarms appears, may do more harm to trees than is commonly supposed. Dr. Thoennes has kept track of trees affected by an outbreak of seventeen-year cicadas in Missouri six years ago, and is of the opinion that the consequences of the excessive egg-deposition in the rind of young twigs are being too lightly dismissed by biologists. Dr. Thoennes stated that in the case of orchard trees especially, measurements made for the past six years indicate a marked decrease in the yearly growth of injured branches. This change in growth rate is more noticeable in older trees than in younger ones, and in neglected trees than in those that have been well cultivated. In either case, however, the growth of affected branches is less than that of uninjured ones.

An extract of last year's dead leaves will delay the opening of next year's buds, on cut fruit-tree twigs set in it, was reported by Professor C. G. Vinson, of the University of Missouri. A contrary effect on peach twigs, forcing the flowering at an earlier date, was obtained with several organic acids commonly found in plant tissues—succinic, maleic, fumaric and malic. Tannic acid had an effect similar to that of the dead-leaf extract, hindering flower opening. The experiments reported by Professor Vinson are preliminary steps in a search for a compound that can be sprayed on dormant fruit trees in early spring, to prevent them from blossoming too early and then getting caught by frost, at present a source of great losses in northern orchard regions.

Cotton yields were increased by a third in experimental

plots sprayed daily for three weeks during July with a one-to-one-million solution of the growth-promoting chemical, indole acetic acid, according to a report presented by Professor J. C. Ireland of Oklahoma Agricultural and Mechanical College. This would suggest that the use of a synthetic hormone causes the cotton plants to develop more bolls to maturity. There is an apparent increased vigor of the plants, probably due to an increased rate of the use of plant foods. In another experiment, performed on individual plants in the greenhouse, the pistil, or seed-bearing part of the flower, was treated with a paste containing colchicine and indole acetic acid. Unpollinated pistils produced fertile seed, which thus had a mother but no father. Plants are now being grown from those seeds. The cotton fiber from the colchicine-treated flowers was longer and stronger than that from untreated flowers.

To break up the inconvenient habit certain apple trees have of producing huge crops one year and practically none the next, is a possible outcome of experiments reported by J. R. Magness and L. P. Batjer of the U. S. Department of Agriculture. They succeeded in breaking the rhythm of bearing in some of these "two-year" apple trees simply by spraying the buds, just as they began to show pink, with caustic chemicals that killed the flowers. The following season, when ordinarily the trees would have borne little or no fruit, they produced plenty of apples. The happy mean, a method whereby only part of the superfluous buds can be killed and equal crops produced every year, is still being sought.

### ITEMS

THE closest imitation made thus far in the laboratory of the strange green light of the northern lights has been obtained by Dr. Joseph Kaplan, of the University of California at Los Angeles. This was done in a tube to which oxygen and nitrogen were admitted, and an electrical discharge passed through. A shutter covers the tube while the discharge takes place, but uncovers it afterwards, to expose the afterglow which persists for several seconds. In such a manner he has obtained, by itself, the green light of the aurora. This is a so-called "forbidden" radiation, that is, it can not be reproduced with the usual laboratory behavior of these gases. "A perfect reproduction of the auroral spectrum should now be possible. Strangely enough, one has to go to high pressures in the laboratory to reproduce low pressure auroral phenomena; the higher the pressure, the better the reproduction."

FISH in the sea, no less than fish in rivers, are governed in their movements to a considerable extent by water currents, states Dr. Harald U. Sverdrup, director of the Scripps Institution of Oceanography at La Jolla. Upwelling currents, that bring water rich in marine food from the depths to the surface, are an especially important factor in determining the places where fish congregate to feed. There are strong upwelling currents along most of the California coast, which account to a considerable extent for the wealth of West Coast sardine and other fisheries.