

SCIENCE NEWS

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CEPHEID VARIABLE STARS

CEPHEID variable stars, which change periodically in light in a characteristic manner, getting bright rapidly and dimming more gradually, may represent a stage in the evolution of another kind of star, called the "red giants," and the Cepheids may themselves turn into a star of an ordinary kind.

This theory was suggested by Dr. Edward Teller, of George Washington University, at the recent meeting in Washington of the American Physical Society devoted to sources of stellar energy. Cepheid stars are important to astronomers as measuring rods of the universe. The brighter they become, the more slowly they change. Thus, when the period of variation of one is found, the astronomer can judge its candlepower. Seeing how bright it looks, he can tell how far away it is.

The red giants are typified by Antares, in the summer constellation of the Scorpion, and Betelgeuse, which shines in the winter sky in the figure of Orion. They are many millions of miles in diameter, ten to a hundred times as big as the blue stars. The red giants are really very diffuse. If we had a piece of one on earth, we should call it a pretty good vacuum.

Though the reactions in the nuclei of atoms which yield the stellar energy are on an entirely different scale from ordinary chemical reactions, Dr. Teller said that they have the common characteristic that both are speeded with high density and temperature. Thus, more easily reacting nuclei must be present in the red giants, since these stars, in spite of their lower densities and their presumably lower internal temperatures, produce as much energy as ordinary stars.

In ordinary stars the atoms responsible for energy production are mainly those of carbon and nitrogen. However, the responsible atoms in the red giants probably are lighter ones like those of beryllium, lithium, boron and deuterium (or heavy hydrogen). Moses Greenfield, in a paper to be published shortly, discusses the consequences of these reactions in greater detail. Dr. Teller's studies indicate that the main production of energy from these atoms would sometimes not be at the center of such a star, but in a shell a little way out from the center. If this shell gets sufficiently far away from the center, the star would probably not be stable, but it would start oscillating, as astronomers believe the Cepheids to be doing. So, he concludes, the red giants may become Cepheids in one stage of stellar evolution. However, after some millions of years, the supply of the light elements would become exhausted and then the Cepheid might become an ordinary, non-variable star.

FLUORESCENT LIGHT

FLUORESCENT light, made by certain substances when invisible ultra-violet rays fall upon them, lasts for 1/1470th of a second after the exciting rays are turned off, Dr. R. D. Rawcliffe, of the University of Illinois, reported at the meeting of the American Physical Society, at the National Bureau of Standards.

This kind of light is becoming widely used in modern illuminating fixtures in which a long tube shines with a brilliant white or sometimes bluish glow. Inside the tube is a mercury arc. Though this gives little visible light, it is rich in ultra-violet rays. Lining the tube is a layer of fluorescent material, which takes the invisible rays, turns them into visible light, and sends them out into the room. Such lamps are many times more efficient than old style incandescent lamps.

Dr. Rawcliffe's work represents the most accurate measurement thus far of the time the fluorescent light lasts. He measured it by having sharply interrupted flashes, from a mercury arc, fall on a fluorescent screen. The light from the screen fell on a form of electric eye, or photoelectric cell, which has a built-in amplifier. It is called an electron multiplier tube.

It was in turn connected to a tube similar to that used for receiving television pictures, in which a beam of electrons shines on a screen, and becomes visible. It was so connected that the beam was held to the side of the tube while the mercury light was shining, but as soon as it went off momentarily, the beam started across the screen. Thus, it traces a curved line showing the way the fluorescent light decays.

His results show a decay in 1/1470th of a second, with a probable error of 3 per cent. He pointed out that this was in good agreement with an earlier measurement, using another method, which had an error perhaps of 10 per cent.

RESEARCH IN AGRICULTURAL SCIENCE

In presenting the medal of the American Institute of Chemists to Dr. Henry G. Knight, chief of the Bureau of Agricultural Chemistry and Engineering, on May 17, Vice-president Wallace expressed the opinion that research in agricultural science will be a powerful aid in bringing about Hemisphere unity.

Vice-president Wallace, who, as Secretary of Agriculture, was Dr. Knight's chief, said that he has especially high hopes for the four great regional laboratories for research on industrial uses for farm products, and that he expects these to become Meccas for scientific men from all over the world. He pointed to the passing leadership in chemistry from Nazi-dominated Germany to the United States as striking evidence that science can thrive only in an atmosphere of freedom.

Dr. Knight, in accepting the medal, called attention to some of the outstanding contributions made by research chemists in his bureau to better living in America, and promised even greater things in the future, especially when the regional research laboratories shall have had time to get their programs into full swing. Of particular value, he pointed out, will be the pilot-plant setups in these laboratories, for in them can be wrought the transitions from test-tube scale experiments to mass production on factory basis.

As a single, dramatic example of the returns obtainable on small outlay in research, Dr. Knight cited the case

of the ethylene gas treatment of oranges, to bring a bright color to the skins of some types of fruit that persist in staying green after the oranges themselves are ripe. "The treatment bleaches out the predominant green color and leaves the orange a beautiful natural yellow. The chemical investigations leading to the development of this treatment which is now in rather general use cost the taxpayers of the country about \$4,000 and is estimated to be worth about \$4,000,000 a year to the producers of citrus fruits in Florida alone and about the same amount to producers in California. And yet some people say that research doesn't pay. I know it does. I think the criticism that sometimes comes to research comes mainly because the scientists are forced to try the results of laboratory investigations on a commercial scale before they have had time to pick out all the "operating bugs." That happened in the case of the sweet potato starch plant, and it's likely to happen to any undertaking that is pushed too fast. Developments and discoveries and inventions take painstaking time for checking and rechecking, and they shouldn't be pushed too rapidly."

The speaker also related the history of phenothiazine as an example of the unforeseen beneficial ramifications that often spring from research started with a definitely limited objective. Phenothiazine, a sulfur-containing organic compound, was tried out as an insecticide, in the hope that it might replace arsenical sprays in the protection of orchards and garden crops. It proved quite successful for this purpose. Then it was also found that phenothiazine could be used in medicine for the treatment of kidney and bladder infections, and in veterinary medicine to rid animals of parasitic worms.

VIRUSES

ELEVEN different kinds of viruses are now known to attack the human nervous system and to produce as many distinct maladies, according to a report by Dr. Albert B. Sabin, associate professor of pediatrics at the University of Cincinnati, who spoke at the Chicago meeting of the American Academy of Pediatrics. Viruses are disease germs so small that they can not be seen under even high-powered microscopes. Influenza, measles and yellow fever are caused by viruses, but these are not the nerve-attacking type described by Dr. Sabin.

The eleven viruses that attack the human nervous system are: infantile paralysis; St. Louis encephalitis (encephalitis is popularly termed "sleeping sickness"); Japanese encephalitis; Eastern equine encephalomyelitis (so-called horse sleeping sickness); Western equine encephalomyelitis; rabies; louping ill; lymphocytic choreomeningitis; pseudo lymphocytic choreomeningitis; "B" virus, and herpes simplex, or fever blisters.

Besides these eleven known viruses and the maladies they cause, there are at least two other diseases of the human nervous system which are probably caused by viruses although the infectious agents have not been isolated. These are the epidemic encephalitis or "sleeping sickness" which was so prevalent during and immediately after the last war and herpes zoster or shingles.

The first four viruses that attack the nervous system

have caused epidemics of diseases, affecting thousands of people at a time, while the others occur only sporadically. Most of them can produce unrecognized or very mild infections without any signs of involvement of the nervous system. The virus of fever blisters is an example. It not only can invade the central nervous system of animals and produce fatal disease in them, but there is suggestive evidence that even in human beings it may wander beyond the skin and mucous membranes.

Lymphocytic choreomeningitis appears to affect mice and dogs under natural conditions but is transmitted to human beings. Pseudo choreomeningitis is a new virus recently identified in England. "B" virus occurs in monkeys under natural conditions and has been known to cause disease in at least two laboratory workers who were bitten by monkeys and presumably also in a former king of Greece.

The eleven known viruses that attack the nervous system are as different and distinct from each other as are the germs of tuberculosis, typhoid fever and pneumonia, and the viruses, even though they can not be seen under the microscope, can be identified with as much certainty as the tubercle bacillus. The identification is made by determining whether or not the unknown virus can produce disease in monkeys, mice, guinea pigs and rabbits and by estimating its approximate size from its capacity to pass certain filters and by the changes it produces in infected cells.

All these viruses except those of infantile paralysis, rabies and herpes have been isolated, recognized and identified within the past five to ten years.—JANE STAFFORD.

TRANSPLANTED EYES IN SALAMANDERS

EYES of various kinds of animals have been successfully transplanted, with return of vision, in experiments reported in a lecture in New York City by Professor L. S. Stone, of the School of Medicine of Yale University. Most of the work has been with salamanders, long-bodied relatives of frogs and toads. The transplants were made at all ages, from embryo to adult.

While the transplanted eyeballs grew into place successfully, the regaining of vision was a somewhat roundabout process. The severed ends of the optic nerve did not unite. Instead, there was a new growth of both nerve and retina, and vision was restored when this process was completed, after about two months. The same eye, Professor Stone stated, has been repeatedly grafted, with return of vision each time. He has even exchanged eyes between salamanders of different species.

Thus far, experiments with mammalian eye transplants have not been successful. When rats' eyes were transplanted, they degenerated and were resorbed into the animals' bodies, the process taking about four months. Resorption also occurred in fish with transplanted eyes.

"At the present time the opossum is being studied as the most promising mammal for eye transplantation. At birth the young are embryonic. The eye is so primitive at this time that it is in the same stage of development as a five-weeks-old human embryo. This condition

lends itself to an experimental analysis in a way that is not possible in any other mammal."

In operations on the eyes of embryo salamanders, Professor Stone learned some new facts about the factors influencing normal eye development. The experiments showed that the formation of the lens was dependent on the action of the optic centers growing from the primitive nervous system, and that the lens could be primarily governed by an early interference with the factors underlying the primitive nervous system. "So far as we know," he said, "all vertebrate eyes, with the exception of a small group of salamanders, have no power of restoring a lost lens. . . . The common vermilion-spotted newt is an example of the rare group which has the ability to replace the completely excised lens by a growth of cells from the pupillary margin of the dorsal rim of the iris."

HUNGER SIGNS IN CROPS

A NEW book, "Hunger Signs in Crops," written by a committee of fourteen specialists and edited by Gove Hambidge, has been published by Judd and Detweiler. It describes and depicts in color some of the principal types of malnutrition in plants and tells what can be done about them.

Different plants naturally show different symptoms for the lack of any given mineral element, but there may be at least some general resemblances. Thus nitrogen starvation manifests itself as a yellowing of the leaves in several different species; most prominently along the midrib, in corn; entire lower leaves on the stalk, in tobacco; a dirty yellowish-green tinge, in cotton leaves. Other deficiencies also manifest themselves in this similarity-with-differences pattern.

Of particular importance is research on the effects of a shortage in the so-called trace elements—mineral nutrients needed only in exceedingly minute amounts, but indispensable in those amounts. Until a few years ago, it was thought that plants needed only seven mineral elements: nitrogen, potassium, phosphorus, sulfur, magnesium, calcium and iron. Needs for the first six of these are measurable in scores or hundreds of pounds per acre of crop.

But to the seven elements of classic plant physiology there have now been added another six: manganese, boron, chlorine, iodine, zinc and copper. The need for these, per acre of crop, is measurable in ounces: the equivalent of a quarter of a pound of borax, enough iodine crystals to make up one ounce of tincture, and so on. Discovery of the necessity of these trace elements has been so recent, and research results are still coming in so fast, that all statements about them must still be regarded as provisional. This new book, however, does bring together all pertinent present information on the subject.

ITEMS

SAMPLES of what the interiors of the hottest stars may be like are produced in the laboratories of the National Bureau of Standards, was reported by Dr. F. L. Mohler, to a meeting of the Society of the Sigma Xi in Washington on May 15. By suddenly discharging 40,000 kilowatts

of electrical energy through a quartz tube with a one tenth inch bore, a spark was obtained lasting only five millionths of a second, but nearly 50 times as bright as the sun while it lasted, and having a temperature of 45,000 degrees Fahrenheit. New understanding of the properties of matter at extreme temperatures is expected to result from these studies.

THE capacity of the Goodrich synthetic rubber factory at Akron is being increased from 6 to 18 tons per day, was announced by John L. Collyer, president of the B. F. Goodrich Company, on May 15, while speaking as a guest on Science Service's Adventures in Science radio program over the Columbia Broadcasting System. This kind of synthetic rubber, called Ameripol, is made from petroleum, soap, natural gas and air. About a year ago the first synthetic passenger car tires made of this substance were offered to the public. American motorists have purchased at premium prices several thousand tires and several hundred leading corporations are equipping light trucks and company cars with such tires in order to get first-hand experience for use in the eventuality that natural rubber is cut off by the war. Synthetic rubber is also being used in de-icers for airplane wings and in gasoline tanks that seal themselves after being punctured by bullets.

STARLINGS, long a pest in the East, have apparently become firmly established in the Rocky Mountain region. S. W. Gadd, ornithologist of Colorado Springs, states that Colorado was entirely free of them until the winter of 1938-39. Then a group of about 75 was discovered on the South Platte watershed north of Denver. Now they are spreading into the city in large numbers. "Recently I found a flock of starlings at the Johnson reservoir, just south of Colorado Springs," says Mr. Gadd. "It is safe to predict that starlings will soon become a major worry in the Pike's Peak region and the eastern Rockies generally."

A TINY baby is governed by the natural laws of physics and chemistry just as is a molecule or a crystal. Showing a motion picture film entitled "Infant Eyes and Hands," and starring diminutive actors and actresses younger than is the normal baby at birth, Dr. Arnold Gesell, of the Clinic of Child Development of Yale University, described how the complicated patterns of human behavior are produced by the same factors and forces that are being investigated in the biochemical laboratory. "Behavior has shape in the same sense that limb-bud and finger prints have shape." And shape, he said, has the same origin for patterns of mental behavior as for bodily behavior. Long before the baby comes into the world, he begins to show human behavior. More than seven months earlier than normal birth, its behavior begins to assume characteristic forms and patterns. His development follows an orderly sequence which is not disturbed by premature birth. What the baby who is prematurely born can do is approximately the same as the behavior of an unborn baby of the same age; it is not like the behavior of a full-term baby born at the same time.