SCIENCE NEWS

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THE BRIGHTNESS OF THE SUN AND MOON

DR. WILLIAM A. CALDER, of the Harvard College Observatory, has made pioneer determinations of the brightness of the two bodies with the electric eye or photocell, showing that the sun gives off only about seven tenths of the radiation it should, but, on the other hand, that the moon has been found to be slightly brighter than has heretofore been believed.

Harvard astronomers said that the research gives the first indications they have had that the sun is below normal. An exact measurement of the sun's brightness is highly important because the sun is used as a standard for measuring and describing the energy emission and luminosity of more distant stellar bodies.

The new value obtained for the sun's magnitude by Dr. Calder is minus 26.32, four tenths of a magnitude dimmer than the value derived in 1916 by Dr. Henry Norris Russell, of Princeton University, and used by astronomers all over the world since that time. Astronomically speaking, this is a large correction, indicating that the sun emits thirty per cent. less radiation than is normal for a star of its type. The sun is astronomically classified as a "G zero dwarf" star, signifying one predominantly yellow and of relatively low brilliance. Dr. Calder urges, however, that his new value "be taken with caution" because of the important implications of his results.

This new value for the luminosity of the moon is also considered highly significant, and Harvard astronomers said that the finding of a greater reflecting power than was suspected "has probably unsnarled one of the minor mysteries of this body." Previous research had indicated that the moon's surface was made up of a very dark material with low reflecting power, technically known as an albedo of .07. Other investigators have held that the surface was composed of rocks of more normal reflecting power. Dr. Calder's work supports this latter view, giving the surface of the moon an albedo of .12, close to that of ordinary rocks.

For the moon's magnitude, Dr. Calder has determined the figure minus 12.66, slightly higher than the generally accepted value of minus 12.55. He has also found that the sun and moon are of virtually the same color, and that the moon is not more reddish as has been suggested.

The new values were obtained by comparing the sun's light with that given off by first-magnitude stars, among the brightest in the heavens, but only about a hundred billionth the brightness of the sun as viewed from the earth. Both were compared wtih a standard lamp, the sun in the day time and the stars at night, with the lamp 500 feet away. Stars used were Vega, in the constellation Lyra, Deneb in the Swan and Capella in the Charioteer. Measurements of the light of the full moon were conducted in a very similar manner.

SOME PAPERS READ BEFORE THE FIFTH INTERNATIONAL CONGRESS OF RADIOLOGY

RADIOLOGY, the study and use of x-rays, radium and other radiations, is a comparatively young science, but reports to the International Congress of Radiology held this week in Chicago show the enormous strides it has made.

The two-fold benefit from x-rays was described by Dr. William J. Mayo, surgeon and co-founder of the Mayo Clinic at Rochester, Minn. The first value of x-rays to be recognized was its aid as a diagnostic tool. Man's superior power over all other animals, Dr. Mayo said, comes from the fact that he has a visual brain and gets his truest knowledge from his eyes. The compound microscope, which enables man to see the tiniest cells in his own body as well as the disease germs that attack it, was "the most significant contribution of all time, which was to revolutionize medicine and change the history of mankind." X-rays were an important step further forward in letting man see the invisible. Besides its contribution to medicine, radiology has gone even farther, developing methods, not only for breaking the cell up into atoms, but for dividing atoms themselves into their component parts. Along with the new knowledge radiology has given has gone its new use in treatment as well as diagnosis of disease. Many cases of cancer that have advanced beyond the point where the surgeon's knife can safely cut them out are curable by x-rays or by the gamma and beta rays of radium.

APPLYING heat to the area that has been x-rayed should hasten the destruction of cancer cells, while chilling the area x-rayed should lessen the danger of skin burns from the powerful rays. These tips, of probable value to physicians treating cancer and other conditions with x-rays, were gained from studying the effect of another kind of rays, ultra-violet, on a protein like egg white. The study was reported by Dr. Janet Howell Clark, of Baltimore. Dr. Clark studied the effects of radiation on proteins because these chemicals are found wherever there is living matter, so the way they react to radiation gives a good indication of how living tissue, normal or cancerous, may react. The effect of the rays on proteins depends, Dr. Clark found, on the nature of the protein, whether it is in acid or alkaline solution, and the salts present. One change, called denaturation, occurs in all protein solutions when exposed to radiation, regardless of temperature, alkalinity or acidity. Denatured protein can not act as a constituent of a living cell. Denaturation must be followed by an increase of temperature before the next change, visible flocculation, takes place. Denaturation of the protein in a living cell may be enough to kill the cell, but this is not yet definitely known. Further study

is needed to clear up this and other important points about the effect of radiation on cell life. Experiments have shown, however, that when cells are kept at low temperatures after radiation they show less injury than cells kept at higher temperatures. This, Dr. Clark suggested, may have applications in x-ray and radium treatment.

PNEUMONIA due to oily substances being drawn into the lungs is "not uncommon," according to Drs. Ralph S. Bromer and Irving J. Wolman, of the University of Pennsylvania. Cod-liver oil, mineral oil or liquid petrolatum, poppy seed oil, olive oil, sesame oil and even cream are among the oily substances which have caused the condition, known as lipoid pneumonia. The oil may get into the lungs from the nose, or from the throat if the child does not swallow properly, especially if he is resisting it. The mild vegetable oils caused the least reaction while cod-liver oil, lard and other animal fats caused sudden, violent reaction in the lungs with bleeding and tissue destruction. Liquid petrolatum or mineral oil caused proliferative pneumonia. X-ray diagnosis can be made in severe cases, but in moderate and mild cases serial x-ray pictures and an accurate history of the case are needed for positive diagnosis. The need for serial x-ray pictures was emphasized. In a series of 27 cases at the Children's Hospital, Philadelphia, 16 patients had had x-ray pictures made, but the diagnosis of lipoid pneumonia was made in only one case. Twenty-two of the 27 patients died.

DR. LEO G. RIGLER, of the University of Minnesota, stated that x-rays may help in determining whether twins and triplets are identical, originating from a single egg cell, or fraternal, each coming from a separate egg cell. He reported one of the few extensive x-ray studies made of the characteristics of twins and triplets. X-ray examination shows, in the case of twins or triplets originating from a single egg, striking similarities in the rate of development of the skeleton, form, size and position of the bone formation centers and of the paranasal sinuses, size and shape of the heart, and other anatomical features.

"THE third great contribution" of x-rays to medicine and related science is their ability to show the ultimate nature of living material, Dr. G. L. Clark, of the University of Illinois, told members of the congress. The arrangement of atoms and molecules in both living and non-living substances can be determined by the technique of x-ray diffraction. Such knowledge of the arrangements of molecules in living nerves and in blood substances concerned with the transport of life-essential oxygen through the body promise aid in solving some of the most complex biological problems.

X-RAYS kill living cells by suffocating them, it appears from studies reported by Drs. Hillyer Rudisill, Jr., and J. Hampton Hoch, of the Medical College of the State of South Carolina. The findings, in the opinion of the investigators, also show why cancer cells are more susceptible to x-rays than normal cells, and may "supply the successful answer to the question, Why cancer?" Yeast cells were used in the studies. When these cells are x-rayed certain coenzymes essential for the breathing process of the cells are inactivated by the nascent hydrogen and hydrogen peroxide produced by the x-rays. Once the coenzymes are inactivated they can not play their part in the complicated mechanism by which cells get their oxygen, and thus deprived of oxygen the cells die. The inactivated coenzymes can not be reactivated. Cancer cells, like actively growing cells such as are found in embryonic tissues, have a "greater speed of life" than normal cells, Dr. Rudisill pointed out. It is this, he believes, which accounts for their greater sensitivity to x-rays and radium. Nothing is known of how the cell produces the coenzymes that help it to breathe and the substances which normally protect the coenzymes from destruction are also unknown. Investigation of these two points are likely to answer the question of why cancer develops.

A NEW x-ray and gamma ray generator which can be put in almost any ordinary room and which has a radiation output equivalent to the million-volt x-ray tubes or to two and one half pounds of radium, with a value of $25,000,000, was described by Dr. A. Bouwers, of Eindhoven, Holland. Developed for atom-smashing experiments, the generator may prove valuable for the treatment of cancer and other conditions which are benefited by ray treatment. A generator for the production of neutrons, the new atomic particles without electric charge discovered in 1932, was also described.

FURTHER PAPERS READ AT THE ROCHESTER MEETING OF THE AMERICAN CHEMICAL SOCIETY

FATS, one of the means by which the animal and human bodies store surplus energy against an emergency, have a short life inside the body. Half of a mouse's stored fat is replaced in five to nine days. Even vital substances, such as cholesterol, which have been believed to remain stable inside the body, do not last long. Although the total quantity of fat may not change, new fats are being manufactured continuously to take the place of fats which are just as continuously being broken down. This in substance is the latest chapter in the story of life which "tagged atoms" told Professor Rudolf Schoenheimer and Dr. David Rittenberg, of the Columbia University College of Physicians and Surgeons. Professor Schoenheimer reported details of the study at the Rochester meeting of the American Chemical Society. Heavy hydrogen, whose discovery won Professor Harold C. Urey, of Columbia University, the Nobel Prize two years ago, furnished the "tagged" tracer atoms that enabled them to follow what happens to food inside the body.

PREVENTION of dreaded blood clots, an often fatal condition known medically as thrombosis, may now be nearer at hand. This appears from research reported by Dr. Erwin Chargaff, of the College of Physicians and Surgeons, Columbia University, at a meeting of the society.

By combining a small amount of sulfuric acid with a wax-like substance found in the brain, Dr. Chargaff obtained a substance which very markedly checks the clotting of blood. The material is called cerebroside sulfuric acid, and this is the first time it has been made in the laboratory.

SUPER-GASOLINES that four years ago were so rare they cost $30 a gallon will next year be made in a production of over 18,000,000 gallons. The government is purchasing that amount for the Army, Navy and other branches to increase the performance of airplanes in the federal air service by 30 per cent. Bombing planes that now could carry 2,000 pounds of bombs will be enabled to carry 3,000 pounds of their deadly missiles with the new 100 octane number fuels. Dr. Gustav Egloff, of the Universal Oil Products Company, reported the potentialities of these new fuels that the chemist is developing. If the engines of the great *China Clipper* were designed to use these newest fuels the increased payload possible would be worth $2,000 on each single trip between Alameda and Honolulu. Iso-octane is a synthetic fuel that is improved in its burning characteristics over any thing which nature produces. Normal octane, said Dr. Egloff, burns too rapidly in a motor of a modern automobile or airplane, because its eight carbon atoms are strung out in line. During combustion in the cylinder of a motor the flame rushes rapidly down this straight line of atoms and produces the engine knock known so well to motorists. What the chemists have done with the new iso-octane fuels is to introduce a chemical "maze" through which the flame spreads more slowly, as though it seems to be bewildered. The maze in reality consists of carbon atoms branching off from the main chain. The slower burning yields less engine knock at higher compression in the cylinders of a motor. And higher compression means more power per gallon of fuel. While this added power is valuable for automobiles it is most vital to increase the payload of airplanes whether in passengers, freight or bombs.

ARTIFICIAL fever and an apparatus working like the so-called "iron lung" in reverse are now making possible new studies on what happens when anmials like dogs, cats and rabbits use their specialized type of respiration known as panting. Allan Hemingway, of the School of Medicine of Yale University, described how the animal's intake of air was measured by the "reverse" iron lung. The animal lies in the metal chamber with only its neck protruding through an air-tight seal. Every time it breathes it forces air in and out through special valves. The flow of air can be accurately measured. While in the chamber it is subjected to artificial fever from diathermy machines. Soon the animals start panting to establish a constant body temperature despite the excessive heat. Faster and faster the animal inhales and exhales the air to evaporate moisture from the tongue, mouth tissues and the upper part of the throat. Only these small areas provide the surface by which the animal must maintain even temperature. In man and horse, in contrast, sweat glands all over the body secrete water whose evaporation controls body temperature. The object of the experiments was to study the effect of the rapid flow of air on the blood in the dog's panting method of keeping cool. One bad effect is that a too rapid air motion can blow carbon dioxide out of the blood. Some carbon dioxide is needed in the blood stream in the form of the mild carbonic acid. When the carbonic acid content of the blood is reduced to normal acid—alkali balance in the blood stream is changed. In severe cases of carbon dioxide loss tetany develops; a morbid state characterized by intermittent muscular spasms.—ROBERT D. POTTER.

ITEMS

TUBERCULOSIS of cattle is almost wiped out in the United States, with the exception of the state of California, where infection is still wide-spread and heavy. East of the Sierras, the U. S. Department of Agriculture's bovine tuberculosis map is "all white" except for relatively light occurrences in South Dakota, New York and New Jersey.

MAUNA LOA, 13,675-foot volcano on the Island of Hawaii, is due for eruption soon, according to a prediction made by Dr. T. A. Jaggar, volcanologist of the U. S. National Park Service. He expects it to be a lava eruption, and does not look for destruction of property or loss of life. Hualalai, another major volcano on the island, may also go into action. Hualalai has been inactive since 1801, when it ended a prolonged eruptive period of 22 years. Brother Othmar, astronomer at St. Louis College, likewise is of the opinion that Mauna Loa or Kilauea will burst into eruption shortly. E. K. Martin, U. S. Weather observer, adds statements by old natives of "volcano weather" to his prediction of likely volcanic action.

A NEW process for drying vegetables that first soaks them and then dries them for storage more thoroughly and rapidly than any other process has been perfected by chemists of the government and of the Chemical Foundation. Chemicals which do not harm the vegetables or fruits are added as the first step in the process, so that they will soak up large quantities of water. The food is then pressed to extract its juice and the pressed residue dried for storage. Potatoes and other fleshy plants can be satisfactorily dried for storage by this method, it is believed. There has previously been difficulty in pressing out all the moisture from potatoes; as a result they frequently sprouted when in storage or were damaged by freezing. The discovery was made by Dr. E. F. Hopkins, of the Chemical Foundation, while he and other investigators at Laurel, Miss., were studying methods of preventing changes in sweet potatoes put into storage. Toluene, chloroform, ether, benzol, petrol ether, carbon tetrachloride, sulfur dioxide and chlorine are a number of the chemicals which can increase the vegetable's ability to absorb water. Increasing the water content of foods makes pressing out juices a more efficient process. Rapid drying at relatively low temperatures is a property of the food residues obtained in this way. Pressed residues dried thoroughly in 36 hours at room temperature.