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by **A. Guilliermond**, Prof. of Botany at the Sorbonne, Paris, authorized translation by **L. R. ATKINSON**:—A critical review of our present knowledge of the cytoplasm, the plastids, chondriosomes, vacuome, microsomes, vital staining, etc., by the eminent French cytologist. — A New Series of Plant Science Books, edited by **FRANS VERDOORN**, Vol. 6, 247 pages, 156 ill., buck., autumn 1941.

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THE DISTANCE OF THE SUN FROM THE EARTH

ASTRONOMERS were considerably shocked to find, according to their most recent measurements, that the sun is more than 100,000 miles farther from the earth than was previously supposed. These measurements now give its mean distance as 93,003,000 miles in place of the formerly accepted 92,870,000 miles.

The layman is not likely to get unduly excited over this correction to the figure that has never meant much to him, but to the astronomer it is of the utmost importance. The sun's mean distance is the astronomer's yardstick by which he measures everything else in the universe. He calls it the astronomical unit and writes it AU. Any change in this unit means that every other dimension in the universe has to be changed.

On this unit depend our figures for the masses of the earth, sun and moon, and on these depend in turn the accuracy of tide predictions and of navigations. Because of its importance, astronomers have been measuring and remeasuring it from the time when the Greek astronomer Aristarchus made the first attempt two and a half centuries before the birth of Christ down to the present time, always striving for greater and greater accuracy.

Evidence of the care and labor expended on this task is the fact that the present figure was arrived at after ten years of calculations. They were based on thousands of observations made on the asteroid Eros on its last close approach to the earth in 1931, when it came to within 16,200,000 miles of us. The calculations were made by Dr. H. Spencer Jones, astronomer royal of England, and were announced at the June and July meetings of the Royal Astronomical Society. They have now been reported in the first issue of the new magazine, *Sky and Telescope*, issued from Harvard College Observatory. The long time consumed in the calculations was due to the fact that the material was gathered from all over the world, and much of it was late in coming in.

But, after all the trouble and labor, the new figure is not yet definitely accepted by astronomers. The calculations so far have been purely geometric—they have involved only angles, lengths and positions. The same data can be used to determine the gravitational attractions or perturbations of the sun and earth on Eros during the time of its close approach. These give new measures of the masses of the sun and earth from which the distance can be determined. This gravitational method is considered even more accurate than the purely geometrical one. Its results must be awaited before astronomers can make a final decision as to the value of the unit.

DAILY VARIATIONS IN THE HEAT OF THE SUN

THE floor of the stratosphere, tropopause, may shift up and down from day to day, in response to daily variations in the sun's heat. This in turn may have far-reaching effects on world weather. Indications that these

fluctuations are influenced by solar radiation changes have been brought out in researches of Dr. Henryk Arctowski, the Polish meteorologist who is now working at the Smithsonian Institution.

The occurrence of daily fluctuations in the sun's heat was established as a fact long ago, by Dr. Charles G. Abbot, secretary of the Smithsonian Institution. The scope of these variations is frequently as much as half of one per cent., and occasionally much more than that. These variations occur in a complex series of cycles.

If the earth were without an atmosphere, like the moon, changes in solar heat would be felt immediately at the earth's surface. But the sun's heat has to pass through a hundred-mile blanket of air to reach the ground, so that its effects are delayed and complex. Winds, clouds and other factors all have far-reaching effects in the distribution of radiations coming to us from the sun.

At some place, however, it is necessary to look for direct effects of solar radiation. According to Dr. Arctowski, the most probable place is the tropopause—the level where temperature decrease with altitude comes to an end. His researches indicate that solar radiation variations cause changes in the height of this surface over the tropics, where it normally is about 12 miles high, and that these changes proceed northward and southward in wave-like motion.

An up-and-down movement of the tropopause, in turn, causes a variation in the height of the highest clouds and in the movements of air masses. These in turn produce different rainfall effects in various parts of the earth.

METEOROLOGISTS AND NATIONAL DEFENSE

METEOROLOGISTS watch the skies now-a-days with first thought for national defense. They have postponed "for duration" many important research projects and are devoting themselves to the training of field observers for the Army and Navy, and to the instruction in such parts of their science as will enable aviators to fly better. These and other contributions of meteorologists were pointed out by Professor Charles F. Brooks, head of Blue Hill Meteorological Observatory of Harvard University, at a symposium on Science and Defense by the American Association of Scientific Workers. Dr. Brooks estimated that perhaps a quarter to a half the time of meteorologists in the United States is now being devoted to defense activities. There are those in the armed forces and civilian instructors in the numerous schools for airplane pilots and navigators who are devoting all their time to the defense effort. There are those in the five universities and technical schools who are devoting practically all their time to training hundreds of cadet officers to become weather forecasters. There are probably 50 or 100 meteorologists among the instructors in the C.A.A. courses at 1,000 institutions of higher learning throughout the country. The U. S. Weather Bureau is working on many projects at the behest of the Army or Navy, and its general forecasting

service is used directly or indirectly by the people of the United States, including defense workers, while special forecasting in connection with particular defense needs is much in demand. There are, indeed, few meteorologists whose time is not being devoted in part to defense.

Deflection of research effort to problems of immediate defense significance is felt most acutely in the fields of pure research. Professor Brooks pointed out that it is exactly this kind of research that in the end pays the biggest, though often the least foreseen, dividends. This handicap is partly offset, however, by the intensification of research in certain other applied lines, and in the increase in facilities which are being made available because the defense program calls for their use. Results thus obtained will not be confined to defense, nor will the benefits gained be discontinued with the cessation of the national emergency.

DEATHS FROM TUBERCULOSIS

DEATHS from tuberculosis have decreased more swiftly among industrial groups than among the general population, was reported by Dr. L. U. Gardner, director, the Saranac Laboratory, at the opening session of the sixth annual meeting of the Industrial Hygiene Foundation of America.

Dr. Gardner's statement was based on careful studies by 30 observers in different industrial environments. It was made to refute "a growing tendency to account for a freshly discovered case of tuberculosis as a product of industrial environment."

"A low standard of living, rather than specific environmental factors, is responsible for most of the tuberculosis among wage earners," Dr. Gardner said. "For example, the influence of nutrition, fatigue, extremes of temperature and humidity and specific intoxications such as lead, were discussed and it was agreed that only nutrition had an appreciable effect upon tuberculosis incidence among workers."

Dr. Gardner found that of the respiratory irritants, including fumes and gases, as well as dusts, only free silica has a specific influence upon the disease. To illustrate the negative tubercular effects of a pulmonary irritant, Dr. Gardner cited an experiment in which guinea pigs with super-imposed tuberculosis were exposed to arc welding fumes.

A control group of tubercular animals was not exposed. It was discovered that in spite of severe inflammatory reaction in the lungs due to the welding fumes, the exposed animals recovered from tuberculosis as well as the non-exposed controls.

Another group of guinea pigs—200 were used in all—was infected with the same type of tuberculosis, and at subsequent intervals of four, six and eight months, exposed to the fumes. The preformed healing tubercles in the lungs were not reactivated by the fumes as was the case when the animals were exposed to quartz dust.

TOOTH DECAY AND PYORRHEA

TOOTH decay, one of the commonest of dental diseases, may be due to a deficiency of some of the vitamins in the B group, it appears from laboratory experiments reported

by Dr. Hermann Becks, professor of dental medicine at the Hooper Foundation for Medical Research, University of California, and Dr. Agnes Fay Morgan, professor of home economics at the university.

Dogs on a diet lacking one of the B vitamins developed tooth decay, normally absent in dogs. The B vitamin lacking was the filtrate factor. Its function is still a mystery. When the dogs' diet was deficient in nicotinic acid, the animals developed pyorrhea and severe bleeding of the gums. A third, or control group, on a balanced diet, developed no decay or pyorrhea.

Dr. Becks makes no attempt to fit his findings to human tooth decay since he worked only with dogs. "On the other hand," he points out, "clinical experience has already produced excellent results with certain vitamin B fractions in the treatment of Vincent's disease, an infection of the mucous membrane, and other inflammatory diseases of the mouth. Ulcer formations of the tongue and inside the cheek have been successfully treated by the administration of nicotinic acid."

Dr. Becks said that the experiments provide a most encouraging link between carbohydrates and dental decay. The body converts carbohydrates into sugars. It is well known that vitamin B is necessary for the correct assimilation of sugars. However, a large percentage of the foods of the modern diet have the vitamin B removed in processing. This leaves the body, including the teeth, without protection against the harmful effects of sugars which do not contain vitamin B.

Dr. Becks and other research dentists have shown that there is a direct relationship between tooth decay and a bacillus, called *Lactobacillus acidophilus*. The number of bacilli found in the mouth has been found to be in direct proportion to the amount of sugars and carbohydrates consumed, that is, sugars and carbohydrates which have the vitamin B removed in processing.

Dental decay, like the common cold, is one of the mysteries of medicine. The American Dental Association has provided a fellowship for dental research at the National Institute of Health, the U. S. Public Health Service, to help to solve this problem.

THE MOLD PENICILLIUM

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FOR most human beings the age of cannibalism is over. But not so with microbes. One eats another with the careless abandon of a vegetarian tucking into his beans. This cannibalism amongst microbes has led to a discovery by British investigators of profound importance to doctors and patients the world over. The story is found in recent issues of two British medical journals. It opened some years ago in the department of bacteriology of one of London's largest teaching hospitals, St. Mary's.

Professor A. Fleming was engaged in his daily routine work in his bacteriology laboratory. He was growing colonies of different germs on specially prepared plates. One of his plates he noticed was contaminated by a mold, not unlike the molds that grow on stale bread or cheese or sausages. This too is a common occurrence in a laboratory, for one of the most difficult tasks is to grow germs pure and uncontaminated.

Most of us would have removed the mold and started again, but Professor Fleming went one better. He allowed the mold and germ to remain on the plate, only to find that while the mold was there the germ would not grow. In fact the mold killed the germ. This was the first, indeed the fundamental, discovery—if the microbe did not eat its fellow microbe it certainly killed it.

The professor pursued the matter further. He discovered that it was only some germs which found it impossible to live side by side with the mold. So whenever he wanted to get rid of one of the germs he knew the mold could not live with, he added some mold to his plates. He exploited their known unneighborliness.

So far the discovery was interesting, but not of great importance. Then came the suggestion that this mold, *Penicillium*, might be used to kill germs which were actually in the human body. Could not the germ-killing substance which *Penicillium* contains be used as an anti-septic to kill germs inside the human body?

Professor Florey, of the University of Oxford, headed a team of workers to tackle this problem. After many experiments they succeeded in extracting from the mold the substance in it which possesses the antiseptic quality. From the mold *Penicillium* they extracted the germ-killing substance penicillin. This done, further experiments soon showed that penicillin was the most powerful germ-killer both inside and outside the body, superior even to the latest drugs. That is saying a great deal, for in recent years medical science has made enormous strides in anti-septic drugs.

Prontosil, sulfanilamide, M & B 693, sulfathiazol—already these new drugs all in the same big family have saved thousands of lives. In pneumonia, meningitis and in severe infections of many kinds they have been found to be immensely useful. But penicillin goes one better—it is both the strongest and the safest germ-killer yet discovered. It does its work even when diluted to the astonishing extent of one in a million. It can be given by mouth or injected directly into a vein. Most important of all, it kills the germ inside the body without harming the body itself. Its work of germ-killing done, it passes through the body into the urine, from which it can be extracted by the chemist and used again.

There is one snag. Although there are plenty of molds in this world, there is not enough *Penicillium* mold of the right kind to give us large quantities of penicillin. That difficulty may not prove insuperable. Research is now being undertaken to discover other sources of penicillin. Its chemical composition is being investigated in the hope that chemists may be able to manufacture it artificially in the laboratory.

We do well to remember that the value of lemon juice in preventing scurvy was known before vitamins were ever heard of. But when it was found that lemon juice prevented scurvy because it contained vitamin C, the chemists got busy and made the vitamin artificially in their laboratories. Let us hope that the story of penicillin is the story of vitamin C. Hopes are very high. *The British Medical Journal*, known for its cautious attitude, has gone so far as to say that penicillin is to other anti-

septics what radium is to other metals. In view of that praise it is not too much to say that St. Mary's Hospital, London, and the University of Oxford have made a most important contribution to human knowledge.—CHARLES HILL, *Deputy Secretary, British Medical Association*.

ITEMS

THE earthquake that damaged Los Angeles suburbs early on the morning of November 14 had its epicenter directly under the damaged areas, or at least very near them, in the opinion of seismologists of the U. S. Coast and Geodetic Survey. They also believe that its intrinsic force was not very great. This opinion is based on the rather local distribution of the damage. Had the earthquake been a really violent one, with its epicenter at some distance, the damage would have been more wide-spread. It seems to have been similar to one that occurred in the same general region on the night of October 21–22. It was a double shock, with a maximum force of 7, on the seismologists' scale of 10. The epicenter of this earthquake was at Keystone, near Wilmington, Calif. The U. S. Coast and Geodetic Survey has a number of special pieces of apparatus, known as strong-motion instruments, which are distributed at Los Angeles, Hollywood, Pasadena, Long Beach and other points in the Southern California region. These are so set that they begin to record earth motion only after an earthquake actually begins.

THE Federal Bureau of Investigation reports that it has deciphered the contents of a 100-year-old American history document sealed in a bottle and buried. Several of these bottled documents have been unearthed recently by the Louisiana Geodetic Survey from mounds along the Louisiana-Texas boundary. In all but one bottle the parchment had deteriorated. When the preserved parchment was sent to the FBI technical laboratory, experts first photographed the bottle from different angles, to obtain as much of the writing inside as possible. Then they removed the sealing wax and extracted the old parchment and photographed it immediately. It reads: "To mark the Meridian Boundary Between the United States of America and the Republic of Texas, this Mound is erected on this the 26th day of April 1841, six miles North of the 32nd degree of North Latitude." Names of officers of both republics who took part in the bottle-burying ceremonies along the border were inscribed below.

A "LOST HORIZON" constituting the boundary between the Age of Dinosaurs and the Age of Mammals has been found by paleontologists of the U. S. Geological Survey and the Smithsonian Institution in the Colorado mountains near Denver. The sequence from extinct reptiles to ancient mammals has been studied by Dr. R. W. Brown and Dr. C. Lewis Gazin, of the U. S. National Museum. The site is a mesa topped with a layer of basalt. About 200 feet down from this protecting cap of hard rock is a layer containing fossils of paleocene mammals, primitive flesh-eating creatures that roamed the earth about fifty million years ago. Below this is a layer of about fifty feet of barren rock, containing no fossils, and immediately below that is a stratum containing the dinosaur bones.