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THE AURORA BOREALIS

THE Aurora Borealis, least understood of heavenly phenomena, is not as distant from the earth as has previously been thought. Fifty to seventy-five miles from the ground is the height fixed in a report made to the Royal Society of Canada, meeting in Toronto on May 21, by Professor J. C. McLennan, Dr. Hugh Wynne-Roberts and Dr. H. J. C. Ireton, of the department of physics of the University of Toronto.

Utilizing the fact that the northern lights are visible farther south in eastern Canada than anywhere else in the northern hemisphere, the physicists photographed displays last January and February. They set up two observing stations near James Bay. One was at Blacksmith Rapids, 50 miles from Moose Factory, and the other at Coral Rapids, 30 miles farther south. The stations were connected by telephone lines and each was provided with cameras similar to those used in aerial surveying.

When the aurora was visible from both stations, the photographers focussed their cameras on areas of the sky selected by telephone, and took simultaneous pictures. The exact times were compared by telephone and checked against a master clock. Reference points in the heavens were provided by the stars, photographed on the plates at the same time. When the plates were developed and compared, the heights of shafts of light recorded at both places were calculated by the same triangulation methods used in surveying. In this case instead of a horizontal triangle, the physicists computed a vertical triangle with one side as the line joining the two observing stations.

The results show that the auroral flashes may occasionally lie 155 miles over the earth. Less than 100 miles is the usual height, however. This result agrees with similar measurements obtained in Scandinavia.

According to the Vegard hypothesis, the aurora is caused by the impinging of ultra-violet rays in the heavens on crystals of solid nitrogen. This view has long since been abandoned by physicists, however, and this report adds weight to the conclusion that some explanation other than the nitrogen hypothesis must be found for the aurora.

A GIANT DOUBLE STAR

THE greatest double star yet measured, 184 times as massive as the sun, was described before the joint meeting of the Royal Society of Canada and the Royal Astronomical Society by Dr. J. A. Pierce, astronomer at the Dominion Astrophysical Observatory at Victoria, B. C. Dr. Pierce's results were obtained with the collaboration of Dr. J. S. Plaskett, director of the observatory where he worked.

The star was first recorded at the great observatory at Mount Wilson, California, between 1920 and 1924, when preliminary spectroscopic observations were made on it. Further investigation of the star fitted into the research program of the Victoria observatory, and the announcement is the result of spectroscopic and other photographs made with the 72-inch reflecting telescope there.

Like all double stars, the newly-measured giant consists of two great glowing spheres, instead of a single one like our sun. These constantly circle round each other, the period for the full circuit in the present case being 56 days. The two component spheres are of unequal size, one being 134 times as massive as the sun, the other only 50. The star is receding from the part of the universe we are in at the rate of nearly five miles a second.

STUDY OF YEAST CELLS

NEW facts on the chemical control of the life processes of the yeast cell were reported to the Royal Society of Canada, on May 21, by Dr. Helen Stantial and Dr. W. Lash Miller, of the chemistry department of the University of Toronto. They have found that acetate of soda and certain sugars will send yeast into a spore or sleeping stage.

It was Dr. Miller who two years ago surprised biological investigators by announcing at a meeting of the Royal Society the chemical formula for a substance, similar to but not identical with the vitamins, which is necessary for the growth of yeast.

Dr. Miller chose yeast cells because each microscopic yeast plant is composed of only one cell. This simplifies the investigation. Yeast cells, less than a thousandth of an inch in diameter, can be brought up in large families all alike, and they can be watched at work under the microscope. Their activity shows itself by certain chemical changes which can be found by analysis. In addition to being easy to work with as material for biological experiments, the yeast cell goes through the same changes as the cells of larger living things.

Dr. Stantial and Dr. Miller can now do some of the things by means of lifeless compounds for which elusive vitamins, extracts of glands or blood serum preparations were thought necessary. They have discovered that yeast grown with grapefruit juice would readily form "spores," or go to sleep. This spore-forming behavior is sometimes resorted to by yeasts dried-up or deprived of food material. Analysis of the juice of grapefruit showed the constituents which serve as a sleeping powder. They are now inquiring whether yeasts which have "spored" can remember processes they have been taught. This experiment is of interest in the science of heredity.

Inosite, an alcohol, the magic compound previously announced as one of the essentials for growth, may be the agent which makes the cells break in two. On a diet containing insufficient inosite, giant yeast cells, or clusters stuck together, can be produced.

DIET AND CANCER IN MICE

DIET is not responsible for the development of cancer, it appears from experiments reported by Sir Leonard Hill to the British medical publication, *The Lancet*. Sir Leonard described his studies of mice on different diets and different beddings, which he conducted in the National Institute for Medical Research.

"Cancers have occurred indifferently in mice on all diets and on all beddings," he reported. "The significant influence has been age."

The mice were kept on five different diets as follows: an approximately natural diet for wild mice, consisting of barley, oats, wheat and fresh green food; a canteen lunch diet of cooked meat, vegetables with the usual amount of common salt, pudding and canned fruit; a canteen tea diet poor in vitamins, consisting of white bread, margarin, rock cakes and biscuits; a diet found to be the average one of Essex farm laborers, low in protein value, and the same diet of which a third had been browned by frying, in order to see whether cancer-producing products were produced in food by such burning. Some of the stocks of mice were fasted two days each week to determine whether abstinence had any effect on cancer-production.

While some of the diets had an effect on the size of the mice and their reproductive ability, there was no effect on the development of cancers. Cancers occurred spontaneously in the mice, two fifths of these tumors occurring in mice dying between the ages of one and one half and two years. Three years in a mouse corresponds to very old age in a man, Sir Leonard pointed out. About one third of the cancers occurred in mice dying between two and two and one half years.

Besides reporting his investigations of mice, Sir Leonard recounted observations on the relation of cancer and diet made by other investigators. In this connection he quoted a report of the Imperial Cancer Research Laboratory as follows: "There is no reliable evidence, experimental, statistical or clinical, which would indicate a causal correlation between cancer and the absence, or the presence, or the excess of any particular dietetic constituent. Sensational statements to the contrary are unfounded and ill-considered, and only serve to alarm the public."

INHERITANCE OF LONGEVITY

OLIVER WENDELL HOLMES'S advice to "advertise for a couple of parents both belonging to long-lived families" in order to live to a ripe old age has been tested actuarily by Dr. Raymond Pearl and his associates in the department of biology of the School of Hygiene and Public Health of the Johns Hopkins University, at Baltimore.

He finds that longevity is inherited and that there are scientific grounds for the widely prevalent idea that length of days tends to run in families. Preliminary results of his extensive studies of the inheritance of longevity are reported in the current issue of *Human Biology*, and they promise to cause geneticists to consider length of life as much an inheritable family trait as color of eye, shape of head, form of nose or other physical features.

Thousands of family history records collected by Dr. Pearl's department were used in the investigation. Using methods by which life insurance companies determine the life tables upon which they base their rates, Dr. Pearl reports, "that the expectation of life of sons of fathers dying or living at 80 or over years of age, is greater at all ages from birth on than the expectation of life of sons of fathers dying at ages between 50 and 79 years inclusive, and is still greater than the expectation of life of sons of fathers dying under 50 years of age."

In order to establish still more soundly the conclusions, Dr. Pearl also studied the expectation of life of parents of long-lived sons and daughters in comparison with the expectation of life of parents of short-lived sons and daughters. Many other similar actuarial comparisons were made.

Parents of children dying at 50 years or over live longer by 7 to 28 per cent. than parents of children who die under 50 years of age. Grandparents whose children live to over 50 years of age themselves by the life tables have lifetimes 7 to 59 per cent. longer than the grandparents with shorter lived children.

Over half a million years of life were contained in the records upon which the studies were based. Extensive pedigrees of over 100,000 members of white Baltimore families were available for the study, each record of which was obtained by a trained field worker.

Dr. Karl Pearson, the famous English biometrist, and Alexander Graham Bell, inventor of the telephone, made studies of the inheritance of longevity which Dr. Pearl considers are based on inadequate evidence and faulty methods, and therefore do not give a correct picture of the true relations.

EUROPEAN MUSEUMS

MUSEUMS in Europe are not only unlike those in America, but the museums of one European country differ from those of another country, members of the American Association of Museums were told at their meeting in Pittsburgh, on May 22, by Mr. Laurence V. Coleman, director of the association.

"Three quarters of Germany's 1,500 museums deal with folk-lore or history. A majority of France's 1,000 museums are devoted to art or archeology. Three fifths of England's 500 museums are general in character."

Most museums in Europe are owned and supported by local or national governments. Gifts of funds are not an important source of support for such institutions abroad. Museums in foreign countries are used in education rather differently from the United States usages.

"Museums are intimate expressions of the social order," Mr. Coleman explained, in accounting for the trend which museums have been taking in various countries. "We should expect, then," he added, "to find a close relationship between museum development and the course of society. A glance at history is almost startling in its revelations of the intimacy of this bond.

"Observe what social upheavals have done for art museums alone. The French Revolution produced the idea of museums for all the people. The industrial revolution made public institutions out of the private collections which the Romantic revolution had induced and it gave art museums an active rôle by setting them up as fortresses against invasions of the machine. The 'Financial Revolution' enabled the machine age to achieve new values, and thus it has induced museums for the first time since the Crystal Palace Exposition to look without fear upon their own day and time."

THE S-ROTOR

THE S-rotor, a new, simple and inexpensive type of windmill which, in addition to its chief duty as the world's most efficient harnesser of power from moving air, will ventilate buildings, generate power from the tides and draw smoke from stubborn chimneys, was described before the aeronautic division of the American Society of Mechanical Engineers, meeting in Baltimore, by its inventor, S. J. Savonius, of Helsingfors, Finland.

Mr. Savonius began work on the S-rotor several years ago after his interest had been aroused by the success of Anton Flettner, the well-known inventor of the rotor ship. To make an S-rotor, so named after similarity between its cross-section and the letter S, a Flettner rotor was cut in half vertically and the halves separated along the cutting plane. Thus a vertical rotor that will turn equally well regardless of the direction of the wind is made.

Although rotors of this type are more efficient than ordinary windmills, they cost no more to make. They are coming into wide use in Europe where one of the manufacturers is Anton Flettner, who is recouping some of the fortune consumed in the exploitation of his rotor.

As a ventilator, the Savonius rotor was said to be operating efficiently where ordinary cowls have failed. It develops uncommonly strong suction power. In the water the rotor operates the same way it does in the air, but since water is about 800 times as heavy as air the power generated is greater in proportion. One of its advantages as a tidal motor is that it always turns in the same direction regardless of whether the water is ebbing or flooding.

Mr. Savonius did not make exaggerated claims for his invention. He said that it is not suitable for power plants of such magnitude as those contemplated by Georges Claude in his recent experiments in Cuba, but that it is adapted to small and inexpensive plants working in a river or tidal creek and that as such it could extract a considerable amount of power for use in irrigation and for supplying light and power to farms and villages.

ITEMS

FIRE has destroyed the computing room of the Smithsonian Institution Astrophysical Observatory station on Montezuma Mountain, Chile, and as a result the study of the sun's radiation conducted by observers there will be delayed slightly. Each day on that mountain peak, nearly 9,000 feet above sea-level, two investigators measure the radiation of the sun, and cable the results to Dr. C. G. Abbot and his associates of the Smithsonian Institution. The solar constant so determined is distributed throughout the world by radio and promises to be a fundamental inconstant of nature, of use in making long-range weather forecasts. The fire loss just reported to Washington by Clay P. Butler, director, and Walter Watson, Jr., assistant, did not affect the actual observing instruments, but the loss of charts and records will prevent computation of the daily cable for about two weeks.

OBSERVATIONS of a comet at the great distance of 588,000,000 miles, or about 6.33 times the distance of the sun from the earth, have given astronomers ground for thinking that it will be observed completely around its orbit, and that it will return to the neighborhood of the sun without ever having been out of sight. A study of the Schwassmann-Wachmann comet, discovered last winter by two German astronomers, indicates that it will probably establish this new record, according to Dr. George Van Biesbroeck, of the Yerkes Observatory. When first photographed, on December 16, it was of the sixteenth magnitude, far too faint to be visible to the naked eye. A second photograph, made on February 11, showed that it had brightened to the twelfth magnitude, which is also much below naked-eye visibility. A month later it was again of the sixteenth magnitude. It is now so far away that it will probably not become greatly fainter. Only about two years will elapse before it reaches aphelion, the point of greatest distance from the sun.

STUDIES of rubber and cellulose are reported by Professor Kurt H. Meyer and Dr. H. Mark, of the I. G. Farbenindustrie A. G. By correlating the evidence from X-ray and chemical investigations with those of microscopic form it is now possible to have a clear idea of the arrangement of the atoms. It is easy to understand how a simpler substance like sugar, for instance, is built up as there the molecular units are laid regularly side by side like the bricks in a wall. The molecules of cellulose, the tough, fibrous material of wood, cotton, linen and paper or the carbon and hydrogen atoms of rubber, however, are linked together in a network resembling a sponge where it is difficult to say where one brick leaves off and the next begins.

THE whole width of the Pacific, from Mexico to the Philippine Islands, was traversed by a drifting bottle in about a year and a half, according to a report recently made to the U. S. Hydrographic Office. The bottle, which was picked up on February 23, in latitude 11 degrees 53 minutes north, longitude 124 degrees 10 minutes east, contained a paper stating that it had been thrown overboard by Second Officer C. E. Carlsen, of the American steamer *Castle Town*, on August 11, 1929, in latitude 18 degrees 38 minutes north, longitude 124 degrees 4 minutes west. It had drifted about 7,900 miles.