

BACTERIOLOGY

Germs From Sleeping Sickness Change Form Like Butterflies

THAT A METAMORPHOSIS or change in form similar to that of butterflies is part of the regular life cycle of certain germs, is suggested by the work of Miss Alice C. Evans, senior bacteriologist of the U. S. Public Health Service, who has investigated germs cultivated from cases of encephalitis.

This disease is sometimes called sleeping sickness because extreme drowsiness and lethargy are characteristic symptoms. Germs belonging to the family of streptococci have been recovered from these cases. These are small round germs, well-known to bacteriologists, and the cause of many diseases. They cannot pass through the pores of fine filters. Investigating these germs, Miss Evans was astonished to find them change into the long narrow germ known to bacteriologists as rods. Also, she found that sometimes these germs were able to pass through her fine-pored filters.

Thought They Knew

A few years ago, bacteriologists were certain they knew all about the lives and habits of the well-known germ families, like the streptococci. Some germs might be round and some straight, some reproduced by dividing or splitting and some by growing spores. But they all remained true to type all their lives, and did not change forms like butterflies and many other living creatures that spend part of their life cycle in one form and part in another.

In fact, bacteriologists were so sure of the stability of germ families that when they saw a rod-shaped germ growing in a family of round ones, they concluded that the rod was a contaminating organism that had gotten into the colony by mistake. For the most part they are right about this, but Miss Evans' studies led her to suggest that bacteriologists may for years have been seeing the rod-forms of round streptococci and mistaking them for contaminating organisms of another family.

Waver From Form to Form

The germs exist in the body either in the filterable form or in several different forms of bacteria, Miss Evans thinks. It is only with difficulty that the

germs living in the body can adjust themselves to growing on artificial material outside the body. For the first few days after they have been transferred from the body to the artificial growth material, they waver from one form to another. But once they are established on ordinary culture material, one form or the other grows and multiplies indefinitely without variation.

The rod-shaped form of the germ that Miss Evans investigated was more virulent in animals than the familiar coccus form. However, she could not conclude that one or the other form was the cause of the disease in humans.

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PHYSICS

Cosmic Ray Work Sped By Recording Electroscopes

WITHIN four months Dr. Robert A. Millikan hopes to determine whether latitude affects in small degree the intensity of the ray and exactly to what extent its effects vary with altitude at higher levels than those at which accurate measurements have thus far been made.

PUBLIC HEALTH

College Students Found to Have Three Colds Per Year

EACH COLLEGE student averages three colds a year. Members of families living at home, however, average only about half a cold a year, or one every two years.

The figures are from a study of the incidence and time distribution of common colds just published by the U. S. Public Health Service. The study was made by Dr. Wade H. Frost of the Johns Hopkins School of Hygiene and Public Health and Mary Gover, associate statistician of the U. S. Public Health Service.

The higher incidence of colds in college students might be due to conditions

of student life, or might be due to more accurate reporting on the part of the students.

Dr. Millikan is now making cosmic ray observations in the northern part of the United States after having made a scientific journey to northern Manitoba where airplanes of the Royal Canadian Air Force carried his electroscopes to altitudes of over 20,000 feet.

Dr. Millikan and his associate, Dr. Victor Neher, had previously made observations at Lake Arrowhead, 5200 feet high and some 65 miles east of the California Institute of Technology, of which Dr. Millikan is chairman of the executive council. They used both the older style of cosmic ray electroscope and the newer self-recording electroscope, designed by both scientists and built by Dr. Neher.

In ten years of research on cosmic radiation, Dr. Millikan has made observations in various parts of the world, both in the Arctic and at the equator; but he relies more on the observations made at Lake Arrowhead, at Pasadena, at Churchill, Manitoba, and at Pikes Peak than at his other observation posts. It is especially at Arrowhead that he has developed his technique of lake measurements, for Arrowhead is a body of water free from radioactive constituents and holds few minerals in solution, since its waters are derived from melted snow in the nearby mountains.

In making the observations, Drs. Millikan and Neher take their electroscopes and attendant apparatus, all weighing 900 pounds, out in small boats seven or eight hundred feet from shore in water 200 or (Turn to page 200)

Both at home and at college there were more colds in the period from September to March than in the April to September period. The latter half of July and the first half of August was the period in which there were fewest colds. The attack rates in the different student groups, which were scattered all over the country, were remarkably uniform, showing no consistent relation to latitude, longitude or climate.

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able piece of clockwork, which solves in an elegant way the problem of uniform motion in the particular case where there is no work to be done. Its success is so complete that every day I am able to start the mirror at 400 revolutions per second and to watch the two pieces of apparatus go in agreement of about 1/10,000 for whole minutes together.

Yet, in spite of having obtained such certainty on the side of measuring the time, I was surprised to find in my results discrepancies which were not in accord with the precision of the methods of measurement. After quite a long search, I finally found that the source of error was in the micrometer, which did not admit of nearly the degree of precision which we assumed for it. To meet this difficulty, I introduced into the system of observation a modification which finally resulted in a simple change of variable. Instead of measuring the deviation micrometrically, I adopt a value for this defined in advance, it shall be 7/10 of a millimeter or 7 whole divisions of the image, and I find by experiment what distance to establish between the scale and the revolving mirror to produce this deviation; the measurements have thus a length of about 1 meter, the lesser fractions still have a size visible directly and no longer allow room for error.

By this means the apparatus was cleared of the chief cause of uncertainty; since then the results have agreed within the limits of error of observation and the averages have been so constant that I am able to give with confidence the new value which it seems to me ought to represent something very close to the speed of light in space, namely: 298,000 kilometers per second of mean time.

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GENETICS

Dingo-Wolf Hybrid In Australian Zoo

SUCCESSFUL crossing between the dingo, wild dog of the Australian bush, and a male European wolf is reported in *Nature*. The litter of six pups, all female, was born in the zoological garden at Adelaide, Australia. One of the animals has been sent to Melbourne for hybridization experiments.

It is well known that dingo and domestic dogs can interbreed, but the present is apparently the first case on record of a cross with a wolf.

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GENERAL SCIENCE

Scientist Makes New List Of Extremes in Nature

THE BIGGEST elephant, the smallest germ, the shortest dwarf, the highest mountain, all the things of the universe to which can be applied the superlative "est," stir the human imagination.

Dr. B. S. Hopkins, University of Illinois professor who wrote his name into chemical history a few years ago by discovering the element illinium, has compiled in an article in the *Scientific Monthly* a list of the extremes of nature.

"Our natural curiosity which is stimulated by the use of the superlative degree is reenforced by the needs of our modern civilization," Dr. Hopkins observes. "A study of the extremes of nature soon passes far beyond the realm of mere curiosity and establishes itself as a means by which we can measure our progress in solving the problem of selecting the best material to serve our purpose in a certain specific application."

Some of nature's extremes include:

The heaviest substance known upon our earth is osmium, with a density which varies from 21.3 to 24.

The lightest substance known is hydrogen gas, unless there be considered highly evacuated X-ray tubes which

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more feet deep. Since the discharge of the electroscope in general is due to the cosmic rays and the radioactivity of the earth, the investigators feel that this location in and above non-radioactive water gives the best conditions under which to pursue their investigations.

Up to this time Dr. Millikan has obtained much evidence as to the nature of the cosmic ray by observing its effects through the eye piece on the electroscope. The newer apparatus contains a photographic film for permanently self-recording these effects. These records should render further repetition of these measurements unnecessary since any one interested will henceforth only need to come and measure up the films for himself, for these films will be completely free from the preconceptions as well as the errors of the individual observer.

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contain streams of electrons which are fragments of disrupted hydrogen atoms.

The hardest material is the diamond.

The most ductile and malleable of our metals is gold.

The highest temperatures which have been sustained for a considerable time and measured with reasonable accuracy are in the neighborhood of 3500 to 3800 degrees Centigrade.

The most extreme cold that has ever been reached is the melting point of solid helium, 272.2 degrees Centigrade below zero which is within eight-tenths of a degree of absolute zero, that theoretical point where all heat vanishes.

The most costly substance known to commerce is radium which sells at a price that corresponds to more than two million dollars per troy ounce, making radium worth more than a hundred thousand times its weight in gold.

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PLANT PATHOLOGY

Enzyme Theory of Virus Disease Upheld

EVIDENCE that the so-called "virus diseases" of plants and animals are caused by a non-living chemical substance that can attach itself to living matter, rather than by ultra-tiny living organisms, is claimed as the result of experiments on tobacco plants performed by Dr. Carl G. Vinson of the University of Missouri. Dr. Vinson's work apparently supports the belief, held on theoretical grounds by many physiologists and pathologists during the past thirty years, that the causes of these mysterious diseases of plants and animals are compounds analogous to enzymes, the digestive and respiratory "ferments" of normal organisms, but malefic rather than beneficent in their effects.

Frozen and Squeezed

Dr. Vinson's method of isolating the virus of tobacco mosaic was worked out during four years he spent at the Boyce Thompson Institute for Plant Research at Yonkers, N. Y., prior to coming to the University of Missouri. The first step was to freeze a quantity of