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FILTERABLE AND NON-FILTERABLE BACTERIA

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GIVING germs human proteins to eat is the key to the revolutionary experiments by which Professor Arthur I. Kendall, of the Northwestern University Medical School, has made invisible germs visible and caused visible ones to vanish into filterable viruses.

This work, hailed as the greatest stride that bacteriology has taken since the days of Pasteur, indicates that many, possibly all, the germs we know can change from visible to invisible and back again, according to what they feed on.

It has hitherto been impossible to cultivate the invisible germs of such diseases as influenza, smallpox and measles outside living bodies. Professor Kendall believed this to be due to the fact that all laboratory workers offered them the wrong kind of food. All traditional germ diets were made of such things as beef tea, gelatin, etc., containing the decomposition or breakdown products of proteins. But in human and animal bodies, natural prey of disease-causing germs, there are almost none of these; germs naturally feed on the pure proteins themselves.

Professor Kendall undertook to get a high-protein ration for his germs. He took pieces of small intestine, human, dog, pig or rabbit, and after treating them chemically to remove the breakdown products, made a culture fluid with what was left. Planted in this, blood from human "flu" patients caused the fluid to become cloudy. A few drops of this cloudy fluid injected into a rabbit's vein gave the animal all the typical symptoms of the "flu." Transferred from this "K medium," as Professor Kendall calls his fluid, to the old-fashioned germ foods, the germless fluid soon developed thriving colonies of tiny round germs. These appear to be the visible form of the elusive and long sought influenza germ.

Having induced one invisible germ to come out and become visible, Professor Kendall tried his hand with others. He also took germs that have hitherto been known only in their microscopically visible form, on old-fashioned culture media, and grew them in his new, high protein cultures. Every one of them turned from visible into invisible form. He filtered the invisible form germs through a porcelain filter so fine that some organic molecules can not pass through it. He took the fluid that came through and planted it on the old-fashioned germ foods again. Colonies of visible germs appeared out of the invisible. He could repeat this process as often as he liked, getting visible germs out of invisible virus filtrates, and making the visible forms change back again by planting them in his new form food.

The following germs he lists as having been "put through their paces" from visibility to invisibility and back again: infantile paralysis, streptococcus, scarlet fever streptococcus, one form of parathyroid bacillus, typhoid bacillus, the staphylococcus that causes boils, and the crooked germ that the late Dr. Hideyo Noguchi found in yellow fever patients, as well as the little round germ Professor Kendall himself found in his influenza cultures. He concludes that possibly all bacteria lead this Dr. Jekyll and Mr. Hyde existence.

A sensational by-product of this research is an insight into the nature of the bacteriophage, the mysterious filter-passing something that kills germs as germs kill us. By planting filtered "phage" on old type culture media Professor Kendall obtained good growths of the germs they destroy. Bacteriophage therefore seems to be nothing but the invisible form of the germ it seems to delight in wiping out. Professor Kendall could produce phage from germs by planting the germs in his new medium.

The behavior of germs in changing from visible to invisible is peculiar. They begin to lose sharpness of outline, growing fuzzy and dim under the microscope. At last nothing but tiny granules remain, which will pass through the fine filters, and grow back (or perhaps reassemble themselves) into visible germs again. Other granules, too large to pass through the filter, appear none too anxious to resume full-fledged germ form, but under proper encouragement in the new medium will do so.

This new knowledge of the changeability of germs can be found in patients in the early state of the disease, but not in the later, though the patients are sicker than ever. But certain puzzling granules have been found in the spinal fluid of such patients, and it now appears quite possible that these may be the half-transformed germs themselves, on the road to invisibility.

Professor Kendall calls attention to the fact that the majority of known filterable virus diseases, like common cold, influenza, measles, etc., enter the body through the lungs and not through the digestive tract. The digestive tract is always full of decomposition products of proteins which tend to keep germs in the visible, non-filterable phase.

For further experiments he has a new refinement of his medium, made of highly purified, crystalline proteins. This will replace the one he used in these experiments.

NAGATA'S COMET

A COMET, with a tail eight times as long as the moon's diameter, is now on exhibition in the early evening skies.

A small telescope is needed at the present time to see this visitor to the solar system since it is not bright enough to be seen with the unaided eyes. The tail is difficult to see in a small telescope, but can be found on astronomical photographs.

It is located in the constellation of Leonis, the Lion, a little east of the bright star Regulus, which is in the handle of the Sickle pattern of stars in that group of stars. This constellation is visible near the western horizon just after sunset. As Leo and its comet go to bed behind the horizon shortly after the sun, it is necessary to look for the comet just after sundown.

The comet, probably new to astronomy, was discovered by Masani Nagata, of Brawley, California, on July 15, at 8:30 P. M. He reported his finding to the Mount Wilson Observatory where Glenn Moore, with one of the 12-inch telescopes, confirmed its discovery and made photographs. Other observations were made and then astronomers throughout the world were sent telegraphic notifications through the Harvard College Observatory, the distributing center of astronomical data.

The position of Nagata's comet, as determined at Mount Wilson on the evening of July 19, is right ascension ten hours forty-nine minutes and twenty-two and three tenths seconds and declination north nine degrees fifty-eight minutes twelve seconds. It is between seventh and eighth magnitude and its tail is reported as four degrees long.

The comet is moving north and east so that it may stay in view for some time. Whether it will become visible to the naked eye can not be told until an orbit is computed. Astronomers are now at work on this laborious mathematical task.

Nagata's comet gives more promise of being seen easily by the public than any comet of recent months. The solar system has had very few visitors from outer space in the past few years and it has been years since a really striking comet appeared in the skies. There is no hope that Nagata's comet will become visible to the unaided eye. Orbit computations made at the University of California's Students' Observatory under the direction of Professor R. T. Crawford show that the comet was nearest the sun on June 15. It was then one hundred million miles from the sun. It is now one hundred and sixty-seven million miles from the earth. It is receding from both the earth and the sun.

The orbit shows that the comet will be four degrees south of the star Beta Leonis on August 3 and that it is moving eastward two degrees a day. Its orbit is inclined to the ecliptic 41 degrees.

[EDITOR'S NOTE: This is the exclusive story of how a Japanese melon ranch worker discovered the new comet. He tells it in his own words.]

STATEMENT BY MASANI NAGATA

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I am purely an amateur astronomer. On July 15, about 8:30 P. M. Pacific Standard Time, I was observing the planet Neptune with my three-inch telescope which has a thirty diameter eyepiece of eighty millimeter and an altazimuth mounting. Near one of the stars, in the constellation of Leo, I found what seemed to be a nebulous hazy star. As I am very familiar with that area of the heavens I was therefore very puzzled and doubtful about what I had seen. Soon the hazy unfamiliar star faded away under the horizon.

The next evening at about 8 P. M., observing the same point, I found the same "star" moved about one degree to the northeast. It seemed to be a comet. As I could not believe that a comet of this brilliance, magnitude seven, could have escaped the eyes of thousands of comet-seekers with much more improved and more efficient instruments than mine, I inquired at Mount Wilson Observatory if such a comet were known. They replied in the negative. Then I pointed out to them the position and they answered me that two photographs they had taken showed the comet.

As I am only an amateur astronomer, and I have had no special study or courses in astronomy in school. Perhaps I inherited my interest in the stars from my father. I am head foreman for one of Sears Brothers, Inc., ranches near here, which grow vegetables and melons. If this discovery does anything for the good of astronomy, nothing will please me more.

EARTHQUAKES IN THE MISSISSIPPI VALLEY, CHILE AND SIBERIA

EARTHQUAKES in the Mississippi Valley of this country, Siberia and Chile were recorded on American Seismographs on Saturday (July 18) and their location determined through the earthquake reporting service of *Science Service* and cooperating agencies.

The Mississippi Valley earthquake was not severe but it was centered in the region near New Madrid, Mo., where in 1811 and 1812 the famous series of New Madrid violent earthquakes occurred. Saturday's shock (July 18) which came at 8:45.3 A. M. Eastern Standard Time was recorded on the seismograph at St. Louis University, St. Louis, Mo., and reported to *Science Service* through the Jesuit Seismological Association.

The region of northern Chile near the town of Iquique on the coast was probably shaken and perhaps damaged by the earthquake at just 27.1 minutes after midnight early Saturday morning (July 18) which was recorded by Fordham University at New York City, St. Louis University at St. Louis and the Seismological Laboratory at Pasadena, Calif. The epicenter of the earthquake was determined by both the U. S. Coast and Geodetic Survey and the Jesuit Seismological Association experts to be at latitude 21 degrees south and longitude 71 degrees west, in the Pacific Ocean just off the Chilean coast.

The Siberian earthquake was located in the region of the Bay of Kronotski on the east coast of the Kamchatka Peninsula and its time was 6:23.9 A. M. Eastern Standard Time on Saturday (July 18). Fordham University, St. Louis University, Pasadena Seismological Laboratory and the U. S. Coast and Geodetic Survey station at Tucson recorded it and the latitude and longitude as determined by the U. S. Coast and Geodetic Survey was 53 degrees north and 162 degrees east. Because of the sparsely inhabited region this quake probably did little damage.

With the earthquake that centered off the west coast

of Mexico on Friday morning and the local, probably volcanic earthquake in Ecuador the same day, the earth has been very restless the past few days.

THE TIDES OFF CAPE COD

THE strange whirlpool reported off Cape Cod was probably not a whirlpool at all but merely the every-day movement of currents which rip and surge over the shoal areas of George's Bank. This is the opinion voiced to *Science Service* by Commander G. T. Rude, chief of division of hydrography and topography of the U. S. Coast and Geodetic Survey. Commander Rude has just returned from a two-weeks' inspection tour of the four Survey vessels now engaged in the first complete charting of George's Bank.

"Currents passing from ocean depths over shallow areas must necessarily speed up considerably," said Commander Rude in explaining the occurrence, "and the fact that the water sometimes rises up above the surface in 'tide-rips' may account for the idea of 'whirlpools.'"

Commander Rude expressed the belief that such statements as Captain W. E. Parker, of the Coast Survey ship, *Hydrographer,* who is said to have described the whirlpool, made to the newspapers had been misconstrued. Commander Rude was at George's Bank when Captain Parker charted some of the shoal area at its rough spots and was aboard the ship *Hydrographer* for several days.

Commander Rude also said that observation of the "whirlpool" was made at the time of the spring tides when the new moon gives the ocean currents forty per cent. more strength than when the moon is at the quarter. "Thus," he pointed out, "a current of three or four knots moving where the depth is not more than thirty or forty feet is powerful enough to be felt on the side of a Survey vessel but would not, of course, hinder its head-on progress or jeopardize its safety."

The Coast Survey vessels left the base at Boston, July 21, after a short trip to port and will continue the charting until the latter part of September when weather conditions make the work impracticable. The work of charting George's Bank began last summer and will be carried on during the summer of 1932, when it is expected to be finished. George's Bank is a tongue-shaped area of 15,000 square miles lying about 200 miles east of Cape Cod.

ITEMS

HIGHLY purified iron, possessing many of the qualities of copper, is prepared in Germany by a new process described recently by Dr. Ing. L. Schlecht. Carbon monoxide of a high degree of purity is passed over hot iron, previously purified by ordinary methods. The two unite to form a liquid of relatively low boiling point, iron carbonyl. Heating this drives off the carbon and oxygen, leaving iron with hardly a trace of impurities, in an exceedingly finely powdered form. The individual spherical particles are only 20 millionths of an inch in diameter. Heating this powder to a temperature of 1,200 degrees Centigrade changes it into solid iron that resembles copper in its softness, resistance to corrosion and other properties.

ATOMS, even the heavy atoms of lead, are wanderers. Professor J. G. von Hevesy, of the University of Freiburg in Breisgau, has been investigating their properties. Lead atoms are constantly in motion, even in solid metal, he believes. In an alloy of lead and gold, at a temperature half again as high as that of boiling water, the atoms wander through a space of a hundredth of a cubic inch in a day. When there is nothing but lead in the lump, however, moving about is not nearly so easy; in pure lead an atom can migrate in one day through a space of only two ten-billionths of a cubic inch.

MAGNETISM will detect differences in hardness of otherwise similar bars of steel, it was revealed in a report made by Haakon Styri, of Philadelphia, to the American Society for Testing Materials meeting in Chicago on June 24. Steel bars that test magnetically the same before heat treatment will test magnetically the same afterwards, Mr. Styri said, provided no differences in hardness or impact strength are brought about during the heating and quenching processes. Mr. Styri's method of testing is to place the steel bars in a magnetic field and note whether the steel would make a good core for an electromagnet. Former methods of testing uniformity in steel hardness, according to the report, have required mechanical means which involve partial destruction of the steel, whereas the testing of the steel's magnetic properties does not have this disadvantage.

OYSTERS open up when the water over their beds grows warmer, and they shut up when it gets cooler, has been found by Dr. A. E. Hopkins, of the U. S. Bureau of Fisheries. It was previously thought that oysters opened by day and closed at night because of light changes, but Mr. Nelson's experiments indicate that it is the daily changes in water temperature rather than the daily light changes that affect the behavior of the shellfish. The experiments were performed on the Pacific coast oyster, but there are indications that the conclusions from the study hold good for the Eastern oyster as well. The opening and shutting of oysters is of very great practical importance, because oysters can feed only when their shells are open.

DIGGING in a cave at Cedar Grove, Arkansas, an expedition from the Bureau of American Ethnology has discovered the burials of twelve individuals and hundreds of the tools, weapons and beads that once belonged to them. Ozark life and culture is comparatively unexplored and unknown, it was stated at the bureau. Two previous expeditions had made some progress, but much is yet to be discovered. Dr. W. M. Walker, in charge of the cave expedition, states that he has uncovered the burials of four adults, one adolescent and seven children or infants. Among the relics collected are 233 flint objects in perfect or nearly perfect condition, fifty bone implements and numerous shell spoons and beads.