

SCIENCE NEWS

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BACTERIOPHAGE SAID TO ACT BY PRODUCING ANTITOXINS

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BACTERIOPHAGE, popularly known as the "germ-eater," cures disease not by "eating" or dissolving the causative bacteria but by producing antitoxins in the body. The famous bacteria-dissolving power is merely a side-issue, apparently of no importance in curing or preventing disease, as has long been suspected by some investigators.

This explanation of how the potent but mysterious phage acts to cure or to prevent disease was given by Dr. N. W. Larkum, of the Michigan Department of Health, at the Indianapolis meeting of the American Public Health Association. Dr. Larkum reported studies supporting this theory.

When Dr. F. d'Herelle, formerly of the Pasteur Institute and Yale University, announced his discovery of bacteriophage, it gave rise to great hopes that here at last was a way to wipe out disease. All that would be necessary to stop an epidemic of cholera, for instance, would be to pour a tube of the proper bacteriophage into the drinking water supply. These hopes were not entirely fulfilled, but results were sufficiently good to encourage a number of physicians in continuing to use the phage and to investigate its mode of action. Among them has been Dr. Larkum.

If it is true, as he now strongly suspects, that all bacteriophages are capable of producing antitoxins, scientists now have the means to fight specifically most, if not all, known diseases caused by bacteria. This may be done from the preventive standpoint, by immunizing well persons with bacteriophage; or sick persons may be treated by injecting serums prepared by immunizing animals with bacteriophage.

Dr. Larkum pointed out that in most, if not all, infectious diseases, the serious illness is caused not by the bacteria themselves but by the toxins or poisons they produce in the body. Bacterial or infectious diseases have only been successfully treated when soluble toxins could be obtained from the organisms causing the disease and antitoxins developed.

For example, success in the treatment of diphtheria followed the development of diphtheria antitoxin. Prevention of this disease now is possible by injecting substances known as toxin-antitoxin or toxoid. These stimulate the body to produce enough antitoxin of its own to neutralize the poison from any diphtheria germs that invade it.

The effect of bacteriophage when used to treat disease suggested that this was also the way it acted. When typhoid bacteriophage was injected into typhoid fever patients, it was particularly noticed that the symptoms of poisoning subsided. The bacteria did not disappear any sooner than usual, but the patients were not sick.

Earlier investigators, among them Dr. d'Herelle, considered this possibility but their studies led them to believe that bacteriophage did not produce antitoxin.

Dr. Larkum and his associate, Ruth Corpron, however, conducted experiments with exactly opposite results. Their work showed that bacteriophage is not a toxin, is not itself an antitoxin, but produces or stimulates the production of antitoxin in the body.

RABBIT TICK AND ROCKY MOUNTAIN SPOTTED FEVER

A RABBIT tick with the impressive name of *Haemaphysalis leporis-palustris* may be the mysterious agent that has spread the deadly Rocky Mountain spotted fever from its original haunts in the Bitterroot Valley of Montana to the Pacific and Atlantic coasts of this country. This new explanation for the recent spread of this highly fatal disease was suggested by Dr. R. R. Parker, of the U. S. Public Health Service, at the meeting of the American Public Health Association on October 9. He is in charge of the spotted fever investigations of the federal health service at Hamilton, Montana, where serum for protection against this disease is manufactured.

Dr. Parker also pointed out the effects of meteorological conditions and changing agricultural practices on the prevalence of the disease. For instance, in the Snake River Valley sheep raising was the only form of agriculture for many years. Men engaged in this occupation are particularly exposed to bites of the Rocky Mountain wood tick that carries the disease, and there was a high percentage of cases among these shepherders. Now sheep raising has been almost crowded out by more intensive forms of agriculture, such as dry land wheat raising, which are less favorable to spotted fever, and a much smaller number of cases are being reported.

Irrigation and the gradual grubbing out of the sage brush and intensive cultivation of the land have created conditions less and less favorable for ticks, and cases of the disease are now infrequent in this valley. One physician who used to treat between 35 and 50 cases a year now sees only from one to three cases in a year. In addition, vaccination of the shepherders and local campaigns against the rodents that harbor the ticks are reducing the number of cases.

The rabbit tick which Dr. Parker suspects of being a factor in spreading the disease across the country does not bite man, as do the Rocky Mountain wood tick and the dog tick, which transmit the disease in the East. However, the infection, kept alive by the rabbit tick with the long name, may be picked up by other rabbit ticks that do bite man. Dr. Parker has found the virus of the disease consistently in the particular rabbit tick he suspects, and he pointed out that this tick is wide-spread in the United States and other parts of North America, whereas the Rocky Mountain wood tick does not range far from its mountain habitat.

The disease was presumably prevalent in the Rocky Mountain region long before this part of the United States was settled. It was not commonly recognized until the late 90's. It is now found in all the Pacific Coast states and all the Rocky Mountain states; in parts of Minnesota, Iowa, North and South Dakota, Nebraska,

Tennessee, Louisiana, possibly in Missouri, in Alabama, Oklahoma, Arkansas, the District of Columbia, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North and South Carolina and Indiana. This wide distribution of the disease has been of great concern to health officers, particularly since they have not yet been able to find the way in which the disease has been spread.

STANDARDIZATION OF TESTS FOR GERMS CAUSING FOOD TO SPOIL

TESTS for germs or bacteria that cause foods to spoil need to be standardized, members of the American Public Health Association were told by Lawrence H. James, of the Bureau of Chemistry and Soils, U. S. Department of Agriculture. Mr. James termed such standardization a "present necessity." It will aid in the better protection of the health of the consuming public. It will also pave the way for the development of new and improved methods of food preservation. "The quality and safety of many foods depend upon the control of spoilage bacteria, yeasts and molds," he said.

At present, different laboratories use different methods for detecting these organisms. No detailed directions, simplified and standardized for general use, are available. Every state in the union conducts some type of official food analysis and practically all cities of metropolitan size, with populations of 500,000 and over, maintain food analytical laboratories. In addition, many college, university and consulting laboratories are called upon to make analyses in which they have had but little experience either with the food products or with the special methods required. The whole situation will be simplified and many more laboratories will be able to make the necessary tests, if accepted directions are made available in printed form, it was pointed out.

Mr. James reported that a committee of the American Public Health Association, of which he is chairman, has secured the official cooperation of that organization, of the Society of American Bacteriologists and of the Association of Official Agricultural Chemists in organizing a group of experts on food bacteria to develop standard procedures for the microbial analysis of foods.

LOWER ANIMALS KILLED BY "HEAVY WATER"

HEAVY water, containing the recently discovered double weight hydrogen, kills tadpoles, guppy fish and worms. Professor W. W. Swingle, of Princeton, using some of the rare heavy water manufactured by Princeton chemists, has found that the extraordinary H_2O , with 92 per cent. of its hydrogen atoms consisting of the isotope mass two (deuterium), is lethal to certain fresh-water animals.

Green frog tadpoles survived only an hour when placed in the heavy water. Tadpoles of the same sort immersed in distilled water that contained only 30 per cent. heavy water, were unaffected by a 24-hour treatment. Paramecia, one-celled organisms that are favorite biology experimental material, resisted the heavy water successfully for an equal period.

Relatively large quantities of heavy water are now being produced in the Frick Chemical Laboratory at

Princeton University by Professor Hugh S. Taylor and Dr. Henry Eyring and Arthur A. Frost. A cubic centimeter, approximately a thimbleful, of the heavy water is produced every two days. This unusual supply is allowing its use in various untried experiments. Professor Earle E. Caley has demonstrated that it has a smaller capacity for the dissolving of salts than ordinary water. Tests are now being made to ascertain its effect upon acids.

Physicists studying the structure of the atom will find the heavy water of great use, because most of its hydrogen atoms are twice the ordinary hydrogen mass. Experiments have shown that in attempts to break down the atom by collision with electrically propelled hydrogen projectiles, much smaller voltages are required when heavy water is used.

Professor Taylor explained that there is one part of heavy water in every 5,000 parts of ordinary Princeton rain-water. Twelve hundred gallons of ordinary water are treated in order to produce three ounces of heavy water. The new substance has become one of the most valuable known in the commercial field. A price of \$150 is asked for a gram. At this rate a teaspoonful is worth nearly \$600 and a quart \$150,000. Princeton now has on hand about a glassful and is about to raise its production to a thimbleful a day.

What effect the drinking of heavy water will have on animals and human beings is not yet known, but it is believed that it may bring on a fever, and therefore might be useful in diseases that are treated by raising body temperatures.

GRASSHOPPERS IN 1933

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GRASSHOPPER depredations in the United States during the past summer were the worst for many years, according to a statement made by Dr. W. H. Larrimer, of the Bureau of Entomology, U. S. Department of Agriculture, in an interview with Science Service. Although the early hatching from their eggs in the soil was slowed down by wet, cold spring weather, subsequent heat and drought operated to the advantage of the 'hoppers, and the damage they caused in late summer more than made up for their delayed start. Even into early October they were reported as still going strong in the Northern Plains states.

Egg-laying for 1933 was finished in August, Dr. Larrimer stated, and preliminary cursory examinations give every indication that 1934 will again be an exceedingly bad grasshopper year, unless unpredictable climatic factors come to the rescue of the farmers. The bureau's annual detailed grasshopper-egg survey is now in progress, and will be completed some time in November. It will then be possible to make a better estimate of damage to be expected next summer.

The one bright spot on the whole depressing grasshopper map, Dr. Larrimer said, is Minnesota. Here an active and informed state government has been cooperating with the farmers and local authorities in an intense eradication campaign for the past two or three seasons, with the result that in Minnesota the grasshopper dam-

age last summer was negligible, while the insect hordes played havoc in states farther west and southwest.

There are four species of grasshopper that figure in the heavy damage, of which the one known as the "lesser migratory grasshopper," offspring of the "Rocky Mountain grasshopper" of pioneer days, has become the worst pest. Its egg-laying habits are such that deep plowing, either in fall or early spring, will reduce its numbers very materially. Farmers in the grasshopper-infested areas are being urged to set their plows for deep furrows this fall, and to use a type of share that turns the top soil completely upside down. If the eggs are buried four inches or more, the young grasshoppers hatch, but are unable to make their way to the surface. Plowing the eggs out upon the surface exposes them to the weather and thus results in partial destruction. However, practical entomologists are agreed that at least part of the eggs survive the winter, and that much more satisfactory results are obtained by plowing them under as deep as possible.

MILK AS A CONSTANT SOURCE OF VITAMINS

MILK, as produced under present market conditions, is a fairly constant source of all the vitamins except the rickets-preventing D and this can be added in a number of ways, Professor H. C. Sherman, of Columbia University, told members of the American Public Health Association recently.

Man has been able to extend his learning period much longer than other animals chiefly because of his use of cow's milk for food, Professor Sherman pointed out. This makes the quality of the milk highly important. The body can not produce vitamins by itself in the way that it can and does produce enzymes and hormones. Either the vitamin or its precursor must be furnished by the food or some other factor of the environment, such as ultra-violet light in the case of vitamin D.

In the case of the cow, the rations which are economically profitable for the dairy farmer to feed are almost always of fairly high vitamin A content, and in addition the cow is able to store a surplus of this vitamin in her body, so that cow's milk is both a highly important and a highly reliable source of vitamin A, Professor Sherman explained.

The rations which are found profitable in modern milk farming are also sufficiently rich in vitamin B to make it fairly certain that the cow's milk will also be a constant and reliable if not outstandingly rich source of this vitamin. This is the more certain because the digestive tract of the cow furnishes a favorable environment for certain vitamin B-producing bacteria, so that the cow may continue to produce milk of normal vitamin B value even when her food lacks this vitamin.

Milk is also a reliable if not rich source of vitamin C. The amount of vitamin D in cow's milk may be increased either by adding vitamin D concentrate to it, by irradiating the milk with ultra-violet light or by feeding yeast or other suitable irradiated material to the cow. Recent work shows that the vitamin D content of the milk may also be increased by exposing the cow to ultra-violet

light. There is also considerable evidence that milk as ordinarily produced is a rich and reliable source of vitamin G, important in the prevention of pellagra.

ITEMS

BEFORE trying to give encephalitis or "sleeping sickness" to convicts by the bite of presumably infected mosquitoes, officers of the U. S. Public Health Service have tried the experiment on themselves, as is the custom among medical investigators. Dr. J. P. Leake, in charge of the federal health service's encephalitis investigations at St. Louis, Dr. L. L. Williams, Jr., and Dr. Bruce Mayne, all let mosquitoes feed on patients with the disease and then on themselves. None of them has contracted the disease as a result. This may be because, in the course of their work with the patients, they have already acquired immunity. The next step was to repeat the experiment with ten convicts, volunteers from the Mississippi Penitentiary, who will win their freedom if they survive. It is too early yet to know whether or not they will develop the disease.

A PROPRIETARY medicine now advertised over the radio and apparently new on the market has as its essential drug the dangerous dinitrophenol, the American Medical Association reports. This is the reducing agent which resulted in the death recently of a San Francisco physician who took an overdose in an effort to lose weight. At that time and previously, when the chemical's weight-reducing power was first announced, the American Medical Association warned against the dangers of the drug. Another case of poisoning from it is reported by Drs. Hamilton H. Anderson, Alfred C. Reed and George A. Emerson, of the University of California Medical School, in the current issue of the *Journal of the American Medical Association*. In this case the patient did not die and no overdose was responsible for the poisoning. Instead it appears that this particular patient had a lessened resistance to the drug. She had suffered from arthritis before treatment with dinitrophenol was started.

X-RAYS played upon water or nutrient fluids make them deadly to protozoa presumably by producing very small quantities of hydrogen peroxide. Experiments by which this fact was discovered will be reported in the forthcoming issue of *Physiological Zoology* by Dr. C. V. Taylor, J. O. Thomas and M. G. Brown, of Stanford University. Experimenters first discovered that if they x-rayed a nutrient solution and then put in the species of protozoon they were using, *Colpidium campyllum*, the animals died, despite the fact that the deadly rays never touched them. They found the same fate following their protozoa if introduced into x-rayed water. They tested both the culture fluid and the water with titanium chloride, a compound extremely sensitive to the presence of hydrogen peroxide. The test indicated hydrogen peroxide in very small quantities—on the order of one part in a hundred thousand of water. The addition of one part of hydrogen peroxide to 450,000 parts of water rendered it toxic to the protozoa.