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HEALTH AND HAPPINESS

"Mens sana in corpore sano"

Number 22.

How bacteria appear when seen under the microscope was carefully described in last week's "Watchman." Fig. I is here reproduced with explanations in order that scientific terms necessary to be used may become familiar to the reader.

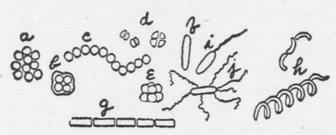

Fig. I.—Forms of bacteria (Jordan.) High Magnification. a, Staphylococcus (cluster coccus;) c, streptococcus (chain coccus; b, d, cocci showing cleavage in two planes; e, sarcina (cubical mass or packet;) f, bacillus (straight rod;) g, straight rods connected to form filament or chain; h, spirilla (spiral forms;) i, j, bacilli with motile organs.

The forms of bacteria are simple and comprise only three principal types—the straight rod (bacillus,) the sphere or dot (coccus,) and the spiral (spirillum.) If fission or division goes on in the same plane continually, it results in the formation of a cell-row. A coccus forming such a chain of cells is called strepto-coccus (chain coccus.) If the cells cohere to form a group, it is called staphylococcus (cluster coccus.) If division takes place in three dimensions of space a cell-mass or sarcina is produced. (See Fig. I.)

Environmental Influences Upon Bacteria.

With bacteria as with other living organisms certain conditions must prevail before development can occur. Among the most important of the natural environmental influences are temperature, light, moisture, oxygen-supply and food-supply.

TEMPERATURE RELATIONS

(As the Fahrenheit (F.) thermometer is more commonly used than the centigrade, degrees of temperature have been converted into the former; fractions of a degree cannot be given.)

Bacteria are highly adaptable to temperature conditions. Some are able to grow at or near the freezing point; others at 167 degrees F. to 170 degrees F.; "Heat loving" bacteria have been found living in the waters of hot springs at a temperature of 192 degrees F. In the growth of any given species, there are three temperature points: A minimum or the lowest point at which growth occurs; an optimum or point of best growth; and a maximum or highest temperature at which growth can take place. These three points differ greatly for different species; what is minimum for some bacteria may be maximum for others and the range of this temperatuhe zone is much wider for some than for others. For example, the bacillus of tuberculosis has a minimum point of 34 1-5 F., 29 C., an optimum of 100 2-5 F., 38 C. and a maximum of 107 3-5 F., 42 C., while a species found in fermenting manure (B. thermophilus) has a minimum of 107 F. The hay bacillus (B. subtilis) is able to multiply at 42 F. and also at 122 F. with an optimum point of 86 F. The temperature zone of most dairy bacteria in which growth occurs ranges from about 40 degrees F. to about 110 degrees F. In general, it may be said that the most favorable growing point for bacteria is determined by the temperature of their habitat; for instance, bacteria parasitic in the bodies of animals have an optimum approximating the normal temperaof the body (98 3-5 degrees F., 37 degrees C.)

Effect of Heat.—The temperature at which all the organisms are destroyed is known as the **thermal death point** for the species. Just as there is a wide range in the temperatures that permit growth of bacteria, so there is diversity in their resistance to extreme temperatures. The death-point varies with the nature of the bacteria, with the time of exposure and the condition in which the heat is applied. Spores are always much more resistant to heat than vegetative forms; some species when in the spore-state can withstand the temperature of boiling water for many hours (210-212 degrees F.) The vegetative forms of most bacteria, on the other hand, are killed at 55 degrees to 58 degrees C., (131 F.—140 degrees F.) by ten minutes exposure in the presence of moisture. Dry heat is much less effective as a germicide than steam. **In a dry atmosphere, temperatures ranging from 140 degrees to 180 degrees C. (260 F. to 300 F.) must be employed to insure sterilization. Where steam is confined under pressure, as in the autoclave** exposure for fifteen minutes to a temperature of 125 degrees C. (230—240 degrees F.) **is sufficient to destroy all known microbes.**

The thermal death point as determined carefully for the common bacteria varies in species but, as many figures are apt to be confusing to the average reader, they are not given here. In this connection, a point of practical significance may be noted—that while tubercle bacilli in suspension in milk are destroyed at 140 F., 60 C. in fifteen to twenty minutes, the pellicle that forms on the surface of milk during exposure at this temperature may contain living bacilli after sixty minutes. For this reason in heating milk for sanitary reasons it should be done in a closed vessel to prevent formation of the pellicle or "skin" on the surface or should be subjected to a higher temperature. This will be later more carefully considered under pasteurization of milk. The question may be asked, Why is water that has been merely boiled for five minutes said to be safe? The thermal death point of those bacteria that are likely to be present in polluted water is low (135 to 140 F.) and since they do not form spores, the practice of bringing water to the boiling point for five minutes suffices to insure its safety for drinking purposes.

Effect of Cold.—Bacteria are much less sensitive to low than to high temperatures. While chilling largely prevents fermentative action and actual freezing stops all growth processes, it does not follow that exposure to low temperatures will effectually destroy the vitality of bacteria. The common forms of water and soil, and also pathogenic bacteria, like the typhoid and diphtheria bacilli, have been exposed for days to the temperature of liquid air (—310 F.) without destroying their vitality. Numerous non-spore-bearing species remain alive in ice for a prolonged period, although the death rate is high. With typhoid bacilli, experiments have shown that when water freezes, the great majority of these bacteria are immediately destroyed. Those that survive die off progressively. According to Park, not one in a thousand lives in ice longer than one month and at the end of six months all are dead. Typhoid infection from ice, however, has been known to occur several months after the ice was frozen.

Light.—Direct sunlight is highly injurious to certain forms of bacterial life, many being killed almost instantly when exposed to the full action of the sun's rays. Diffuse daylight has a hindering effect upon the growth of bacteria although naturally less marked than that of direct sunlight. Spores, perhaps because of oily substances that they contain, are especially sensitive to light.

This germicidal action of light has been proven due to the violet end of the spectrum and not the heat or red rays. The electric light exerts a germicidal influence similar to that of the sun's rays.

Experiments by Soparker, Calcutta, (Med. Jour. Aug. 1917) show that, in the case of direct sunlight, tubercle bacilli in sputum remain alive approximately two hours. When deposited in a place exposed to diffused daylight the interval during which sputum dust may remain infective can be calculated in days. When sputum is deposited indoors, especially in dark, ill-ventilated places, the tubercle bacilli may retain their vitality and power to cause the disease as long as 309 days. Bovine tubercle bacilli were found to be more resistant to sunlight and diffused daylight than human tubercle bacilli. When exposed to electric light the bovine bacilli were found alive for seventy-four days but dead after one hundred days. A practical conclusion of these results is that the entrance of sufficient light and air in all inhabited rooms will do much to combat the spread of tuberculosis.

Next week—"Environmental Influences" continued.

Glass Bottle Prices to Rise.

During the last week glass bottle manufacturers in South Jersey and elesewhere have been revising their cost tables to cover the advances in glass-blowing wages agreed upon at the Atlantic City conference, which closed August 6. This annual wage conference between the National Association of Glass Manufacturers and the Glass Blowers' Association, which is affiliated with the American Federation of Labor, sets wages for virtually all glass bottle workers in the United States and Canada, and as labor is the largest item of cost in bottle making, it can be seen that the determinations of this joint body have a far-reaching effect in the bottle trade.

At the conference 15 per cent. were granted on virtually the entire hand-made bottle line, while on machine-made bottles 10 per cent. was agreed upon. This increase applies only to organized or union labor, which comprises 40 to 50 per cent. of the total employees in each plant. It is very probable that the unorganized labor in each plant will receive much higher advances, for it is from this unorganized labor that the greatest withdrawals will be made by the Government draft. This will necessitate bringing in men from other industries which have higher wage scales. Wages alone will increase the cost of bottles next year not less than 8 to 10 per cent. depending upon their size.

A further increase, it is said, will be necessary to cover the increased cost of materials. Sand, which is the principal constituent of glass by weight, has increased at least fifty cents per ton since contracts were made in August, 1916. Soda ash, the heaviest material item in cost, although not in weight, is holding steady, but the price today on long-term contracts is more than double what it was a few years ago, and all but a few manufacturers of bottles have exhausted their old contracts and are forced to use soda ash at the new pirces. Lime, although used in smaller quantities, has increased in cost about 20 per cent. since last August, and minor chemicals are holding steadily to a high scale of prices compared with previous years.

——All those who have seen Kerensky with the armies declare that it is wonderful what he is able to do with the men by his own strong faith in Russia and the Revolution. A Finnish soldier tells of an experience he had on the eve of the battle between Brzezany and Pinsk. "The Minister of War," he says, "came into our trench the evening before the battle. He shook hands with us, and exhorted us to do our duty. He had on the same uniform as ourselves, with nothing to distinguish him, except a red silk scarf, which he wore over the shoulder. The next morning at five o'clock, the first infantry attack was made, and Kerensky was one of the first to leave the shelter of the trench, armed with a revolver. It was a marvel that he escaped scathless. We would follow that man to the end of the world."

——**They are all good enough, but the "Watchman" is always the best.**

Alfonso Losing His Grip.

Five years ago a Spanish republic was but a wild dream in the minds of a few irreconcilable extremists. The Republican leaders had no prestige whatever in the country at large and their following was being reduced to a mere handful. The causes of this were, of course, many, but everybody agreed that among them the personal influence of the King was paramount. That young sovereign seemed indeed to be chosen by Fate or Providence to gather around him all sections of his people and lead them united to great destinies. Today, writes a Barcelona correspondent to the New York World, things have altogether changed.

A little retrospect is necessary for the better understanding of the present situation. As soon as he was able to move about unfettered, King Alfonso appeared, and to a certain extent proved himself to be a ruler with an open mind, a keen perception of realities, a genuine interest in the welfare of the country and an earnest desire to promote it by all means in his power. His youth and physical energy appealed to the popular imagination as symbols of hope and power, but his achievement as a polo player and a crack shot and his undeniable qualities as an all round sportsman were, perhaps, more praised abroad than appreciated at home.

The high water mark of popularity was reached when, two years before the breaking out of the war, King Alfonso called to counsel several prominent men of the Spanish political left. Among other representative personalities there went to the royal palace Prof. Azcarate, the veteran Republican leader, and Prof. Simarro, the man chiefly responsible for the showing up of Francisco Ferrer's judicial murder; and although no publicity was given to the interviews, both these men admitted privately that the King had made on them the best of impressions. Simultaneously with this royal move the right wing of the Republican party detached itself from the old fold, made clear its acceptance of the monarchial regime and formed a new political party, which was styled the Reformist party. Everything then seemed to point toward a future of close co-operation and understanding between the crown and the democracy.

The King, however, if not unwilling, was at any rate unable to follow energetically the path of liberalism and reform, and as far back as three years ago the disappointment of the Spanish people had already begun. Then came the war and the sharp division of the country into pro-Germans and pro-Allies. The King was credited with pro-Ally leanings. He devoted himself to the relief of prisoners of war of all nationalities and did very good work, particularly in locating prisoners believed to have been killed. But when all is said, it must be recognized that kind-heartedness and willingness to oblige are poor substitutes for statesmanship.

King Alfonso is learning this now. The present crisis has been brought about by the army, whose loyalty to the crown, up to very recently, was supposed to be unconditional. But the army at length grew tired of the personal interference of the King and the members of his military household in all questions connected with the promotion of officers, and, to stop once and for all favoritism and intrigue, the officers themselves set up a committee of defense and sent an ultimatum to the Government, asking, among other things, for the dismissal of every member of the royal military household. To this the King yielded, and his military household, to which belonged Count Grove and Colonel Echague, two close personal friends of the King, was completely overhauled. Thus we see that the King is not quite the master of his own house.

But it would be hasty to infer from all that the King of Spain has got to go. He has still many chords in his arch. Senor Azcarate, who was again called to the palace a few days ago, told the King frankly—we have it on the most reliable authority—that great opportunities had been lost. The royal task now is to find new ones, and the sooner the better.

The Bintz Sisters.

It was just after the Bintz sisters' refined juggling act, the worst performance of any kind that the great detective ever yawned through, so he decided to seek relaxation and diversion by surprising the occupants of his stage box with his intimate knowledge concerning them.

"Pardon me," he said smilingly to the thin, nervous man at his right, "but how is the restaurant business?"

"Pretty well, thank you—er—that is, rotten. But—how—did—?"

"Very simple," explained the great detective. "You have the underfed, illnourished look of the typical restaurant proprietor. And you, sir"—turning to the stout man in the checked suit on his right—"are a barber. How do I know? Because, like 11 out of every 10 barbers, you are in urgent need of a shave."

The stout man nodded meekly, and the bushy-faced gentleman just behind opened his mouth in amazement.

"You, sir," the great detective said to him, "are for the first time in your life witnessing a vaudeville performance. I notice that you applauded that last act vociferously for at least two minutes, whereas if you had ever witnessed a vaudeville performance before, no matter how poor, you would have known that act was not worth applauding."—Detroit Free Press.

——There is untold value in an economical and mathematical outlook in camp life. The British armies have proved it over and over again; the use to which are put chunks of bread which remain uneaten being only one instance. A year ago these were simply thrown away, but now, owing to the calculating power of one officer, they are carefully collected and turned into chicken food. The officer in question not only had a mathematical mentality, but the capacity, an extremely valuable one, of being able to impress government officials with the soundness and desirability of his views.

THE SIGNAL CORPS.

This Branch of the Service Is the Nerves of the Army.

An army must have eyes and ears as well as muscles and legs. It has a brain to direct its members in accord with the things the eyes and ears bring to the attention of the general in command. But it must also have nerves to carry the messages of the eyes and ears to the commanding brain.

The eyes and ears of an army are its scouts, its cavalry, its aeroplanes, its balloons, its spies, its photographers, its observers. The brain is the commanding general and his staff. The nerves are a hundred different activities of that branch of the service known as the signal corps.

It is the duty of the signal corps to transmit information. It performs this duty in many ways, ranging from the courier to wireless, from rockets at night to heliograph flashes by day, from permanent telephone and telegraph lines to the curious "buzzer" and its wire on the ground, on fence tops, strung among trees, anywhere it can be put. It uses the wigwag code with flags, searchlight signals, telephones, signal flares—any and all means of communication which the ingenuity of man has devised are employed by the signal corps as necessity may dictate.—Brigadier General Squier in American Boy.

NEW YORK'S DIRECTORY.

In Early Editions They Turned a Poet Loose Upon the Job.

The first New York city directory was printed in 1786 and was a scanty affair, with the "Van" descendants of the Dutch settlers of New Amsterdam taking up pretty nearly all the space.

The first attempt to compile names of New Yorkers by business or trade was made in 1805, when a classified list was appended to the directory. At the top of each classification the publishers inserted the work of a poet whose lyre was turned to commerce. This, for instance, is the bard's thoughts on hairdressers:

Ye ragged pates, your hair we'll crop
And dress it vastly pretty,
Or if your blocks are bare walk in,
I warrant we can fit ye,
With bag or queue or long pig tail
Or brushed wig or grizzled—

It was pointed out that the poet evidently had no trouble finding inspiration for each of the different businesses he was called upon to sing about until he came to the list of restaurants, which was published without verse, leading to the belief that the strain of singing of food had been too much for the bard.—New York Times.

Sea Water.

Sea water is a complicated mixture of a great variety of substances. Roughly speaking, it consists of 96½ per cent of fresh water plus 3½ per cent of mineral salts. Three-fourths of these salts is chloride of sodium, or common table salt, and the next largest constituent is chloride of magnesium. After these come sulphate of magnesium, sulphate of lime, sulphate of potash, bromide of magnesium and carbonate of lime. In addition to these substances, sea water contains minute quantities of quite a variety of elements, including iodine, phosphorus and arsenic. It also contains some silver, copper, zinc, nickel, cobalt, iron and gold. Copper and zinc are found in some seaweeds, and certain species of coral is three-millionths silver.

Curved Arms of Flywheels.

A great many people imagine that the arms of flywheels and pulleys are curved for the sake of beauty and graceful appearance. But this is not so. In the making of these wheels they are cast in sand from molten iron poured in. As the arms are of less thickness and body than the heavy rim and the hub, they begin to cool off quicker. By the time the arms are "set" the rim and hub are still cooling and contracting, and the effect of their shrinkage is to cause a very powerful pull on the arms. As the latter are solidly set they become severely strained, but if the arms are curved they withstand the pull that goes on during shrinkage and simply straighten out a little.

The Beginning of Brazil.

Rising brisk and early one bright morning toward the close of the fifteenth century, a nice Portuguese gentleman, to wit, Cabral, going for a sail, decided to take his comical little fleet down the west coast of Africa, turn to the east, totter across the Indian ocean and, before he grew quite old, reach the Indies. The opening voyage was shorter than expected. He awoke one day to find land on his right instead of on his left, land which Pinzon had scratched three months earlier, land in the west and not in the east. It was Brazil.—London Chronicle.

Without Fear.

"The first shall be last and the last shall be first," quoted the devout citizen.

"It makes no difference to me how you arrange 'em," replied the expert commercialist. "I'll get mine either way. I'm the middleman."—Washington Star.

Hard Task.

"What's the matter, my dear?"

"Oh, I'm trying to tell that Gotrox person how perfectly beautiful we think her horrid old wedding present is."—Life.

Very Good.

"Did he get a good wife?"

"Good for a million."

"Good enough."—Louisville Courier-Journal.

Pluck is always trying to forget that it was beaten yesterday.