The Relation of Bacteria to Diseases.

Maude Hart.

The Relation of Bacteria to Diseases.

Introduction

Bacteria.

Defined.

History

Classification.

Importance of bacteria.

Pathogenic Bacteria.

Sources

Immunity.

Natural immunity.

Acquired immunity.

Conditions suited for the growth of bacteria.

Disinfection.

Special Diseases.

Tuberculosis.

Diphtheria.

The Relation of Bacteria to Diseases

The division of Biology called bacteriology is a very important subject, the importance has not been realized until the last few years, and greater progress has been made in this time than ever before.

"Bacteria are single celled plants microscopic in size, usually destitute of chlorophyll and reproducing by fission or fructification". Bacteria have a cell wall composed of cellulose, in the interior is protoplasm which may contain starch grains, but contains according to most authorities no nucleus.

It has only been in recent years that much has been known about bacteria. It was found that all decomposing substances swarmed with micro-organisms, and this led some to believe that diseases might be caused by micro-organisms or bacteria, but no great advancements were made along this line as microscopes were not invented until

the time of Anthony Van Leeuwenhoeck, who is called the Father of microscopy. He constructed microscopes and examined the bacteria. In 1675 he discovered bacteria in rain water and well water and was able to tell by their size, form and movements that there were many kinds of them. He made drawings of the micro-organisms that are quite accurate considering the apparatus he used. In 1701 Nicholas Andry a physician classed these micro-organisms as worms; and thought that they might be found in the blood. Linneas upheld the theory that infectious diseases were caused by micro-organisms. Plenciz in 1762 upheld this theory and discussed the nature of contagion and the relation of bacteria to diseases. Muller in 1786, criticized the work of previous writers for not examining the micro-organisms more closely and finding out something about their life history, forms, habits and etc.; he then took up a study of them examining their form, mode of reproduction and biological characters

and on this based a classification. At this time two theories arose which caused a lively discussion; first the theory of spontaneous generation or abiogenesis, while the rival theory was the one on the preexistence of micro-organisms or biogenesis. Needham upheld the school of abiogenesis, while Bonnet, Appert and Schwann opposed. Pasteur also helped to overcome the theory of abiogenesis. Robert Koch in 1877. published the results of experiments on anthrax or splenic fever in which he proved that bacteria were the cause of this disease.[2]

Bacteria are divided into several different classes. Morphologically they are classified as the coccus, bacillus and spirillum. Biologically there are several classifications as chromogenic and non-chromogenic, motile, and nonmotile, and several others but the classification with which we are most concerned is the pathogenic - disease producing and non-pathogenic - not disease producing.

The importance of bacteria is

understood better every day. Man stands at the head of all living organisms and bacteria are among the lowest forms of organisms. But there is a close relation between man and bacteria. It would be practically impossible for man or any other living organism to exist without them. They are the means by which the complex substances which compose the animal and vegetable tissues are broken down and given back to the soil and atmosphere, so these materials can again be used in building up different tissues; if this did not take place we would find in time, a stage when no organisms could be formed.

The saphrophytic bacteria are very important. They are always present in the alimentary canal, and after death invade the tissues causing putrefaction. Another important class is the Zymogenic bacteria which are found quite extensively in food. They give flavors to those foods which contain them, thus making the foods more desireable; but they often produce

Toxic substances in foods which are injurious to man.

Pathogenic bacteria are very numerous. A great many are found in the air and may rise with the dust. We may by inspiration be infected from the air. Bacteria may be expelled from a diseased body by expiration and infect the surrounding air. A healthy individual may be infected by inspiring this contaminated air. Thus the air is often infected in rooms or buildings; especially where there is no ventilation. In free air where there is an abundance of sunlight and oxygen the bacteria cannot exist for any great length of time.

Water is a common source of pathogenic bacteria. The water should be examined and watched carefully. It may become contaminated by pathogenic bacteria from its source, the soil it traverses or by coming in contact with sewerages or seepage from cemetaries, with decaying organic matter, public dump yards etc. Water is often contaminated with

typhoid bacillus which can pass through the porous soil and contaminate the water in which its vitality is retained for some time. There are other disease germs such as tuberculosis and scarlet fever, but the typhoid bacillus is the most common in water.

Soil contains bacteria, however most of these are concerned in the formation of plant food; but there are pathogenic bacteria in the soil which may contaminate the vegetable foods; the vegetables may absorb the bacteria or their products then when animals or man ingests this food they are infected with the bacteria, or its toxic products. Bacteria may also be lodged in the soil and in dry seasons circulated with the dust

Foods are another source of these bacteria; they were spoken of in connection with the soil, but they may become infected when stored away, or by being handled by people or coming in contact with animals having an infectious disease.

Dwellings and vehicles. If these are used by any one who has an infectious disease they should be disinfected and we should avoid them until they are disinfected

Articles and Utensils. These should be avoided if they have been used by an infected person. The germs can be transmitted readily by them if they are not disinfected or destroyed.

Cadavers. The bodies of men and animals dead of infectious diseases are a common source of pathogenic bacteria, as the bacteria will contaminate the air and water around them and may remain in the soil in some cases for years for example the tubercle bacillus. It is better to cremate the bodies dead of infectious diseases and decrease the danger.

Infected organisms are another source we should avoid any person or animal which has an infectious disease unless it is absolutely necessary to come in contact with them.

Bodies may become infected by infectious diseases directly or indirectly. In becoming infected directly they may inherit

the disease or come in contact with one having the disease. Indirectly is where the germ is deposited on some surrounding thing or object. In this way they may enter the body through wounds, the skin, alimentary canal or through any external passages of the body.

The micro-organisms produce poisonous substances such as toxins, bacterial poisons and ptomaines.

The animal body is able to resist infectious diseases through natural or acquired immunity. An immune animal is one in which the pathogenic bacteria do not produce infectious diseases the body being able to withstand their action. Natural immunity is where animals have a natural power to resist infection, it may have been brought about by being free from exposure; by heredity, for example, our parents may have been able to withstand some infectious diseases and we have inherited that power from them this would be an inherited acquired immunity; or it may have been brought about by a physiological action. Then we have a race immunity, that is a race is exempt from some disease. For

example the human is not, as a rule subject to diseases of the lower animals. There is also an individual immunity probably due to individual idiosyncracies. young animals are usually susceptible to diseases, for example the human is less susceptible to Tuberculosis after 40 years of age.

Acquired immunity is the artificial production of a condition in an animal by which it is able to resist infection. It may be brought about in two ways. First by an attack of an infectious disease ending in recovery This usually protects against the disease for some time but the animal may be rendered susceptible again by some abnormal condition. Second. Preventive inoculation is considered the best way to prevent infectious diseases. Either a virus or serum may be used for preventive inoculation. The virus is the disease germ attenuated. The serum is taken from an animal which has a naturally or acquired immunity. Immunity is supposed to be due to the production of bacterial products in the animal into which the bacteria or its products are introduced.

The growth of bacteria are affected by several things, there is considerable difference in the kind of soil on which they grow, some thrive better on an acid medium others better on an alkaline medium.
The temperature best suited to them is from 30°C to 40°C. The tubercle bacillus grows best at a temperature from 30°C to 41°C. others from 5 to 45°C. Some spores can be exposed to a temperature of 60°C. but as a rule we find that all pathogenic bacteria grow best at the temperature of their host. Oxygen is necessary for some, and for others, they require organic substances for their nourishment although they may absorb some inorganic compounds from ammonia salts.
Electricity retards their growth. When exposed to the Xrays their virulence is decreased but they are probably not killed.

Disinfection. Disinfection is the destruction of bacteria, both the vegetative and spore form. Disinfectain in cases of all infectious diseases is very important. Cleanliness is the first principle, in disinfecting things should be kept as clean as possible. Accumulation of filth near the house or in the cellar favors the devel-

opement of pathogenic bacteria.

All clothing used by a sick person or nurse should be carefully disinfected. To disinfect clothing, remove from the patient and immerse in a 5% solution of carbolic acid in the sick room, and allow it to soak one hour, then remove from the carbolic solution, and boil in a strong solution of soapsuds for one hour, and if there is any doubt dip the clothes in a carbolic solution again. Bed clothes may be disinfected in the same way. Disinfect all excretions by receiving them in an earthen vessel containing the disinfectant, such as a solution of carbolic acid or bichloride of mercury; chloride of lime is another good disinfectant for this purpose.

To disinfect rooms, curtains, carpets and all furniture, fumigate with formaldehyde gas by exposing them at a moderate temperature about 24 hours, using 30 ounces of formalin for each 1000 cuft. Sulphur can be used but it is not as good. Steam is one of the best disinfectants when it can be used.

Special Diseases.

Tuberculosis. Tuberculosis is an in-

Jectious disease caused by the Tubercle bacillus It is a disease common to man and most of the lower animals.

It was first studied in 1874 by Baillie but Koch discovered the tubercle bacillus in 1882, by this discovery he was enabled to prove that tuberculosis in man and animals is the same thing. It is one of the most dreaded of diseases affecting both old and young, male and female alike and probably causing more deaths than any other infectious disease.

The Tubercle bacillus varies in size being rod shaped with rounded ends and is from 1.5 – 3.5 μ in length and from 2 to 5 μ in width. It has no motile organs it is ~~aerot~~ aerobic.

The bacillus grows and multiplies very rapidly in a suitable medium. The most favorable medium is the tissues of the animal body. However it can be grown artificially on serum or glycerine agar. It reproduces by fission. Spores are probably produced which resist a higher temperature than the bacteria.

Effects of Physical conditions on the Bacillus. 1. Moisture decreases the virulence

of the bacillus; it becomes inert in from 50 to 69 days when suspended in water. But it may retain its virulence for years when in a dried condition. 2. Temperature. The bacilli will grow outside of the body at a temperature of from 29°C. to 42°C. 3. Light tends to decrease its virulence. If exposed to bright sunlight it will soon be killed. To cultivate it keep it in a dark place

Sources of the Bacillus.

Infected organisms are one source. Doctors often become infected by examining consumptive patients, excretory products. Foods, infected dwellings, vehicles, clothing and utensils are other sources of infection.

Channels of Infection.

1. Digestive canal.
2. Air passages.
3. Wounds. circulation etc.

The bacillus acts very differently on some organisms. It may leave the channel through which it enters perfectly free. Miliary tubercles are usually formed at the first which may break down, and allow the germ to be distributed over the body by the

by inphalies. The bacilli may also be distributed by continuity, or by the blood vessels.

Disinfection in connection with Tuberculosis is a very important factor. All excretory products should be disinfected with chloride of lime, or a 5% solution of phenolor creolin. Sodium hydroxide may be used. Steam is also a good disinfectant for things which can be steamed. To disinfect rooms use formalin.

Every precaution should be used to prevent Tuberculosis since there is no known remedy for it. Children should not be allowed to come in contact with Tuberculous subjects neither should they be allowed to eat food that is left by the patient. The same dishes should not be used until they have been disinfected.

Diphtheria.

Diphtheria is a specific infectious disease caused by the Klebs-Loeffler bacillus.

Diphtheria has been known since the first century, but the real cause of it was unknown until 1883 or 1884. Klebs in 1883 found that a bacillus existed in the

false membrane, and Loeffler found it in 1884 in persons suffering from diphtheria. The bacillus is now known by a combination of both names.

The bacillus is from 2.5 to 3 μ in length and from 5 to 8 μ in thickness it is slightly bent with rounded ends. It is not motile.

The bacillus produces a toxic substance or a toxalbumin which is absorbed from the seat of the local infection; it is this toxin that produces the symptoms of the disease and not the invasion of the blood by the bacillus.

Suppuration and pseudo-diphtheria bacteria are often found in conjunction with the Klebs-Loeffler bacillus. This may be one explanation for suppuration and for inflamatory conditions in diphtheria.

Debilitated persons are more susceptible and less able to resist diphtheria as well as others infectious diseases. Uncleanliness of the mouth, teeth and fauces, and chronic inflammatory conditions such as nasopharyngeal catarrah favor the development of the diphtheria bacteria.

The bacillus is generally transmitted by discharges from the nose or mouth, by means of the air, but it may be transmitted by ingested material, by excretions and anything which has been handled extensively. The bacillus may live a long time, outside of the body. This disease is more common to children but adults are not exempt from it, a very young child is not subject to it. Girls are more susceptible than boys.

In treating this disease it is best to have a competent physician. A 1/20% solution of corrosive sublimate is a good disinfectant to moisten the affected parts with occasionally. Milk is a good food to use, but it should be carefully sterilized.

For disinfecting in general use the same things as you would in a case of Tuberculosis.

Authorities.

1. Notes - given by A. T. Kinsley
2. Crookshank.
   Sternberg.
   McFarland.