Microbiology in living organisms

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ABSTRACT

Microbiology is the study of small organisms called micro-organisms or microbiota. In the late 1600’s and early 1700’s primitive microscopes existed. The Father of Microbiology, Anton van Leeuwenhoek, was a Dutch merchant and an amateur lens maker. He made a microscope by grinding lenses and putting them together in a way that they magnified an image 300X with little distortion. Leeuwenhoek was the first person to observe living micro-organisms and he referred to them as "animalcules". He found the micro-organisms in many different environments, such as stagnant water, sea water, his mouth, scrapings from between his teeth and in sick people. During his lifetime he observed bacteria, protozoa, algae, yeast, and fungi. During the span of the next Century, there was controversy over the theories of spontaneous generation and biogenesis. Spontaneous generation was the belief that living organisms arise from non-living matter. Biogenesis is the belief that living cells arise from pre-existing cells. The Golden Age of Microbiology existed from the mid-1800’s to the early 1900’s and involved rapid advances that led to microbiology as a science. During this time: a) micro-organisms were identified as the cause of diseases; b) vaccines were produced; c) surgical techniques and aseptic surgery were developed; d) the role of immunity in the prevention and cure of diseases was identified; e) chemical activities of organisms were studied; f) improved techniques for perfecting microscopy and culturing micro-organisms were developed and g) spontaneous generation was disproved. Louis Pasteur and Robert Koch were prominent scientists during this time period. Louis Pasteur performed a series of experiments which proved micro-organisms produce disease in other organisms, they cause plant and animal tissues to decompose, cause food to spoil and are found virtually everywhere. Once spontaneous generation was disproved, the field of microbiology changed from an observable science to an experimental science.

Keywords: Causative agent, postulates, susceptible organism, phylum.

INTRODUCTION

The germ theory of disease, which simply means that micro-organisms cause infectious diseases, became popular. Robert Koch provided a method of establishing the germ theory of disease which was known as Koch’s Postulates. The method involves four steps to establish that a micro-organism is the causative agent of a disease: 1) The specific microorganism causing the disease must be found in every case of the disease, but not in a healthy organism; 2) The disease-causing microorganism must be isolated in a pure culture (free of other micro-organisms); 3) Inoculation of a sample of the pure culture into a healthy susceptible organism must produce the same disease; 4) The disease-causing microorganism must be recovered from the newly infected organism.

Study of micro-organisms, or microbes, a diverse group of minute, simple life forms include bacteria, archaea,
algae, fungi, protozoa and viruses. The field is concerned with the structure, function and classification of such organisms and with ways of both exploiting and controlling their activities (Woese et al., 1990).

The 17th century discovery of living forms existing invisible to the naked eye was a significant milestone in the history of science and from the 13th century onward it had been postulated that "invisible" entities were responsible for decay and disease. The word microbe was coined in the last quarter of the 19th century to describe these organisms, all of which were thought to be related. As microbiology eventually developed into a specialized science, it was found that microbes are a very large group of extremely diverse organisms (Yarza, 2014).

Valued products such as antibiotics and insulin are produced. Micro-organisms are of incalculable value to the Earth's ecology, disintegrating animal and plant remains and converting them to simpler substances that can be recycled in other organisms (Yarza, 2014).

Leeuwenhoek, a Dutch draper whose hobby was lens grinding and making microscopes was the first to provide proper documentation of his observations. His descriptions and drawings included protozoans from the guts of animals and bacteria from teeth scrapings. His records were excellent because he produced magnifying lenses of exceptional quality. Leeuwenhoek conveyed his findings in a series of letters to the British Royal Society during the mid-1670s. Although his observations stimulated much interest, no one made a serious attempt either to repeat or to extend them. Leeuwenhoek's "animalcules," as he called them, thus, remained mere oddities of nature to the scientists of his day and enthusiasm for the study of microbes grew slowly. It was only later, during the 18th century revival of a long-standing controversy about whether life could develop out of non-living material, that the significance of micro-organisms in the scheme of nature and in the health and welfare of humans became evident.

**GENERATION OF MICROBIOLOGY**

The early Greeks believed that living things could originate from non-living matter (abiogenesis) and that the goddess Gea could create life from stones. Aristotle discarded this notion, but he still held that animals could arise spontaneously from dissimilar organisms or from soil. His influence regarding this concept of spontaneous generation was still felt as late as the 17th century, but toward the end of that century a chain of observations, experiments and arguments began that eventually refuted the idea. This advance in understanding was hard fought, involving series of events, with forces of personality and individuals often obscuring the facts (Woese et al., 1990) in the mid-1700s. In the early half of the 1800s, Franz Schulze and Theodor Schwann were major figures in the attempt to disprove theories of abiogenesis until Louis Pasteur finally announced the results of his conclusive experiments in 1864. In a series of masterful experiments, Pasteur proved that only pre-existing microbes could give rise to other microbes (biogenesis). Modern and accurate knowledge of the forms of bacteria can be attributed to German botanist Ferdinand Cohn, whose chief results were published between 1853 and 1892. Crohn's classification of bacteria, published in 1872 and extended in 1875 dominated the study of these organisms thereafter (Yarza, 2014).

**MICROBES AND DISEASE**

Girolamo Fracastoro, an Italian scholar, advanced the notion as early as the mid-1500s that contagion is an infection that passes from one thing to another. A description of precisely what is passed along eluded discovery until the late 1800s, when the work of many scientists, Pasteur foremost among them, determined the role of bacteria in fermentation and disease. Robert Koch, a German physician, defined the procedure (Koch's postulates) for proving that a specific organism causes a specific disease.

The foundation of microbiology was securely laid during the period from about 1880 to 1900. Students of Pasteur, Koch and others discovered in rapid succession a host of bacteria capable of causing specific diseases (pathogens). They also elaborated an extensive arsenal of techniques and laboratory procedures for revealing the ubiquity, diversity and abilities of microbes (Pace, 2006).

America at this time had studied either under Koch or at the Pasteur Institute in Paris. Once established in America, microbiology flourished, especially with regard to such related disciplines as biochemistry and genetics. In 1923, American bacteriologist David Bergey established that science's primary reference, updated editions of which continue to be used today (Gouy et al, 2015).

Since the 1940s microbiology has experienced an extremely productive period during which many disease-causing microbes have been identified and methods to control them developed. Micro-organisms have also been effectively utilized in industry; their activities have been channeled to the extent that valuable products are now both vital and common (Pace, 2006).

**CONCLUSIONS**

Bacteria have a variety of shapes including spheres, rods and spirals. Individual cells generally range in width from 0.5 to 5 micrometres (µm; millionths of a metre). Although unicellular, bacteria often appear in pairs, chains, tetrads (groups of four), or clusters. Some have flagella and external whip-like structures that propel the organism through liquid media; some have capsule, an external coating of the cell; some produce spores-reproductive
bodies that function much as seeds do among plants. One of the major characteristics of bacteria is their reaction to the Gram stain. Depending upon the chemical and structural composition of the cell wall, some bacteria are gram-positive, taking on the stain’s purple colour, whereas others are gram-negative (Williams et al., 2013).

REFERENCES


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