

Microbiology and Micro-organisms

a brief introduction:

MICROBIOLOGY: The section of biology concerned with organisms which are not visible by the naked eye. The study of micro-organisms, or microbiology began when the first microscopes were developed in the 1600's. In 1665 the English Scientist, Robert Hooke constructed a simple microscope and published a book with many illustrations of a previously unseen world of biological materials. His drawings of the honeycomb structure of cork, in which he named the compartments as "cells", resulted in the use of the word "Cell Biology". Hooke also observed fungi and protzoa, i.e. micro-organisms. Greater advances were made by the Dutch merchant Anton van Leeuwenhoek in 1674 with a microscope which observed minute forms of life in droplets of pond, rain, and sea water.

The serious study which is the basis of modern Microbiology began only with the pioneering work of Louis Pasteur in the mid 1800's. Pasteur showed that putrefaction of food arose from micro-organisms present in ordinary air. Lactic acid fermentation was shown to be due to bacteria, but wine and beer fermentation by yeasts. He identified the organisms which caused silkworm disease (pebrine) and developed a vaccine. He also showed how to prevent the spread of anthrax, developed a vaccine for rabies, and established the pasteurisation process for milk. Although Pasteur proposed the Germ Theory of disease, Robert Koch provided the proof with experiments on the spread of anthrax, clearly showing that specific micro-organisms caused specific diseases, and isolated the bacilli of tuberculosis, cholera and diphtheria.

SIZES OF MICRO-ORGANISMS:

Viruses: 0.02 to 0.2 microns

Bacteria: 0.2 to 5 microns

Yeast Cells: 8 to 10 microns

Fungal cells: 20 to 40 microns

Note: One micron is a millionth of a metre or $1/1,000,000$ of a metre = $1/1000$ of a millimetre

VIRUSES: These are the smallest micro-organisms. They take various shapes, e.g. icosahedron (20 sided), a helix (coil), or complex. They are made up of nucleic acids (DNA or RNA). Viruses cannot replicate themselves except by invading another cell, then utilising its cell metabolism to produce a copy of itself. The host cell can be destroyed or damaged by this process. Although they are very simple structures, viruses are the cause of many diseases such as influenza, hepatitis, chicken pox, polio and AIDS. Antibiotics are of no value in control of viral infections, which can be treated with anti-viral drugs or by use of vaccines.

BACTERIA: Bacterial cells contain a single chromosome made up solely of a single long strand (closed loop) of DNA. Chemical activities take place in the cytoplasm which surrounds the nucleus. Also suspended in the cytoplasm are ribosomes. These are small particles of protein and ribonucleic acid (RNA). There can be several thousand ribosomes in a bacterial cell. This is all contained by a cell membrane surrounded by a cell wall.

Movement is by coiled tubes of protein called flagellum. Bacteria are the most abundant organisms on Earth, they can survive in air, soil or water, under extreme conditions of heat, cold, acidity, with or without oxygen. They play a very important role in many essential natural processes, e.g. digesting sewage, digesting the remains of dead animals and plants, extract nitrogen from air, and manufacture foods for human consumption. However some bacteria (there are about 200 species) cause disease by growing in body tissues, destroying healthy cells, and producing toxins. Bacteria reproduce by binary fission, providing the conditions for a particular bacteria are suitable.

YEASTS AND FUNGI: Strictly fungi may be yeasts or moulds. Yeasts are unicellular organisms, the size of large bacteria, moulds are multicellular with long chains and filaments. Both obtain food by direct absorption of nutrients.

Yeasts are spherical, oval or cylindrical. Reproduction or growth is by budding, where a new cell forms a growth on a cell, enlarges, then separates. Yeasts remain a collection of single cells. Yeasts flourish in the presence of sugars, found naturally in fruits, flowers and other plants. Bakers and brewers yeasts – members of the *Saccharomyces* genus are important commercial yeasts.

Moulds with their filament structure (furry appearance) can frequently be seen on stale bread, fruit, cheese and other foods. Together with bacteria they are responsible for the decay and decomposition of all organic matter. Some can cause serious plant and animal disease.