Microbiology Part

Definitions:

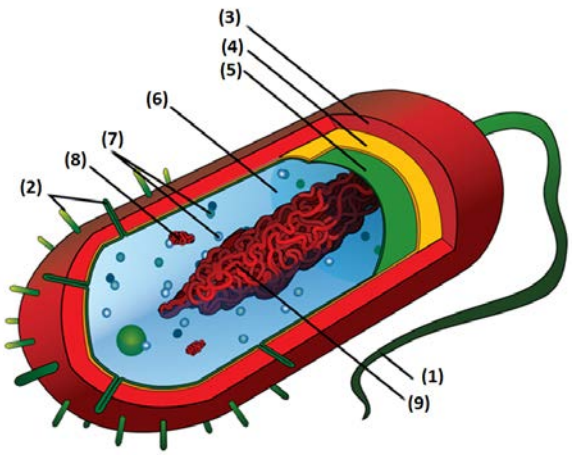
- **Microbiology** is the study of microscopic organisms (..microorganisms...). They are also referred to as .microbes....., or more commonly, ..germs..... , especially to ordinary people. Principal groups of microorganisms are: bacteria, viruses, archaea, fungi and protozoa. This discipline includes fundamental research on the biochemistry, physiology, cell biology, ecology, evolution and clinical aspects of microorganisms, including the host response to these agents.

- **Sterilization**: [Latin *sterilis*, unable to produce offspring or barren] is the process by which all .living..... cells, viable .spores..... , viruses, and viroids are either .destroyed... or removed..... from an .object.....or .habitat.....

- **Disinfection** is the killing, inhibition, or removal of microorganisms that may cause .illness..... . The primary goal is to destroy potential .pathogens.., but disinfection also substantially .reduces..... the total microbial population.

- It is frequently necessary to control microorganisms on living tissue with chemical agents. .Antisepsis.. [Greek anti, against, and sepsis, putrefaction] is the prevention of infection or sepsis and is accomplished with antiseptics... These are chemical..... agents applied to tissue to prevent infection by killing or inhibiting .pathogens.. growth; they also reduce the totalmicrobial..... population.... Because they must not destroy too much .host... tissue, antiseptics are generally not as toxic as .disinfectants

Activity: Name the different cellular structures of a bacterium (Figure below)



1- Bacterial flagellum

2- Pili

3- Capsule

4- Cell wall

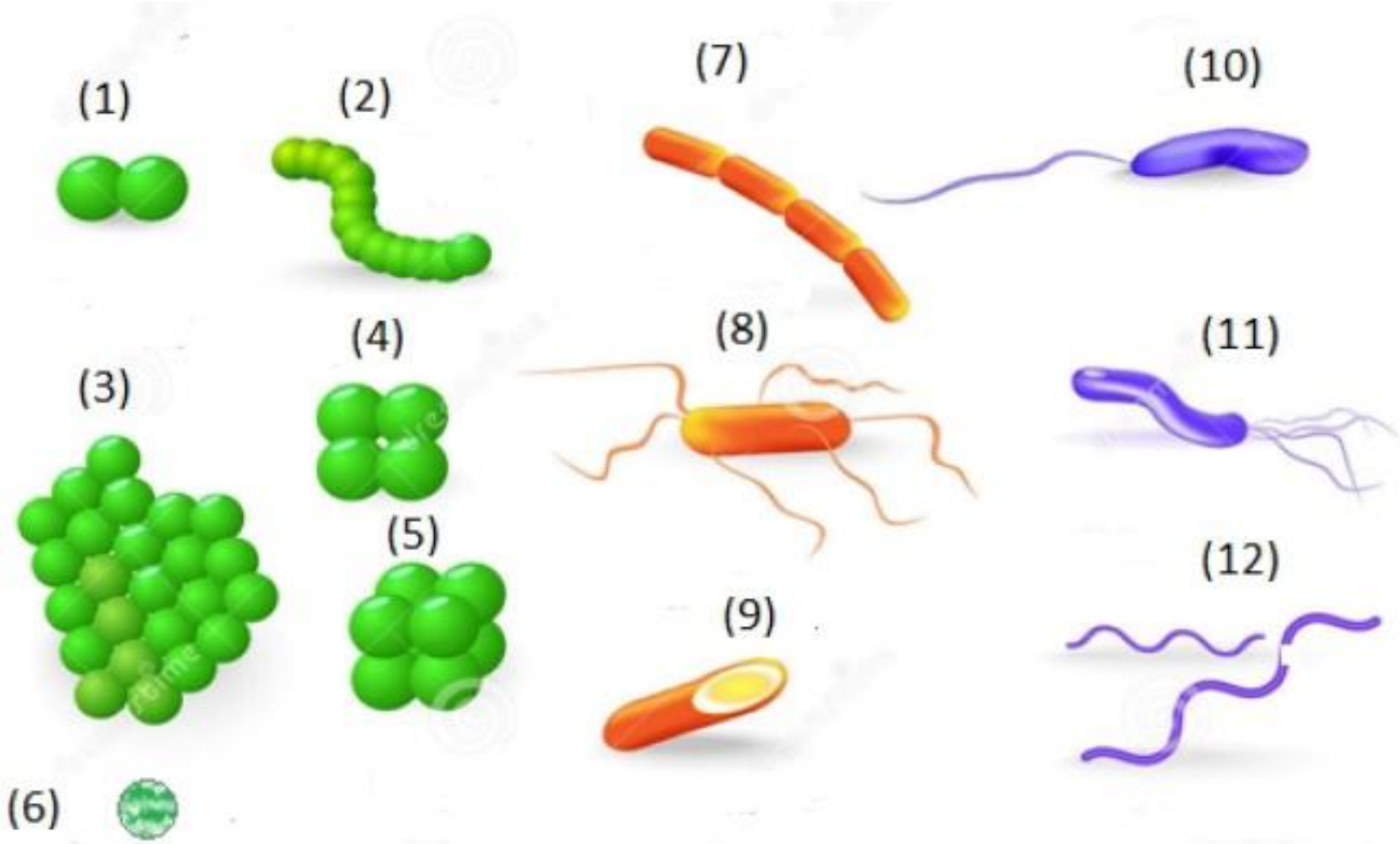
5- Plasma membrane

6- Cytoplasm

7- Ribosomes

8- Plasmid

9- Nucleoid (Circular D.N.A.)



(1 + 2 + 3 + 4 + 5 + 6) spherical (cocci).

(7 + 8 + 9) rod (bacilli),

(6;8;9;10;11;12) single cell ,

(1) in pairs,

(2; 7) chains, (3 + 4 + 5) clusters.

(11) spiral (spirilla), (10) comma (vibrios), (12) corkscrew (spirochaetes).

Principal groups of Microorganisms:

Bacteria: Bacteria are single celled microbes. The cell structure is simpler than that of other organisms as there is no nucleus or membrane bound organelles. Their control centre containing the genetic information is contained in a single loop of DNA (circular chromosome). Some bacteria have an extra circle of genetic material called a plasmid. The plasmid often contains genes that give the bacterium some advantage over other bacteria. For example, it may contain a gene that makes the bacterium resistant to a certain antibiotic.

Principal shapes: Bacteria are classified into 5 groups according to their basic shapes: spherical (cocci), rod (bacilli), spiral (spirilla), comma (vibrios) or corkscrew (spirochaetes). They can exist as single cells, in pairs, chains or clusters.

Archaea: Archaea can be spherical, rod, spiral, lobed, rectangular or irregular in shape. Some exist as single cells, others form filaments or clusters. Until the 1970s this group of microbes was classified as bacteria. They are similar to bacteria by the lack of nuclear membrane (prokaryotes), yet they are different by the lack of peptidoglycan.

Virus: Viruses are the smallest of all the microbes although there might be some exceptions (Mimivirus). They are unique because they are only alive and able to multiply inside the cells of other living things. The cell they multiply in is called the host cell.

Algae: Most algae are found in freshwater and marine environments; a few grow in terrestrial habitats. They are a diverse, polyphyletic assemblage of unicellular, colonial, and multicellular eucaryotic organisms. Most are photoautotrophs and store carbon in a variety of forms, including starch, oils, and various sugars.

Fungi: Fungi can be single celled or very complex multicellular organisms. They are found in just about any habitat but most live on the land, mainly in soil or on plant material rather than in sea or fresh water. A group called the decomposers grow in the soil or on dead plant matter where they play an important role in the cycling of carbon and other elements. Some are parasites of plants and can lead to significant monetary loss for the farmer. A very small number of fungi cause diseases in animals. In humans these include skin diseases such as athletes' foot.
(Yeast, Mold, Mushrooms)

Protozoa: *Protozoa* are single celled organisms. They come in many different shapes and sizes. *Protozoa* live in a wide variety of moist habitats including fresh water, marine environments and soil as free-living organisms such as *Paramecium*, some others take a parasitic lifestyle by infesting biological organisms such as *Leishmania*.

Multicellular Parasites: Helminths are large, multicellular organisms that are generally visible to the naked eye in their adult stages (while also microscopic stages in life cycles occur). Like protozoa, helminths can be either free-living or parasitic in nature (see chapter zoology for more details).

☺ **Activity:**

❖ Find the problems (illnesses, symptoms) that may cause the following microbes:

Salmonella (Typhoid fever): Weakness , abdominal pain, constipation and headaches

Aspergillus (Aspergillosis): Dyspnea (breathing disorder) , cough , fever , thoracic pain

Trypanosoma (African trypanosomiasis or sleeping sickness): fevers, headaches, itchiness, and joint pains (1rst stage of the disease) ,confusion, poor coordination, numbness and trouble sleeping (2nd stage)

Plasmodium (Mother-to-child (congenital)): (Disease : Malaria) : Appetite loss , digestion problems, dizziness, tiredness , abdominal pain , vomiting , nausea

H5N1 (Bird flu): Breathing troubles . Diarrheas , vomiting, nosebleeding and gumsbleeding , abdominal pain

❖ Find the benefits (products) that may be produced the following microbes:

Penicillium: can produce penicilin a molecule that is used as an antibiotic, which kills or stops the growth of certain kinds of bacteria inside the body

Lactococcus and *Lactobacillus*: They produce acid lactic

Streptomyes: can produce antibiotic ,

Algae: Oxygen and oil productions

❖ Look for the definition and the translation of the below vocabularies:

Bunsen burner. Bec Bunsen :a type of gas burner that produces a single open gas flame, which is used for heating, sterilization, and combustion

Food spoilage. Alteration des aliments : Spoilage is the process in which food deteriorates to the point in which it is not edible to humans or its quality of edibility becomes reduced

Gram Stain (dye). Coloration de Gram is a method of staining used to differentiate bacterial species into two large groups (Gram-positive and Gram-negative)

Lab bench: Paillasse : a workplace for the conduct of scientific research

Lab coat. Blouse a light coat worn to protect clothing from substances used while working in a laboratory

Media agar. Milieu gelose A gelatinous material derived from certain marine algae. It is used as a base for bacterial culture media and as a stabilizer and thickener in many food products

Petri dishes. Boite de Petri is a shallow cylindrical glass or plastic lidded dish that biologists use to culture cells such as bacteria

Sampling: Echantillonnage A small portion, piece, or segment selected as a sample.

Screening. Depistage A systematic examination or assessment, done especially to detect an unwanted substance or attribute.

Spread. Etalement : The action of spreading a substance in order to cover the area

Strains Isolation. Isolation d'une souche : The action of separating a strain from his natural media

Target. Cible an object or area toward which something is directed.

☺ **Reading: Read and color (underline) the keywords.**

Microbes Interactions:

They are found almost everywhere on planet. They are on our skin, in the air we breathe, on every surface we touch, and even inside our bodies. Usually, we do not notice microorganisms until they cause physical damage (illness). We often forget microbes play beneficial role in human health; benefits are greater than problems created by microbes.

Microbial ecology:

Most microorganisms in complex communities have not been grown or characterized. This has limited our understanding of microorganism interactions and their roles in nature and disease. Molecular techniques are providing a better understanding of these uncultured organisms.

Microbial ecology is the study of microbial relationships with other organisms and also with their nonliving environments. The term symbiosis, or "together-life," can be used to describe many of the interactions between microorganisms, and also microbial interactions with higher organisms, including plants and animals. These interactions may be positive or negative.

Extreme environments restrict the range of microbial types able to survive and function. This can be due to physical factors such as temperature, pH, pressure, or salinity. Many microorganisms found in "extreme" environments are especially adapted not only to survive, but to function metabolically under these particular conditions.

Most microorganisms associated with the human body are bacteria; they normally colonize specific sites. There are both positive and negative aspects of these normal microorganisms. Sometimes they compete with pathogens; other times they are capable of producing opportunistic infections. The host's ability to resist infection depends on a constant defense against microbial invasion. Resistance arises from both nonspecific and specific body defense mechanisms.

Clinical Microbiology:

Clinical microbiologists and clinical microbiology laboratories perform many services, all related to the identification and control of microorganisms.

Success in clinical microbiology depends on (1) using the proper aseptic technique; (2) correctly obtaining the clinical specimen from the infected patient by swabs, needle aspiration, intubation, or catheters; (3) correctly handling the specimen; and (4) quickly transporting the specimen to the laboratory.

One of the challenging issues in clinical microbiology is antibiotic resistance.

Microbiology of Food:

Foods often provide an ideal environment for microbial survival and growth. Microbial growth in foods involves successional changes, with intrinsic, or food-related, and extrinsic, or environmental, factors interacting with the microbial community over time.

Food spoilage is a major problem in all societies. This can occur at any point in the course of food production, transport, storage, or preparation. Food-borne toxins are of increasing concern, especially with increases in international shipments and extended storage of food products before use. Growth of fungi can result in the synthesis of toxins. Algal-derived toxins can be transmitted to humans through freshwater and marine-derived food products.

Foods can be preserved by physical, chemical, and biological processes. Refrigeration does not significantly reduce microbial populations but only retards spoilage. Pasteurization results in a pathogen-free product with a longer shelf life. Chemicals can also be added to foods to control microbial growth.

Industrial Microbiology and Biotechnology:

Microorganisms are used in industrial microbiology and biotechnology to create a wide variety of products and to assist in maintaining and improving the environment.

Most work in industrial microbiology has been carried out using microorganisms isolated from nature or modified through mutations "natural genetic engineering.". In modern biotechnology, microorganisms with specific genetic characteristics can be constructed to meet desired objectives. A major challenge in biotechnology is to be able to grow and characterize these observed but uncultured microorganisms in what is called "bioprospecting."

The development of growth media and specific conditions for the growth of microorganisms is a large part of industrial microbiology and biotechnology.

Additional materials and references:

http://www.nature.com/subjects/microbiology
http://www.microbiologyonline.org.uk/
http://biology.clc.uc.edu/Fankhauser/Labs/Microbiology/Micro_Station_Equipment.htm
http://www.cdc.gov/

Prescott M. L. Harley P. J. Klein A. D. (2002): *Microbiology*. McGraw-Hill Science/ Engineering/ Math; 5 edn. 1026 P.