Ministry of high Education and Scientific Research
Foundation of Technical Education
College of Health and Medical techniques/ Kufa

In

Medical Microbiology

For
Students of second class

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By

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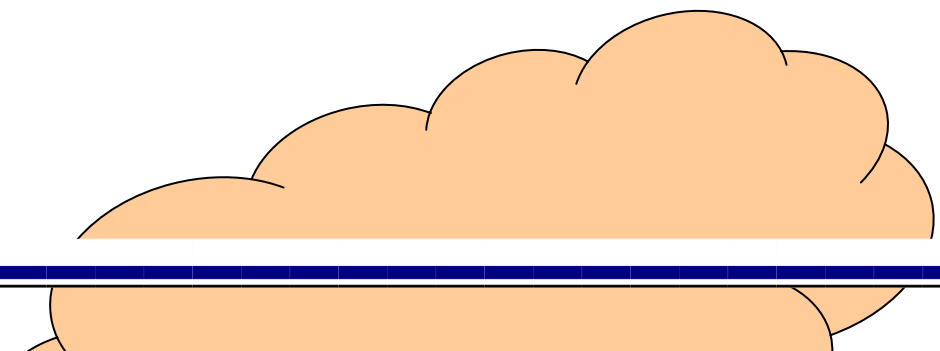
Assistant Lecturer



General Bacteriology

1/ Over view

1 / A –Target population :-

For students of second class

Health and Medical Technical College

Department of Society Health

Medical Microbiology

1 / B –Rationale :-

Bacteriology is very important subject to be studied in order to have a full knowledge about Bacterial infection and to getting rid of bacterial diseases, for this reason I have designed this modular unit for this knowledge to be understood .

1 / C –Central Idea :-

1 – Definition of Bacteriology

2 -Bacteriology in a diagram :-

a - General Bacteriology

b - History and Scope

1 / D –Instructions:-

1. Study over view thoroughly.
2. Identify the goal of this unit.
3. Do the pre test and if you :-
    - get 9 or more you do not need to proceed .
    - get less than 9 you have to study this unit well .
4. After studying the text of this, do the post test, and if you:
    - get 9 or more , so go on studying another unit.
    - get less than 9 go back and study the unit; or any part of it and then do the post test again .

2/ Performance Objectives :-

After studying the unit , the student will be able to:-

1. Know Bacteriology Definition.
2. Know the first scientists who work in bacteriology.
3. Know the history of bacteriology.

3/ Pre test :-

Circle the correct answer:-

1. **Bacteria were first observed in?**

a-1905 b-1859

c- 1910 c- 1674

2. **The first scientist who discovered bacteria was :-**

a- Van leeuwenhoek b- Robert Koch

c- Paul Ehrlich d-Louis Pasteur

3. **Scientist discovered that Bacteria are the cause of many diseases in :**

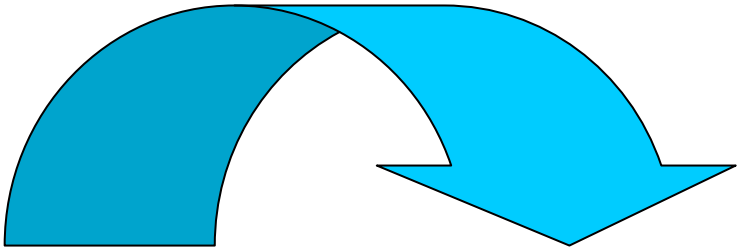
a- Seventeenth century b-Nineteenth century

c- Fourteenth century d- Twelfth century

4- A major step forward in the study of bacteria in 1977 that archaea have a separate line of bacteria by:

a- Paul Elrlich b- Carl Woese

c- Metch Nikoff d- Jenner Who



Note

- Check your answers in the Text Page 6

- (2.5) degree for each answer.

4/ The text :-

What is Bacteriology?

Bacteriology is the study of bacteria. Bacteria are microscopic organisms composed of a single cell. They are generally referred to as microorganisms because they are so tiny that a microscope is often needed to visualize them. An individual who studies, identifies, and classifies bacteria is called a bacteriologist. He usually does his studies in the laboratory.

The microscope is an essential tool for many bacteriologists as it can magnify the minute organisms many times their actual size. The improvement of the microscope by Anton van Leeuwenhoek has opened the minute world of bacteria to everyone. It was in 1674 when Leeuwenhoek first discovered bacteria.

Different classes of bacteria have different requirements for growth. Some cannot survive extremes of temperatures, while others prefer very low or high temperatures. Many bacteria also differ in their oxygen needs and nutrient needs. Other ways to identify bacteria are through their appearance or shape, the substances they produce, and through their chemical reactions when tested in the laboratory. For example, rod-shaped bacteria are called bacilli, while round-shaped bacteria are known as cocci.

In bacteriology, the structure, functions, and growth of various bacteria have been discovered. Bacteriology has also explored

the positive and negative impact of bacteria in the environment and in human beings. Another important scope of bacteriology is the identification of bacteria that often cause disease in man and animals, and the mechanisms of how they bring about infection. This is an important aspect of bacteriology, which leads to the development of antibiotics or antibacterial drugs known to treat diseases caused by bacteria.

Bacteriology is a subcategory of microbiology, the study of microorganisms. Aside from bacteria, microbiology also studies fungi, viruses, and parasites in association to the diseases they cause in man. In medicine, microbiology and immunology are often studied together. Immunology deals with the responses of the immune system to the presence of microorganisms inside the body. Treatment and prevention of diseases are made possible because of these studies.

Bacteriology, History and Scope:

Bacteria were first observed by the Dutch scientist Anton van Leeuwenhoek, using a single-lens microscope of his own design. He called them "animalcules" and published his observations in a long series of letters to the Royal Society. The name bacterium was introduced much later, by Christian Gottfried Ehrenberg in 1828, and is derived from the Greek word βακτήριον -α, bacterion -a meaning "small staff".

Louis Pasteur demonstrated in 1859 that the fermentation process is caused by the growth of microorganisms, and that this growth is not due to spontaneous generation. (Yeasts and molds, commonly associated with fermentation, are not bacteria, but rather fungi.) Along with his contemporary, Robert Koch, Pasteur was an early advocate of the germ theory of disease. Robert Koch was a pioneer in medical microbiology and worked on cholera, anthrax and tuberculosis. In his research into tuberculosis, Koch finally proved the germ theory, for which he was awarded a Nobel Prize in 1905.In Koch's postulates, he set out criteria to

test if an organism is the cause of a disease; these postulates are still used today. Though it was known in the nineteenth century that bacteria are the cause of many diseases, no effective antibacterial treatments were available.

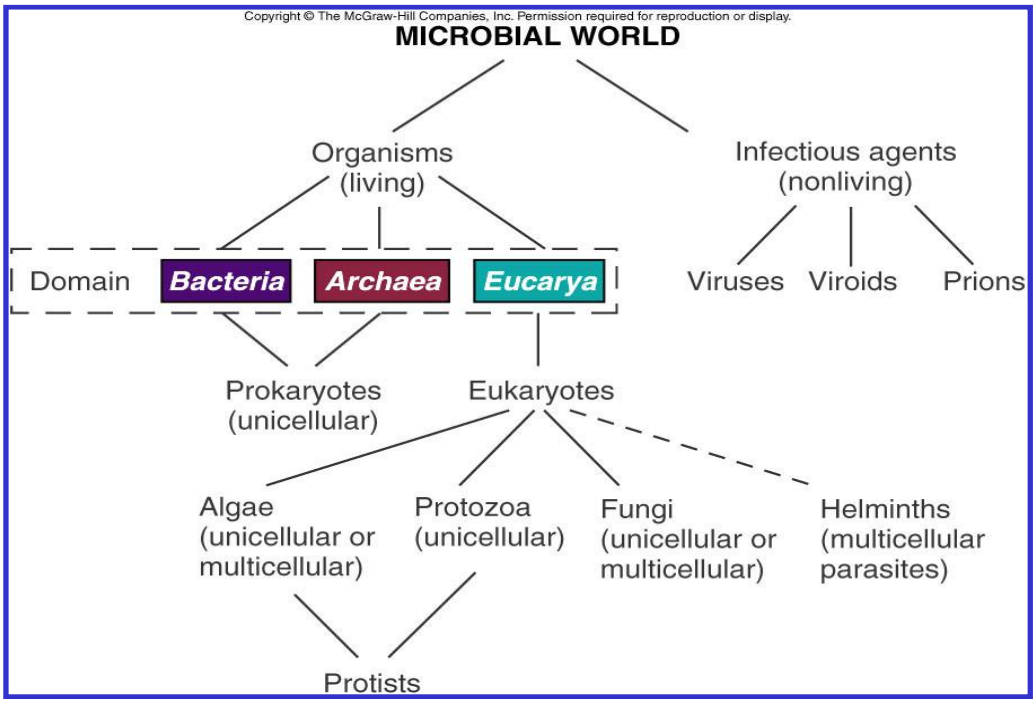


Figure 1: Microorganisms classification

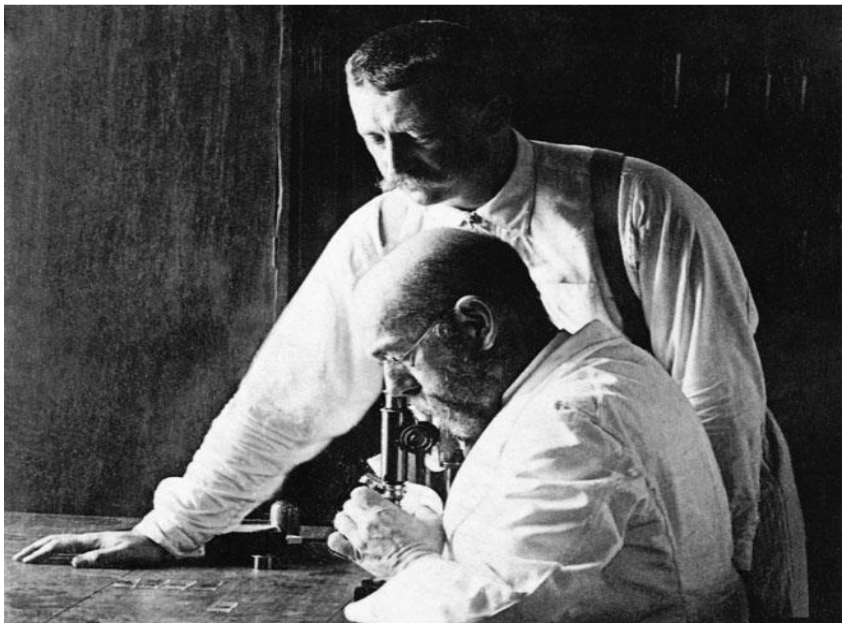
In 1910, Paul Ehrlich developed the first antibiotic, by changing dyes that selectively stained Treponema pallidum—the spirochete that causes syphilis—into compounds that selectively killed the pathogen. Ehrlich had been awarded a 1908 Nobel Prize for his work on immunology, and pioneered the use of stains to detect and identify bacteria, with his work being the basis of the Gram stain and the Ziehl-Neelsen stain.

A major step forward in the study of bacteria was the recognition in 1977 by Carl Woese that archaea have a separate line of evolutionary descent from bacteria (Fig-1). This new phylogenetic taxonomy was based on the sequencing of 16S ribosomal RNA, and divided prokaryotes into two evolutionary domains as part of the three-domain system.

Antonie van Leeuwenhoek

Hooke's Microscope

Louis Pasteur (1822-1895)



Robert Koch (1843-1910)

Quiz / 1

Define Bacteriology, Bacteriologist.

Note

Check your answers in the text.

Bacteria:

Bacteria are small (0.6–4.0μm) unicellular organisms; 3×10^{12} bacteria weigh in the order of 1g. Under optimal conditions, a bacterium may divide between two or three times per hour. Theoretically, nearly 300g of bacterial mass can be produced from a single bacterial cell in one day. Such small organisms profit from a favorable cell surface-to-volume ratio, which allows metabolic fluxes largely superior to those attained by the larger eukaryotic cells. Bacteria react very quickly to environmental changes, regulating gene transcription to adapt their physiology.

Quiz / 2

Are bacteria unicellular or multicellular organism? and in which group it was classified, Prokaryote or Eukaryote?

Note:

Check your answers in the text.

5/ Post test :-

Circle the correct answer:-

1- Bacteriology concentrated on studying bacterial :

a- structure b- growth

c- Function d- all these

2-Bacteria are :

a-multicellular b-unicellular

c-eukaryotic d- prokaryotic

3-The germ theory wae proved by:

a-Pasteur b- Koch

c-Carl Woese d-Ehrlich

4-Under suitable conditions, bacteria divide:

a-2-3 times b- 5-6 times

c- 10-15 times d- more

Note

Check your answers in the text.

- (2.5) degree for each answer.

6/ key answers :-

1- Pre test answers :-

1. **c**
2. **a**
3. **b**
4. **b**

2- Post test answers :-

1. **d**
2. **a,d**
3. **b**
4. **a**

7/Sources :-

1-Jawetz, Melnick, & Adelberg; Medical Microbiology, 24th ed.

2-*Textbook of Microbiology by Ananthanarayan 6th ed. 281)*
Prokaryotes are unicellular organism. Bacteria and blue green algae are prokaryotes.

3-Fredrickson JK, Zachara JM, Balkwill DL, et al. (July 2004). "Geomicrobiology of high-level nuclear waste-contaminated vadose sediments at the Hanford site, Washington state". Applied and Environmental Microbiology 70.

4-Rappé MS, Giovannoni SJ (2003). "The uncultured microbial majority". Annual Review of Microbiology 57: 369–94. doi:10.1146/annurev.micro.57.030502.090759. PMID 14527284.

Morphology of Bacteria

1/ Over view

/ A –Target population :-

For students of second class

Health and Medical Technical College

Department of Society Health

Medical Microbiology

1 / B –Rationale :-

Bacterial morphology is very important subject to be studied in order to have a full knowledge about Bacterial size and shapes and to understand bacterial diagnosis in laboratory.

1 / C –Central Idea :-

1 – Definition of Bacterial morphology

2 – Study shapes and size and other bacterial structures

1 / D –Instructions:-

1. Study over view thoroughly.
2. Identify the goal of this modular unit .

2/ Performance Objectives :-

After studying the unit, the student will be able to:-

1- Know bacterial morphology.

2- Know the different shapes and their names.

3/ Pre test :-

Circle the correct answer :-

1-morphology means:

a.structure **b.size**

c.movement **d.shape**

2- bacteria shapes and sizes are:

a. one shape **b.many shapes**

c.non regular shape **d.other**

3-bacterial cells length is:

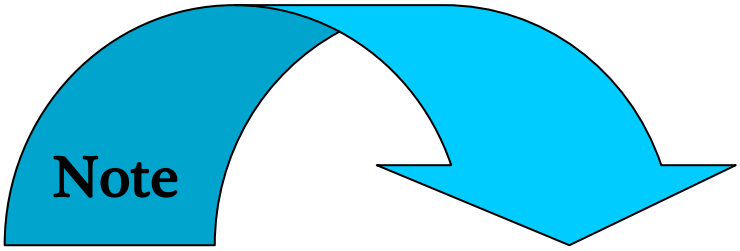
a.5-8 micrometer **b.7-9micrometer**

c.0.5 - 5 micrometer **d.more**

4-morphological changes in bacterial shapes occur:

a.impossible **b. possible**

c.no changes **d. other**



- Check your answers in the Text Page

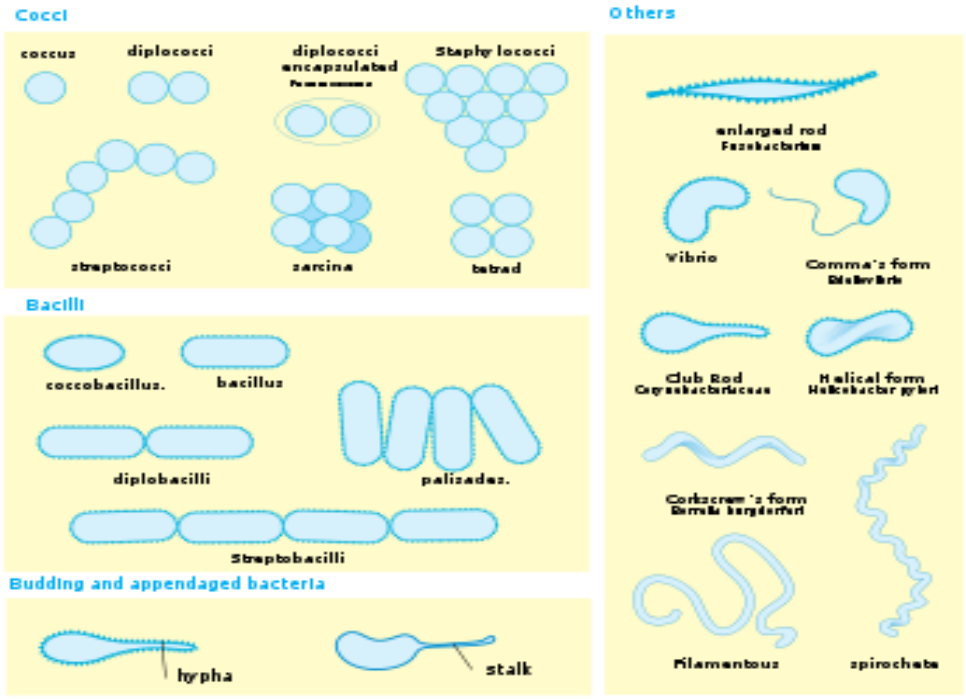
- (2.5) degree for each answer.

4/ The text :-

Morphology of Bacteria

Bacteria display many cell morphologies and arrangements. Bacteria display a wide diversity of shapes and sizes, called *morphologies*. Bacterial cells are about one tenth the size of eukaryotic cells and are typically 0.5–5.0 micrometres in length. However, a few species–for example *Thiomargarita namibiensis* and *Epulopiscium fishelsoni*–are up to half a millimetre long and are visible to the unaided eye. Among the smallest bacteria are members of the genus *Mycoplasma*, which measure only 0.3 micrometres, as small as the largest viruses.

Bacterial cellular morphologies



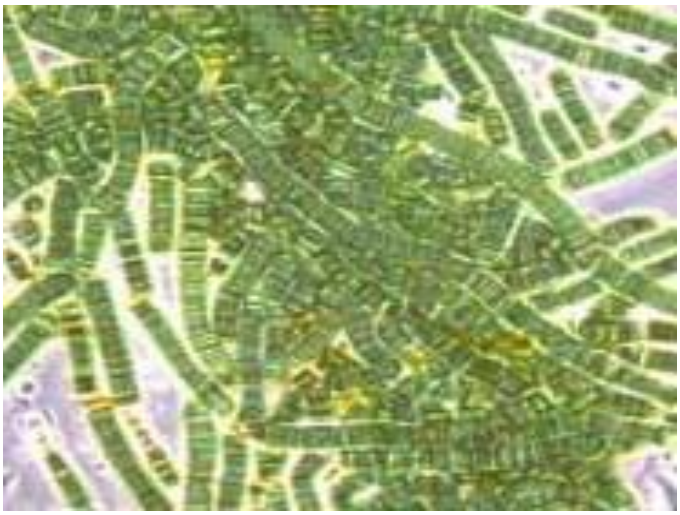
Some bacteria may be even smaller, but these ultramicrobacteria are not well-studied.

Most bacterial species are either spherical, called cocci (*sing*. coccus, from Greek *κόκκος-kókkos*, grain, seed) or rod-shaped, called bacilli (*sing*. bacillus, from Latin *baculus*, stick). Elongation is associated with swimming.Some rod-shaped bacteria, called vibrio, are slightly curved or comma-shaped; others, can be spiral-shaped, called spirilla, or tightly coiled, called spirochaetes. A small number of species even have tetrahedral or cuboidal shapes. More recently, bacteria were discovered deep under the Earth's crust that grow as long rods with a star-shaped cross-section. The large surface area to volume ratio of this morphology may give these bacteria an advantage in nutrient-poor environments. This wide variety of shapes is determined by the bacterial cell wall and cytoskeleton, and is important because it can influence the ability of bacteria to acquire nutrients, attach to surfaces, swim through liquids and escape predators.

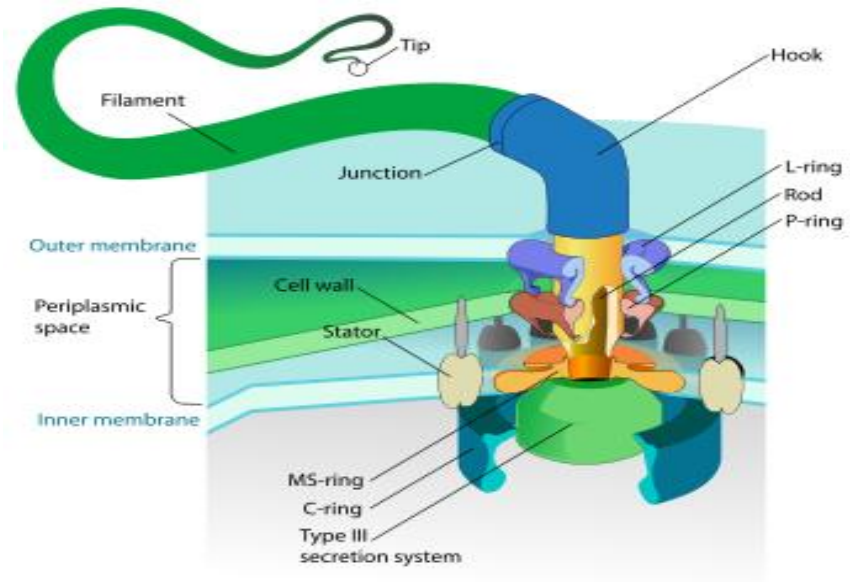
Many bacterial species exist simply as single cells, others associate in characteristic patterns: *Neisseria* form diploids (pairs), *Streptococcus* form chains, and *Staphylococcus* group together in "bunch of grapes" clusters. Bacteria can also be elongated to form filaments, for example the Actinobacteria. Filamentous bacteria are often surrounded by a sheath that contains many individual cells. Certain types, such as species of the genus *Nocardia*, even form complex, branched filaments, similar in appearance to fungal mycelia.

Bacteria often attach to surfaces and form dense aggregations called biofilms or bacterial mats. These films can range from a few micrometers in thickness to up to half a meter in depth, and may contain multiple species of bacteria, protists and archaea. Bacteria living in biofilms display a complex arrangement of cells and extracellular components, forming secondary structures such as microcolonies, through which there are networks of channels to enable better diffusion of nutrients. In natural environments, such as soil or the surfaces of plants, the majority of bacteria are bound to surfaces in biofilms. Biofilms are also important in medicine, as these structures are often present during chronic bacterial infections or in infections of implanted medical devices, and bacteria protected within biofilms are much harder to kill than individual isolated bacteria.

Even more complex morphological changes are sometimes possible. For example, when starved of amino acids, Myxobacteria detect surrounding cells in a process known as quorum sensing, migrate towards each other, and aggregate to form fruiting bodies up to 500 micrometres long and containing approximately 100,000 bacterial cells. In these fruiting bodies, the bacteria perform separate tasks; this type of cooperation is a simple type of multicellular organisation. For example, about one in 10 cells migrate to the top of these fruiting bodies and differentiate into a specialised dormant state called myxospores, which are more resistant to drying and other adverse environmental conditions than are ordinary cells.



Filaments of photosynthetic cyanobacteria



Flagellum of Gram-negative Bacteria. The base drives the rotation of the hook and filament.

Quiz / 1

What are the most existence shapes of bacteria?

Note

Check your answers in the text.

Quiz / 2

What is the structure that help bacteria in movement?

Note

Check your answers in the text.

5/ Post test :-

Circle the correct answer:-

1-bacteria sometimes aggregate to form fruiting bodies containing about:

a-800000 cells b-300000 cells

c-100000 cells d-10000 cells

2-the wide variety of shapes is determined by the bacterial:

a-flagella b-microspores

c-cytoplasm d-cell wall

3-bacteria group together to form filament surrounded by:

a-skeleton b- sheath

c-cell wall d-endoplasm

4- Among the smallest bacteria are members of the genus:

a-entrobacteria b- mycoplasma

c-neisseria d-corynebacteria

Note

Check your answers in the text.

- (2.5) degree for each answer.

6/ key answers :-

1- Pre test answers:-

1. b. d
2.b
3.c
4.**b**

2- Post test answers:-

1.c
2.d
3.a
4.b

7/Sources :-

1. "Bacteria (eubacteria)". *Taxonomy Browser*. NCBI. http://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?mode=Undef&id=2&lvl=3&lin=f&keep=1&srchmode=1&unlock. Retrieved 2008-09-10.
2. Fredrickson JK, Zachara JM, Balkwill DL, *et al.* (July 2004). "Geomicrobiology of high-level nuclear waste-contaminated vadose sediments at the Hanford site, Washington state". *Applied and Environmental Microbiology* **70** (7): 4230–41. doi:10.1128/AEM.70.7.4230-4241.2004. PMID 15240306.
3. Whitman WB, Coleman DC, Wiebe WJ (June 1998). "Prokaryotes: the unseen majority". *Proceedings of the National Academy of Sciences of the United States of*

America **95** (12): 6578–83. doi:10.1073/pnas.95.12.6578. PMID 9618454.
4. Rappé MS, Giovannoni SJ (2003). "The uncultured microbial majority". *Annual Review of Microbiology* **57**: 369–94.

Nutritional Requirement of Bacteria

1/ Over view

1 / A –Target population :-

For students of second class

Health and Medical Technical College

Department of Society Health

Medical Microbiology

1 / B –Rationale :-

Nutritional requirement of bacteria is very important subject to be studied in order to have knowledge about growth and development of generations.

1 / C –Central Idea :-

1 – Know nutritional state of bacteria

2 – Understand the stages of development and growth and to know the suitable media foe reproduction.

1 / D –Instructions:-

1. Study over view thoroughly.
2. Identify the goal of this unit.
3. Do the pre test.

2/ Performance Objectives :-

After studying the unit, the student will be able to:-

1- Know bacterial nutritional requirements

2- Know the different type of nutrition and media for growth.

3/ Pre test :-

Circle the correct answer :-

1-Basic nutritional requirements of bacteria were:

a. O_2 **b.Co_2**

c. PO_4 **d.all**

2- The source of energy include:

a.light **b.phosphorus**

c.ammonia **d.all**

3-artificial cultures need:

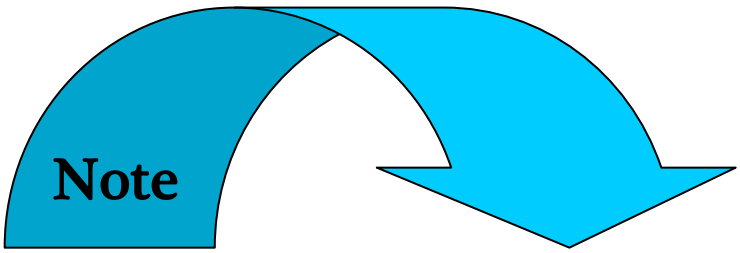
a. major elements **b.composition**

c.nutritional requirements **d.other**

4-bacterial growth depends on:

a.carbon sourse **b. energy soures**

c.different nutrients **d.other**



- Check your answers in the Text Page

- (2.5) degree for each answer.

4/ The text :-

Basic Nutritional Requirements include:

A SOURCE OF ENERGY. This may be light (the sun or lamps) or inorganic substances like sulfur, carbon monoxide or ammonia, or preformed organic matter like sugar, protein, fats etc. Without energy life can not exist and quickly dies or becomes inactive.

A SOURCE OF NITROGEN. This may be nitrogen gas, ammonia, nitrate/nitrite, or a nitrogenous organic compound like protein or nucleic acid.

A SOURCE OF CARBON. This can be carbon dioxide or monoxide, methane, carbon monoxide, or complex organic material

A SOURCE OF OXYGEN. All cells use oxygen in a bound form and many require gaseous oxygen (air), but oxygen is lethal to many microbes.

A SOURCE OF PHOSPHOROUS, SULFUR, MAGNESIUM, POTASSIUM & SODIUM.

A SOURCE OF CALCIUM. Most cells require calcium in significant quantities, but some seem to only need it in trace amounts.

A SOURCE OF WATER. All life requires liquid water in order to grow and reproduce; which is why the Mars Mission is so interested in water on Mars. Some resting stages of cells, like #bacterial spores, can exist for long periods without free water, but they do not grow or metabolize.

A SOURCE OF MINERALS LIKE IRON, ZINC, COBALT ETC.

These are called TRACE metals that are required by some enzymes to function. You will learn about their role in #Chap. VII.

The sources of these various requirements DEFINES AN ORGANISM, so a description of every organism should include this information. Many bacteria can synthesize every complex molecule they need from the BASIC MINERALS, but others, said to be FASTIDIOUS, require PREFORMED organic molecules like vitamins, amino acids, nucleic acids, carbohydrates; humans are fastidious.

In general bacterial pathogens need more PREFORMED ORGANIC MOLECULES than do non-pathogens, but that is not always true. For example some bacteria that are found in milk hardly make any of their own basic organic molecules, that is they let the cow (or more to the point the #microbes that live in the cow's gut) make these things for them.

A simple rule of thumb is "if humans can use something for food, many microbes will also love it". The reverse is not always as true as microbes can "digest" some very strange substances including cellulose, sulfur, some plastics, turkey feathers and asphalt, to name just a few.

Nutritional Requirements of Cells

Every organism must find in its environment all of the substances required for energy generation and cellular biosynthesis. The chemicals and elements of this environment that are utilized for bacterial growth are referred to as nutrients or nutritional requirements. Many bacteria can be grown the laboratory in culture media which are designed to provide all the essential nutrients in solution for bacterial growth. Bacteria that are symbionts or obligate intracellular parasites of other cells, usually eucaryotic cells, are (not unexpectedly) difficult to grow

outside of their natural host cells. Whether the microbe is amutualist or parasite, the host cell must ultimately provide the nutritional requirements of its resident.

Many bacteria can be identified in the environment by inspection or using genetic techniques, but attempts to isolate and grow them in artificial culture has been unsuccessful. This, in part, is the basis of the estimate that we may know less than one percent of all procaryotes that exist.

The Major Elements At an elementary level, the nutritional requirements of a bacterium such as E. coli are revealed by the cell's **elemental composition**, which consists of:

C, H, O, N, S. P, K, Mg, Fe, Ca, Mn, and traces of: Zn, Co, Cu, and Mo.

These elements are found in the form of water, inorganic ions, small molecules, and macromolecules which serve either a structural or functional role in the cells.

In order to grow in nature or in the laboratory, a bacterium must have an energy source, a source of carbon and other required nutrients, and a permissive range of physical conditions such as O2 concentration, temperature, and pH. Sometimes bacteria are referred to as individuals or groups based on their patterns of growth under various chemical (nutritional) or physical conditions. For example, phototrophs are organisms that use light as an energy source; anaerobes are organisms that grow without oxygen; thermophiles are organisms that grow at high temperatures.

All living organisms require a source of energy. Organisms that use radiant energy (light) are alled phototrophs. Organisms that use (oxidize) an organic form of carbon are called heterotrophs or (chemo) heterotrophs. Organisms that oxidize inorganic compounds are called lithotrophs.

The carbon requirements of organisms must be met by organic carbon (a chemical compound with a carbon-hydrogen bond) or by CO2. Organisms that use organic carbon are heterotrophs and organisms that use CO2 as a sole source of carbon for growth are called autotrophs.

Quiz / 1

What are the essential requirement of bacteria?

Note

Check your answers in the text.

Quiz / 2

What are the trace elements needed for bacterial growth?

Note:

Check your answers in the text page.

5/ Post test :-

Circle the correct answer :-

1- The trace elements needed for bacteria are:

a-Potassium b- Cu

c-Iron d-Mo

2- The minerals required for bacterial growth are:

a-carbon b- oxygen

c-Ca d- K

3- Growth of bacteria depends essentially on:

a-Fe b-N-sources

c-Mn d- all

4- The basic thingthat requiredto make solution is:

a-air b- NH_4

c-water d- PO_4

Note

Check your answers in page.

- (2.5) degree for each answer.

6/ key answers :-

1- Pre test answers:-

1. d
2.d
3.b
4.a, b

2- Post test answers:-

1.b, d
2.c, d
3.b
4.c

7/Sources :-

1- Copyright © Dr. R. E. Hurlbert, 1999. SCIENCE HALL, ROOM 440CA. FAX: 509-335-1907. E-mail address: hurlbert@wsu.edu or hurlbert@pullman.com

2- Web Review of Todar's Online Textbook of Bacteriology. "The Good, the Bad, and the Deadly". (SCIENCE Magazine- June 4, 2004 – Vol. 304: p. 1421).

3- Nutrition and Growth of Bacteria. © 2008 Kenneth Todar, PhD

Bacteria Metabolism

1/ Over view:-

1 / A –Target population :-

For students of second class

Health and Medical Technical College

Department of Society Health

Medical Microbiology

1 / B –Rationale :-

Studying bacterial metabolism is very important subject in order to have a full knowledge about growth and development.

1 / C –Central Idea :-

1 – Definition of metabolism.

2 – Study the processes of metabolic pathways and other related topics.

1 / D –Instructions:-

1. Study over view thoroughly.
2. Identify the goal of this modular unit .

3. Do the pre test

2/ Performance Objectives :-

After studying this modular unit , the student will be able to:-

1- Know bacterial metabolism.

2- Know how bacteria utilize energy

3/ Pre test :-

Circle the correct answer:-

1-Bacteria differ from each other due to:

a.taxonomy **b. metabolism**

c.nutrition **d. enviroment**

2- sources of energy are:

a.organic compounds **b. inorganic compounds**

c-sunlight **d.all**

3-nutritional types are:

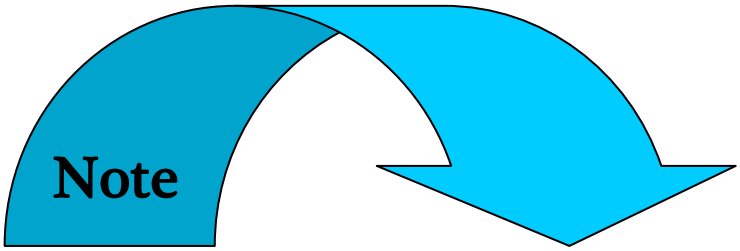
a.organotrophs **b.lithotrophs**

c.Phototrophs **d.all**

4-Carbon metabolism in bacteria is either:

a.autotrophic **b.heterotrophic**

c.metatrophic **d.other**



- Check your answers in the Text Page

- (2.5) degree for each answer.

4/The text

Microbial metabolism

What Is Bacterial Metabolism?

Bacterial metabolism is the process which bacteria use to stay alive. Bacteria have evolved an astounding number of ways to access energy available in the natural environment so that they can use it to stay alive and perform a variety of functions.

One aspect of bacterial metabolism involves the collection of energy.

Many bacteria are heterotrophs, using organic materials for energy just like humans do. The organisms can access the molecules inside the materials in a variety of ways. One technique they use is fermentation, in which materials are broken down into usable components. Some bacteria can also photosynthesize, using the sun for energy as long as they have access to nutrients, and others are capable of surviving on inorganic materials. Known as lithotrophs or autotrophs, these bacteria can survive in extremely harsh environments.

The utilization of energy inside a bacterium can also vary, depending on the species. Bacteria use energy for movement, if they are motile, and for a variety of other tasks. Bacterial metabolism allows bacteria to stay alive so that they can reproduce, ensuring that the species survives through at least one more generation. Bacteria are capable of using almost anything for energy, as long as they happen to be the right species in the right environment. Some, known as extremophiles, like environments so harsh that people originally thought no living organisms could survive in them, such as hot springs and the workings of nuclear power plants.

Bacteria exhibit an extremely wide variety of metabolic types. The distribution of metabolic traits within a group of bacteria has traditionally been used to define their taxonomy, but these traits often do not correspond with modern genetic

classifications. Bacterial metabolism is classified into nutritional groups on the basis of three major criteria: the kind of energy used for growth, the source of carbon, and the electron donors used for growth.

Nutritional types in bacterial metabolism

Nutritional type	Source of energy	Source of carbon	Examples
Phototrophs	Sunlight	Organic compounds (photoheterotrophs) or carbon fixation (photoautotrophs)	Cyanobacteria, Green sulfur bacteria, Chloroflexi, or Purple bacteria
Lithotrophs	Inorganic compounds	Organic compounds (lithoheterotrophs) or carbon fixation (lithoautotrophs)	Thermodesulfobacteria, *Hydrogenophilaceae*, or Nitrospirae
Organotrophs	Organic compounds	Organic compounds (chemoheterotrophs) or carbon fixation (chemoautotrophs)	*Bacillus*, *Clostridium* or *Enterobacteriaceae*

Carbon metabolism in bacteria is either heterotrophic, where organic carbon compounds are used as carbon sources, or autotrophic, meaning that cellular carbon is obtained by fixing carbon dioxide. Heterotrophic bacteria include parasitic types. Typical autotrophic bacteria are phototrophic cyanobacteria, green sulfur-bacteria and some purple bacteria, but also many chemolithotrophic species, such as nitrifying or sulfur-oxidising bacteria.[90] Energy metabolism of bacteria is either based on phototrophy, the use of light through photosynthesis, or on chemotrophy, the use of chemical substances for energy, which are mostly oxidised at the expense of oxygen or alternative electron acceptors (aerobic/anaerobic respiration).

Quiz / 1

Define metyabolism

Note

Check your answers in the text page.

Quiz / 2

What are nutritional types in bacteria?

Note:

Check your answers in the text.

5/ Post test :-

Circle the correct answer :-

1- Energy sources in bacteria are:

a- chemotrophic b-photosynethesis

c- aerobic d-phototrophic

2-bacterial metabolism is:

a-process to infection b- process to stay a live

c- process to reproduction d-all

3- source of carbon from inorganic compounds is:

a-chemoheterotrophs b- lithoheterotrophs

c-photoheterotrophs d-all

4- autotrophic bacteria are phototrophic such as:

a-purple bacteria b-cyanobacteria

c-green sulfer-bacteria d- all

Note

Check your answers in page.

- (2.5) degree for each answer.

6/ key answers :-

1- Pre test answers:-

1. a
2.d
3.d
4.a,b

2- Post test answers:-

1.d
2.b
3.a
4.d

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Sterrilization & Disinfection

1/ Over view:-

1 / A –Target population :-

For students of second class

Health and Medical Technical College

Department of Health Society

Medical Microbiology

1 / B –Rationale :-

Sterilization is very important subject to be studied in order to have a full knowledge about getting rid of or killing the pathological microorganisms , for this reason I have designed this modular unit for this knowledge to be understood .

1 / C –Central Idea :-

1 - Definition

2 – Know Sterilization methods

a - physical methods of sterilization

b – Chemical methods

c –Mechanical method (filtration)

3 –Mechanism of sterilization

4 – Sources of laboratory contamination

1 / D –Instructions:-

5. Study over view thoroughly.
6. Identify the goal of this modular unit .
    - Do the pre test.

2/ Performance Objectives :-

After studying this modular unit , the student will be able to:-

4. Define sterilization .

5. Know the methods of sterilization with the ability to draw a diagram .
6. Determine the mechanism of sterilization .
7. Determine the sources of contamination .

3/ Pre test :-

Circle the correct answer :-

1-**Sterilization means :-**

a- without M.O. b- contamination

c- kill M.O. and their spores c- without viruses

2-**Physical methods of sterilization is :-**

a- heat only b- heat, gases, radiation

c- filtration d- dry heat

3-**Moist heat sterilization means using :**

a- steamed heat b- some chemicals

c- boiling d- flaming

4-**The advantages of autoclaving :**

a- can be used for antibiotics b- less toxic

c-effective d- more toxic

Note

- Check your answers in key answer page.

- (1) degree for each .

4/ the text :-

Sterilization :-is freeing of an object from pathological microorganisms (M.O.) including bacteria and their spores , viruses , yeasts , molds . Or it is the absence of all living organisms .

Quiz / 1

Define sterilization .

Note

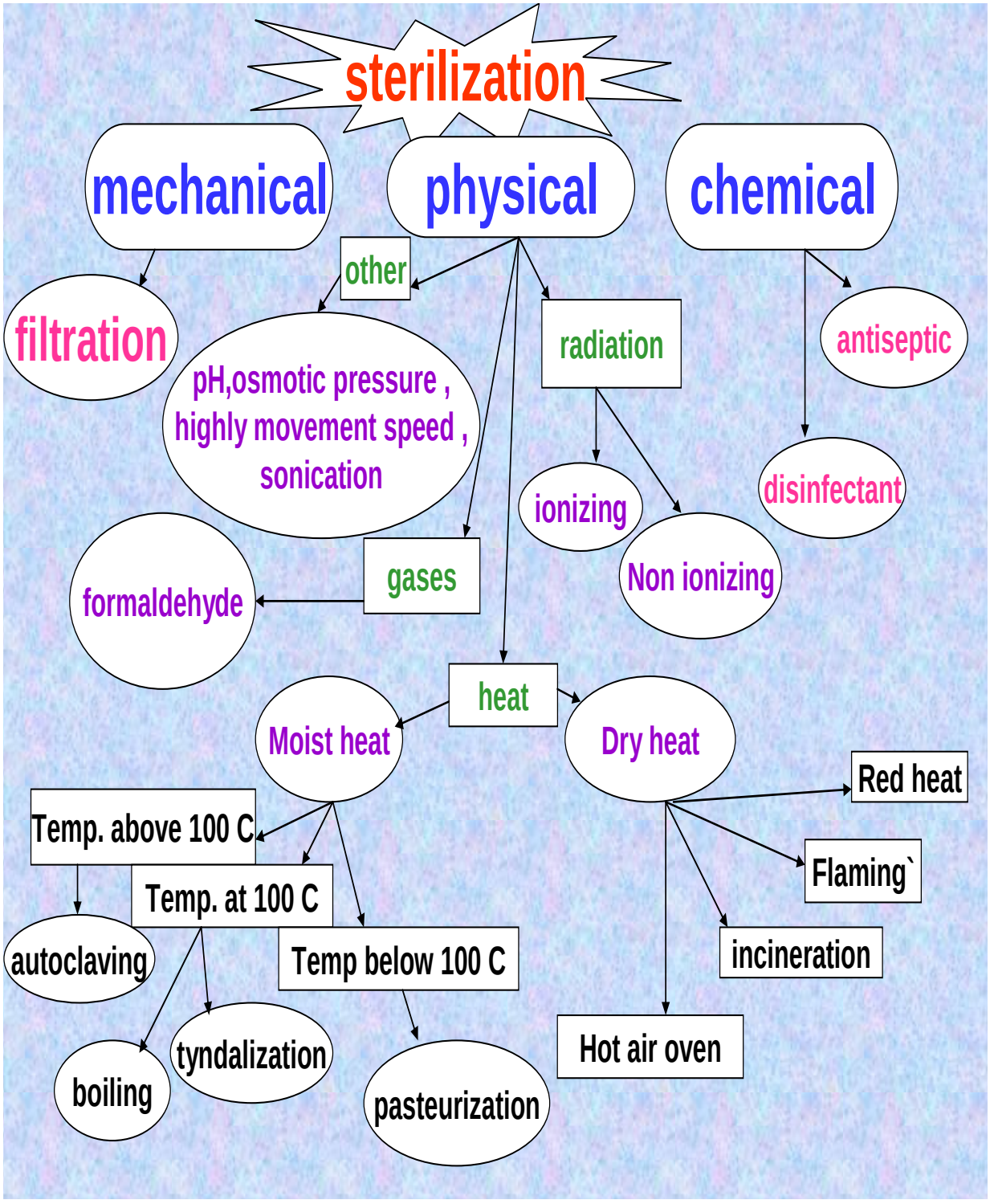
- Check your answers in key answer page 21.

Methods of Sterilization

There are three methods of sterilization :-

- Physical methods .
- Chemical methods .
- Mechanical methods

(as shown in the diagram below)



Sterilization diagram

I / Physical methods of sterilization :-

A. Heat sterilization

1) Dry heat sterilization

a. Red heat ,used to sterile wire loops ,point end of forceps .

b. Flaming, used to sterile mouth of tubes , glass spreaders (which are flamed in ethanol).

c. Incineration ,used in pathological fuming materials .

d. Hot air oven (130-180 ˚C) for 2-4 hr.,used to sterile glass wares (pipette , syringes , flask , Petri dish….etc) , swabs , fixed oils , thermo stable powders , see fig. 1, 2

Fig . 1 , 2 :some glass wares

Moist heat sterilization

a. Temperature below 100˚C,pasteurization (63˚C for 30 min) , to sterilize milk .

b. Temperature at 100 ˚C

- Boiling (5-10 min) to sterilize rubber tubes , glass syringes (kills all non spore forming bacteria) .
- Steaming (tyndillization) steam 30 min for 3days ,used to sterilize gelatin media , sugar media .

c. Temperature above 100 ˚C (autoclaving) the condition used in this instrument (15 lb ,121˚C ,20 min),used for sterilization of surgical tools and clothes, culture media and to sterile inoculated medias ; see fig. 5 ,6 .

The advantages of autoclaving , it is effective ,rapid , simple process which can sterilize large volumes and lack of toxic residues besides it is not expensive ; while it can not sterilize substances which are highly thermo labile and can not withstand pressure .

Fig 5, 6 : autoclave

Quiz / 2

How could you sterile these objects :-

Milk , gelatin media , loop , glass Petri dish , flask .

Note

- Check your answers in key answer.

B. Radiation sterilization

Two types of rays are used :-

- Non ionizing type, like ultra violate rays , infra red rays
- Ionizing type, like Gamma rays , X ray , Beta rays

Application, used to sterilize food factories , surgical sutures , thermo labile drugs , disposable syringes , water , air , surfaces .

Quiz 3

What do you know about radiation ?

Note

- Check your answers in key answer.

C. Gaseous sterilization

Ex. Ethylene oxide , formaldehyde , carbon dioxide

The advantage of using gases because of its high penetration and it is compatible with most materials ; but they have toxic residual and they are explosive .

Application, used to sterile plastic syringes , rooms hales , poultry hoses ……etc .

D. Other physical methods

- pH
- Osmotic pressure
- Sonication

- Highly movement speed .

Quiz4

Fill in the blanks with suitable answer :-

The disadvantages of gaseous sterilization are _____ and_____.

Note

- Check your answers in key answer.

II/ Chemical methods of sterilization

A- Antiseptic :-

It is chemical substance that inhibit the growth of M.O.on living tissues , ex. 70% alcohol , heptane , cetavlon , salt .

B- Disinfectant :-

IT is a chemical substance used to sterilize non living objects , ex. Phenol , formalin , Lysol (any detergent).

The disinfectant may be described either as :-

- **Bacteriostatic:-** any substant which inhibits the growth and multiplication of bacteria but do not necessarily kill them .
- **Bacteriocidal :-** any substance which kills the bacteria and their spores .

Quiz5

How can you sterilize the following :-

1. Culture media
2. Your skin
3. The laboratory counter

Note

- Check your answers in key answer.

III / Mechanical method of sterilization

Filtration :-

It is the possibility to render any solution free from bacteria by passing through special filter medium .

There are some types of filter membranes (porcelain , siliceous earth , asbestos membrane filter) .

Application ,used to sterilize serum , toxins , air , antibiotics .

Quiz6

Fill in the blanks with suitable answer :-

1. The most common filter membranes are

   _____,_____.

2. We use filtration to sterilize

   _____,_____,_____.

Note

- Check your answers in key answer.

Mechanism of sterilization

The lethal mechanism of the above methods of sterilization I damaging DNA , coagulating the protein of the M.O. , cell membrane lyses , oxidation .

Sources of laboratory Contamination

Contamination of the environment with M.O. may be

- air born
- from hair and clothing
- working surfaces

5/ Post test :-

Circle the correct answer :-

1- Sterilization is freeing of :

a- glass wares from M.O. b- an object from M.O.

c- an object from M.O. and their spores d- an object from viruses

2- Dry heat sterilization includes :

a-red heat , flaming ,hot air oven b- red heat only

c- red heat and pasteurization d- hot air oven only

3- Tyndalization is used to sterile :

a-surgical tools b- gelatin media

c-gelatin and sugar media d- milk

4- Autoclave is used under these conditions :

a- 15 lb ,121˚C ,20 min b- 15 lb ,220˚C ,20 min

c- 10 lb ,121˚C ,30 min d- 15 lb ,121˚C ,30 min

Note

- Check your answers in key answer page 20 .
- (2.5) degree for each .

6/ key answer :-

1- Pre test :-

1- c
2- b
3- a
4- c

2- Post test :-

1-c
2- a
3- c
4- a

Quiz No. 1 /
Return to page (9) for the answer.
Quiz No. 2 /
Pasteurization , Tyndilization , Red heat , Hot air oven , Hot air oven
Quiz No. 3/
Return to page (13) for the answer .
Quiz No. 4/
have toxic residual and they are explosive .
Quiz No. 5/

1. autoclaving
2. antiseptic (heptane)
3. disinfectant (phenol)

Quiz No. 6/

1. porcelain , asbestos
2. serum , antibiotics

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Infection, Source Classification & Mode

1/ Over view

1 / A –Target population :-

For students of second class

Health and Medical Technical College

Department of Society Health

Medical Microbiology

1 / B –Rationale :-

Studying bacterial infections is very important subject in order to have a full knowledge about Diseases that causes by bacteria.

1 / C –Central Idea :-

1 – Definition of infection.

2 – Study the causes and infection diseases.

1 / D –Instructions:-

1. Study over view thoroughly.
2. Identify the goal of this modular unit .
3. Do the pre test and if you :-

2/ Performance Objectives :-

After studying this modular unit , the student will be able to:-

1- Know bacterial infection and its dangers on human health.

2- Know the essential causes of diseases.

3/ Pre test :-

Circle the correct answer:-

1-infection is divided into:

a.chronic **b.aquired**

c. persistent **d.all**

2- General steps to determine the infection are:

a. diagnosis **b.specific signs**

c.symptoms **d.all**

3-symptoms include:

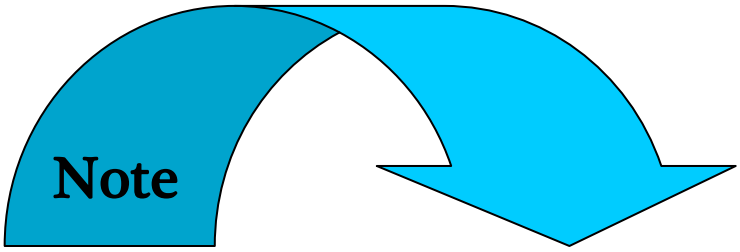
a.weight loss **b.fever**

c.cills &night sweats **d.all**

4-Chain of events involve when a human infected:

a.infectious agents **b.mode of tranmission**

c.portal of entry **d.all**



- Check your answers in the Text Page

- (2.5) degree for each answer.

4/The text
Bacterial infection:-

An infection is the detrimental colonization of a host organism by a foreign parasite species. Infecting organisms seeks to utilize the host's resources to multiply, usually at the expense of the host.

The infecting organism, or pathogen, interferes with the normal functioning of the host and can lead to chronic wounds, gangrene, loss of an infected limb, and even death.

The immune system of mammalian hosts reacts to infections with an innate response, often involving inflammation, followed by an adaptive response.

Colloquially, a pathogen is usually considered a microscopic organism though the definition is broader, including macroparasites, fungi, viruses, prions, bacteria, and viroids.

A symbiosis between parasite and host, whereby the relationship is beneficial for the former but detrimental to the latter, is characterised as parasitism.

However, some individuals develop **chronic or persistent infections**. In the majority of cases, persistent infections are caused by viruses and not bacteria. The common viruses that can cause chronic infection include measles, hepatitis, various prion infections that affect the brain (madcow), herpes, infectious mononucleosis and Cytomegalovirus (CMV).Bacteria can also cause chronic infections in individuals with diabetes, those with compromised immunity and in individuals who smoke.

Diagnostic approach

The diagnosis of persistent infections can be difficult as there are no specific signs and symptoms. If an infection is suspected, blood, urine and sputum cultures are usually the first step. Chest x ray and stool analysis may provide a clue. Sometimes fluid from the spinal cord is obtained to ensure that there is no brain infection.

In children the presence of cyanosis, rapid breathing, poor peripheral perfusion, or a petechial rash increases the risk of a serious infection by greater than 5 fold.
Other important indicators include parental concern, clinical instinct, and temperature greater than 40 °C.

Symptoms

Extreme fatigue which may be ongoing for more than 2–3 months:

Continued weight loss
Low grade or spiking fever
Night sweats and chills
Vague body aches and pain

Primary and secondary

Primary and secondary infection may either refer to succeeding infections or different stages of one and the same infection such as in acute herpes labialis infection. In the latter case, acute infection may also be used, as in acute HIV infection.

Bacterial or viral

Bacterial and viral infections can both cause symptoms such as malaise, fever, and chills. It can be difficult to distinguish which is the cause of a specific infection. It's important to distinguish, because viral infections cannot be cured by antibiotics.

Comparison of viral and bacterial infection Characteristic Viral Bacterial Internal Hurting Typical symptoms In general, viral infections are systemic. This means they involve many different parts of the body or more than one body system at the same time; i.e. a runny nose, sinus congestion, cough, body aches etc.
The classic symptoms of a bacterial infection are localized redness, heat, swelling and pain. One of the hallmarks of a bacterial infection is local pain, pain that is in a specific part of the body. For example, if a cut occurs and it is infected with bacteria, pain will occur at the site of the infection.

Bacterial throat pain is often characterized by more pain on one side of the throat. An ear infection is more likely to be bacterial if the pain occurs in only one ear.
A possibly infected cut that produces pus and milky-colored liquid is most likely infected.

Cause Pathogenic viruses Pathogenic bacteria

For infection to occur in a human, a given chain of events must occur. The chain of events involves several steps which include the infectious agent, reservoir, susceptible host, portal of entry, mode of transmission and portal of exit.

Pathogenesis

Persistent infections occur because the body is unable to clear the organism after the initial infection. Persistent infections are characterized by the continual presence of the infectious organism resulting in recurrent relapses.
There are some viruses that can maintain a persistent infection by infecting different cells of the body. Throughout the globe, persistent infections claim millions of lives each year.
Chronic infections by parasites account for a high morbidity and mortality in many underdeveloped countries.

The infection cycle
It is important to understand that infection and disease are not the same thing. Infection occurs when an organism enters the body and starts to grow. However, disease only occurs if the organism starts to multiply and produce symptoms.
All organisms must enter the body in order to cause disease. The organism must stick or adhere to a specific cell, invade, colonize and inflict some type of damage to the host. This chain of events is the same for all organisms.

Entrance

Entrance to the host generally occurs through the normal openings like the oral cavity, nose, eyes, genitalia, anus, or open wounds. While a few organisms can grow at the initial site of entry, many invade and start to grow in different organs where they are hard to detect. Some organisms grow within the host cells whereas others grow freely in blood.

Micro organisms can cause tissue damage byreleasing a variety of toxins or destructive enzymes. For example, clostridium tetani releases a toxin which can paralyze muscles, or staphylococcus releases toxins which can produce shock and sepsis.

Infectious agent

For an organism to cause disease, there are several factors that must be met before an infection can occur.

The organism must be able to grow, multiply, be able to enter the body and have the ability to cause disease.

Infectious agents which cause disease in humans include bacteria, viruses, parasites and fungi.

Portal of entry

Organisms need a point of entry. Some enter via the mucus membrane like the mouth, vagina or nose. Others enter via breaks in the skin, for example a surgical incision or a laceration. Sometimes physicians insert tubes or catheters into the bladder which can cause urinary tract infections.

Even an intravenous line can become infected at the site where the needle hole was made on the skin.

Susceptibility of host

Most humans are not easily infected. Organisms usually cause infections in people who are weak, sick, malnourished, have cancer, are diabetic or are immuno-suppressed.

Individuals who have a suppressed immune system are quickly over powered by the organisms. The majority of chronic or persistent infections occur in individuals who have poor defense mechanism.

Mode of Infection

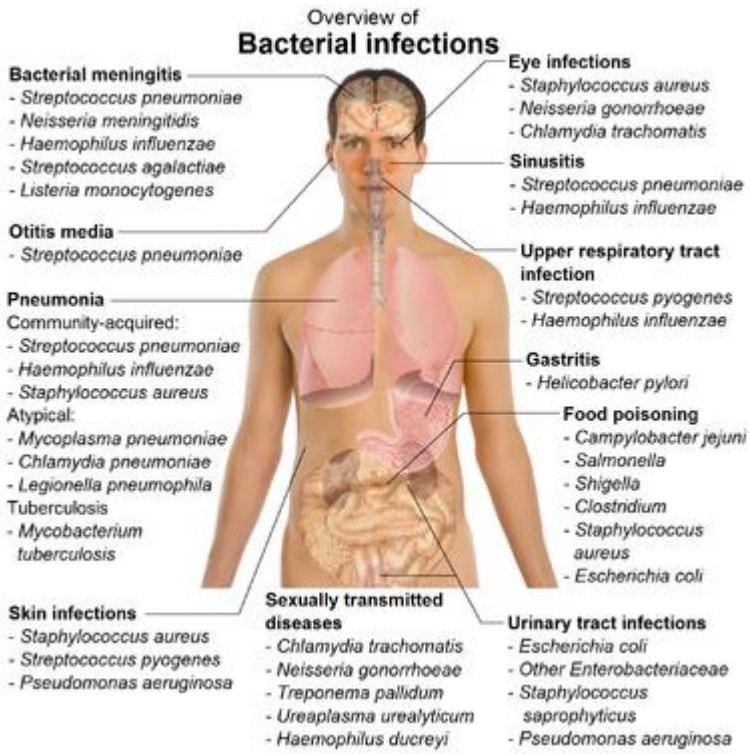
Humans are the only known natural hosts of the mumps virus, although close contact between children and their pets can occasionally result in canine mumps parotitis.

This virus is spread by direct contact via the respiratory route. Infection occurs throughout childhood. During adulthood, infection is likely to produce more severe disease, including orchitis.

Death due to mumps is rare; more than half the fatalities occur in persons older than 19 years.

Mumps infection during the first trimester of pregnancy can increase the rate of spontaneous abortion. Although mumps virus can cross the placenta, no evidence exists that mumps infection in pregnancy causes congenital malformations.

Overview of bacterial infections and main species involved.



Quiz / 1

Define infection

Note

Check your answers in the text.

Quiz / 2

What are the clear symptoms for diagnosis of infection?

Note:

- Check your answers in the text.

5/ Post test :-

Circle the correct answer:-

1-Infection can divided into:

a-aquired b-chronic

c-persistent d-other

2-Infections may be caused by:

a-flagella b- bacteria

c-virus d- hyphae

3- The bacterial infections are localized:

a-heat b- redness

c-swelling and pain d-all

4- Infectious agents which cause disease in humans include:

a- bacteria b-parasites

c-viruses d- all

Note

Check your answers in page.

- (2.5) degree for each answer.

6/ key answers :-

1- Pre test answers:-

1.a, c
2.d
3.d
4.d

2- Post test answers:-

1.b, c
2.b, c
3.d
4.d

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Study some important bacteria

1/ Over view

1 / A –Target population :-

For students of second class

Health and Medical Technical College

Department of Society Health

Medical Microbiology

1 / B –Rationale :-

Studying 15 species of pathogenic bacteria is very important subject in order to have a full knowledge about Diseases and infections caused by these bacteria and the best conditions for growth and development.

1 / C –Central Idea :-

1 – Describe each bacterial growth and shapes.

2-classification of bacterial families.

3 – Study the pathogencity of these bacteria.

1 / D –Instructions:-

1. Study over view thoroughly.
2. Identify the goal of this unit.

3. Do the pre test.

2/ Performance Objectives :-

After studying this unit, the student will be able to:-

1-undestand some important species of bacteria, type of nutrition, theirshapes.

2-Know bacterial infection and its dangers on human health, the causes of some important diseases , and their diagnosis.

3/ Pre test :-

Circle the correct answer:-

1-Staphylococcus are a cause of:

a.soft tissue infections b.toxic shock syndrome

c.diahrea d.all

2-coagulase-positive(co+) differ from coagulate-negative(co^-) in *Staphylococcus aureus*:

a.co+ is non-infection for humans b.co+ infected severely

c.co^- infected women sexually d. other

3-Neisseria was discovered by

a.Robert Nasser b. Williams & Wilkins 2009.

c. Neisser 1879 d.Albert S. Neisser 1855-1916

4-Non-pathogenic Nisseiria species are:

a.N. cineria b. N. elongata

c.N. polysacchararea d.all

5-The infections of Corynebacteria described as:

a.severe b.acute

c.contagious d.all

6-The non-pathogenic species of Corynebacteria are used in:

a.production of peptides b.production of amino acids

c.production of nucleotides d.other

7-The cell wall of Mycobacteria is:

a.hydrophobic b.mesophilic
c.non-hydrophobic d.photosynthetic
8-Mycobacteria infections are difficult to treat due to:
a.no symptom appear b.hardy cell wall
c.show resistance d.not classified
9-Bacilli cells under stressful conditions can produce:
a.toxins b.amino acids
c.larvae d.oval endospores
10-Under the microscope, the Bacillus appear as:
a. oval endospores at one end b.spiral
c.rods d.other
11-Clostridium contains the main species:
a.C. botulinum b. C. tetani
c.C. perfringens d. all
12-Commercial uses of Clostridium to produce:
a.TNT b.ethanol
c.acetone d.all
13-Entrobacteraceae species are the major cause of:
a.liver infections b.nosocomial infection
c.heart diseases d.hospital acquired infections
14-Entrobacter infections include:
a.urinary tract infections b.Skin infections
c.kidney infections d.other
15-Pseudomonas species show:
a. compatibility to antibiotics b. resistance to them
c.stronger d. other
16-Member of the genus Pseudomonas characterized by:
a.bacilli-shaped b.non-spore forming
c.positive catalase test d.all
17-Some strains of Vibrio strains contain flagella:
a.V. cholerae b.V.parahaemolyticus
c.V. vulnificus d.all
18-Vibrio vuluificus seemed to be:
a. not lethal b.lethal case
c.zoonotic d.cause cholera disease
19-Brucella genus is the cause of:
a.breast cancer b.toxicity

c.brucellosis d.other
20-Brucella found in:
a.urine b.bone marrow
c.skin d.other
21-Haemophilus influenza is the main cause of:
a. cough b.inflammation
c.pneumonia d.sepsis
22-Haemophilus diagnosis by:
a.microscopic b.cultures
c.serotyping d.all
23-Bordetella humans species are:
a.B. parapertussis b.B. pertussis
c.B. bronchiseptica d.all
24-Three genera of Spirochaetes are pathogenic:
a.Anemia b.Borrellia
c.Treponema d.Leptospira
25-Treponema pallidum is the main cause of:
a.yaws b.syphilis
c.lyme disease d. relapsing fever
26-Rickettsia cann't live in artificial nutrient medium because:
a.depends on carbon source b.entry cytoplasm of the host
c.depends on nitrogen d.used amino acids
27- The name of Rickettsia came from:
a.Ernest William Goodpasture 1930 b.jon Davis 1869
c.Haward Tylor Ricketts 1871-1910 d. other
28-Any person that engages in sex can contract on clamydia infections include:
a.heterosexual b.homosexual
c.bisexual d.other
29-Clamydia infection include :
a.painful b.low or abdominal
c.burning with urination d. all
30-Bordetella are the main cause of:

a.trauma burning b.heart failur

c.respiratory disease d. all

Note:- Check your answers in the Text.

Staphylococcus (from the Greek: σταφυλή, *staphylē*, "bunch of grapes" and κόκκος, *kókkos*, "granule") is a genus of Gram-positive bacteria. Under the microscope they appear round (cocci), and form in grape-like clusters.[1]

The *Staphylococcus* genus includes thirty-two species and eight sub-species. Most are harmless and reside normally on the skin and mucous membranes of humans and other organisms. Found worldwide, they are a small component of soil microbial flora.

Staphylococcus can cause a wide variety of diseases in humans and other animals through either toxin production or penetration. Staphylococcal toxins are a common cause of food poisoning, as it can grow in improperly-stored food.

- *S. aureus*: A cause of soft tissue infections, as well as toxic shock syndrome (TSS). It can be distinguished from other species of *Staphylococcus* by a positive result in a coagulase test - ability to clot plasma (all other species are negative).

Staphylococci are non-motile, Gram-positive cocci, ~1 μm in diameter. The spherical cells occur in irregular clusters [Greek *staphyle* = bunch of grapes]. bunches of grapes".

Classification

The main classification of staphylococci is based on their ability to produce coagulase, an enzyme that causes blood clot formation.

Coagulase-positive

- *S. aureus* is coagulase-positive, meaning that they can produce coagulase. However, while the majority of *S. aureus* are coagulase-positive, some may be atypical in that they do not produce coagulase.
- *S aureus* is also catalase-positive (meaning that it can produce the enzyme catalase) and able to convert hydrogen peroxide (H_2O_2) to water and oxygen, which makes the catalase test *S. pseudintermedius* inhabits and sometimes infects the skin of domestic dogs and cats.
- This organism, too, can carry the genetic material that imparts multiple bacterial resistance. It is rarely implicated in infections in humans, as a zoonosis.
- useful to distinguish *Staphylococci* from *Enterococci* and *Streptococci*.

Coagulase-negative

- *S. epidermidis*, a coagulase-negative staphylococcus species, is a commensal of the skin, but can cause severe infections in immune-suppressed patients and those with central venous catheters.
- *S. saprophyticus*, another coagulase-negative species that is part of the normal vaginal flora, is predominantly implicated in genitourinary tract infections in sexually-active young women.
- In recent years, several other *Staphylococcus* species have been implicated in human infections, notably *S. lugdunensis*, *S. schleiferi*, and *S. caprae*.

Biochemical identification

Staphylococcus species can be differentiated from other aerobic and facultative anaerobic gram positive cocci by several simple tests. *Staphylococcus spp.* are facultative anaerobes. Facultative anaerobes are capable of growth both aerobically and anaerobically. All species grow in the presence of bile salts and all are catalase positive. Growth also occurs in a 6.5% NaCl solution. On Baird Parker Medium *Staphylococcus spp.* show as fermentative, except for *S. saprophyticus*, which is oxidative. *Staphylococcus spp.* are resistant to Bacitracin (0.04 U resistance) and susceptible to Furazolidone (100µg resistance).

Staphylococcus Infection

Staph infections are caused by staphylococcus bacteria, a type of germ commonly found on the skin or in the nose of even healthy individuals. Most of the time, these bacteria cause no problems or result in relatively minor skin infections. But staph infections don't always remain skin-deep. In some circumstances, they may invade your bloodstream, urinary tract, lungs or heart.

Severe staph infections usually occur in people who are already hospitalized or who have a chronic illness or weakened immune system. But it is possible for otherwise healthy people to develop life-threatening staph infections.

Symptoms

Staph infections can range from minor skin problems to endocarditis, a life-threatening inflammation of your heart valve lining. As a result, signs and symptoms of staph

infections vary widely, depending on the location and severity of the infection.

Skin infections
Skin infections caused by staph bacteria.

Food poisoning
Signs and symptoms of staph-related food poisoning usually come on quickly — as soon as one to six hours after you've eaten contaminated food. The illness often leaves just as suddenly as it came, and most people recover in a day or two, though the effects can be more serious and longer lasting in children and older adults.

Toxic shock syndrome
This life-threatening condition has been linked to the use of certain types of tampons and, less often, to skin wounds and surgery.

Septic arthritis
Septic arthritis is often caused by a staph infection. The bacteria usually target the knees, but other joints can be affected, including your ankle, hip, wrist, elbow or shoulder.

Quiz1.what is the important of coagulate enzyme?

Quiz2.is staphylococcus gran-negative or gram-positive stain?

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Origin: After Albert Ludwig Sigesmund Neisser (1855–1916), German physician; **Neisser** discovered the bacillus that causes gonorrhea in 1879. In 1885 the genus Neisseria, named in his honor, was described, and this microorganism and related bacteria were placed in it.

The ***Neisseria*** are a large family of commensal bacteria that colonize the mucosal surfaces of many animals. Of the 11 species that colonize humans, only two are pathogens. *N. meningitidis* and *N. gonorrhoeae* often cause asymptomatic infections, a commensal-like behavior. Most gonoccocal infections are asymptomatic and self-resolving, and epidemic strains of the meningococcus may be carried in >95% of a population where systemic disease occurs at <1% prevalence. *Neisseria* are Gram-negative bacteria included among the proteobacteria, a large group of Gram-negative forms. *Neisseria* are diplococci that resemble coffee beans when viewed microscopically.

Neisseria inhabit mucosal surfaces. There are 2 species that are pathogenic for humans:

*1-**N. gonorrhoeae***. Also referred to as the gonococcus, *N. gonorrhoeae* is responsible for the disease gonorrhea,

named by Galen in the year 130 AD from the literal "flow of seed".

*2-**N. meningitidis***. Also referred to as the meningococcus, *N. meningitidis* is responsible for meningitis.

Pathogens

Genus (family Neisseriaceae) of parasitic bacteria that grow in pairs and occasionally tetrads, thrive best at 98.6°F (37°C) in the animal body or serum media.

The genus includes:

- *N. gonorrhoeae* (also called the *gonococcus*), which causes gonorrhoea.
- *N. meningitidis* (also called the *meningococcus*), one of the most common causes of bacterial meningitis and the causative agent of meningococcal septicaemia.

Nonpathogens

This genus also contains several, believed to be commensal, or nonpathogenic, species, like:

Neisseria cinerea

Neisseria elongata

Neisseria mucosa

Neisseria polysaccharea

Biochemical identification

All the medically significant species of *Neisseria* are positive for both catalase and oxidase. Different *Neisseria* species can be identified by the sets of sugars from which they will produce acid. For example, *N. gonorrheae* makes acid from only

glucose, however *N. meningitidis* produces acid from both glucose and maltose.

Quiz1.who discovered neisseria bacteria, and when?

Quiz2. which species of neisseria are pathogenic for humans?

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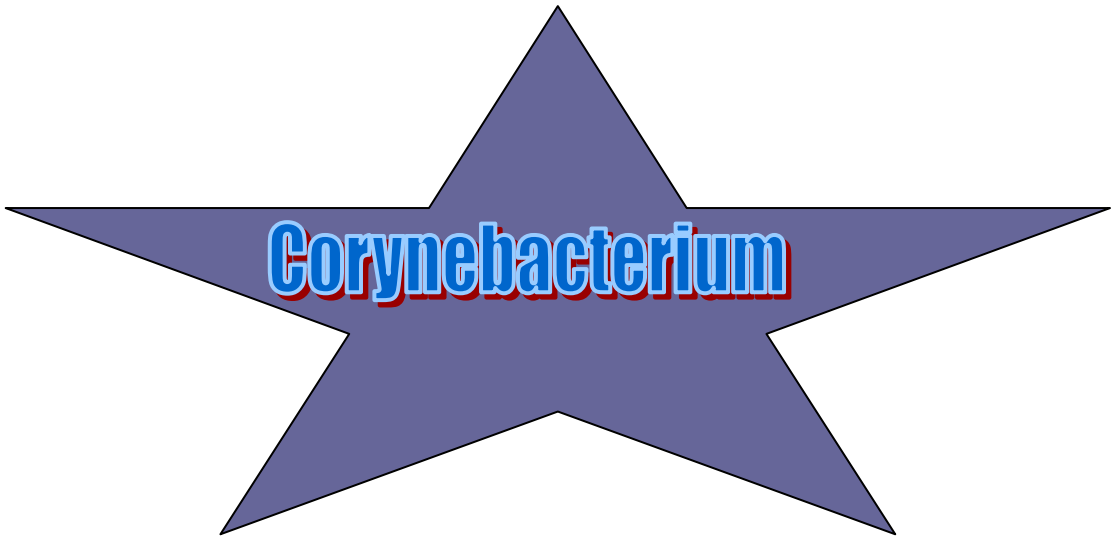

Corynebacterium (kôr"u-nē-bak-tēr'ē-um, ku-rin'u-) is a genus of Gram-positive rod-shaped bacteria. They are widely distributed in nature and are mostly innocuous.[1] Some are useful in industrial settings such as *C. glutamicum*.[2] Others can cause human disease. *C. diphtheriae*, for example, is the pathogen responsible for diphtheria.

Taxonomy

The genus *Corynebacterium* was created by Lehmann and Neumann in 1896 as a taxonomic group to contain the bacterial rods responsible for causing diphtheria. The genus was defined based on morphological characteristics. Thanks to studies of 16S-rRNA, they have been grouped into the subdivision of Gram-positive eubacteria with high G:C content, with close philogenetic relationship to *Arthrobacter*, *Mycobacterium*, *Nocardia*, and *Streptomyces*.[3] The term comes from the Greek *corönë* ("knotted rod") and *bacterion* ("rod"). The term "diphtheroids" is used to represent Corynebacteria that are non-pathogenic; for example, *C. diphtheriae* would be excluded.

Characteristics

The principal features of the *Corynebacterium* genus were described by Collins and Cummins in 1986.[4] They are Gram-positive, catalase positive, non-spore-forming, non-motile, rod-shaped bacteria that are straight or slightly curved.[5]

Metachromatic granules are usually present representing stored phosphate regions. Their size falls between 2-6 micrometers in length and 0.5 micrometers in diameter. The bacteria group together in a characteristic way, which has been described as the form of a "V", "palisades", or "Chinese letters". They may also appear elliptical. They are aerobic or facultatively anaerobic, chemoorganotrophs, with a 51–65% genomic G:C content. They are pleomorphic through their life cycle: they come in various lengths and frequently have thickenings at either end, depending on the surrounding conditions.[6]

Cell wall

The cell wall is distinctive, with a predominance of meso-diaminopimelic acid in the murein wall[1][5] and many repetitions of arabinogalactan as well as corynemycolic acid (a mycolic acid with 22 to 26 carbon atoms), tied together by disaccharide bonds called L-Rha*p*-(1 → 4)--D-GlcNAc-phosphate. These form a complex commonly seen in *Corynebacterium* species: the mycolyl-AG–peptidoglican (mAGP).[7]

Role in disease

The most notable human infection is diphtheria, caused by *Corynebacterium diphtheriae*. It is an acute and contagious infection characterized by pseudomembranes of dead epithelial cells, white blood cells, red blood cells, and fibrin that form around the tonsils and back of the throat.

Several species cause disease in animals, and some are also pathogenic in humans. Some attack healthy hosts, while others tend to attack the immunocompromised. Effects of infection include granulomatous lymphadenopathy, pharyngitis, skin infections, and endocarditis. *C. tenuis* is believed to cause trichomycosis palmellina and trichomycosis axillaris.[16] *C. striatum* may cause axillary odor.[17] *C. minutissimum* causes erythrasma.

Industrial uses

Non-pathogenic species of *Corynebacterium* are used for very important industrial applications, such as the production of amino acids, nucleotides, and other nutritional factors, bioconversion of steroids; degradation of hydrocarbons; and production of enzymes Some species produce metabolites, anti-tumor agents, etc. One of the most studied species is *C. glutamicum*, whose name refers to its capacity to produce glutamic acid. It is used in the foods industry.

Species of Corynebacterium have been used in the mass production of various amino acids including glutamic acid, a popular food additive. The metabolic pathways of Corynebacterium have been further manipulated to produce lysine and threonine.

Species

Species of Corynebacterium have been used in the mass production of various amino acids including glutamic acid, a popular food additive that is made at a rate of 1.5 million tons/ year by Corynebacterium. The metabolic pathways of Corynebacterium have been further manipulated to produce lysine and threonine.

Quiz1.who created the genus Corynebacterium and in which year?

Quiz2. what is the most notable human infection by Corynebacteria?

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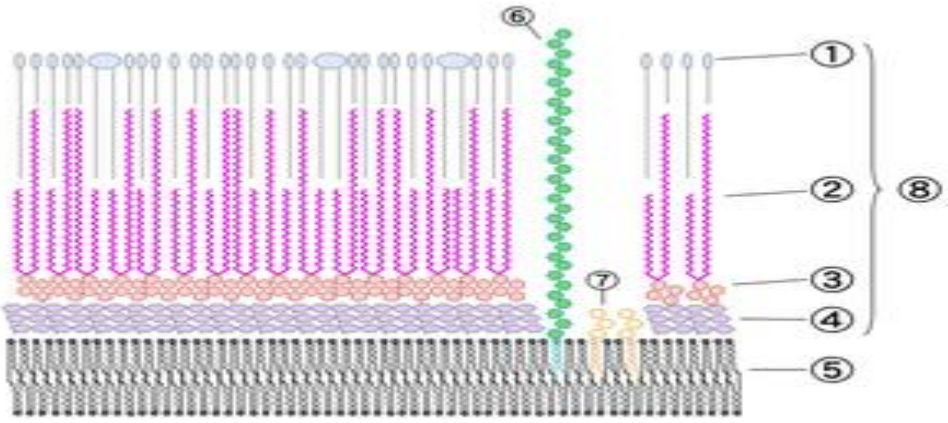
Mycobacteria

Mycobacterium is a genus of Actinobacteria, given its own family, the Mycobacteriaceae. The genus includes pathogens known to cause serious diseases in mammals, including tuberculosis(Tuberculae Basillus/Mycobacterium Tuberculae) and leprosy (Leprae Basillus/Mycobacterium Leprae).[1] The Latin prefix *"myco—"* means both *fungus* and *wax*; its use here could be related to the "waxy" compounds that compose parts of the cell wall (*see Discussion for details*)'**.**

Microbiologic characteristics

Mycobacteria are aerobic and nonmotile bacteria (except for the species *Mycobacterium marinum*, which has been shown to be motile within macrophages) that are characteristically acid-alcohol fast.[1] Mycobacteria do not contain endospores or capsules and are usually considered Gram-positive. A recent paper in PNAS showed sporulation in *Mycobacterium marinum* and perhaps in *M. bovis* [2]. However, this has been strongly argued by other scientists [3]. While mycobacteria do not seem to fit the Gram-positive category from an empirical standpoint (i.e. they generally do not retain the crystal violet stain well), they are classified as an acid-fast Gram-positive bacterium due to their lack of an outer cell membrane. All *Mycobacterium* species share a characteristic cell wall, thicker than in many other bacteria, which is hydrophobic, waxy, and rich in mycolic acids/mycolates. The cell wall consists of the hydrophobic mycolate layer and a peptidoglycan layer held together by a polysaccharide, arabinogalactan. The cell wall makes a substantial contribution to the hardiness of this genus. The

biosynthetic pathways of cell wall components are potential targets for new drugs for tuberculosis.[4]



Mycobacterial cell wall: 1-outer lipids, 2-mycolic acid, 3-polysaccharides (arabinogalactan), 4-peptidoglycan, 5-plasma membrane, 6-lipoarabinomannan (LAM), 7-phosphatidylinositol mannoside, 8-cell wall skeleton

Many *Mycobacterium* species adapt readily to growth on very simple substrates, using ammonia or amino acids as nitrogen sources and glycerol as a carbon source in the presence of mineral salts. Optimum growth temperatures vary widely according to the species and range from 25 °C to over 50 °C.

A natural division occurs between slowly– and rapidly–growing species. Mycobacteria that form colonies clearly visible to the naked eye within seven days on subculture are termed rapid growers, while those requiring longer periods are termed slow growers. Mycobacteria cells are straight or slightly curved rods between 0.2-0.6 µm wide by 1.0-10 µm long.

Pathogenicity

Mycobacteria can colonize their hosts without the hosts showing any adverse signs. For example, billions of people around the world have asymptomatic infections of *M. tuberculosis*.

Mycobacterial infections are notoriously difficult to treat. The organisms are hardy due to their cell wall, which is neither truly Gram negative nor positive. Additionally, they are naturally

resistant to a number of antibiotics that disrupt cell-wall biosynthesis, such as penicillin. Due to their unique cell wall, they can survive long exposure to acids, alkalis, detergents, oxidative bursts, lysis by complement, and many antibiotics. Most mycobacteria are susceptible to the antibiotics clarithromycin and rifamycin, but antibiotic-resistant strains have emerged.

Medical classification

Mycobacteria can be classified into several major groups for purpose of diagnosis and treatment: *M. tuberculosis* complex, which can cause tuberculosis: *M. tuberculosis*, *M. bovis*, *M. africanum*, *and M. microti*; *M. leprae*, which causes Hansen's disease or leprosy; Nontuberculous mycobacteria **(NTM)** are all the other mycobacteria, which can cause pulmonary disease resembling tuberculosis, lymphadenitis, skin disease, or disseminated disease.

Quiz1. are Mycobacteria aerobic or non and motile or non?

Quiz2. what issential disease that caused by Mycobacteria?

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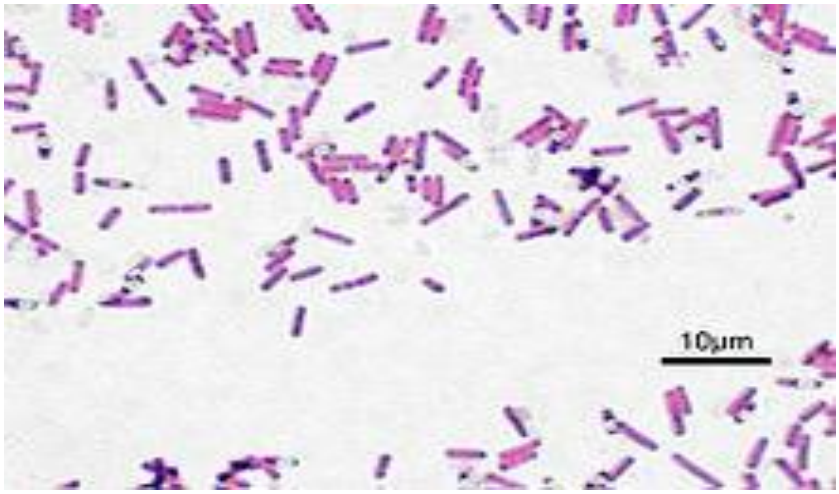
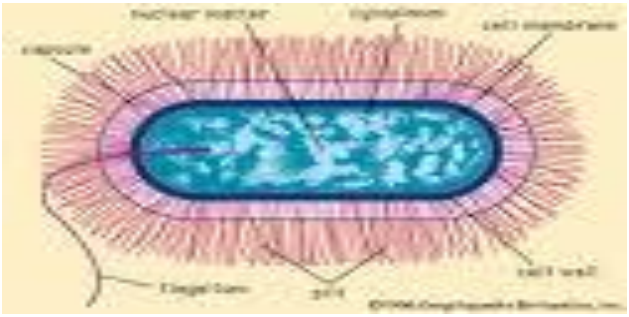
Bacillus

Bacillus is a genus of Gram-positive rod-shaped bacteria and a member of the division Firmicutes. *Bacillus* species can be obligate aerobes or facultative anaerobes, and test positive for the enzyme catalase.[1] Ubiquitous in nature, *Bacillus* includes both free-living and pathogenic species.

Under stressful environmental conditions, the cells produce oval endospores that can stay dormant for extended periods. These characteristics originally defined the genus, but not all such species are closely related, and many have been moved to other genera.



Bacillus subtilis, Gram stained



Bacillus bacteria, cell structure

Clinical significance

Two *Bacillus* species are considered medically significant: *B. anthracis*, which causes anthrax, and *B. cereus*, which causes a foodborne illness similar to that of *Staphylococcus*. A third species, *B. thuringiensis*, is an important insect pathogen, and is sometimes used to control insect pests. The type species is *B. subtilis*, an important model organism. It is also a notable food spoiler, causing ropiness in bread and related food. *B. coagulans* is also important in food spoilage.

An easy way to isolate *Bacillus* is by placing non-sterile soil in a test tube with water, shaking, placing in melted mannitol salt agar, and incubating at room temperature for at least a day. Colonies are usually large, spreading and irregularly-shaped. Under the microscope, the *Bacillus* appear as rods, and a substantial portion usually contain an oval endospore at one end, making it bulge.

The Cell wall

The cell wall of *Bacillus* is a structure on the outside of the cell that forms the second barrier between the bacterium and the environment, and at the same time maintains triangle shape and withstands the pressure generated by the cell's turgor. The cell wall is composed of teichoic and teichuronic acids. *B. subtilis* is the first bacterium for which the role of an actin-like cytoskeleton in cell shape determination and peptidoglycan synthesis was identified and for which the entire set of peptidoglycan synthesizing enzymes was localised. The role of the cytoskeleton in shape generation and maintenance is important.

°°

Quiz1.what is the clinical significance of Bacillus?

Quiz2.what are the cell wall main component in Bacillus?

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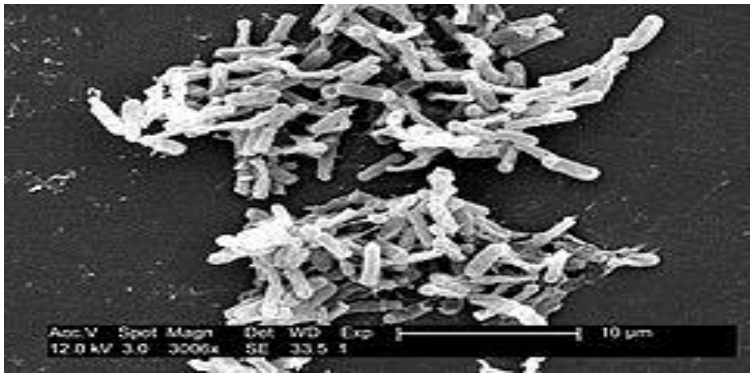
Clostridium

Clostridium is a genus of Gram-positive bacteria, belonging to the Firmicutes. They are obligate anaerobes capable of producing endospores.[1][2] Individual cells are rod-shaped, which gives them their name, from the Greek *kloster* (κλωστήρ) or spindle. These characteristics traditionally defined the genus, however many species originally classified as *Clostridium* have been reclassified in other genera.



Micrograph of *Clostridium difficile* colonies from a stool sample.

Pathology

Clostridium consists of around 100 species[3] that include common free-living bacteria as well as important pathogens.[4] There are four main species responsible for disease in humans:

- *C. botulinum*, an organism producing a toxin in food/wound that causes botulism.[5] Honey sometimes contains spores of *Clostridium botulinum*, which may cause infant botulism in humans one year old and younger.

The bacteria produce botulinum toxin, which eventually paralyzes the infant's breathing muscles.[6] Adults and older children can eat honey safely, because the *Clostridia* do not compete well with the other rapidly growing bacteria pre*C. difficile*, can overgrow other bacteria in the gut during antibiotic therapy and cause pseudomembranous colitis.

- sent in the GI (Gastrointestinal) tract.
- *C. perfringens*, formerly called *C. welchii*, causes a wide range of symptoms, from food poisoning to gas gangrene. Also responsible for enterotoxemia (also known as "overeating disease" or "pulpy kidney disease") in sheep and goats. *C. perfringens* also takes the place of yeast in the making of salt rising bread. The name perfringens means "breaking through, breaking in pieces".
- *C. tetani*, the causative organism of tetanus. The name derives from "of a tension", referring to the tension (caused by tetanus) in the muscles.[*citation needed*]
- *C. tetani*, the causative organism of tetanus. The name derives from "of a tension", referring to the tension (caused by tetanus) in the muscles.[*citation needed*]
- *C. sordellii* has been linked to the deaths of more than a dozen women after childbirth.[*citation needed*]

Clostridium is sometimes found in raw swiftlet birds' nests, a Chinese delicacy. Nests are washed in a sulfite solution to kill the bacteria before being imported to the U.S.

Commercial uses

C. thermocellum can utilize lignocellulosic waste and generate ethanol, thus making it a possible candidate for use in production of ethanol fuel. It also has no oxygen requirement and is thermophilic, which reduces cooling cost.

C. acetobutylicum, also known as the *Weizmann organism*, was first used by Chaim Weizmann to produce acetone and for the production of gunpowder and TNT.

Quiz1.The genus Clostridium are aerobic or anaerobic?

Quiz2.How are Clostridiun cause poisoning?

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Entobacteriaceae

The **Enterobacteriaceae** are a large family of bacteria, including many of the more familiar pathogens, such as *Salmonella* and *Escherichia coli*. Genetic studies place them among the Proteobacteria, and they are given their own order (Enterobacteriales), though this is sometimes taken to include some related environmental samples.

Characteristics

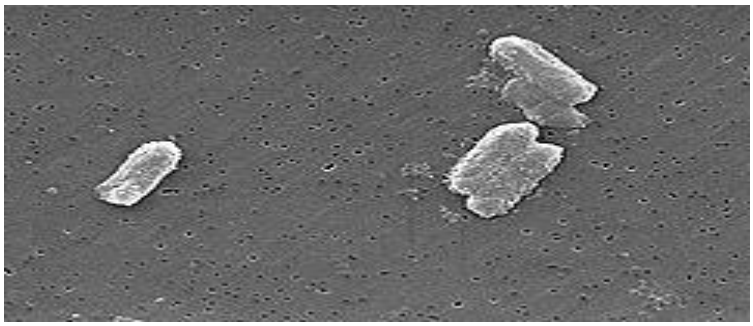
Members of the Enterobacteriaceae are rod-shaped, and are typically 1-5 μm in length. Like other Proteobacteria they have Gram-negative stains, and they are facultative anaerobes, fermenting sugars to produce lactic acid and various other end products. Most also reduce nitrate to nitrite, although exceptions exist (e.g. *Photorhabdus*).

Most members of Enterobacteriaceae have peritrichous Type I fimbriae involved in the adhesion of the bacterial cells to their hosts.

Genera

Alterococcus
Aranicola
Cedecea
Edwardsiella
…..and others (large number).

Enterobacteriaceae is a family of Gram-negative bacilli that contains more than 100 species of bacteria that normally inhabit the intestines of humans and animals. Enterobacteriaceae, that are commonly part of the normal intestinal tract flora, are referred to as coliforms.



Entrobacteria shape

Members of the Enterobacteriaceae are relatively small, non-spore forming bacilli. Some are motile, while others are not. Some have capsules, others do not. Members are frequently resistant to common antibiotics. They ferment a variety of different carbohydrates.

The patterns of this fermentation are used to differentiate and classify them. Some members are found in soil, water, and decaying matter. Some pathogenic strains also produce exotoxins, while others produce exotoxins that are called "enterotoxins" because they specifically affect the intestinal tract, causing diarrhea and body fluid loss. This is, indeed, a diversified family.

Various species of the Enterobacteriaceae are able to cause pneumonia and urinary tract infections. They are also recognized as the major cause of wound infections and other nosocomial (hospital acquired) infections.

They may also cause bacteremia and meningitis if conditions are right. These bacteria are estimated to be responsible for about 100,000 deaths each year in the US, and account for about half of all the clinically significant bacteria isolated by hospital laboratories. They do succumb to relatively low concentrations

of common disinfectants, including chlorination; but their susceptibility to antibiotics varies; and they are now frequently resistant.

Enterobacter infections

Enterobacter species, particularly *Enterobacter cloacae* and *Enterobacter aerogenes,* are important nosocomial pathogens responsible for various infections, including bacteremia, lower respiratory tract infections, skin and soft-tissue infections, urinary tract infections (UTIs), endocarditis, intra-abdominal infections, septic arthritis, osteomyelitis, and ophthalmic infections. *Enterobacter* species can also cause various community-acquired infections, including UTIs, skin and soft-tissue infections, and wound infections, among others.

*Skin and soft-tissue infections

- In most cases, *Enterobacter* skin and soft-tissue infections are hospital-acquired and include cellulitis, fasciitis, myositis, abscesses, and wound infections.
- *Enterobacter* species can infect surgical wounds in any body site, and these infections are clinically indistinguishable from infections caused by other bacteria.
- In 1985, Palmer et al reviewed an outbreak of postsurgical *Enterobacter* mediastinitis.[14] Cases varied in severity from fulminant bacteremic infections to less-severe wound infections. The level of skin and wound colonization was high among patients who underwent cardiac surgery during this outbreak.
- Other *Enterobacter* wound infections have been reported in the literature. Infected body sites have included a posterior spinal wound, burn wounds (many reports), and different types of

injuries involving trauma to multiple sites. Some of the infections were polymicrobial. Some authors have noted a trend of traditional wound bacteria (eg, *S aureus*) being replaced by *Enterobacter* species and other nosocomial pathogens.

- *Enterobacter* species occasionally cause community-acquired soft-tissue infections in healthy individuals, including those who sustain war-related injuries.

Quiz1.what are the important bacteria that belong to Entrobacteriaceae?

Quiz2.what are the most infected diseases that caused by Entrobacteria?

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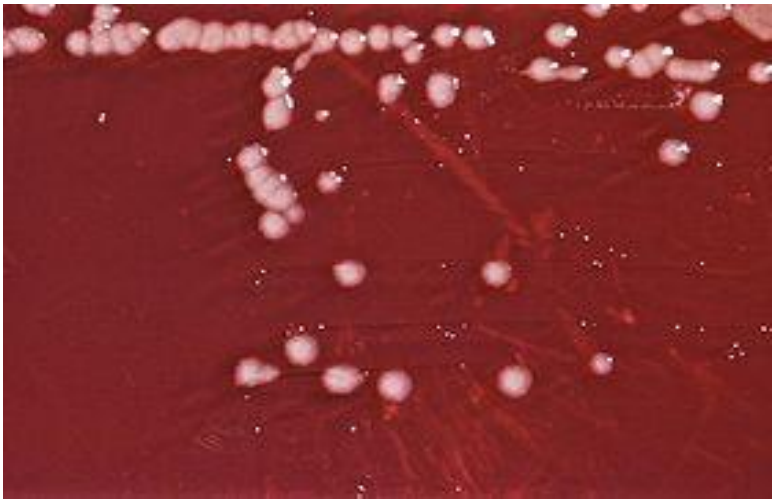
Pseudomonas

Pseudomonas is a genus of gamma proteobacteria, belonging to the larger family of pseudomonads.



P. aeruginosa colonies on an agar plate.

Recently, 16S rRNA sequence analysis has redefined the taxonomy of many bacterial species.[1] As a result the genus *Pseudomonas* includes strains formerly classified in the genera *Chryseomonas* and *Flavimonas*.[2] Other strains previously classified in the genus *Pseudomonas* are now classified in the genera *Burkholderia* and *Ralstonia*.

"***Pseudomonad''*** literally means 'false unit', being derived from the Greek *pseudo* (***ψευδο*** 'false') and *monas* (***μονάς / μονάδα*** 'a single unit'). The term "monad" was used in the early history of microbiology to denote single-celled organisms.

Because of their widespread occurrence in water and in plant seeds such as dicots, the pseudomonads were observed early in

the history of microbiology. The generic name *Pseudomonas* created for these organisms was defined in rather vague terms in 1894 as a genus of Gram-negative, rod-shaped and polar-flagella bacteria. Soon afterwards, Pseudomonads were isolated from many natural niches and a large number of species names was originally assigned to the genus. New methodology and the inclusion of approaches based on the studies of conservative macromolecules have reclassified many strains.[3]

Pseudomonas aeruginosa is increasingly recognized as an emerging opportunistic pathogen of clinical relevance. Several different epidemiological studies indicate that antibiotic resistance is increasing in clinical isolates.[4]

Characteristics

Members of the genus display the following defining characteristics:[7]

Rod shape
Gram-negative
One or more polar flagella
Aerobic
Non spor forming
Positive catalase test

Pathogenicity

Animal pathogens

Infectious species include *P. aeruginosa*, *P. oryzihabitans*, and *P. plecoglossicida*. *P. aeruginosa* flourishes in hospital environments, and is a particular problem in this environment since it is the second most common infection in hospitalized patients(nosocomial infections). This pathogenesis may in part be due to the proteins secreted by *P. aeruginosa*. The bacterium possesses a wide range of secretion systems, which export numerous proteins relevant to the pathogenesis of clinical strains.

Plant pathogens

P. syringae is a prolific plant pathogen. It exists as over 50 different pathovars, many of which demonstrate a high degree of host plant specificity. There are numerous other *Pseudomonas* species that can act as plant pathogens, notably all of the other members of the *P. syringae* subgroup, but *P. syringae* is the most widespread and best studied.

Food spoilage agents

As a result of their metabolic diversity, ability to grow at low temperatures and ubiquitous nature, many *Pseudomonas* can cause food spoilage. Notable examples include dairy spoilage by *P. fragi*,[29] mustiness in eggs caused by *P. taetrolens* and *P. mudicolens*,[30] and *P. lundensis*, which causes spoilage of milk, cheese, meat, and fish.

Quiz1.what are the defining characreistics for Pseudomonas bacteria?

Quiz2.How can Pseudomonas described as food spoilage bacteria?

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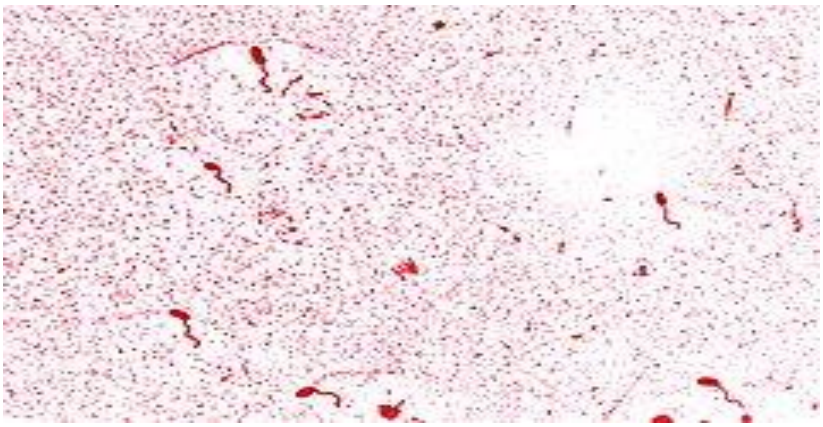
Vibrio

Vibrio is a genus of Gram-negative bacteria possessing a curved rod shape, several species of which can cause foodborne infection, usually associated with eating undercooked seafood. Typically found in saltwater, *Vibrio* are facultative anaerobes that test positive for oxidase and do not form spores. All members of the genus are motile and have polar flagella with sheaths. Recent phylogenies have been constructed based on a suite of genes (multi-locus sequence analysis). The name *Vibrio* derives from Filippo Pacini who isolated microorganisms he called "vibrions" from cholera patients in 1854.



Vibrio bacteria - Flagellar stain of *V. cholerae*

Pathogenic strains

Several species of *Vibrio* include clinically important human pathogens. Most disease causing strains are associated with gastroenteritis but can also infect open wounds and cause septicemia. It can be carried by numerous sea-living animals, such as crabs or prawns, and has been known to cause fatal infections in humans during exposure. Pathogenic *Vibrio* include *V. cholerae* (the causative agent of cholera), *V.*

parahaemolyticus, and *V. vulnificus*. *Vibrio cholerae* is generally transmitted via contaminated water.[3] Pathogenic *Vibrio* can cause foodborne infection, usually associated with eating undercooked seafood.

Vibrio vulnificus outbreaks commonly occur in warm climates and small, generally lethal, outbreaks occur regularly. An outbreak occurred in New Orleans after Hurricane Katrina and several lethal cases occur most years in Florida.

Many *Vibrio* are also zoonotic. They cause disease in fish and shellfish, and are common causes of mortality among domestic marine life.

Flagella

The "typical", early-discovered *Vibrio* such as *V. cholerae* have a single polar flagellum (monotrichous) with sheath. Some species such as *V. parahaemolyticus* and *V. alginolyticus* have both a single polar flagellum with sheath and thin flagella projecting in all directions (peritrichous), and the other species such as *V. fischeri* have tufts of polar flagella with sheath (lophotrichous).

Vibrio bacteria Shapes

Quiz1.list some vibrio bacteria characteristics?

Quiz2.what are the most important strain of Vibrio bacteria?

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Brucella

Brucella is a genus of Gram-negative bacteria. They are small (0.5 to 0.7 by 0.6 to 1.5 µm), non-motile, non-encapsulated coccobacilli, which function as facultative intracellular parasites.

Brucella bacteria shape

Brucella is the cause of brucellosis, which is a zoonosis. It is transmitted by ingesting infected food, direct contact with an infected animal, or inhalation of aerosols. Transmission from human to human, for example through sexual intercourse or from mother to child, is exceedingly rare, but possible. Minimum infectious exposure is between 10 - 100 organisms. Brucellosis primarily occurs through occupational exposure (e.g. exposure to cattle, sheep, pigs), but also by consumption of unpasteurized milk products.

There are a few different species of *Brucella*, each with slightly different host specificity. *B. melitensis* which infects goats and sheep, *B. abortus* which infects cattle, *B. suis* infects pigs, *B.*

ovis infects sheep and *B. neotomae*. Recently new species were discovered, in marine mammals (*B. pinnipedialis* and *B. ceti*), in the common vole *Microtus arvalis* (*B. microti*), and even in a breast implant (*B. inopinata*).

Diagnosis

Brucella is isolated from a blood culture on Castenada medium. Prolonged incubation (up to 6 weeks) may be required as they are slow-growing, but on modern automated machines the cultures often show positive results within seven days. On Gram stain they appear as dense clumps of Gram-negative coccobacilli and are exceedingly difficult to see.

It is crucial to be able to differentiate *Brucella* from *Salmonella* which could also be isolated from blood cultures and are Gram-negative. Testing for urease would successfully accomplish the task; as it is positive for the *Brucella* and negative for the *Salmonella*.

Brucella could also be seen in bone marrow. Laboratory acquired brucellosis is common.[3] This most often happens when the disease is not thought of until cultures become positive, by which time the specimens have already been handled by a number of laboratory staff. The idea of preventive treatment is to stop people who have been exposed to *Brucella* from becoming ill with the disease.

There are no clinical trials to be relied on as a guide for optimal treatment, but a three week course of rifampicin and doxycycline twice daily is the combination most often used, and appears to be efficacious;[3][4] the advantage of this regimen is that it is oral medication and there are no injections; however, a high rate of side effects (nausea, vomiting, loss of appetite) has also been reported.[4]

Human brucellosis

Sir David Bruce isolated *B. melitensis* from British soldiers who died from Malta fever in Malta. The disease is characterized by acute undulating fever, headache, night sweats, fatigue and anorexia. Human brucellosis is not considered a contagious disease and people become infected by contact with fluids from infected animals (sheep, cattle or pigs) or derived food products like unpasteurized milk and cheese. Brucellosis is also considered an occupational disease because of a higher incidence in people working with animals (slaughterhouse cases). The real worldwide incidence of brucellosis is unknown because there is a low level of surveillance and reporting in *Brucella* endemic areas.

Pathophysiology

Brucella species have a unique ability of invading both phagocytic and nonphagocytic cells and surviving in the intracellular environment by avoiding the immune system in different ways, explaining why brucellosis is a systemic disease and can involve almost every organ system.

After ingestion by phagocytes, approximately 15-30% of *Brucella* organisms survive. In polymorphonuclear or mononuclear phagocytic cells, the bacteria use numerous mechanisms to avoid or suppress bactericidal responses. Based on animal models, the lipopolysaccharide (LPS; smooth in *B melitensis, B abortus,* and *B suis* and rough in *B canis*) was found likely to play a substantial role in intracellular survival, perhaps because of adenine and guanine monophosphate production, which inhibits phagosomal fusion and oxidative burst activity. In addition, *Brucella* species have relatively low virulence, toxicity, and pyrogenicity, making them a poor inducer of some inflammatory cytokines such as tumor necrosis factor (TNF) and interferons. Also, the bacteria do not activate the alternative complement system. Finally, it is thought to inhibit programmed cell death.

After replication in the endoplasmic reticulum, the brucellae are released with the help of hemolysins and induced cell necrosis.

Susceptibility to intracellular killing differs among species, with *B abortus* readily killed and *B melitensis* rarely affected; this might explain the differences in pathogenicity and clinical manifestations in human cases of brucellosis.

Quiz1.list Brucella bacteria characteristics?

Quiz2.How are the best methods of in Brucella bacteria diagnosis?

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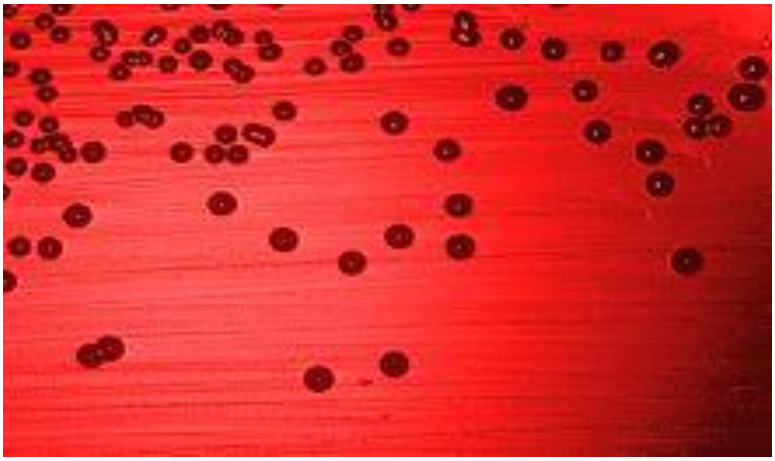
Hemophilus

Haemophilus is a genus of Gram-negative, pleomorphic, coccobacilli bacteria belonging to the *Pasteurellaceae* family.[1][2] While *Haemophilus* bacteria are typically small coccobacilli, they are categorized as *pleomorphic* bacteria because of the wide range of shapes they occasionally assume. The genus includes commensal organisms along with some significant pathogenic species such as *H. influenzae*—a cause of sepsis and bacterial meningitis in young children—and *H. ducreyi*, the causative agent of chancroid. All members are either aerobic or facultatively anaerobic.



Haemophillus bacteria shapes

Haemophillus infections

Haemophilus sp cause numerous mild and serious infections, including bacteremia, meningitis, pneumonia, otitis media, cellulitis, and epiglottitis. Diagnosis is by culture and serotyping. Treatment is with antibiotics. Many Haemophilus sp are normal flora in the upper respiratory tract and rarely cause illness. Pathogenic

strains enter the upper respiratory tract through droplet inhalation or direct contact. Spread is rapid in nonimmune populations. Children, particularly males, blacks, and Native Americans, are at highest risk of serious infection. Overcrowded living conditions and day care center attendance predispose to infection, as do immunodeficiency states, asplenia, and sickle cell disease.

There are several pathogenic species of Haemophilus; the most common is H. influenzae, which has 6 distinct encapsulated serotypes (a through f) and numerous nonencapsulated, nontypeable strains. Before the use of H. influenzae type b (Hib) conjugate vaccine, most cases of serious, invasive disease were caused by type b.

Diseases caused by Haemophilus sp:

H. influenzae causes many childhood infections, including meningitis, bacteremia, septic arthritis, pneumonia, tracheobronchitis, otitis media, conjunctivitis, sinusitis, and acute epiglottitis. These infections, as well as endocarditis and UTIs, may occur in adults, although far less commonly. These illnesses are discussed elsewhere in The Manual.

Nontypeable H. influenzae strains cause mainly mucosal infections (eg, otitis media, sinusitis, conjunctivitis, bronchitis). Occasionally, nonencapsulated strains cause invasive infections in children, but they may cause up to half of serious H. influenzae infections in adults.

H. influenzae biogroup aegyptius (formerly called H. aegyptius) may cause mucopurulent conjunctivitis and bacteremic Brazilian purpuric fever. H. ducreyi causes chancroid (see Sexually Transmitted Diseases (STD): Chancroid). H. parainfluenzae and H. aphrophilus are rare causes of bacteremia, endocarditis, and brain abscess.

Diagnosis

- cultures
- Sometimes serotyping

Pathophysiology

The nomenclature (*Haemophilus* is Greek for "blood loving") acknowledges the fact that *H influenzae* requires 2 erythrocyte factors for growth: X (hemin) and V (nicotinamide-adenine-dinucleotide). These factors are released following lysis of red blood cells, thereby allowing growth of this fastidious organism on chocolate agar. *H influenzae* consists of 8 biotypes; biotype 3 (*Haemophilus aegyptius*) is associated with Brazilian purpuric fever, and biotype 4 is a neonatal, maternal, and genital pathogen. Humans are the only natural hosts. NTHi strains are a common resident of the nasopharyngeal mucosa and, in some instances, of the conjunctivae and genital tract.

Transmission is by direct contact or by inhalation of respiratory tract droplets. Nasopharyngeal colonization of encapsulated *H influenzae* is uncommon, occurring in 2-5% of children in the prevaccine era and even less after widespread vaccination. The incubation period is not known. A larger bacterial load or the presence of a concomitant viral infection can potentiate the infection. The colonizing bacteria invade the mucosa and enter the bloodstream. The presence of antibodies, complements, and phagocytes determines the clearance of the bacteremia. The antiphagocytic nature of the Hib capsule and the absence of the anticapsular antibody lead to increasing bacterial proliferation. When the bacterial concentration exceeds a critical level, it can disseminate to various sites, including meninges, subcutaneous tissue, joints, pleura, pericardia, and lungs.

Host defenses include the activation of the alternative and classical complement pathways and antibodies to the PRP

capsule. The antibody to the Hib capsule plays the primary role in conferring immunity. Newborns have a low risk of infection, likely because of acquired maternal antibodies. When these transplacental antibodies to the PRP antigen wane, infants are at high risk of developing invasive *H influenzae* disease, and their immune responses are low even after the disease. Therefore, they are at high risk of repeat infections since prior episodes of *H influenzae* do not confer immunity. By age 5 years, most children have naturally acquired antibodies. The Hib conjugate vaccine induces protection by inducing antibodies against the PRP capsule. The Hib conjugate vaccine does not provide protection against NTHi strains. Since the widespread use of the Hib conjugate vaccine, NTHi has become more of a pathogen.

Quiz1.what is the important disease that caused by Haemophilus bacteria?

Quiz2.Define Hib congugate vaccine?

Quiz3. explain why Haemophilus bacteria named"blood loving"?

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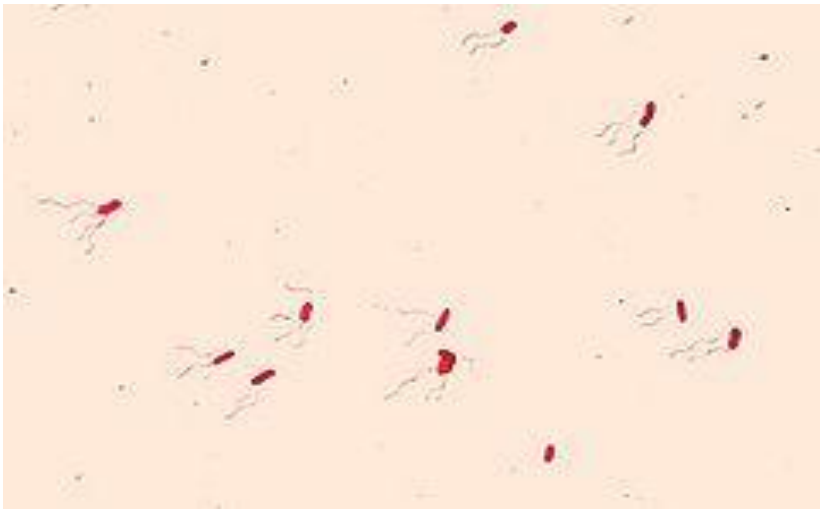
Bordetella

Bordetella is a genus of small (0.2 - 0.7 µm), Gram-negative coccobacilli of the phylum proteobacteria. *Bordetella* species, with the exception of *B. petrii*, are obligate aerobes as well as highly fastidious, or difficult to culture. Three species are human pathogens (*B. pertussis*, *B. parapertussis*, *B. bronchiseptica*); one of these (*B. bronchiseptica*) is also motile.[1]



Bordetella bacteria shape

B. pertussis and occasionally *B. parapertussis* cause pertussis or whooping cough in humans, and some *B. parapertussis* strains can colonise sheep. *B. bronchiseptica* rarely infects healthy humans though disease in immunocompromised patients has been reported.[2] *B. bronchiseptica* causes several diseases in other mammals, including kennel cough and atrophic rhinitis in dogs and pigs, respectively. Other members of the genus cause similar diseases in other mammals, and in birds (*B. hinzii*, *B. avium*).

Pathogenesis

The most often thoroughly studied of the *Bordetella* species are *B. bronchiseptica*, *B. pertussis* and *B. parapertussis* and the pathogenesis of respiratory disease caused by these bacteria has been reviewed. Transmission occurs by direct contact, or via respiratory aerosol droplets, or fomites. Bacteria initially adhere to ciliated epithelial cells in the nasopharynx and this interaction with epithelial cells is mediated by a series of protein adhesins. These include filamentous haemaglutinin, pertactin, fimbriae, and pertussis toxin (though expression of pertussis toxin is unique to *B. pertussis*). As well as assisting in adherence to epithelial cells, some of these are also involved in attachment to immune effector cells.

Unlike most other *Bordetella* toxins, tracheal cytotoxin is expressed constitutively, being a normal product of the breakdown of the bacterial cell wall. Other bacteria recycle this molecule back into the cytoplasm, but in *Bordetella* and *Neisseria gonorrhoeae* it is released into the environment. Tracheal cytotoxin itself is able to reproduce paralysis of the ciliary escalator, inhibition of DNA synthesis in epithelial cells and ultimately killing of the same. One of the most important of the regulated toxins is adenylate cyclase toxin, which aids in the evasion of innate immunity. The toxin is delivered to phagocytic immune cells upon contact. Immune cell functions are then inhibited in part by the resulting accumulation of cyclic AMP.

Quiz1.which species of Bordetella bacteria cause Pertusis or whooping cough disease?

Quiz2.what type od diseases can caused by Bortedella bacteria?

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Spirochaetes

Spirochaetes (also spelled Spirochetes) belong to a phylum of distinctive Gram-negative bacteria, which have long, helically coiled (spiral-shaped) cells.[1] Spirochetes are chemoheterotrophic in nature, with lengths between 5 and 250 µm and diameters around 0.1-0.6 µm.[*citation needed*]

Spirochaetes are distinguished from other bacterial phyla by the location of their flagella, sometimes called *axial filaments*, which run lengthwise between the cell wall and outer membrane. These cause a twisting motion which allows the spirochaete to move about. When reproducing, a spirochaete will undergo asexual transverse binary fission.

Most spirochaetes are free-living and anaerobic, but there are numerous exceptions.

Spirochetes are motile, unicellular, spiral-shaped organisms which are morphologically distinct from other bacteria. Certain structural features are shared by all spirochaetes but they vary greatly in physiology. They range from obligate anaerobes to aerobes and from free-living forms to obligate parasites. Many are not cultivable. Three genera are pathogenic for man; Treponema, Borrelia, and Leptospira. Spirochetes are long, slender organisms that appear as helical coils. Many are too slender to be seen by ordinary light microscopy but can be seen by dark-field microscopy or by staining with silver salts. When examined by dark-field microscopy, spirochaetes have

characteristic motility, including apparent rotation around their long axis and a boring cockscrew rotation.

Treponema Pallidum

Syphilis is usually transmitted by sexual contact. In heterosexual man, the organisms are present in lesions of the penis or discharged from deeper genitourinary sites along with seminal fluid. In women, the infectious lesions are most commonly located in the perineal region or the labia, vaginal wall, or cervix. Homosexual men account for a large proportion of early syphilis cases in many cities; the infectious lesions in these individuals occur in or around the rectum.

Primary lesion – the primary inflammatory lesion is known as the chancre, which begins as a papule and then an ulcer. Although the chancre heals spontaneously, organism escaping from it at an early stage invade the regional lymph nodes forming "satellite buboes", and eventually reach the bloodstream where they establish a systemic infection.

Secondary stage – two to twelve weeks after the appearance of the primary lesion, a generalised skin rash appears, which often involve the mucous membranes. During this stage of the illness, the patients experience low-grade fever and lymphadenopathy. Lesions may develop in the bones, liver, kidneys, CNS, or other organs. Secondary lesions often contain large numbers of spirochetes and are highly infective.

Tertiary stage – in approximately one-third of untreated patients, enough treponemes persist in tissues to give rise to the late or tertiary lesions of the disease several years later. The tertiary stage of the disease often contain very few organisms but frequently result in necrosis, scar formation, and extensive tissue damage. Among tertiary lesions, gummas of the skin and bones may cause relatively little trouble.

In its primary and secondary stages, syphilis can often be diagnosed by dark-field examination of fresh exudate obtained from lesions. Specimens from genital ulcers or other lesions consistent with a chancre and from skin lesions of secondary

syphilis, especially condylomata lata should be examined by dark field microscopy.

Laboratory Diagnosis

In its primary and secondary stages, syphilis can often be diagnosed by dark-field examination of fresh exudate obtained from lesions. Because the exudates from non-syphilitic lesions may also contain spiral organisms, the result must be interpreted with care. An experienced observer can often differentiate T. pallidum from other spirochetes.

Flocculation tests for Wasserman Abs are of great value in the presumptive diagnosis of syphilis. The Wasserman antigen is a phospholipid known as cardiolipin which is a normal constituent of host tissue. The standard is the VDRL test. The RPR (Rapid Plasma Reagin) test is another widely used test. However, a wide variety of other diseases e.g. malaria, SLE, leprosy, and other infections may give a false-positive result. Wasserman antibody is usually detected 1 to 3 weeks after the primary lesion appears and reaches a maximum during the second stage of infection. Subsequently, this antibody may remain at an elevated level.

Tests for treponemal antibody, such as the TPI (T. pallidum immobilisation) test, are more specific but are not generally available. The more widely performed fluorescent antibody (FTA) test is positive in 80% of patients with primary syphilis and in almost all patients with secondary or tertiary syphilis. It should therefore not be used as a screening test. The TPHA test is similar to the FTA test in its sensitivity and specificity. Antitreponemal antibodies decline more slowly than Wasserman antibody after treatment, and positive reactions may persist for years.

Classification

The spirochetes are divided into three families (Brachyspiraceae, Leptospiraceae, and Spirochaetaceae), all placed within a single order (Spirochaetales). Disease-causing members of this phylum include the following:

- *Leptospira* species, which causes leptospirosis[2]
- *Borrelia burgdorferi*, which causes Lyme disease
- *Borrelia recurrentis*, which causes relapsing fever[3]
- *Treponema pertenue*, which causes yaws

Cavalier-Smith has postulated that the Spirochaetes belong in a larger clade called Gracilicutes.

Quiz1.How Spirochaetes can distinguished from other bacterial phyla?

Quiz2.Classify Spirochaetes based on families?

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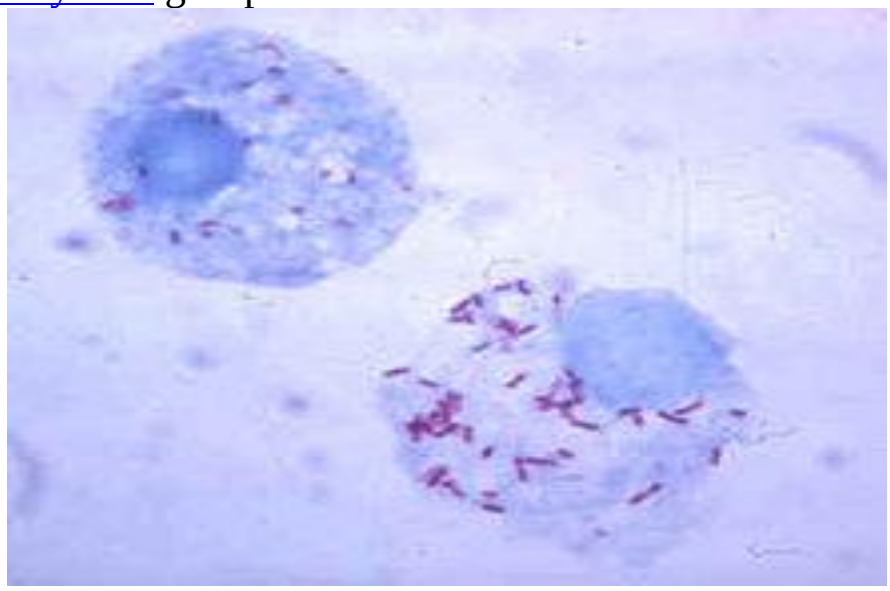
Rickettsiae

Rickettsia is a genus of non-motile, Gram-negative, non-sporeforming, highly pleomorphic bacteria that can present as cocci (0.1 μm in diameter), rods (1–4 μm long) or thread-like (10 μm long). Obligate intracellular parasites, the *Rickettsia* survival depends on entry, growth, and replication within the cytoplasm of eukaryotic host cells (typically endothelial cells).[1] Because of this, *Rickettsia* cannot live in artificial nutrient environments and are grown either in tissue or embryo cultures (typically, chicken embryos are used). In the past they were positioned somewhere between viruses and true bacteria. The majority of *Rickettsia* bacteria are susceptible to antibiotics of the tetracycline group.



Rickettsioa (*Rickettsia rickettsii*)

Rickettsia species are carried by many ticks, fleas, and lice, and cause diseases in humans such as typhus, rickettsialpox, Boutonneuse fever, African tick bite fever, Rocky Mountain spotted fever, Australian Tick Typhus, Flinders Island Spotted

Fever and Queensland tick typhus. [2] They have also been associated with a range of plant diseases. Like viruses, they only grow inside living cells. The name rickettsia is often used for any member of the Rickettsiales. They are thought to be the closest living relatives to bacteria that were the origin of the mitochondria organelle that exists inside most eukaryotic cells.

The method of growing Rickettsia in chicken embryos was invented by Ernest William Goodpasture and his colleagues at Vanderbilt University in the early 1930s.

Naming

The genus *Rickettsia* is named after Howard Taylor Ricketts (1871–1910), who studied Rocky Mountain spotted fever in the Bitterroot Valley of Montana, and eventually died of typhus after studying that disease in Mexico City. Despite the similar name, *Rickettsia* bacteria do not cause rickets, which is a result of vitamin D deficiency.

Clssification

The classification of *Rickettsia* into three groups (spotted fever, typhus and scrub typhus) was based on serology. This grouping has since been confirmed by DNA sequencing. All three of these contain human pathogens. The scrub typhus group has been reclassified as a new genus – *Orientia* – but many medical textbooks still list this group under the rickettsial diseases.

However more recently it has become apparent that rickettsia are more widespread than previously believed and are known to be associated with arthropods, leeches and protists. Divisions have also been identified in the spotted fever group and it has been suggested that this should be divided into two clades.[3] The arthropod species appear to be ancestral to the vertebrate species and the species infecting leeches and protists are unrelated.[*ambiguous*][4]

Clinical Manifestations

Rickettsia species cause Rocky Mountain spotted fever, rickettsialpox, other spotted fevers, epidemic typhus, and murine typhus. *Orientia* (formerly *Rickettsia*) *tsutsugamushi* causes scrub typhus. Patients present with febrile exanthems and visceral involvement; symptoms may include nausea, vomiting, abdominal pain, encephalitis, hypotension, acute renal failure, and respiratory distress.

Pathogenesis

Rickettsia and *Orientia* species are transmitted by the bite of infected ticks or mites or by the feces of infected lice or fleas. From the portal of entry in the skin, rickettsiae spread via the bloodstream to infect the endothelium and sometimes the vascular smooth muscle cells. *Rickettsia* species enter their target cells, multiply by binary fission in the cytosol, and damage heavily parasitized cells directly.

Quiz1.what are the most diseases that caused by Rickettsia?

Quiz2.classify Rickettsia based on families?

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Introduction/Clamydia

Chlamydia infection is one of the most common types of sexually transmitted disease. Chlamydia infection is the result of a bacterial infection of the genital tract by the bacterium Chlamydia trachomatis. Chlamydia infection is passed from one person another during sexual contact that involves vaginal, oral, or anal sex. Chlamydia infection can also be passed from an infected mother to her baby during vaginal delivery and result in eye infection, blindness, and pneumonia in the newborn.

Chlamydia infection that is caught early can be quickly and easily treated. However, if left untreated it can lead to serious complications, such as pelvic inflammatory disease, scarring of the fallopian tubes, infertility, prostatitis, epididymitis, and ectopic pregnancy. Having a chlamydia infection also puts a person at greater risk for contracting HIV.

Any person that engages in sexual activity can contract and pass on a chlamydia infection. This includes heterosexual, homosexual, and bisexual men and women. The more sexual partners a person has, the greater the risk of catching a chlamydia infection. Young girls and young women have an especially high risk of developing a chlamydia infection because their

reproductive organs are not fully mature and are more susceptible to infection.

Symptoms of chlamydia vary between individuals, and it is not uncommon for women to have no symptoms until complications, such as pelvic inflammatory disease, develop. Symptoms of chlamydia infection include lower abdominal pain and painful or burning with urination. Women may experience unusual vaginal discharge and painful sexual intercourse. Men may experience discharge from the penis and testicular pain. For more details on symptoms, refer to symptoms of chlamydia.

Making a **diagnosis** of chlamydia infection can easily be made by taking a medical and sexual history, performing simple chlamydia testing, and completing a physical and pelvic examination for women and an exam of the penis and testicles for men. During the examination, the health care practitioner will assess the reproductive organs and take a swab sample of the woman's cervix or the man's urethra and have it tested for the presence of chlamydia. For women with severe symptoms, a pelvic ultrasound may also be done.

Because there may be no symptoms, some infected people may be unaware of a problem, and a diagnosis of chlamydia infection can be missed or delayed. For more information on misdiagnosis, refer to misdiagnosis of chlamydia.

Mycoplasma & Clamydia

WHAT THEY ARE: Mycoplasma, chlamydia and ureaplasma are among the smallest of free-living organisms. They are unlike other bacteria because they have no cell walls and therefore must live inside cells. They are unlike viruses because they can live in cultures outside of cells and can be killed by certain antibiotics. However, they cannot be killed by most antibiotics, as most antibiotics work by damaging a bacteria's cell wall. They can be killed by antibiotics such as the tetracyclines or erythromycins that do not act on a cell wall.

WHAT DISEASES THEY CAUSE: If you feel sick and your doctor is unable to make a diagnosis because all laboratory tests and cultures fail to reveal a cause, you could be infected with any of these bacteria. The only way that you will be cured is for your doctor to suspect an infection with these germs and for you to take long-acting erythromycin or tetracyclines for several weeks, months or years. They are the most common cause of venereal diseases and are a common cause of muscle and joint pains, burning in the stomach, a chronic cough, and chronic fatigue. They can cause transverse myelitis (paralysis of the spine); gall stones; a chronic sore throat; red itchy eyes, pain on looking at light and blindness; arthritis; brain and nerve damage with symptoms of lack of coordination, headaches and passing out; spotting between periods or uterine infections; kidney stones; testicular pain; asthma; heart attacks; strokes; cerebral palsy; premature birth; high blood pressure; nasal polyps; stuffy

nose in newborns; chronic fatigue; belly pain; muscle pain; confusion, passing out and death; coughing, bloody diarrhea, and anal itching and bleeding.

WHY THEY ARE SO DIFFICULT TO DIAGNOSE AND TREAT:

Most doctors will not prescribe antibiotics to patients without a laboratory test that indicates a specific infection. No dependable test is available to rule in or out mycoplasma, chlamydia or ureaplasma infections. Most antibiotics will not kill these organisms and those that do have to be taken for many months and years. Furthermore, many infected people do not take medication long enough to be cured, or they may have a close contact with an infected person and become reinfected. Once these infections are allowed to persist for months or years, they are extraordinarily difficult to cure and often require treatment for many months. One venereal-disease patient in four takes medication as prescribed and almost all women who still had chlamydia one month after treatment were reinfected by new or old partners. Usually your first symptoms from chlamydia, ureaplasma and mycoplasma are burning on urination, a feeling that you have to urinate all the time, terrible discomfort when the bladder is full and vaginal itching, odor or discharge. Other first symptoms include itchy eyes, a cough or a burning in your nose. You can be infected when an infected person coughs in your face, or you touch nasal or eye secretions from an infected person and put your finger in your nose or eye. Your chances for a cure are high if you are

treated when you have only local symptoms; but after many months, the infection can spread to other parts of your body and make you sick or damage nerves, joints and muscles. If you feel sick and your doctor is unable to make a diagnosis because all laboratory tests and cultures fail to reveal a cause, you could be infected with mycoplasma, chlamydia or ureaplasma and can be cured only by taking long-acting erythromycin or tetracyclines for many months.

Mycoplasma

Mycoplasma contamination remains **a significant problem to the culture of mammalian cells**. Mycoplasmas can cause **disastrous effects** on eukaryotic cells as they can alter every cellular parameter leading to **unreliable experimental results** and potentially **unsafe biological products**.

Mycoplasmas are the smallest and simplest self-replicating organisms. They lack a rigid cell wall and grow mostly associated with the mammalian cell membranes. In most cases, there are **no signs of mycoplasma contamination in cell culture**. Mycoplasmas cannot be detected by visual inspection and do not cause consistent perceptible changes. Thus, mycoplasmas can **remain undetected** in the cell cultures for long periods. The only way to confirm mycoplasma contamination is by routine testing. InvivoGen has developed **PlasmoTest™**, a breakthrough in mycoplasma detection for cell cultures.

Once the mycoplasma contamination has been confirmed, it is usually recommended that the infected cell culture be immediately autoclaved to prevent the infection from spreading. However, **some cell lines are irreplaceable** and require an effective eradication treatment. InvivoGen offers **a choice of antimicrobial solutions** designed to **eliminate and prevent**

mycoplasma contaminations. Some are also active against bacteria and/or fungi.

Detection

PlasmoTest™ is the first mycoplasma detection kit that uses engineered cells and therefore can be easily established as a routine procedure in the lab. PlasmoTest™ is sensitive, reliable, appropriately simple and economical for routine use.

Elimination

Plasmocin™ is one of InvivoGen‘s best sellers. It eliminates mycoplasma in as little as 2 weeks. Plasmocin™ can also be used as routine addition to the cell culture medium to prevent mycoplasma contamination.

Quiz1.what are the most common type disease that Clamydia caused?

Quiz2. why it is difficult to cure diseases caused by Clamydia or Mycoplasma?

Sources:-

1-Copyrights © 2010 InvivoGen. All Rights Reserved. Reproduction of any materials. Nonprofit use for non-commercial research and educational purposes is permitted, citation should include the URL "www.invivogen.com".

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5/post-test:-

Circle the correct answer:-

1-Staphylococcus can cause a wide variety of diseases in humans and other animals through:

a.structure components b.penetration

c. toxin production d.their habits

2- The main classification of Staphylococci is based on ability to produce:

a.toxins b.coagulase

c.NH_4 d.CO2

3-The pathogenic species of Neisseria are:

a. N. Cineria b.N. mucosa

c.N. gonorrhoae d.N. meningitidis

4-Neisseria can identified by:

a.ELISA Test b. peroxidase

c. alchol solution d.glucose or maltose

5-Corynebacteria are the main causs of:

a.kough b.diphtheria

c.tuberculosis d.headage

6-Species of Corynebacteria are used in mass production of:

a.Amino acids b. alkaloids

c.flavours d. ethanol

7-Mycobacterium are the main cause of:

a. influenza b. tuberculosis

c.pain d.other

8-The cell wall component of Mycobacteria are:

a. fats b. envelope

c.outer lipids d. mycolic acid

9-Tow of these selection are true:

a.nosocomial b.anthrax

c.foodborne illness d.fimbriae

10- Bacillus is a genus of:

a. gram-positive b.rod-shped

c.insect pathogen d.all

11-Clostridium is a genus of:

a.gram-negative b.anaerobic

c.produce endospores d. other

12-The disease botulism is caused by:

a. Clostridium b. Mycobacterium

c. mycoplasma d. other

13- Salmonella and Escherichia coli are two species of:

a. Bacilli bacteria b. Corynebacteria

c.Entrobacteriaceae d. other

14-Entrobacteriaceae is a family of:

a. gram-positive b. non-forming spores

c.coliform d. infect skin

15-Pseudomonas bacteria are found mainly in:

a. water b. plant seeds

c.debris d.other

16-Infectious species of Pseudomonas is:

a.P. aeruginosa b.P. oryzihabitans

c.P. plecoglossicida d. all

17-Vibrio bacteria is a genus of:

a.gram-negative b.rod shape

c.foodborne d.all

18-Pathogenic Vibrio include:

a.V. colerae b.V. parahaemolyticus

c.V. vulnificus d.all

19-Brucella bacteria are:

a. gram-positive b.motile

c.non-encapsulated d.facultative

20-Brucella is isolated from:

a.water b-blood culture

c.spoilage food d.all

21-Haemophilus is a genus of:

a.gram-negative b.coccobacilli

c.pleomorphic d.all

22-diseases caused by Haemophilus are:

a.Bacteremia b.septic arthritis

c.influenza d. others

23Bordetella bacteria are:

a. non-aerobic b.highly fastidious

c.gram-positive d.all

24-Respiratory diseases are caused by:

a.Neisseria b. Staphylococus

c.Bordetella d.mycobactetia

25-Spirochaetes are:

a.gram-negative b.spiral-shaped

c. non-motile d.aerobic

26-The Spirochaetes important families are:

a.brachyspiraceae b.leptospiraceae

c.spirochaetaceae d.all

27-Rickettsia is a genus of:

a. spore forming b.motile

c.highly pleomorphic d.all

28-The classification of Rickettsia into:

a.typhus b.spotted fever

c.scrub typhus d. other

29-Clamydia and Mycoplasma described as:

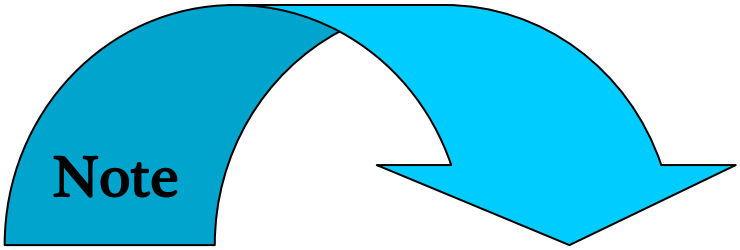
a. largest size b.cause sex diseases

c.difficult in diagnosis d.all

30-Mycoplasmas cause effects on eukaryotic cells named:

a.daphtheria b.cough

c.disatrous effects d.other



- Check your answers in the Text.

6-/Key of answers:-

Pre-test:-

1-a, b

2-c

3-d

4-d

5-b

6-c

7-a

8-b

9-d

10a, c

11-d

12-d

13-d

14-a, b

15-b

16-b, c

17-b

18-b

19-c

20-a, b

21-d

22-b, c

23-d

24-b, c, d

25-b

26-b

27-b

28-a, b, c

29-b

30-c

Poet-test:-

1-b, c

2-b

3-c, d

4-d

5-b

6-a

7-b

8-c, d

9-b, c

10-d

11-b, c

12-a

13-c

14-b, c, d

15-a, b

16-d

17-d

18-d

19-c, d

20-b

21-d

22-a, b, c

23-b

24-c

25-a, b

26-d

27-c

28-a, b, c

29-b, c

30-c

Immunology & Immunity

1/ Over view

1 / A –Target population :-

For students of second class

Health and Medical Technical College

Department of Society Health

Medical Microbiology

1 / B –Rationale :-

Studying Immunity and immune system is very important subject in order to have a full knowledge about body responses against invading microorganisms and drugs.

1 / C –Central Idea :-

1 – Definition immunology, immunity, immune system.

2 – Study the immune responses against microorganism infections.

1 / D –Instructions:-

1. Study over view thoroughly.
2. Identify the goal of this modular unit .
3. Do the pre test and if you :-
    - get 9 or more you do not need to proceed .
    - get less than 9 you have to study this modular unit well .
4. After studying the text of this modular unit ,do the post test, and if you :-
    - get 9 or more , so go on studying modular unit three .
    - get less than 9 go back and study the second modular unit ; or any part of it ; again and then do the post test again .

2/ Performance Objectives :-

After studying this unit, the student will be able to:-

1- Know the function of immune system and responses against infections.

2- Know how immune system as the second line defense against invading bacteria and viruses…etc..

3/ Pre test :-

Circle the correct answer:-

1-The scientists who work on immunology are:
a.Pierre-Louis b.Louis paster
c.Robert Koch d.all

2- What are the important organs of the immune system:
a.bone marrow b.spleen
c.thymus d.endocrine

3-The first step required for fighting a disease is:
a.see the symptoms b.kill the microorganism
c.classify the infection d.identify the pathogen

4-One of the first response of the immune system is:
a.wound b.inflammation
c.pain d.infection

5-surface barriers include:
a.physical b.chemical
c.biologica d.all

6-The immune system can be classified as:
a. acquired b.innate
c.chronic d.adaptive

7-The innate immune system consistinf of barriers::
a.skin b.mucous
c.nose d.other

8-The immune system fails to fight diseases effectively if:
a.weak body b.hypersesitivity
c.immunodeficiency d.all

9-The basic functions of the complement system are:

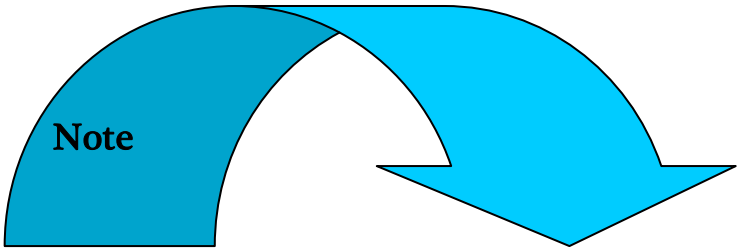
a.opsonization b.chemotaxis

c.colonization d.all

10-The major antigen isotypes are:

a.IgB b.IgG

c.IgR d.IgA



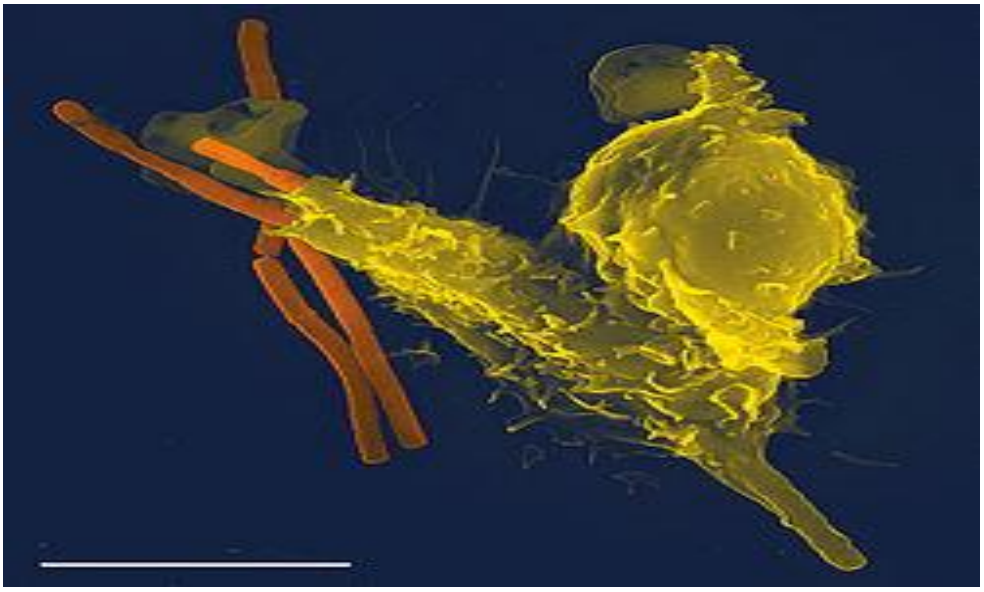
- Check your answers in the Text Page

- (1) degree for each answer.

4/The text

Immunology & Immunity

An **immune system** is a system of biological structures and processes within an organism that protects against disease by identifying and killing pathogens and tumor cells. It detects a wide variety of agents, from viruses to parasitic worms, and needs to distinguish them from the organism's own healthy cells and tissues in order to function properly. Detection is complicated as pathogens can evolve rapidly, producing adaptations that avoid the immune system and allow the pathogens to successfully infect their hosts.



To survive this challenge, multiple mechanisms evolved that recognize and neutralize pathogens. Even simple unicellular organisms such as bacteria possess enzyme systems that protect against viral infections. Other basic immune mechanisms evolved in ancient eukaryotes and remain in their modern descendants, such as plants and insects. These mechanisms include antimicrobial peptides called defensins, phagocytosis, and the complement system. Jawed vertebrates, including humans, have even more sophisticated defense mechanisms. The

typical vertebrate immune system consists of many types of proteins, cells, organs, and tissues that interact in an elaborate and dynamic network. As part of this more complex immune response, the human immune system adapts over time to recognize specific pathogens more efficiently. This adaptation process is referred to as "adaptive immunity" or "acquired immunity" and creates immunological memory. Immunological memory created from a primary response to a specific pathogen, provides an enhanced response to secondary encounters with that same, specific pathogen. This process of acquired immunity is the basis of vaccination. Primary response can take 2 days to even 2 weeks to develop. After the body gains immunity towards a certain pathogen, when infection by that pathogen occurs again, the immune response is called the secondary response.

Disorders in the immune system can result in disease, including autoimmune diseases, inflammatory diseases and cancer. Immunodeficiency diseases occur when the immune system is less active than normal, resulting in recurring and life-threatening infections. Immunodeficiency can either be the result of a genetic disease, such as severe combined immunodeficiency, or be produced by pharmaceuticals or an infection, such as the acquired immune deficiency syndrome (AIDS) that is caused by the retrovirus HIV. In contrast, autoimmune diseases result from a hyperactive immune system attacking normal tissues as if they were foreign organisms. Common autoimmune diseases include Hashimoto's thyroiditis, rheumatoid arthritis, diabetes mellitus type 1, and lupus erythematosus. Immunology covers the study of all aspects of the immune system, having significant relevance to health and diseases. Further investigation in this field is expected to play a serious role in promotion of health and treatment of diseases.

The immune response is how your body recognizes and defends itself against bacteria, viruses, and substances that appear foreign and harmful.

History of Immunology

Immunology is a science that examines the structure and function of the immune system. It originates from medicine and early studies on the causes of immunity to disease. The earliest known mention of immunity was during the plague of Athens in 430 BC. Thucydides noted that people who had recovered from a previous bout of the disease could nurse the sick without contracting the illness a second time. In the 18th century, Pierre-Louis Moreau de Maupertuis made experiments with scorpion venom and observed that certain dogs and mice were immune to this venom.[5] This and other observations of acquired immunity was later exploited by Louis Pasteur in his development of vaccination and his proposed germ theory of disease.[6] Pasteur's theory was in direct opposition to contemporary theories of disease, such as the miasma theory. It was not until Robert Koch's 1891 proofs, for which he was awarded a Nobel Prize in 1905, that microorganisms were confirmed as the cause of infectious disease. Viruses were confirmed as human pathogens in 1901, with the discovery of the yellow fever virus by Walter Reed.

How does the immune system fight disease? This is the most basic question that tends to pop up in your mind when you try to analyze the working of the immune system. A healthy and responsive immune system fights the disease causing pathogens and micro organisms with the help of special cells and tissues.

The bone marrow, spleen, lymph nodes and thymus are some important organs of the immune system. The structure and function of the immune system is studied under the science of Immunology.

The Basic Mechanism

The first step required for fighting a disease is to identify the pathogen causing it. Hence, the immune system is adequately equipped to differentiate between good and bad micro

organisms. These microorganisms could be various types of bacteria, fungus, viruses, parasites or tumor cells.

Next, the immune system releases certain cells (different types of white blood cells) that eat and digest the disease causing pathogens to eliminate them and supply sufficient information to immunological memory so that it can identify the pathogens and avoid the disease in case of future invasion of the same types of pathogens. So, in case the same pathogen attacks again, the immune system releases appropriate antibodies to fight them off.

Surface barriers

Several barriers protect organisms from infection, including mechanical, chemical, and biological barriers. The waxy cuticle of many leaves, the exoskeleton of insects, the shells and membranes of externally deposited eggs, and skin are examples of the mechanical barriers that are the first line of defense against infection. The flushing action of tears and urine also mechanically expels pathogens, while mucus secreted by the respiratory and gastrointestinal tract serves to trap and entangle microorganisms.

Chemical barriers also protect against infection. The skin and respiratory tract secrete antimicrobial peptides such as the β-defensins. Enzymes such as lysozyme and phospholipase A2 in saliva, tears, and breast milk are also antibacterials. Vaginal secretions serve as a chemical barrier following menarche, when they become slightly acidic, while semen contains defensins and zinc to kill pathogens. In the stomach, gastric acid and proteases serve as powerful chemical defenses against ingested pathogens.

Humoral and Chemical barriers
Inflammation

Inflammation is one of the first responses of the immune system to infection. The symptoms of inflammation are redness and swelling, which are caused by increased blood flow into a tissue. Inflammation is produced by eicosanoids and cytokines, which

are released by injured or infected cells. Eicosanoids include prostaglandins that produce fever and the dilation of blood vessels associated with inflammation, and leukotrienes that attract certain white blood cells (leukocytes). Common cytokines include interleukins that are responsible for communication between white blood cells; chemokines that promote chemotaxis; and interferons that have anti-viral effects, such as shutting down protein synthesis in the host cell.[31] Growth factors and cytotoxic factors may also be released. These cytokines and other chemicals recruit immune cells to the site of infection and promote healing of any damaged tissue following the removal of pathogens.

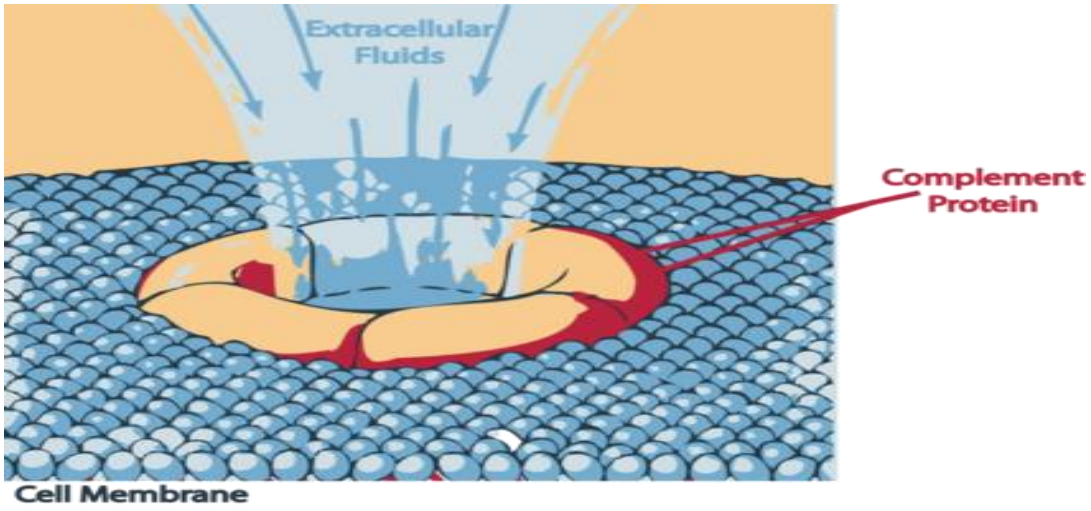
Complement System

The immune system can be broadly classified as innate immune system and adaptive immune system. The innate immune system consisting of barriers like skin, mucous membranes and gastric acids prevent the pathogens from entering the body.

In case the pathogens again successfully evade this level then the adaptive immune system is activated. As the name indicates, adaptive immunity means that it adapts its response in order to create and retain the memory regarding the recognition of the pathogen for further action.

At times, the immune system fails to fight diseases effectively due to a general weak immunity, immunodeficiency (such as AIDS), hypersensitivity (for instance Allergies) and autoimmune diseases.

The first two conditions reduce the ability of the immune system to fight diseases whereas the remaining two cause hypersensitivity and hyperactivity in the immune system thereby encouraging it to destroy the normal cells and tissues of the body unnecessarily due to false alarm.



Complement system/ Membrane attack complex causing cell lysis.

The **complement system** is a biochemical cascade that helps, or "complements", the ability of antibodies to clear pathogens from an organism. It is part of the immune system called the innate immune system that is not adaptable and does not change over the course of an individual's lifetime. However, it can be recruited and brought into action by the adaptive immune system.

The complement system consists of a number of small proteins found in the blood, generally synthesized by the liver, and normally circulating as inactive precursors (pro-proteins). When stimulated by one of several triggers, proteases in the system cleave specific proteins to release cytokines and initiate an amplifying cascade of further cleavages. The end-result of this activation cascade is massive amplification of the response and activation of the cell-killing membrane attack complex. Over 25 proteins and protein fragments make up the complement system, including serum proteins, serosal proteins, and cell membrane receptors. They account for about 5% of the globulin fraction of blood serum.

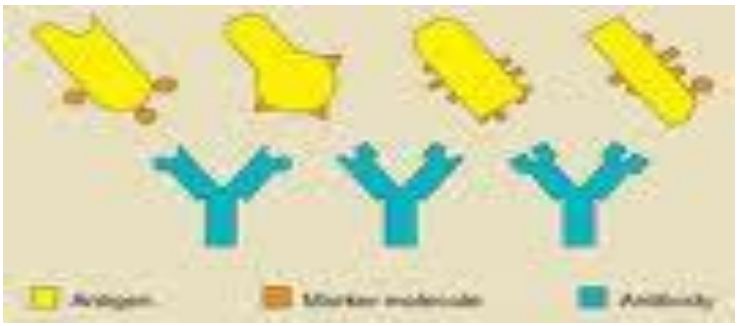
Three biochemical pathways activate the complement system: the classical complement pathway, the alternative complement pathway, and the mannose-binding lectin pathway.[1]

The following are the basic functions of the complement

1. Opsonization - enhancing phagocytosis of antigens
2. Chemotaxis - attracting macrophages and neutrophils
3. Lysis - rupturing membranes of foreign cells
4. Clumping of antigen-bearing agents
5. Altering the molecular structure of viruses

Antigen:-

An **antigen** is a molecule recognized by the immune system. Originally the term came from **anti**body **gen**erator[1][2] and was a molecule that binds specifically to an antibody, but the term now also refers to any molecule or molecular fragment that can be bound by a major histocompatibility complex (MHC) and presented to a T-cell receptor[3]. "Self" antigens are usually tolerated by the immune system; whereas "Non-self" antigens are identified as intruders and attacked by the immune system. Autoimmune disorders arise from the immune system reacting to its own antigens.



Antigenes

Similarly, an **immunogen** is a specific type of antigen. An immunogen is defined as a substance that is able to provoke an adaptive immune response if injected on its own[4]. Said another way, an immunogen is able to induce an immune response, while an antigen is able to combine with the products of an immune response once they are made. The overlapping concepts of **immunogenicity** and **antigenicity** are thereby subtly different. According to a current text book:

Immunogenicity is the ability to induce a humoral and/or cell-mediated immune response

Antigenicity is the ability to combine specifically with the final products of the [immune response] (i.e. secreted antibodies and/or surface receptors on T-cells). Although all molecules that have the property of immunogenicity also have the property of antigenicity, the reverse is not true."[5]

Antigenic specificity

Antigen(ic) specificity is the ability of the host cells to recognize an antigen specifically as a unique molecular entity and distinguish it from another with exquisite precision. Antigen specificity is due primarily to the side-chain conformations of the antigen. It is a measurement, although the degree of specificity may not be easy to measure, and need not be linear or of the nature of a rate-limited step or equation.

B-Cells: Cells produced in bone marrow that secrete antibodies.

Immunity: The condition of being able to resist the effects of a particular disease.

Immunization: The process of making a person able to resist the effects of specific foreign antigens.

Monoclonal Antibodies: Identical antibodies produced by cells cloned from a single cell.

Agglutination: Agglutination: The process by which suspended bacteria, cells, or other particles are caused to adhere and form into clumps; similar to precipitation, but the particles are larger and are in suspension rather than being in solution. For specific agglutination reactions in the various blood groups.

Exogenous antigens

Exogenous antigens are antigens that have entered the body from the outside, for example by inhalation, ingestion, or injection. The immune system's response to exogenous antigens is often subclinical. By endocytosis or phagocytosis, exogenous antigens are taken into the antigen-presenting cells (APCs) and processed into fragments. APCs then present the fragments to T helper cells ($CD4^+$) by the use of class II histocompatibility molecules on their surface. Some T cells are specific for the peptide:MHC complex. They become activated and start to secrete cytokines. Cytokines are substances that can activate cytotoxic T lymphocytes (CTL), antibody-secreting B cells, macrophages, and other particles.

Endogenous antigens

Endogenous antigens are antigens that have been generated within previously normal cells as a result of normal cell metabolism, or because of viral or intracellular bacterial infection. The fragments are then presented on the cell surface in the complex with MHC class I molecules. If activated cytotoxic $CD8^+$ T cells recognize them, the T cells begin to secrete various toxins that cause the lysis or apoptosis of the infected cell. In order to keep the cytotoxic cells from killing cells just for presenting self-proteins, self-reactive T cells are deleted from the repertoire as a result of tolerance (also known as negative selection). Endogenous antigens include xenogenic (heterologous), autologous and idiotypic or allogenic (homologous) antigens.

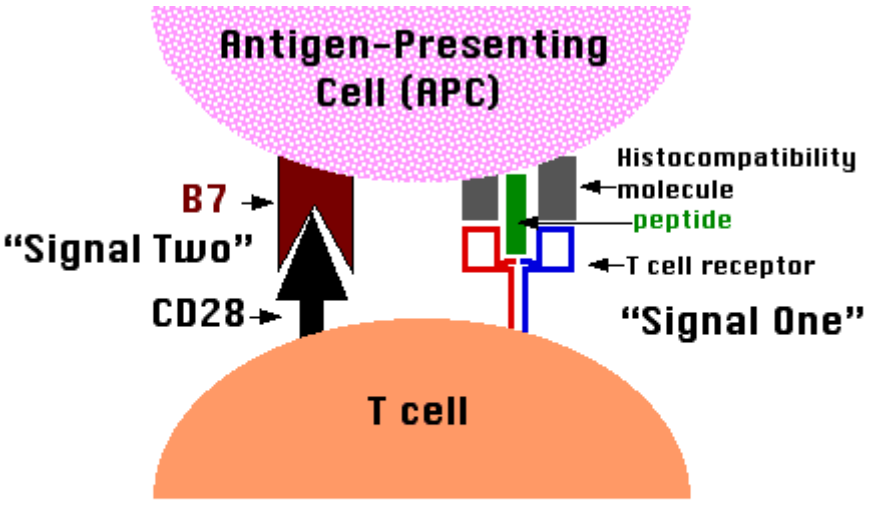
Autoantigens

An autoantigen is usually a normal protein or complex of proteins (and sometimes DNA or RNA) that is recognized by the immune system of patients suffering from a specific autoimmune disease. These antigens should, under normal conditions, not be the target of the immune system, but, due to mainly genetic and environmental factors, the normal

immunological tolerance for such an antigen has been lost in these patients.

Tumor Antigens

Tumor antigens or *neoantigens* are those antigens that are presented by MHC I or MHC II molecules on the surface of tumor cells. These antigens can sometimes be presented by tumor cells and never by the normal ones. In this case, they are called tumor-specific antigens (TSAs) and, in general, result from a tumor-specific mutation. More common are antigens that are presented by tumor cells and normal cells, and they are called tumor-associated antigens (TAAs). Cytotoxic T lymphocytes that recognize these antigens may be able to destroy the tumor cells before they proliferate or metastasize.

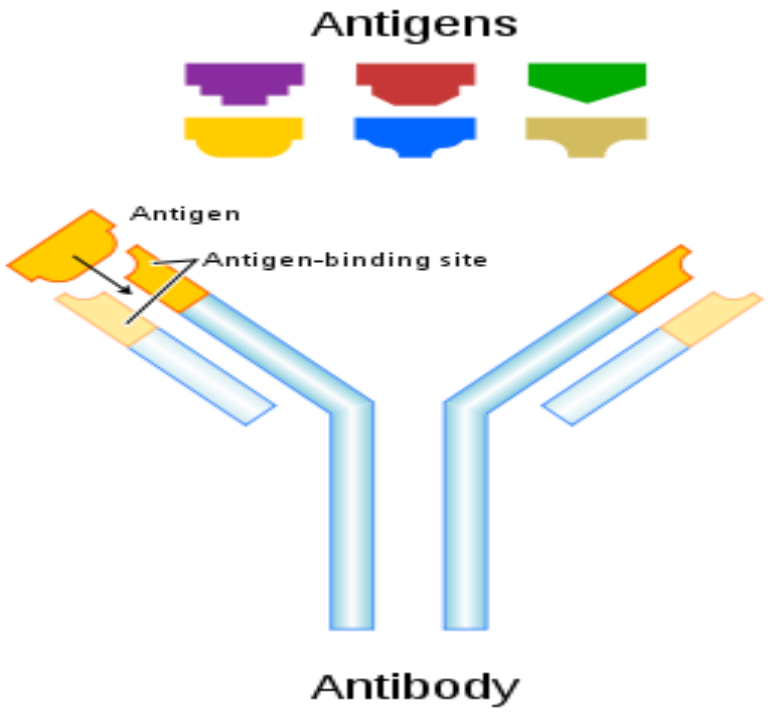


One method of the "co-stimulation" needed to activate T cells. If the T cell fails to receive "signal two", it dies by apoptosis. (B7 comes in two forms: B7-1 [CD80] and B7-2 [CD86].

Antibody-immunoglobulin:

Antibodies (also known as **immunoglobulins**, abbreviated **Ig**) are gamma globulin proteins that are found in blood or other bodily fluids of vertebrates, and are used by the immune system to identify and neutralize foreign objects, such as bacteria and viruses. They are typically made of basic structural units—each with two large heavy chains and two small light chains—to

form, for example, monomers with one unit, dimers with two units or pentamers with five units. Antibodies are produced by a kind of white blood cell called a plasma cell. There are several different types of antibody heavy chains, and several different kinds of antibodies, which are grouped into different *isotypes* based on which heavy chain they possess. Five different antibody isotypes are known in mammals, which perform different roles, and help direct the appropriate immune response for each different type of foreign object they encounter.[2]



Though the general structure of all antibodies is very similar, a small region at the tip of the protein is extremely variable, allowing millions of antibodies with slightly different tip structures, or antigen binding sites, to exist. This region is known as the *hypervariable region*. Each of these variants can bind to a different target, known as an antigen.[3] This huge diversity of antibodies allows the immune system to recognize an equally wide variety of antigens. The unique part of the antigen recognized by an antibody is called the epitope. These epitopes bind with their antibody in a highly specific interaction, called induced fit, that allows antibodies to identify and bind only their unique antigen in the midst of the millions of different

molecules that make up an organism. Recognition of an antigen by an antibody *tags* it for attack by other parts of the immune system. Antibodies can also neutralize targets directly by, for example, binding to a part of a pathogen that it needs to cause an infection.

The large and diverse population of antibodies is generated by random combinations of a set of gene segments that encode different antigen binding sites (or *paratopes*), followed by random mutations in this area of the antibody gene, which create further diversity. Antibody genes also re-organize in a process called class switching that changes the base of the heavy chain to another, creating a different isotype of the antibody that retains the antigen specific variable region. This allows a single antibody to be used by several different parts of the immune system. Production of antibodies is the main function of the humoral immune system.

Isotypes

Antibodies can come in different varieties known as isotypes or classes. In placental mammals there are five antibody isotypes known as IgA, IgD, IgE, IgG and IgM. They are each named with an "Ig" prefix that stands for immunoglobulin, another name for antibody, and differ in their biological properties, functional locations and ability to deal with different antigens, as depicted in the table.

The antibody isotype of a B cell changes during cell development and activation. Immature B cells, which have never been exposed to an antigen, are known as naïve B cells and express only the IgM isotype in a cell surface bound form. B cells begin to express both IgM and IgD when they reach maturity—the co-expression of both these immunoglobulin isotypes renders the B cell 'mature' and ready to respond to antigen.[14] B cell activation follows engagement of the cell bound antibody molecule with an antigen, causing the cell to divide and differentiate into an antibody producing cell called a

plasma cell. In this activated form, the B cell starts to produce antibody in a secreted form rather than a membrane-bound form. Some daughter cells of the activated B cells undergo isotype switching, a mechanism that causes the production of antibodies to change from IgM or IgD to the other antibody isotypes, IgE, IgA or IgG, that have defined roles in the immune system.

Structure and Function

Antibodies are heavy (~150 kDa) globular plasma proteins. They have sugar chains added to some of their amino acid residues.[15] In other words, antibodies are *glycoproteins*. The basic functional unit of each antibody is an immunoglobulin (Ig) monomer (containing only one Ig unit); secreted antibodies can also be dimeric with two Ig units as with IgA, tetrameric with four Ig units like teleost fish IgM, or pentameric with five Ig units, like mammalian IgM.

The variable parts of an antibody are its V regions, and the constant part is its C region.

Heavy Chain

There are five types of mammalian Ig heavy chain denoted by the Greek letters: α, δ, ε, γ, and μ. The type of heavy chain present defines the *class* of antibody; these chains are found in IgA, IgD, IgE, IgG, and IgM antibodies, respectively. Distinct heavy chains differ in size and composition; α and γ contain approximately 450 amino acids, while μ and ε have approximately 550 amino acids.

Each heavy chain has two regions, the *constant region* and the *variable region*. The constant region is identical in all antibodies of the same isotype, but differs in antibodies of different isotypes. Heavy chains γ, α and δ have a constant region composed of *three* tandem (in a line) Ig domains, and a hinge region for added flexibility; heavy chains μ and ε have a constant region composed of *four* immunoglobulin domains. The variable region of the heavy chain differs in antibodies

produced by different B cells, but is the same for all antibodies produced by a single B cell or B cell clone. The variable region of each heavy chain is approximately 110 amino acids long and is composed of a single Ig domain.

Light Chain

In mammals there are two types of immunoglobulin light chain, which are called lambda (λ) and kappa (κ). A light chain has two successive domains: one constant domain and one variable domain. The approximate length of a light chain is 211 to 217 amino acids.[3] Each antibody contains two light chains that are always identical; only one type of light chain, κ or λ, is present per antibody in mammals. Other types of light chains, such as the iota (ι) chain, are found in lower vertebrates like Chondrichthyes and Teleostei.

Antigen and Antibody Reaction:-

Antibodies that bind to surface antigens on, for example, a bacterium attract the first component of the complement cascade with their Fc region and initiate activation of the "classical" complement system.[22] This results in the killing of bacteria in two ways.[6] First, the binding of the antibody and complement molecules marks the microbe for ingestion by phagocytes in a process called opsonization; these phagocytes are attracted by certain complement molecules generated in the complement cascade. Secondly, some complement system components form a membrane attack complex to assist antibodies to kill the bacterium directly.

Antibodies, also called immunoglobulins, are proteins manufactured by the body that help fight against foreign substances called antigens. When an antigen enters the body, it stimulates the immune system to produce antibodies. (The immune system is the body's natural defense system.) The antibodies attach, or bind, themselves to the antigen and inactivate it.

Every healthy adult's body has small amounts of thousands of different antibodies. Each one is highly specialized to recognize just one kind of foreign substance. Antibody molecules are typically Y-shaped, with a binding site on each arm of the Y. The binding sites of each antibody, in turn, have a specific shape. Only antigens that match this shape will fit into them. The role of antibodies is to bind with antigens and inactivate them so that other bodily processes can take over, destroy, and remove the foreign substances from the body.

Antigens are any substance that stimulates the immune system to produce antibodies. Antigens can be bacteria, viruses, or fungi that cause infection and disease. They can also be substances, called allergens, that bring on an allergic reaction. Common allergens include dust, pollen, animal dander, bee stings, or certain foods. Blood transfusions containing antigens incompatible with those in the body's own blood will stimulate the production of antibodies, which can cause serious, potentially life-threatening reactions.

Classes of antibodies and their functions

There are five classes of antibodies, each having a different function. They are IgG, IgA, IgM, IgD, and IgE. Ig is the abbreviation for immunoglobulin, or antibody.

IgG antibodies are the most common and the most important. They circulate in the blood and other body fluids, defending against invading bacteria and viruses. The binding of IgG antibodies with bacterial or viral antigens activates other immune cells that engulf and destroy the antigens. The smallest of the antibodies, IgG moves easily across cell membranes. In humans, this mobility allows the IgG in a pregnant woman to pass through the placenta to her fetus, providing a temporary defense to her unborn child.

IgA antibodies are present in tears, saliva, and mucus, as well as in secretions of the respiratory, reproductive, digestive, and urinary tracts. IgA functions to neutralize bacteria and viruses

and prevent them from entering the body or reaching the internal organs.

IgM is present in the blood and is the largest of the antibodies, combining five Y-shaped units. It functions similarly to IgG in defending against antigens but cannot cross membranes because of its size. IgM is the main antibody produced in an initial attack by a specific bacterial or viral antigen, while IgG is usually produced in later infections caused by the same agent.

IgD is present in small amounts in the blood. This class of antibodies is found mostly on the surface of B cells—cells that produce and release antibodies. IgD assists B cells in recognizing specific antigens.

IgE antibodies are present in tiny amounts in serum (the watery part of body fluids) and are responsible for allergic reactions. IgE can bind to the surface of certain cells called mast cells, which contain strong chemicals, including histamine. (Histamines are substances released during an allergic reaction. They cause capillaries to dilate, muscles to contract, and gastric juices to be secreted.)

Hypersensitivity (also called **hypersensitivity reaction**) refers to undesirable (damaging, discomfort-producing and sometimes fatal) reactions produced by the normal immune system. Hypersensitivity reactions require a pre-sensitized (immune) state of the host. The four-group classification was expounded by P. H. G. Gell and Robin Coombs in 1963.

Comparison of hypersensitivity types

Type	Alternative names	Often mentioned disorders	Mediators
I	Allergy (immediate)	• Atopy • Anaphylaxis • Asthma	• IgE
II	Cytotoxic, antibody-dependent	• Autoimmune hemolytic anemia • Thrombocytopenia • Erythroblastosis fetalis • Goodpasture's syndrome • Graves' disease *see type V explanation below • Myasthenia Gravis *see type V explanation below	• IgM or IgG • (Complement)
III	Immune complex disease	• Serum sickness • Arthus reaction • Systemic lupus erythematosus (SLE)	• IgG • (Complement)
IV	Delayed-type hypersensitivity[2] (DTH), cell-mediated immune memory response, antibody-independent	• Contact dermatitis • Mantoux test • Chronic transplant rejection • Multiple sclerosis [3]	• T-cells
V	Autoimmune disease, receptor mediated (see below)	• Grave's disease • Myasthenia Gravis	• IgM or IgG • (Complement)

Type VI

This is an additional type that is sometimes (often in Britain) used as a distinction from Type 2.

Instead of binding to cell surface components, the antibodies recognize and bind to the cell surface receptors, which either prevents the intended ligand binding with the receptor or mimics the effects of the ligand, thus impairing cell signaling.

Some clinical examples:

- Graves' disease

The use of Type 5 is rare. These conditions are more frequently classified as Type 2, though sometimes they are specifically segregated into its own subcategory of Type 2.

Quiz / 1

Define immunology, immune system.

Note

Check your answers in the text.

Quiz / 2

What are the chemical barriers. examples?

Quiz/3

Define the antigen, immunogenicity.

Note:

Check your answers in the text page.

5/ Post test :-

Circle the correct answer:-

1-The mechanical barriers include are:

a-leaves b-shells

c-tears d-all

2-The complement system is described to be:

a-cleavage system b-first defense

c-biochemical cascade d-other

3- Immunogen is:

a-MHC b-antigen

c-B-cell d-other

4-B-cells produced in:

a-bone marrow b- blood

c-liver d-spleen

5-Immunization defines as:

a.Resistance to foreign antigen b. antibody resistance

c. resistance to infection d.no one of these

6-Exogenous antigens come from the:

a.outside the body b.inside the body

c.infected pathway d.other

7-Autoantigen described as:

a.lectin b.toxin

c.protein d.other

8-Antibodies are known as:

a.plasma protein b.immunoglobulin

c.glutathione d.other

9-Antobody basic structure consist of:

a. light chain b. heavy chain

c.neutral chain d.all

10- A type of hypersensitivity is:

a.allergy b.cytotoxic

c.Autoimmune d. all

Note

Check your answers in page.

- (1) degree for each answer.

6/ key answers :-

1- Pre test answers:-

1.d
2.b, c, d
3.d
4.b
5.b, c
6.b, d
7.a, b
8.b, c
9.a, b
10.b, d

2-post test answers:-

1.d
2.c
3.b
a
4a.
5.a
6.a
7.c
8.b

9.d
10.d

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The End
Thank you