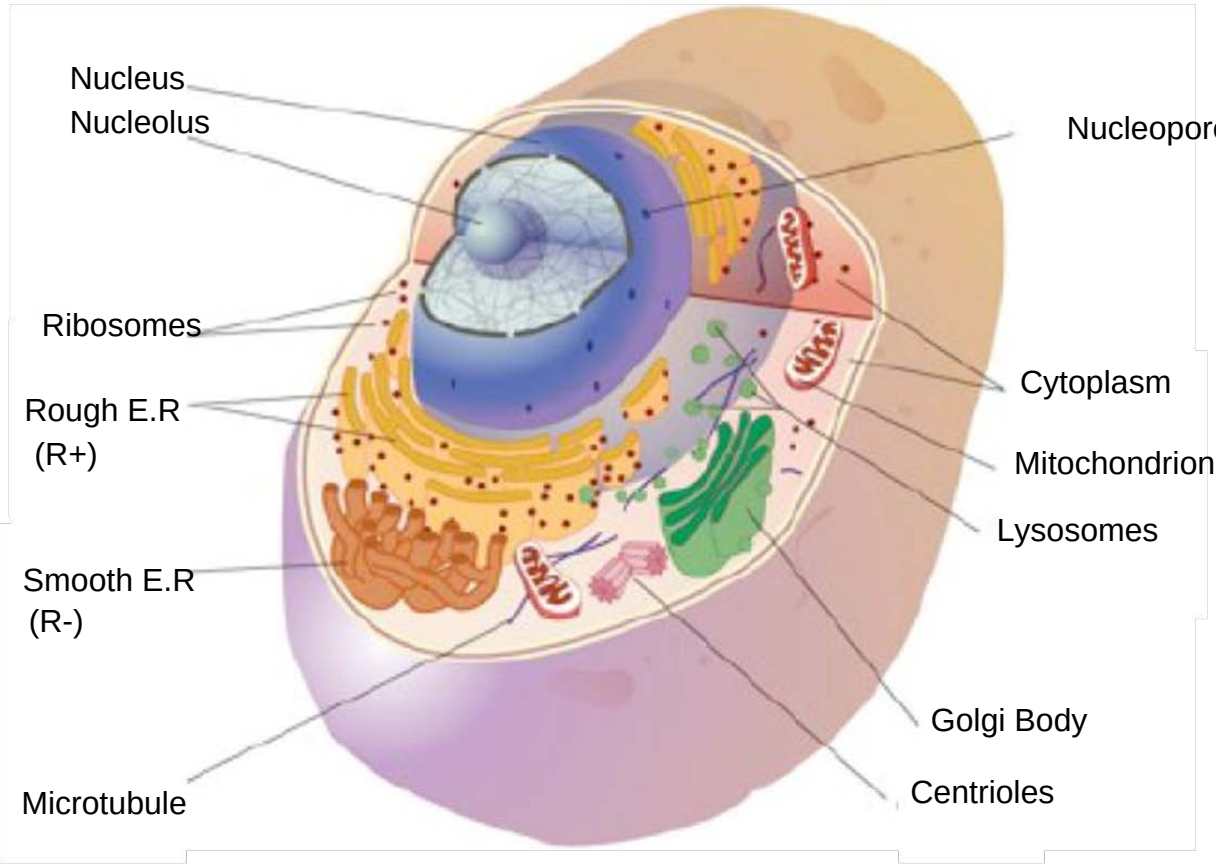
Table des Matieres

Genetic Part

I- What is a cell?

Animal cells are …Eukaryotic cells……, or cells with a membrane-bound nucleus. Unlike…Prokaryotic cells……., **DNA** in animal cells is housed within the nucleus. In addition to having a nucleus, animal cells also contain other membrane-bound organelles, or tiny cellular structures, that carry out specific functions necessary for normal cellular operation.

Organelles have a wide range of responsibilities that include everything from producing …..hormones……..and …enzymes…… to providing energy for animal cells.



Title : Ultrastructure of an Animal Cell

Organelles and Components

The following are examples of structures and organelles that can be found in typical animal cells:

- Cell Membrane …… - thin, semi-permeable membrane that surrounds the **cytoplasm** of a cell, enclosing its contents.

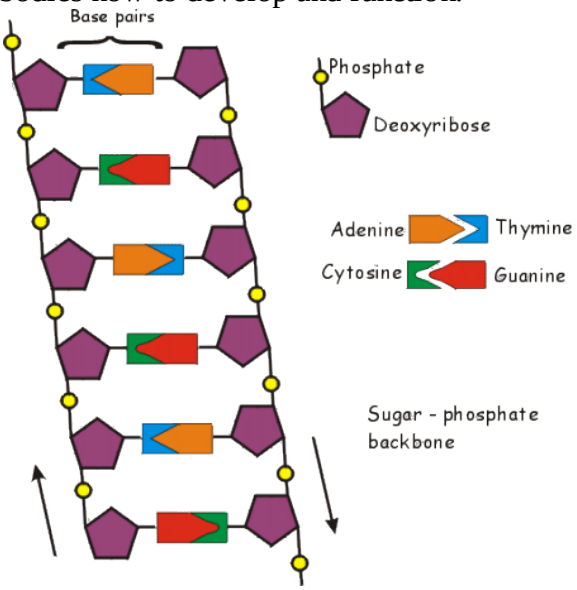
- Centrioles ..... - cylindrical structures that organize the assembly of microtubules during **cell division**.
- Hyaloplasm ..... - gel-like substance within the cell.
- Endoplasmic Reticulum .....- extensive network of membranes composed of both regions with ribosomes (rough ER) and regions without ribosomes (smooth ER).
- Golgi Body ..... - also called the Golgi apparatus, this structure is responsible for manufacturing, storing and shipping certain cellular products.
- Lysosomes ..... - sacs of enzymes that digest cellular macromolecules such as **nucleic acids**.
- Microtubules ....., - hollow rods that function primarily to help support and shape the cell.
- Mitochondrion ..... - Cell components that generate energy for the cell and are the sites of **cellular respiration**.
- Nucleus ..... - Membrane bound structure that contains the cell's hereditary information.
    - Nucleolus ..... - Structure within the nucleus that helps in the synthesis of ribosomes.
    - Nucleopore ..... - tiny hole within the nuclear membrane that allows nucleic acids and proteins to move into and out of the nucleus.
- Ribosomes ..... - consisting of RNA and proteins, responsible for protein assembly.

II- What is a nucleus?

Nucleus contains most of the cell's genetic material..., organized as multiple long linear D.NA..... molecules in complex with a large variety of proteins....., such as **histones**, to form chromosomes..... The genes..... within these chromosomes are the cell's nuclear genome. The function of the nucleus is to maintain the integrity of these genes and to control the activities of the cell by regulating gene expression..... The nucleus is, therefore, the control center of the cell

III- What is DNA? DNA = DesoxyriboNucleic Acid

DNA is an essential molecule for life. It acts like a recipe holding the instructions telling our bodies how to develop and function.



a- What is DNA made of?

DNA is a long thin molecule made up of something called nucleotides. There are four different types of nucleotides: adenine, thymine, cytosine, and guanine. They are usually represented by their first letter:

- A- Adenine.....
- T- Thymine.....
- C - Cytosine.....
- G - Guanine.....

Holding the nucleotides together is a backbone made of **phosphate** and **deoxyribose**. The nucleotides are sometimes referred to as **"bases".**

b- Shape of the DNA Molecule

Although DNA looks like very thin long strings under a microscope, it turns out that DNA has a specific shape. This shape is called a ……Double Helix……. On the outside of the double helix is the backbone which holds the DNA together. There are two sets of backbones that twist together. Between the backbones are the nucleotides represented by the letters A, T, C, and G. A different nucleotide connects to each backbone and then connects to another nucleotide in the center.

> Only certain sets of nucleotides can fit together: A only connects with T and G only connects with C.
>. U (Uracile) only connects with G…….

IV- What is a gene?

Within each string of DNA are sets of instructions called genes. A gene is transcribed to an RNA which may then be translated to a protein. Proteins are used by the cell to perform certain functions, to grow, and to survive.

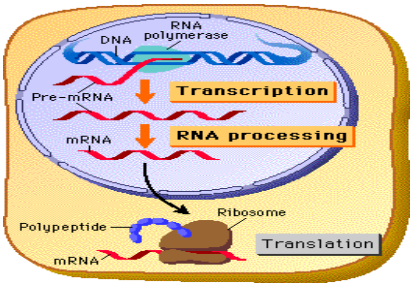
a- How do cells know what to do?

>> The DNA Code

The DNA code is held by the different letters of the nucleotides. As the cell "reads" the instructions on the DNA the different letters represent instructions. Every three letters makes up a word called **a codon**. A string of codons may look like this:

ATC TGA GGA AAT GAC CAG

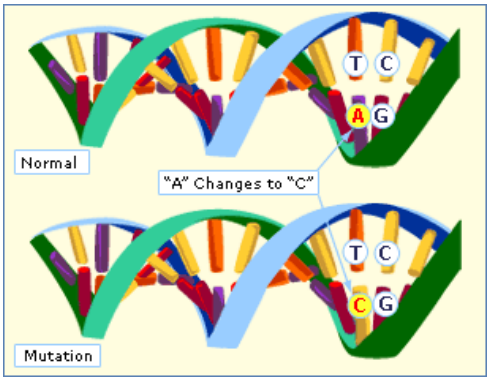
>> Gene expression



It first involves .transcription……., in which DNA is used as a template to produce RNA. In the case of genes encoding proteins, that RNA produced from this process is ……messenger R.N.A.…… , which then needs to be translated…….. by .ribosomes……to form a protein. As ribosomes are located outside the nucleus, mRNA produced needs to be exported.

V- What is a mutation?

Mutation is a permanent alteration in the DNA sequence that makes up a gene, such that the sequence differs from what is found in most people. Mutations range in size; they can affect anywhere from a single DNA building block (gene mutation) to a large segment of a chromosome that includes multiple genes (chromosome mutations).



VI- What is a chromosome?

When a cell is not dividing (interphase of the cell cycle), the chromosome is in its chromatin form. In this form it is a long, very thin, strand. When the cell begins to divide, that strand replicates itself and winds up into shorter tubes. Before the split, the two tubes are pinched together at a point called the centromere. The shorter arms of the tubes are called the "p arms" and the longer arms are called the "q arms."

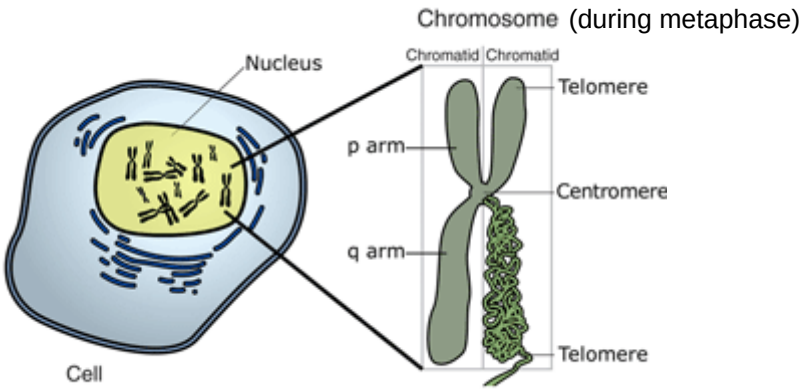
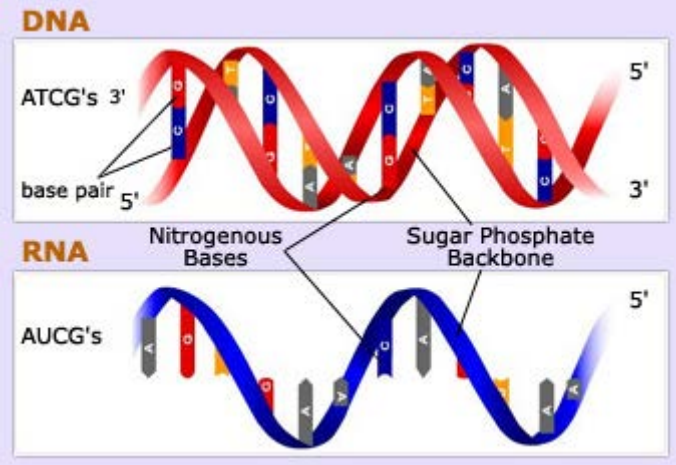


Image adapted from: National Human Genome Research Institute.

Where is the mistake on this figure?

We can't see the chromosomes inside the nucleus

Activity : Compare between DNA and RNA:



Similarities:

1. They are both made of building blocks , called nucleotides

2. Each nucleotide is made of a base attached to a piece of backbone

3. Nucleotides in both DNA and RNA are complementary base pairs : C pairs with G and A with T (or U)

Differences:

1. The backbones of DNA and RNA are slightly different in their chemical makeup
2. The bases in DNA are G C A T and the bases in RNA are : G C A U
3. In DNA , each base is paired with another along the entire length of 2 strands

In RNA , only certain bases are paired with their complement

4. DNA molecules have a regular uniform shape ; RNA molecules have an irregular varied shape
5. DNA molecules are huge , typically made of billions of nucleotides

RNA // // much smaller , made of hundreds of nucleotides

- **Question:** can we use the presence of DNA as an argument to say that an organism is living?

  We don't focus on DNA to say if the cell is dead or not but the RNA can give this information

Immunology Part

Introduction:

Immunology is the study of immune system including its responses to microbial pathogens and damaged tissues and its role in disease

Immunity is the ability of the host to protect its self against exogenous or endogenous pathogens: viruses, bacteria, fungi, parasites and toxins.

The immune system comprises tissue, cells and molecules which mount **the immune response**

➔ **The concept of innate and adaptative immunity:**

The immune response consists of two types of responses:

Innate immune response also called natural or native immunity is the first line of defense against invading pathogens, it comes immediately after the start of an infection and is mediated by cells and proteins.

The most components of innate immunity are always present in healthy individuals and ready to prevent the entry of pathogens in host tissues.

The innate immunity mechanisms rely on the ability to recognize conserved microbial structures shared by large groups of pathogens, also called PAMP's (Pathogen Associated Molecular Patterns) or endogenous molecules that are produced or released from damaged and dying cells called DAMP's (Damage-Associated Molecular Patterns). Moreover, pattern associated molecular pathogen are essential for microbial survival, they are produced only by microbes and not by host cells.

The major components of the innate immune response are:

- **Epithelial barriers**: skin and other epithelial surfaces of the respiratory and gastrointestinal tract constitue a physical barrier that prevent the entry of microbes. These surfaces are covered by a mucus layer that provides a physical impediment. Natural antibiotics with broad spectrum of anti-microbial activity such as defensins and cathelicidins are also secreted by epithelia and kill pathogens or inhibit their growth.

- **Leukocytic phagocytes**: Microorganisms invading tissues are exposed to phagocytes when they do breach the epithelial barrier. phagocytes engulf and digest them. Phagocytes such as macrophages & neutrophils display a variety of cell-surface receptors that enable them to recognize, ingest pathogens into vesicles and destroy them chemically. Macrophages secrete also proteins called cytokines that stimulate inflammation and lymphocytes response. These cells act as antigen presenting cells and activate the cells of adaptive immune response.

- **Dendritic cells** recognize molecular structures of microbes through pattern recognition receptors, they produce numerous cytokines in response to microbes that initiate inflammation and stimulate adaptive immune response. Moreover, dendritic cells provide initial defense against viruses. The major function of these cells is The presentation and the capture of the antigen They constitue therefore an essential link between innate and adaptive immunity.

- **Natural killer cells** are a class of lymphocytes that recognize and kill infected cells They detect and kill self cells that have down-regulated class I molecule expression They also respond by secreting the macrophage activating cytokine Interferon- Interferon-γ (IFN–γ).

- **Plasma proteins:** the proteins of the complement system constitute the major plasma proteins among many circulating proteins that are important in defense against pathgens. Complement proteins coat pathogens and promote phagocytosis by interacting with complement protein receptors on the surface of macrophages. This process is called opsonization Some complement proteins promote also the recruitement of monocytes and neutrophils at the site of infection. The complement system plays a role in adaptive immunity since it is activated by antibodies. The complement system is a group of circulating and membrane associated proteins. A number of these proteins are proteolytic enzymes that are themselves activated by proteolytic cleavage.

- **Cytokines:** are soluble proteins that stimulate and regulate immune and inflammatory responses and are responsible for communications between leukocytes and leukocytes with other cells. The binding of microbial products (PAMPs) to their receptors (PRR) on the surface of dendritic cells and macrophages induces cytokines secretion. In innate immunity , cytokines serve many functions, some cytokines act as chemmoattractant of neutrophils and monocytes to the site of infection, induce fever and stimulate the production of acute pahse reactants from hepatocytes. …..... produced by a subset of dencritic cells and some infected cells inhibit viral replication and limit the spread of the infection to uninfected cells.

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However, many pathogens are able to overcome the innate immune response. Defense against that pathogens requires the activation of the Adaptive immune response...

Adaptive immune response, also called specific or acquired immunity, is a more .powerful defense that operates later in the infection. It is activated against pathogens that resists innate immunity. The adaptive immunity is mainly mediated by Lymphocytes and their products.....such as Antibodies. These components requires **activation, expansion and differenciation** in response to microbes in order to provide effective defense.

Memory cells persist after a response and respond **rapidly and effectively** in a secondary response to the same antigen.

Adpative immunity is divided into two major types of immune responses:

Humoral immune response is mediated by **antibodies** produced by **B lymphocytes** and provides defense a**gainst** ….extracellular pathogens

Cell-mediated immunity is mediated by T-Lymphocytes**…….**and provides defense **against intracellular pathogens.**

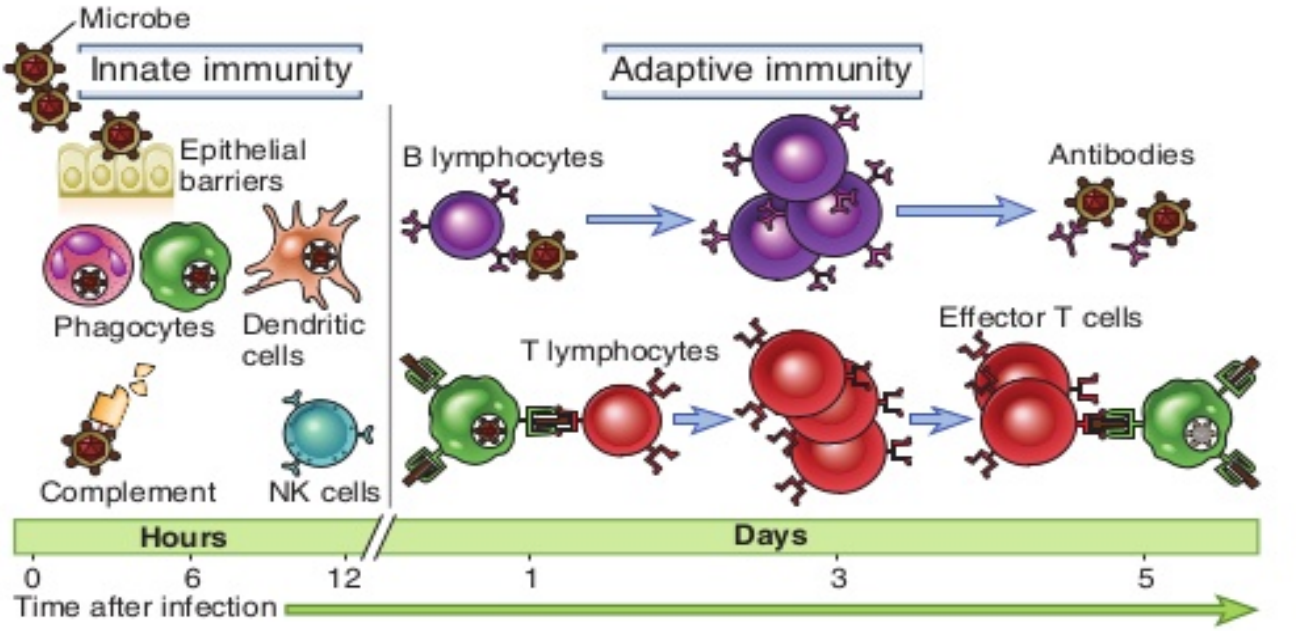
The major components of adative immunity are:

- B Lymphocytes**....** derive and mature in **the bone marrow**, they are essentially present in lymphoid tissues, peripheral blood and bone marrow and other lymphoid tissues. These cells mediate **humoral immunity** since they are the only cells that produce **antibodies**. B cell receptor is membrane bound antibody (membrane bound

immunoglobulin) and known as ……B Cell receptor…….. Antigen binding to BCR intiate the process of B cell activation and differentiation into ……Plasma cells…….. which secrete a large amount of **antibodies**. **Antibodies** bind to microbial antigen, neutralize and eliminate microbes and microbial toxins that are present outside of host cells.

- **T lymphocytes** mature in ……the Thymus……, they are essentially present in peripheral blood (60 to 70% of circulating lymphocytes), spleen and lymph nodes. T lymphocytes mediate ……cell mediated immune response…….. The receptors of most T lymphocytes also called **T cell receptor (TCR)** recognize only ……Peptide fragments…… that are dispalyed by specialized peptide display molecules called ……Major histocompatibility complex…….. on the surface of **antigen presenting cells.** There are two major subsets of T lymphocytes, **$CD4^+$ T cells** called ……helper-T……., they help B lymphocytes to produce antibodies and phogocytes to eliminate ingested microbes. ……CD8+ cells…….. called **cytotoxic T lymphocytes**, they kill host infected cells and tumor cells.

➔ **Innate immunity vs adaptive immunity**



Abbas & al. Basic immunology: functions and disorders of the immune system. Elsevier Health Sciences, 2012

FIGURE 1 : Comparison between innate and adaptive immunity mechanisms

• Always present in healthy individuals and ready to block the entry of pathogens • Immediate response , less potent • PRR…general specificity. recognize molecules…. shared by classes of pathogens • receptors with limited diversity encoded in . germ line • non clonal distribution of receptors • Non clonal expansion • no memory, response with equal potency to repeated exposures to the same antigen	• Normally silent • Slower response (1-2 weeks) but more powerful • Highly specific receptors for structural details of microbial molecules : TCR/BCR • receptors with greater diversity generated by somatic recombination of gene segments • clonal distribution of receptors • clonal expansion of antigen specific lymphocytes • Memory cells respond rapidly and effectively upon the 2nd exposition to the same antigen

➔ **Humoral immune response:**

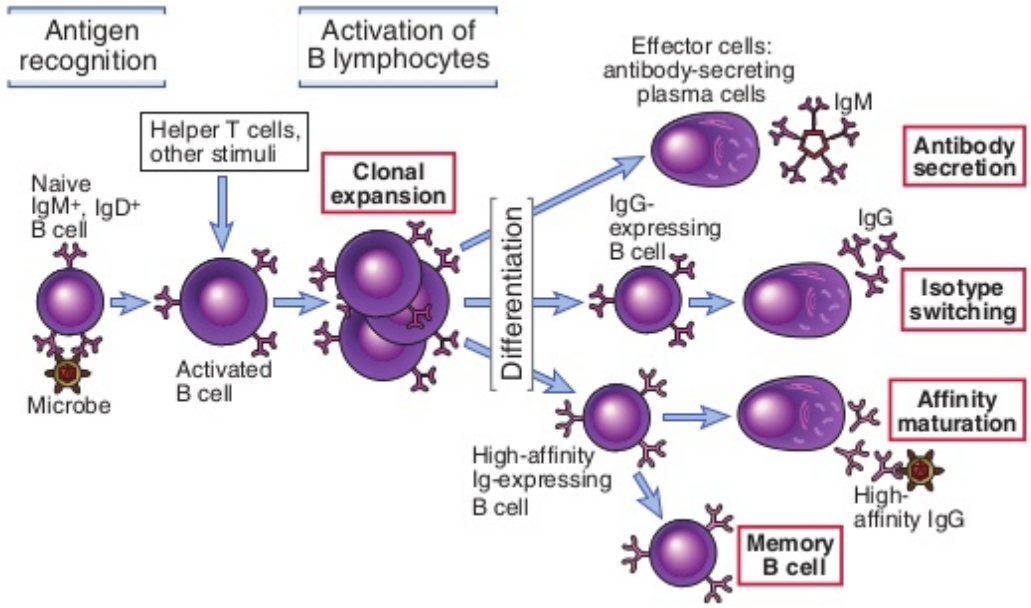


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FIGURE 2: phases of humoral immune response

1- Antigen recognition

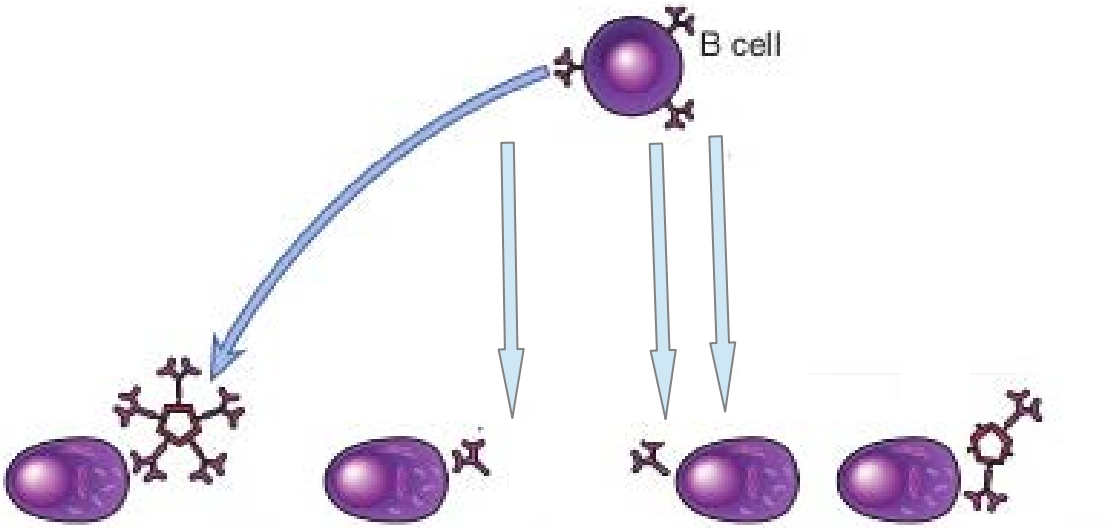
2- Clonal expansion

3- Cellular differentiation

4- Antigen elimination

5- Memory

➔ **Different classes of antibodies:**



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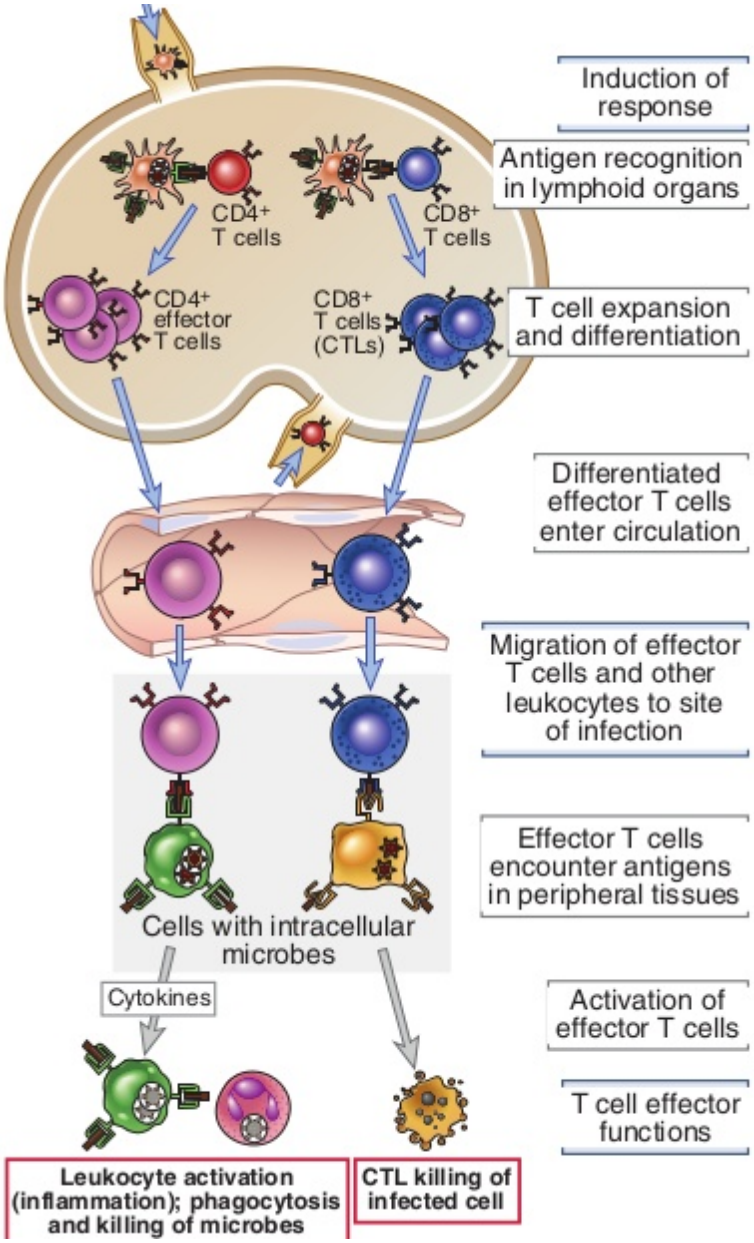
IgM	IgG	IgE	IgA
- Neonatal - Complement activation - Secretory immunoglobulin	- Activation of complement - Opsonization - Protects the body from infection - Antibody-dependent cell-mediated cytotoxicity - Possesses receptors to facilitate passage through the human placenta,	- Fights gut parasites - can recognize cancer - Allergies - Fixation to FcεRI	- initiates inflammatory reactions - Secretory immunoglobulin

➔ **T cell-mediated immune response :**



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1- Antigen recognition
T cell CD4+

T cell CD8+

2- Clonal expansion
T cell CD4+

T cell CD8+

3- Cellular differentiation

T cell CD4+

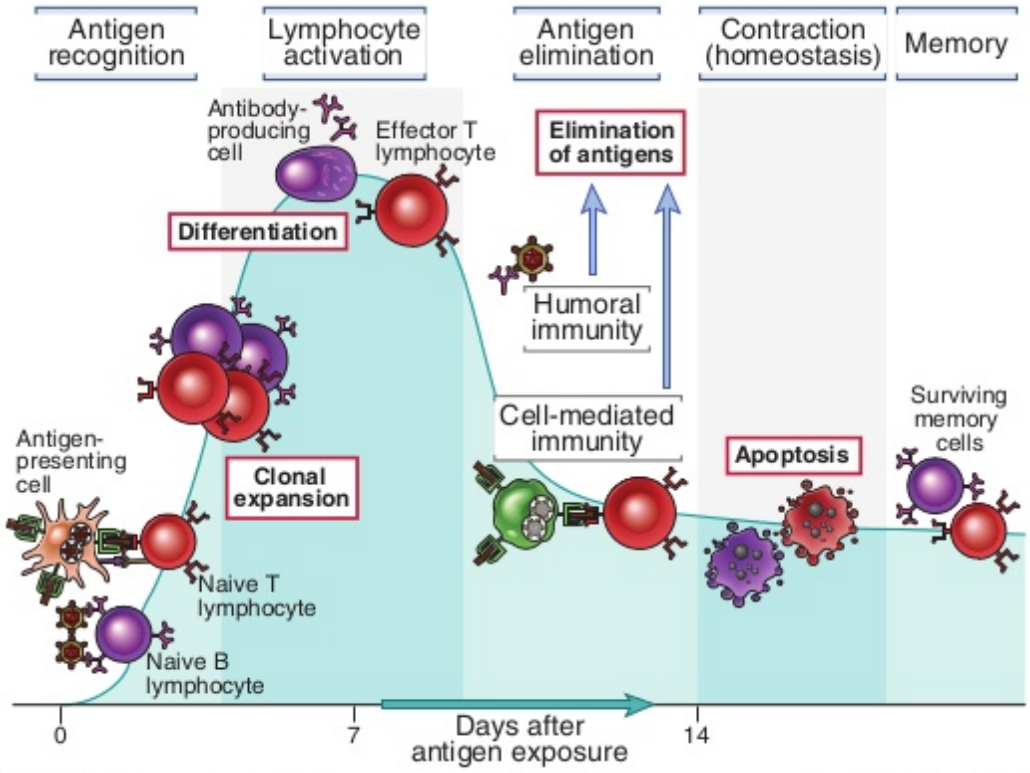
T cell CD8+

4- Antigen elimination
T cell CD4+

T cell CD8+

5- Memory

➔ **Phases of immune response:**



Abbas & al. Basic immunology: functions and disorders of the immune system. Elsevier Health Sciences, 2012

FIGURE 5: phases of immune response

1- Antigen recognition

2- Activation

3- Antigen elimination

4- Contraction memory

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Microbiology Part

Definitions:

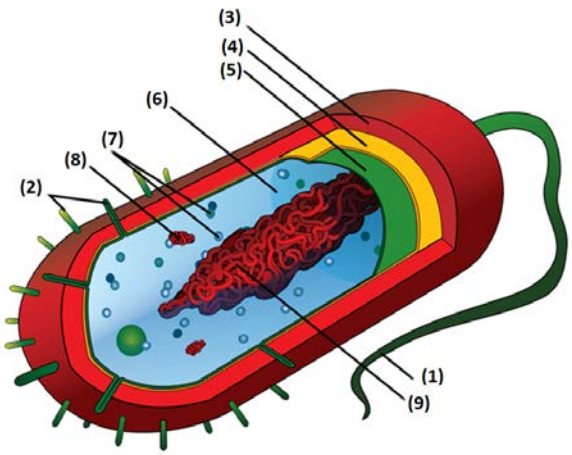
- **Microbiology** is the study of microscopic organisms (..microorganisms...). They are also referred to as .microbes....., or more commonly, ..germs..... , especially to ordinary people. Principal groups of microorganisms are: bacteria, viruses, archaea, fungi and protozoa. This discipline includes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

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

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

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

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



1- Bacterial flagellum

2- Pili

3- Capsule

4- Cell wall

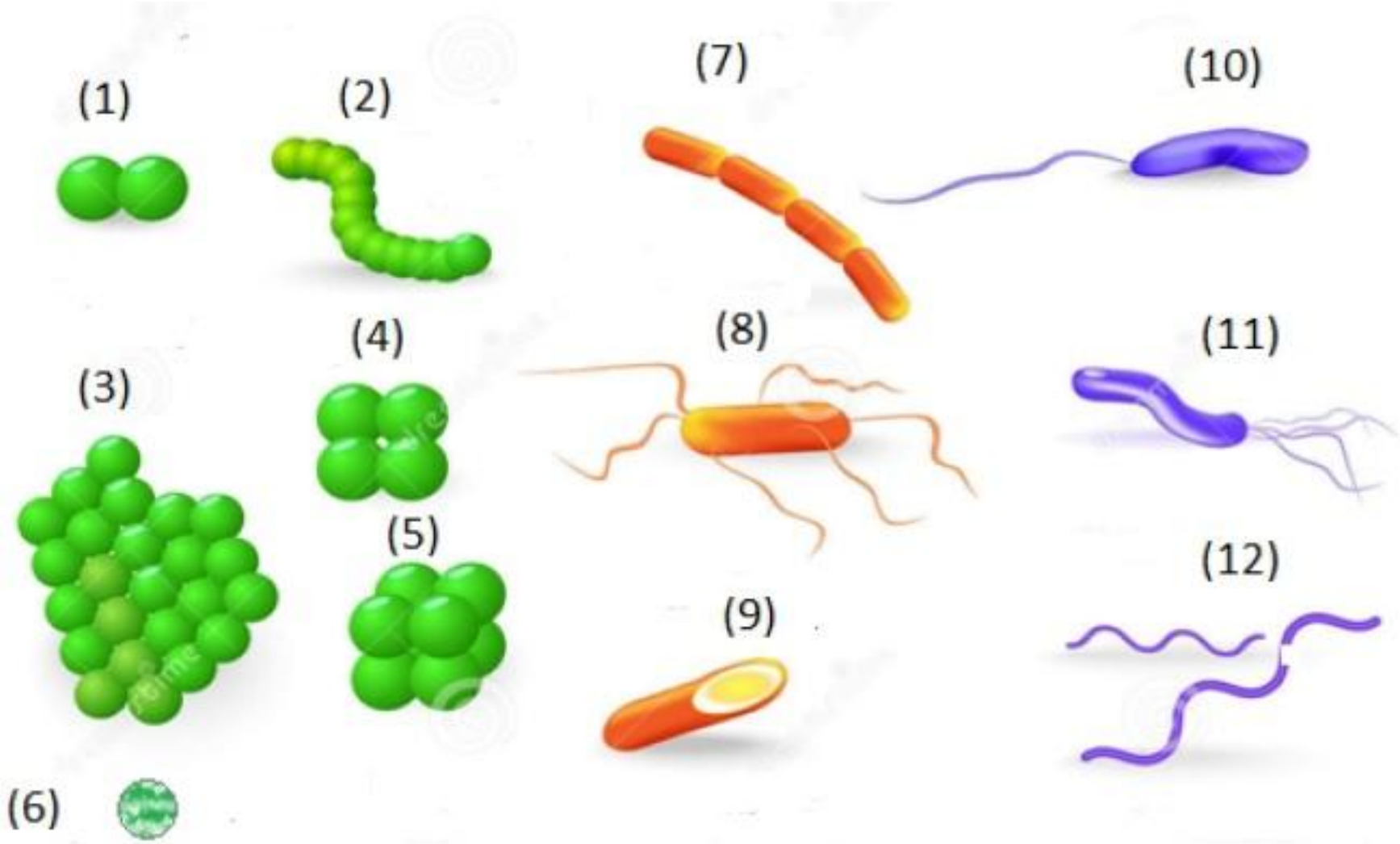
5- Plasma membrane

6- Cytoplasm

7- Ribosomes

8- Plasmid

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



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

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

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

(1) in pairs,

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

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

Principal groups of Microorganisms:

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

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

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

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

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

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

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

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

☺ **Activity:**

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

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

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

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

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

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

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

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

Lactococcus and *Lactobacillus*: They produce acid lactic

Streptomyes: can produce antibiotic ,

Algae: Oxygen and oil productions

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Microbes Interactions:

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

Microbial ecology:

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

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

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

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

Clinical Microbiology:

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

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

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

Microbiology of Food:

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

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

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

Industrial Microbiology and Biotechnology:

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

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

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

Additional materials and references:

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Zoology Part

PART I: INTRODUCTION

The Greek philosopher **Aristotle** (384-322 BC) devotes many treaties to the animal world. Thus, his book [*History of Animals*] is adefense of his method of investigating zoology. **Aristotle** investigates four (4) types of differences between animals: Differences in particular body parts[1] (Books I to IV); differences in ways of life [2] and types of activity[3] (Books V, VI, VII and IX); and differences in specific characters[4] (Book VIII).

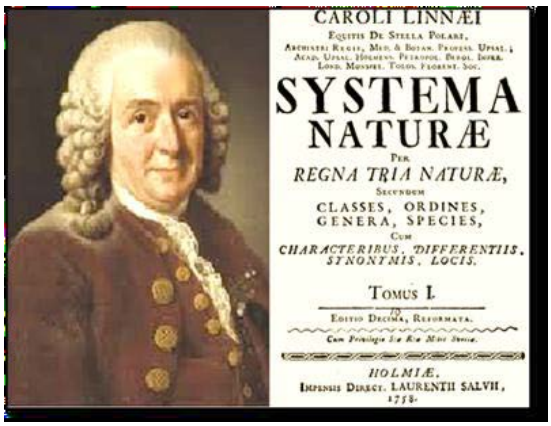
Al-Jāḥiẓ (full name Abūʿ Uthmanʿ Amr ibn Baḥr al-Kinānī al-Baṣrī) born in Basra 776, was an Arabic prose, writer and author of works of literature.

He sold fish along one of the canals in Basra in order to help his poor family. Financial difficulties, however, did not stop Al-Jāḥiẓ from continuously seeking knowledge. He continued his studies. Over a span twenty-five years, he would acquire considerable knowledge on Arabic poetry, Arabic philology, and pre-Islamic Arab and Persian history. He also studied the Qur'an and the Hadiths. Additionally, **Al-Jāḥiẓ** read translated books on Greek sciences, especially that of Greek philosopher **Aristotle**. [*Kitāb al-Hayawān*], Book of Animals is one of his most important books. It is an encyclopedia of seven volume of

anecdotes, poetic descriptions and proverbs describing over 350 varieties of animals. He died in Basra in January 869 at the age of 93, in his private library.

Carl Linnaeus (23 May 1707- 10 January 1778), also known as Carl von Linn, was a Swedish botanist, physician, and zoologist, who laid the foundations for the modern biological naming system of binomial nomenclature. He is known as the father of modern taxonomy and is considered one of the fathers of modern ecology.

Many of his writings were in Latin, and his name in Latin is *Carolus Linnæus*. He published *Species Plantarum*, the work that is now internationally accepted as the starting point of modern botanical nomenclature, in 1753. *Systema Naturae* [System of nature] was one of the major works of *Carolus Linnaeus* and introduced the Linnaean taxonomy.



The 1st Edition was published in 1735. The 10th Edition of this book (1758) was considered the starting point of zoological nomenclature. It was also officially regarded by the International Commission on Zoological Nomenclature as the 13th edition of *Systema Naturae*.

1. WHAT IS ZOOLOGY?

Zoology (zō-ŏl'ə-jē) or animal biology is the scientific study of .Organisms.. in the kingdom .Animalia.., including their .growth….., structure,evolution, habitat and behavior.

2. WHY STUDY ZOOLOGY?

We know that zoology is the black sheep…. of most.students….. in second-year biology (L2/SNV). But, please note that study Zoology is good at all levels. Look, briefly there are three reasons that show the importance of Zoology:

- If you study Zoology, you will get to work on to the animals themselves. Moreover, working with animals.. can be extremely challenging and rewarding.
- Zoology is important to us to understand the urgency of preserving the animals. This .science… would help us learn the needs that animals lack and we can respond by thinking of solutions we can give to the different..species of animals.
- Studying zoology would help people achieve clarity over the common myths we have on different. types of…. animals. In this course….,we can be able to learn the natural behavior as well as their habitats so we would completely understand why they would behave in a defensive manner when they seem .threatened...

3. CELLS AS UNITS OF LIFE

The body of all living organisms is made up of one or more cells which carry out certain basic functions. Thus, cells are called "Basic structural and functional units of living organisms". The branch of biology that deals with the study of structure, function and life history ofa cell is called "Cell Biology".

3.1.Kinds of cells

There are two basic kinds of cells: .Prokaryotic.cells and .Eukaryotic…..cells.

Prokaryotes, bacteria and archaea, are. simple…. cells that have no nucleus. However, **Eukaryotes** are .complex. cells with many organelles and other structures in the cell.They store their genetic information (*DNA*) on . chromosome... in the nucleus.

3.2. Kinds of Eukaryotic cells

There are two types of eukaryotic cells:plants…….. (for more comprehension of plant cell, form and function, please refer to the chapter Botany) and .animal….. cells (Fig.1: Please, give a title to the figure).

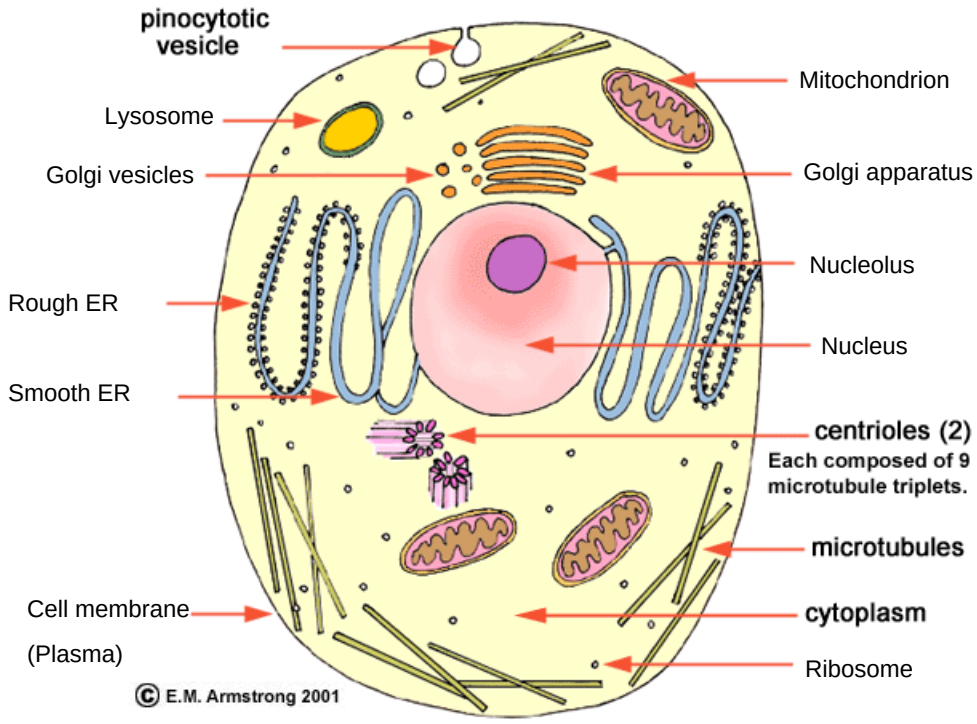


Fig.1. Animal cell and its organelles…..

3.3. Organisms show variety in cell number

The organisms made up of a single cell are called Unicellular….. organisms. Eg: Protozoa as *Amoeba*, *Paramecium* etc… However, others made up of more than one cell are called .Multicellular…..organisms.

4. BINOMIAL NOMENCLATURE

In biology, we traditionally classify animals by the structure of their .Anatomy….., in a descending hierarchy of .taxons…..: kingdom, phylum, class, order, family, genus, and species.

For example, human beings are classified as belonging to the:

Kingdom…	Animal
Phylum	Chordates
.Class…..	Mammals
Order	.Primates..
.Family….	Hominidae
Genus	.Homo…...
.Species…	*Sapiens*

The Swedish scientist .LINNEAUS…developed a system of naming living things in the eighteenth century. He invented the binomial nomenclature (2 Latin names: Genus-species).

Ex. Scientific name of humans is *Homo sapiens* L., 1758. Thus, Homo is the .genus…… name and sapiens is the .species….name.

-Rules for writing scientific names

The Latin scientific name of a species, whether it is a plant, animal, bacterium, fungus, etc., is a .two-part…… name consisting of the genus name first (by the way: one genus, two genera) and the species name second. For example, the domestic cat is known as *Felis catus*. Although the genus name can be used on its own but the species name never appears on its own.

For writing a scientific name, we must

Use both .genus… and .specis… name: *Felis catus*.
Italicize the .whole…. name.

Capitalize only the .genus.. name.

5. CLASSIFICATION OF ANIMALS

Classification is a way of .listing…….. living things. According to the presence/ absence of the .spine……., scientists have divided the Animal Kingdom into two main groups:

1/ .Invertebrates. are animals without a backbone

2/ .Vertebrates… are animals with a backbone

Based on the .number…. of .cells……forming the body, the Animal Kingdom is generally divided into two Sub-Kingdoms:

1/.Protozoa……. (First animals): unicellular, microscopic animals, no tissues.

2/.Metazoa…: Multi cellular animals. Cells arranged in tissues

6. SYMMETRY IN ANIMALS

Symmetry means an arrangement of body parts into a geometrical…. design. It refers to the division of body into .equal…….. parts by lines or planes. A plane of symmetry is a straight line that divides organisms into corresponding .halves…….

An animal is called symetrical.when a plane passing through its center will divide it into similar halves. When an animal cannot be divided into like parts by a plan, it is called .asymetrical…..(Fig.2: Please fill the legend by following the course).

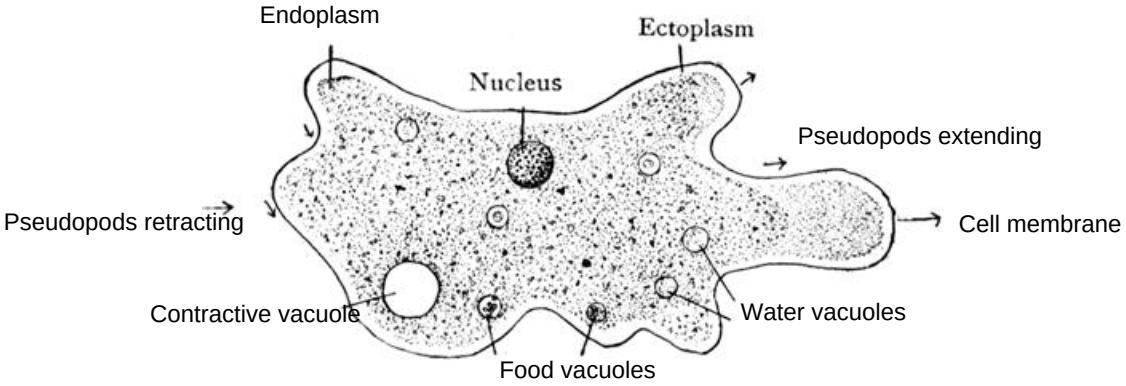


Fig. 2. Structure of an Amoeba

Other .types……..of symmetry are also recognized……(Please follow the course in the amphitheater).

PART II: Invertebrates Zoology

1. THE ROLE OF FRESHWATER INVERTEBRATES IN THE FOOD WEB

Invertebrates are a cornerstone (base) of our ecosystems, providing vital services such as .pollination….and acting as important environmental indicators…. (for instance of water quality in rivers).These animals do not possess a vertebral column…..; they are an important link in the food web (Fig.3) as they convert the energy in plant and other organic matter into protein (their own bodies). This allows larger predators such as fish to live in fresh water as they feed on the

invertebrates

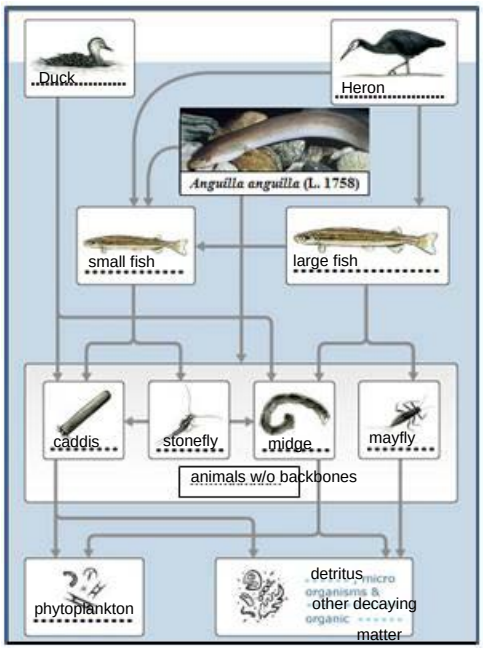


Fig. 3. The role of freshwater invertebrates in the ..food..... ..web.....

Over 95% of all animals on the earth are .invertebrates Invertebrates are found everywhere in both soil, water and air, and include animals ranging from sponges, corals and seastars to insects, crabs and worm

2. PORIFERA

Sponges are .aquatic…animals (Follow the water circulation in the course). Most of them are marine. They live attached to .sand….or rocks. The body is perforated by ..pores…and supported by small .needles..called spicules. They have an internal cavity with an upper hole called .osculum…and can reproduce sexually or..asexually... They are filtering animals.

3. CNIDARIA

Most of Cnidaria are marine animals. They have two body forms:

- Sessile polyps (Fig. 4A).- Swimming medusae (Fig. 4B).

They have a mouth with tentacles with stinging cells called cnidocytes and a gastrovascular cavity. Cnidaria are carnivores. They can reproduce sexually or asexually.

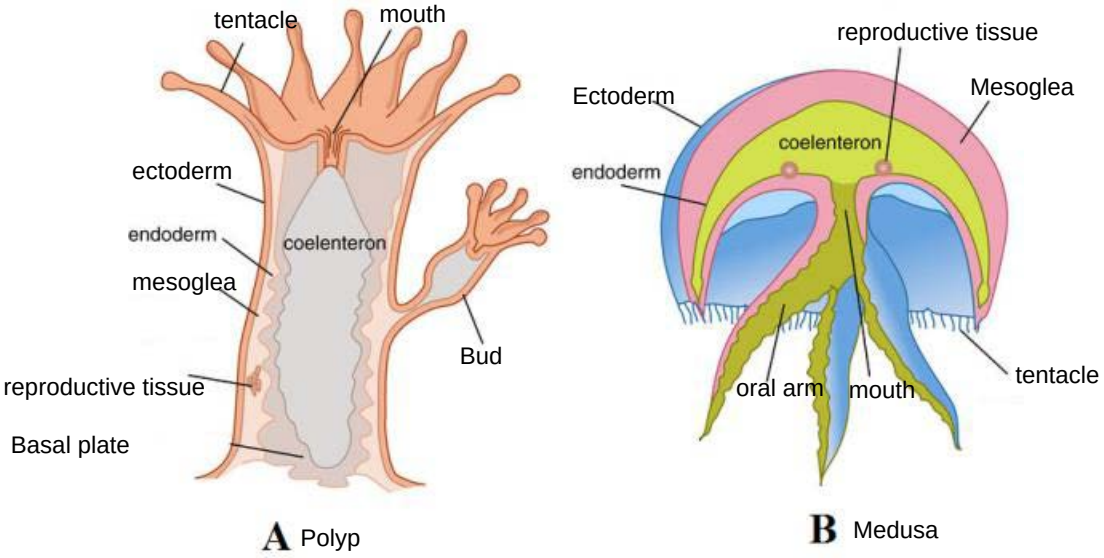


Fig.4: 2 types of Cnidaria……..

4. PLATYLMINTHES

Photo A

Photo B

This phylum has three common names: Flat worms, tapeworms…… and Flukes. There are over 20,000 species of flatworms. Most Platy helminthes organisms are hermaphrodites and reproduce sexually. Asexual reproduction (fission) is also common. Flatworms can be free

(photo A) or parasites (photo B). Follow the explanation of the parasite *Ligula intestinalis* (in the course).

5. MOLLUSKS

They are aquatic and terrestrial animals (snails, slugs). Their body comprises three parts: - The head: contains the sense organs -The visceral mass: contains the internal organs -The muscular food: to move around, excavate or catch the prey. They reproduce sexually. Main groups are: Gastropods (snail, slugs), Bivalves (mussels, clams), Cephalopods (squid, octopus, nautilus).

6. ARTHROPODS

They are terrestrial (spiders) or aquatic animals. The body is segmented. They have hard appendages (antennas, legs, palps). The body is covered by a rigid and articulated exoskeleton. They breathe by gills (aquatic) or tracheas (terrestrials). They reproduce sexually and some of them have complete (Follow the life cycle of the lady beetle -photo C- in the course) or incomplete metamorphosis.

Photo C

7. ECHINODERMS

They are marine animals (starfish, sea urchins, sea cucumber, brittle star (Photo D). Generally with .spines... and a hard .skeleton…. They have an .ambulacral... system to move around. They reproduce .sexually…. or by fragmentation like starfish.

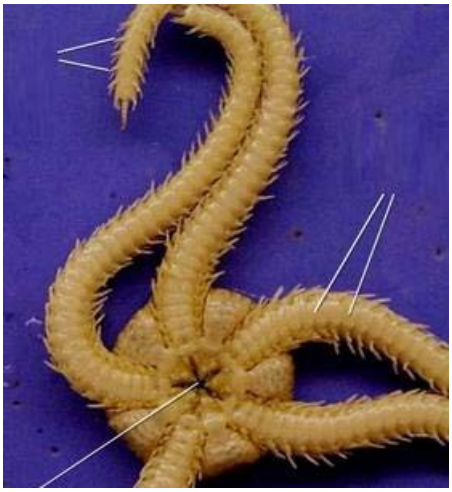


Photo D

8. THE MAIN CHARACTERISTICS OF ANIMALS

Animals are the most complex living things.
They usually have organs and systems.

They can perform the three vital functions: nutrition……., interaction and reproduction.

They can. move…… and . interact.. with other living things.

Animal reproduction can be: Asexual (Budding) and fragmentation or sexual.
Animals can be:

- viviparous: develop the embryo .inside.… the mother's body.

- Oviparous: lay eggs .outside…..the body.

- Ovoviviparous: develop inside eggs that remain inside the mother's body.

PART III: Vertebrate Zoology…

(Follow the course in the amphitheater)

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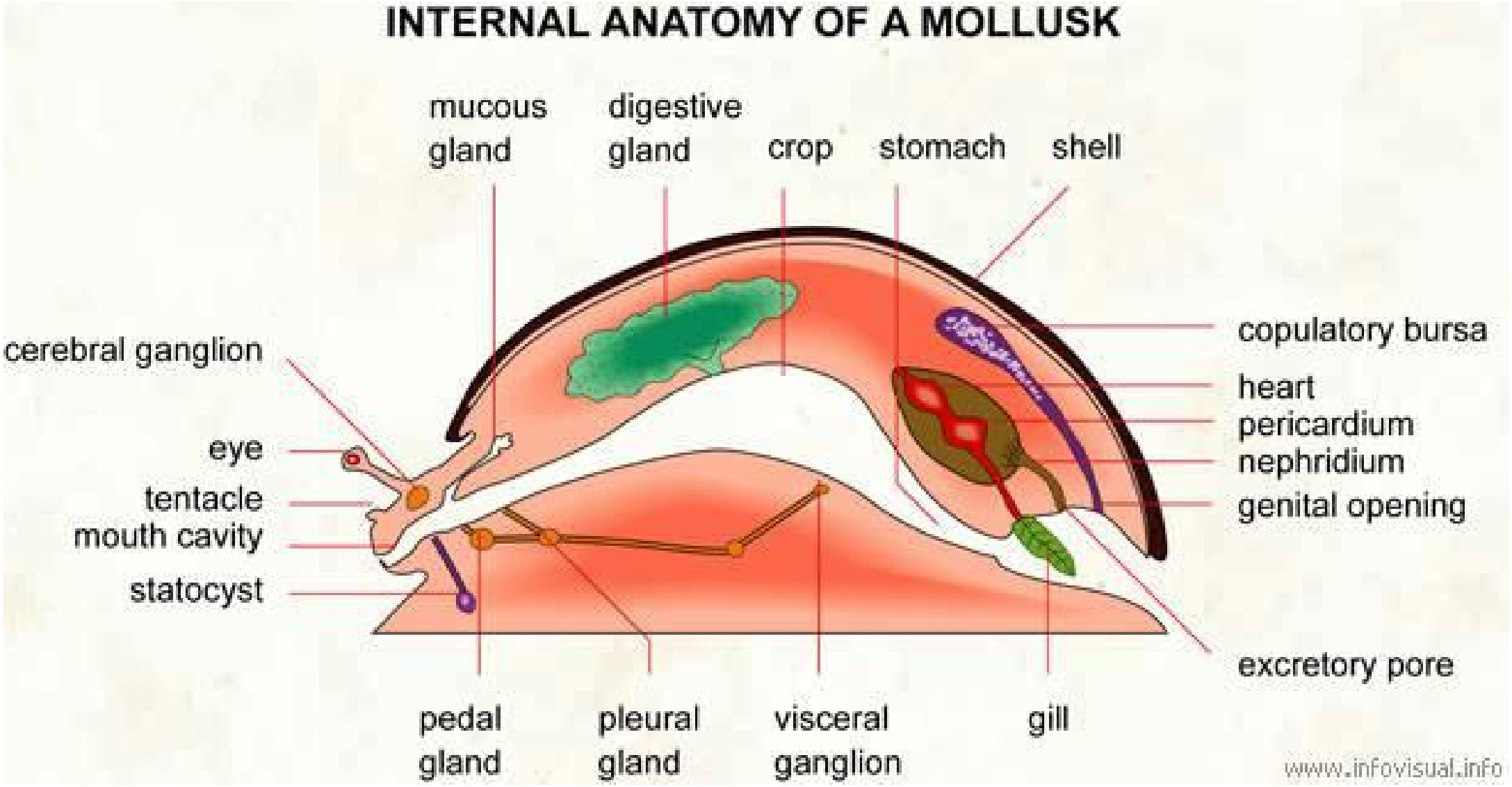
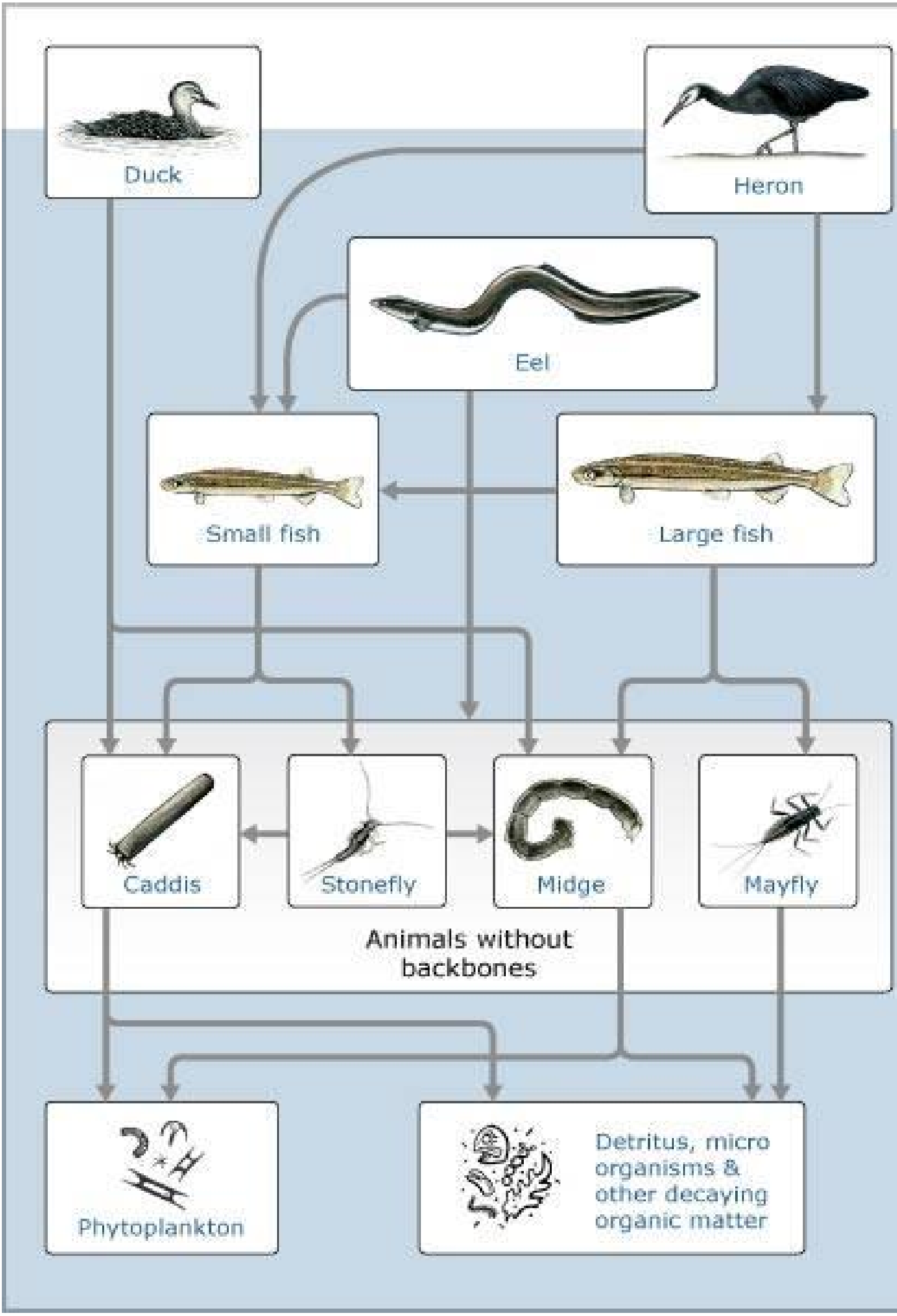
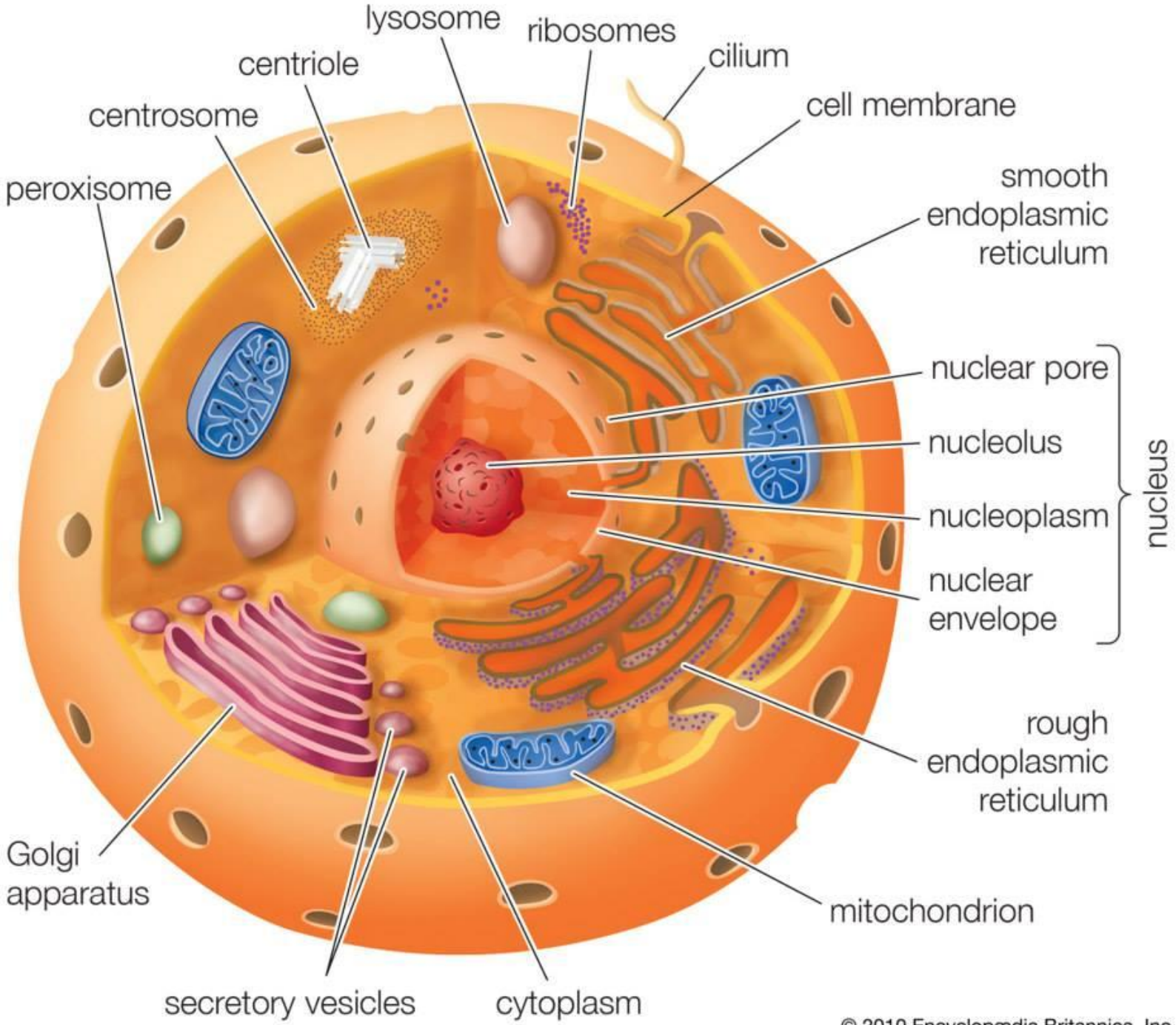

INTERNAL ANATOMY OF A MOLLUSK
mucous gland
digestive gland
crop
stomach
shell
cerebral ganglion
eye
tentacle
mouth cavity
statocyst
copulatory bursa
heart
pericardium
nephridium
genital opening
excretory pore
pedal gland
pleural gland
visceral ganglion
gill
www.infovisual.info


Duck
Heron
Eel
Small fish
Large fish
Caddis
Stonefly
Midge
Mayfly
Animals without backbones
Phytoplankton
Detritus, micro organisms & other decaying organic matter

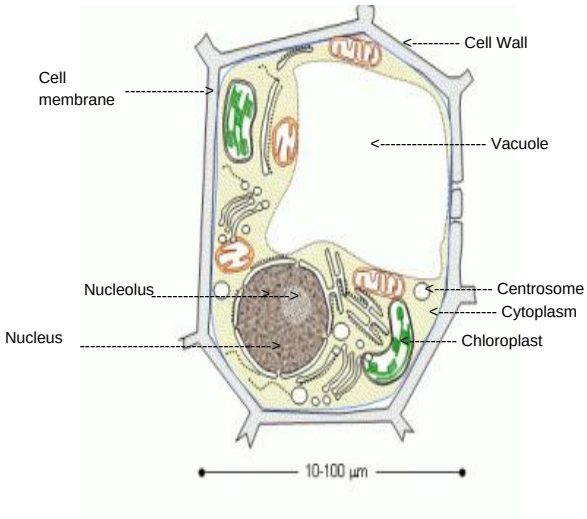
Animal cell



Introduction

Living things are organisms that display the key characteristics of life. These characteristics include the ability to grow, reproduce, take in and, use energy excrete waste, respond to, the environment, and possess an organized , structure. more complex than that of non-living things.

Botany Botane, comes from Greek and means plant…., it is the, science, interesting to plants. Currently, a plant.., is defined as , a multicellular, organism with, photosynthetic, activity. It is a natural, autotrophic, group with, a cell wall, constituted by cellulosic compounds. **Plant** is defined as multi cell organism with photosynthetic activity, it is a natural autotrophic group with cell wall constituted by cellulosic compounds (**see plant cell**).



Ultrastructure of an Eukaryotic cell (Plant cell)

Plant cell is characterized by geometric shape , surrounded by cell wall. with many Cell structures as chloroplast…, vacuole…and nucleus…

Classification and Principal Groups (see lecture)

Nowdays, there are tree taxa based on RNA16S, existed in all living things in the world. (Woese et *al,.* 1990), named

- Bacteria
- Archaea
- Eukarya

Eukarya is divided to 5 kingdoms **(Cavalier – Smith, 1998)**

- Kingdom of plants.. Autotrophic with cell wall ..... composed of cellulose
- Kingdom of Fungi, Saprobiontic ..... , symbiotic or parasites, with cell wall composed of chitin.....
- Kingdom of Animalia . Animals as consumers with digestive nutritional mode without cell wall.
- Kingdom of Chromista = brown line
- Kingdom of Chromista

The plant is classified by giving the name of genus.... and species.....(**Binomial nomenclature**) according to **Linnaeus (** 1758.....**)** who invented the system of taxonomy..... still used today for each plant, animal, bacteria or fungi. Genus and species written in italic character or underlined.

Algae: *Algae* are a very large and diverse group of eukaryotic.....photosynthetic organisms, ranging from unicellular.....genera such as Chlorella and the diatoms to .pluricellular.....forms such Ulva lactuca.....and others. Characterized by a lack of complex .organs.....and .tissues..... (without leaves, ..stems..... , and roots).

Ex. Ulva lactuca..... « Sea lettuce »

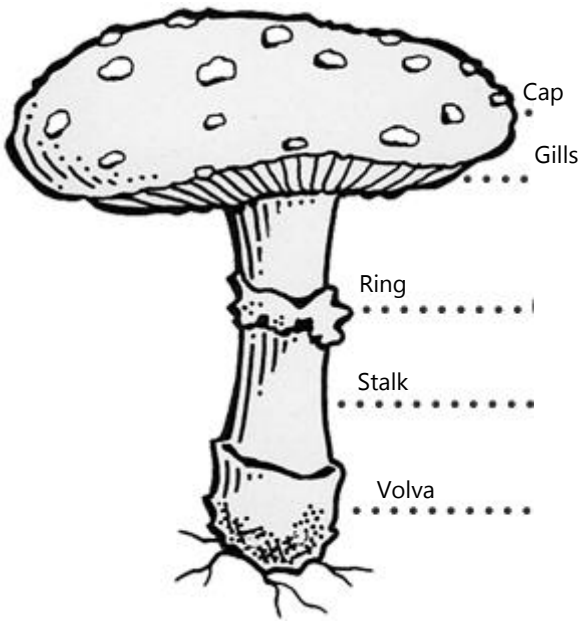
Polystic..... (multicellular) ..prothallus... formed of two .layers.....of cells rich of chloroplast...

Fungi a taxonomic kingdom, or in some classification schemes a division of the kingdom..Plantae....., comprising all the fungus groups and sometimes also the slime molds, also called..mycota..... any organisms that lack..Chlorophyll.., leaves, true stems..... , and..roots..... , reproduce by..spores....., and live as saprotrophs or..parasites..... The group includes moulds, mildews, rusts, yeasts, and mushrooms.

The main body of most fungi is made up of fine, branching, and usually colorless threads called..hyphae..... Each fungus will have vast numbers of these hyphae, all intertwining to make up a tangled web called the..mycelium.....

A mushroom has..two parts..... The part underground is called the..mycelium..... It gets food for the mushroom. Sometimes it dies quickly, but if it gets enough food it may live for hundreds of years.

The umbrella-shaped body of a..mushroom..... that we can see is called the fruit or..sporocarp..... It only lives for a few days. The fruit **starts out** as a small button which grows into a ...stalk.....and a **cap**. The **stalk** or **stem** grows quickly because it can **absorb** a lot of water. As the cap becomes larger it **unfolds** like an umbrella. Soon small plates, called..gills....., **appear** under the mushroom's..cap..... They have small **spores** on them. When these spores fall off the mushroom the wind blows them away. If they fall on a warm, wet area a new mycelium **develops**.



EX. ..Agaricus sp.....(Cap with margin..edge....., stem with ..ring.....and mycelium in..at the base..).

.

Lichens are composite, ..symbiotic.....made up from ..Fungi.....and ..algae..... The dominant partner is a fungus. Fungi (.....Ascomycota.....) are incapable of making their own food. They usually provide for themselves as parasites or decomposers. The second partner partners are algae (..Cyanobacteria Chlorophyta).

Ex. *Xanthoria parietina* *showing* .apothecia..(discs)

The anatomic structure of this lichen allows the observation of many tissues as followed:

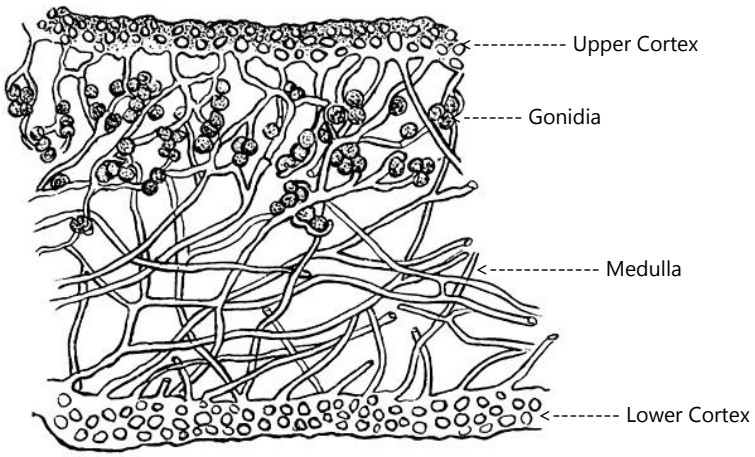


Fig. 8. *Physcia parietina* De Not. Vertical section of thallus obtained by synthetic culture × 130 (after Bonnier).

Vertical section of thallus

Part II EMBRYOPHYTA

Listen and understand (see lecture)

Recognize and underline the key words of each group of plants.

Are the most familiar subkingdom of green plants that form vegetation on earth. Living embryophytes include most familiar plants such as mosses, Ferns, cycadophyta, coniferophyta and Angiosperms (Monocotyledonous dicotyledonous). It called as "embryo"-phytes because they formed an embryo after reproduction.

Most species are terrestrial, land plants are mostly photosynthetic.The embryophytes support directly our life as foods (ex. rice, corn, wheat, potato etc.), luxuries (tobacco, coffee, paper etc.), feeds (timothy, alfalfa etc.), material (cotton, pine etc.), drugs (opium, digitalis etc.).

Land plants basically show alternation between the haploid gametophyte diploid sprorophyte.

Mosses: Simplest plants of damp terrestrial land with simple stems and leaves. No true roots, they have rhizoids and no vascular tissues.

Ferns A **fern** is a member of vascular plants that reproduce via spores and have neither seeds nor flowers. They differ from mosses by being vascular. They have stems and leaves like other vascular plants and roots.

Coniferophyta conifer (cone-bearer) + *-ophyta:* Organisms collectively called Conifers because all of them can produce cones. A cone is a collection of sporophylls. The vegetative organs can be distinguished as the roots, stems and leaves. They do not produce flowers, but the sporophylls would form collections and make up the cones. They have a simple reproduction. The plant produces naked seeds. Naked seed means that the seed is exposed in air, or not totally enclosed with other structures, as the pericarps etc.)

Angiosperms, the largest and most diverse group within the kingdom Plantae (flowering plants). Angiosperms are vascular seed plants in which the ovule (egg) is fertilized and develops into a seed in an enclosed hollow ovary. The ovary itself is usually enclosed in a flower, that part of the angiospermous plant that contains the male or female reproductive organs or both.

Traditionally, the flowering plants have been divided into two major groups, or classes: the Dicots (Magnoliopsida) and the Monocots (Liliopsida).

Traditionally, the flowering plants have been divided into two major groups, or classes: the Dicots (Magnoliopsida) and the Monocots (Liliopsida).

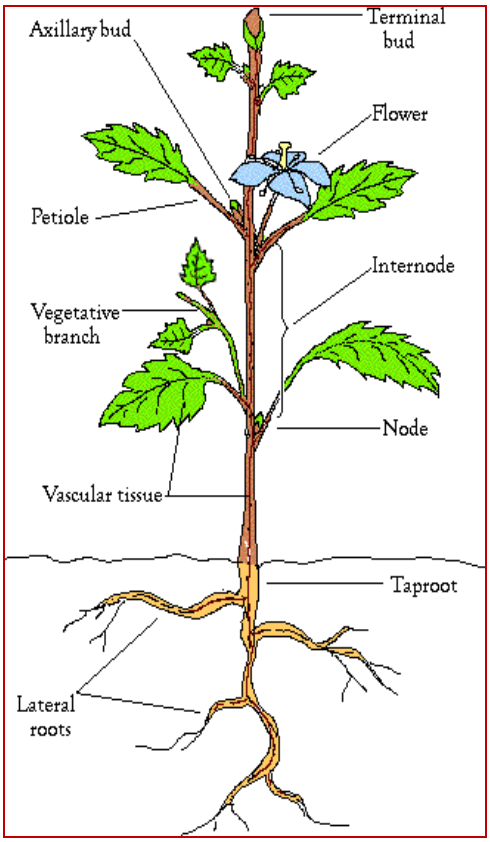
Discover: complete the presenter's paragraph according to the lecture.

Morphology of plants, is an interested tool used in the identification of plants. This concerns particularly vegetative and reproductive structures:

*The vegetative structure ..... Of vascular plants are divided to two organ systems:

- **Shoot system** composed of **stems and leaves**
- **Root system** composed of two types of **roots: taproots (Dicots)** and **fibrous roots (Monocots).**

*The reproductive structure ..... used for the classification of plants than vegetative characters are varied; **Flowers** and fruits in the **angiosperms. Seed cones** in **Conifers and Other Gymnosperms** and **Sori** in **Ferns**

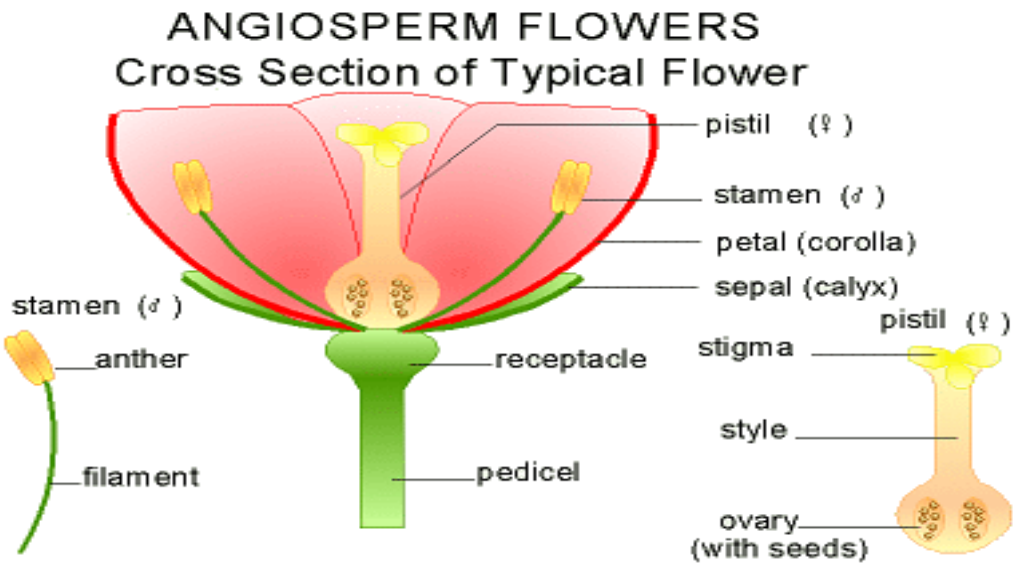


Morphology of plant « Angiosperm »

Many characterics of the flower are important to be considered for classification of angiosperms

*Symmetry of flower, Actinomorphic.....flower is **regular** and ..zygomorphic..flower is **irregular**.

***Flower constitution, theorical flower is constituted by Calyx +Corolla+ Stamen +Pistil**. **S: calyx** of sepals, **C: corolla** of petals, **S** = **stamen** consisting of anther and filament, P = **pistil** consisting of stigma, style, and ovaries, with the terms carpels, locules, ovules, and/or placenta referring to parts of the ovary.



Flower constitution

Part III. Interests of Plants and Uses

Plants and Ecology (see lecture)

Ecology (from greek: οἶκος, "house"; -λογία, "study of") is the scientific analysis and study of interactions among organisms and their environment, such as the interactions organisms have with each other and with their abiotic environment. Topics of interest to ecologists include the diversity, distribution, amount (biomass), number (population) of organisms, as well as competition between them within and among ecosystems.

Plants, as the base for ecological…. food chains, serve as the structural and functional foundation of ..natural……..and managed systems.

Plant biotechnology (see lecture)

Biotechnology develops .methods……to produce adventitious plants efficiently..in vitro….., and has been successful in developing a high frequency somatic embryogenesis protocol and identifying highly regenerable cultivars.

Production of many plants by in vitro culture

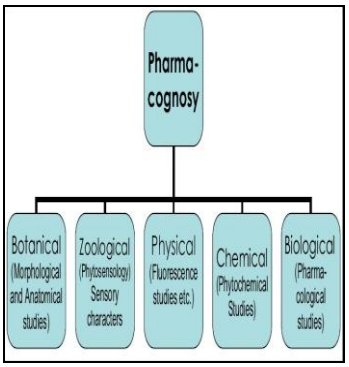
Phytopharmacy (see lecture)

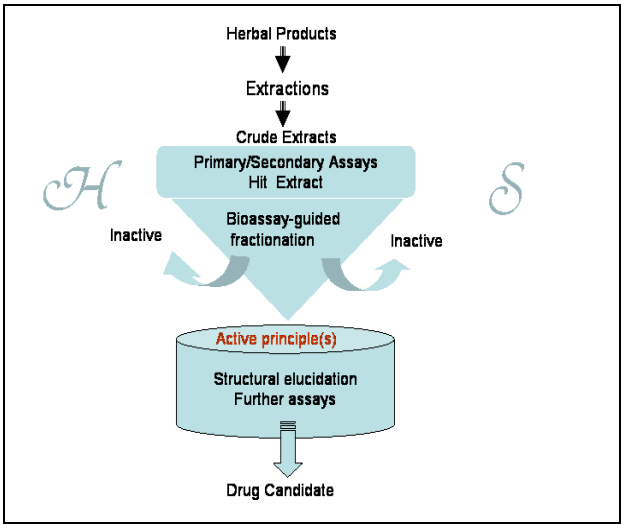
Survey & Documentation of .medicinal……of biosphere

Pharmacological studies to ascertain efficacy off ……herbal extracts……

Acute, sub acute and chronic toxicity studies to ascertain safety of herbal extracts/formulations

drug……discovery from ……natural……sources.





Interests of pharmacognosy in drug establishment

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Exercices

Exercice 1. Tick the right boxes [x]

1. Embryphytes characters

"embryo"-phytes formed an .embryo……..after reproduction. [x]

"embryo"-phytes do not formed an ……..after reproduction

"embryo"-phytes have no true roots.

2. Mosses are simplest plants with

True roots

No true roots, named rhizoids [x]

No true roots, no rhizoids

They have rhizoids, true roots

3. The coniferophyta produces other parts of reproduction

Coniferophyta produces cones [x]

Coniferophyta produces neither cones nor flowers

Coniferophyta produces flowers

4. Angiosperms are composed by

Shoot system and root systems [x]
Neither roots nor stems
They have not leaves either

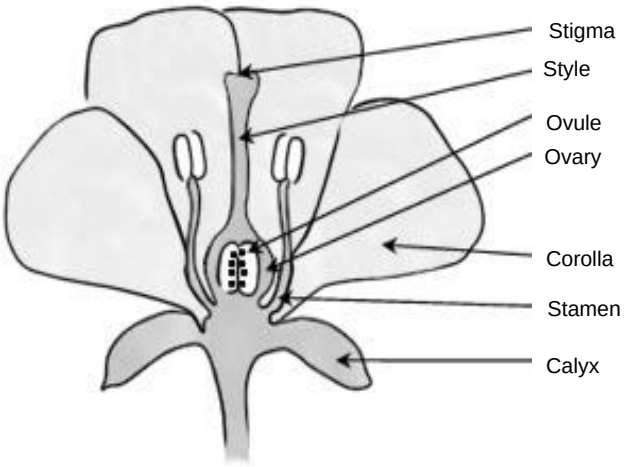
Exercice 2. Listen and take notes about some plants. Discuss your answers with your partner then write two important characters of each one below.

A Mosses (Bryum Sp.)
No true roots = rhizoids
Bryophytes

b Borago officinalis
Dicotyledon , real cormus

c Polypodium vulgare
Fern , sorus

Exercice 3. Complete the scheme below and propose a title according to the characteristic chosen (symmetry, ovary position…).



Details of cross section of a hypogenus and zygomorphic flower (Dicotyledon)

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