BIO192
GENERAL BIOLOGY PRACTICAL II

Course Team

Course Writer Prof. (Mrs) R.W. Ndana
University of Abuja

Course Reviewer Dr. Yisa Abraham Gana
National Open University of Nigeria

Head of Department Dr. Maureen N. Chukwu

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National Open University of Nigeria
Headquarters
University Village
Plot 91, Cadastral Zone Nnamdi
Azikiwe ExpresswayJabi, Abuja

Lagos Office
14/16 Ahmadu Bello Way
Victoria Island, Lagos

e-mail: centralinfo@nou.edu.ngURL:
www.nou.edu.ng

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Course Guide

Introduction

General Laboratory Practical II (BIO 192) is a fundamental course for undergraduate students of Biology that deals with the Observation and description of the morphological and diagnostic features as well as the differences among the different phyla of the plant, animal, archebacteria, eubacteria, fungi and protista kingdoms. Identification of the taxonomic hierarchy of the members of the above groups. Study of the structure and functions of their parts and habitats specifications

Course Competencies

This course aims to enable you to understand the organization of life forms and becoming familiar with the basic characteristics of the different taxonomic groups

Course Objectives

The Comprehensive Objectives of the Course are to;

1. Explain the bacteria kingdoms
2. Explain the beginning of multicellularity
3. Explain the plant kingdom
4. Explain the animal kingdom diversity

Working Through this Course

To successfully complete this course, you are required to read each study unit, read the textbooks and other materials provided by the National Open University.

Reading the reference materials can also be of great assistance. Each unit has self –assessment exercise which you are advised to do.

There will be a final examination at the end of the course. The course should take you about 8 weeks to complete.

This course guide provides you with all the components of the course, how to go about studying and how you should allocate your time to each unit so as to finish on time and successfully.

CONTENTS

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MODULE 1THE BACTERIAL KINGDOMS

UNIT 1 THE ARCHAEBACTERIA

CONTENTS

1.0 INTRODUCTION

Archaebacteria is the first kingdom in the six kingdom classification of living things. The word Archae simply means ancient. This kingdom contains organisms at the simplest level of organization. They are prokaryotes, who were previously in the kingdom Monera but now recognized as being genetically and structurally distinct, forming their own domain, Archaea. Unlike bacteria, archaea lack peptidoglycan in their cell walls and have unusual (ether-linked) lipids in their cell membranes which are not found in any other group of organisms. .This group ofsingle celled organisms live under extreme conditions like no oxygen and very high temperatures. The structure and function of the genes in archaea are similar to the structure and function of the genes in eukaryotes, while those of eubacteria are not.

2.0 Objectives

At the end of this chapter you should be able to

1. State the diagnostic features of the kingdom
2. Identify the major phyla of Archaebacteria
3. Differentiate the three groups of Archaebacteria
4. Know the observable adaptive features of the archaebacteria.

3.0 Main Body

3.1. Diagnostic Features of Archaebacteria

Archaebacteria have no peptidoglycan in their cell walls

The cell wall is made up of glycoproteins and polysaccarides.

The cell wall envelopes have a high resistance to antibiotics and lytic agents due to difference in cell wall composition.

They have a very different lipid bilayer making up the cell membranes

The RNA polymerase of archae is very similar to that of eukaryotes

The eukaryotes and archea ribosomal proteins are similar to each other

Archaebacteria are about 1/10th of a micrometer to about 15 micrometer in size. A few are flagellated and the flagella structure is different from the flagella of other bacteria.

The archaebacteria are non-pathogenic bacteria that live in and around other organisms.

Archaebacteria are autotrophs and use CO2 in atmosphere as a source of carbon for a process called carbon fixation.

3.2 Classification of Archaebacteria.

The archae are currently placed in four phyla, they are

Eurychaeota e.g Pyrococcus abysi

Crenarchaeota e.g sulfolobus acidocaldarius

Nanoarchaeota e.g Nanoarchaeum equitans

Korarchaeota

3.3 MORPHOLOGY

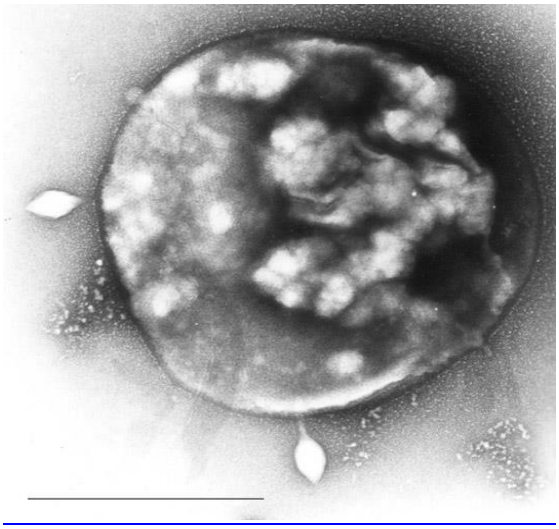

Figure 1.1 An Archae Retrieved from "http://en.wikipedia.org/wiki/File:RT8-4.jpg

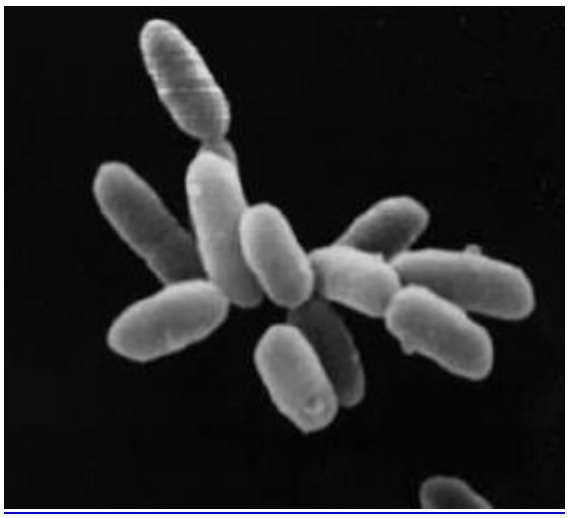

Fig 1.2 Halobacteria Retrieved from "http://en.wikipedia.org/wiki/File:Halobacteria.jpg"

Archaebacteria cells have diameters which range from about 0.0002–0.0004 in (0.5–1.0 micrometer). The volume of their cells is only around one-thousandth that of a typical eukaryotic cell. They have three main forms or shapes

1) Spherical cells called cocci,

2) Rod shaped cells called bacilli,

3) spiral shaped cells which can either be vibrio, spirillum , or spirochete

4) Some other shapes may occur such as irregularly shaped lobed cells , needle-like filaments , almost perfectly rectangular rods , flat, square archaea , and filaments form aggregates or filaments and multicell colony

3.4. STRUCTURE

Archaebacteria, like all prokaryotes, have no membrane bound organelles. This means that the archaebacteria are without nuclei, mitochondria, endoplasmic reticula, lysosomes, Golgi complexes, or chloroplasts. The cells contain a thick cytoplasm that contains all of the molecules and compounds of metabolism and nutrition . Archaebacteria have a cell wall that contains no peptidoglycan. This rigid cell wall supports the cell, allowing an archaebacterium to maintain its shape, and protecting the cell from bursting when in a hypotonic environment. Because these organisms have no nucleus, the genetic material floats freely in the cytoplasm. The DNA is a single circular molecule. This molecule is tightly wound and compact, and if stretched out would be more than 1,000 times longer than the actual cell. Little or no protein is associated with the

DNA. Plasmids may be present in the archaebacterial cell. These are small, circular pieces of DNA that can duplicate independent of the larger, genomic DNA circle. Plasmids often code for particular enzymes or for antibiotic resistance.

3.5 HABITAT

These organisms live in extreme environmental conditions, such as very high temperatures, (above 100 °C) and in the absence of oxygen and light （ therefore are also known as extremophiles）

Specific examples includes

1) Near volcanic activity2) Geysers, black smokers and oil wells 3) Deep oceans4) Very cold habitats 5) highly saline ,acidic, or alkaline water.6) Marshland 7)Sewage 8)Soils

9) Gut of humans and ruminants.

3.6 ARCHAEBACTERIA GROUPS

Archaebacteria are autotrophs and use CO2 in atmosphere as a source of carbon for a process called carbon fixation. They employ different chemical reactions to be able to survive in these harsh conditions. Based on the nature of their habitats the archae are grouped into three , these are

1. Methanogens
2. Halophiles
3. Thermoacidophiles.

Methanogens:- they can reduce carbon dioxide into methane. They can only survive in the absence of oxygen. They produce marsh gas that one can observe as bubbles in stagnant waters. They are also present in the gut of cattle and termites. These bacteria are rod shaped or spherical and can be gram positive as well as negative.eg Methanobacterium, Methanococcus, Methanomicrobium

Halophiles :- they are found in areas with very high salt concentrations sea. They contain bacteriorhodopsin, a red or orange pigment.eg Halobacterium,Halococcus, Natronabacterium

Thermoacidiophiles :- Organisms that can survive in extremely high temperatures and low pH.

They can survive at 100° Celsius with a pH of 2. Most of these organisms are anaerobic nature e.g Pyyrodictium, Pyrococcus, Sulfolobus, thermococcus, thermoproteus.

3.7 ADAPTIVE FEATURES

Archaebacteria do not form spores and a few species of haloarchae undergoes phenotypic switching. This means it can grow several different cell types that are resistant to osmotic shock. Thus, the organisms can survive in low salt concentration aquatic environments.

3. 8 ACTIVITY

A) 0bserve Fig2.1 and 2 .2.What diagnostic feature of the Archae can you see?

B) Observe prepared slides of the archae bacteria make labeled diagrams of your observations

C) Visit a stagnant water site especially in a swamp. Can you observe any bubbles?

D) What group of organisms are responsible for the bubbles in B above

In Text Question

What are Halophiles?

Answer: Halophiles are archaebacteria found in areas with very high salt concentrations sea

4.0 Conclusion

The Archaebacteria simply means ancient bacteria. They are believed to be one of the first group of living things to occupy the earth. They are prokaryotes and have been found in habitats otherwise thought of as inhabitable

5.0 Summary

In this unit you have studied the habitat , diagnostic features , structure, morphology ,classification, groups and adaptive features of the phylum **A**rchaebacteria.. they are prokaryotic organisms. They have the special ability to stay in areas with extremes of temperature and pH conditions as well as in the absence of oxygen. They do not have peptidoglycan in theircell walls. They have unusual (ether-linked) lipids in their cell membranes which are not foundin any other group of organisms. **Based on the nature** of their habitat archae are grouped into three viz Methanogens

. Halophiles Thermoacidophiles. examples of organisms in this group are Pyrococcus abysi

6.0 Tutor-Marked Assignment

a) List the types of habitat in which Archaebacteria are found?

b) Which features of the Archae help them adapt to harsh condition

c) Make labeled drawing of the Haloarchae

7.0 REFERENCES/FURTHER READING

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UNIT 2 THE KINGDOM EUBACTERIA

CONTENTS

1.0 INTRODUCTION

In the last unit, you learnt about archaebacteria. In this unit we shall consider the Kingdom Eubacteria This is the second kingdom in the six kingdom classification of living things. They are also known as the true bacteria. They are prokaryotes and a lot of them live as single cells, but they are able to produce colonies or link up in chains to form filaments.

2.0 OBJECTIVES

At the end of this unit the students should

A) Know the methods of classification of the Eubacteria

B) Know the diagnostic features of the Eubacteria,

C) Know the differences between the gram positive and gram negative bacteria.

D) Know the adaptive features of the Eubacteria

3.0 MAIN BODY

3.1 Habitat

The Eubacteria are cosmopolitan, they live everywhere, soils, water, faeces, decaying substances, bodies of plants and animals.

3.2 Classification

There are three main criteria used to classify the Eubacteria, they are

Shape

It is easy to distinguish the Eubacteria based on their shape. Bacterial cells have three main shapes:

1) Cocci: round with bumps

2) Bacilli: rod-shaped with lacerations

3) Spirilli: spiral-shaped with grooves

Furthermore, bacteria can be classified by their growth characteristic patterns (Groupings). The prefix diplo- means that the cells are arranged in pairs. The prefix staphylo- means that the

bacterial cells are arranged in clusters like grapes. The prefix strepto- means that the bacteria are arranged in a chain.

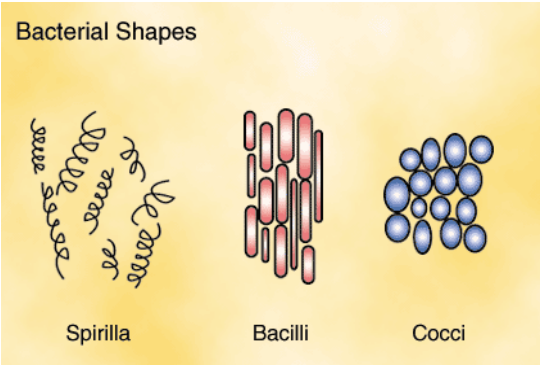

Figure 2.1 :Common shapes of eubacteria Retrieved at http://www.sparknotes

2. Type of cell wall structure

1) Gram-positive: Gram-positive bacteria have simple cell walls, that are made up of only one layer of peptidoglycan before the plasma membrane. When stained with violet and red dye, gram-positive bacteria appear purple. Sometimes blue, depending on the temperature.

2) Gram-negative: Gram-negative bacteria have more complex cell walls, consisting of one layer of a lipopolysaccharide membrane and a peptidoglycan layer. Gram-negative bacteria appear red when stained with violet and red dye.

3 Carbon and Energy Sources

a) Photoautotrophs b) Photoheterotrophic c)Autotrophic d) Heterotrophic

3.3 Structure

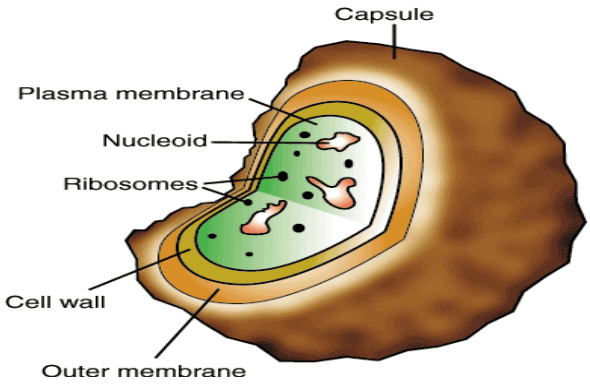

Figure 2.2 Retrieved at http://www.sparknotes

Eubacteria have prokaryotic chromosomes, which have circular DNA molecules called plasmids. They do not have a nuclear membrane, instead they have plasmids, that can be seen in relativelyclear areas in the cytoplasm called nucleoids. The rest of the cytoplasm is filled with ribosomes.

Many eubacteria have specialized internal membranes. For example, cyanobacteria have membranes that contain chlorophyll and other chemicals used to carry out photosynthesis.

Many eubacteria have cell walls that lie outside of their plasma membranes. These are similar to the cell walls found in plants and fungi, but are made of peptidoglycan rather than cellulose or chitin. In some eubacteria, this cell wall is covered by another layer called the outer membrane. Many eubacteria have yet another coating layer called a capsule. It is made up of complex sugars and serves to protect the cell against environmental dangers, such as attack by host immune defenses or dehydration.

Comparison of the Archaebacteria and the Eubacteria

	Archaebacteria	Eubacteria
Definition:	Single celled organisms without any cell organelles or nucleus.	All true bacteria or group of unicellular prokaryotic microorganisms.
Morphology:	Occur in various shapes like spheres, rods, plates and spirals.	Various shaped bacteria have been identified like rods, cocci, spirals, comma shaped, tightly coiled etc.
Cell Wall:	Lack of peptidoglycan .	Peptidoglycan is present.
Cell Membrane:	Branched chain ether linked lipids.	Straight chain ester linked lipids.
tRNA:	Lacks thymine in tRNA.	Thymine present in tRNA.
RNA polymerase:	Ten subunit RNA polymerase core.	Ten subunit RNA polymerase core.
Role in ecology:	Role in bio-geochemical cycles is unexplored.	Vital in nutrient recycling.
Interactions with other organisms:	Mutualism, commensal	Predators, mutualists, pathogens.
Pathogenicity:	None are pathogenic.	Some are pathogenic.
Significance in technology and industry:	Thermostable enzymes, sewage treatment, antibiotics, organic solvents, production of biogas.	Fermented foods, bioremediation, waste processing, agrichemicals, biological pest control, scientific research.

Source : http://www.diffen.com/difference/special:ArticleList

3.5 Adaptive Features

1. Shape Spiral shaped bacteria can move through fluids more easily than can cocci or bacilli bacteria.

2. Plasmids Bacteria contain plasmids, that can be transmitted from one cell to another. This ability to trade genes with all comers makes bacteria amazingly adaptible; beneficial genes, like those for antibiotic resistance, may be spread very rapidly through bacterial populations.

3. Capsule protects the cell against environmental dangers, such as attack by host immune defenses or dehydration.

4. Endospore – These are formed when surrounding conditions are unfavorable and are for protection .thick walled endospores

5. Outer membrane- Increases the potential surface area for photosynthesis

3.6 ACTIVITY

A) **To stain bacteria for examination with a light microscope. (Gram's method)**.

This staining procedure is very important because it helps in the recognition and identification of bacteria. It separates nearly all bacteria into two groups either as Gram's positive or Gram negative . This is based on whether or not they resist decolourization of methyl violet and subsequent treatment with iodine.

Procedure

Make a smear of the bacteria culture given to you(or which you have prepared) on a clean grease –free slide.

Air-dry the film by waving it around for a while.

Heat fix the smear by waving it over a bunsen flame.

Then place the slide on a rack over a sink.

Cover the smear with crystal violet reagent for one minute.

Rinse the slide in a slowly running tap for 5 seconds.

Then rinse the slide with Gram's Iodine and flood it with the same reagent for1 minute.

Rinse again in a slowly running tap.

Apply alcohol reagent slowly until no more dye runs off from the smear

Cover smear with Safranin(or Carbol Fuchsin) reagent for 30 seconds

Rinse slide under slowly running water

Blot dry using paper towel

NB Blot, don't rub

Observe the slide using the oil immersion lens of the Microscope.

Record your observations

What are the differences between the gram positive and gram negative bacteria?

B) Shapes of bacteria

Procedure

i) With the sterile loop, take a small portion from bacterial colonies you have

grown or provided for you and smear this evenly on a microscope slide. Fix over a flame by passing the under surface of the slide swiftly through the top of a flame.

ii) Flood the dried smear with either methylene blue or crystal violet and leave for

3 minutes.

iii) Drain dry.

iv) Lower a cover slip over the preparation and observe under the microscope.

You will see the cultured bacteria .

In Text Question

Give the shape of cocci, bacilli and spirilli bacteria respectively

Answer: Their shapes are, round, rod-shaped and spiral respectively.

4.0 Conclusion

The Eubacteria also known as the true bacteria are prokaryotes. They are cosmopolitan being found everywhere and in the bodies of plants and animals. They cannot be seen with the naked eye being microscopic.

5.0 Summary

In this unit you have studied the habitat , diagnostic features , structure, morphology, classification and adaptive features of the Kingdom Eubacteria. They are known as the true bacteria and are also prokaryotes and microscopic. They are found everywhere. Major criteria used in their classification is the reaction to Gram's staining .All bacteria are either Gram positive or negative. common examples Also very important to their taxonomy and nomenclature is their shapes. , Cocci or round , Bacilli: rod-shaped, Spirilli: spiral-shaped .Common examples of

of Bacteria include Anabaena, Rhizobium,Neisseiria gonorrhoeae, Treponema palladium.

6.0 Tutor-Marked Assignment

How many shapes can you identify?

Make labeled drawings of your observations.

Submit your books for assessment and evaluation.

7.0 REFERENCES/FURTHER READINGS

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UNIT 3 THE KINGDOM PROTISTA

CONTENTS

MODULE 2 BEGINNING OF MULTICELLULARITY

Unit 3 The Kingdom Protista

1.0 INTRODUCTION

In the last unit, you learnt about Eubacteria . In this unit we shall consider the Kingdom Protista

The Protists are the first group of eukaryotic organisms. They are diverse and do not have much in common apart from a relatively simple organization, as unicellular, or multicellular organisms that do not have specialized tissues or organs. It is this simple cellular organization that is the main difference between the protists and the other eukaryotes in the kingdoms Fungi, Plants and Animals.

2.0 OBJECTIVES

At the end of this unit the student should be able to

1) know the major groups of the kingdom protista.
2) know the classes in the groups of the kingdom protista.
3) Know the adaptations shown by the various groups.

3.0 MAIN BODY

3.1 HABITAT

Protists are found anywhere there is water. Which can be fresh or marine water, snow, damp soils, and in the bodies of other animals.

3.2 MORPHOLOGY

Protists may be unicellular, colonial, or multicellular. In the colonial forms, all the cells are similar with similar, generalized functions, while in the truly multicellular forms, the "body" of the organism is made up of a variety of cells, each cell type with its own specialized function.

3.3 CLASSIFICATION

There are three groups of Protists they are,

The Protozoan Protists

The Algal Protists

The FungalProtists

3.3.1 The Protozoan Protist

These protists are animal-like, especially in their nutrition. They ingest their food by phagocytosis

Some have mouth-like structures into which the prey is put while others use pseudopodia to move and to engulf prey. The protozoans are further classified into four divisions viz:

Rhizopoda They are unicellular and have pseudopodia e.g *Amoeba proteus found* in fresh-water. *Entamoeba hystolytica* found in the colon

Amoeba

Amoeba proteus is a microscopic living organism which consists of a single cell. Like most plant and animal cells, it has cytoplasm, nucleus, cell membrane and a variety of inclusions in the cytoplasm. It is about 0.3 mm across and inhabits the mud at the bottom of fresh water ponds. Although it is just a single cell, it shows all the essential functions of any living organism.

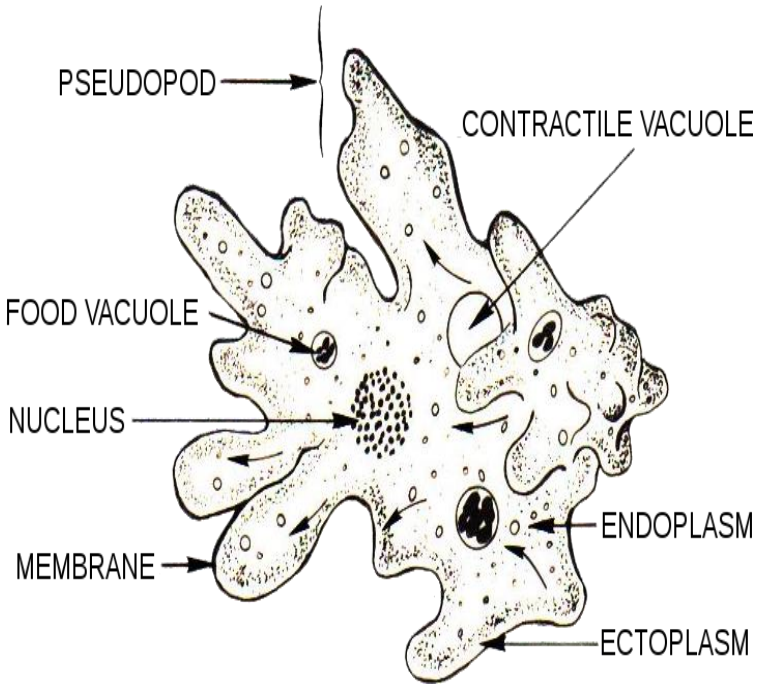

Figure 3.1 *Amoeba* Retrieved from "http://en.wikipedia.org/wiki/File:Amoeba_(PSF).svg"

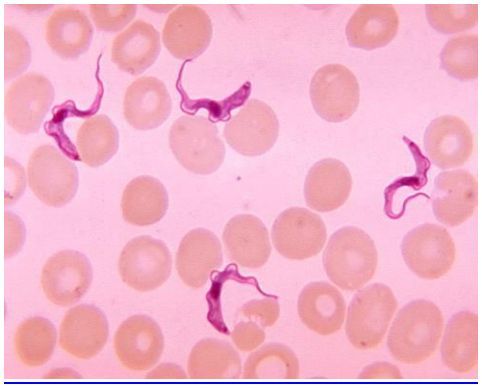

Figure3.2Trypanosoma Retrieved from "http://en.wikipedia.org/wiki/File:Trypanosoma_sp._PHIL_613_lores.jpg"

Division Apicomplexa

These are all parasites and form tiny, infectious spores. All have complex life cycles. Examples are species of *Plasmodium* such as *P. falciparium, P .malariae and P .vivax* which is known to cause malaria..

Division Zoomastigophora The organisms are free-living, or symbiotic and parasites. e.g *Trypanosoma gambiense* which causes African sleeping sickness and is spread by the bite of the tsetse fly.

Division Ciliophora

An example of an organism in this Division is Paramecium These are solitary, fresh water organisms and use cilia to move. They have two nuclei, the larger macronucleus and smaller micronucleus . Sexual reproduction is by conjugation

Figure 3.3 Paramecium Retrieved from "http://en.wikipedia.org/wiki/File:Paramecium.jpg"

Paramecium

Paramecium is a ciliate protozoan. The paramecium, genus of protozoa of the phylum Ciliophora, is often called slipper animalcules because of their slipper-like shape.

Unlike amoeba, paramecium has a distinct and permanent shape and certain areas of cytoplasm, (cell organelles), are specialised to carry out specific functions.

. **STRUCTURE AND FUNCTION**

Pellicle - a membrane covering that protects the paramecium like skin

Cilia - hair like appendages that help the paramecium move food into the oral groove

Oral Groove - collects and directs food into the cell mouth

Cell Mouth - opening for food

Anal Pore - disposes of waste

Contractile Vacuole - contracts and forces extra water out of the cell

Radiating Canals - paths to the contractile vacuole

Cytoplasm - intercellular fluid needed to contain vital cell parts

Trichocyst - used for defense

Gullet - forms food vacuoles

Food Vacuole - storage pocket for food

Macronucleus - larger nucleus which performs normal cell functions

Micronucleus - smaller nucleus which is responsible for cell division

3.3.2 . The Algal Protists

These protists are photosynthetic; their nutrition is plant-like. Almost all of them have chlorophyll A, most have chlorophyll C, but only a few have chlorophyll B. They also have a variety of carotenoids and other pigments, and frequently they are grouped into Divisions based on similarities in pigments or colour.

1). Dinoflagellata

These are abundant in plankton, occasionally occurring in large numbers. They can occasionallybecome so numerous that the water looks red, thus this algal bloom (meaning there are largenumbers of them, having nothing to do with flowers, which they do not have) is called Red Tide.. **2)Euglenophyta**

An example of this Division is genus Euglena. It has flagella on its anterior end, is used for movement. They have chloroplast for photosynthesis. If they are not in the light, they can also obtain nutrition by phagocytosis. Euglena have a light-sensitive "eyespot" or stigma near their anterior ends. This is a photoreceptor which senses the light level in the organism's environment.

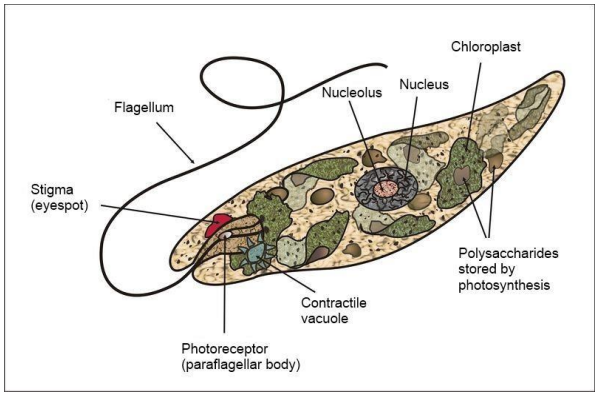

Figure 3.4 Structure of an euglena From Wikipedia, the free encyclopedia

3) Chlorophyta examples are Volvox ,Clostridium, Ulva, Spirogyra, Chlamydomonas.

These protists are also known as the “green algae.” Their chloroplasts and the pigments therein are similar to plants (this is about the only group of algae with chlorophyll B).

Spirogyra

Spirogyra is a filamentous alga. Its cells form long, thin strands that, in vast numbers, contribute tothe familiar green, slimy ‘blanket weed’ in ponds.

Seen under the microscope, each filament consists of an extensive chain of identical cells.

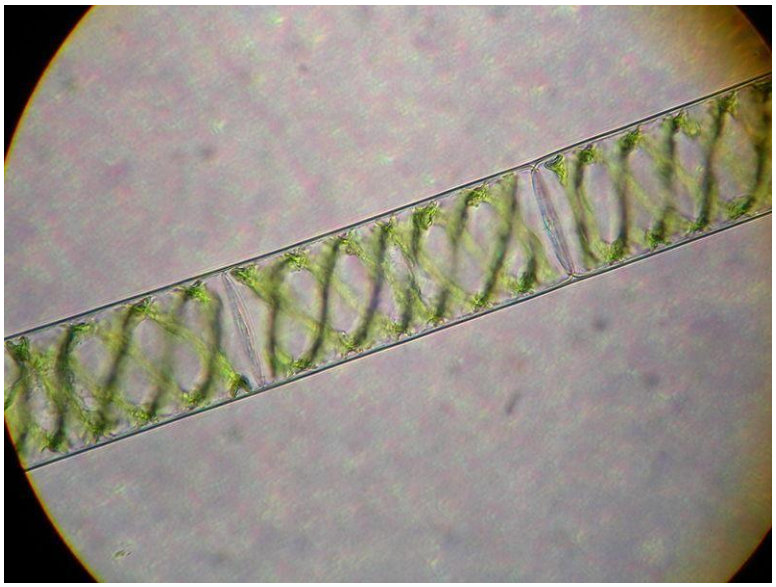

Figure 3.5 Spirogyra filament Retrieved at http://en.wikipedia.org/wiki/File:Spirogyra.JPG

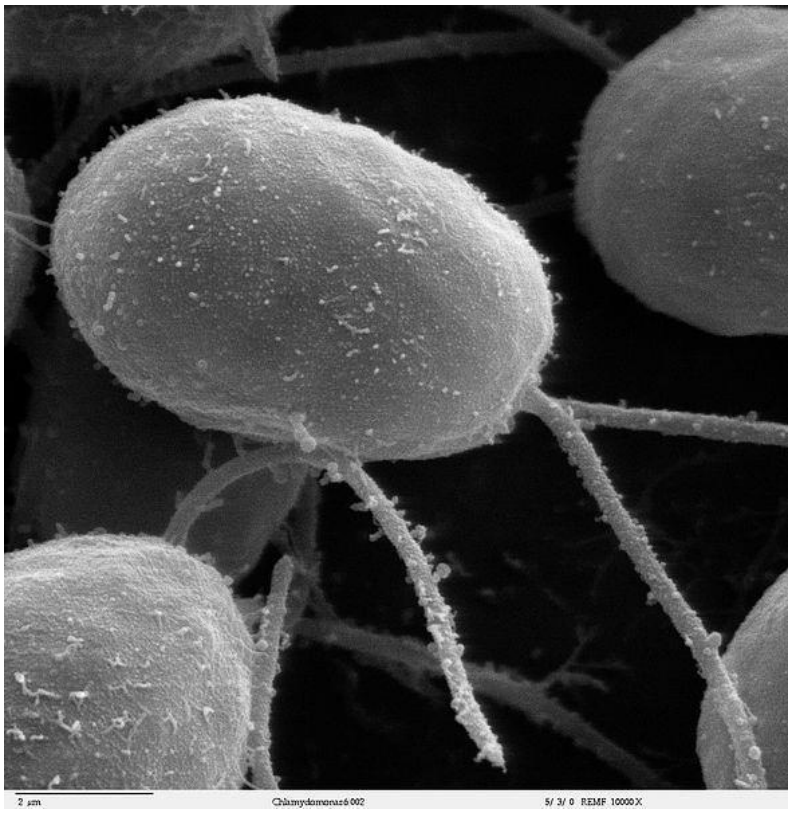

Figure 3.6 Chlamydomonas Retrieved from "http://en.wikipedia.org/wiki/File:Chlamydomonas_(10000x).jpg"

4) Phaeophyta

These organisms are commonly known as the “brown algae.” They are multicellular and live in marine, temperate zone, coastal areas e.g. Kelp, Fucus and/or Laminaria..

Fig 3.7 Fucus .Retrieved from "http://en.wikipedia.org/wiki/File:Fucus_serratus2.jpg"

5) Rhodophyta

These are the “red algae.” They also are multicellular and marine-dwelling, but are more typically found in tropical zones and deeper in the ocean.

3.3.3 The **Fungus-like Protists**

Myxomycota: Also known as the slime moulds.

Habitat : They are found on decaying wood,soil, lawns, forestfloors, fresh cowdung e.t.c.

These organisms are called “slime molds.” They are fungus-like in their nutrition in that they absorb nutrients from their environment.

Structure : The structure of the slime mould is unusual in that the nuclei undergo mitosis, but there is no cytokinesis. Rather, the “body” is a giant, multinucleate mass of cytoplasm. Slime molds are often brightly-colored (yellow or orange).

Slime molds are mobile moving by amoeboid movement,

There are three groups of slime moulds these are

A) Plasmodial slime moulds exist as single cells with thousands of nuclei.

B) Cellular slime moulds exist as separate single-celled amoeboid protists

C) The slime nets

Fig 3.8 Slime mould .Retrieved from "http://en.wikipedia.org/wiki/File:Dog_vomit_slime_mold.jpg"

3.4. Adaptive features

Formation of cysts in adverse conditions.

Mucilage to prevent dessication.

Green pigment Chlorophyll for photosynthesis'

Some have holdfast for anchorage.

Some have air bladders for buoyancy.

Thalloid body that offers little resistance to water flow.

3.5Activity

A) Observe the structures of Amoeba and Paramecium from prepared permanent slides

Are there any similar structures and what are their functions?

B) To prepare a culture of Paramecia

Put some dry grass in a beaker .then cover it with water. Leave the preparation for about five days. This preparation is called an 'hay infusion '. The organisms exist in cyst-form on the grass. After this period, you will see a number of white specks moving about near the surface of the water. These white specks are Paramecia cells

C) Go to a nearby stream or pond. Look out for floating green slimy filaments of organisms Spirogyra.Collect some and observe in the laboratory. Compare the prepared slides with the fresh

specimens you have collected.

D) Examine prepared and stained slides of Chlamydomonas and Euglena under the microscope and make labeled drawings of the specimens

In Text Question
Which protist is photosynthetic?
Answer: Algal Protists

4.0 Conclusion

These are the first group of eukaryotic organisms. They are however very different from eachother even within the kingdom. The members however have a simple organization

5.0 Summary

In this unit you have studied the habitat , diagnostic features , structure, classification and adaptive features of **the kingdom** protista. **Protists make up the first kingdom of eukaryotes. They are found where ever there is water. These organisms are simple and multicellular. the protists are grouped into three , the protozoan , the algal and the Fungus like protists or the slime moulds .Examples of organisms in this kingdom includes plasmodium Amoeba, spirogyra, Volvox Fucus, euglena.**

6.0 Tutor-Marked Assignment

.Make well labeled diagrams of the specimens you have observed.

What commom features do they share?

Submit your notebooks for assessment and evaluation

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https://www.youtube.com/watch?v=vRj9NafEshQ

https://www.youtube.com/watch?v=IohFmTkwNKA

UNIT 4 THE KINGDOM FUNGI

1.0 INTRODUCTION

In the last unit, you learnt about protists. In this unit we shall consider the Kingdom Fungi This is the fourth kingdom in the six kingdom classification of living things. The members of this kingdom do not have the green pigment chlorophyll. The absence of chlorophyll dictates most of their characteristics. They are eukaryotes and a great majority are multicellular except the yeasts that are unicellular. They have the remarkable power to disintegrate or dissolve almost anything they attack by the secretion of suitable enzymes. The plant body, except the unicellular forms, is commonly made of an interwoven mass of very fine and delicate threads called hyphae, collectively called mycelium. The wall of the hyphae may be made of chitin or pure cellulose

2.0 OBJECTIVES

At the end of this unit the student should be able to

Identify the different phyla of the fungal kingdom

Differentiate the phyla in the kingdom

Know the various adaptive features of the fungal kingdom.

3.0 MAIN BODY

3.1 Diagnostic Features

•The fungi are eukaryotes.

•They are multi-cellular organisms except yeast which is unicellular (does not have hyphae). The main body of fungi is made up of hyphae which are long thin threads.

• All are heterotrophs and never contain chloroplasts as such do not photosynthesise.

• Fungi feed saprotrophically absorbing soluble organic substances as well as inorganic from their surroundings. Many fungi feed on dead plants, animals, animal faeces and bread.

• Fungi reproduce by means of spores sometimes asexual and sometimes sexual.

• Fungal cells always have cell walls which are made up of chitin.

3.2 Structure

The fungi are eukaryotic and have membrane-bound cellular organelles and nuclei. They have no plastids of any kind (and no chlorophyll).The hyphae of the fungi are of two general kinds: Some are septate, and are divided by septa (walls) that separate the cylindrical hypha into cells; in the nonseptate fungi, the hypha is one long tube. (The septa are perforated, however, permitting the cytoplasm to flow throughout the length of the filament.) Mitosis occurs in the nonseptate hyphae, but there is no accompanying cytokinesis (division of the cytoplasm) so the hyphae are multinucleate (with many nuclei). The special name for this condition—an organism or part of an organism with many nuclei not separated by walls or membranes—is coenocytic, and the organism is a coenocyte. They have rigid cell wall composed of chitin, which may be layered with mannans, glucans and other polysaccharides in association with polypeptides. Some lower fungi possess

cellulose in their cell wall Inner to the cell wall is the plasma membrane that is a typical bi-layered membrane in addition to the presence of sterols. Fungal membranes possess ergosterol in contrast to cholesterol found in mammalian cells. The cytoplasm consists of various organelles such as mitochondria, golgi apparatus, ribosomes, endoplasmic reticulum, lysosomes, microtubulesand a membrane enclosed nucleus. A unique property of nuclear membrane is that it persists throughout the metaphase of mitosis unlike in plant and animal cells where it dissolves and re-forms. The nucleus possesses paired chromosomes.

3.3 Morphology

The Fungi exist in two fundamental forms; the filamentous (hyphal) and single celled budding forms (yeast).

All fungi have typical eukaryotic morphology.

3.4 Classification

There are four phyla in the kingdom fungi. They are

1) **Ascomycota** they show the following characteristics

- they are single celled.
- The mycelium is septate
- Conidia formation is a common feature
- The ascus usually has 8 ascospores that are formed endogenously
- Sexual reproduction is reduced to the fusion of two compatible nuclei
- Motile cells are absent
- The ascocarp is multicellular and complex bearing the asci
- It is open and cup- or saucer shaped (apothecium) oval or flask shaped with a small apical opening. (Called perithecium) or completely closed (Called cleistotherium). - Hook or crosier is common

e.g Saccharomyces, Aspergillus, penicillium

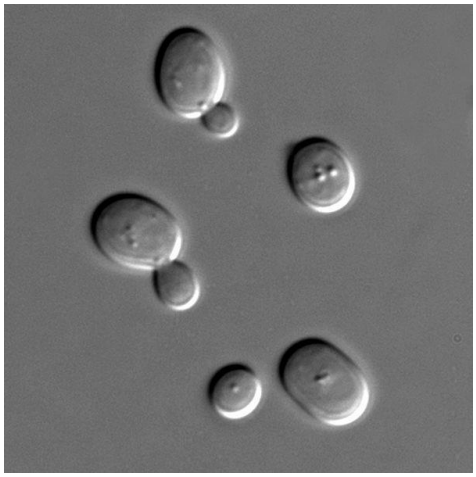

Fig 4.1 YeastRetrieved from "http://en.wikipedia.org/wiki/File:S_cerevisiae_under_DIC_microscopy.jpg"

2) **Deuteromycota:** they show the following diagnostic features

- Myceluim is septate
- Sexual or perfect stage is unknown
- Reproduce mostly by means of conidia e.g fusarium

3) **Zygomycota** :they show the following diagnostic features

The mycelium is unseptate and coenocytic

- The sporangia has innumerable sporangiospores
- Sexual reproduction is oogamous in Oomycetes and isogamous in zygomycetes.
- Biciliate motile cells are produced by many species
- The zygote is unicellular and simple e.g Mucor, Cystopus, Rhizopus

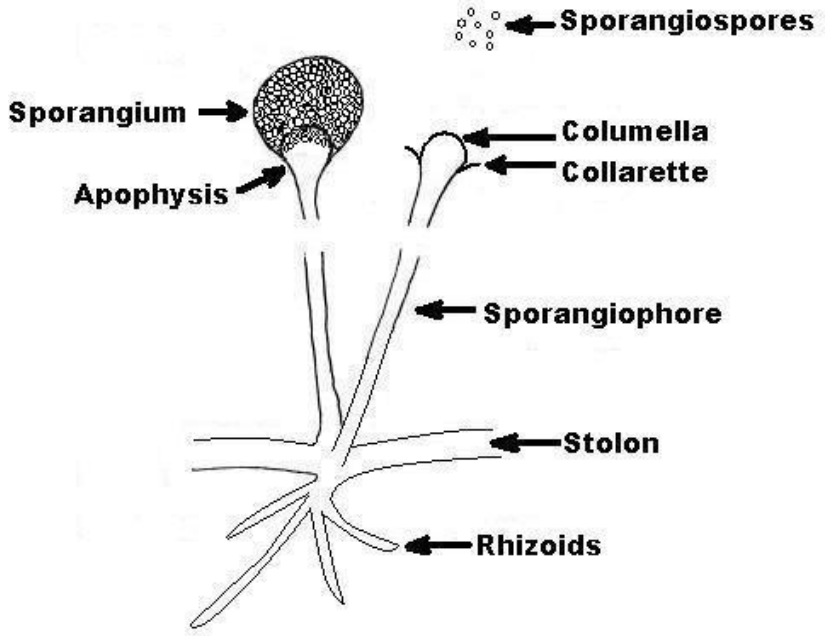

Fig 4.2 Rhizopus spp Retrieved from "http://en.wikipedia.org/wiki/File:Structure_of_Rhizopus_spp.-english.JPG"

4) Basidiomycota

1) The mycelium is septate

2) Conidiia formation is not a common feature

3) The basidium usually has 4 basiodiospores formed exogenously

4) Sexual reproduction is reduced to the fusion (karyogamy) of two compatible nuclei (+ ands-) in the young basiduim

5) Motile cells absent

6) The basidiocarp (fruiting body) is unicellular and complex. Bearing the basidia – often open, sometimes closed.

7) Clamp connection is common e.g Puccinia, Ustilago, Agaricus

Fig 4.3 A mushroom .Retrieved from "http://en.wikipedia.org/wiki/File:Armillaria_ostoyae_MO.jpg"

3-5 **Adaptive features**

Fungi; although grow best in the damp habitats, are found wherever organic matter is present. They are a successful group of land organisms. They possess several features in their body and reproduction that adapt them to terrestrial mode of life.

a)Fast spreading Hyphae

b)Chitinous Wall

Chitin in their thickened hyphal wall is more resistant to decay than are cellulose and lignin found in plant cell wall.

c)Rhizoids

Rhizoids anchor the fungus to the substrate and also digest and then absorb the food.

d)No Flagellated cells

They lack flagellated cells through out their life.

e)Production of numerous spores

They produce large number of small, non motile spores.

Thick protective conidia

They produce conidia with tick protective covering.

f)..Tolerate temperature extremes

Many can tolerate temperature extremes -5 degree centigrade below freezing and some can

tolerate 50 degree centigrade or more

3.6 **Activity**

A) Place damp bread, eba in a warm and moist place. Obseve after 3 days. What colours can you observe on the various foods. Can you guess what they represent . Observe some of these under the microscope. Let your tutor help you to identify some of them.

B) Move around and look for old or decaying logs of wood. Can you see any white or creamy plant like growths around, near or on them? What do you think they are? They are the mushrooms or puff balls. Carefully collect some and bring to the laboratory for observation. Look carefully at the lower side of the cap or pileus to observe the gills.

To be able to see the mycelia put the lower end of the plant in a basin of water and gently swash off the soil you will then be able to observe the hyphae which make up the mycelium.

To see the spores cut transversely through the stipe and then shake the gills over a sheet of brown paper. Spores will collect on the paper . Observe these spores using a hand lens.

C) Observe palm wine that has been left to stand for some time under the microscope . what can you see?

In Text Question`

How do fungi reproduce?

Answer: Fungi reproduce by means of spores sometimes asexual and sometimes sexual

4.0 Conclusion

The fungi are multicellular eukaryotes except the yeasts which are unicellular. They lack the green pigment chlorophyll. The plant body is mainly made up of mycelia except in theunicells.

5.0 Summary

In this unit you have studied the habitat , diagnostic features , structure, classification and adaptive features of **the kingdom** Fungi. There are four phyla in this kingdom.the major diagnostic feature of the fungi is the absence of the green pigment chlorophyll as such they are heterotrophs living mainly as saprophytes parasites or decomposers. They also have a chitinous cell wall. They produce spores. The Fungi exist in two fundamental forms; the filamentous (hyphal) and single celled budding forms (yeast). Common examples of fungi includes the yeasts Mucor, Aspergillus, Penicillium.

6.0 Tutor-Marked Assignment

D) Make well labeled diagrams of all your specimens to show your observations.

Submit to your books for assessment and evaluation

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MODULE 3 THE PLANT KINGDOM

UNIT 5 THE SEEDLESS PLANTS

1.0 INTRODUCTION

In the last unit, you learnt about kingdom fungi. In this unit we shall discuss on the seedless plants The plant kingdom includes the Bryophytes, Pteridophytes, the Gymnosperms and the

Angiosperms.

They all possess chlorophyll and are autotrophic. They are generally immobile

2.0 OBJECTIVES

At the end of this unit the student should be able to know

The divisions in the plant kingdom

The various habitats of the divisions

Identify members of the divisions

The adaptations exhibited by the divisions

3.0 MAIN BODY

3.1. DIVISION BRYOPHYTA

3.1.1 Introduction

They are the first division in the plant kingdom. The Bryophytes were the earliest land plants and are a transitional group between terrestrial and aquatic plants. Unlike the algae, they are all multicellular and are more complex.

3.1.2 Diagnostic features

They are primitive plants which can only survive in wet damp or shady

places.They do not have true roots, stems, or leaves.

They do not have the vascular tissues of xylem and phloem.

Their sizes are very small.

The gametophyte generation is the dominant phase of the life cycle.

The sporophyte is attached to and is dependent on the gametophyte for its nutrition.

The spores are produced by the sporohyte in a spore capsule on the end of a slender stalk above the gametophyte

3.1.3 Classification

The Division Bryophyta is divided into three classes, they are

1 **Hepaticae or liverworts** e.g Riccia, Marchantia

(A)Marchantia (B)Gemmae cups in Liverwort Marchantia

(A) Marchantia Retrievedfrom "http://en.wikipedia.org/wiki/Bryophyte

(B) Gemmae cups in liverwort Marchantia Retrievedfrom http://una.edu/faculty/pgdavision/images/liverworts/Marchpolygemcups.jpg

2 **Anthocerotae or Horned liverworts** e.g Anthoceros

Fig 5.1 *Anthoceros agrestis* Retrieved from "http://en.wikipedia.org/wiki/File:Anthoceros_agrestis_060910c.jpg"

3 **Musci or Mosses** e.g *Spagnum, Funaria Polytrichum*

Fig 5.2 *Funaria hygrometrica1*Retrieved from "http://en.wikipedia.org/wiki/File:Funaria_hygrometrica1.jpg"

3.1.4 Adaptive Features

1 They have pores on their leaves which allows the entry of atmospheric oxygen.

2 Air-dispersed asexual spores.

3 The embryo is developed within the female sex organ; (this is a feature of all terrestrial plants).

4 They can not withstand desiccation, this is because they do not have a cuticle.

However, the Bryophytes are still restricted to moist areas as they still require aquatic medium for the male gametes to travel to the female egg before fertilization can occur.

3.2. DIVISION PTERIDOPHYTA

3.2.1. **Introduction**

The term Pteridophyte refers to non-seed vascular plants, i.e. plants with xylem and phloem whose dispersal relies on spores not seeds. The sporophyte is the dominant phase of the life cycleof the Pteridophytes.

3.2.0 Main body

3.2.1 Diagnostic features

They are specialized plants

The sporophyte is the dominant and conspicuous generation

The gametophyte generation of Pteridophytes is small and found in wet places

The sporophyte is differentiated into true roots, stems and leaves

They have vascular system made up of xylem and phloem

The epidermis of pteridophytes are covered by cuticle and also possess stomata.

The sporophyte produces spores which may be homosporous or heterosporous

3.2..2 **Classification.**

There are four classes of the Pteridophytes they are

1) **Psilotopsida** e.g Psilotum and Tmesipteris

Fig 5.3 Psilotum "http://en.wikipedia.org/wiki/Psilotum"

B) **Lycopsida** e,g Lycopodium,Selaginella

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Fig 5.4 Lycopodium dendroideum.Retrieved from "http://en.wikipedia.org/wiki/File:Lycopodium_dendroideum.JPG"

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Fig 5.5 Selaginella Retrieved from "http://en.wikipedia.org/wiki/File: Selaginella-sp.jpg"

C) **Sphenopsida** e,g Horsetails, Equisetum

Fig 5.6 Equisetopsida.jRetrieved from "http://en.wikipedia.org/wiki/File:Equisetopsida.jpg"

Fig 5.7 Equisetum arvense strobilus Retrieved from "http://en.wikipedia.org/wiki/File:Equisetum_arvense_strob.jpg"

D) Pteropsida or Filicinae e.g Fern,Azolla. Adiantum

- 

Fig 5.8 A Fern Retrieved from "http://en.wikipedia.org/wiki/File:Sa-fern.jpg"

3.2.4 **Adaptive features**

They have true roots, leaves and stems

They have a vascular system made of xylem and phloem.

Their epidermis is covered by the cuticle

Their epidermis has stomata which helps to control water loss

3.5 **ACTIVITY**

A) Go to a damp wall ,you will find some greenish tufts growing on it. Gently collect some and bring to the laboratory for observation.

These are members of the Bryophytes .and what you have collected is the gametophyte stage of the life cycle of a moss plant .Examine these carefully with the aid of a hand lens.

Some of the plants have the sporophyte already growing out. Gently detach this and observe under the microscope.

B)Go to a nearby stream , farmland or where you have palm trees growing(Ferns grow on palm trees) or even a forest floor . Collect some ferns gently and bring to the laboratory .Collect along with their rhizome. This is the sporophyte generation.

Collect a leaf or pinna turn to the underside surface and observe the sori.

In Text Questions
State 4 diagnostic features of the Kingdom bryophyta

1. They are primitive plants which can only survive in wet damp or shady places.
2. They do not have true roots, stems, or leaves.
3. They do not have the vascular tissues of xylem and phloem.
4. Their sizes are very small.

4.0 Conclusion
The bryophytes are known as the amphibians of the plant kingdom and the gametophyte is the dominant phase of its life cycle. While the Pteridophytes have the sporophyte as the dominant phase. They all reproduce using spores.

5.0 Summary
In this unit you have studied members of the plant divisions Bryphyta and Pteridophyta. These plants have the green pigment chlorophyll as such can manufacture their own food. The bryophytes are the first to come to land but are limited to wet or damp places due to the absence ofthe conducting vessels of xylem and phloem. The Pteridophytes on the other hand have the xylem and phloem as weli as the cuticle and stomata and so are more successful on land

6.0 Tutor-Marked Assignment

Make well labeled drawings of your observations on all the specimens you have observed

Make well labeled drawings of your observations on the fern sorus.In what observable features are the Pteridophytes more advanced than the Bryophytes

7.0.References/ Further readings

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UNIT 6: THE SPERMATOPHYTES

1.0 INTRODUCTION

In the last unit, you learnt about the seedless plants. In this unit we shall consider spermatophytes The plant kingdom includes the Bryophytes, Pteridophytes, the Gymnosperms and the

Angiosperms. The gymnosperms and the angiosperms make the spermatophytes

They all possess chlorophyll and are autotrophic. They are generally immobile

2.0 OBJECTIVES

At the end of this unit the student should be able to know

The divisions making the spermatophytes

The various habitats of the divisions

Identify members of the divisions

The adaptations exhibited by the divisions

3.0 MAIN BODY

3.3.0 **DIVISION GYMNOSPERMAE**

3.1.1 Introduction

They are plants that produce naked seeds. Most of the members of this division are extinct no living representatives.

3.1.2 Diagnostic features

The seeds are naked i.e not enclosed

The seeds are borne on a cone Leaves - needles bundle of 3 is called a fascicle.

Archegonia is present with eggs.

Germinations are short

Single fertilization

Examples :Cycas, Pinus, Gnetum.

3.1.2 CLASSIFICATION

A) CYCADOPSIDA e.g Cycas

Fig 6.1 Cycas Retrieved from Cycas

B) **CONIFEROPSIDA** e.g Pinus

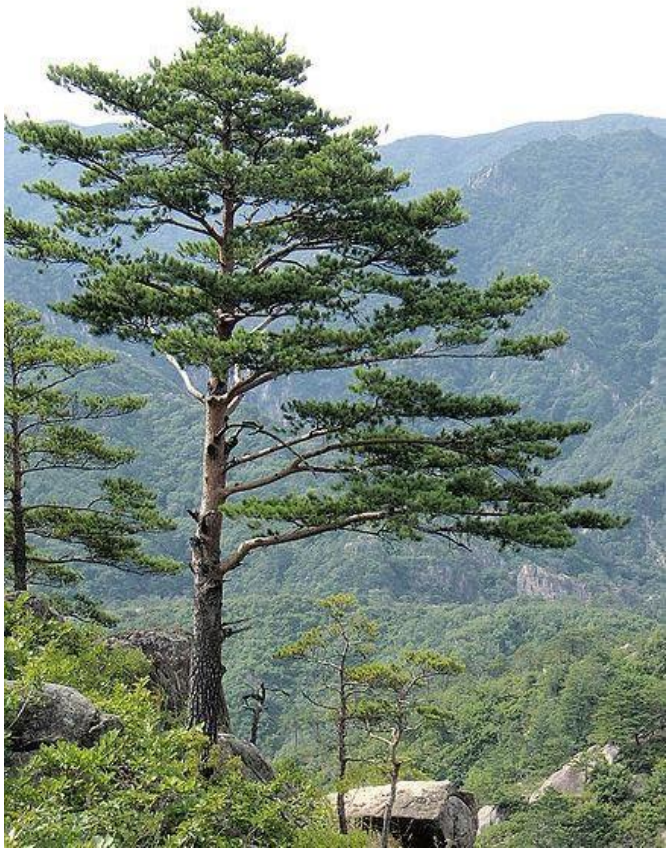

Fig6.2Pinus. Retrieved from "http://en.wikipedia.org/wiki/File:Pinus_densiflora_Kumgangsan.jpg"

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C) **GNETOPSIDA** e.g Gnetum

Fig 6.3Retrieved from "http://en.wikipedia.org/wiki/File:Gnetum_gnemon_BotGardBln1105C.JPG

3.2 DIVISION ANGIOSPERMAE

3.2.1 INTRODUCTION

These are plants that bear flowers and produce seeds. They are also called the flowering plants . Most of the plants we see around us belong to this division . The orange ,mango ,banana, papaya flamboyant, baobab , grasses , e.t.c all belong to this division. They have been able to successfully adapt to life on land. The plant you see standing is usually the sporophyte generation.

3.2.0 **MAIN BODY**

3..2.1 **Diagnostic Features**:

The seeds are covered

-Seeds are covered by the flower or a fruit

-No archegonium present

-Germination is long

-Double fertilization (3N) structure

3.2.3. **MORPHOLOGY**

The plant body is divided into a root system and a shoot or stem system, connected by vascular tissue that is continuous throughout the plant. The root system of this dicot consists of a taproot and several lateral roots. Shoots consist of stems, leaves, and flowers. The blade, the expanded portion of a leaf, is attached to a stem by a petiole.

Nodes, the regions of a stem where leaves attach, are separated by internodes. At a shoot's tip is the terminal bud, the main growing p

3..2.4 **CLASSIFICATION.**

There are two classes of angiosperms and they are

1)The Monocotyledonae and 2) Dicotyledona

Fig 6.4 BANANA (Musa spp) Retrieved from "http://en.wikipedia.org/wiki/File:Lacatan.jpg"

Fig 6.5PALM TREE Retrieved from "http://en.wikipedia.org/wiki/File:Elaeis_guineensis_fruits_on_tree.jpg

PALM TREE (Elaeis spp)

Fig 6.6 Oranges Retrieved from "http://en.wikipedia.org/wiki/File:OrangeBloss_wb.jpg"

Fig 6.7 Lemon grass (Cynbogon spp) Retrieved at Wikipedia ms.

3.3 **Adaptive Features**:

1) Possession of a waxy cuticle,

2)They have surface pores (stomata) that enable gas exchange

3) Possession of an efficient vascular system (xylem and phloem) for the transport of water and mineral salts and translocation of manufactured food

4) Reproductive structures are protected or covered or enclosed

5) Retention of the embryonic sporophyte within the female gametophyte 6) Many of their flowers are designed to attract pollinators, e.g colors, nectar, and fragrances

6) Their fruits are often designed to aid in the dispersal of their seeds.

3.4 ACTIVITY

Observe the following plants and note their types of structures. water leaf, S*ida acuta,* maize ,onion, pineapple, ginger, sugarcane, banana, elephant grass. Lemongrass, cocoyam, okra, orange, Euphorbia, Tridax, Cassia, Acacia. To which class do these plants belong

In Text Questions

What are angiosperms?

Answer: These are plants that bear flowers and produce seeds.

4.0 Conclusion

The Gymnosperm and the Angiosperm produce seeds. They all have chlorophyll and can manufacture their own food. However they cannot move from one place to another.

SAE In what observable features are the angiosperms more advanced than the gymnosperms.

5.0 Summary

In this unit you have studied the habitat , diagnostic features , structure, classification and adaptive features of the divisions Gymnospermae and Angiospermae. **T**hey are all eukaryotes and possess the green colouring pigment chlorophyll as such they can make their own food living as autotrophs. They have a cellulose cell wall. They exhibit an alternation of generations in their life cycle. The gametophyte alternating with the sporophyte. They however do not have the ability to move from one place to the other. They produce seeds and flowers

6.0 Tutor-Marked Assignment

Make well labeled drawings of your observations on all the specimens you have observed

Based on observable features differentiate between the angiosperm classes

Compare and contrast the morphlogical characteristics of the water leaf, *Sida acuta*, maize plant

Observe the following plants and note their types of structures. water leaf, *Sida acuta,* maize ,onion, pineapple, ginger, sugarcane, banana, elephant grass. Lemongrass, cocoyam, okra, orange, Euphorbia, Tridax, Cassia, Acacia. To which class do these plants belong.

What observable features of the plants above help to adapt them to their environments.

Submit your note books for assessment and evaluation.

7.0.References/ Further readings

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Module 4 Animal Diversity

UNIT 7 THE ANIMAL KINGDOM

1.0 INTRODUCTION

In the last unit, you learnt about spermatophytes. In this unit we shall consider the animal kingdom This is the sixth kingdom of living things. It contains the highest number of phylum and individuals. They are all animals at various levels of complexity from the simple multicellular ones to the complex ones.

2.0 OBJECTIVES

1) know the diagnostic features of the kingdom animalia
2.) know the various phyla in the animal kingdom

3.0 MAIN BODY

3.1 THE DIAGNOSTIC FEATURES

They are eukaryotes and their cells do not have cell walls.
They are multi-cellular.
They are heterotrophs and do not have chloroplasts.
Most animals are sessile. That is, they spend most of their lives in one place.
Animals are motile, meaning that they can move their whole body from place to place unlike plants.

3.2 Classification

In the animal kingdom there are ten phyla And they are listed below based on increasing

complexities and developmental advancement.

Phylum Porifera

Phylum Cnidaria

Phylum Platyhelminthes

Phylum Rotifera

Phylum Nematoda

Phylum Annelida

Phylum Arthropoda

Phylum Mollusca

Phylum Echinodermata

Phylum Chordata

In Text Questions

Mention 3 Phyla of the animal kingdom
Answer: Phylum Porifera, Cnidaria, Nematoda

4.0 Conclusion

This kingdom is made up of the animals and they are very diverse

5.0 Summary

In this unit you have learnt the diagnostic features of the animal kn igdom as wel las the various phyla in the kingdom. The lowest phylum in the taxonomic hierarchy is the porifera and the most advanced is the chordate.

6.0 Tutor-Marked Assignment

Outline the phyla in the animal kingdom

7.0. References /Further reading

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UNIT 8 Phylum Porifera

1.0 **Introduction**

In the last unit, you learnt about the different phyla of the animal kingdom. In this unit we shall consider the phylum porifera

The Porifera are also known as the Sponges . The name means "pore-bearing". They are aquatic animals and almost all of them are marine. Sponges are the simplest form of multi-cellular animals. They are very diverse and come in a wide variety of colours, shapes and structural complexities. Their walls are lined with many small pores called ostia that allows water to flow into the sponge's body. Their cells remain totipotent, or developmentally flexible.

2.0 Objectives

At the end of this unit the student should be able to

Know the diagnostic features of the phylum

Know the basis for the classification in the phylum

Observe and know the features that help adapt the members to the environment

3.0 Maim Body

3.1 Diagnostic features

Body-cells are loosely arranged in two layers, which are separated by mesenchyme.

Numerous Ostia are present throughout the body and a large opening osculum is found on the upper end.

Canal system is present, through which water flows throughout the body supplying food and oxygen.
Endoskeleton is made up of calcareous and siliceous spicules, and spongin fibres.
Several Choanocyte-lined spaces are present.

3.2 Habitat

Almost all sponges live in marine water, but some sponges made of spongin fiber live in freshwater.

3.3 MORPHOLOGY

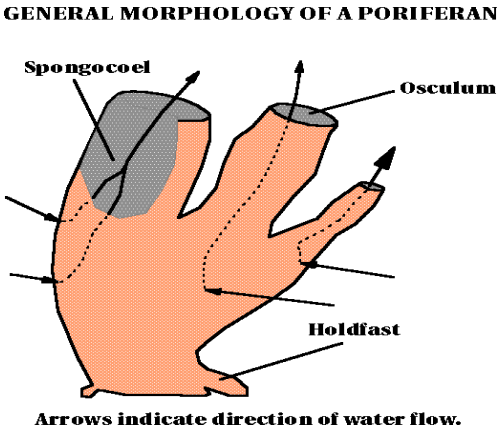

Fig 8.1 Morphology of Porifera Retrieved at http://www.ucmp.berkeley.edu/porifera/poriferamm.html

Sponge bodies are diverse in form, they may be

1) encrusting sheets,
2) volcano-shaped mounds,
3 tubes
4) upright sheets

In all cases, poriferans have a canal system, through which they pump water. Water enters through pores called ostia, flows through canals to a spacious chamber called a spongocoel, and finally exits through large openings called oscula.

Sponges can be differentiated by the level of complexity exhibited by their bodies.

1) Ascon This is the simplest form consists of a single tube, two cell layers thick. Poriferans with this type of architecture are necessarily very small due to surface area to volume constraints

2) Sycon A simple folding of the wall that yields a sponge body.

3) Leucon The vast majority of sponges are organized in a more complex way, the leucon condition, with folds upon folds, resulting in a series of flagellated chambers connected by canals.

3.4 STRUCTURE

The structure of a sponge is simple. One end is attached to a solid such as a rock while the other end, called the osculum, is open to the environment. Sponges are able to get microorganisms such as algae and bacteria for food through openings. Some sponges are carnivorous and use their spicules to capture small crustaceans.

Sponges are made of four simple and independent cells. The first are the collar cells, which line the canals in the interior of the sponge. Flagella are attached to the ends of the cells and they help pump water through the sponge's body. By pumping water, they help bring oxygen and nutrientsto the sponge while also removing waste and carbon dioxide. The second cells are the porocytes, which are cells that make up the pores of the sponge. Epidermal cells form the skin on the outside of the sponge. Finally, the amoebocytes exist between the epidermal and collar cells in an area called the mesohyl. They carry out functions of the sponge and help transport nutrients. They also form spicules, which are the sponge's skeletal fibers. They work together with the collar cells to digest the food for the sponge and produce gametes for sexual reproduction. Sponges are split into classes based on the type of spicules they have. For example, spicules may be made of calcium carbonate or a spongin fiber.

3.5 Classification

There are three classes of the poriferans. They are

1. Calcarea. e.g Sycon,Leucosolenia
2. Hexatinella .e.g Euplectella, Hyalonema
3. Demonspongia e.g Spongilla,Cliona

Fig 8.2 A sponge Retrieved from "http://en.wikipedia.org/wiki/File:Spongilla_lacustris.jpg

3.6 ADAPTIVE FEATURES

1) Skeleton types: Allows them to live in either hard or soft sediments.

2) Pores : Allows them to filter the water around them for food.

3) Flagella :Creates currents so their collar cells may trap the food.

4) Strong Structures : These enables the sponges to handle the high volume of water that flows through them each day.

5) Constricting Openings: This helps the sponges to control the amount of water that flows through them.

6) Colours : The colours act as a protection from the sun's harmful Ultra Violet rays.

7) Toxins: They can release toxins into the environment around them to make sure they have a good place to grow in.

8)Body Repair: Sponges are also able to repair damages to their bodies. These characteristics of sponges are ideal because even small parts of sponges may survive in the water.

3.7 ACTIVITY

Observe prepared slides of some named sponges e.g Spongilla, Euplectella, Hexatinella

4.0 Conclusion

The Poriferans also called sponges are the simplest form of multicellular animals.

In Text Questions

What are the adaptive features for the phylum porifera

Answer: Colour for protection, secrete toxins to restrict predators

5.0 Summary

In this unit you have studied the habitat , diagnostic features , structure, classification and adaptive features of the phylum porifera. They are also known as the sponges and it is the simplest of all the phyla in the animal kingdom they are all marine animals Body-cells are loosely arranged in two layers, which are separated by mesenchyme.

Numerous Ostia are present throughout the body and a large opening osculum is found on the upper end. Canal system is present, through which water flows throughout the body supplying foodand oxygen.

Endoskeleton is made up of calcareous and siliceous spicules, and spongin fibres. Common examples of the poriferans include Spongilla, Euplectella, Hexatinella.

Sponge bodies are diverse in form, they may be encrusting sheets, volcano-shaped mounds, tubes upright sheets

6.0 Tutor Marked assignments

Make well labelled diagram of a named sponge you have seen

Which observable features you have seen/observed help adapt it to its environment and what are the functions of the parts mentioned .

Submit your practical notes for assessment and evaluation

7.0 REFERENCES/FURTHER READING

REFERENCES/Further Reading

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UNIT 9 PHYLUM CNIDARIA

1.0 INTRODUCTION

In the last unit, you learnt about the phylum Porifera. In this unit we shall consider the phylum Cnidaria These are invertebrate marine animals that have tentacles surrounding their mouth . They all have a simple structure. Their bodies can be visualized as being saclike, The phylum cnidaria includes the jellyfish, anemones, corals and hydroids.

2.0 OBJECTIVES

At the end of this unit the student should be able to
Know the diagnostic features of the phylum
Know the basis for the classification in the phylum
Observe and know the features that help adapt the members to the environment
3.0MAIN BODY

3.1 HABITAT

They are marine animals

3.2 Diagnostic features

1) Tissue grade of organization with 2 tissue types:
a) gastrodermis
b) epidermis
They have a layer of mesoglea (a protein) between the tissues.
Their symmetry is radial.
Their nerve cells, are organized in a loose “nerve net”.
They have a cnidocyte(nettle cell) which contains the nematocyst
Their most obvious unique feature is their highly specialized stinging cells (nematocysts).

Hydra

Fig 9.1 Hydra Retrieved from "http://en.wikipedia.org/wiki/Hydra_(genus)"

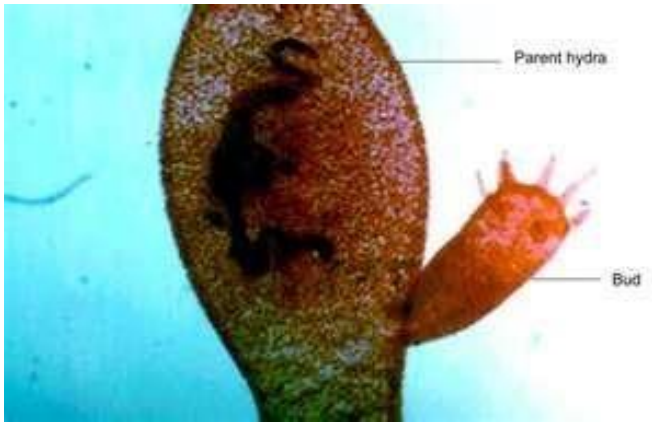


Fig 9.2 Hydra budding http://www.arthursclipart.org/biologya/biology/page_04.htm

3.3 MORPHOLOGY

There are two body forms in this phylum. The Polyp eg Hydra and the Medusa e.g Obelia

polyp: this is a sessile flower like cnidarian e.g Hydra

medusa: motile bell shaped e.g Obelia

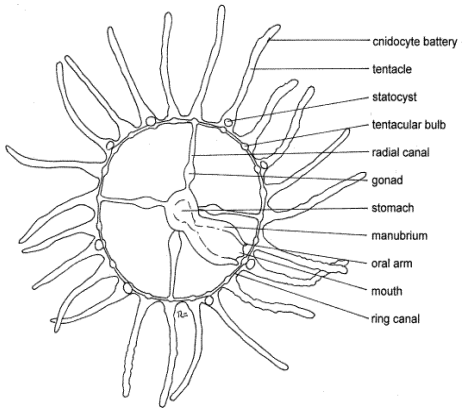


Fig9.3 Obelia medusa. Retrieved at Hydrozoa5L.gif

3.4 CLASSIFICATION

Taxonomy is based upon the 2 body forms:
Polyp and medusa
There are three main classes in the phylum

1) Hydrozoa e.g Hydra
2) Scyphozoa e.g Jellyfish (medusa)
3) Anthozoa e.g sea anemones, most corals (polyps)

3.5 Adaptive Features

Hydrostatic Skeleton: This type of skeleton allows Cnidarians to move quickly and easily through the water.
Nematocytes: Cnidarians use their nematocytes to stun, kill, or paralyze their prey and to protectthem
Tentacle : They may use their tentacles to drag their prey into the "mouth" alive

3.6 Activity

Observe prepared slides of Hydra and Obelia.
Compare and contrast the two forms of the Cnidarians

In Text Questions

Mention three diagnostic features of cnidarians
Answers: (i) Presence of epidermis (ii) Presence of gastrodermis (iii) Tissue level of organization

4.0 Conclusion

The cnidarians are simple multicellular marine animals that show a tissue grade organization.

5.0 Summary

In this unit you have studied the habitat , diagnostic features , structure, classification and adaptive features of the phylum Cnidaria they show tissue grade organization with 2 tissue types the gastrodermis and epidermis. They have a layer of mesoglea (a protein) between the tissues. Their symmetry is radial. Their nerve cells, are organized in a loose “nerve net”.
They have a cnidocyte(nettle cell) which contains the nematocyst. There are two body forms in this phylum the polyp and the medusa. Common examples are jellyfish, anemones, corals and hydroids.

6.0 Tutor-Marked Assignment

Make well labeled diagrams of Hydra and Obelia indicating the functions of the labeled parts.
What observable features adapt them to the environment.
Submit your notebooks for assessment.

7.0 References/Further reading

Phylum Cnidaria From www.ucmp.berkeley.edu/cnidaria/images/cuboeye.gifHydra (genus)Retrieved from "http://en.wikipedia.org/wiki/Hydra_(genus)"
http://simple.wikipedia.org/wiki/File:Hydra_biology.jpg

UNIT 10 PHYLUM PlATYHELMINTHES (The flat worms)

1.0 INTRODUCTION

You learnt about phylum cnidaria in the last unit, in this unit, you will learn about an interesting group of invertebrates i.e Phylum Platyhelminthes

Most members of this phylum are parasitic (flukes and tapeworms), but some are free living (e.g planaria).They are dorsoventrally compressed (i.e., "flat").Platyhelminthes are hermaphroditic, and the parasitic species often have very complex reproductive cycles.

2.0 Objectives:

After studying this unit the student should be able to:

·Describe the diagnostic features of the phylum .

Make observations on the features that equip them for their habitats and parasitic modes of life

3.0 Main Body

3.2 Diagnostic Features

Flatworms have a dorsoventrally compressed and bilaterally symmetrical body.

They are the lowest triploblastic, acoelomate metazoans but they are advanced over coelenterates because their tissues are organized into organs.

· The mesoderm forms a type of connective tissue called parenchyma which fills the body spaces between the ectoderm and endoderm so that there is no coelom; hence they are called as acoelomate animals.

· The excretory system has one or two canals with branches which end in structures known as flame cells and the canals have no internal opening, but they open to the exterior.

·They do not have circulatory and respiratory systems

· The nervous system consists of a network, but it has ganglia at the anterior end which serves as a brain.

· Reproductive organs are well developed; most of flatworms are hermaphrodites.

3.4 Classification

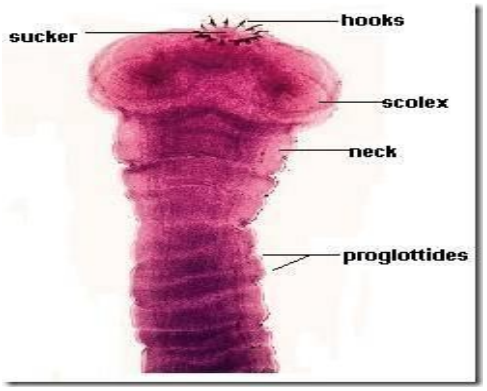


Fig 10.1Anterior end of Taenia solium (tapeworm)Retrived athttp://train-srv.manipalu.com/wpresswpcontentclipimage00839.jpg

Fig 10.2 Fasciola hepatica Retrieved at http://en .wikipedia.org/wiki /Fasciola_ hepatica

The phylum is divided into three classes as given below:

1: TURBELLARIA

1. Mostly free-living flatworms but some are ecto-commensals and endo-commensals or parasitic with simple life cycles. Examples are Planaria, Ectoplana, Notoplana.

2: TREMATODA

They live as ectoparasitic or endoparasitic forms, commonly called flukes.

Body shape usually leaf-like, dorsoventrally flattened. They have well developed suckers and.cuticle on their body. Their life history may be simple or complicated. Examples Fasciola

3: CESTODA

1. Endoparasites in the intestine of vertebrates.2. Commonly called tapeworms.3. Body without epidermis and cilia but covered with cuticle.. Life cycle complicated usually involving two or more hosts. Embryos possess hooks.

Examples: Taenia

Parasitic Adaptations

The shape of their body is flattened like a leaf or a ribbon so that they can fit into any space that is available to them.

They do not have cilia

Their body is covered with a several layered cuticle to protect them from the hosts enzymes

They possess suckers and hooks to help keep them attached to host.

There is a reduction in trophic organs. In the cestodes the mouth and alimentary canal have disappeared. They do not have any locomotory organs.

Some parasites have an additional multiplicative stage at some point in their life cycle

intrematodes he rediae may produce daughter rediae or the sporocyst may either divide by transverse fission or itnmay produce miracidium larvae in cestodes there may be several generations of bladder worms as in a hydatid cyst.

They do not have any locomotory organs.

They produce a lot of eggs to enhance their survival.

The eggs have thick shells to protect them and prevent dessication

The parasites have one or more intermediate hosts which act as transmitting agents to new final hosts.

3.5 Fasciola hepatica (Liver Fluke)

Fasciola, a common fluke, is a parasitic flatworm which inhabits the liver and bile passage of vertebrates, viz., cattle, sheep, goat, rabbit, dog, pig and man.

Habitat

Fasciola hepatica, the sheep liver fluke, is found as an endoparasite in the bile passage of sheep. It needs two hosts to complete Its life cycle a sheep ,goat ,horse e.t.c and a gastropod mollusc

TAPEWORM :Taenia solium the primary host is man and the secondary host is pig.

Structure: It is long (c. 3 metres), flat and tapers towards the anterior end. The body has a small head (scolex), a narrow neck and a body consisting of flat segments called proglottids. The segments develop behind the neck and they enlarge and mature towards the posterior end. The head has hooks and four suckers by which it attaches itself to the intestinal wall.

Parasitic adaptation

1. Attachment devices – hooks and suckers on the scolex – prevent removal from the host gut by peristalsis.
2. Use of secondary host ensures transmission from host to host.
3. Many eggs are produced to ensure that some eggs reach the secondary host; this ensures survival.
4. Hermaphrodite segment ensure reproduction since usually only one tapeworm lives in one person.
5. The outer layer of body protects the worm from the digestive action of host's intestinal enzymes.
6. The ability to respire anaerobically enables the worms to survive in the low oxygen concentration in the gut.
7. The flattened body and the presence of surface cytoplasmic projections called microtriches increase surface area for absorption of food from host gut.

3.5. Activity

Observe preserved specimens of the Tapeworm and Liver fluke.

Note the observable diagnostic features of the platyhelminthes from the specimens before you

In Text Questions

Mention three classes of Platyhelminthes

Answer: (i) Turbellaria (ii) Trematoda (iii) Cestoda

4.0 Conclusion

This phylum is made up of acoelomate metazoans whose tissues have been organized into organs. The animals may be parasitic or free living。

5.0 Summary

In this unit you have studied the habitat , diagnostic features , structure, classification and adaptive features of the phylum platyhelminthes. Most of them are parasites of vertebrates and are well adapted structurally to this life while a few are free living. They are dorsiventrally compressed and bilaterally symmetrical. They do not have a coelom and their tissues have been organized into organs. This gives them an advancement over the Cnidarians. Common examples are the Taenia , Fasciola and Planaria.

6.0 Tutor-Marked Assignment

Enumerate the observable parasitic adaptative features exhibited by Tapeworm and Liverfluke.
What similar structures can you observe between the tapeworm and the Liver fluke
Make well labelled drawings to illustrate the Head regions of Taenia and Fasciola
Submit your books for assessment and evaluation

7.0 References

Jordan,E.L and Verma,P.S. (2006). “Platyhelminthes in General”Invertebrate Zoology. Pg 381-383S.Chand &Co New Delhi

Odunfa ,S.A.(2001). Invertebrates “Essentials of Biology”.Heinemann Educational Books Nigeria.pg 26.

UNIT11 PHYLUM ROTIFERA

1.0 Introduction

The last unit gave us insight into the phylum Platyhelminthes, in this unit you will learn about an important phylum of the animal kingdom called Rotifera.

The name Rotifera means "wheel bearing," they are so called because of the corona, a feeding structure which is on their head and looks like a wheel .The Rotifers contains pseudocoelomate animals that are microscopic and near-microscopic.

2.0 Objectives

At the end of this study the student should be able to

1 Enumerate the diagnostic features of the phylum

2 Identify the habitats where the rotifers are found

3 Observe and know the features which aids the adaptations exhibited by the rotifers to their habitats.

3.0 Main Body

3.1 Habitat

Most live in fresh water, a very few are marine or live in damp terrestrial habitats.

3.2 MORPHOLOGY

Most rotifers are around 0.1–0.5 mm long (although their size can range from 50 μm to over 2 millimeters)., Some rotifers are free swimming and truly planktonic, others move by inch worming along a substrate, and some are sessile, living inside tubes or gelatinous holdfasts that are attached to a substrate. About 25 species are colonial (e.g., Sinantherina semibullata), either sessile or planktonic. They are triploblastic, bilaterally symmetrical, and unsegmented. They are considered pseudocoelomates

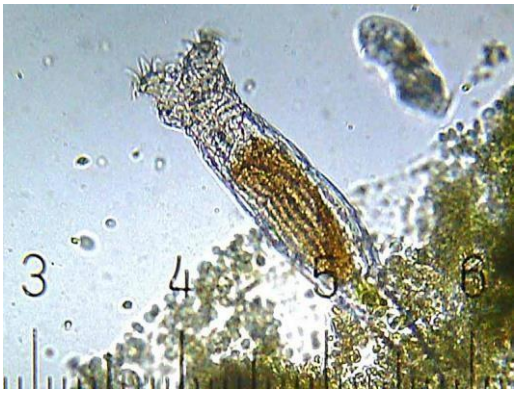


Fig 11.1 Bdelloid rotifer Retrieved from "http://en.wikipedia.org/w/index.php?title=File:20090920_213234_BdelloidRotifer.jpg&oldid=468489358"
Categories:

3.3 STRUCTURE

The body of the rotifer is divided into three parts, the head, trunk and foot. The head has a ciliary organ called the corona that, when beating, looks like wheels turning. The corona is used for feeding .They have a complete gut. The rotifers have protonephridia but lack specialized circulatory or gas-exchange structures. Most structures in rotifers are syncytial ("a mulitnucleate mass of protoplasm not divided into separate cells," or "a multinucleated cell") and show eutely (here, "constant number of cells within a species, usually on the order of 1,000.

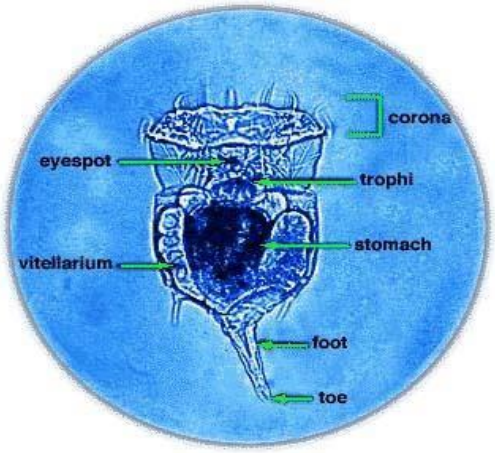


Fig 11.2 Structure of a Rotifer. Retrieved from "http://en.wikipedia.org/wiki/Rotifer"

3.4 CLASSIFICATION

Phylum Rotifera is divided into three classes:
Monogononta,
Bdelloidea, and
Seisonidea.

3.5 ADAPTIVE FEATURES

1 Cryptobiosis this is remarkable ability to survive drying or to withstand desiccation. Rotifer eggs can also withstand drying, with older embryos having a greater chance of survival.

2 Energy conservation e,g *Brachonius calyciflorus* it reduces the rate of its respiration when

food is scarce to save energy. while other species show no change in respiration rate.

3 Coexistence of competing species .It is predicted that the ability of some rotifer species to adapt to resources with temporal variation in availability allows the coexistence of competing species of rotifers.

4 Anhydrobiosis Under drought conditions, bdelloid rotifers contract into an inert form and lose almost all body water; when rehydrated, however, they resume activity within a few hours..

5 Adhesive glands on the foot helps to to attach the animal to the substratum..

6 Resting eggs. Individuals of some species form two distinct types of parthenogenetic eggs; one type develops into a normal parthenogenetic female, while the other occurs in response to a changed environment and develops into a degenerate male that lacks a digestive system, but does have a complete male reproductive system that is used to inseminate females thereby producing fertilized 'resting eggs' (also termed diapausing eggs). Resting eggs develop into zygotes that are able to survive extreme environmental conditions such as may occur during winter or when the pond dries up. These eggs resume development and produce a new female generation when conditions improve again.

3.6 Activity

Observe prepared slides and charts of some Rotifers

In Text Questions

What is cryptobiosis?

Answer: Cryptobiosis this is remarkable ability to survive drying or to withstand desiccation.

4.0 Conclusion

The Rotifers is a phylum of microscopic and near microscopic animals that have a pseudocoelom. And found in aquatic habitats.

5.0 Summary

In this unit you have studied the habitat , diagnostic features , structure, classification and adaptive features of the phylum Rotifera. They have a wheel like structure on their head which is used for feeding. This phylum is made up of animals that are mostly microscopic eukaryotes found in fresh and marine water. They are triploblastic, bilaterally symmetrical, and unsegmented. They are pseudocoelomate animals that exhibit eutely ie constant number of body cells. Common example of the Rotifers is *Sinantherina semibullata*

6.0 Tutor-Marked Assignment Take note of features of diagnostic and adaptive significance for the Rotifers

Make well labeled drawings to illustrate their observations

How many types of eggs are produced by the Rotifers

Students submit their books for assessment

7.0 REFERENCES/FURTHER READING

REFERENCES/Further reading

Myers, P., R. Espinosa, C. S. Parr, T. Jones, G. S. Hammond, and T. A. Dewey.(2008). The Animal Diversity Web (online). Accessed at http://animaldiversity.org.

"http://en.wikipedia.org/wiki/Rotifer"

UNIT 12 PHYLUM NEMATODA

1.0 Introduction

In the previous unit learnt about the Rotifers, in this unit you will learn about the Phylum Nematoda.

The name Nematoda comes from the Greek word for "thread". The phylum is made up of the round worms. They are vermiform, or wormlike and their body is covered by a layered cuticle. Juveniles in this phylum grow by molting. They are important parasites of plants, man and animals .

2.0 OBJECTIVES

At the end of this unit the student should

1 Know the diagnostic features of the phylum

2 Identify the habitats in which the members of the phylum are found

3 ·Know the observable features that helps adapt them to their habitats and parasitic mode of life

3.0 MAIN BODY

3.1 Habitat

Nematodes are found in the soil, inside plants and animals including man, ice hot deserts, the oceans

`3.2 Morphology

their main body axis is longitudinal. They are primarily bilaterally symmetrical and have lateral sides a dorsal and a ventral side which includes body openings. Nematodes are not segmented and are generally colorless. They do not have a true body cavity lined with epithelial tissue.

3.3 Structure

This includes a body wall, digestive system, nervous excretory and reproductive system, but lacks a typical circulatory respiratory and endocrine system. The body wall is made up of somatic muscles. hypodermis and cuticle. The cuticle is the outermost layer and gives protection and support. The cuticle has alternating horizontal grooves and ridge at regular intervals called striations or annulations also longitudinal markings. other structures on the cuticle includes papillae, setae, spines or bristles.

Ascaris

Ascaris is the most common roundworm; its species are found as intestinal parasites in

vertebrates .The species of Ascaris are quite large in size. Ascaris lumbricoides is found in humans, A. megalocephala is found in horse, A. suum is found in pig, A. galli is found in the chicken.

Figure 12.1 Ascaris lumbricoides Retrieved from "http://en.wikipedia.org/wiki/File:Ascaris_lumbricoides.jpeg"

Habitat

Ascaris lumbricoides is an endoparasite in the small intestine of man lying freely in the lumen. It is cosmopolitan in distribution. It is found more commonly in children than in adults. Sometimes it migrates from intestine to stomach and comes out through the mouth or nostrils of the host. As many as 1000 to 5000 adult worms may inhabit a single host. Mode of nutrition is holozoic, as it feeds on host's partly digested food by sucking action of its pharynx. It produces anti-enzymes to protect itself from the action of the host enzymes. Sexual dimorphism is well distinct; only sexual reproduction takes place; asexual reproduction does not occur. Life cycle is simple and monogenetic ~no secondary host

3.4 Adaptive Features

Physical Adaptive features

They have a simple Structure

External Cuticle The cuticle provides structural support and, along with longitudinal muscles, allows the roundworms to bend from side to side and to move in a thrashing manner. The cuticle is permeable by fluids and gases, thus allowing respiration to occur over the whole body.

The adaptation of a hard and flexible yet permeable skin cuticle enables roundworms to maintain their internal fluids under high pressure.

Nervous System The nerve cords relay sensory information with tactile, chemosensory and light sensitive receptors and help with movement.

Digestion The digestive system of the roundworms includes a mouth with teeth, a gut, anus and a pharynx.

Reproduction； roundworms lay eggs which can be highly resistant to adverse environments such as dry, hot or cold conditions

Eutely : every individual of the roundworm species has the exact, same number of cells.

3.5 Activity

Observe preserved specimens of A. lumbricoides

Collect the alimentary canal of some slaughtered chickens from the local market and observe for the presence of roundworms. How many worms did you collect per chicken?

In Text Questions

What is the most common round worm?

Answer: Ascaris

4.0 Conclusion

These are round worms .They have the cuticle and grow by moulting.

5.0 Summary

In this unit you have studied the habitat , diagnostic features , structure, classification and adaptive features of the phylum **Nematoda.** They are primarily bilaterally symmetrical and have lateral sides a dorsal and a ventral side **They are pseudocoelomate** roundworms . their body is covered by a cuticle. They grow by moulting a feature they share with the insects. They do not show any segmentation. Examples of nematodes are *Ascaris lumbricoides, Meloidogyne* spp

6.0 Tutor-Marked Assignment

What are the observable diagnostic and adaptive features that you saw?

what observable features of the Round worms enables them to live successfully as parasites

What are the Differences between Flatworms and Roundworms

Make well labeled drawings to show your observations.

Submit your books for assessment and evaluation

7.0 REFERENCES/FURTHER READING

Jordan,E.L and Verma,P.S (2006). "Nematodes in General"Invertebrate Zoology. Pg418-419 S.Chand &Co New Delhi

Baldwin J G.(1978). The morphology of nematodes Nematology Circular No.41

UNIT 13 PHYLUM ANNELIDA

1.0 Introduction

You learnt about phylum Nematoda in the last unit, you shall learn about phylum Annelida in this unit.

The name means ringed derived from the Greek word annulatus. Members of the phylum Annelida are the segmentedall display bilateral symmetry, cephalization, have an open digestive system, segmentation, and a body cavity.

This phylum consists of earthworms, leeches, and various marine worms given many different names (e.g., sand wormMajor advances of this phylum include the true coelom, segmentation, both longitudinal and circular muscles, a clos excretory system (metanephridia)

2.0 Objectives

At the end of this unit the students should be able to

Know the diagnostic features of this phylum.

Identify the habitats where this animals are found.

Know the features of advancement among the members of this phylum and the previous phyla

3.0 Main body

3.1 HABITAT

Annelids may be found in aquatic environments either marine or fresh water and on land

3.2 Diagnostic features

They are segmented worms

The segments are both internal and external

The segments are separated by crosswalls or septa and each segment can function as an individual

The have a true coelom

3.3 CLASSIFICATION

Phylum Annelida is divided into three main groups

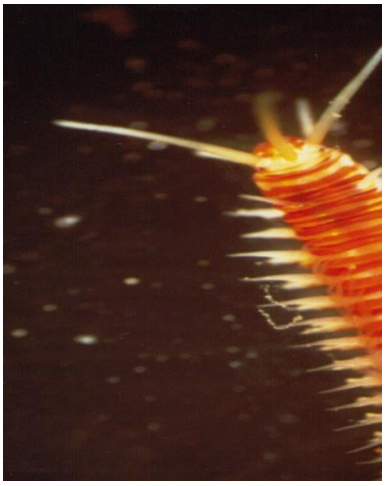
1) Class Oligochaeta:

This class of segmented worms include the earthworm and a variety of aquatic species. The earthworm extractssoil. Undigested material mixed with mucus secreted into the digestive tract is egested through the anus. There are abo found in soil (e.g. earthworms) or in shallow or estuarial water (EG 2).

Fig 13.1 Retrieved from "http://en.wikipedia.org/wiki/File:Regenwurm1.jpg"

2) Class Polychaeta:

Each segment of polychaeta has a pair of paddle-like structures called parapodia ("almost feet") that function in locomotion.



Most polychaetes are marine.

Fig 13.2 Retrieved from http://sharontaxonomy2009p3wikispaces.com

3) Class Hirudinea(Leeches):

Majority of leeches live in freshwater, but some are land leeches that move through moist vegetation.

Leeches are usuto no current and a slightly basic pH. Leeches also tend to avoid light and to hide under stones or within aquatic p leeches feed on other invertebrates, and some are blood sucking parasites that feed on animals and humans.

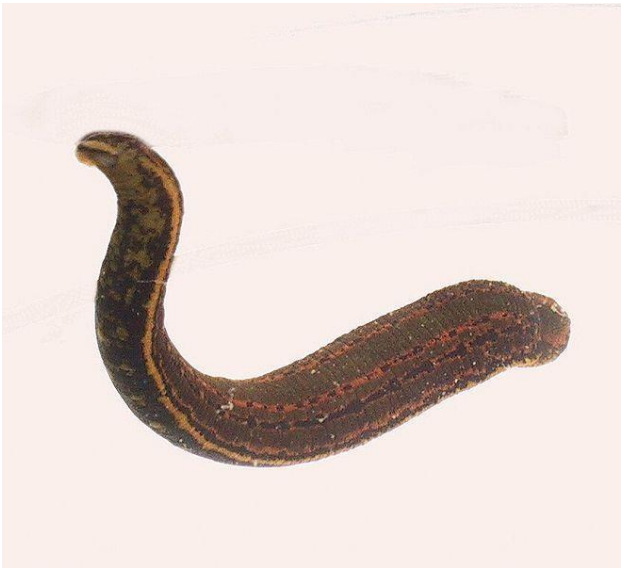


Fig 13.3 Retrieved from "http://en.wikipedia.org/wiki/File:Sv%C3%B8mmende_blodigle.JPG"

3.3 Structure

The body cavity is a true body cavity called a coelom. This is a fluid-filled space between the innermost cell la reproductive and digestive organs have evolved into complex structures with complex functions.

Also the digestive s the digestive system take place without interacting with the inner or outer body walls. Earthworms and other annelids have numerous segments, each separated from the others by internal partitions. Most of the segments, remove water and waste. Needed water is reabsorbed, and waste material passes out of thelongitudinal and circular muscles that contract, compressing fluid to form a water-based skeleton called a hydrostatic The annelids have a digestive and circulatory system running their entire length. The circulatory system is closed, muscular vessels called hearts.

The phylum Annelida contains several classes of worms, among them the worms found in mud and sand, the familiarby a sexual method where sperm and egg cells are released into water for fertilization to take place.

3.4 Adaptive features

Presence of the coelom

Easily replaceable body parts

Metameric segmentation

Longitudinal muscles aid movement

3.5 Activity

Collect earthworms and bring to the laboratory for observation.

Observe preserved specimens of Earthworm ,Leech and Nereis

In Text Questions

State 2 adaptive features of annelids.

Answer: (i) Presence of Coelom (ii) Easily replaceable body parts

4.0 Conclusion

These are the segmented worms having a true coelom or body cavity.

5.0 Summary

In this unit you have studied the habitat , diagnostic features , structure, classification and adaptive features of the phylum Annelida. They are segmented worms and have a true coelom or body cavity. They are bilaterally symmetrical and also show cephalization . They have both the circular and longitudinal muscles. Examples of members of this phylum includes the Earthworm, the Leech and Nereis.

6.0 Tutor-Marked Assignment

Draw and label the specimens you. have observed
Record their observable diagnostic features
What are the differences between the 3 main groups of Annelida?
Submit your books for assessment and evaluation

7.0 REFERENCES/FURTHER READING

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UNIT 15 PHYLUM MOLLUSCA

1.0 Introduction

You learnt about phylum Annelida in the last unit, you shall learn about phylum Molluscs in this unit.

This phylum includes animals like the snails, slugs, bivalves, chitons, squids, octopus, .They are soft bodied animals usually with an exoskeleton that is made of calcareous shell. They have at least two characters radula and mantle not found elsewhere in the animal kingdom. Their life cycles include a trochophore larva found also in annelids.

2.0 Objectives

At the end of this unit the students should be able to

Know the diagnostic features of this phylum.

Identify the habitats where this animals are found.

Know the features of advancement among the members of this phylum and the previous phyla

3.0 Main Body

3.1 Habitat

The molluscs are found in a wide range of habitats terrestrial, aquatic which may be fresh or marine. the abysses of the sea, coral reefs, mudflats, deserts , forests, rivers, lakes , underground and in the body of other animals.

3.2 Diagnostic features

Their bodies are normally elongate and bilaterally symmetrical.

Most of the organs are contained by a body wall divided into a muscular lower part (the foot) used for locomotion or feeding, and an upper part (the mantle) which covers most of the body along with a free space (the mantle cavity).

Sensory structures are concentrated in a head (cephalization) (except the bivalves).

They all have a characteristic type of larval development.

Most molluscs secrete some type of $CaCO_3$ shell from the mantle; they utilize either aragonite or calcite, or a mixture of both.

3.3 Classification

There are three classes in the phylum mollusca they are
Gastropoda (gastropods) e.g Helix aspersa (land snail)patella(limpet) Buccinum(whelk)Limax slug) Pelycopoda (bivalves) e.g Mytilus edulis (marine mussel) ostrea (oyster)
Cephalopoda(cephalopods) e.g Sepia officinalis (cuttlefish)Loligo (squid)Octopus vulgaris

3.3 Structure
A muscular foot, usually used for movement.
A visceral mass, containing most of the internal organs.
A mantle, a fold of tissue that drapes over the visceral mass and secretes the shell, if present.
Most have a radula, or a rasping organ to scrape food.

· Organisms may be terrestrial or aquatic; if aquatic, fresh water or marine.

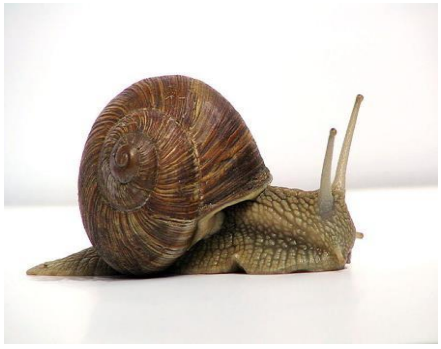

Figure 15.1 Variety of molluscs
(A) Snail Retrieved from "http://en.wikipedia.org/wiki/File:Grapevinesnail_01.jpg"
(B) Octopus Retrieved from "http://en.wikipedia.org/wiki/File:Octopus2.jpg" File:Clams.JPG
(C) Clams Retrieved from "http://en.wikipedia.org/wiki/File: Clams.JPG"

Adaptive features
The shell for protection
The radula for drilling
The teeth having poisons

3.Activity
Students should collect snails and shells and bring to the laboratory for observation.
Students observe preserved specimens of Octopus, Sepia, Oyster, S nails.
Students take note of observable diagnostic features.

In Text Questions

What is the body symmetry of Molluscs?

Answer: They are bilaterally symmetrical

4.0 Conclusion

The Molluscs are soft bodied animals that usually have an exoskeleton made up of calcareous shell.

5.0 Summary

In this unit you have studied the habitats, diagnostic features , classification and features that adapt the molluscs to their various habitats. This phylum is made up of animals like the land snail, Helix aspersa, Limax(slug), Mytilus edulis(marine mussel), ostrea(oyster), Loligo(squid),Octopus vulgaris(octopus). Their major features includes possession of a soft body that is divided into a head, ventral muscular foot and visceral hump, a mantle that secretes the calcareous shell, main body cavity is a haemocoel, no limbs, bilateral symmetry, unsegmented triploblastic coelomates. The mantle and radula are found only in this Phylum.

6.0 Tutor-Marked Assignment

Students compare the features of snail, Oyster and Octopus

Students should make labeled drawings of these specimens. What are the features that help adapt these specimens to their habitat?

Classify Mollusca up to classes giving diagnostic characters and suitable examples.

7.0 REFERENCES/FURTHER READING

5.0 References/Further reading

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UNIT 15 PHYLUM ARTHROPODA

1.0 Introduction

You learnt about phylum Mollusca in the last unit, you shall learn about phylum Arthropoda in this unit.

Arthropoda(Gr.,arthros=jointed +podos=foot) is the largest phylum of the animal kingdom. This phylum has more individuals and a greater diversity and ecological spread than all the other phyla in the animal.

The most notable advancement of this phylum is a rigid exoskeleton. It has major implications in these organisms' locomotion, flexibility, circulatory systems, gas exchange systems, and growth. It also was partially responsible for the ability of the arthropods to move on to land.

2.0 Objectives

At the end of this unit students should be able to

Know the diagnostic features of the phylum

Identify the various classes of the phylum

Know the various adaptive features of the members of the classes.

3.0 Main Body

3.1 Diagnostic features

They have segmented bodies

They possess jointed appendages

They have a chitinous exoskeleton

3.2 Classification

The Classes are

A) Class Arachnida (mites, scorpions, spiders, ticks)

(A) (B)

(C)

Fig 15.1 Diversity of Arachnida

(A) A scorpion. Retrieved from "http://en.wikipedia.org/wiki/File: SCORPIO_MAURUS_PALMATUS.jpg"

(B) Retrieved from "http://en.wikipedia.org/wiki/File: Ixodes_hexagonus_(aka).jpg"

:Ixodes hexagonus (aka).jpg

(C) A spider Retrieved from "http://en.wikipedia.org/wiki/File: Araneus_diadematus_(aka).jpg

B) Class Diplopoda (Millipedes)

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Fig 16.2 A curled millipede Retrieved from "http://en.wikipedia.org/wiki/File: Millipede_curled.jpg

C) Class Chilopoda (Centipedes)

Fig 15 .3A Centipede Retrieved from "http://en.wikipedia.org/wiki/File: Centipede.jpg

D) Class Insecta

Fig 15.4 Drosophila melanogaster Retrieved from "http://en.wikipedia.org/wiki/File:Drosophila_melanogaster_-_side_(aka).jpg

Fig 15.5Aedes aegypti biting human. Retrieved from "http://en.wikipedia.org/wiki/File:Aedes_aegypti_biting_human.jpg"

Termite Cathedral

Fig 15.6Retrieved from "http://en.wikipedia.org/wiki/File:Termite_Cathedral_DSC03570.jpg"

E) Class Crustacea (Crabs, Crayfish, Lobsters, Shrimps)

Fig 15.8 Shrimps Retrieved from "http://en.wikipedia.org/wiki/File:Shrimps_at_market_in_Valencia.jpg" File:Krillanatomykils.

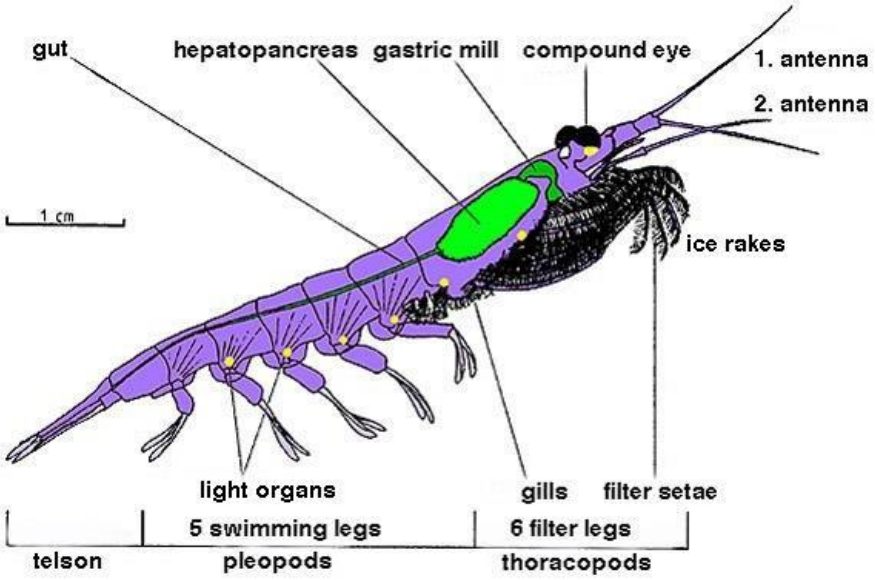

Fig15.9 Retrieved from "http://en.wikipedia.org/wiki/File:Krillanatomykils.jpg"

3.3 Habitat

The arthropods are found everywhere. Soils, water, decaying organic material. bodies of otherliving things including humans.

3.4 Adaptive Features

They have a hard outer body covering the exoskeleton.

They have jointed appendages.

4.0 Activity

Students should collect grasshoppers, mosquito, spiders, scorpions ,cockcroaches ,termites, centipede and millipedes , crayfish ,lobster , daphnia , cyclops and bring to the laboratory for observation.

Students observe preserved specimens of grasshoppers, mosquito, spiders, scorpions ,cockcroaches ,termites, centipede and millipedes , crayfish ,lobster , daphnia , Cyclops .

In Text Questions

What is the most notable advancement of the phylum arthropoda

Answers: The most notable advancement of this phylum is a rigid exoskeleton

4.0 Conclusion

This is the most populous phylum in the animal kingdom they possess jointed appendages and a chitinous exoskeleton

5.0 Summary

In this unit you have studied the habitat , diagnostic features , structure, classification and adaptive features of the phylum Arthropoda. This is the phylum with the largest number of individuals and they are found almost anywhere in the soil ,water ,air ,on land on the bodies of other living things. The presence of jointed appendages , chitinous cuticle are some of their most obvious diagnostic feature . Examples of the members of this phylum are Crabs, Crayfish, Lobsters, Shrimps grasshoppers, mosquito, spiders, scorpions ,cockcroaches ,termites, centipede and millipedes

6.0 Tutor-Marked Assignment

Compare and contrast the observable features of these arthropods you have observed.

Make well labeled drawing of the specimens.

Compare the structures of the scorpion, the mite and the spider .what observable features do they share ? What are the functions of these features?

Students take note of the distinguishing features between the spider and the insects.

Students submit their notebooks for assessment and evaluation

7.0 REFERENCES/FURTHER READING

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Duyilemi,B.O and Duyilemi A.N.(2000) General classification and diversity ofOrganisms. Practical Biology for schools and colleges. Gbabeks publ.Ibadan Nigeria. Pg38

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Retrieved from "http://en.wikipedia.org/wiki/Crustacean"

UNIT 16 PHYLUM ECHINODERMATA

1.0 Introduction

You learnt about phylum Arthropoda in the last unit, you shall learn about phylum Echinodermata in this unit.

The name Echinoderm means "spiny skin" examples of animals in this phylum includes the sea stars, brittle stars, sea urchins, and sea cucumbers. They are mostly sessile or very slow moving animals.

As adults, they are radially symmetrical, but in the larval stage, they are bilaterally symmetrical. And are considered deuterostomes.

Echinoderms are unique in that they have a water vascular system made of a system of fluid-filled canals. These canals branch into the tube feet, and are used for feeding, locomotion, and gas exchange.

2.0 Objectives

After studying this unit you should be able to

· List the characteristic features of Phylum Echinodermata

· Classify Echinodermata up to classes giving diagnostic features of each class; also provide suitable examples for each class.

3.0 Main Body

3.1 Habitat

The echinoderms are found only in the marine habitat.

3.2 DIAGNOSTIC FEATURES

1) They have calcite skeletons which are made of plates of calcite. Each plate is, crystallographically, a single crystal.

2) They have radial symmetry (usually 5-fold symmetry in most star-fish) but other degrees of radial symmetry are known.

3.3 Classification

There are two subphyla in this phylum, they are

a) Pelmatozoa has one living class Crinoidea

b) Eleuthrozoa has four living classes, Asteroidea, Echinodea, Ophiuroidea and Holothuroidea.

Class Crinoidea (Gk. Krinou, sea-lily)·

Example : Sea lilies (Antedon)

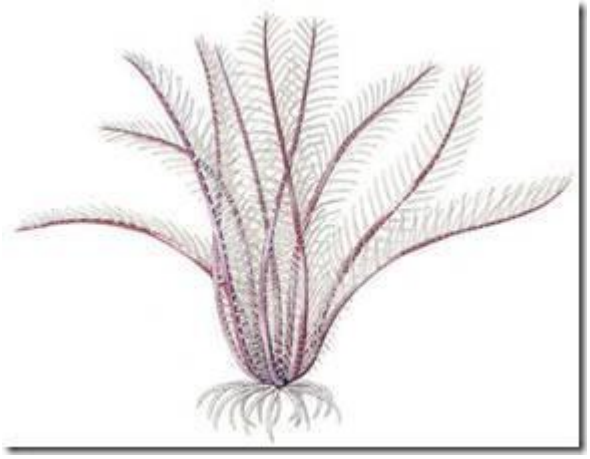

Fig.:16.1 Antedon – sea lily – a crinoid echinoderm Retrievedathttp://train-srv,manipalu.com/wpress/wp-content/uploads/2010/clipimage00234jpg

Class 1. Asteroidea (Gk. aster, star; eidos, form). ·

Example : Starfish (Astropecten)

Fig 16.2Retrieved from "http://en.wikipedia.org/wiki/File:Red-knobbed.starfish.arp.jpg"

Class 2. OPHIUROIDEA (Gk. ophis, snake; uro, tail)

Examples : Brittlestar. Ophiothrix, Ophiura.

Class 3. ECHINOIDEA (Gk. echinus, hedge-hog)

Fig16 3 Sea urchin –an echinoid echinoderm Retrievedathttp://train-srv,manipalu.com/wpress/wp-content/uploads/2010/clipimage00844.jpg

Class 4. HOIOTHUROIDEA. (Gk. holothurian, water polyp)

Examples : Sea cucumbers; Holothuria Synapta.

The Starfish (Asterias) is marine, bottom dwelling, mainly in the littoral zone where they crawl about or may remain quite.

External characters

The starfish lives in the sandy and rocky parts of the sea. Its body is flat and consists of a disc with five radiating arms, which are broad at their bases and tapering towards their outer extremities. The lower side of the animal is called the oral side as the mouth is in the center and the upper side is termed abroal or abactinal side. The terms dorsal and ventral surfaces are not applicable, as they correspond to the right and left sides of the larva and not to the dorsal and ventral sides. The region between any two arms is known as an inter-radius

3.4 ADAPTATIONS

Spikes and toxins to keep away predators

Sea Stars and sea cucumbers, can stay in rocky areas while others often stay in sandy areas where they can bury themselves.

Echinoderms can live inside the skin of other animals e.g fish to hide theirselves in the day timeEchinoderms have adapted to match the colour of their surroundings.

Echinoderms e.g sea urchins have interlocking plates of Calcium Carbonate which form a very hard internal skeleton for protection and maintaining their body structure

Sea stars and brittle stars have slightly more flexible internal skeletons to allow them to flex and bend their arms. Sea cucumbers have barely any Calcium Carbonate, resulting in a very flexible body containing only remnants of a sturdy internal skeleton.

Echinoderms can regenerate or replace lost body parts.

3.5 Activity

Observe preserved specimens of Starfish. Sea Stars and Sea cucumbers

In Text Questions

What does Echinodermata means?

Answer: The name Echinoderm means "spiny skin"

4.0 Conclusion

This phylum contains marine animals that have spines and a radial symmetry

5.0 Summary

In this unit you have studied the habitat , diagnostic features , structure, classification and adaptive features of the phylum Echinodermata. This phylum includes animals with spine like structures on the skin **and that is how they came about the name** echinoderm. They are all radially symmetrical and their body is arranged along five axes radiating from the centre. The phylum is divided into two subphyla the Pelmatozoa and the Eleutherozoa. Members of this phylum includes the starfish, Sea Stars and sea cucumbers

6.0 Tutor-Marked Assignment

Record your observations on the diagnostic and adaptive features of the star fish Sea Stars and sea cucumbers.

Give an outline classification of phylum Echinoderm.

Make labeled drawings of the specimen.

Submit your books for assessment and evaluation.

7.0 REFERENCES/FURTHER READING

. http://www.nature.com/nature/journal/v417/n6891/extref/nature00805_s1.htm#1

http://www.evolutionpages.com/index.html

UNIT 17 PHYLUM CHORDATA

CONTENT

1.0 INTRODUCTION

You learnt about phylum Echinodermata in the last unit, you shall learn about phylum Chordata in this unit.

This is the last phylum in the animal kingdom. These are animals with a notochord at one stage or the other in their life cycle, a dorsal hollow nerve tube located just dorsal to the notochord; and a pharynx with gill slits for respiration. The members of this phylum includes the tunicates, lancelets, and the vertebrates. For most observers, these are not obvious characteristics of the phylum. This is because they may only be present in embryonic stages. The notochord degeneratesin the adult tunicate; these animals change so much as adults that they appear more like sponges than other chordates. Vertebrates replace the notochord with vertebrae, and the embryonic gill slitsdisappear in adult tetrapods (four-legged land vertebrates). Only the lancelets show all chordate diagnostic features as adults.

2.0 OBJECTIVES

Identify morphological features of different vertebrates.

Compare and contrast skeletons of various vertebrates and explain their differences with respect to adaptations to their environments.

Identify major organs of a mammal from a dissection.

3.0 Main body

3.1 Habitat

Chordates are found on land and in water

3.2 Diagnostic Features

1) They all have a notochord (a non-bony structure that runs the length of the back and provides them with some rigidity and an attachment for muscles) at some stage in their lives. In vertebrates, the notochord appears only in embryos and is replaced in the adult organism by the articulated backbone.

2) They have bi-lateral symmetry.

3) They have a differentiated 'head' and 'tail'

4) They all have pharyngeal slits at some stage in their life cycle. These slits are openings from the pharynx or throat to the outside. They are used in primitive chordates to filter food, are modified by addition of gills in fish and used for breathing, and in most land animals (like you and me) appear only in the embryo and are converted into other structures (such as the lower jaw and parts of the cardiovascular system) before birth. Living chordates do not have radial symmetry or a calcite skeleton.

Chordates have a segmented body plan, at least in development. This segmentation evolved independently from the segmentation of annelids**.**

3.4. Classification

Three subphyla make up the phylum Chordata:

Subphylum Urochordata (tunicates): the adults are enclosed in a tunic made of a carbohydrate much like cellulose. They squirt water out of an excurrent siphon. Urochordates are characterized by errant (mobile and active) larvae and sessile adults. All are filter feeders. The only "chordate" characteristics retained in adult life are the pharyngeal slits. Larval urochordates look more like

adult cephlochordates & adult vertebrates than adult urochordates.

Fig17.1:Bluebell tunicates Retrieved from "http://en.wikipedia.org/wiki/File:Bluebell_tunicates_Nick_Hobgood.jpg"

Fig17.2Branchiostoma lanceolatum Retrieved from "http://en.wikipedia.org/wiki/File:Branchiostoma_lanceolatum.jpg"

Subphylum Cephalochordata: Cephalochordates are known as lancelets because of their blade-like shape; they are also known as amphioxus. .They are marine animals and usually live on the

bottom, but can swim.

Subphylum Vertebrata (vertebrates)

Formally, the phyla Urochordata and Cephalochordata are considered invertebrates.

3.4.1 Subphylum Vertebrata

Vertebrata refers to the presence of vertebrae and a vertebral column.

Vertebrates show extreme cephalization.

The notochord generally is replaced by the cranium & vertebral column in adults.

Key features of Vertebrata

 The main diagnostic features of chordates are a notochord, dorsal nerve cord, pharyngeal gill pouches, postanal tail - all present at some stage of the life cycle.

 Integument basically of two layers, an outer epidermis derived from the ectoderm and inner dermis of connective tissues derived from mesoderm; many modifications of skin among the various classes, such as glands, scales, feathers, claws, horns and hair.

 Notochord more or less replaced in jawed vertebrates by the spinal column of vertebrae composed of cartilage, bone or both; distinctive endoskeleton consisting of vertebral column with the cranium, visceral arches, limb girdles and two pairs of jointed appendages.

 Muscular perforated pharynx.

 Many muscles attached to the skeleton to provide for movement.

 Complete digestive system ventral to the spinal column and provided with large digestive glands, liver and pancreas.

 Circulatory system consisting of the ventral heart (2-4 chambers); a closed blood vessel system of arteries, veins and capillaries; blood fluid containing red blood corpuscles with haemoglobin and white corpuscles.

 Well developed coelom largely filled with the visceral system.

3.4.2 CLASSIFICATION OF THE VERTEBRATA

There are five classes of the vertebrates. These are

The Pisces or Fish e.g. Tilapia, trout, carp and galjoen

Fig17.3(A)Tilapia B)Shark

(A) Retrievefrom"http://en.wikipedia.org/wiki/File:Fresh_tilapia.jpg"

（B）Retrieved from "http://en.wikipedia.org/wiki/File:Whale_shark_Georgia_aquarium.jpg

Adaptations

1. Stream-lined shape with no neck minimizes friction during passage in water.
2. Slime exuded from the skin further reduces friction and also protects the fish against bacterial infection,influx of water into the body and diffusion of ions out of the body.
3. The skin is protectively coloured. The grayish dorsal surface blends with the dark appearance of water when viewed from above. The silvery white ventral surface matches the sky background from below. This makes it difficult for predators both above and below to see it.
4. Fins are present for locomotion in water; the pectoral and pelvic appendages are also modified as fins.
5. The respiratory organ is the gill which is efficient only in water.
6. The body surface has tubular canals and patches called the lateral line which contains hair cells sensitive to vibration; they help to detect movement in water.
7. The swim bladder contains gas whose volume is adjustable with changing pressure; it keeps the fish buoyant.
8. The body has powerful muscle blocks for movement and piloting the tail.
9. Fishes generate electric current to varying degrees by special cells called electrolytes; this ability enables

them to detect objects within the electric field and guides their movement in the dark or in turbid water.

10. The eyes are covered with nictitating membranes to protect them from dirt in water.

THE AMPHIBIA

File:Oophaga.pumilio.zoo.jpg

(A)

(B)

(C)

(D)

Fig17.4 Diversity of Amphibians

(A) Retrievedfrom "http://en.wikipedia.org/wiki/File:Oophaga.pumilio.zoo.jpg"

(B) Retrieved from "http://en.wikipedia.org/wiki/File:Dermophis_mexicanus.jpg"

(C) Retrieved from "http://en.wikipedia.org/wiki/File:SpottedSalamander.jpg"

(D) Bufo regularis Retrieved from http://www. Theamphibian.co.uk

Adaptation of toads to aquatic life

1. Oval stream-lined shape with no neck minimizes friction while swimming.
2. Webbed feet facilitate swimming.
3. Dark dorsal surface and light ventral surface makes it difficult for enemies to see the toad above or below water.
4. The eyes and nostrils are located at the top of the head so that they are above water while swimming.
5. Eggs have no amnion or shell and hence have to be deposited in water lest they dry up.
6. Eyes are protected from water-borne dirt by nictitating membranes.

Adaptation of toads to terrestrial life

1. They breathe atmospheric air by lungs.
2. The skin has mucus glands all over the body surface; these secrete mucus to keep the skin moist and permit diffusion of air.
3. The skin is capable of changes in colour tone to give camouflage in different environments.
4. Poison glands are located on the dorsal surface of the skin to ward off predators.
5. Muscular limbs are developed and are suited to movement on land.
6. The tongue is sticky and can be flipped into the air to catch insects and carry them back into the mouth.

The Reptilia

Adaptation of lizard to terrestrial environment.

(A) Crocodile

(B) Camelion

(C) Snake

(D) Tortoise

Fig17.5 Diversity of Reptiles Retrieved from http://reptilesandamphibians.org/index.html

1. Use of lungs permits use of atmospheric air for respiration.
2. Dry scaly skin reduces evaporation.
3. Fertilisation is internal thereby eliminating the need for an aqueous medium for meeting of gametes.
4. Eggs have membranes and shells to protect the embryo from mechanical damage, microbial infection and desiccation. They also have a fluid-filled chamber (amnion) inside which the embryo can develop even when the egg itself is in a dry place.
5. Limbs are developed for movement on land.

The Aves/ Birds e.g. ostriches, chickens, eagles, flamingo and eagles

• They have beaks

• They have feathers, and the front pair of limbs is modified to form wings.

• They are endothermic.

• They have dry scales on their legs and their bodies are covered with feathers.

• They lay eggs with hard calcium shells.

Fig17.6 Chickens

•Adaptations of birds for flight

1. Feathers provide a dry and extremely light covering for the body, as well as good insulating layer.
2. Bones are light-weight because they are thin and hollow.
3. Vertebrae, pelvic girdle and wrist bones are fused so that they do not sway during flight.

Retrieved from "http://en.wikipedia.org/wiki/File:YellowLabradorLooking_new.jpg4. Are sacs in the body contribute to the bird's lightness.

5. Birds eat concentrated foods rather than bulky low calorie foods like grasses.

6. Food is digested rapidly and the residue egested within a relatively short time.
7. Teeth and heavy jaws are absent.

The Mammalia e.g. zebras, cats, cows, elephants and whales and Human beings (man)

Fig 17.7 Zebra Retrievedfrom**http://en.wikipedia.org/w/index.php?title=File:Plains_Zebra_Equus_quagga.jpg&oldid=460666343**

Fig 17.8 ElephantRetrieved from "http://en.wikipedia.org/w/index.php?title=File:African_Bush_Elephant.jpg&oldid=445311504"

Fig 17.9 CAT Retrieved from "http://en.wikipedia.org/wiki/File:AfricanWildCat.jpg"

Fig 17.10 A dog Retrieved from "http://en.wikipedia.org/wiki/File:YellowLabradorLooking_new.jpg4.

Fig 17.11Kangaroo Retrieved from "http://en.wikipedia.org/wiki/File:Kangaroo_and_joey03.jpg"

Fig 17.12 HUMAN BEING (MAN)

General adaptation of mammals to terrestrial life

1. Lungs enable mammals to use atmospheric air.
2. Homoiothermy ensures high sustained metabolic activity at all times.
3. Internal fertilization and viviparous reproduction (i.e bringing out the young alive) ensure proper nourishment and development of the young protected from desiccation and predators.
4. The hair and fur on the skin insulate the body against heat loss; sebaceous glands lubricate these hairs.
5. Keen sense organs enable mammals to search actively for food, and to avoid predators.
6. Sweat glands in the skin cool body on hot days.
7. Limbs are variously modified for different locomotory functions on land, such as for running, climbing, burrowing, walking.
8. Horny structures are present on skin for different functions e.g. claws for defence, hoofs and flashy sole pads for walking and running.

3.5 Activity

Observe the various specimens that represent the diversity of chordates. Be able to identify chordates to class, and state the distinguishing features of each class.

Observe preserved adults or prepared slides of larval sea squirts (tunicates).

Observe the model of the lancelet (Amphioxux or Branchiostoma). Identify the major structures, including the characteristics that are diagnostic of the phylum.

Observe the prepared slides of Amphioxus in cross section and/or whole mount. Then identify the major parts of the specimen.

Observe and identify the external structures of Superclass Agnatha (hagfish and lamprey).

Observe and identify the external structures of the Class Chondrichthes (shark).

Observe and identify the external structures of Class Osteichythes.

Observe and identify the major organs of Class Reptilia using the freeze-dried specimen of a turtle snake, and alligator

Observe and identify the major organs of Class Aves using the freeze-dried specimen of a pigeon or local

hen or chicken

In Text Questions

What is the function of homeothermy?

Answer: Homoiothermy ensures high sustained metabolic activity at all times

.4.0 Conclusion

This is the last phylum of the Animal kingdom. It contains animals with the highest complexities.

5.0 Summary

In this unit you have studied the habitat , diagnostic features , structure, classification and adaptive features of the phylum **.** Three subphyla make up the phylum these are the urochordata, cephalochordate and the vertebrata. The former two sub phyla are all marine habitat based while the vertebrates are found on land water and in the air. Main diagnostic feature of this phylum is the presence of the notochord. The vertebrates are so called because theyhave the vertebral column. Examples of animals in the phylum includes the Branchiostoma, lancelets the fishes , the amphibians, reptiles, birds and the mammals including man.

6.0 Tutor-Marked Assignment

Explain how these observable external features relate to their different environments or ways of life.

Classify chordates to their subphylum or class and describe the distinguishing characteristics of each

group.

Make well labeled drawings of all the specimens you. Have observed

Submit your books for evaluation and assessment

7.0 REFERENCES/FURTHER READING

"http://en.wikibooks.org/wiki/General_Biology/Classification_of_Living_Things/Eukaryotes/Animals/Phyla"

Category: General Biology

About Reptiles retrieved from http://reptilesandamphibians.org/index.html