

BIO 102
INTRODUCTORY BIOLOGY II
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BASIC PRINCIPLES OF ZOOLOGICAL NOMANCLATURE - TAXONOMY, CLASSIFICATION OR SYSTEMATICS.

Species or organisms that have many attributes in common are placed in the same genus.

Genera that have similar attributes are placed in the same family.

Families with common characteristics constitute or form an order.

Orders in turn are grouped into classes.

Classes that have similar features form a phylum

The different phyla form the animal kingdom

Sometimes we can have sub kingdom as well as sub phylum.

The full systematic position or classification of the common toad can therefore be given as:

Kingdom:	Animalia
Sub Kingdom:	Metazoa
Phylum:	Chordata
Sub Phylum:	Craniata
Class:	Amphibia
Order:	Anura
Family:	Ranidae
Genus:	Rana
Species:	Temporaria

GRADES OF ORGANISATION OR LEVELS OF ORGANISATION

Three grades of organization are recognized. The great majority of animals, like the mammal, are on the organ level: that is, their body functions are carried out for the most part by organs and organ systems e.g. the alimentary system, kidney, liver, pancreas, reproductive organ, sense organ, skin etc.

At the other end of the scale are single-celled organisms representing the unicellular level of organization. In these unicells or protists, the functions, which in higher forms are carried out by organs and organ systems, must be performed by organelles within the single cell.

Between these two extremes are primitive multicellular animals at the tissue level of organization e.g. such animals include coelenterates, like Hydra.

Cells → Tissues → Organs e.g. skin

A BRIEF INTRODUCTION OF THE VARIOUS ANIMAL PHYLA

Kingdom: Animalia

Sub-Kingdom: Protozoa

Phylum: Protozoa e.g. Amoeba, Euglena, Paramecium, Trypanosome
Sub-Phylum: Metazoa

Phylum: Coelenterata e.g. Hydra, Obelia
Phylum: Platyhelminthes e.g. tapeworm
Phylum: Nematoda(round worm) e.g. Ascaris
Phylum: Annelida(ringworm) e.g. Nereis, earthworm, leeches
Phylum: Mollusca e.g. Snail, Octopus
Phylum: Arthropoda e.g. mosquito, cockroach
Phylum: Echinodermata e.g. starfish, sea cucumber
Phylum: Chordata e.g. fish, frog, man.

ANIMAL DIVERSITY

INVERTEBRATES: THE ANIMAL KINGDOM

They have exoskeleton and the skeleton could be made up of any structure even combination of particles.

They are divided into Phyla.

THE PHYLUM PROTOZOA

FEATURES-- they are unicellular

They are very small and cannot be seen with the naked eyes.

They are microscopic. They have organelles which are not divided into tissues-hence they are called organelles (organs in animals). They have respiratory organelles

REPRODUCTION: - Asexual and sexual method. Asexual is by binary and cyst format. Sexual method is by the fusion of gametes.

LOCOMOTION: - they move by either pseudopodia, cilia or flagella.

They have one or more nuclei.

Nucleus is for the general well being of the animal not for a particular sect.

NUTRITION: - Holophytic, holozoic, parasitic or saprophytic.

The phylum has four classes.

- 1 Sarcodina or Rhizopoda _____ pseupodia
- 2 Mastigophora _____ flagella
- 3 Ciliophora _____ cilia. Depending on the type or method of locomotion
- 4 Sporozoa _____ parasitic _____ no external organelles

CLASS: Sarcodina e.g. Amoeba.

Characteristics: Principal phase Amoeboid

No shell, exoskeleton

Lobose (blunt) pseudopodia

Method of reproduction – binary fusion

HOW AMOEBA ILLUSTRATES THE CHARACTERISTICS OF LIVING THINGS

FEEDING: Amoeba is found in ponds and feeds on smaller organisms e.g. diatoms. It engulfs its food with the pseudopodia and absorbs it into the endoplasm. The unwanted material is ejected into the water through the ectoplasm because there is no special organelle for this purpose but the food vacuole.

MOVEMENT: It makes use of its pseudopodia by producing it in any direction.

RESPIRATION: By taking oxygen from the water and diffusing Carbon dioxide from the water through the ectoplasm.

EXCRETION: This is by osmoregulation. It excretes by discharging the waste products through the contractile vacuole.

IRRITABILITY: The whole body is sensitive and feels the environment in which it is.

REPRODUCTION: Asexual and sexual method.

Asexual	Binary and cyst formation
Sexual	Fusion of gametes.

CLASS: MASTIGOPHORES e.g. Euglena
SUB CLASS: Phytomastigina e.g. Euglena
SUB CLASS: Zoomastigina e.g. Trypanosoma
 This class has both properties of plants and animals.

LIFE HISTORY OF TRYPANOSOMA
 It has two hosts. They are vertebrate man and tsetse fly.

CONTROL METHODS

To control trypanosome, you have to control the vectors i.e. tsetse fly, hence, you have to know the life histories of the two vectors, tsetse fly and man in order to know when to attack the vectors.

LIFE HISTORY OF TSETSE FLY

They are Oviparous.



CLASS: CILIOPHORA e.g. Paramecium

They possess cilia

They possess mega and micro nucleus

They reproduce by binary fission and by conjugation

ORDER: Holotricha – uniform cilia whereas in others the cilia are restricted to certain parts of the body.

PARAMECIUM

PHYLUM: Protozoa

CLASS: Ciliophora

ORDER: Holotricha

SPECIES: Paramecium

CLASS: Ciliophora P. Caudatum

Differentiation

Cilia – locomotion and nutrition (around the oral groove)

- Trichocyst – anchoring and attacking
- Meganeucleus – somatic activities
- Contractile vacuole – excretion and osmoregulation
- Food vacuole – digestion
- Pellicle – covering – a permanent shape
- Myonemes – contractile – squeeze through narrow passages
- Cytostome – point of ingestion
- Undulating membrane, oral groove, gullet – feeding purposes
- Anal spot – point of defaecation

FEEDING OF PARAMECIUM

Digestion and absorption of food particles takes place all over the body and finally the waste materials are egested through the anal spot.

RESPIRATION: osmoregulation

CONJUGATION: Fusion of gametes, involving two paramecia of different strains. Each of the two strains is known as conjugant. The meganeucleus does not take part in conjugation, the meganeucleus disappear.

SIMILARITIES BETWEEN CONJUGATION AND SEXUAL REPRODUCTION IN THE HIGHER METAZOA

CONJUGATION	SEXUAL REPRODUCTION
1. Individuals of different strains	Male and Female
2. Meiotic formation of haploid gametic nucleus	Haploid gametes formed by meiosis
3. Fusion of two gametic nuclei which differ in size and behaviour to form a zygotic nucleus	Fusion of two dissimilar gametes to form zygote

CLASS: Sporozoa e.g. Plasmodium vivax

Characteristics

- 1. Parasitic
- 2. No external organelle of locomotion
- 3. No meagnucleus

It causes malaria fever. It has two hosts, mosquito, vector, man.

The female mosquito sucks blood and takes in malaria from where it sucks blood and transfers it to another person by biting that one. This is how malaria is spread.

Polymorphs of plasmodium

- 1. Trophozoites in the liver of man
- 2. Shizozoites in the blood cell
- 3. Sporozoites in the saliva of mosquito
- 4. Sporozoites in the blood of man.

Control of Malaria parasite

1. Treatment of infection in the patient _____ drugs.
2. Prevention of infection. _____ eradication of the vector.
3. Control of the vector _____ life history.

Treatment of infection

The effect is known when the symptoms appear on the patient. And treatment is by taking tablets of chloroquin, primaquine etc.

Prevention of infection

This is done by eradicating the vector by clearing the bush etc. and taking care of ourselves from being bitten by mosquitoes, cover up yourself at midnight.

Control of infection

With the knowledge of the life history of the sporozoites, we know that effect of mosquito bite is not immediately known, but after 8-10 days when the trophozoites might have been developed in the liver, then we take drugs to kill the trophozoites, thus preventing them from growing further.

2. Knowledge of the life history of mosquito can also help in control. Egg – larva – pupa – adult. We can control the larva stage by pouring oil on the eggs on water, thus preventing them from proceeding to pupa stage.

3. Introduction of fishes that will eat the larvae and introduction of D.D.T (insecticides to kill adult mosquitoes.)

Phylum: Coelenterata ----- metazoan.

Characteristics:

1. They are multi cellular animals.
2. They have two body layers i.e. diploblastic ectoderm and endoderm with mesogloea in between i.e. the two body layers are separated by a structureless, jelly-like layer called mesogloea.
3. They possess a body cavity called enteron, hence, coelenterons.
4. There is only one opening ---- the mouth, there is no anus.
5. The mouth is surrounded by tentacles.
6. They possess nematocysts ---this is for defense and for food captures because the nematocysts contain poison and they are ejected out of the body.
7. They reproduce asexually by budding and sexually by fusion of gametes.
8. No excretory or respiratory tissue.
9. Some are solitary, while some are colonial.
10. Some exhibit polymorphism.
11. They are mostly marine.

They are subdivided into two sub – phyla.

Sub – phylum I Cnidaria – possess nematocysts, locomotion by muscular activity. E.g. hydra, obelia, physalia (Portuguese man of war), vellela, jelly fishes.

Sub – phylum II Ctenophora – no nematocysts, locomotion with the help of cilia. E.g. beroe, pleurobrachia.

Sub – phylum Cnidaria – has 3 classes

Class: Hydrozoa e.g. obelia, hydra.

1. They are solitary or colonial forms with both polyp and medusa forms in the life history.

Order: Hydrida e.g. hydra

Solitary, polyps

No medusoid stage.

Possess hollow tentacles

No coenosarc or perisarc (differentiation of body into layers.)

Order: Calyptoblastea e.g. obelia, colonial, possess both polyps and meduloid stage.

Possession of coenosarcs and perisarc

They exhibit polymorphism – polyp or feeding zooid hydranth.

Asexual reproduce zooid called gonozoid which bud the medusa.

Sexual___ sexes are separate but not externally distinguishable. They are 4 gonads in a medusa.

The blastostyle or gonozoid is the reproductive polyp, which has lost the tentacles, mouth and the capacity to feed, and become specialized for asexual reproduction. Each one arises as a hollow extension of the coenosarcs, which is enclosed in a flask- shaped extension of the perisarc called the gonotheca, with a distal aperture. A blastostyle grows at the base of a branch of the stem carrying a hydranth. Along the sides of the blastostyle medusae-buds are formed, which on maturity separate off and leave the gonotheca through its aperture to swim away from the colony (thus disseminating the species).

Phylum Platyhelminthes e.g. flatworms

Characteristics:-

1. Triploblastic
2. Dorsoventrally flattened body
3. Bilaterally symmetrical
4. Acoelomate
5. Ciliated ectoderm in free living forms
6. They have suckers and hooks
7. They have thick cuticle
8. Digestive system incomplete, no germs
9. Well developed circular and longitudinal muscles
10. There are spaces between organs filled with parenchyma ----- a form of connective tissue
11. Platyhelminthes have simple sense organs like eye-spots
12. Excretory system consisting of two longitudinal canals which branch and terminate in flame cells. (Flame cells are ciliary of flagellory structures on the upper part of the cell lumen.)

13. No respiratory, circulatory or skeletal system.
14. They are mostly hermaphrodite with direct development in some but indirect in some parasitic forms.
15. Possession of proglottides in some form.
16. Ability to regenerate.

There are three classes of platyhelminthes

Class Turbellaria e.g. Planaria

They are free – living forms
 They have ciliated ectoderm
 No proglottides, no hooks and suckers
 They are capable of regenerating
 Sense organs are frequently well developed

Class Trematoda (parasites) e.g. flukes

They are flat and leaf – like shaped with suckers for attachment.
 They possess thick cuticle for clinging.
 No ciliated ectoderm
 There are some backwardly directed spines e.g. fasciola.

Order Monogenea (heterocotylea)

They have no alteration of hosts
 Their anterior sucker is poorly developed or absent
 Posterior sucker is well developed.
 No larva stage e.g. polystomium.

Order Digenea (Malacotylea) e.g. Fasciola hepatica (liver fluke.)

There is alteration of two hosts
 Well developed anterior sucker.
 Indirect development e.g. snail and sheep.

Class III Cestoda e.g. Tapeworm

They are extreme endoparasites
 They have gut, suckers and hooks
 They have two hosts ___ pig and man
 Very thick cuticle
 Form proglottides.

Structural, physiological and reproductive modifications of Fasciola to the parasitic mode of life

1. Flat shape for early adaptation in the host intestine, presence of suckers, for attachment.
2. Hermaphrodite, no need for searching for opposite sexes.
3. Thick cuticle, for protection against enzyme actions from the host.

4. Anti – enzymes produced, for protection against enzyme actions from the host.
5. Backwardly directed spines, for early adaptation in the host intestine.
6. Production of large numbers of eggs, to make sure of getting offsprings.
7. Possession of two hosts, for long survival of thee Fasciola (parasite).
 - a. Cilia in miracidia larvae
 - b. Penetrating gland for easy entrance into its hosts.

Each larva stage with morphological adaptations to enable them survive the ordeal during their brief sojourn in the outside world.

- c. Tailed cercaria produced
- d. Ability of cercaria to encyst, to ensure survival.
- e. Possession of eyespot to know the right host to infest.
- f. There is polyembryony, ability to produce.

Many larval stages develop asexually to balance the mortality rate when exposed to hazards.

EFFECT ON THE HOST

It affects the liver of the sheep and when they are many they can kill the sheep. But they do not affect man.

PARASITIC ADAPTATIONS OF TAENIA SOLIUM

1. Possession of hooks and suckers, for attachment.
2. Flat shape, for easy existence in the host.
3. Thick cuticle, for prevention of enzymes produced by the host.
4. No digestive system, because it is in the environment of digested food which it depends on.
5. Nervous, locomotory system and excretory system reduced, because no need for all these as its well situated.
6. Hermaphrodite, no need for search for opposite sexes.
7. Production of large numbers of fertilized eggs, for assurance of getting offsprings.
8. Regeneration, for survival of the parasite.
9. Two hosts, for survival of the parasite.
10. Encystment of oncosphere and cysticerus, for survival of the parasite.
11. Anaerobic respiration, because it exists in an environment of low oxygen, it respire anaerobically.
12. Anti-enzymes, prevention against enzymes actions of the host.

Effect on the host – man

It causes taeniasis.

The symptoms i.e. effects are

1. Sharp abdominal pains.
2. Constipation
3. Vomiting
4. Indigestion
5. Loss of appetite and nervous disorder
6. Hunger, loss of weight

Phylum NEMATODA (roundworms)

They are thread-like, cylindrical, round worms. They are triploblastic acoelomate animals. They are bilaterally symmetrical and unsegmented. There is a peculiar perivisceral cavity. The body is covered by a smooth non-chitinous cuticle. There is a single layer of longitudinal muscle underlying the epidermis. They are divided into four quadrants. The excretory system consists of two intracellular tubes with a single excretory pore. The alimentary canal is simple straight and opens by a mouth and an anus. Sexes are usually separate and gonads are tubular. No vascular or respiratory system. The cilia are absent even in the developmental stage.

Classification

Class Ascarididae e.g. Ascaris.

They have between three to six lips around the mouth. Males have curve posterior ends while female ends are straight. They have two spicules, they have no copulatory bursai.

Class Strongylidae e.g. Ancylostoma

These are nematodes with simple mouth without papillae. The males have two copulatory spicules and three bursai for ejaculation.

This phylum is one of the largest phyla in the animal kingdom as regards number of individuals and species. Its members live either freely in the sea, soil or decaying organic matter, or parasitically on other animals as well as plants i.e. they are parasitry both plants and animals. In spite of their very wide dispersal, their anatomy is remarkably simple and uniform.

Phylum ANNELIDA

Characteristics

1. Metamerically segmented worms.
2. Body wall with well developed outer circular and inner longitudinal layers of muscle with glandular epidermis.
3. Transparent thin, moist cuticle
4. Possession of chitinous chaetae which are borne on parapodia in some.
5. Possession of COMPLETE DIGESTIVE SYSTEM.
6. Respiration by skin or gills
7. Excretory system consists of segmentally arranged nephridia.
8. Well developed nervous system
9. May be hermaphrodite or of separate sexes

10. Presence of a trocophore larva in some, others have direct development.
11. Closed blood vascular system with haemoglobin.

There are three main classes

1. Class Polychaeta e.g Nereis
2. Class Oligochaeta e.g. Earthworm
3. Class Hirudinea e.g. Parasites, leeches

Class Polychaeta

Characteristics

1. Possession of parapodia on which are borne numerous chaetae
2. Possession of distinct head with eyes, palps and tentacles, cephalisation
3. No clitellum
4. Separate sexes
5. They are mostly marine.
6. They have trocophore larva.

Class Oligochaeta

Characteristics

1. No parapodia
2. Few setae
3. Possess clitellum
4. They are hermaphrodite
5. They have direct development
6. Their head is not clearly distinct.

Class Hirudinea

Characteristics

1. They are ectoparasites
2. Possession of anterior and posterior suckers
3. Body with fixed number of segments which is subdivided into annuli
4. No parapodia or chaeta

5. They are hermaphrodite, direct development.
6. They develop clitellum when sexually mature.
7. They have direct development.

Phylum ARTHROPODA

Characteristics

1. Triploblastic, coelomate, metametrically segmented.
2. Jointed appendages modified for various purposes.
3. Exoskeleton of chitin
4. Body usually divided into 3 regions, head, thorax and abdomen.
5. Possession of striated and non-striated muscles
6. Complete digestive system with mouth-parts for different methods of feeding
7. Open blood system, haemocyanin which are blue in colour
8. No nephridia
9. No cilia except in peripatus
10. Respiration is through body surface, spiracles, trachea, gills or lung books
11. Excretory system by green or antennary gland in aquatic ones and malpighian tubules in terrestrial ones.
12. Well developed nervous system
13. Sensory organs well developed consisting of eyes, antennae and antennules, balancing organs and in some auditory organs
14. Pronounced cephalisation with definite anterior end where sensory organs are concentrated.
15. Sexes nearly always separate
16. Some show metamorphosis

There are many classes of arthropods