BIO 102 SUMMARY

BIO 102 SUMMARY

GENERAL BIOLOGY II

COURSE OUTLINE

1. Principles of Classification

2. Phylum Protozoa

3. Phylum Porifera

4. Phylum Coelenterata (Cnidaria) and Platyhelminthes 5. Phylum Nematoda

6. Phylum Annelida

7. Phylum Mollusca

8. Phylum Echinodermata 9. Phylum Arthropoda

10. Phylum Chordata

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TOPIC ONE: PRINCIPLES OF CLASSIFICATION

Classification is placing objects into groups. Each group is called a taconomical group or a taxon (pl=taxa). Carolus Linnaeus proposed the hierarchical system of classification: KP-COF-GS (Kingdom, Phylum, Class, Order, Family, Genus, Species). Species are members of a population that can interbreed freely to produce viable and fertile offsprings. When different species are breeded, they produced sterile offsprings. Species possess the highest number of smiliarities.

TYPES OF SIMILARITIES

1. HOMOLOGY: Anatomical similarities that exist due to a common ancestor

e.g. forelimbs of cat, bear, human (arm) and bird (wing). They are all similar

anatomically due to a common ancestor.

2. ANALOGY: Similarities that are due to the same function but not from a

common ancestor. Wings of a bird (bony structure) ans wings of a butterfly

(fluid) are analogies. This may be due to homology or homoplasy.

3. HOMOPLASY: This is the opposite of homology. Homoplastic structures are

non homologous structural similarities that the common ancestor did not possess. These similarities are due to independent development in the evolutionary lines.

REASONS FOR HOMOPLASY

A. PARALLELISM: Also known as parallel evolution, this is when the common ancestor had an initial anatomic feature that led to the similarities though not possessing them. An example is the common ancestor of large body sized south American and African monkeys is a much smaller monkey which is reminiscent (or a copy) of these descendant species.

B. CONVERGENCE: Also known as convergent evolution, this is when the similarities come from a more distant common ancestor that did not have the initial trait that led to it e.g. the similar appearance and predatory behaviour of the North American wolf (a placental mammal) and Tasmanian wolf (an Australian marsupial like kangaroo) are due to a common ancestor that lived 125 million years ago.

C. MERE CHANCE: Homoplasy can merely occur on its own.

CLASSIFICATION OF ANIMALS

BRANCHES: Mesozoa, Parazoa (Phylum Porifera), Metazoa (true multicellular animals). They are further divided into two:

GRADE: Radiata (Phyla Cnidaria and Ctenophora) and Bilateria. Bilateria are further divided into three based on the presence of body cavity (coelom).

DIVISION: Acoelomates (Phyla Platyhelminthes and Nemertina), Pseudocoelomates (Phyla Nematoda, Rotifera etc) and Eucoelomates. These animals with true body cavity are classified into three based on formation of mouth.

SUBDIVISION: Protostomia (mouth is formed from blastophore) e.g Phyla Annelida, Mollusca, Arthropoda etc, Lophophorata (filter feeders) e.g Phylum Phoronida etc amd Deuterostomia e.g Phyla Echinodermata, Hemichordata, Chordata etc.

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Principles of Classification

1. For binomial nomenclature, generic name comes before specific name.

2. When typed, write them in italics. When handwritten, underline them.

3. When already written before, abbreviate e.g F.domestica

4. When mentioning for the first time, give the authority and the year it was

named e.g Felix domestica (Hassan, 1880)

5. Note that trinomial nomenclature is used to classify subsecies e.g Locusta

migratoria migratorioides.

MORE POINTS

1. Natural classification is based on phylogenetic relationship.

2. Numerical taxonomy is numerical differentiation of similarities and differences.

3. The method of naming plants and animals is Nomenclature.

4. The act of naming organism by an adopted system is Taxonomy.

5. Pseudocoelom is present in Aschelminthes or Roundworms.

TOPIC TWO: PHYLUM PROTOZOA ('pro' - before', 'zoa' - animals)

They are multicellular acellular animacules under Kingdom Protista which are unicellular, having one or more nuclei, an outer ectoplasm and inner endoplasm, contractile vacuole for osmoregulation/excretion and different locomotory organelles. Examples are Euglena, Amoeba, Paramecium, Plasmodium Podophyra etc. CLASSES (Based on type of locomotory organelles)

1. Class SARCODINA: Sarcodines have temporary cytoplasmic extensions (pseudopodia) for movement. They have thin and flexible pellicle, feed through pseudopodia, may have flagella during certain stages and may have external shell (folaminiferan) or skeleton (radiolarian) e.g Amoeba proteus

2. Class MASTIGOPHORANS: Mastigophorans whether phytomastigophorans (Euglena, Chlamydomonas) or Zoomastigophorans (Trypanosome, Leishmania, Opalina) all have flagella, one nucleus, thin pellicle, free-living or parasitic. In zoomastigophorans, a flagellum is free while the other is attached to the pellicle to form an undulating membrane e.g. Trypanosome.

3. Class CILIATA: Ciliates possess cilia and have hard pellicle, distinct cytosome (mouth), dimorphic nuclei (macronucleus for metabolism and micronucleus for reproduction), trichocysts (pellicular structures for protection), and some may live attached to their substrate and they are called suctorians. An example of a ciliate is Paramecium.

4. Class SPOROZOANS: They are parasites with no locomotory organelle. Their adults move by gliding, twisting and bending. Most are single-celled, parasitic and form spores. They have a apical complex. They could be apicomplexan parasites (form distinctive oocysts containing

infective sporozoites) e.g. Plasmodium falciparium, microsporan parasites (form unicellular spores containing coiled polar tubes), haplosporidian parasites (form unicellular spores without polar filaments) and paramyxean parasites (form unique spore-within-spore arrangement).

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MORE POINTS

1. Stenor spp does not possess flagellum.

2. Ciliates are thought to have evolved from the flagellates.

3. Glossina spp (tsetse flies) is the vector of sleeping sickness in man.

4. Opalina is an animal-like protozoan.

5. The unstable body form in Ameoba proteus is due to lack of rigid pellicle.

6. Parasitic animals have well developed reproductive system.

TOPIC THREE: PHYLUM PORIFERA ('porus' - pore, 'fera' - bearers)

They are the lowest multicellular animals in Kingdom Animalia. Their pores are known as ostia and the water outlet known as osculum. They are sessile, have a central cavity known as spongocoel, diploblastic, digest food in choanocytes, have power of regeneration (replacement of lost parts) and no specific nervous system. BODY PLANS: Asconoid (most basic; water is pumped through the ostia and leaves through the osculum; digestion takes place in spongocoel lined with choanocytes), Synconoid (more complex; water is pumped through the ostia goes into a network of canals before leaving through the spongocoel; digestion takes place in the canals lined with choanocytes) and Leuconoid (most complex; water is pumped through the ostia into the canals before leading to digestive chambers and leaving through the osculum; no real spongocoel; digestion takes place in digestive chambers lined with choanocytes).

CLASSES (Based on type of spicules- needle-like structures that provide skeletal support)

1. Class CALCAREA: They have calcerous spicules made of calcium carbonate; all three body plans present, cylindrical and radial symmetry e.g. Scypha, Clathrina

2. Class HEXACTINELIDS: They have six-rayed siliceous spicules made of silicates; synconoid or leuconoid; cylindrical and radial symmetry e.g Euplectella, Hyalonema

3. Class DESMOSPONGIAE: True sponges; have spongin fibres and siliceous spicules; leuconoid; asymmetrical and cylindrical e.g Spongia, Spongilla

MORE POINTS

1. The true sponges belong to the class Desmospongiae

2. Binary fission does not take place in sponges.

3. The gastric cavity of sponges (spongocoel) is lined with choanocytes

4. Principal excretory product of sponges is ammonia.

5. Respiration of sponges is due to presence of choanocytes.

6. Regeneration can be best described as replacement of lost parts.

TOPIC FOUR: PHYLUM CNIDARIA AND PLATYHELMINTHES

PHYLUM CNIDARIA ('cnidos' - stinging nettle)

They are diploblastic eumetazoans with stinging cells called nematocyst (found in the cnidocytes), have polyp (sessile - hydroid [hydra-like] with mouth-up orientation)

and medusa (motile- umbrella or bell-shaped with mouth-down orientation) forms, outer epithelium (ectodermis), inner epithelium (gastrodermis) and central cavity called coelenterata, have a remarkably power of regeneration.

CLASSES (Based on their appearance)

1. Class HYDROZOA (=water animals): Mostly marine and colonial, have both polyp and medusa, medusa is craspedote (has velum) though absent in few, polyp is predominant, colonies are polymorphic (different types of zooids) e.g. Hydra, Obelia, Physalia, Bougainvillia.

2. Class SCYPHOZOA (= cup animals): True jelly fish; all marine, medusa is predominant, mouth is surrounded by four oral arms, polyp is scyphistoma which produces juvenile medusa called ephyrae e.g Aurelia (jelly fish), Pelagia, Portugese man o'war (Physalia physalis)

3. Class ANTHOZOA (= flower animals): All marine, largest class of cnidarins, only polypoid forms are present, mouth leads into a tubular pharynx called stomadaeum e.g. sea anemone, sea fan, whip coral, sea pen, soft coral etc.

4. Class CUBOZOA (= cube animals): Amazing box jellies with complex eyes, most venomous of all cnidarians, unusual in having image-forming eyes, have separate sexes, planula larvae develop into a polyp which may in turn form more polyps to create a colony. Each polyp then transforms into a single medusa e.g. Carydea marsupialis, Chironex yamaguchii, Chironex fleckeri

PHYLUM PLATYHELMINTHES (FLAT WORMS)

They are bilaterally symmetrical and triploblastic, no body cavity or coelom (acoelomates), lack an anus, central nervous system and are hermaphrodites. Mouth is usually located at the anterior end or mid-body on ventral surfaces, excrete through flame cells and posses a simple nervous system.

CLASSES (Based on their behaviour/appearance)

1. Class TURBELLARIANS: They are free-living flatworms that create a "turbulence" by beating of their cilia. A large class of ribbon-shaped flatworms found primarily in the bottom of the ocean e.g Planaria

2. Class MONOGENEA: They are named so because they reproduce only sexually. They are parasitic flatworms that spend their life cycles on the outside of the same fish, turtle or amphibians (simple life-cycle), possess hooked attachment structures e.g. Entobdella soleae, Polystoma

3. Class TREMATODA ('trematos' = pierced with holes): They are parasites of a high order of complexity. Also called flukes, they have leech-like bodies with a sucker, the organ of attachment (trematos). They have a gut and a well-developed reproductive sysystem.

a. Subclass Digenea (reproduce sexually and asexually) is a large class of trematodes that are endoparasites and have two suckers (oral and ventral), complex life-cycles e.g Fasciola gigantica, Fasciola hepatica, Schistosoma mansoni etc.

b. Subclass Aspidogastrea ('aspis' = shield, 'gaster' = stomach) is a small group of about 80 species, all aquatic with indirect life-cycle e.g Aspidogaster

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4. Class CESTODA (=belt): Also known as tapeworms, they have a scolex (head) and proglottis. Each animal has 3000 - 4000 and they may havd contain several ovaries and 1000 distinct testes. Middle proglottides are mature while posterior/gravid proglottides has ripe eggs.

MORE POINTS

1. The somersaulting coelenterates belong to the class Hydrozoa.

2. The absence of a central nervous system in the coelenterates is replaced by

nerve nets.

3. A cnidarian with two body forms alternated in their generation is Obelia.

4. Coelenterates share most characteristics with sponges except parasitism.

5. A stage in the life cycle of Fasciola spp that infect snail is miracidium.

6. Small intermediate host is necessary for the transmission of Fasciola spp

(liver fluke).

7. Taenia spp is not leaf-like.

8. Eggs of tapeworm are stored in the gravid proglottids.

9. Animals of platyhelminthes show blind sac body plan.

10.The parenchyma cells found in platyhelminthes originate from mesoderm.

TOPIC FIVE: PHYLUM NEMATODA (Roundworm/threadworm, "nema" = thread) They are mostly widespread and abundant of all metazoans. Helminthology is the study of animal parasitic nematodes while Nematology is the study of plant parasitic nematodes. Majority are free-living while some are parasites. Their body is covered with a tough, smooth and elastic cuticle, have anus, male smaller and thinner than female, pseudocoeloomates i.e there is a space/cavity between the endoderm and mesoderm. They have buccal cavity with lips, teeth, stylet amd jaw. Excretion is through RENETTE gland cells or via the digestive system. They have nerve rings and cords, no respiratory organ, separate sexes, oviparous or ovoviviparous, high incidence of parthogenesis (mating without sperm nucleus used) while some are hermaphrodites.

CLASSES (Based on caudal sense organ or phasmid)

1. Class ADENOPHOREA (Asphamidea - those without phasmids).

2. Class SECERNENTEA (Phasmidea - those with phasmids)

Also, there are 17 orders in this phylum. Important orders are:

● Order Ascaroidea - Ascaris

● Order Filarioidea - Wuchereria

● Order Trichuroidea - Trichuris

EXAMPLE: Ascaris lumbricoides (common name: roundworm)

Phylum Nematoda, Class Secernenta, Order Ascaroidea, Family Ascaroidea, Genus Ascaris Species lumbricoides

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TOPIC SIX: PHYLUM ANNELIDA (= little rings)

They are coelomates where majority of the mesoderm that lines the coelom develops into muscles which aid locomotion and peristalsis. They have well-developed vascular system, triploblastic, bilaterally and metamerically segmented, presence of central nervous system, excretory organ is nephridia, have chaetea except leeches. Larvae are called trochopore.

CLASSES (Based on number of chaetae/common name)

1. Class POLYCHAETA (= many chaetae): Largest class and mostly marine

dwellers, different from other annelids by a well differentiated head with specialised sense organs, paired appendages called parapodia on most segments, no clitellium (used for copulation), have many setae usually arranged in bundles on parapodia. They are further grouped into two: Sedentary polychaetes which spend much or all of their time in tubes or permanent burrows and Errant polychaetes are free-swimming pelagic forms e.g. clam worms, Nereis diversicolor

2. Class OLIGOCHAETA (= few chaeta): They include the familiar earthworms. Most are terrestrial or freshwater forms. Setae are less numerous and there is no parapodia. Most are scavengers while some are parasites. Earthworms are monoecious (hermaphrodites - male and female on the same animal).

3. Class HIRUDINEA (leeches): They occur predominantly in freshwater habitats but are a few are marine while some are terrestrial. They are more abundant in tropical countries and have a fixed number of segments (34, 15 or 28 in some group), no parapodia or setae, have suckers for attachment, hermaphroditic but cross-fertilize during copulation, also parasites, active predators or scavengers e.g. medicinal leech, Hirudo medicinalis,.Placobdella

Cephalization: An evolutionary trend in which the neural and sense organs become centralized at one end (the head) of an animal.

TOPIC SEVEN: PHYLUM MOLLUSCA ("mollis" = soft)

They are triploblastic, bilaterally symmetrical, non-metamerically segmented, head has 2 pairs of tentacles and two eyes with ventral, muscular and flat foot used for creeping.

CLASSES (Based on type of shell/foot)

1. Class MONOPLACOPHORA (= bearing one plate) e.g. Neopilina

2. Class POLYPPLACOPHORA (= bearing many plates) e.g. chitons

3. Class BIVALVIA (= two shells) e.g. clams

4. Class GASTROPODA (= stomach foot) e.g. snail

5. Class SCAPHOPHODA (=boat foot) e.g. Elephant tusks shell

6. Class CEPHALOPODA (=head foot) e.g. squids, octopus

CLASS GASTROPODA: They are the largest class of molluscs, possess head bearing tentacles and eyes, radula and jaw well developed, shell is univalve (one piece), mantle covers only the visceral mass while foot and head are exposed, torsion (ability of the visceral mass or internal structures to rotate anti-clockwise

through 1800) is possible. An example is the Giant African land snail (Archachatina

marginata).

TOPIC EIGHT: PHYLUM ECHINODERMATA (=SPINY SKIN)

They are the closest relative of the chordates. Their skin contains calcerous spines and ossiclea in the dermis. They lack head and radiate five arms. They posses a water vascular system, lack excretory organ, have poor blood system and separate sexes.

CLASSES (Based on their appearance)

1. ClassASTEROIDEA(star-like)

2. Class OPHIUROIDEA (snake tail)

3. Class ECHINOIDEA (spiny)

4. Class HOLOTHUROIDEA (violent expulsion)

5. Class CRINOIDEA (hair)

CLASS ASTEROIDEA (Starfish): The occur at the sea edge and burrow in sand. The surface bearing mouth is the oral surface while the upper surface is the anorak surface. They reproduce asexually by regeneration or sexually by release of gametes. Zygote develops into bipinnaria larva which later becomes brachlolaria.

TOPIC NINE: PHYLUM ARTHROPODA (=JOINTED LEGS/APPENDAGES)

Arthropods are the largest phylum because they have the largest number of species, widespread in habitat, exploit greatest variety of food sources and defend themselves against enemies. They are triploblastic, bilaterally and metamerically segmented, epidermis secrets chitinous exoskeleton or cuticle which moults during growth. Excretion is by mallpighian tubules

CLASSES

1. Sub-phylum ONYCHOPHORA (claw bearers): They are terrestrial

caterpillar-like animals which has both properties of annelids and arthropods

e.g. Peripatus

2. Sub-phylum CHELICERATA (horn): Their body is divided into prosoma and

opisthosoma. Sexes are separate e.g. spider, scorpion, tick.

a. Class Merostoma: Primarily aquatic chelicerates with a long spinelike telson.

e.g. horse shoe crabs - limulus.

b. Class Arachnida: Orders are scorpoinida, pseudoscorpoinida, araneae

(spiders), and acarina (mites and ticks).

In scorpoins, opisthosoma is divided into a mesosoma and metasosoma which ends in a modified telson called a sting. Catches prey with pedipalps and chew them with chelicerae (claws).

In spiders, prosoma is demarcated from the opisthosoma by a waist or pedicel, repaired by trachea or lung books, predaceous and poison from chelicerae kills prey, web made from special abdominal glands.

In mites and ticks, body is rounded, no apparent body division, no external body segmentation, telson absent, legs modified for swimming, chelicerae have serrated cutting tips which help them suck blood.

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c. Class Pycnogonida

3. Sub-phylum CRUSTACEA (hard shell): Primarily aquatic arthropods whose

body is divided into three: head, thorax and abdomen. Sexes are separate. Green glands are for osmoregulation. Excretory product is ammonia. Classes are Branchiopoda, Ostracoda, Copepod, Branchiura, Cirripedia, and Malacostraca (crayfish, crab, shrimp, lobster, prawn) which has three orders: Isopoda, Amphipoda, and Decapoda (ten legs/ five pairs e.g crab, lobster etc)

4. Sub-phylum UNIRAMIA (a group)

a. Class Insecta: Their body is divided into head, thorax and abdomen. Major

groups are Apteryogota (wingless insects) and Pterygota (wingless forms)

which have 25 orders e.g Grasshopper.

b. ClassChilopoda

c. Class Diplopoda

d. ClassSymphyla

e. ClassPauropoda

TOPIC TEN: PHYLUM CHORDATA (= from the word, NOTOCHORD)

They all possess notochord either restricted to early development or present throughout life. They are bilaterally and metamerically segmented. Nerve cord is single, dorsal and tubular. End of cord forms brain.

CLASSES

1. Sub-phylum UROCHORDATA:

a. ClassAscidiacea

b. ClassAppendicularia

c. Class Sorberacea

d. Class Thaliacea

2. Sub-phylum CEPHALOCHORDATA: Fish-like e.g. Amphioxus

3. Sub-phylum VERTEBRATA

a. Class Cephalaspidomorphi e.g lampreys

b. Class Myxini e.g. hagfishes

c. Class Chondricthyes - fish-like, cartilaginous skeleton e.g. shark, ray, skate

d. Class Osteichythes - bony skeleton with swim bladder e.g. tilapia

e. Class Amphibia - moist skin e.g. frogs, toads, salamanders

f. Class Reptilia - dry skin with scales e.g. snakes lizards, alligators

g. Class Aves - scales modified into feathers e.g. birds

h. Class Mammalia - body covered with hair, mammary glands e.g. mammals