ANIMAL PHYLA

- The lowest metazoan phylum is **Porifera(pore bearers)**
- The animal nature of sponges was confirmed by **R.GRANT.**
- The level of organisation in sponges is **cellular level**
- Fresh water sponges belong to the families **Potamolepidae&Spongillidae.**
- Majority of the sponges are **asymmetrical**
- **E**cologically sponges are **benthic** animals
- The most distinguished feature of sponges is canal or water transport system
- The canal system is formed by **ostia(**inlets),spongocoel/Para gastric cavity and **osculum(**outlet)
- The functions of canal system are food gathering, gaseous exchange, removal of wastes, and transport of sperms.
- Sponges are filter feeders
- The cells that form the lining of spongocoel and canals are collar cells or **choanocytes.**
- The outer and inner layers of the body wall are respectively pinacoderm and choanoderm.
- The gelatinous matrix separating the two layers is **mesohyl**
- The type of nutrition in sponges is holozoic and digestion is **intracellular.**
- The supporting skeleton is formed either by calcareous or siliceous spicules or spongin fibers or both.
- The cells in a sponge act as independent units because there no nerve cells and sensory cells.
- Sponges are monoecious or hermaphrodites(same sponge produces both eggs and sperms)
- Sponges have archaeocytes (TOTIPOTENT), trophocytes, thesocytes, and, and myocytes in addition to porocytes, pinacocytes, and collar cells.
- Sponges have the power of regeneration. Asexual reproduction occurs by fragmentation.
- Fertilization in sponges is internal. The larval form of calcareous sponges is Amphiblastula,
- that of hexactinellida is Trichemella, and that of Demospongia is Parenchymula.
- Sponges are considered as evolutionary blind offshoot as no other group evolved from them.
- Sponges belong to the Sub kingdom PARAZOA

- Sypha, Leucopoenia and GRANTIA are calcareous sponges.
- The sponge that is given as precious gift to friends at the time of marriages and birthdays is Euplectella (Venus flower basket).
- The common name of Hyalonema is Glass rope sponge.
- The class of sponges that includes both marine and fresh water sponges is **Demospongia**
- The common name of Euspongia is Bath sponge.(skeleton as spongin fibres only)
- The class of sponges that includes only colonial sponges is Demospongia.
- Spongilla is a fresh water sponge

PHYLUM CNIDARIA

- Earliest eumetazoans to develop tissue level of organisation are Cnidarians
- The only fresh water cnidarian is HYDRA.
- Free swimming medusoid forms are scyphozoans
- All members are marine in Scyphozoa and Anthozoa
- The class of Cnidaria in which all are solitary and there are no colonial forms is Scyphozoa.
- The class of Cnidaria in which all members are polypoid and sessile is ANTHOZOA
- The cnidarian class in which both the basic forms i.e. polyp and medusa are present is HYDROZOA
- The most distinguished feature of cnidarians is the presence of cnidoblasts or cnidocytes.
- The cells that are useful in anchorage, food collection and defence are cnidocytes.
- The stinging capsules present inside the cnidocytes are nematocytes.
- The first animals to develop two germ layers (diploblastic) are cnidarians.
- The mouth is situated on a conical elevation called hypostome
- Blind sac body plan with a single opening through which ingestion and egestion take place is a feature of Cnidarians.
- The cavity that serves the functions of digestion and circulation is coelenteron or GVC.

- Digestion in cnidarians and flat worms is both extracellular and intracellular.
- Nerve cells and sensory cells appeared for the first time in cnidarians.
- A primitive diffuse nerve net is present in cnidarians.
- The cnidarians having both basic forms exhibit alternation of generations (metagenesis).
- Polyp produces medusae asexually whereas medusae produce polyps sexually.
- The non-cellular layer present between ectoderm and endoderm is mesoglea.
- Non-cellular mesoglea is present in HYDROZOA.
- Thickest mesoglea with amoebocytes is found in scyphozoans.
- Mesoglea with amoebocytes and connective tissue is present in ANTHOZOA.
- Cnidarians in which stinging cells are present only in ectoderm are Hydrozoans.
- Cnidarians in which stinging cell are present both in ectoderm and endoderm are scyphozoans and anthozoans.
- The origin of gonads in hydrozoans is ectodermal (unique).
- The origin of gonads in scyphozoans and anthozoans is endodermal.
- An example for metagenesis is OBELIA.
- Asexual reproduction in cnidarians occurs by BUDDING.
- The characteristic larva of cnidarians is PLANULA.(a ciliated free swimming larva)
- **Physalia (**Portuguese man of war) is a polymorphic hydrozoan.
- **Hydra, Obelia** and Physalia are Hydrozoans.
- Scyphozoans are commonly called 'jell fishes'.
- Aurelia (moon jelly) and Rhizostoma are scyphozoans.
- **Anthozoans** are commonly called sea anemones or sea flowers.
- Coelenteron is divided into 4 chambers and some canals in scyphozoans
- In anthozoans coelenteron is divided in to compartments by septa called mesenteries.
- Adamsia and Metridium are common sea anemones.
- Common name of Corallium **rubrum is red stone coral.**

- Common names of Gorgonia and Pennatula are respectively **sea fan and sea pen**

PHYLUM CTENOPHORA

- **Co**mmon names of ctenophores are sea walnuts or goose berries or comb jellies.
- Ctenophores are exclusively marine animals.
- Ctenophores resemble cnidarians in having tissue level, diploblastic condition and radial symmetry.
- Ctenophores differ from cnidarians in the absence of cnidocytes and in possessing colloblasts plates/lasso cells and eight external rows of ciliated comb plates. (Many, help in locomotion)
- Digestion in ctenophores is same as in cnidarians.
- Most of the ctenophores are bioluminescent forms.
- Ctenophores are monoecious or **bisexual** like **sponges, ascidians, earthworms**, and **leeches.**
- Ctenophores reproduce sexually only.
- Fertilization is external and development is **indirect.**
- Larva of ctenophores is **cydippid.**
- **Pleurobrachia and Ctenoplana** are **CTENOPHORES.**
- The balancing organ in ctenophores is **aboral** sense organ.
- The adult **Pleurobrachia** and **Hormiphora** bear two tentacles whereas **Beroe i**s tentacle less.

PHYLUM PLATYHELMINTHES (flat worms)

- The first triploblastic animals, the first animals to develop mesoderm, the first bilaterally symmetrical animals and the first animals to develop true muscles are flat worms
- The name Platyhelminthes was Proposed by Gegenbaur
- Flat worms are the first animals to evolve organ and organ system level.

- Flat worms are endoparasites except turbellarians and a few flukes.
- They show moderate cephalisation and unidirectional movement.
- As in cnidarians, flat worms have a GVC which communicates to the outside through a single opening that acts both as mouth and anus.
- Digestion in flat worms is both extra cellular and intracellular as in diploblastic animals.
- Organ systems that are absent in flat worms are respiratory and circulatory systems.
- Gutless flat worms are cestodes (tape worms).
- Flat worms with suckers and hooks are tape worms.
- Organs of osmoregulation and excretion are flame cells.
- Sexes are not separate. Fertilisation is internal. Development is indirect
- The sequence of larval stages in the Life history Of liver fluke is MIRACIDiUM---SPOROCYST--REDIA CERCARIA--.MTACERCARIA.
- Trematodes exhibit polyembryony (production of several embryos from a zygote).
- Flat worms that exhibit high degree of regeneration are turbellarians.
- Flat worms with ciliated epidermis and mucous secreting rhabdites are turbellarians (free living)
- They reproduce by both asexual & sexual methods.
- Larva of some marine flat worms is MULLERS' larva.
- Dugesia is a fresh water form.
- Convoluta is a marine flat worm which is an acoel.
- Trematodes are commonly called flukes.
- Body of flukes and tapeworms is covered by a syncytial tegument
- Flat worms with an oral sucker and an acetabulum/ventral sucker are flukes.
- Intestine in flukes is bifurcated
- Scientific name of liver fluke is **Fasciola hepatica.**
- Intermediate host of liver fluke is fresh water snail (Limnea).
- The primary host of liver fluke is SHEEP.

- Scientific name of blood fluke is **Schistosoma haematobium. It is unisexual and dimorphic. Male carries the female in its gynaecophoric canal.**
- The primary host of blood fluke is MAN.
- The intermediate host of blood fluke is Bullinus truncatus.
- A class of flat worms in which all are endoparasites is Cestoda.
- Segmented flat worms are tape worms.
- Segmentation in tape worms is **pseudo -metamerism**.
- Segments of tape worms are called **proglottids.**
- Larval forms of tape worms are HEXACANTH& CYSTICERCUS.
- Common name of **Taenia solium** is pork tape worm.
- Common name of **Taenia saginata is** beef tape worm.
- Scientific name of dog tape worm is Echinococus granulosus.
- The larva that is developed in striated muscles of pig is **CYSTICERCUS OR BLADDER WORM.**

PHYLUM ASCHELMINTHES

- Members of **Aschelminthes** are called round worms because the body is **circular** in shape.
- Some of them are free living either terrestrial or aquatic while most of the known forms are parasites in plants and animals
- Body cavity in nematodes is **PSEUDOCOEL.**
- A remnant of embryonic blastocoel is **PSEUDOCOEL.**
- A complete alimentary canal appeared for the first time in **NEMATODA.**
- An alimentary canal with **muscular pharynx** and **anus** in addition to mouth and intestine is Nematoda.
- Epidermis is **syncytial.**
- Collagenous cuticle is a unique feature of nematodes.
- Excretory system consists of **renette gland.**

- Nervous system includes circum enteric nerve ring with ganglia and nerves.
- Chemo olfactory receptors are amphids(present on labia)
- Caudal glandulo -sensory receptors are **Phasmids.**
- Sexuality: unisexual/dioecious, exhibit **sexual dimorphism**.
- Males are smaller than females and possess penial spicules (Equal in round worms & unequal in filarial worms). Fertilisation is internal.
- Larval form of round worm is Rhabditiform larva which performs **extra intestinal migration.**
- There are **4** moults in the life cycle. Maintaining constant number of cells in the adult body except in gonads is known EUTELY.
- **Trichinella** (trichina worm) andTrichiuris (whipworm) are aphasmid round worms.
- **Ascaris (**round worm**) Ancylostoma** (hookworm**) Enterobius (**pin worm) **Wuchereria** (filarial worm), are **phasmidians**.

PHYLUM ANNELIDA

- Annelids are either aquatic (marine or fresh water) or terrestrial animals**.**
- They are mostly free living and some like leeches are sanguivorous, intermittent ectoparasites.
- Annelids are the first triploblastic animals to evolve, true metamerism, true coelom, dermo- muscular body wall and circulatory system which is of closed type.
- The body is distinctly marked into segments called metameres both externally and internally.
- Neural system consists of paired ganglia connected by lateral nerves to a double ventral nerve cord.
- Nephridia are the organs of excretion and osmoregulation.
- Polychaetes to which Nereis belongs are dioecious.
- Oligochaetes (earth worms) and hirudineans (leeches) are monoecious.
- Fertilisation is external in polychaetes and earthworms whereas it is internal in leeches.
- Development is indirect in Dioecious annelids and direct in monoecious annelids
- Larval form of polychaetes is Trochophore.

- Earthworms and leeches together called clitellaria.
- The coelom in leeches is reduced due to the development of **botryoidal** tissue.
- Earthworms have permanent clitellum whereas leeches have temporary clitellum (formed during breeding season.
- Leeches do not show internal segmentation. Leeches have penis.
- **Hirudinaria** is a blood sucking leech.
- **Nereis** has lateral appendages called Parapodia.
- Earth worms excrete urea whereas aquatic annelids excrete ammonia.
- Most of the annelids have haemoglobin dissolved in plasma.
- Polychaetes are called 'bristle worms' where as earth worms and leeches together called 'girdle worms'
- **NOTE: Neris has numerous setae while earth worm has less setae and leech has no setae.**

PHYLUM ARTHROPODA

- Arthropods are triploblastic, bilaterally symmetrical, metamerically (heteronomous) segmented animals with jointed appendages.
- Tagmosis (fusion of segments into distinct functional regions) made its first appearance in Arthropoda.
- Cephalization in **Arthropoda** is more prominent than in **Annelida**
- Chitinous exoskeleton (one of the features for their success), haemocoel is the functional body cavity as in molluscs.
- Well-developed digestive system with coiled gut which is differentiated is to stomodaeum, mesodaeum and proctodaeum.
- Gills / gill books / trachea and book lungs as organs of respiration in different forms,
- Open type of blood vascular system, tubular dorsal heart are present
- Haemocyanin is common respiratory pigment as in Mollusca.
- Coxal glands, green glands and Malpighi an tubules are organs of excretion,

- Nitrogenous waste are **ammonia** (aquatic forms), **uric acid** (terrestrial forms) and **guanine** (spiders).
- The largest phylum in the kingdom Animalia is Arthropoda.
- The evolutionary acquisition of heteronomous metamerism, chitinous exoskeleton and jointed appendages is referred to as arthropodisation.
- The phylum in which striated muscles appeared for the first time is Arthropoda.
- Receptors are antennae (except chelicerates) simple eyes, compound eyes, Statocysts / Pectines etc.,
- Nervous system is with a distinct brain and a double ventral ganglionated nerve cord.
- Mostly unisexual, fertilization is internal in all terrestrial forms, either internal or external in aquatic forms, except spiders (guanine).
- Eggs are centrolecithal, cleavage is meroblastic and superficial and development is mostly indirect and direct in few forms.
- The largest subphylum in the kingdom Animalia is Mandibulata.
- The subphylum in Arthropoda which includes all extinct forms is trilobitomorpha.
- Dalmanites and Triarthrus are fossils of trilobites.
- Arthropods and annelids exhibit teloblastic growth.

COMPARISON OF THREE SUB PHYLA

S	Character	Trilobitomorpha	Chelicerata	Mandibulata
1.	Habitat and habit	Exclusively marine, bottom dwellers	Marine and terrestrial	Marine, Fresh water terrestrial and parasitic
2.	Tagmata	3 cephalon,thorax & pygidium	2 forms prosoma (cephalothorax) opisthosoma (abdomen)	2 or 3. cephalothorax & abdomen or head, thorax and abdomen or head & trunk
3.	Compound eyes and Antennae	Compound eyes and antennae on head	Lateral compound eyes. Antennae are absent.	Compound eyes are present in crustaceans and hexapods. Antennae are present
4.	Lobes in the body	Trilobed median axial lobe and two lateral lobes	Abdomen with anterior mesosomal and posterior metasoma with telson	Telson is present in crustaceans
5.	Chelicerae	Absent	First pair of prosomal appendages	Absent
6.	Biramous appendages	All post- antennal appendages,unspeci	Absent	Thoracic and abdominal appendages

		alised		are typically biramous .
7.	Mandibles	Absent	Absent	First pair of mouth parts

- Limulus is considered a living fossil as it remained without any evolutionary change for over millions of years.
- Limulus (horse shoe crab) has Trilobite larva.
- Body of Limulus is divisible into prosoma, mesosoma and metasoma that ends in telson prosoma of Limulus bears one pair of chelicerae, 4 pairs of walking legs and one pair of pusher legs.
- Mesosoma bears genital operculum (formed by the fusion of first pair of appendages) and 5 pairs of book gills.
- Class Arachnida includes scorpions, spiders, ticks and mites.
- Prosoma bears one pair of chelicerae, one pair of pedipalps and 4 pairs of walking legs.
- Mesosoma bears genital operculum, one pair of Pectines and 4pairs of book lungs.
- In spiders 4 pairs of posterior abdominal appendages are modified into spinnerets.
- Coxal glands and Malpighian tubules are organs excretion
- Palaemneus (scorpion) is poisonous, viviparous and cannibalistic animal.
- Genus name of spider is Aranea
- Genus name of itch mite is SARCOPTES and it causes scabies in man.

PHYLUM MOLLUSCA

- Molluscs are triploblastic, bilaterally symmetrical, schizocoelomate, soft bodied and unsegmented animals.
- Mostly marine, some are fresh water and a few gastropods are terrestrial.
- They are characterized by the presence of a calcareous shell, mantle or pallium, a muscular foot and haemocoel as the functional body cavity.
- Radula as rasping organ is present in the buccal cavity except in the members of the class PELECYPODA.
- Ctenidia are the organs of respiration. They are absent in Scaphopoda. The highest number is present in Polyplacophora, single ctenidium in gastropods.

- Open type of blood vascular **system except** Cephalopoda (closed type)
- A systemic heart with a pair of atria and one ventricle is present, 4 atria and 2 ventricles in monoplacophorans, 2or4 atria in cephalopods; one atrium and one ventricle in gastropods and no atrium in scaphopods.
- Haemocyanin is the common respiratory pigment.
- Usually a pair of metanephridia is present as organs of excretion, only one in gastropoda.
- Nervous system with pairs of ganglia connected by commissures and connectives, Eyes, (like those of vertebrates in cephalopods) tentacles, statocyst (balancing) and osphradia (chemoreceptor) as sense organs
- Mostly unisexual. Cleavage is holoblastic, spiral and determinate, development includes **trochophore** and **veliger larvae.**
- The second largest phylum in the animal kingdom in terms of the number of species is Mollusca.
- Malacology is the study of molluscs where as Conchology is the study of molluscan shells.
- The largest extant invertebrate is Architeuthis (giant squid)
- Secondarily asymmetrical molluscs are gastropods.
- The largest and the most diverse molluscan class is gastropoda.
- Twisting of digestive and nervous systems and the displacement of mantle cavity to the anterior side are the effects of torsion.
- The twisting of visceral mass, shell and mantle cavity of veliger up to 180^0 counter clockwise with respect to head and foot is known as torsion.
- Pinctada is the Indian pearl oyster which is a bivalved mollusc.
- When ever a foreign particle lodges between the mantle and shell concentric layers of $CaCO_3$ is secreted around it resulting in the formation of a pearl.
- The protein forming the outer most part of shell is Conchiolin.
- Remaining two layers of shell are formed by $CaCO_3$.
- Molluscs with a vestigial head are bivalves
- Pallial cavity contains gills, osphradium, anus, nephridiopores and gonopores.
- Molluscs without radula are bivalves.
- Molluscs with a crystalline style in the stomach are bivalves and some gastropods.
- Molluscs with closed type of blood vascular system are Cephalopoda.
- The molluscan heart is a systemic heart.
- Gills receive blood through afferent branchials.

- Metanephridia open into pericardial cavity and mantle cavity respectively through nephrostomes and nephridiophores.
- The nerve joining a pair of similar ganglia is called a commissure. Eg : cerebral commissure
- The nerve joining different pairs of ganglia is called a connective Pleuro-visceral connective.
- The two lateral ciliated lobes of a veliger constitute velum.
- Molluscs without nephridia but having podocytes in pericardial wall are aplacophorans.
- The mollusk which is considered as a living fossil is …… Neopilina.
- Maximum number of metanephridia and ctenidia are present respectively in monoplacophorans and polyplacophorans.
- Ladder like nervous system without ganglia is present in polyplacophorans
- Primitive worm like molluscans are aplacophorans.
- Serial repetition of internal organs (metamerism) in several systems is seen in monoplacophorans.
- Helix is a land snail.
- Pila is an amphibious, herbivorus gastropod mollusc. It undergoes aestivation during summer
- Captacula of “elephant tusk shells” are food capturing structures.
- Two plates like ctenidia which help in filter feeding are found in bivalves.

PHYLUM ECHINODERMATA

- Echinoderms are triploblastic, enterocoelomate free living and exclusively deuterostomiate and marine animals.
- They are characterized by the presence of calcareous ossicles in dermis that project out as spines.
- Water vascular system (a unique feature) with tube feet that help in locomotion, food collection, respiration and excretion is present.
- Certain specialized structures like papulae, genital bursae, Cloacal respiratory trees and peristomial gills for the purpose of gaseous exchange and diffusion of excretory products. open blood vascular system is present.

- Nervous system is without ganglia and brain, CNS consists of circumoral nerve ring and radial nerves whereas PNS includes two nerve nets one in epidermis and the other in coelomic epithelium,
- Poorly developed sense organs include eye spots, Statocysts and in some terminal tentacles.
- Mostly unisexual, fertilization is external and development is indirect, cleavages are holoblastic, radial and determinate,
- Hypothetical larva which is considered as ancestor of Echinoderm larvae is Dipleurula.
- The subphylum in which echinoderms have no madreporite, oral surface in upward direction, anus on oral surface and ambulacral grooves are open is called Plematozoa
- Echinoderms are the descendents of bilaterally symmetrical deuterostome ancestor.
- Water vascular / ambulacral system is derivative of eneterocoelom.
- The only non-chordate phylum with mesodermal endoskeleton in the form of calcareous ossicles in dermis is Echinodermata.
- The term Echinodermata was coined by Jacob Klein.
- Sea water with amoebocytes is kept in circulation in the ambulacral system.
- Radial ambulacral canals, lateral canals and stone canal are lined with ciliated epithelium.
- A tube foot has an ampulla, podium and sucker.
- Sucker less tube feet are usually present in ophiuroids and cninoids.
- Astropecten is a star fish without suckers in its tube feet.
- Tube feet help in food collection, locomotion, excretion and exchange of gases.
- Pedicellariae are absent in cninoids, holothroids and ophiuroids.
- Two jawed and 3 jawed pedicellariae are found respectively in sea stars an sea urchins.
- Echinoderms which move by serpentine lashing of arms are ophiuroids.
- The only class of Eleutherozoans with open ambulacral gooves is asteroidea.
- Madreporite and anus are in aboral position both in asteroids and echinoids.
- **Synapta similis** is a brackish water sea cucumber.

- (A) Ring canal (B) radial canals (c) tube feet (D) lateral canals (E) madreporite (F) stone canal. Arrange the above in the correct sequence Ans : E-F-A-B-D-C
- The body of echinoids is enclosed by a rigid test or corona.
- The small central disc of crinoids is enclosed by an aboral calyx (calcified cup) and oral tegmen (membranous)
- Echinoderms with leathery / coriaceous skin and isolated microscopic calcareous ossicles in dermis are sea cucumbers.
- Oral surface is upward in pelmatozoans and downward in eleutherozoans.
- Deuterostomeans without specialized organs of excretion are echinoderms.
- Madreporite is oral in ophiuroids, aboral in asteroids and echinoids, internal in sea cucumbers and absent in crinoids.
- Anus is aboral in asteroids and echinoids, oral in crinoids and absent in ophiuroids.