Basic of Biology
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Lecture No. 03
Classification of Living Organism (Part-II)

Hello everybody, this is Dr. Vishal Trivedi from Department of Biosciences and Bioengineering IIT, Guwahati. And what we were discussing? We were discussing about the living organisms. So, if you recall in the previous lecture, we discuss about the, the classification of the living organisms and in that context, we discuss about that, how the organisms are being classified into different kingdoms and what are the different properties of these kingdoms and so, on.

And subsequent to that, we have also discussed about the different types of ways in which the people are keeping the nomenclature of these organisms and so, on. So, to better understand the classifications of the living organisms, we took the example of the two different classes of, or two different kingdoms how we can be able to classify the kingdom.

As you know, that these living organisms actually are very much diversified, they are very, very much varying in terms of sizes, in terms of shapes, in terms of many other properties. So, because of that, you have to adopt a certain criterion on which you can be able to classify the any living organism which is present in that particular kingdom. To understand this aspect, we are taking that two kingdom as an example.

So, we are going to discuss about the animal kingdom. And then we are also going to discuss about the plant kingdom. So, let us discuss about the different criteria on which the animal kingdom is being classified.

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So, we have the set of classification, so, what you can see here is the animal kingdom. So, the criteria for making a classification of the animal kingdom. So, we have 5 criteria, because the animal is, animals could vary from very tiny ant to a very giant elephant. So, that is why you can, you cannot just have a simple criteria, you can have the different types of criteria on which you can be able to classify the different types of animals.

So, what you have? You have the level of organizations, you have the symmetry, then you have the type of the developmental stages like diploblastic or triploblastic organizations. And then we have the segmentations and as well as the notochord. So, let us understand each and all these criteria for classifications and then keeping these criteria in mind how the classification is being done.

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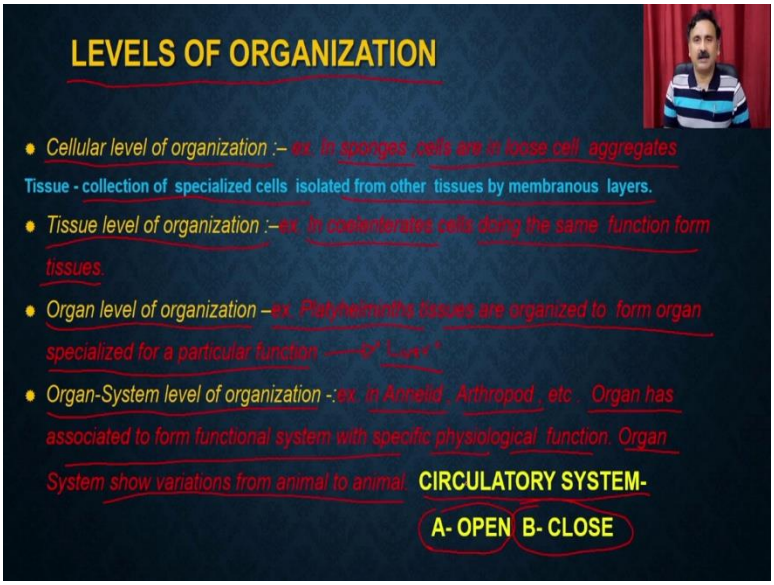

So, let us first start with the level of organizations. So, level of organizations if you recall, we were discussing about the level of organizations it could be of different types. So, you can have the cellular level of organizations. So, these are the organism where only the cells are present, the classical examples are the sponges. These are, these organisms have the cells which are in loose aggregates.

Then we have the tissue level organizations. So, what is tissue? Tissue is the collection of the specialized cells isolated from the other tissue by the membranous layer. So, tissue level organizations examples are the coelenterates, and the cells doing the same function from the tissue, which means if you have a particular type of tissue, all the cells are coming together and that is how they are going to perform that particular functions.

Then the tissues are actually going to come together to give you the organs. So, organ level organizations, classical example is the platyhelminths. The tissues are organized to give you a organ, which is specialized for a particular function. So, classical example is for example, in humans, we have the liver. So, liver is actually performing a function but that has a different type of tissues which are coming together to give you an organ.

And then we have the organ level of organizations. So, the classical example is Annelids, Arthropoda and all the higher animals where the organs has associated to form functional system with pretty specific physiological functions, organ system show variation from the animal to

animal. For example, one of the classical systems is circulatory system. Circulatory system could be of open circulatory system or it could be a closed circulatory system. We are going to discuss all these about when we are going to discuss about the specific class of animals or specific phylum. So, let us understand about other criteria for the classification.

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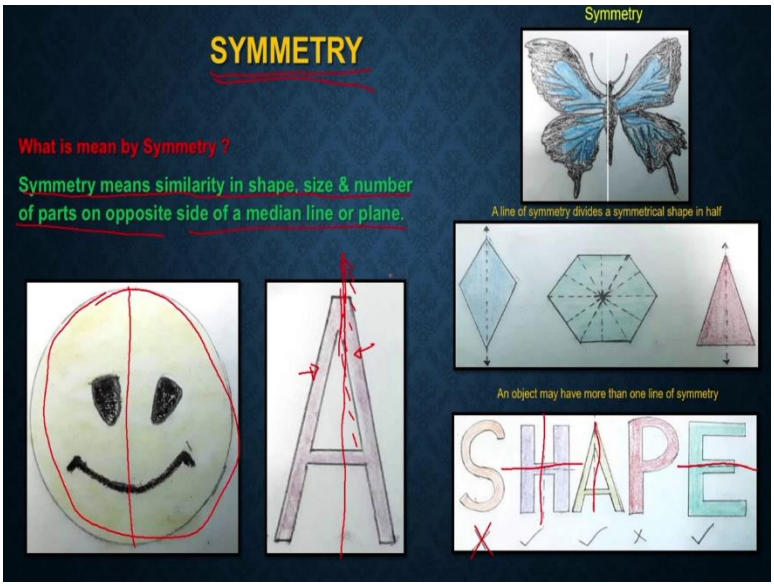

So, another criteria of the classification is the symmetry. So, what is symmetry? Symmetry is, the symmetry means the similarity in shape size and the number of parts on the opposite side of a medial line or the plane. For example, this is a ball. If you have a ball and it has a, faces like this, you can easily be able to draw a line and on this line, you can be able to have the two halves ready.

Similarly, you can also have the alphabets, you can have an alphabet like A. So, if you want to make the symmetry you can actually be able to draw the symmetry in this A, if you cut it from the center, which means, if you keep a mirror here actually, so, you can understand, if you keep a mirror here, this portion the image of this portion and image of this portion is actually going to superimpose to each other and that is called as the symmetry.

Similarly, we have the symmetry in the butterfly, we have the symmetry in this particular type of shapes. For example, if you take an example of this object for example, if you have like word like shape, what you see here is the, this s. So, in the S you do not have the symmetry whereas, H you can easily have a symmetry, you can have two ways symmetry, either you can have the log

additional symmetry or the vertical symmetry. Because this portion this portion is going to be identical.

Similarly, A we have taken an example of A. So, A is also can be divided into two halves, P, P does not have a symmetry because by any mean you cannot be able to divide that particular alphabet into two equal halves. Similarly, E also has a symmetry because it has a horizontal symmetry from this portion, this portion and this portion is going to be identical to each other. So, this is called as symmetry.

The symmetry is where you can have the similarity in shape size and number of parts on the opposite side of a median line or the plane. The plane could be horizontal, the plane could be vertical or the plane could be radial.

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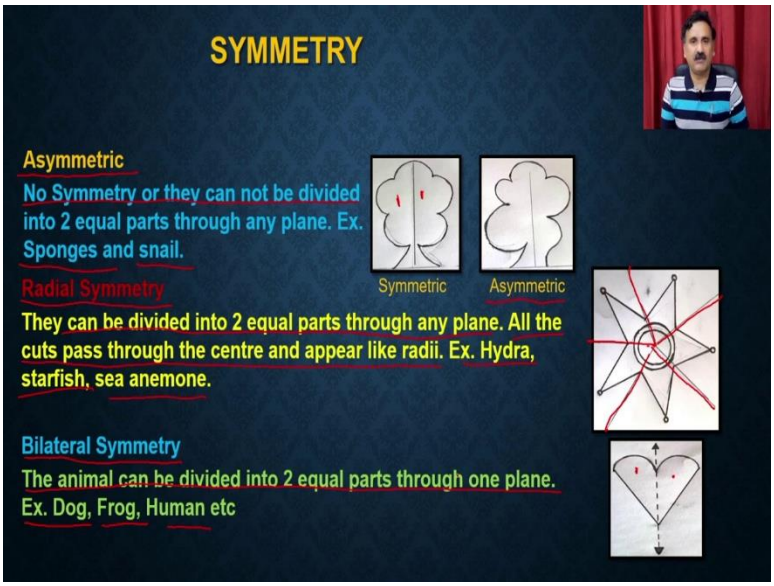

So, based on this you can have the different types of symmetry, you can have organism which are does not show any kind of symmetry. For example, you can have the organism like so, this is like you can see this is a symmetrical organism. You have this portion and this portion is symmetrical in nature, whereas, this is the organism which does not have a symmetry. Because this portion is bigger and this portion is smaller. So, there will be no symmetry.

So, there are organisms which do not have symmetry and you cannot divide their body into two equal parts. One of the classical examples is sponges and the snail. Then we have the radial

symmetry, so radial symmetry is that if you cut it into the radial form for example, from the center, if you cut it into radial form, you are actually going to generate the identical portions.

So, they can be divided into two equal parts through any plane, all the cuts pass through the center and appear like a radii. For example, the Hydra, starfish and sea anemones. Similarly, you can have the bilateral symmetry, bilateral symmetry means you if the symmetry plane is actually going to divide the object into two different parts, so, animal can be divided into two equal parts through one plain.

Classical example is dog, the frog and the humans. So, they this portion and this portion is actually going to be divided. For in humans also we can easily get the bilateral symmetry from the center of our nose. So, if that plane you use that is actually going to divide. So, then third criteria is the developmental stages.

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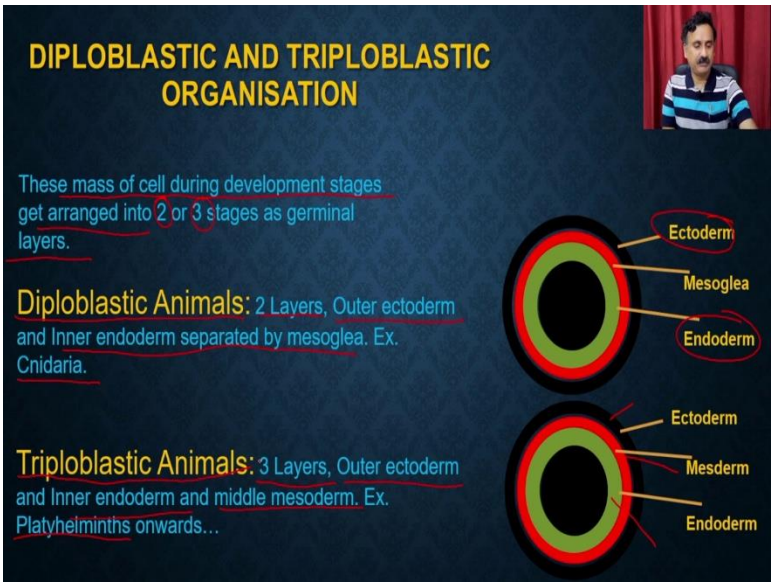

So, we even have the two different types of membranes for the, different developmental stages. So, the mass of cells during the developmental stages gets arranged either into the two membrane or 2 the 3-membrane stage as the germinal layer. So, you can have the organism which are diploblastic animals like the two layers.

So, the where you can have the outer ectoderm and the inner endoderm which are separated by the mesoglea. One classical example is Cnidaria. So, this is the diploblastic animal side where you can have the ectoderm and endoderm, which are clear layers, but they are separated by a

mesoglea. Similarly, you can have the triploblastic animals. So, triploblastic animals are going to have the three layers as the germ layer, where you can have the outer ectoderm and the inner endoderm and the middle mesoderm.

So, this is going to be a clean and clear middle layer. So, you can have the three layers, one this is called the ectoderm, this the inner side it is called endoderm and the middle one is called as the mesoderm. The classical example is the platyhelmenths and the, all the higher animals beyond that is actually being considered to be a triploblastic animal. Then we have the segmentations.

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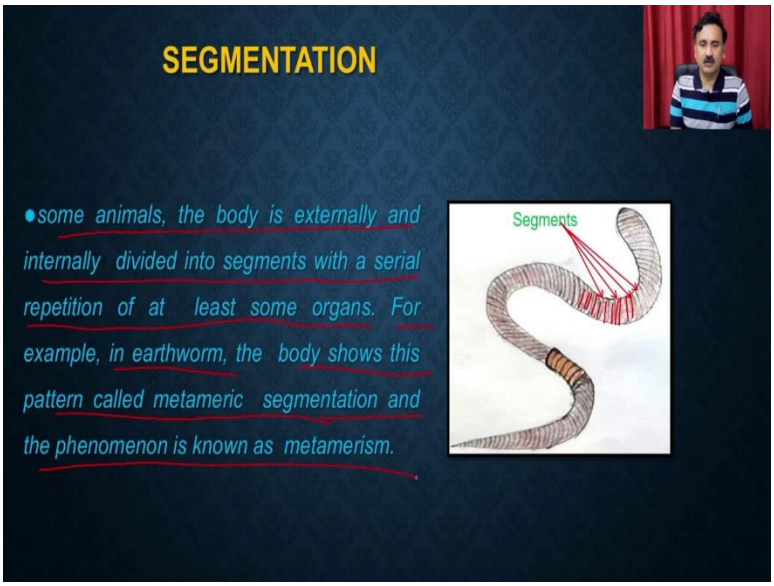

So, you can have the somebody, some animals are being classified based on the segments. So, you can have the segments like there are segments, which are actually going to cut the human, the animal's body. So, some animals the body is externally and internally divided into segments with a serial repetition of at least some organ.

For example, in earthworm the body shows this pattern called the metameric segmentations, and the phenomena is known as the metamerisms. So, that is what it is going to happen when you are going to have the different types of segments. Then we can have the notochord.

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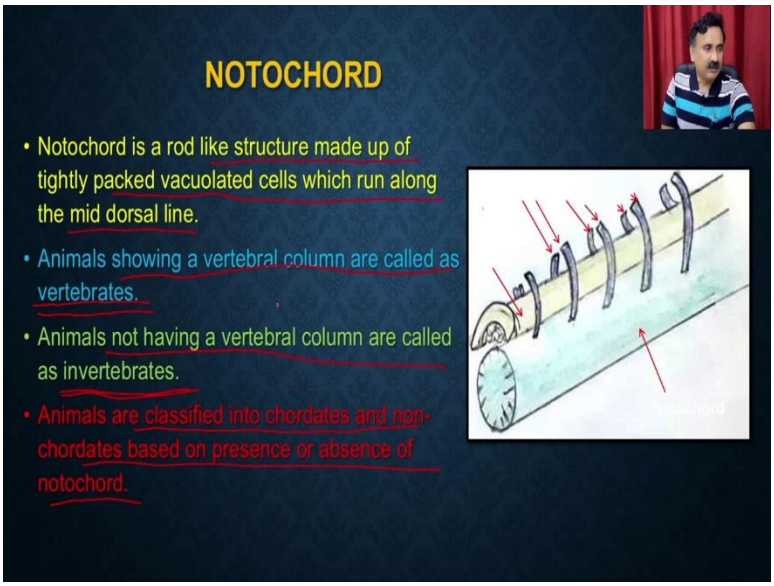

So, the notochord is a rod like structure and it is made up of the tightly packed vacuolated cells, which runs along the mid dorsal line. Animal showing a vertical column are called as a vertebrates, Animal not showing a vertebral column are called as the invertebrates. So, animals are classified into the chordates and non-chordates based on the presence or the absence of the notochord.

So, this is the notochord where you have a rod like structure made up of, of the tightly packed vacuolated cells. And based on this, the organisms are going to be divided into two parts, either they can be having the notochord or they will not be going to have the notochord. If they do not have the vertebral columns, then they are called, they do not have the vertebral column, then they are called as the invertebrates, if they have the vertebral column, then it is called as the vertebrates.

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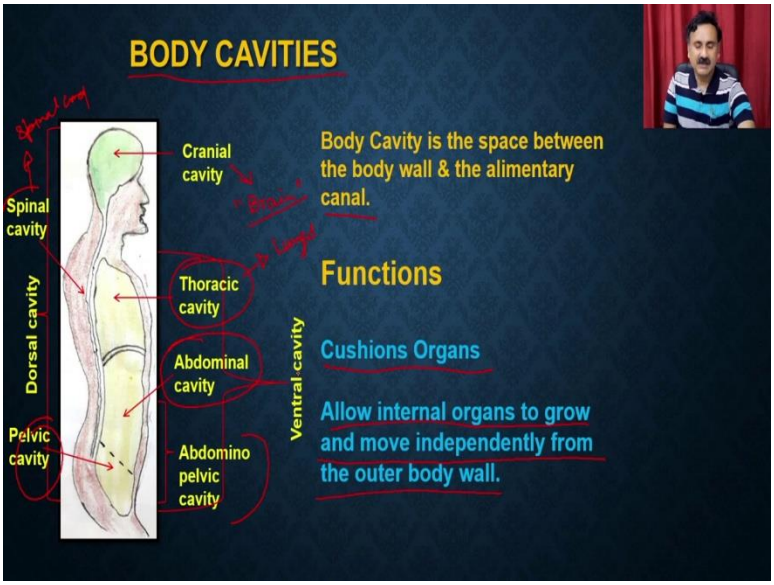

Then the last is body cavities. So, animals can have the different types of body cavities and based on the body cavity also it can be also divided. So, body cavity is a space between the body ball and elementary canal. The function of the body cavity is that it is going to provide the cushion to the organs, you can have for example in the, in a human you can have the cranial capacity, the cranial cavity. The cranial cavity is actually going to house the delicate organ like the brain.

Similarly, you can have the thoracic cavity, thoracic cavity is like this just cavity where you can actually be able to house the lungs. Then you can have the abdominal cavity where the, you can have the different types of elementary canal and all other kinds of organs. And then on the backside you can have the spinal cavity, that spinal cavity is actually going to hold the spinal cord.

And then you can also have the pelvic cavity, the pelvic cavity is actually going to hold the, the urethra and all other kinds of delicate organs. And then we have the abdominal pelvic cavity which is actually going to have the kidney and all other organs. It allows the internal organs to grow and move independently from the outer body wall. So, based on the body cavity, the organisms can be divided into different parts or different types.

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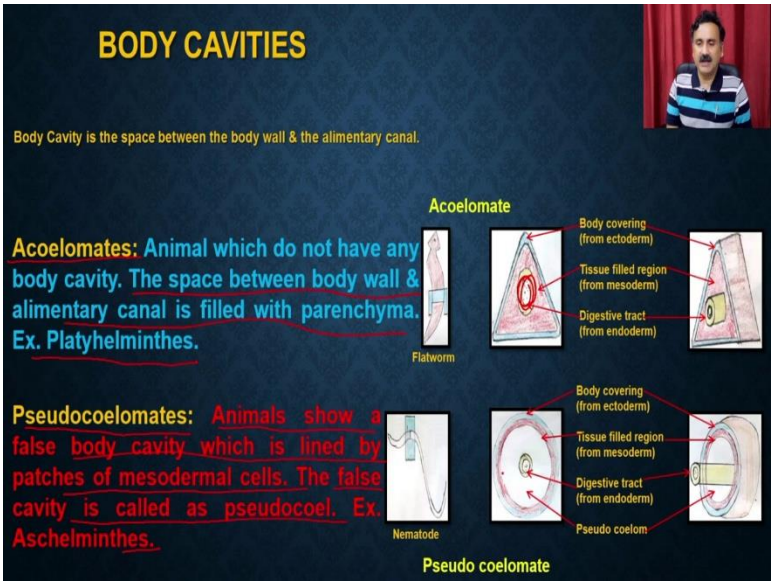

The, they can be acoelomates, acoelomates are the animals which do not have any body cavity, these spaces between body walls and the elementary canal are filled with the parenchyma. For example, the platyhelminths. So, in the platyhelminths are acoelomates, because they do not have the space between the body wall and the elementary canal.

So, this is you see, this is the digestive system this is the elementary canal and this is the body covering, but in between there is a, no space which is filled. This is a space which is filled. So, there is no body cavity. Then we have the pseudocoelomates, the pseudocoelomates are the animals which show false body cavity, which is lined by the patches of the mesodermal cells. The false cavity is called as a pseudocoel.

For example, the Aschelminthes, so in a pseudocoelomates you have the outer body covering and then it is actually having a tissue filled region, which is called as the mesoderm and then it has a digestive tract. So, it has a body cavity, but that is called as the false body cavity or the pseudocoelomates.

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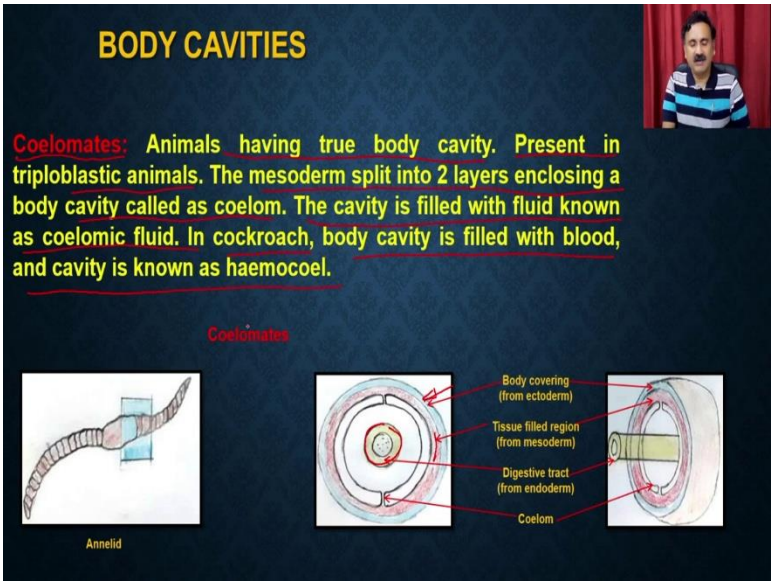

And then we have the coelomates. And the coelomates are the or animal which have the true body cavity present in the triploblastic animals. These, these mesoderm splits into two layers enclosing a body cavity called as the coelom. The cavity is filled with the fluids known as the coelamic fluid. In cockroach, the body cavity is filled with the blood and the cavity is known as the haemocoel.

So, coelomates, if you cut a coelomate, what you are going to see here is this is the body covering which is the outer layer and then it is going to have the tissue filled region which is called as a mesoderm and then it is going to have the digestive tract, this is the digestive tract. And outside this digestive tract, what you are going to see is actually a coelom, or body cavity. So, that is what is so based on the body cavity, the animals are going to be classified according to the whether the body cavity is present or absent.

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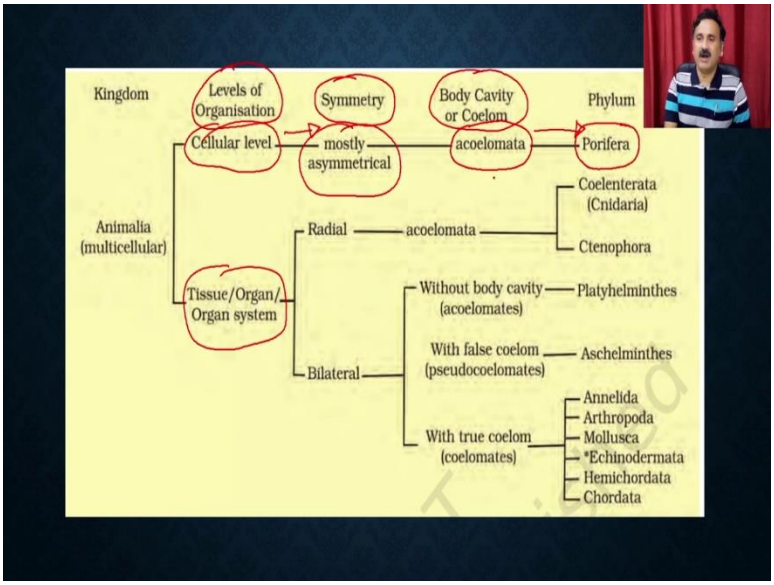

Now, keeping all these criteria into the picture, the all the organisms which are present in the kingdom Animalia are being divided into the different ways. For example, on the based on the level of organizations, it could be a cellular level of organization or to the tissue level of organization. So, if it is a cellular level of organizations, then you are going to go ahead with another criteria whether the system is symmetrical or asymmetrical.

So, if it is a asymmetrical, then you are going to say about body cavity whether it a body cavity is present or not, if the body cavity is not present, and it is called considered to be acoelomate. And all these three criterias you have going to reach to the first phylum which is called as a porifera. So, let us discuss about the porifera.

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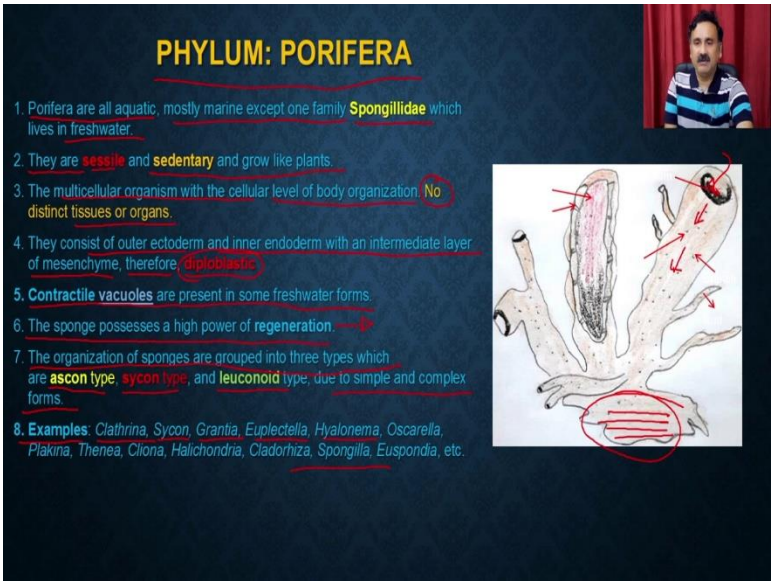

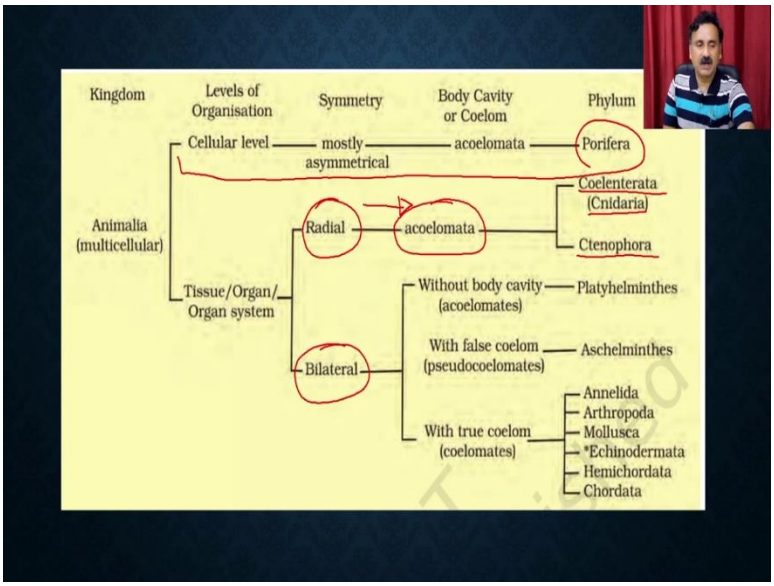

So, porifera the phylum porifera are actually the animals, the porifera are the all aquatic mostly marine except one family which is called as the Spongillidae, which lives in the freshwater. So, all these animals are, all these animals are found in marine. They are sessile which means they do not, grow they do not be moving to each other moving from and they are sedentary and grow like a plant.

So, they actually are attaching to us to a surface and then they are growing like a plant. The multicellular organisms, they are multicellular organism with the cellular level of organization. So, there is a no distinct tissue or the organs. They consist of the outer ectoderm and inner

endoderm, with an intermediate layer of mesenchyme therefore, it is our diploblastic animals. So, they do not have the triple layer, they do not have the third layer which is the mesoderm. Instead of that they have a meso, mesenchyme.

Then the contractile vacuoles are present in some freshwater forms. The sponges process a high degree of regeneration which means even if you take the sponges and if you crush them, they actually have the ability to reorganize themselves to produce fully functional organisms. The organization of the sponges are grouped into three different types, it could be ascon type, it could be sycon type, and it could be leuconoid type, due to the simple and the complex form.

There are several examples you can have the clathrina, you can have sycon, you can have granita, you can have euplectella and all these. And what you see here is a typical sponge, what you are going to be see that it is attached to a hill or the surface. And then it grows like this and from this side, this is the actually the mouth through which the, the food is actually entering into the body and then it is actually filtering the water.

And along with the water it actually takes up the whatever the food material is present in that water. So, these are the marine animals except that one family is spongillidae which is also found in the freshwater. So, this is a based on the, this criteria. So, if you go with this criteria, it will end up into the phylum porifera.

But if you go with the tissue or the organ level of organizations, then you can have the symmetry, either it could be a radial symmetry or the bilateral symmetry. In the radial symmetry you can have the acoelomates and within this you can have the two different phylum. You can have the coelenterate which is called where also called as Cnidaria or you can have the Ctenophora. So, let us discuss about the coelenterate and then we are going to discuss about the Ctenophora.

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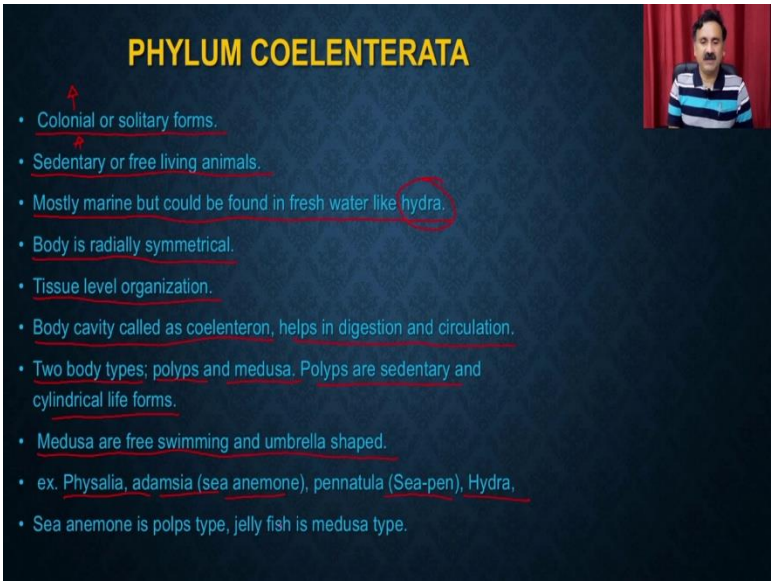

Coelenterata, coelenterates are colonial or the solitary forms. So, this means they are going to form in the bunches or they are going to be formed as individuals. They are sedentary or the free-living animals, which means they are actually either be attached to a surface or they could be a free-living animal. They are mostly marine but could be found in the freshwater like the hydra. Body is radially symmetrical.

Tissue level is a tissue is at a tissue level organization except that the cellular level organization present in the porifera. Then the body cavity is coelenteron, helps in the digestion and circulations. It has two different types of bodies it has a polyps and medusa. And polyps are the sedentary whereas, the cylindrical life forms. Medusa are the free swimming and the umbrella shaped (())(20:45).

So, you, the organism which are found in the coelenterate could be either polyps or could be medusa. Polyps are the sedentary and they are cylindrical, like worm so they will not be moving each other. Whereas, the Medusas are the free livings, free swimming and the umbrella shapes. There are examples, physalia, adamsia like the sea anemone, or the sea pen or the hydra. Sea anemone is a polyp type, whereas jellyfish is a medusa type. So, this is just a simple example to show you that what is mean by the polyps and what is mean by the medusa type.

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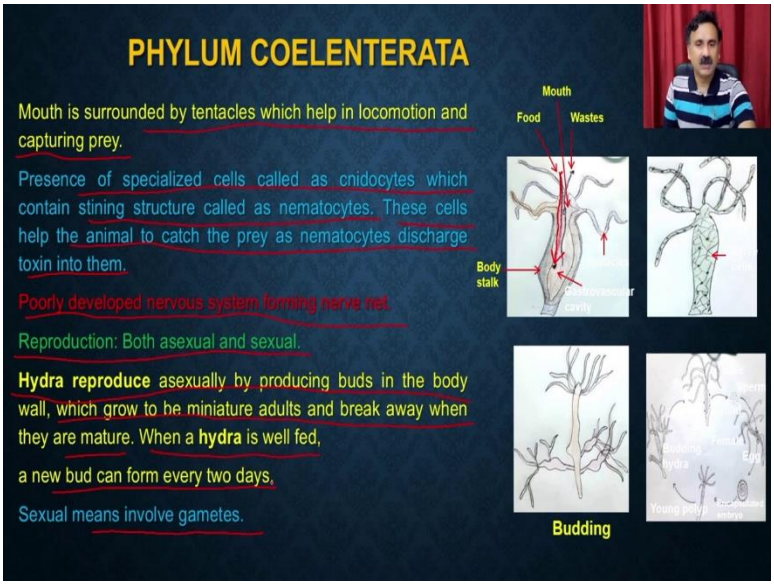

Then we have the phylum Coelenterata. So, what you see here is a phylum Coelenterata what you see here is a hydra where you have this is a body stalk, and it is attached to a set, the surface and this is the gastro vascular cavity. So, mouth is surrounded by the tentacles, which helps in the locomotion and capturing the prey. So, this is what you see here. This is the mouth, where you have the tentacles.

These tentacles are good enough to catch the prey. And this mouth is actually receiving the water from outside and then it goes into the gastro vascular cavity and where the prey what is present inside this water is going to be taken up by the animal. The presence of specialized cells such as cnidocytes, which contain the stinging structure as an nematocytes. These cells help the animal to catch the prey as the nematocytes discharge the toxin into them.

They have a poorly developed nervous system forming the nerve nets. And their reproduction is both sexual and asexual. Hydra reproduces asexually by producing the buds in the body wall, which grows to miniature adult and break away when they are mature when a hydra is well fed, so, this is what you see here.

A hydra is actually reproducing by the budding there, the buds are appearing from the main body and then these buds are getting pinched off and that is how they are actually going to be grow as an adult individual. A new bud come from every two days. Sexual means involving the gametes. Then we have the Ctenophora.

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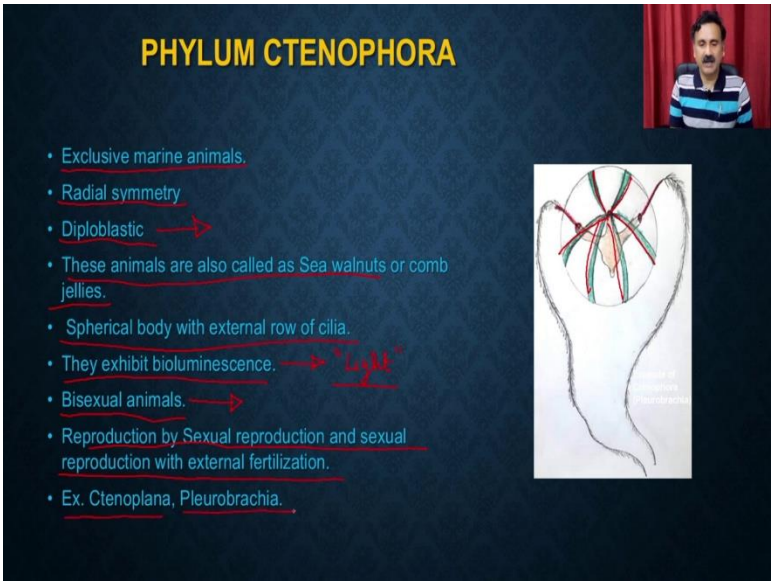

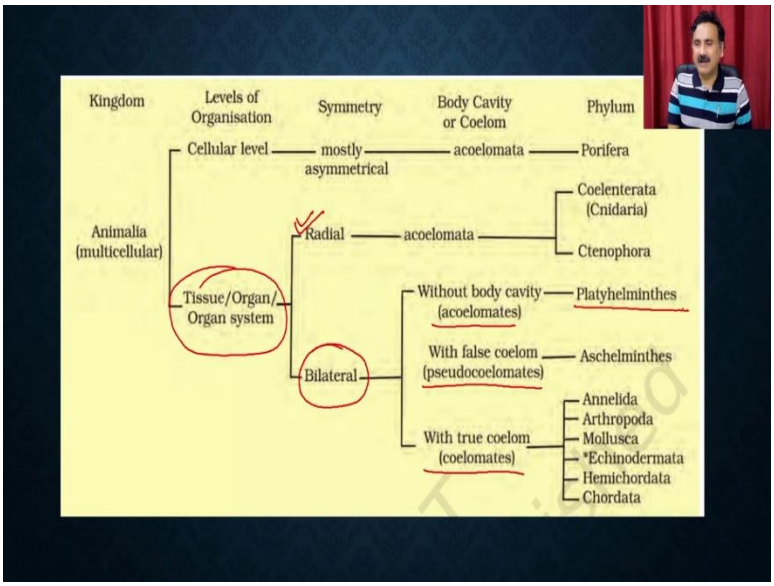

So, Ctenophora is exclusively the marine animals, it has radial symmetry, it is radial symmetry, you can actually divide the animal into the as radii comes it is a diploblastic animal so it had does not have the mesoderm. These animals are classified as the sea walnut or comb jellies. They are spherical body with the external row of cilia. They exhibit the bioluminescence.

So, bioluminescence is a phenomenon where the organism is actually going to produce the light by the light pigments. And that process is called as the bioluminescence. These are the bisexual animals, which means they are going to have to separate male and female and they are actually be reproduced by the sexual reproduction. And the sexual reproduction by the external

fertilization, which means they are going to produce the gametes outside into the water and that then it is going to be fertilized. Examples, are Ctenoplana and Pleurobrachia.

Then, so, we have discussed about this, now, we come back to the tissue level organizations and the symmetry is bilateral. So, when you have a bilateral symmetry, you have the many organisms like you have the acoelomates you have the pseudocoelomates and then you have the coelomates. So, within that you have the acoelomates tissue level organizations, bilateral symmetry and acoelomates, you have the phylum Platyhelminthes.

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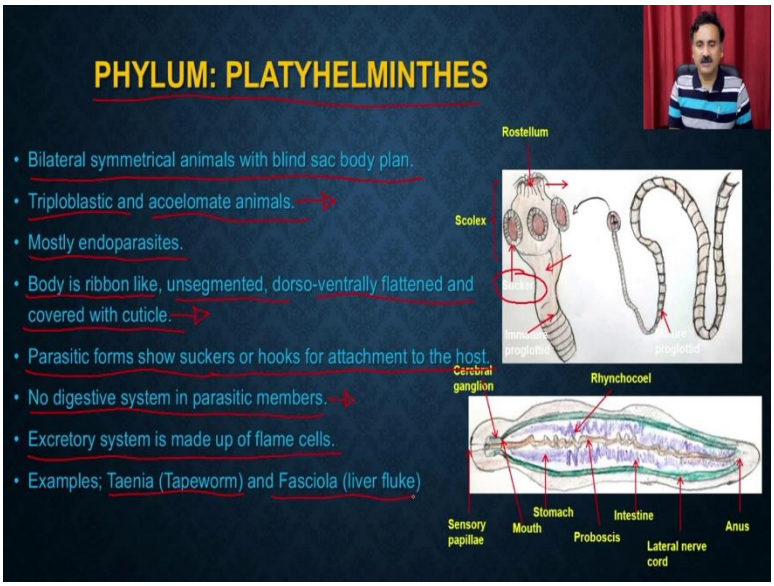

Phylum platyheminthes or the worms actually, so it has the bilateral symmetry animal with a blind sac cloudy plan. It is triploblastic and acoelomate which means it does not have the coelom. It is mostly endo parasitic. So, you can see that it has a very well-defined suctions and because of that they can actually be able suckers, they can be having an ability to suck the food or the nutrition from the host.

Body is ribbon like unsegmented dorsoventral fattened and the covered with a cuticle. Cuticle is a covering which actually makes protects the body from the damages. It is parasitic forms shows the suckers or the hook for the attachment to the host, there is no digestive system in the parasitic membrane. So, because why it is, does not have the parasitic, digestive system? Because it actually takes up the digested food.

Excretory system is made up of, of the flame cells. And examples are the Taeniasolium, the tapeworm, what you see here. And the fasciola which is called as a liver fluid. So, now let us move to the next and which is the false coelom or the pseudocoelom. The examples are aschelminthes or the worms.

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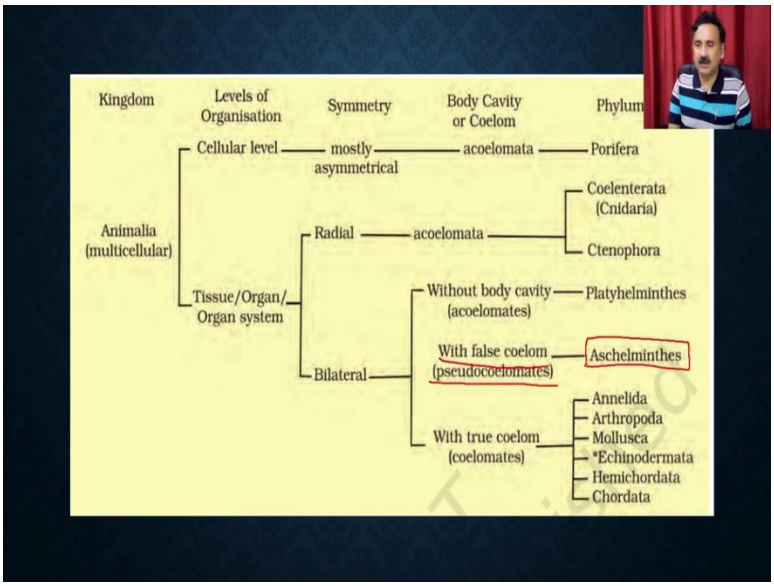

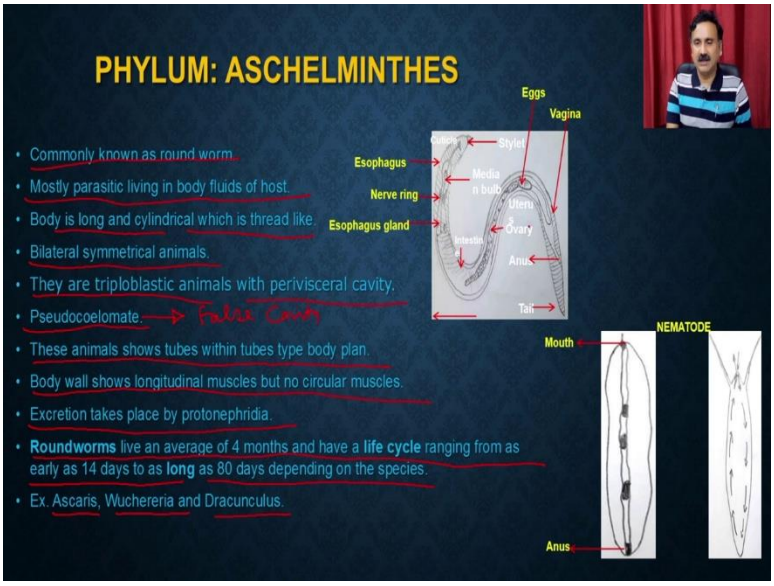

Aschelminthes, which are commonly known as the round worms, round worms are mostly parasitic living in the body fluid of the host. Body is long and cylindrical which is threadlike, it is bilateral symmetrical animal. They are triploblastic animal with a perivisceral cavity. And it has

a pseudocoelomate which means it is actually having a false cavity. And these animals show the tubes within to tube type body plan.

So, you can see here this is a, this is the Aschelminthes, and it has the body wall shows the longitudinal muscle but no circular muscles. The excretion take place by the protonephridia. And roundworms, lives an average of 4 months and have a life cycle ranging from as early as 14 days as long as 80 days depending on the species. Examples are ascaris, wuchereria and Dracuncufus. So, this is what you see here is ascaris which has the separate male and female.

Then we come through the third one, which is the true coelomates, within the true coelomates we have the Annelida, Arthropoda, Mollusca, Echinodermata, Hermichodata, and Chordata. And within the chordata you have the all other, all other species, all other things, all other animals like.

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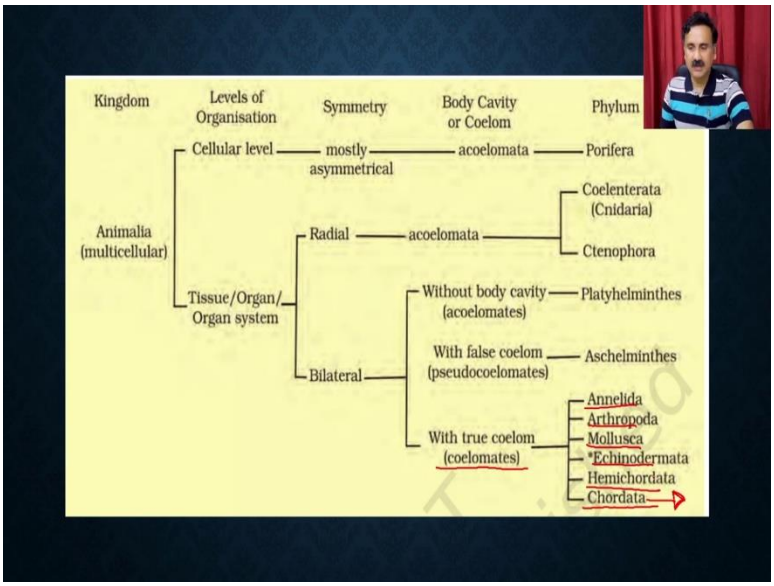

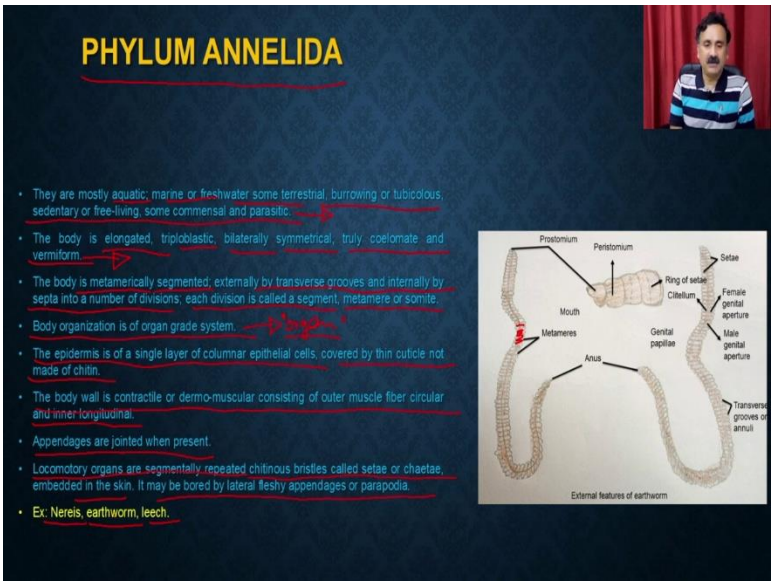

So, phylum Annelida, phylum Annelida you have the these are the earthworm and the leech. Phylum Annelida, they are mostly aquatic, marine or freshwater some are terrestrial borrowing and tubicolous sedentary or the free living, some are commensal and some are as parasitic. Which means, a huge variety of organisms are present within the phylum Annelida, they can be found onto the water, they can be found in freshwater, they can be found in marine, they can be terrestrial, they could be borrowing, which means they will make a dig into the soil and they will remain inside, they could be freely living or they could be parasitic.

The body is elongated, diploblastic, bilateral symmetrical truly coelomates and the vermiform, which means they are worm like. The body is (meta) metmerically segmented. What you see here right, these are segmented and externally by the transfers group and internally by the septa into a number of divisions. Each division is called a segment, metamere or the somite. Body organization is of an organ grade body, which means it also contains the organ.

So, as per as a body organization contains it actually contains the organ but not the organ system. The epidermis is of a single layer of columnar epithelial cells covered by the thin cuticle not made up of the chitin. The body wall is contractile or dermo-muscular consisting of the outer muscles in circular and inner longitudinal. Appendages are joined when present. So, appendages are joined.

Locomotory organs are segmented, segmentally repeated chitinous bristle like setae or the chaetae embedded in the skin. It may be borrowed by the cell, lateral fleshy appendages or the

parapodia. The examples are Nereis, earthworm and the leech. Then we have the second phylum which is called as the Arthropoda.

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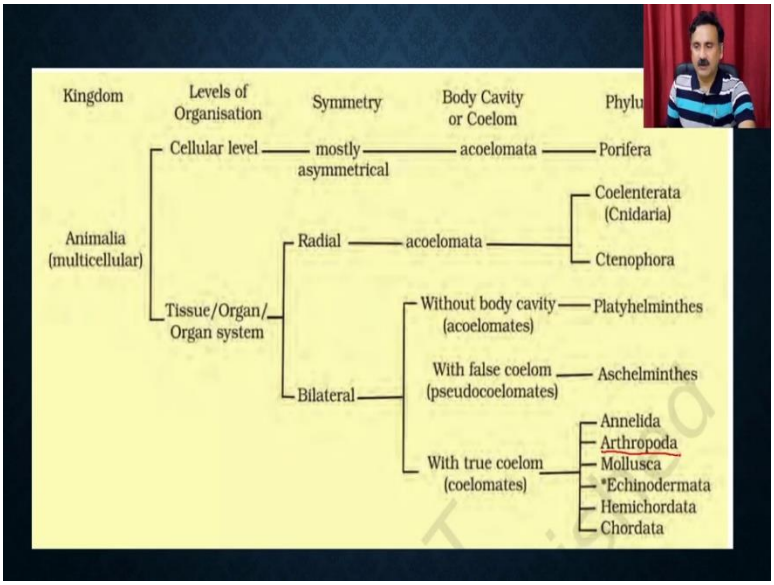

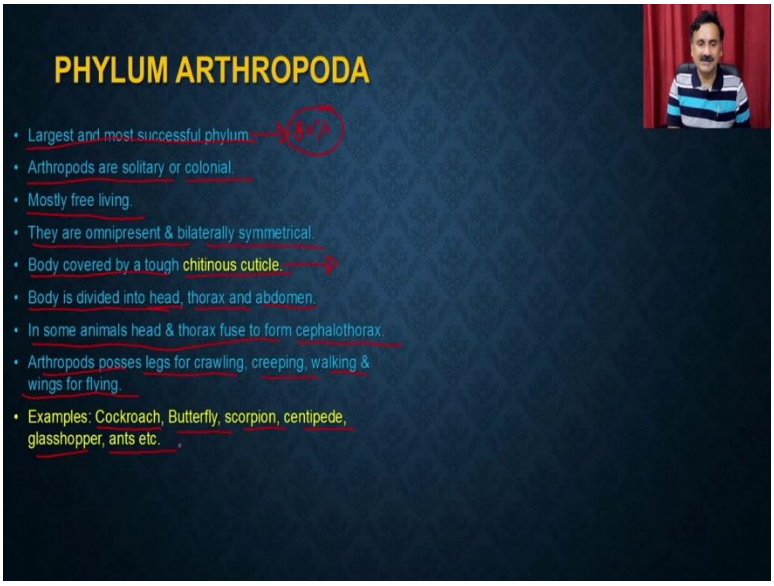

So, Arthropoda are the largest and the most successful phylum. Arthropoda is covering approximately 80 percent of the all the animals that have been found on the earth. Arthropods are solitary and are colonials, they are mostly free living, they are omni present and bilaterally symmetrical. Body covered by a tough chitinous cuticle, so, they are actually having protections.

Body is divided into the three parts, the head, thorax and abdomen. In some animals the head and thorax are fused to form the cephalothorax. The Arthropoda possesses a leg for the crawling,

creeping, walking and the wings for the flying. There are examples, the examples are cockroach, butterfly, scorpions, centipede glass hoppers, and ants.

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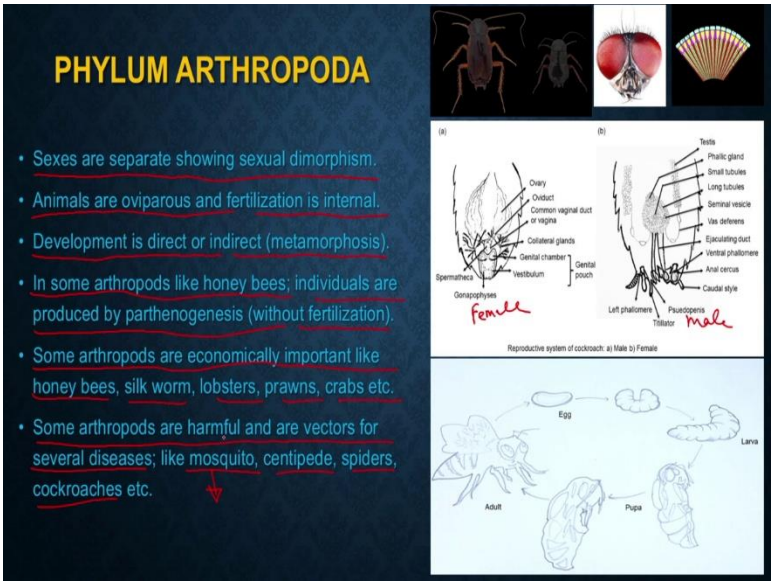

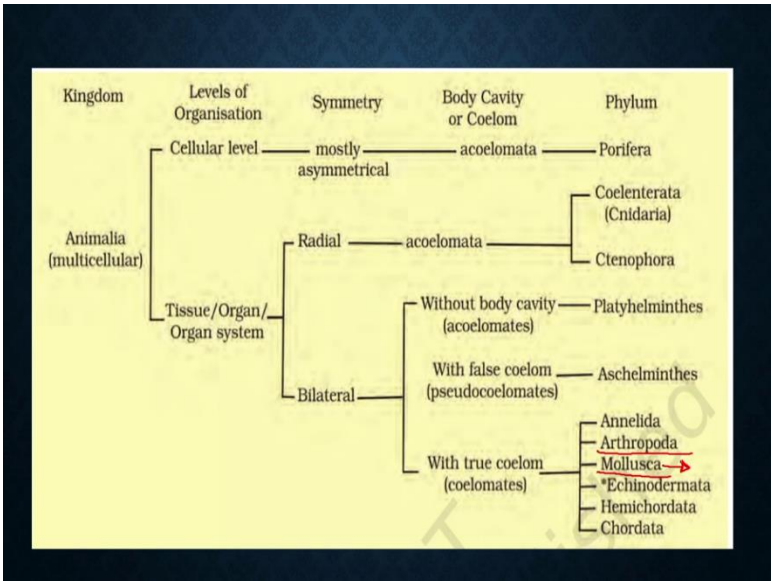

This is what you see here, different types of insects. You have the cockroach and you have this is the eyes of the fly. The sexes are separate showing the sexual dimorphism. So, you have this is what you see here. These are two different types of sex; this is a female sexual organ and this is the male sex organ. Then animals are oviparous and fertilization is internal.

Development is direct or the indirect, which means in some organism development is direct whereas in some cases it is going through the stages of the metamorphosis. In some arthropods

like the honeybee, individuals are produced by the parthenogenesis which means, without fertilizations. One of the classical examples is that the Queen honeybee is actually producing all of the honeybees.

And sometimes the honeybees are being produced without a fertilization. Some Arthropods are economically important like the honeybee, silkworm, lobster, prawn, crabs, etcetera. Some Arthropods are harmful and a vector for the several diseases like the mosquitoes, centipede spiders, cockroach, you know that so, many diseases are being spread by the mosquito like malaria, chikungunya, dengue and all sort of.

Similarly, we have the some of the diseases which are being also spread by the cockroaches. So, this is all about the discussion up to the Arthropoda. Now, let us move on to the discussion about the Mollusca. So, Molluscs are the, the freshwater or the marine animals.

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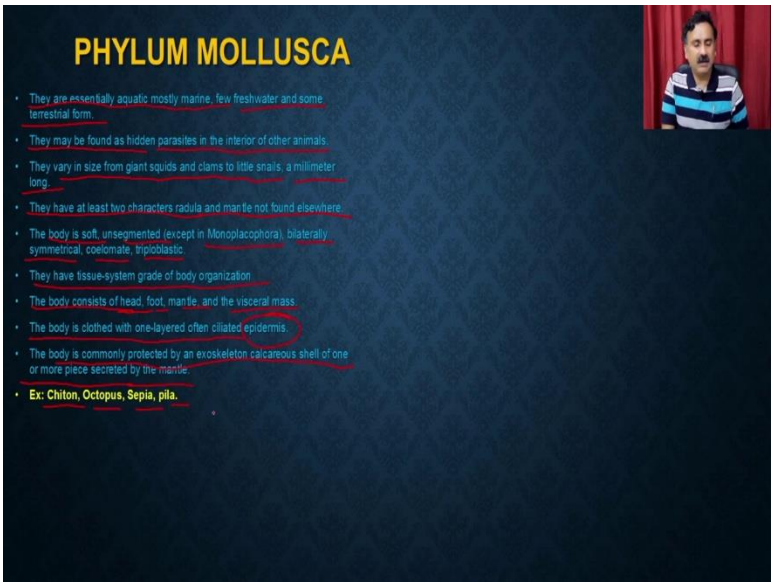

Phylum Mollusca, they are essentially aquatic mostly marine. Few, few are freshwater and some are terrestrial forms, they may be found as the hidden parasite in the interior of some animals. So, they are actually either free living or they are also been parasitic in nature. They vary in size from the giant squids and claimed to be a little snail, a millimeter long. They have at least two-character reticula and mantle not found elsewhere.

The body is soft, unsegmented except in this particular category, bilateral symmetrical coelomate and triploblastic, they have the tissue level organization of the body organizations. The body

consists of the head, food, mantle and the visceral mass. The body is clothed with a one layer often called as the epidermis. The body is commonly protected by an exoskeleton calcareous shell of one or more pieces secreted by the mantle. Examples are Chiton, Octopus, Sepia, pila.

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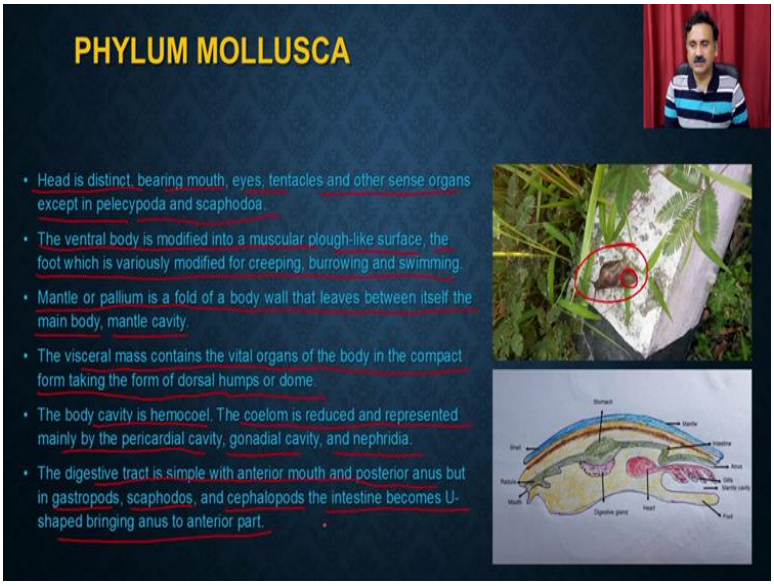

Now, what you see here is the head, head is distinct bearing the mouth, eye, tentacles and other sense organs except in pelecypoda and scaphodoa. The ventral body is modified with a muscular plough like surfaces, the food which is in variously modified for creeping, borrowing and swimming.

What you see here is actually a foot (34:13). And it has actually used this foot so what you see here is this is a foot actually uses it for crawling. So, this is the plough like surfaces on which it actually clips. Mental or the Palladium is a fold of body wall that leaves between the itself and the main body and mantle cavity. The visceral body mass contains vital organs of the body in the compact form taking the form of dorsal humps or the dome.

The body cavity is hemocoel, coelom is reduced and represented mainly by the pericardial cavity, gonadial cavity and nephridia. The digestive tract is simple and the anterior mouth and it is a posterior anus, but in gastropods, scaphoids and the cephalopods, the intestine becomes a u shaped bringing anus to the anterior portions.

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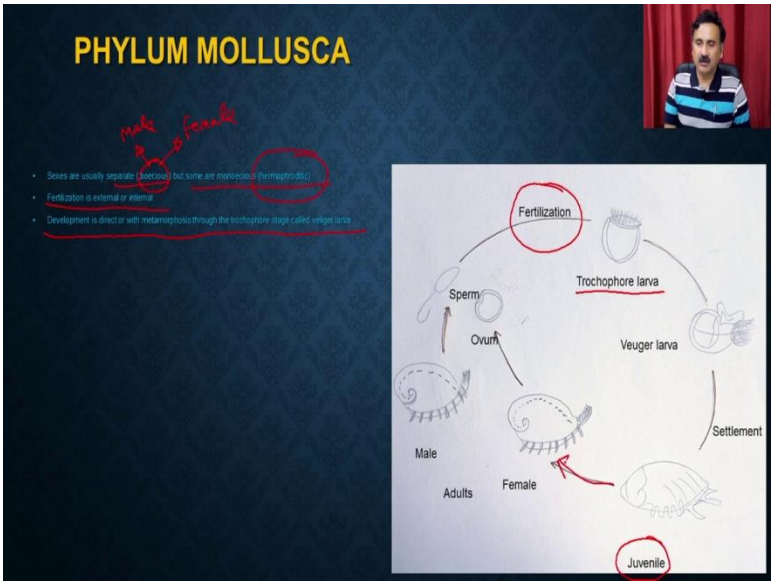

The sexes are usually separate. So, it is a dioecious animal which is means it has a separate male and female organisms. But some are monoecious, which means they are going to be hermaphrodite, fertilization is external or the internal, development is direct or with a metamorphosis through the trochophore stage called as the veliger larva. So, this is what it is showing is here, it could be say for example, the male and the female.

So, male is producing the sperm and the female is producing the ovum. And then they are going through a process of fertilization and that is forming the larva. And then this Larva is eventually going through the developmental stages and then it is going to produce the juvenile animals and that juvenile animal is eventually going to develop into the adults.

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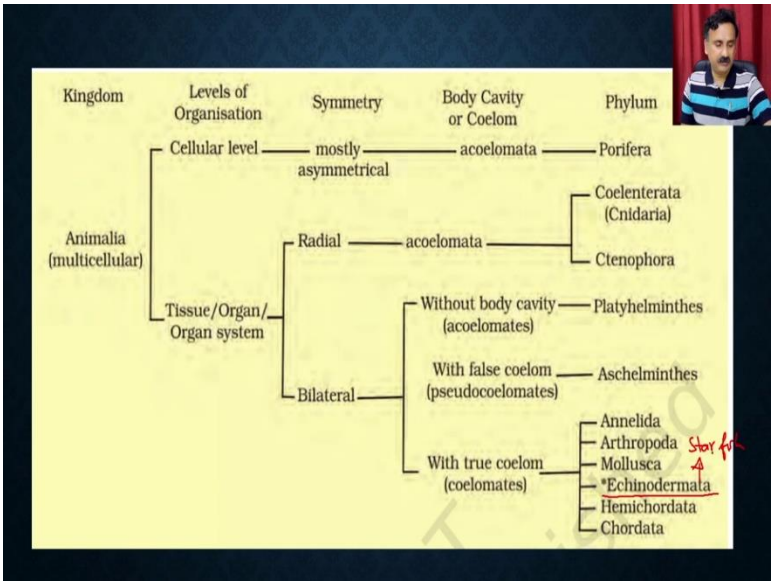

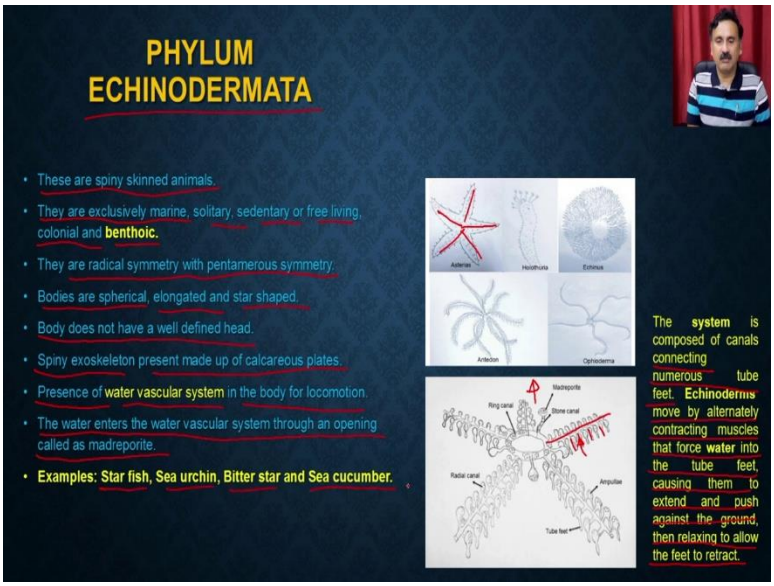

Then we have to talk about the Echinodermata, Echinodermata or the starfish which where the starfish is present. So, the phylum Echinodermata, phylum Echinodermata these are the spiny skinned animals, they are exclusively marine, solitary, sedentary or free living, colonial and the benthoic. They are radial symmetry with the pentamerous symmetry. So, they are having a radial symmetry, this is what we have discussed. So, if you draw a line from the center, it you can be able to divide the animal into the equally divided parts.

The bodies are spherical, elongated and starshape so these are the simple several examples. Then body does not have a well defined head. And the spiny, it has a spiny exoskeleton present made

up of, of the calcareous plate and presence of a water vascular system. So, what you see here is actually a water vascular system in the body for locomotion. This system, the water vascular system is composed of a canal connecting the numerous tube feeds.

So, what you see here is actually the numerous tubes what is being connected to each other. And the Echinodermata is moved by the alternatively contracting muscles that force water into the tube feed causing them to extend and push against the ground. So, what happen is the, it has the contracting muscles and because of that in these tubes, it actually fills the water and then it actually utilizes that to bring the push forces and that is how the Echinodermata actually moves into a particular direction.

So, that is then it is relaxing and allowing the food to retract. So, it actually fills the water and then remove the water and that is how it actually moved from one place to another place. The water enters the water vascular system through an opening called as the madreporite. The examples of these class, this phylum is starfish, sea urchin, bitter star and the sea cucumber.

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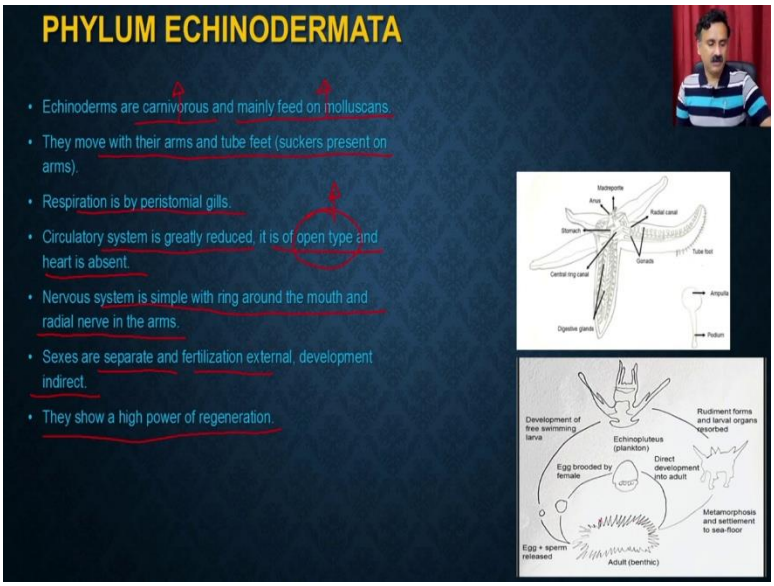

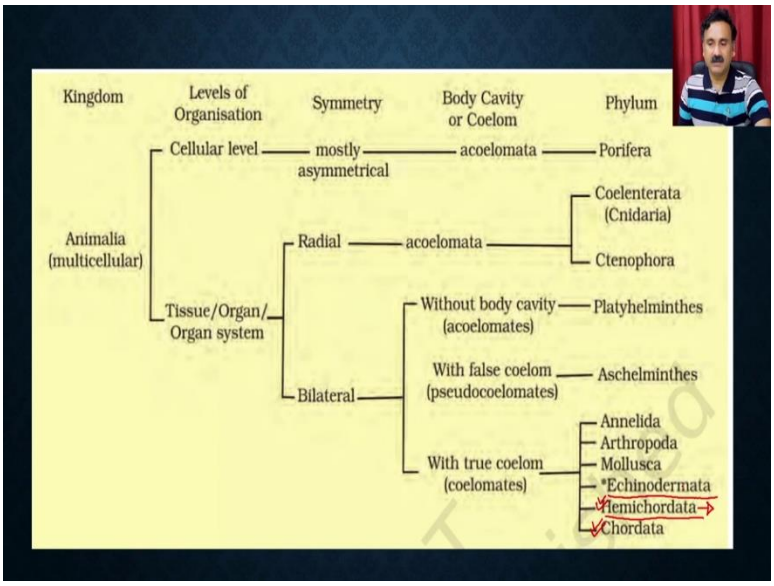

Now, Echinodermata are carnivorous, which means they are actually feeding on to the other animals and they mainly feed on the molluscans. So, they actually are feeding onto the other type of molluscans. They move with their arms and the tube feet. Respiration is by the peristomial gills, circulatory system is largely reduced. It is the open type and the heart is absent. We are going to discuss about the open and close type.

Nervous System is simple with the ring around the mouth and radial nerve in the arms, sexes are separate and fertilization is external and development is indirect, they show a high level of regenerations. So, the sexes are separate, which means the male and female are going to produce their gametes. And then it is going to have the fertilization which is going to be outside and then after that it is actually going to go through the different developmental stages and ultimately it is actually going to form the adults.

So, this is all about the different organism, what is being present in the Echinodermata. Now following this we have the two class which is called as the hemichordata and the chordata. Hemichordates are considered to be underdeveloped chordata or they do not have the well-defined codial vertebra.

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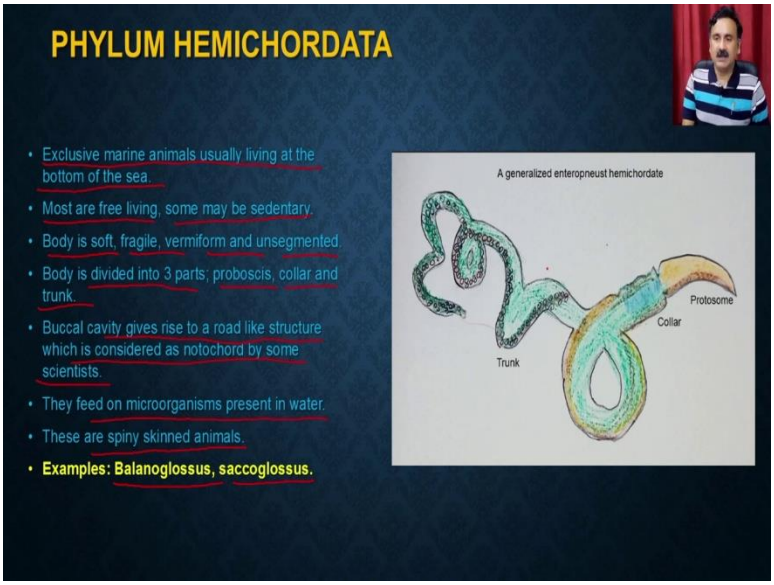

So, hemichordata, these are the exclusive marine animals usually living at the bottom of the sea. They are mostly free living, some may be sedentary, body is soft, fragile, vermiform and unsegmented. Body is divided into three parts proboscis, collar and the trunk. Buccal cavity give rise to a rod like structure which is considered as the notochord by some scientists. They feed on the microorganisms which are present in the water, and they are spiny skinned animals.

The examples are balanoglossus and the saccoglossus. So, this is what you see here is a hemi chordata it does not contain a well-defined vertebra. So, that is why they are also being considered as under the category of invertebrates.

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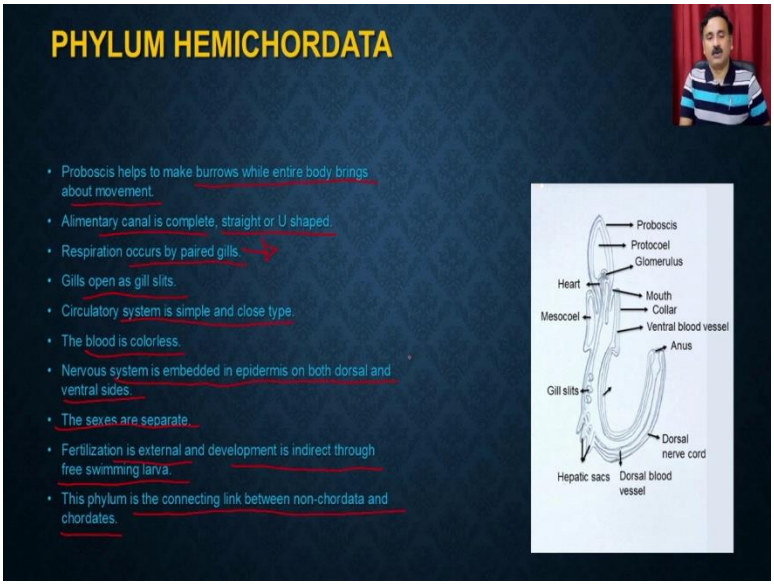

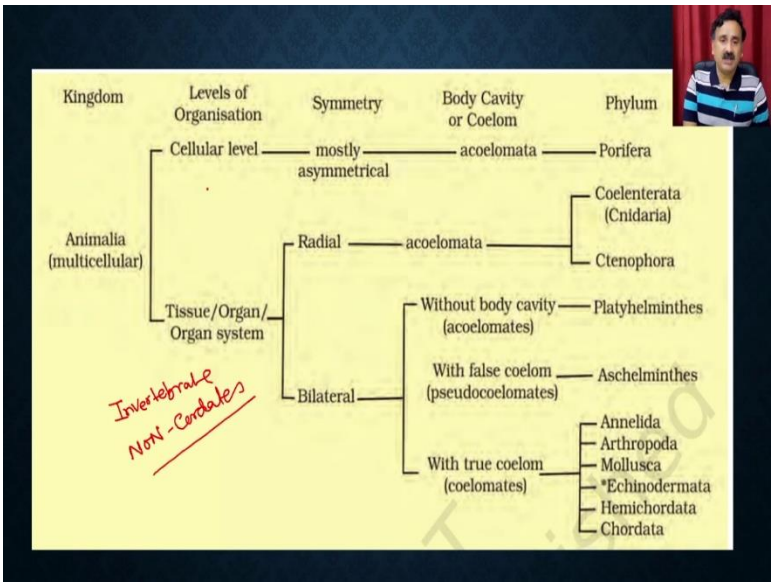

Proboscis helps to make the borrow while the entire body brings about the movement. Elementary canal is complete, it is straight or the U shape. Respiratory occurs by the gills and the gills are open as the gill slit. Circulatory system is simple and the close type, the blood is colorless, the nervous system is embedded in the epidermis on the both dorsal and ventral side. The sexes are separate, fertilization is external and the development is indirect through the free swimming larva.

This phylum is the connecting link between the non-chordata and the chordata. So, the organism what has been found in the phylum hemi chordata are having a characteristic of both the

invertebrate as well as the vertebrates. And that is why they are considered to be a connecting link between the non-chordata and the chordata. So, with this, we have discussed mostly about the invertebrate animal and as well as the chordata.

So, we have discussed about the invertebrate animal and we have also discussed about the non-chordata, what we have discussed? We have discussed about the different types of criterias to classify the animal kingdom and then we have taken the examples of the animals belonging to the different phylum based on the, how they are being classified using different criterias. And with this I would like to conclude my lecture here.

In a subsequent lecture we are going to discuss more detail about the chordatas, where we can go into how we are going to study about the higher animals like the birds, reptiles, mammals and so on. So, with this I would like to conclude my lecture here. Thank you.