Basic of Biology
Professor. Vishal Trivedi
Department of Biosciences and Bioengineering
Indian Institute of Technology Guwahati
Lecture No. 02
Classification of living organisms (Part-1)

Hello everybody, this is Doctor Vishal Trivedi from Department of Biosciences and bioengineering, IIT Guwahati. And what we were discussing, we were discussing about the basics of biology. So, in the previous lecture, we discuss about the different aspects of the living organisms. We have also discussed about the contribution of the different scientists; we have discussed about the contribution of the Aristotle and other scientists and how they have advanced this particular field of science.

In addition to that, we have also discussed about the, what are the different criteria people are using to define a particular organism as a living organism and we have given you in detail a comparison of the living organisms such as the plant or the non-living organisms such as the diesel engines, and we have given you a complete detail, point by its comparison that how the living organism versus non-living objects are different from each other's.

And in contact with that, what we have discussed that the living organisms one of the basic properties of a living organism is that it is very complex in nature, it is very diversified. And in that context, what we said is that, if you want to understand the living organisms, you have to understand the many aspects of these living organisms. So, what are these aspects these aspects are that you are going to discuss about the classification.

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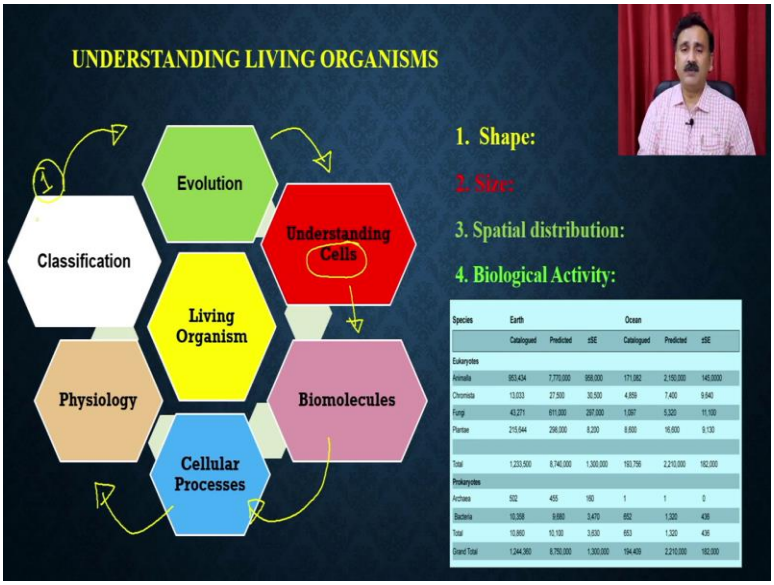

So, we said that, you have to first understand classifications and then you have to understand how the these living organisms are evolved onto the ark. And then once you understand that, and if you want to understand the physiology of that particular living organisms, then first you have to understand the individual cells, then within the cells are made up of the biomolecule. So, you have to understand the biomolecules and once you understand the biomolecules.

Because biomolecules such as protein, DNA, carbohydrates and lipids are actually the executory molecules. So, they will be responsible for the governing and regulating the different types of cellular processes and these cellular processes in combinations are actually going to impact the physiology of that particular organisms.

So, to start the discussing about the particular aspects, which said that first we are going to start with the classification of the living organism. So, our first question comes that what is the need to classify the living organism and why there is a what is the advantage of the living organisms.

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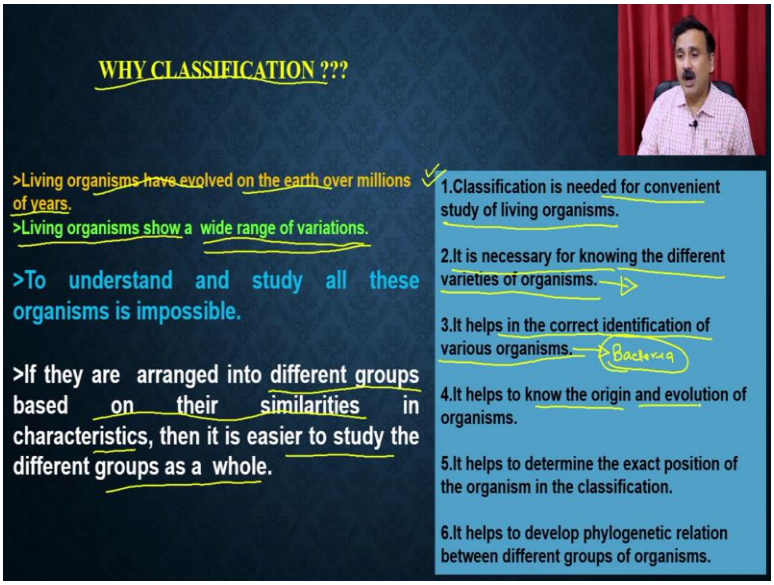

So, why there is a need to classify the living organism? I think very briefly we discussed in our previous lecture that the living organism have evolved onto the earth over the millions of years which means, they have gone through a very, regulated events and through which they have been evolved over the course of time. And the living organism shows a wide variety of variations, because of this, that they are being taken huge amount of time to modify it from the single organism to and diversified into the multiple organisms, they are also showing the wide variety of variations.

Apart from that, as you recall from the previous lecture, that these are also very, very, there it there are approximately 8.7 million species of the living organism present on the earth. And it is almost impossible that you are actually going to study and, in detail about each and every organism, and that is why it is important that you are actually going to group these animals into the different groups based on the similarities in the characteristics.

So, if you can actually classify and if you categorize them based on that some of the basic characteristics, then it is easier to study the different groups as a whole. So, why we need to have a classification? Because classification is needed for the convenient study of the living organism, it is necessary for knowing the different varieties of the organism. So, once you classify it, then only you will be able to know that okay these are the properties are present in the organism belonging to category number 1.

And these are the organism present in the category number 2, and that is how you will be able to can be able to understand that varieties or you can be able to understand the distinguishing factor between the two organisms. It helps in correct identification of the various organisms. So, you can imagine that if I have identified a particular organism and if it is matching or if it is showing a property which is matching with the bacteria, then you can be able to say that this is actually a bacteria.

And that is what people do actually when they identify the new species the when they identify the new species often are a living organism, what they do is they are going to do some classical experiments like they are going to do see the morphology of that whatever organisms, they are going to see what is the genomic makeup of this particular organism and then we are also going to see what are the different types of proteins are present in that particular organism.

And based on these kinds of analysis, they will be able to identify and correctly place at particular organism in that particular group. Once the place that into the particular group for example, as I said give you an example of bacteria, you are actually going to know many of the basic properties of that particular organism without even doing the experiments. For example, you are going to know what are the different types of physiology.

What are the different types of cell makeup is going to be there, whether it is going to be unicellular or multicellular, whether it is going to have the mitochondria and all these kinds of things? So, if it is a eukaryotic organism, you will know that okay this is going to have the eukaryotic cell type of the what structures, it is going to have the plasma membrane if it is belonging to plant then you will know that it is going to have the cell wall.

Then once you are going to do the classifications, it is also going to help to know the origin of that particular organism and as well as how this organism is being evolved from the earlier known organisms. And that helps in determining the exact position of that organism in the classifications and ultimately, it helps to develop the phylogenetic relationship between the different groups of organisms.

Now, what is the advantage of the classification? So, we have said that what are the requirements of the classifications, but what is the advantage of the classifications there are multiple examples like multiple advantages.

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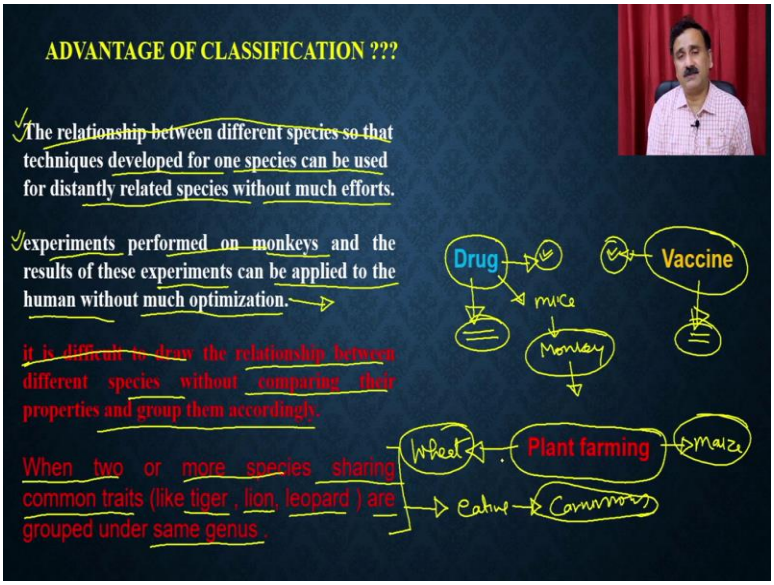

First is that it is actually going to give you the relationship between the different species so, that the techniques developed for the money species can be used for distantly related species without much efforts. Which means, if you are trying to develop a particular type of technique for a buffalo, it can be used for even for the cow and as well as the goat as well because they are similarly related species.

One of the classical examples is that suppose you are performing an experiment; you are performing the experiment on the monkeys. And the results of these experiments can be applied on to the human without much optimization which because that the humans are being involved from the monkeys. And that is what we will do when they are actually going to work with the drug molecules or to the vaccine candidates.

For example, currently that we are actually facing the pandemic of the Coronavirus. So, people are trying to identify the drugs which are responsible which are going to reduce the replication of the Coronavirus or they are also have developed the vaccines. But right now, they do not have the time to test these molecules on to the human beings. And do a very thorough clinical trials and so, what they are doing is they are testing the drugs into the relative species animals like monkey or related species.

And then once they say that, okay, this particular drug is working or this vaccine is working, then what they are doing is they are only doing the safety analysis they are going to do like whether

this is going to be non-toxic for humans or not and whether it is going to keep the protection or not and then they are actually been releasing that particular drug or that particular vaccine for the human applications.

Same is true for even if the regular drugs when they are identifying the regular drugs, that also they are doing the same way where they are trying to identify the drugs then they are actually doing the testing into the lower animals like they are going to first do the testing in mice, then followed by the followed by the monkeys. So, and then once they see that okay drug is working in the monkey because physiologically the monkey is also going to have the similar kind of physiology as like it is for the humans also.

And once they say okay this is working in monkey, then they will be going to say okay you can use this and you can use this product human trials. Apart from that, this is true for the even the plant farming as well like plant farming if you are actually derived some combination of the soil or other kinds of parameters for example, for the wheat, the same can be used even for the maize as well because that the maize and the wheats are more both are monocots. So, they are belonging to a same group.

So, whatever the parameters are going to work for the wheat probably could be used for the maize because they both are monocot, same is true for the rice also. So, it is difficult to draw the relationship between the different species without comparing their properties and group them accordingly which so, apart from that, we will give the similarity between the similar species it also can give you the contrasting features between the different groups.

And that all is also helpful in trying to compare in the properties of the different species and greeting them accordingly. So, when you have two or more species and sharing the common traits, like for example, you have the different types of lions, you can have the lion you can have tiger, you can have leopards, all these are actually belonging to same genus, but they are also they are having the different species, but they are all going to be grouped under the same genus.

So, if you have the prop, if that all these species do so, if since you had done the classifications, you will know the basic property of these organisms. For example, their eating habits all these three like whether it is a tiger, lion or leopard, they all are carnivorous which means they are actually taking the meat as their source of energy and all other kinds of detail also.

So, the first question comes is these are the, we have seen that what is the requirement of the classifications, we have also discussed what is the advantage of the classifications. And now, what we are going to ask is, what is the way we should be able to classify the different types of living organisms as I said, we have a very huge number of living organisms onto the earth and there should be a systematic way to classify them so that you will be able to study them properly.

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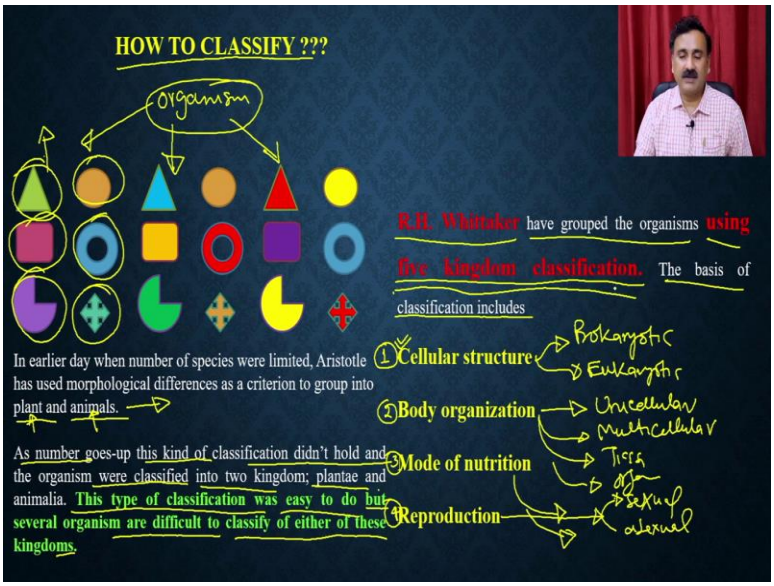

So, how to classify you can and that is a very human stuff. So, you can imagine that, these blocks are representative of the living organism. So, you can have this triangle, you can have the circle, you can have the square, you can have the three-quarter circle, you can have the concentric circles and so, on some so, these are the you can imagine that these are the different shapes of belong in this these are the different shapes, which are representing two different types of organisms.

These shapes could also have the different types of colors. So, these are actually the shapes what and shape and color, what is actually representative of the different types of organisms and you can see that these organisms are varying in terms of shapes and in terms of the different types of properties. For example, this is blue in color, this is green in color and this is red in color. So, these are the same shape.

But different type properties like one is a green, one is blue, and one is red. So, once the number is very small, like what if that happened when the beginning the Aristotle could be able to

classify the animals or classified the living organism into the two groups what it is called as the plant and animals. But, as that during that era, there was no earlier discovery of microscopes, there was no discovered known organisms which are not belonging to any of these groups.

So, that is why the even the organism which are very, very different from the plants or the organism which are very, very different from the animals are actually been grouped into either of the plant or to the animal. Because these are the two things but people were that time no knowing like for example, there was no discovery of microscopes so they cannot be able to see the ultra-structures and because of that they cannot be able to have the idea that okay these kinds of micro organisms are also present.

So, as the number grows up, this kind of classification did not hold and the organism classified into two kingdoms like the Plantea and the animal, but this kind of classic this type of classification was easy to do. But the several organisms are difficult to classify of either of these kingdoms which were because they were not the either the plant or the animals. And because of that, the RH Whittaker have grouped the organism using the five Kingdom classifications.

And the basis of the classification includes, so, what are the different basis he has used the cellular structure, so, what are the different types of cellular structures are present, whether the cells are prokaryotic or eukaryotic. So, whether the cells are prokaryotic or eukaryotic, whether the, what is the body organizations, whether the cells are unicellular or multicellular or they are having the even higher level or organizations like you can have the tissue or even the organs.

Then the mode of nutrition. So, either they are acquiring the they are preparing their own food, like for example, the plants or they are actually being dependent on to the other organisms. For example, you can have the mode of nutrition means, on how you are actually acquiring the nutrition, whether it is the for example, the plants like plants are not taking any nutrition from anywhere else they are taking the sunlight, and that is how they are preparing the food.

So, they are self-dependent whereas, all other organisms are either consuming the plants or they are consuming the other animals and that the fourth criteria what they have used is the mode of reproduction. So, mode of reproduction could be of two types either it could be the sexual or it could be asexual. So, that is the these are the four criteria and utilizing these four criteria, the

R.H Whittaker has classified all the organism into a five Kingdom classification system. What are these kingdoms?

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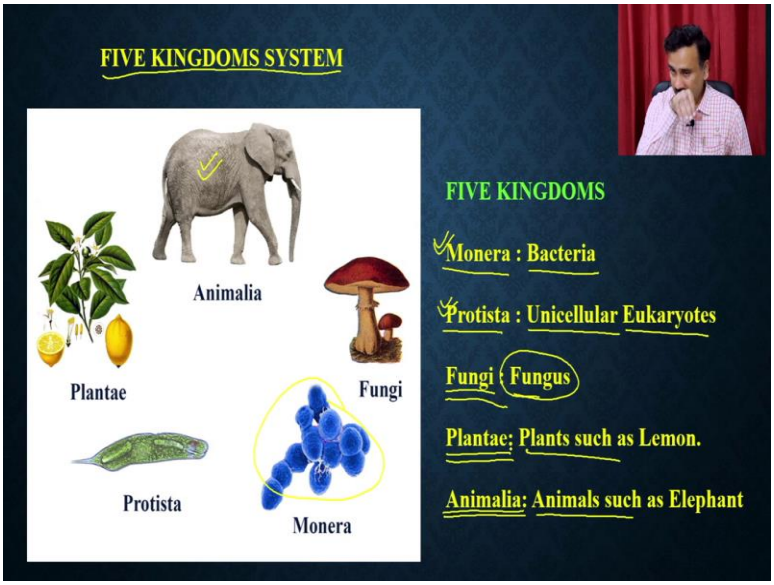

So, in the five classic Kingdom classifications you have the five kingdoms you have the Monera, you have Protista, you have Fungi, you have Plantea, and you have the animals within the Monera you have the bacteria. So, these are these are the different types of bacteria, what is present in the Monera then within the Protista you have the unicellular eukaryotes. So, these are unicellular eukaryotes.

Then you have the fungi, so, when within the fungi you have the fungus, so, you can see these are the fungus actually and then within the Plantea you have the plants for different types of plants. So, what you see here is a lemon plant, where you have the lemon and all these kinds of things. And then within the Animalia you have the all types of animals in the photograph, what you see is the elephants actually.

So, these are the five kingdoms people have, the R.H Whittaker has classified. So, let us see, what are the different properties of these five kingdoms.

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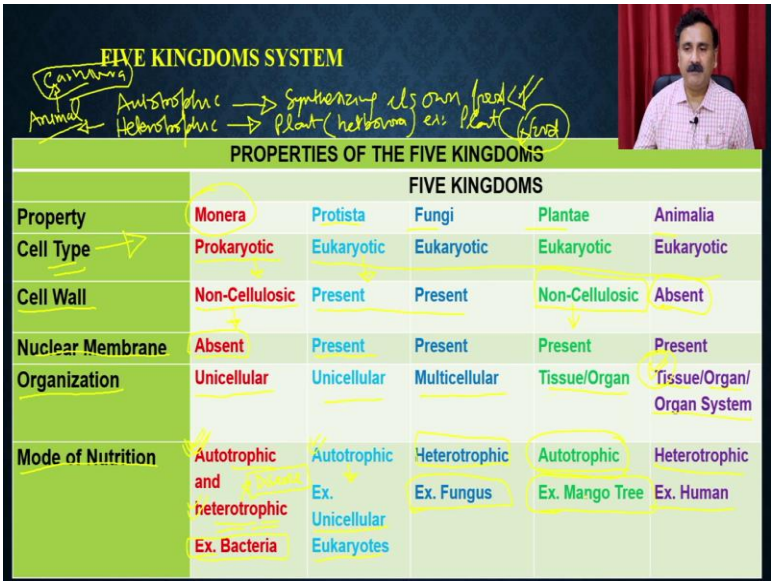

So, the properties of these five kingdoms are being divided based on different types of properties. So, for example, the cell type, so, these are the 4 or 5 criteria what the R.H Whittaker have used. So, as far as the cell type is concerned, you have the prokaryotic cell type. In the case of Monera. It is eukaryotic cell type in the case of all other five kingdoms whether it is the Protista fungi plantae or animals.

Do not worry about why the cells are called as prokaryotic or eukaryotic because when we are going to discuss about the cell biology, we are going to tell you in detail what type of cell type is called as the prokaryotic cell type and what type of cell type is called as the eukaryotic cell type. Then if the cell walls so, cell wall is non-cellulosic, which means, this bacteria is going to have the cell wall, but that does not contain the cellulose.

Whereas, the cell wall was present in the Protista as well as the fungi. But and it will also present in the Plantea. But the Plantea is does not contain the cellulosic cells wall it has a non-cellulosic cell wall whereas the cell was completely absent in the case of the anemia. Then you have the nuclear membrane. So, nuclear membrane is absent in the Monera because these are the prokaryotic cells.

And whereas, the cell wall was nuclear membrane was presented in the all-others kingdoms. Then you have the organizations. So, these are the unicellular organisms these are also unicellular organisms, fungi are multicellular organisms whereas, in the plant you can have the

multicellular as well as the tissue or the organ level organizations whereas, in the animals you can have the tissue organs or the organ system.

So, these are the most developed type of animals or what most developed the type of organisms present on the earth. Then in the third type of the mode of nutrition. So, modes of nutrition could be autotropic or do heterotrophic what is mean by the autotropic is that autotropic mode of nutrition means that the organism is synthesizing its own food. So, it is synthesizing its own food for example, the plants.

So, if the plants are actually taking the sunlight and that is how the plants are synthesizing the food. So, that is called as the autotropic. Heterotrophic means, you are actually taking the nutrition from the other organisms whether it is a plant or whether it is the other animals or other organisms. So, if you are taking from the plant, then you the organism is called as the herbivore and if it is from the other animal, then it is called as the carnivore.

You have seen that when I was talking about the lions, they are belonging to the carnivore because they are heterotrophic animals. But they are actually taking the nutrition from the other animals. So, if you are taking the meat, then it is called as the carnivore. If you are taking the plants, then it is called as the hubiera. So, in the case of Monera the Monera is actually the bacteria.

So, bacteria could be autotropic because you have some bacteria which are actually been able to perform the photosynthesis. And then you also have the heterotrophic bacteria because some of the bacteria are taking the nutrition from the other organism and these are the bacteria which actually causes the disease. So, all the heterotrophic bacteria are one or the other way they are actually causing the disease or they are taking the nutrition from the other source.

In the case of Protista they are autotrophic. So, they are actually going to be synthesize their own food. Example in the case of Monera is the all the bacteria, unicellular bacteria. Whereas examples in the case of Protista is the unicellular eukaryotes. Then you have the fungi, so, fungi are our heterotropics they always take the nutrition from the other sources. Fungi could be the fungi could be pathogenic or fungi could be non-pathogenic.

So, one of the classical fungi is the mushroom that we use for edible purposes. Then you have the plants which are exclusively been autotrophic. There are plants also which are heterotropic

for example, the insects eating plants so, those insect eating plants are heterotrophic because they take the nutrition from the insects. But that is partially because they only take the nitrogen from the insects, but they still do the photosynthesis and prepare their food.

And then, you have the Animalia which is a heterotropics. So, classical example is the human and in the case of plant the classical example is many types of plants and trees. So, this is the exact example I have given you the mango tree. So, let us discuss some of the basic properties of these kingdoms and to understand what are the different properties of these kingdoms and then you will be able to understand more in detail about these properties.

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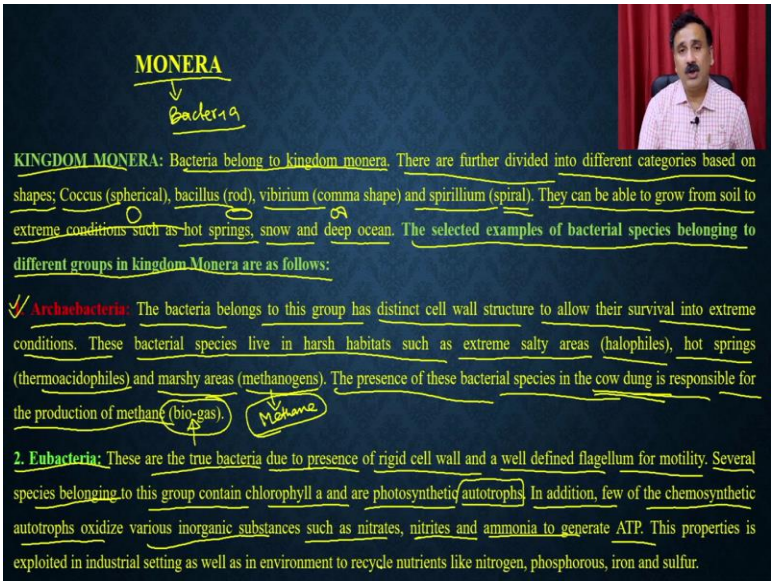

So, we will start with the kingdom Monera. So, Kingdom Monera is actually the kingdom where you have the bacteria. So, Kingdom Monera is the bacteria belongs to this kingdom Monera there are further they are further divided into different categories based on the shape. So, you can have the coccai, you can have bacillus, you can have vibirium, you can have this sprillium site.

So, coccus is going to be spherical, whereas bacillus which is going to be rod shaped, the vibirium which vibirium is going to be a comma shape, then you can have the sprillium, sprillium is is going to be a spiral. They can be able to grow from soil to extreme conditions such as hot springs, snow and deep oceans. The selected example of bacterial species belonging to different groups in different kingdom Monera is our as follows.

So, you can have the Archaebacteria, so the bacteria belonging to these groups have distinct cell wall structure to allow their survival into the extreme conditions. These bacterial species live in harsh habitats such as extreme salty areas like the halophiles, hot springs, like the thermoacidophiles and the marshy area such as the methanogens. Methanogens means the place where you are going to have very high quantity of methane.

And that area is very toxic, but even then, some of these archaebacteria are being able to grow into these conditions because if you remember in the previous lecture also, we have said that the living organisms are very diversified. So, they could be able to change their biochemistry, they could be able to chain the metabolic activities in such a way so, that they can be get acquainted, they can be get adjusted to the changing environments.

The presence of these bacterial species in the cow dung is responsible for the production of the methane or the biogas. So, you can see that the Archaebacteria are not only how like they are also can be used in for the industrial applications or they can be also used for the other kinds of applications where you can you can have these bacteria present in the cow dung and because of that the cow dung is being used for producing the biogas. And that biogas people can use for the as a source of alternate source of fuel.

Then you can have the Eubacteria, these are the true bacteria due to presence of rigid cell wall and a well-defined flagellum for the mobility, several species belong to this group contain the chlorophyll a and our photosynthetic autotrophs. So, the Eubacteria could be autotroph or the heterotrophs. In addition, few of the chemosynthetic autotrophs actually oxidizes various inorganic substances such as nitrate, nitrite, and ammonia to generate the ATP.

This property is exploited in industrial setting as well as the environment to recycle nutrients like the nitrogen phosphorus iron and sulfur. So, the major groups where the in the in the kingdom Monera is belonging to the bacteria and these group has the two subgroups like the Archaebacteria as well as the Eubacteria and Archaebacteria are not archaebacteria are not having the as there is a rigid cell wall as compared to the Eubacteria.

And Archaebacteria's are very adoptive to the harsh conditions like the salty areas hot springs marshy areas and so on. And the Archaebacteria are having the application in the production of biogas. Whereas, the Eubacteria, Eubacteria could be autotrophs or heterotrophs and or

Eubacteria are also having the application that they can be able to release the inorganic substances such as nitrate, nitrites, and ammonia from the organic compounds. And that is how they can be able to utilize this.

So, even imagine that if you are generating the toxic chemical substances, then these bacteria can be utilized to neutralize these substances to release the inorganic substances and that can be used for detoxifying or neutralizing the effects of the ordinary substances.

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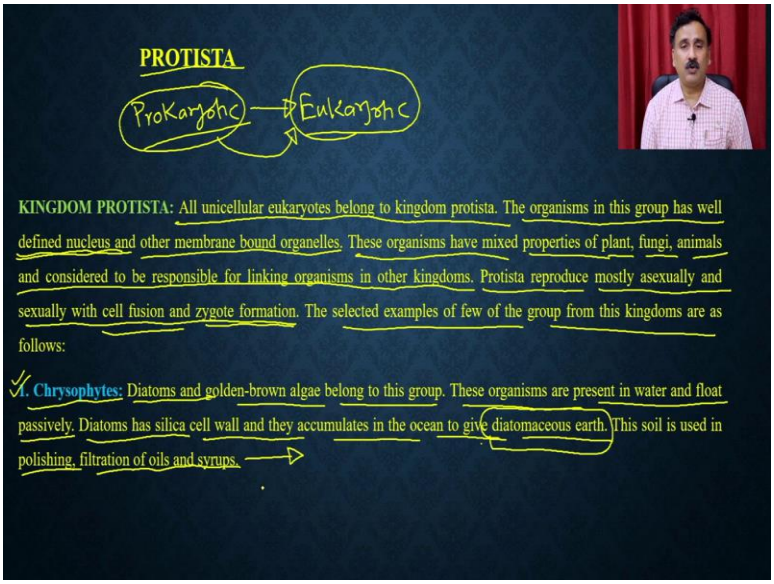

Then we will talk about the Protista. So, the Kingdom Protista is all unicellular eukaryotes belonging to Kingdom Protista the organism in this group has well defined nucleus. So, that is very important to know compared to the Monera, where you which is actually prokaryotic cells, the mono Protista is going to be a eukaryotic cell. So, you can imagine and that, if the classification, you can easily know that, the Protista are actually probably been developed from the, the from the Monera.

Because they somehow, they initially the prokaryotes are being evolved or prokaryotes are being developed and then eventually the prokaryotes got converted into eukaryotes. And other membrane bound organelles. These organisms have the mixed property of plant fungi and animals and consider to be responsible for linking organism in other kingdoms. Protista reproduce mostly by asexual means and sexually with their cell fusion and zygote formations.

So, the Kingdom the molecules or the organism present in the kingdom Protista are mostly been reproducing utilizing by the asexual means. But they sometimes also reproduce by the sexual means by where they can actually have the seafoods and the zygote formations. The selected example of these groups are as follows. So, you can have the chrysophytes so chrysophytes are the diatoms and a golden-brown algae belonging to these groups.

These organisms are present in water and float passively. So, they are not free flowing (what) organism but they we know they are in not a running water but a stagnant water. So, they will be floating into the surface and the diatom has the silica cell wall and they accumulate the silica in the they accumulate in the ocean to give the diatomaceous earth.

Diatomaceous earth is a very valuable item because, that is can be used for gone for making the polish as well as the filtrate of oil and syrups. So, that is very, very useful in terms of the industrial setup where they can be used for making the polish and when they can also be used to filter the oil and the syrups.

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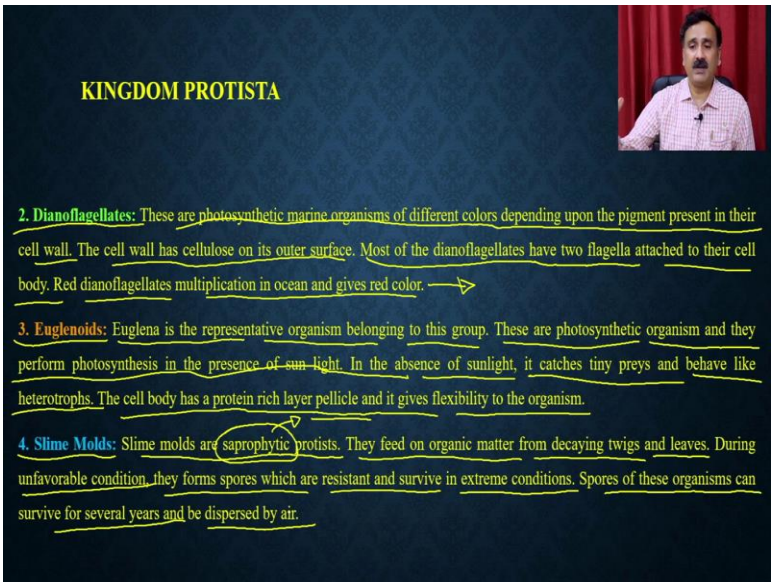

Then you can have the dinoflagellates, so, dinoflagellates, these are the photosynthetic marine organism or different color depending upon the pigment present in their cell wall. The cell wall has cellulose on its outer surface, most of the dinoflagellates have two flagella attached to their cell body. Red dinoflagellates multiplication in ocean and give the red color. So, this because of that, you have the color of that particular water body.

Then you can have the Euglenoids Euglena is the representative organism belonging to this particular group. These are the photosynthetic organisms and they perform the photosynthesis in the presence of sunlight in the absence of sunlight for cause, you can always have the alternate mode of nutrition. So, if the sunlight is present, the euglena is going to synthesize its own food because it has the photosynthetic pigments. And it can have the full machinery to synthesize that

But if the sun no sunlight, because suppose it goes deeper into the ocean and or suppose it is no sunlight because sometimes the surface of the water body is going to be covered with oil or some kind of leaves, then in that case, there will be no sunlight. So, in the absence of sunlight, it catches that tiny prey and behave like a heterotroph. The cell body has a protein rich layer pellicle and it gives the flexibility to the body organism. So, it has a cell body which is called as the pellicle and that pellicle is actually give the flexibility into the organism.

Apart from that you have the slimy molds, slimy molds are saprophytic protists the myth which means what it means by the saprophytic is that they actually acquire the nutrition by dissolving the food molecules. So, that anyway we are going to discuss in detail in later on that what is the different mode of nutrition taking the nutrition. So, one is called saprophytic.

Then you have the halophytic and so on. So, they feed on the organic matter from the decaying twigs and the fisher leaves. During unfavorable conditions they form these spores which are resistance and survive in the extreme conditions. Spores of these organisms can survive for several years and will be dispersed by air.

So, slime molds are saprophytic in nature. So, they can be able to take the nutrition from the decaying organic matters.

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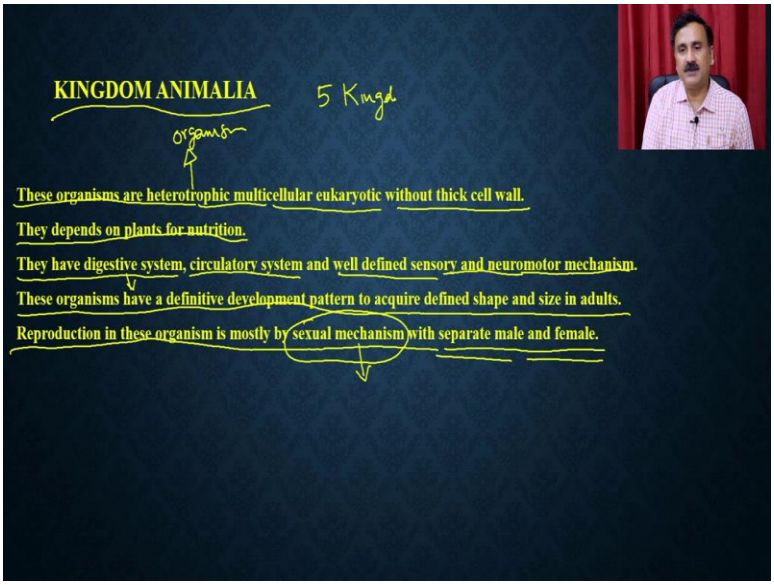

Then you have the kingdom Plantea. So, Kingdom Plantea means it this is the kingdom where you have the plants. So, all the multicellular green plants are part of the Kingdom Plantea. Their cell wall is made up off of the cellulose mostly these organisms are photosynthetic, but the few insects eating plants are parasitic in nature. Which means, you have the insect eating plants and these are called as insectivore and insect eating plants.

And these take up the nutrition from the insects so they trap the insects and if you can, have a chance you can actually go to the YouTube and you can see the very wonderful video where you can see the sun new plant and all other kinds of plants, how they actually catch the insects.

Plants reproduce through asexual vegetative propagation and as well as the sexual methods, plants are either bisexual, which means they are going to have the bisexual or they can be having the unisex fall which means they are going to have the separate male and female plants. Plants are further divided into the different subgroups like bryophyte, pteridophytes gymnosperms and angiosperms. So, these are the things we are going to discuss in detail. So, we are not going to discussing the properties of the different plants belonging to bryophyte, pteridophytes, gymnosperms, and the angiosperms.

Now the kingdom Animalia. So, in Kingdom Animalia these organisms are heterotrophic. Which means they are going to take up the nutrition from the other organisms and they are multicellular eukaryotes without her thick cell walls. So, they are going to only having the plasma membrane

they depend on the plants for the nutrition sometime they also take up the nutrition from the other organisms. So, they have the digestive system. So, they have a well-developed physiology very they can have the separate digestive system.

They can have the circulatory system and they can have the well-defined senses sensory as well as the neuro motor mechanisms. These organisms have a defined developmental pattern to acquire the define shape and size in the adults, which means these organisms have the different developmental stages through which they are actually going to go through and these and that is how they are. So, they will be very different when they are going to bond and they will go through with the different developmental stages and that is how they are actually going to acquire the stage of the adult.

Reproduction in these organisms is are the sexual mechanism as well as in some cases it is also asexual. So, it is there if it is a sexual mechanism, they are actually going to have the separate male and the female apart from these five kingdoms, so apart from for these five kingdoms, you can also have the sum of the organisms which are not belonging to these five kingdoms. So, these are the special organism which does not have the any kind of groups but they are actually not falling into these five kingdoms.

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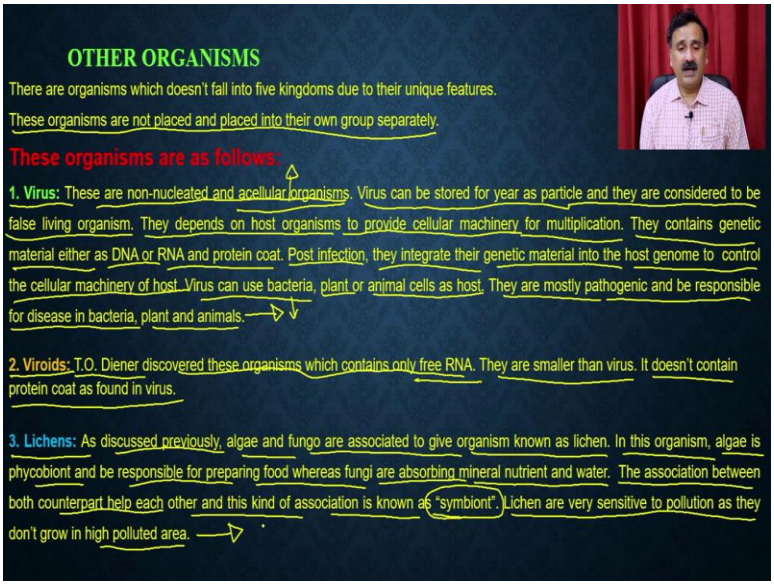

So, what are these organisms? These organisms are not been able to place into these kingdoms because they do not have the any of the properties common to these earlier five kingdoms. What

are these organisms? These are the viruses so these are the non-nucleated and acellular organism so that actually makes them the unique set? Because since they are non-nucleated, you cannot classify them into Monera or Protista. And since they do not have the cellular organism also, they cannot be classified into any other kingdoms.

Viruses can be stored for years as particle and they are considered to be false living organisms. So, they sometimes people also saying that they are not even the living organism. But that is not true they are living organisms but they are false living organisms. They depend on the whole organisms to provide the cellular machinery for the multiplications and because of this feature only they are being considered as a false living argument.

So, you can store them in the bottle you can store them in your in a box for years, and they will not going to have any problem. But the as soon as you open and they will come into contact to the host organism they will be going to utilize that host organism and they will go into multiply. They contain the genetic materials like the DNA or the RNA. And they are also going to have the protein coat and because of this only they are considered as the living organisms.

Post infection, they integrate into the genetic material then they integrate their genetic material into the host genome to control the cellular machinery of the host. Virus can use the back bacteria plants or animal cell as a host. They are mostly pathogenic and be responsible for diseases in bacteria, plant and animal. You are still very much familiar with the virus like the Coronavirus which is the utilizing the nutrition from the animals from the humans.

Viriods, so T.O Diener discovered these organisms, which do not they only contain the free RNA, they are smaller than virus, it does not contain the protein coat as found in the virus. So, Viriods are the even smaller than viruses. Then you have the lichens as discussed previously, the (ly) algae and fungi are associated to keep an organism known as the lichen. In this organism the algae is photobiont and be responsible for preparing the food whereas the fungi are the absorbing material and water.

So, the lichen is a combination of the algae and fungi. And they both are coming together at the symbiont organisms and where the algae are actually preparing the food. But it cannot prepare the food until it actually be able to absorb the minerals as well as the water. So, that is been the part of the fungi.

The association between the both counterparts help each other and this kind of association is known as the symbiont relationship or symbiont. So, lichens are very sensitive to pollution as they do not grow in the high pollution area. So that is why the lichens are called as the pollution indicators. So, you will not find a lichens in those area where the pollution is very high.

And that is why when these pollution monitoring agencies, sometimes what they do is they actually goes into the particular area and they look for whether the lichens are present in that area or not. If the lichens are not present, then they know that the pollution area is very high.

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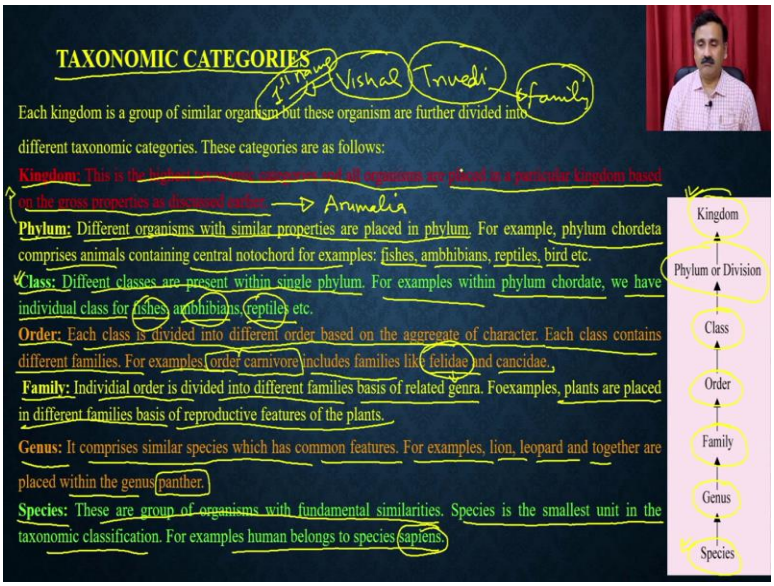

Then the because we are just talking about the classifications. So, classification, we have just discussed about the kingdom up to the kingdom level. But beyond the kingdom also or within a single Kingdom also the organisms are also been categorized into the different taxonomic categories. So, what are these categories you have the species, you have the genus, you have the family, you have the order, you have the class and then you have the phylum or the division and then you have the kingdoms.

So, the smallest unit is the species and the largest unit is the kingdom. So, what is this species so we will go in the reverse order actually. Species, these are the group of organisms with the fundamental similarities, especially this is the smallest unit in that taxonomic classification. For example, the human belongs to the species, which is called as the sapiens. Then the similar species come together, and that is how they are actually going to constitute a genus.

So, genus comprises a similar species, which have the common features. For example, you have the lion leopard, and the tigers these are come together under a single genus, which is called as the Panther. So, within the Panther you could be different in terms of species, so you can be different in terms of a species like the lion species leopard and Panther. But it could be under the same genus which is called as the Panther.

Then the genus, the different types of genus, when they come together, they are actually been grouped under a family. So, individual founder is divided into different families based on the different gender for example, plants are placed in different families based on the reproductive feature of that particular plant. So, within the family, you have the genus and within the genus you have the species.

Then all the families are being placed under the order. So, each class is divided into the different order based on the aggregate of characters. Each class contains the different families for example, the order carnivore, so order carnivore is actually going to include the families like Felidae and Cancidae. Felidae is the family where you are going to have all the catch. Then the orders one come together they are actually going to constitute the class so different classes that are present within the single phylum.

For example, within the phylum chordate we have the individual classes for the fishes, amphibians, and reptiles. So, these fishes, amphibians, and reptiles are the different classes within the fishes, you can have the different orders family genus and species. Similarly, within the amphibians, reptiles and so on. So, class is even higher taxonomic category compared to the order then you have the phylum.

So, different organisms with the similar properties are placed in phylum for example, the phylum chordate comprises the animal containing the central notochord. For example, the fishes, amphibians, reptiles, birds, humans. Then, all the phylum are placed under the which are actually having the different similar properties. So, kingdom is the highest taxonomic category and all organisms are placed in a particular kingdom based on the gross properties.

For example, the all these fishes, amphibians, reptiles, birds will come under the kingdom which is called as the Animalia area. So, since we they have the different types of taxonomic categories, you can also use this particular phenomenon to give the name of that particular

animals. Because as that we have also name for example, my name is Vishal Trivedi but this is not a scientific name.

Although even then in this name also there is a particular pattern what we are following. I am following while this is my family name, and this is my first name. So, this is my family name and this is my first name. So, same, but this is still not a scientific way of writing the name of every organism. So, every organism is actually going to follow a scientific way in which its name is going to be given in the in the textbooks.

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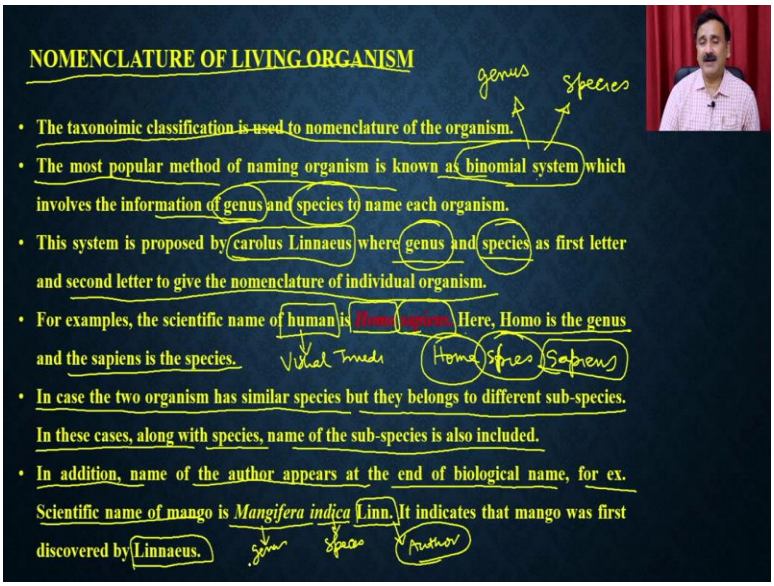

So, what is the rule for making a nomenclature of a living organisms. The taxonomic classification is used for the nomenclature of a particular organisms. The most popular method of naming organism is known as the binomial system. So, binomial system which involves the formation of genus and the species. So, in a binomial system, you can have the name with the two components. One is called as the genus and the other is called as the species.

And this system is being proposed by Carlos Linnaeus. And Carlos Linnaeus actually utilizes the system and he has actually given the name to all the gene, all the organisms which were presented that time, where you are actually going to use the genus as the first and the species as the first letter. Second letter will give the nomenclature of the individual organism. So, you are going to use the genus as the first letter and a species as the second letter for being the nomenclature of a living organism.

Let us take an example. For example, if you want to give the scientific name of a human, it could be a name right it could be a Vishal Trivedi like my name or it could be any other name. But if you talk about the scientifically the humans are actually belonging to a genus, which is called as the homo. And then, it is belonging to a species which is called as the sapiens and that is why the humans scientific name is going to be homosapiens.

Here the homo is the genus of that particular species and the sapiens is the species. In case the end what is the problem? Problem is that you might actually having an organism which is actually having the same genus and the same especially so what how you are going to distinction.

So, if the in case the two organisms have the similar species, but they belong to different sub species, then in that case, you are actually going to keep the species name as well as the sub species also like for example you can have the homo sapiens sapiens. So, that is that third sapien what you see is actually a sub species. Within the homo sapiens, you can also have the sub species or you can have the homosapiens some other sub species.

So, in addition, name of the other author appears at the end of the biological name for example, you can have the scientific name of mango. So, Mango's scientific name is Mangifera indica, Mangifera is the genus and the indica is the species. But what you see here is the linn. So, it is complete name is Mangifera indica Linn. And what is the third name third name is the name of the author who has actually discovered the mango for the first time. And since the Carolus Linnaeus has discovered the mango for the first time. He has actually put his initials at the end.

So, that is why the scientific name of the mango is Mangifera indica Linn. So, this is what the way of the scientific way of actually giving the nomenclature of the living organism This is different from your common name or this is different from your social name this is a scientific name. For example, when you write about the mango, mango is a common name, but if you try to describe the mango into the textbooks, it is going to be Mangifera indica Linn.

So, with this, I would like to conclude my lecture, but before we conclude. Let us discuss what are the difference portion what we have discussed, what we have discussed so far in this lecture. So, what we have discussed? we have discussed about what is the importance of classification.

What is the reason and the need to classify the different organisms? And how the people have tried to classify the different types of organisms.

For example, the Aristotle, the Aristotle has classified the organisms into the two parts like plant or animals. Later on, the people have realized that the organisms are neither falling into the plant is category or the animal category. So, they will actually have used the five kingdoms systems. And within the five Kingdom systems they have actually found out the different types of properties and characteristics and based on these characteristics, they have classified the different types of organism into the different kingdoms.

And apart from that, we have also discussed about the different types of taxonomic categories, what we are using and the last we have also discussed about the scientific nomenclature of these organisms. So, with this I would like to conclude my lecture here. In the subsequent lecture, we are actually going to discuss about the classification of the animals. And we are also going to discuss about the classification of the plants. So, with this I would like to conclude thank you.