Wildlife Conservation
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Lecture – 25
Preliminaries & Introduction to genetics

[FL] Today we will start our next module, which is conservation genetics. In this module, we will have 5 lectures.

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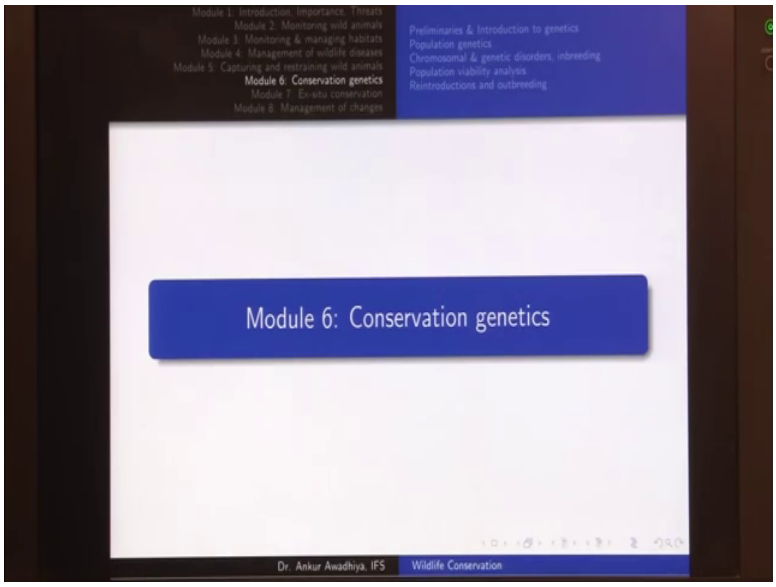

The first one is preliminaries and introduction to genetics followed by population genetics, chromosomal and genetic disorders and inbreeding population viability analysis, reintroductions and out breeding.

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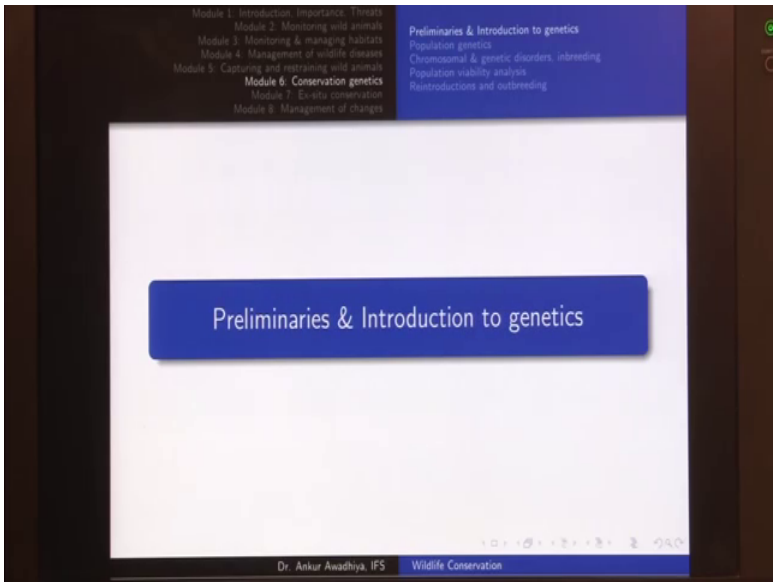

So, let us begin with the first lecture, preliminaries and introduction to genetics.

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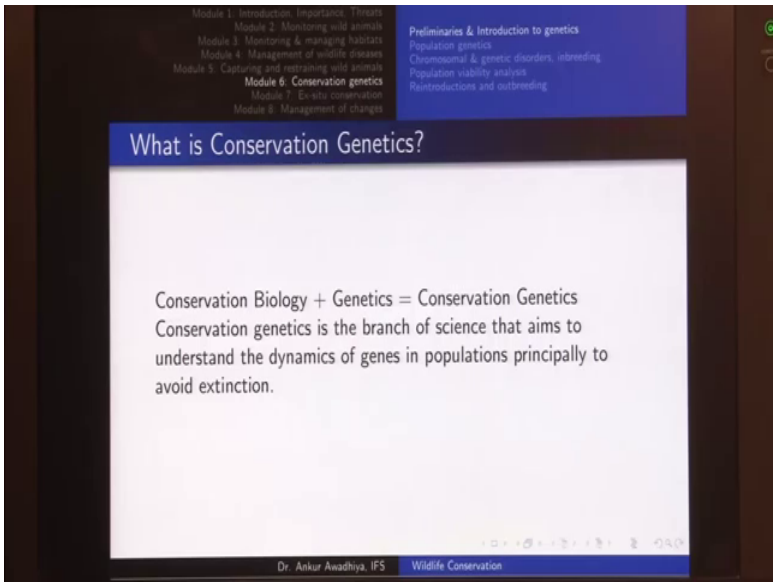

So, let us begin with what is conservation genetics? Now, we know what conservation is we have dealt with in the first module. Now, conservation biology the biology of conservation plus genetics gives us conservation genetics. Now we can define conservation genetics as conservation genetics is the branch of science that aims to understand the dynamics of genes in populations, principally to avoid extinction, we need to look at this definition in more detail. It is a branch of science that, aims to

understand the dynamics of genes in population. So, essentially we are concerned with population of animals the populations is the group of animal that are living together of the same species. Now they will be having genes inside them, we will come to genes in a the short while and these genes function in dynamic ways.

So, essentially we are talking about population genetics or how genes are changing from one generation to the next in the same population? And once we understand their dynamics, we can use that knowledge to avoid extinction.

So, conservation genetics is the branch of science that aims to understand the dynamics of genes in populations principally to avoid extinction. So, our aim is to avoid the extinction of the population of species.

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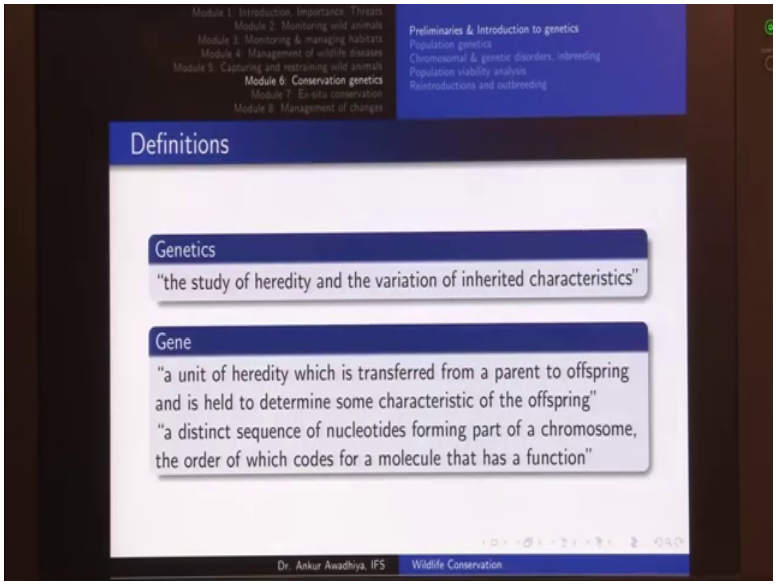

So then, we come to the definition of genetics, in gene genetics is the study of heredity and the variation of inherited characteristics the study of heredity. Now heredity is how different traits move across different generations. So basically, when a child is born then you would often here, statement such as this child has the eye of his mother or this child has the hairs of it is father or the things like that. So, essentially the traits that were there in the parental generation also express themselves in the child.

So, this movement of straight across the generation goes by the name of heredity. So, genetics is the study of heredity, how this thing is happening? And the variation of

inherited characteristics so, basically everybody of us has inherited certain characteristics, but all of us are different. So, all of us have different heights, in different colors of skin, different colors of eyes, different colors of hair, whether the hairs are straight or whether they are rounded and so on, whether they are curled or whether they are straight and when we look at the cross sections whether they have a flat cross section or rounded cross section or an oval cross section.

So, all of these a different inherited characteristics that vary between different organisms or different individuals in the same population. So, genetics is the study of heredity and the variation of inherited characteristics, in on the other hand is a unit of heredity, which is transferred from a parent to offspring and is held to determine some characteristic of the offspring. So, when we talk about all of these different characteristics the height. So, we will say that, there could be a genes for a height, because of which this character of height becomes an inherited character, whether a child has curly hair or whether he or she has straight hair. So, we would say that, there must be a gene that is determining, whether the hair is curly or whether this hairs is straight, because of which this is being transferred as an inherited characteristic.

So, gene is the unit of heredity. Now in spring biological terms, you would even say that gene is a distinct sequence of nucleotides forming part of a chromosome, the order of which codes for a molecule that has a function. So, essentially when we say that there is a gene for height. So, how is this gene impacting the height of the organism? So, this gene would be a sequence of nucleotides. So, this gene would be have a some sequence of nucleotides and this gene where is it located? It is located in chromosome and the order of these nucleotides or the information that is there in the gene is used by the organism to code for something especially for a molecule that has some function.

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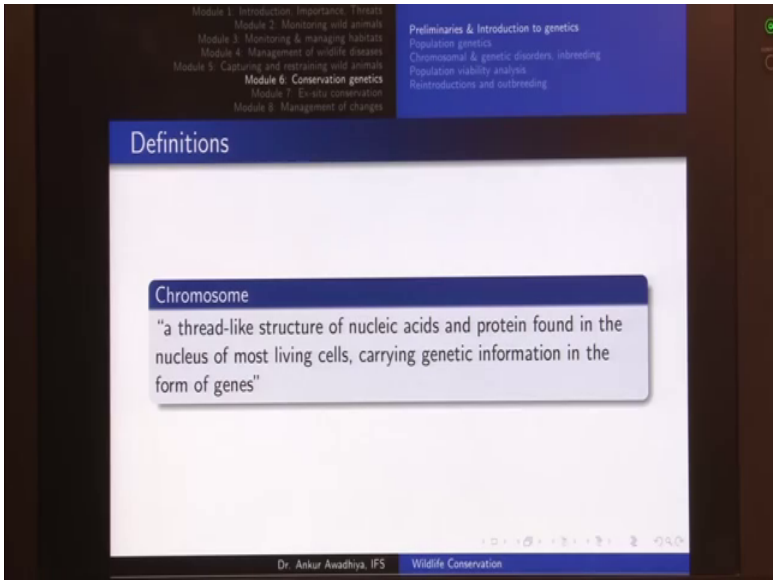

So basically, this gene could be for instance coding for a molecule that impacts height. So in that case, we would call it that gene is the distinct sequence of nucleotides forming part of a chromosome, the order of which codes for a molecule that has a function, then when we say chromosome.

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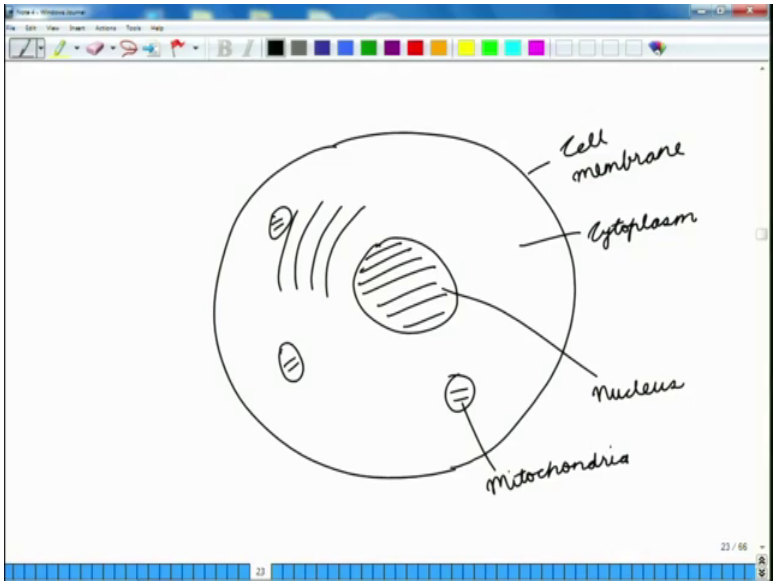

So, then what is a chromosome? Now do before we go to a chromosome, let us understand, how our cells are made? So, in the case of all of our cells will be an animal cell. So, they would be a nucleus inside. So, this is a cell membrane, this is a nucleus and then we will be having a number of other things like cytoplasm, which is the sap that is

filling the cell, we might be having a few mitochondria, which are organelles, where energy is produced.

So, this is mitochondria, we might be having an endoplasmic reticulum. So, which is a distinct structure that is used by different organelles is to move things from one part to another, we could be having(Refer Time: 06:18) bodies and so on, but for the case of genetics the only thing, that you are interested in right now is the nucleus. So, we can forget everything else. So, there is cell and there is nucleus inside.

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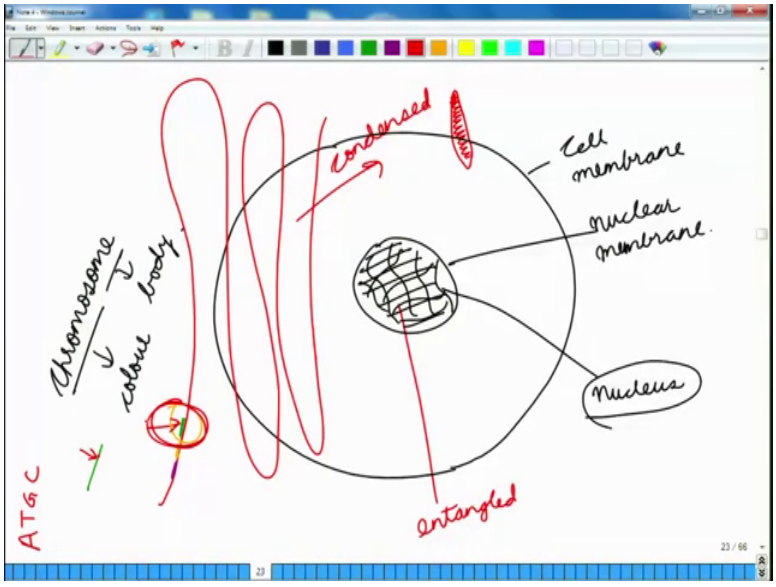

Now this nucleus will be having a number of fibers inside that remain entangle for most of the part, but when the cell is dividing. So, well when the cell is moving from 1 cell to 2 cells, then all of these fibers condense together to form things that go by the new chromosomes. So, what is chromosome? Chromo means color and soma means body.

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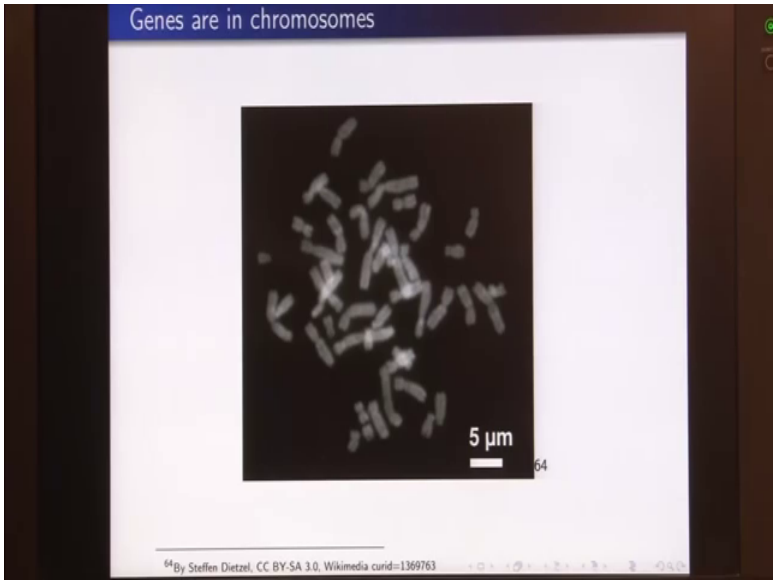

So, it is a body that has some color. So, basically if we take a cell that is dividing and we break that cell will get to the nucleus, we break the nucleus again and in that case, we will be able to see the chromosomes. Now in certain cells in certain anima, cells, whenever we are undergoing a cell division then, there are stages in which this nuclear membrane nuclear membrane. So, this membrane dissolves by itself. So, that all of these chromosomes come out into the cell body, into the cytoplasm. So, if you look at these structures out there in a microscope, we see there are some bodies and they are having some color, because of which, we call them is chromosomes.

So now, technically we would say that chromosome is a thread like structure of nucleic acids and protein found in the nucleus of most living cells, carrying genetic information in the form of genes. So, now, coming back to the drawing board, here we saw that all of these threads, they are in an entangle form. So, if you take any of this thread outside, it would be an extremely long thread and when this thread is condensed, it forms a small completely condensed body, which we call is chromosome. So, this chromosome will be having. So, this is a thread like structure of nucleic acids and proteins, now proteins bind this thread into the tightens structure or other coin structure.

So, a thread like structure of nucleic acids and proteins found in the nucleus of most living cells, why that most living cells? Because certain cells, such as RBCs, the red blood cells will not have a nucleus. So, they are e nucleated, but in most of are living cells, we will be have a nucleus that will be having chromosomes inside, that is found in the nucleus of most living cells and the function is that, it carries genetic information in

the form of genes. So, coming back to the drawing board, so, if this is a long thread that becomes called as chromosome, if we take any small portion, so, say this portion or say this portion.

So all of these, small portion or some of these small portions, may be coding for certain genetic information. So, not all parts of the chromosome will be coding for some genetic information, but such portions of the chromosome that a coding for genetic information, in the form of genes will also be there. So, chromosome is a thread like structure of nucleic acids and proteins found in the nucleus of most living cells carrying genetic information in the form of genes.

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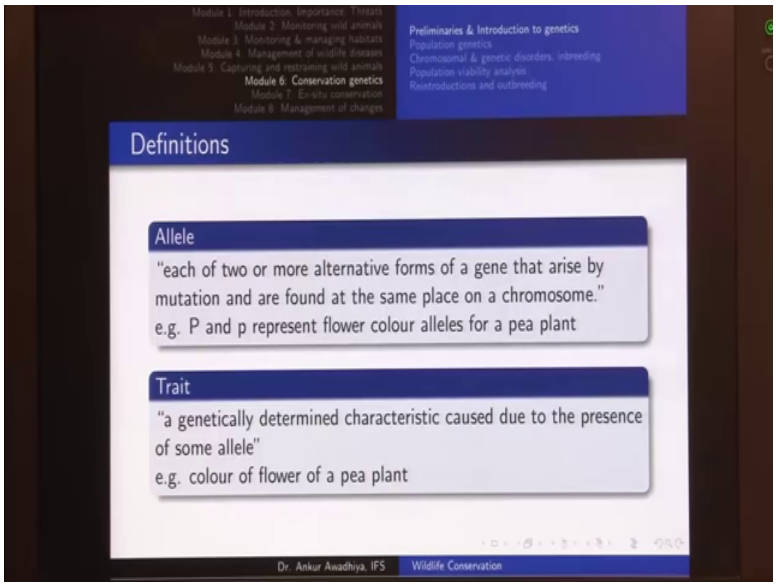

Next we have Alleles. So, in this class will be discussing a number of definitions that will be making use of in the next classes. So, an alleles is each of 2 or more alternative forms of a gene that arise by mutation and are found at the same place on a chromosome. For example, capital P and small p represent flower color alleles for a pea plant.

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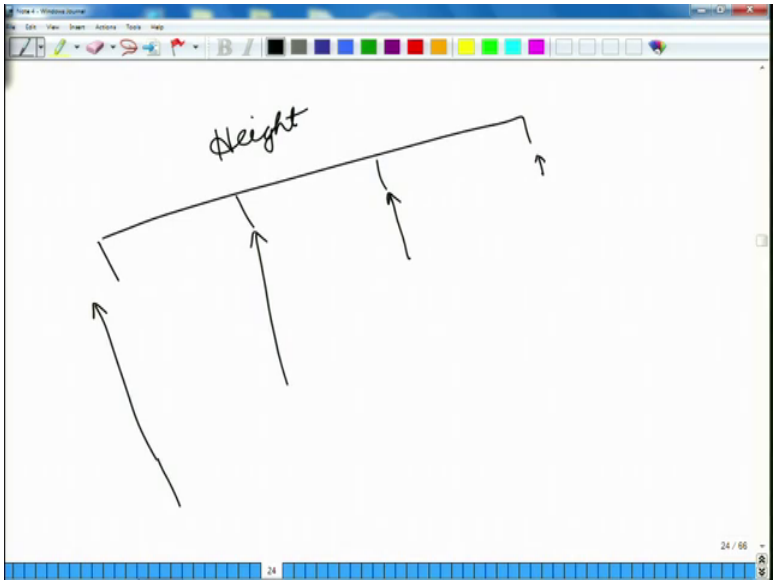

So, what are we saying here? Is that alleles, each of 2 or more alternative forms of a gene. So, when we considering say, the gene for height of a human being. So, let us say height. So, this height gene may come in a number of varieties. So, there could be a gene that codes for a very tall individual, they could be a gene that codes for a very short individual, they could be a gene that code for somewhere in between and also somewhere in between. So, all of these are different forms of the gene and why do they have different forms? Because they have different sequences so, these alternative forms that arise by mutation. So, how do we get changes in the sequences? So here, we saw that this is a sequence of the gene. So, this is the green portion, now suppose some part of it was replaced by say a red dot. So, these sequences are made out of 80 ATGC, which is adenosine, thymine, guanine and cytosine. So, these are 4 different nucleotides that code this whole chromosome.

So, for instance in the case of English language, we say that, we have 26 different letters, a, b, c up till z. In the case of the genetic information, we have 4 different letters A, T, G and C. In the case of computers, we have only 4 letters 0 and 1. So, with just 0 and 1, you can form everything, you can make a drawing, you can make words, you can make music and so on. Similarly in the case of the chromosome, just by using these 4 alphabets, we can make anything. Now when we are having these 4 alphabets, then if there is a change at any location in which, one alphabet gets replaced by some other alphabet, then it is known as a mutation.

So, this is a simplified understanding of mutation also different other kinds of mutations, that will come to in one of the next lectures, but each of 2 or more alternative forms of a gene, that arise by mutation and are found at the same place on the on a chromosome, why the same place on a chromosome? Because coming back to the drawing board, even when this portion was change, even when this letter was change, but the whole of those gene remains at the same place. So, when we consider 2 different chromosomes.

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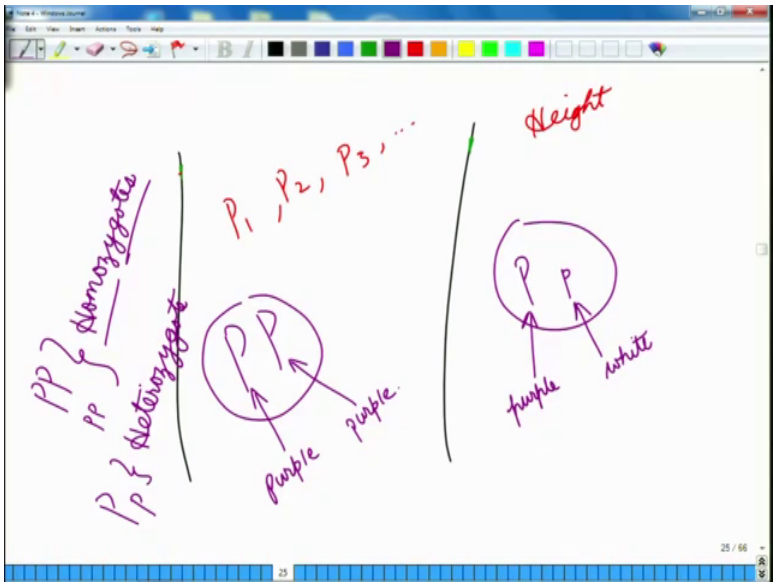

So, let us say that this is 1 chromosome. This is the second chromosome and both of these were having a gene at this location and 1 gene suffered a mutation. So, even then we are having these genes that are coding for the height of the individual at the same location. So, here it says that an allele is each of 2 or more alternative forms of a gene that arise by mutation and are found at the same place on a chromosome. Now we represent alleles with alphabets of groups of alphabets.

So, for example, capital P and small p represent flower color alleles for a pea plant. So, we would say that the color of the flower in a pea plant, could be purple or it could be white. So, we would say that purple, we will represent as capital P and then another form of this alleles found will represented by small p, if you had even more number of form, when we could be using things like P 1, P 2, P 3 and so on. So, all of these will be referred to as different alleles of the same gene, the gene that is coding for the flower color of a pea plant. Now next is trait, a trait is a genetically determined characteristic

caused due to the presence of some allele. So, these are 2 different ways of representing the same thing. So, trait is the flower color of a pea plant and this trait is caused by genes and these genes come in different varieties, which we call as alleles.

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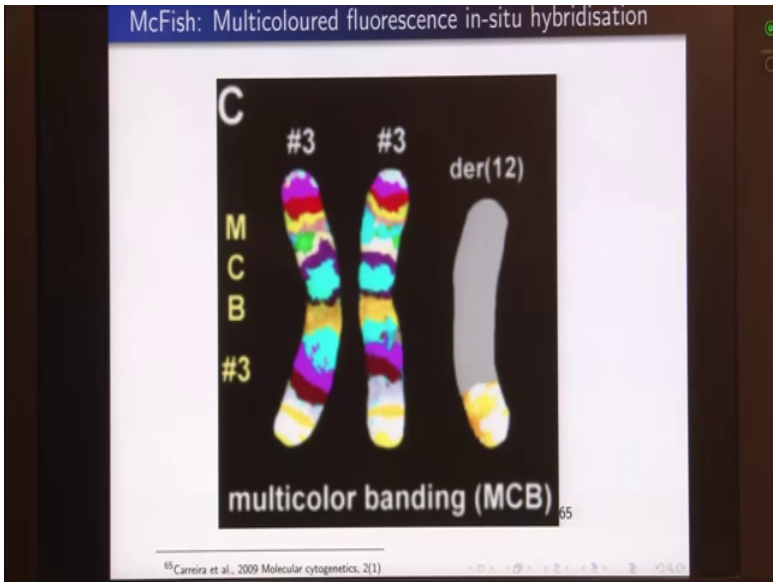

So, when we say that they are found in the same location, we can locate it using McFish, McFish stand for multi colored fluorescence in situ hybridization.

So, here we are looking at chromosome number 3 and in the case of chromosome number 3. The area, that are having the same or very similar sequences of nucleotides in them are represented by different colors. So, all of these chromosomes come in 2 pairs, why a pair? Because one of these chromosomes will be coming from the father, one of these chromosomes should be coming from the mother.

Now in the case of the father chromosome and the mother chromosome both and both of these, we are saying that these colors pink, red, yellow, dark yellow, pink, red, yellow, dark yellow, this white on the on the top all of these come in the same sequence, why? Because this region suppose, this is coding for height gene. So, the height gene in the chromosome number 3 coming from the father will be having, will have a position here. In the case of the height gene coming from the mother in chromosome number 3, it will also be having the same position you would not be having a height gene here and height gene here. So, these come in pairs.

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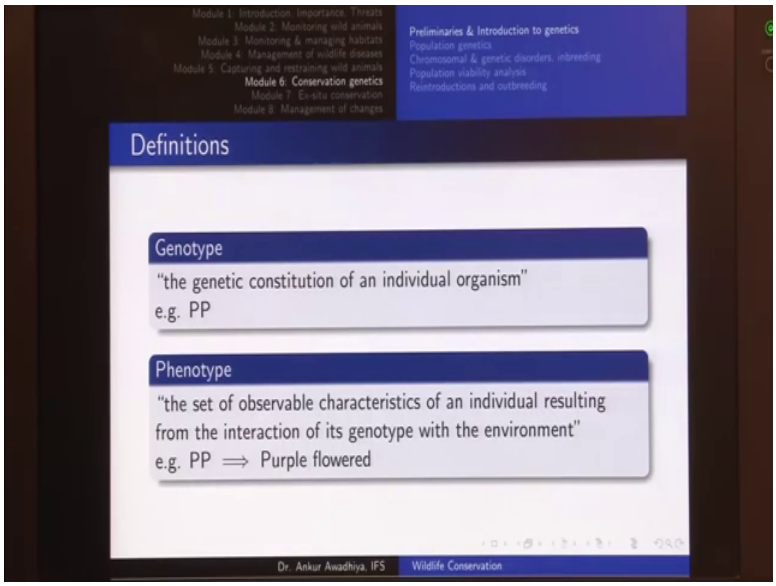

Next we have a genotype. A genotype is the genetic constitution of an individual organism. So, what sorts of alleles are present in that organism? Is represented by the genotype for example, capital P capital P, now in this case, what we are saying? When we say capital P capital P is that this individual or got the allele for purple color from the mother and also for the purple color from the father. In case, this individual had suppose a capital P from one parent and small p from another parent. So, we would say that, this is a purple allele and here, we have a white allele, white allele both of which are coding for the same trait that is the color of the flower.

Now in case, we have capital P capital P or small p small p, we call these individuals as homozygotes. Homozygotes for the gene that is coding for the flower color, homo means same and this is a homozygote, because both of these alleles are the same, but if one of these was capital, one of this was small will call it a heterozygote. So, genotype is the genetic, constitution of an individual organism. Suggest capital P capital P, now phenotype will be the set of observable characteristics of an individual resulting from the interaction of it is genotype with the environment.

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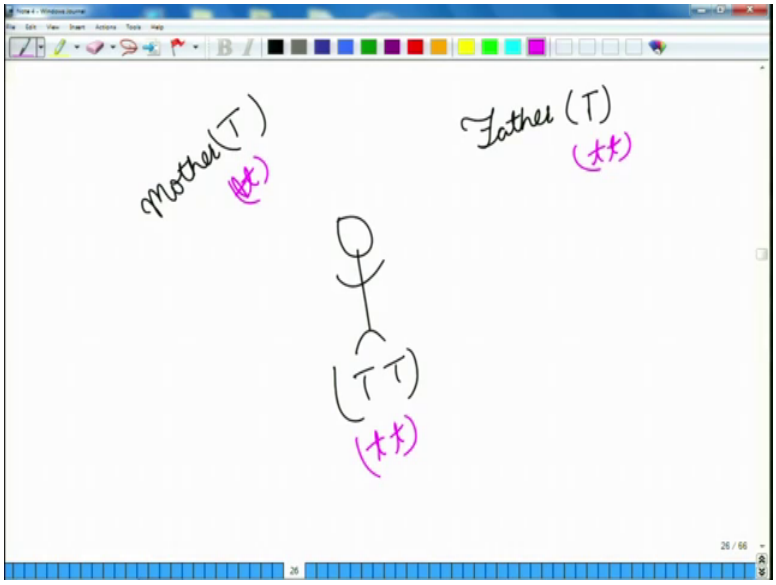

So, for instance this capital P capital P, in the presence of a suitable environment will give purple color flowers. Now why is environment important here? Because suppose there is an individual and the mother is very tall, the father is also very tall and this individual is homozygous for the tall gene. So, essentially this individual is having all the capabilities that it should grow up into a very tall individual, but then suppose this individual did not get proteins during it is childhood. So, essentially this individual was suffering from starvation. So, during those starvation period protein is required for building up the muscles of the body and basically, if this individual lacked protein.

So, it was not able to grow very(Refer Time: 18:16) or suppose this individual was lacking calcium or maybe this individual was infested with some parasites, which did not allow it to absorb all of those nutrients that were there in the food. So, this individual even though he or she is having the genetic constitution, that would coat for tall individual, but in the presence of an environment in which he or she is not getting sufficient nutrients, he or she may turn out to be a dwarf individual. So, which is why, we say that phenotype is the observable, characteristics of the individual resulting from the interaction of it is genotype with the environment. Now on the other hand, if this individual was having short mother and a short father and it is genetic constitution was also coding for a short individual.

So, even if you provide this individual with lots and lots of nutrients, this individual would not grow up to be a tall individual. So, which is why we say that, in the case of a phenotype both the genetic constitution and the environment both are important and it is

an interplay between both of these that tells us, what sort of a phenotype would come out?

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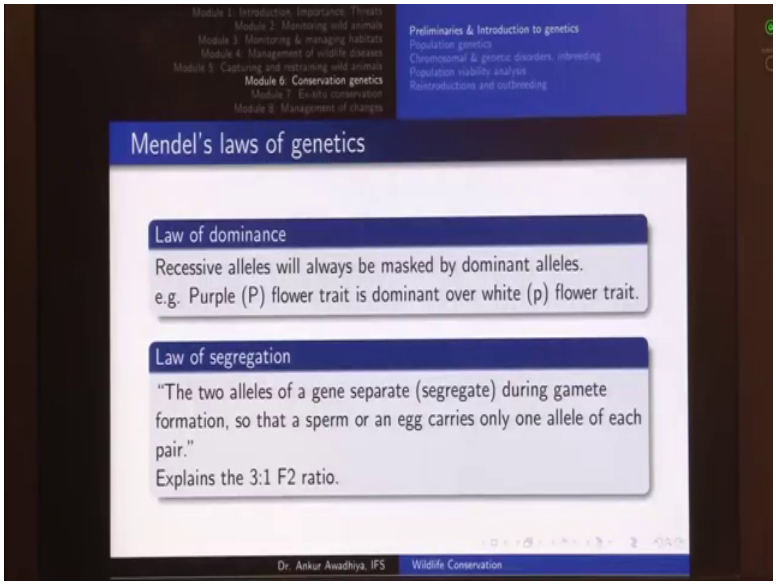

Now, from here we move on to the Mendel's laws of genetics. Now, Gregor Mendel was a monk an Australian monk, who first figured out the different laws of genetics. So, the first law is the law of dominance. So, recessive alleles will always be marked by dominant alleles for example, purple capital P flower trait is dominant over the white or the small p flower tree.

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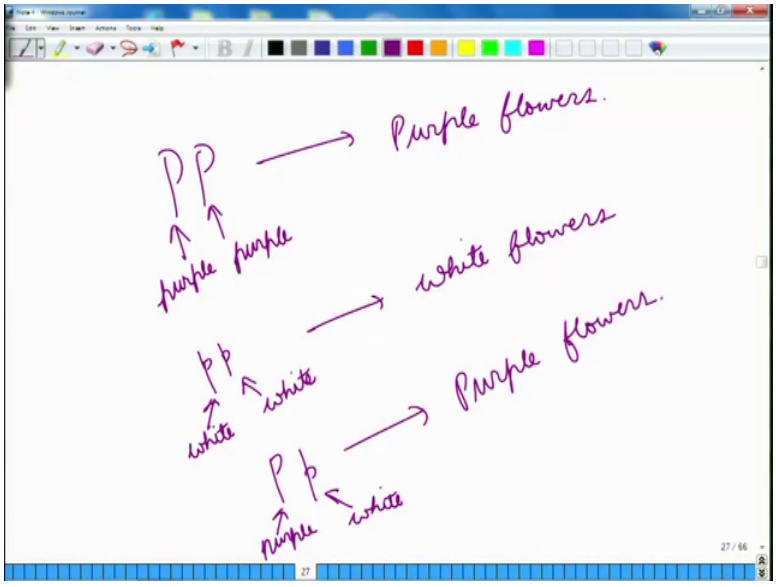

What it says? Is that if you have an individual that is capital P capital P so, the first allele is coding for purple, the second allele is also coding for purple.

So, in this case you get purple flowers, if you have a small p small p. So, let us write it like this. So, the first one code for codes for white, the second one also codes for white. So, in this case, we get white flowers, but what do we have when we have a capital P with a small p? So, here this one is coding for purple and this one is coding for white. So, in this case, do we get individuals that have that have colored, that is somewhere in between purple and white? Or do we have situations in which, sometimes it will show purple, sometimes it will show white? So, the law of dominance tells us the answer to this question, it says that whenever we have 2 alleles and when allele is dominant. In we generally, represent dominant with a capital letter. So, anything that is dominant will mask over the phenotype of recessive one.

So in this case, because capital P is dominant will be having purple flowers only, law of dominance see is that this alleles will always been masked by the dominant alleles. So, if you have capital P and small p will have in the expression of the capital P. Next we have the law of segregation, the 2 alleles of a gene separate or segregate during gamete formation. So, that a sperm or an egg carries only 1 allele of each pair.

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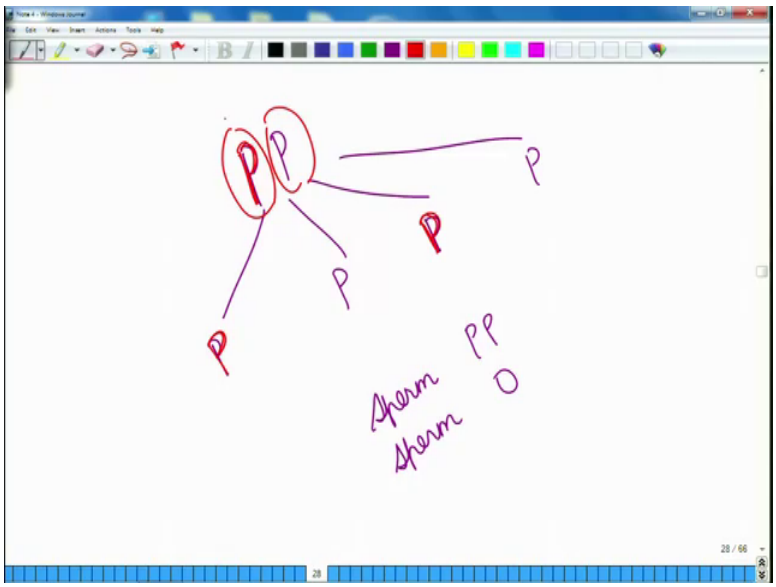

So what it says? Is that suppose you have a parent. That is capital P capital P and this parent is giving out sperms. So, each of these sperms would be having a capital P, but if

everything goes well, if there is no abnormality, we will not be having a sperm that has 2 copies of this capital P or a sperm that does not have any copy of this allele. So, this is the law of segregation and secondly, both of these alleles, let us represent it as by a red color and by a purple color

So, both of these alleles are one and the same, but then we are representing them by different colors, just to see how they will segregate out? So, when you have the sperms, there would be some sperms that carry, this allele that is coming from one chromosome and there will be some that will be having the second allele that is coming from the second chromosome. So, the 2 alleles of a gene, in this case capital P capital P separate or segregate during gamete formation. So, both of they will become separate and a sperm or an egg carries only 1 allele of each pair. So, it does not carry both the alleles, it does not carry 0 alleles and this explains the 3 is 2 1 F 2 ratio.

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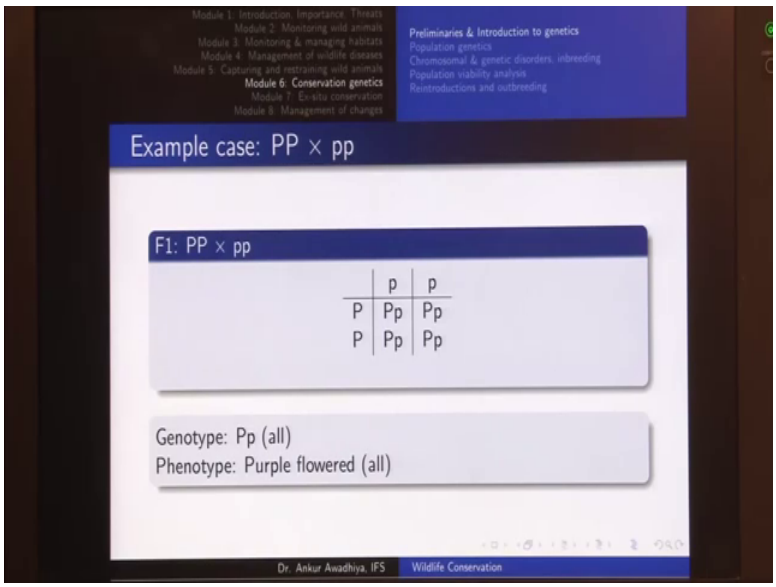

Now what is this F 2 ratio? F 2 is stands for or F stands for a female generation. So, will come to this here so, the example case, yes if you have done across between 2 individuals. One was having capital P capital P and the second one was having small p small p.

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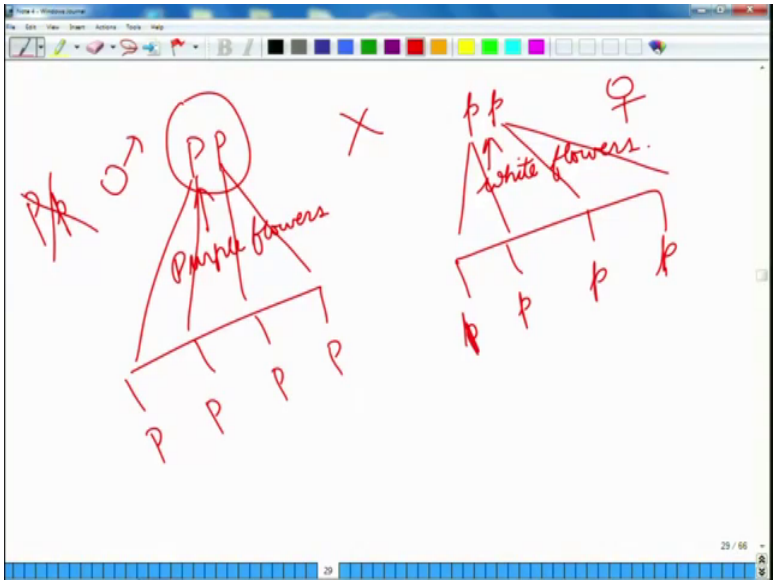

So, what do we mean by this? When you had an individual with capital P capital P, then this individual was having purple flowers and when you had an individual that had a small p small p, you were having and individual that was having white flowers and we are beginning with this example case and which were assuming that both of these individuals are homozygotes, which means that in the case of this capital P capital P, it is homozygotes both of these are capital P, it is not a case in which, there is 1 capital and 1 is small. So, we are starting with 2 homozygotes individuals. Now when we do a cross between both of these so let us say that, this one is a male plant and this one is a female plant, now in the case of P plant it is having both the main organs and the female organs together, but for the case of this example, let us say that we have different plants, one is a male plant and one is the female plant.

So in the case of the male plant, the sperms will be having capital P capital P capital P and capital P, because 2 of the sperms would be having this capital P and 2 of the sperms would be having this capital P. Now in the case of this, female plant will have the 4 eggs, that are small p small p small p and small p, these come from 1 chromosome and these 2 come from the other chromosome.

Now when there is across so, this is how we represent across, this is known as a punnett square. So, we represent the gametes from one parent on the left side, we represent the gamete from the second parent on the top. So, in this case 1 parent give us capital P and capital P and the second parent give us small p and small p. So, when both of these

gametes come together. So, we have an individual, which will be getting a capital P from the father and a small p from the mother.

So, in this case this individual becomes capital P small p. Similarly, this individual also gets a capital P from the father and a small p from the mother. So, it is capital P small p. So similarly, all other- individual are also capital P small p so, in this case, will say that in the first generation. So, in the first filial generation that is the result of this cross all of these individuals are having a genotype of capital P and small p all of these and the phenotype will be purple flowered, because capital P will dominate over the small p, now why do we called a filial generation? Filial means brotherhood, brotherhood or sisterhood or individuals that are siblings. So, this is the first sibling generations. So, all of these are together.

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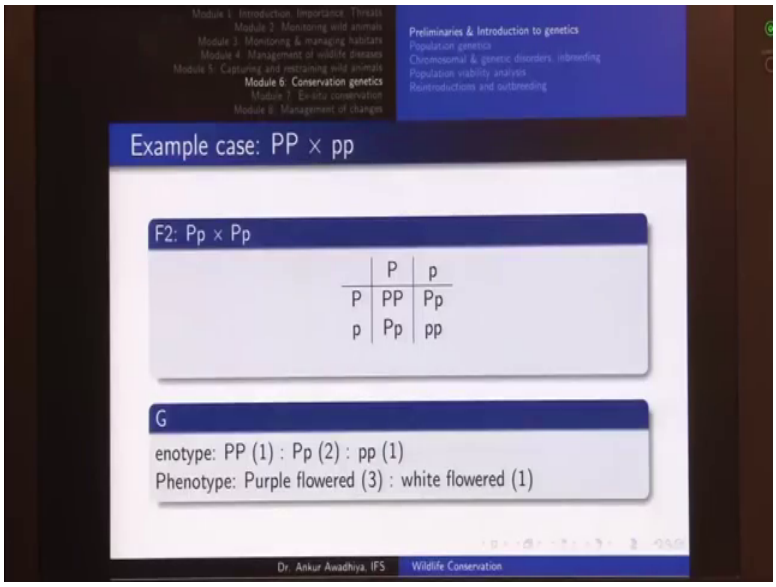

Now if we perform across between the individual in the first case. So in the first case, we had all the individual, that is capital P and small p. Now, we are doing an inbreeding experiment here in which, we are breeding between both of these.

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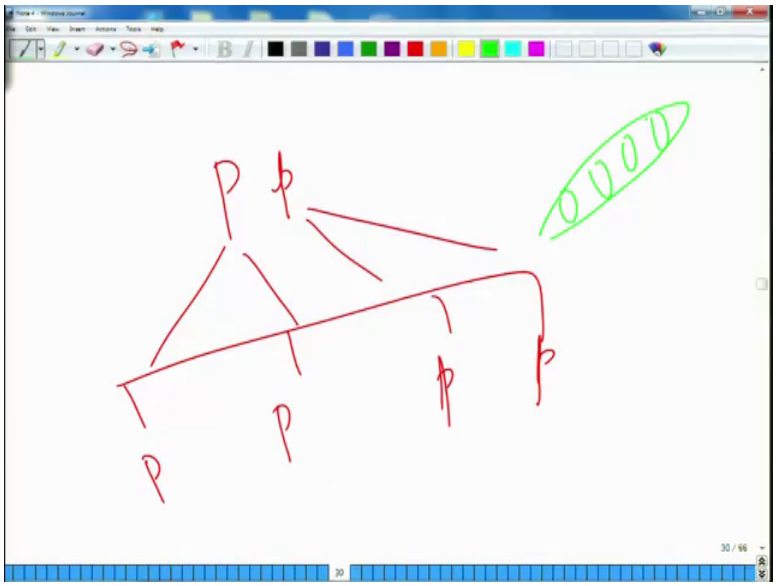

Now the law of segregation will say that, suppose this is the male plant. So, the male plant will gave out sperms in this fashion. So, we have a capital P and a small p. So, when it gives out sperms will have 2 that will be having capital P and 2 that will be having small p, which we are representing here by putting it on the left side.

So, one is having capital P, one is having small p. So, there are only 2 different kinds of sperms that have been produced. Similarly in the case of oven, we also have only two different kinds of oven, capital P and small p. So, what happens when both of these come together? So, this is capital P from father, capital P from mother, this is small p from father, capital P from mother, this one is capital P from father small p from mother and this is small p from the father and small p from mother.

So, we have a genotypic ratio of capital P capital P as 1 capital P small p as 2 and small p small p as 1. So, we have genotypic ratio of 1 is to 2 is to 1. Now if you look at the phenotypic ratio, what will these individuals look like when they grow up? Will be having purple color flowers, this capital P capital P will give us a purple color flower and so will a capital P and small p, we have 2 plus 1 3, individual that are having purple color flower and only 1 individual that is having white flower. Now in the case of genetics, when we talk about these ratio these are an averaged out ratios.

So, it is not necessary that if you are having just, 2 individuals will be having these 4 different phenotypes, but then if you are doing these crosses in a large numbers and then you take averaged out ratios usually get this ratio of 3 is to 1.

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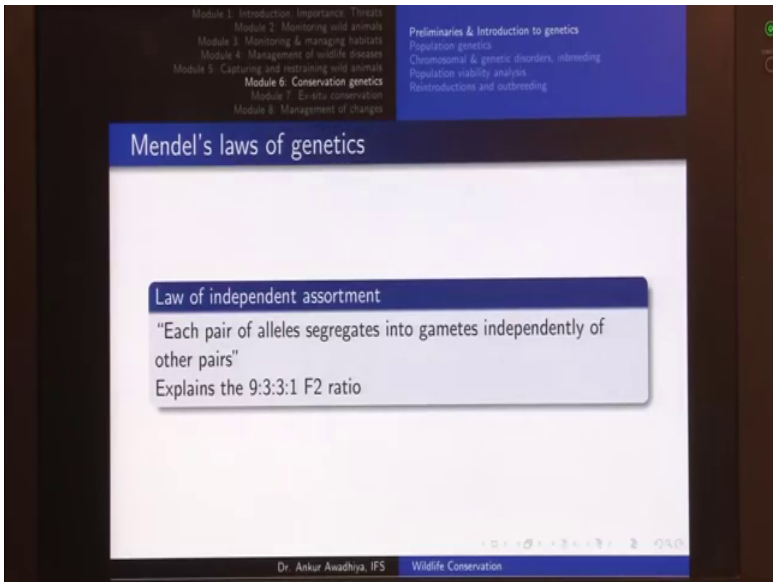

The next law is the law of independent assortment which says that, each pair of aliens segregates into gametes independently of the other pairs and this explains the 9 is to 3 is to 3 is to 1F 2 ratio.

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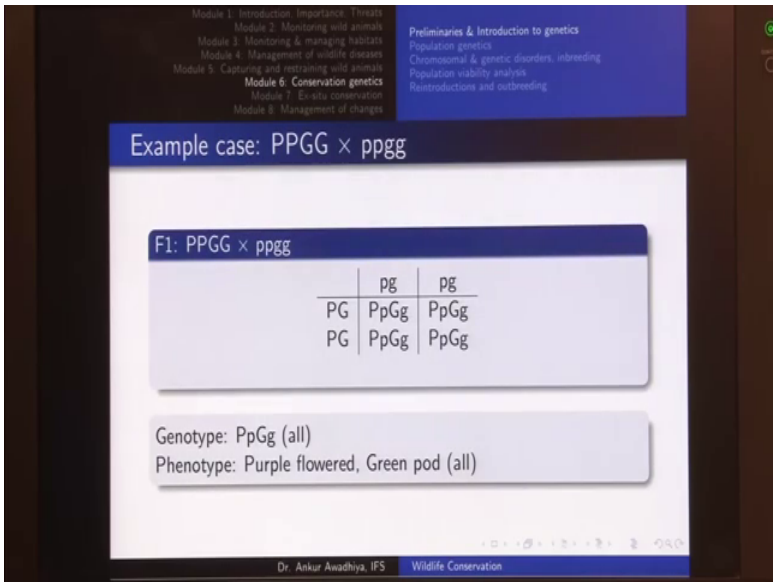

Now what do you mean by this? Is each pair of allele's segregates independently of the others. So, in this case we are considering individuals that are having 2 different rates. So, we have this flower color, which is given by P and small p and we have pod color. So, in the case of a P plant we get pods.

So, there is a pod in side which, we have the seeds. So, what is the color of the pod? Now in this case, we have colors as green and yellow. Now green here is dominant. So, it is written as capital G and yellow is recessive. So, it in it is small g.

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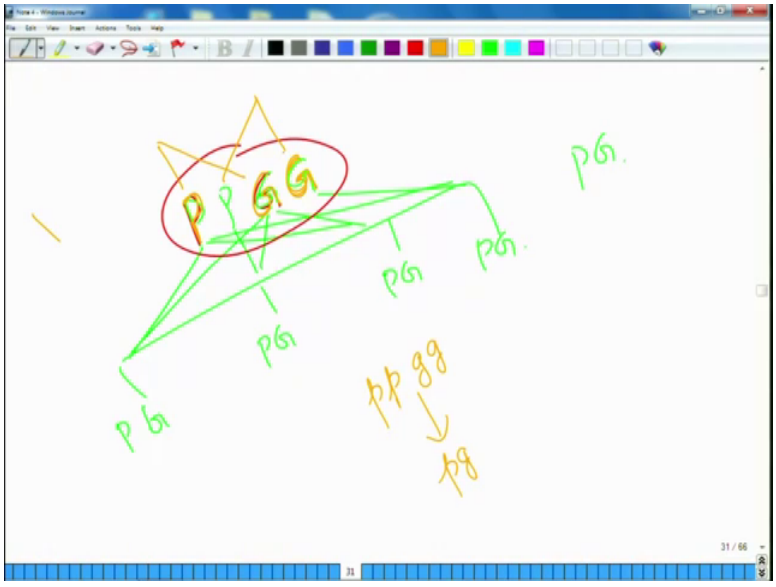

Now in this case, when you have this individual capital P capital P capital G capital G, when it is gives us sperms, what is different kinds of sperms will be found? So, the first is capital P capital G, the second is capital P capital G, the third was capital P capital G and fourth one is again capital P capital G. So, we are getting only one kind of sperm that is having capital P capital G together.

Similarly, when we considered the second case and which we have small p small p small p small g, we are getting one kind of ova that is small p and small g. Now when we say that both of these alleles are separating independently of each other, that is independent assortment, we mean that when considered this case of capital P, capital P, capital G, capital G, then if you are considering this capital P, then another this sperms gets this G, whether this sperm gets this G is a material.

So, most of ours situations will consider that, this P can come with this G or this P can come with this G the second G. So, this is independent assortment, because these alleles are separating independently of each other, they are not coming as the combination. So, they are not coming as the combination like this P will always come with this G and this G is also come with this G, there is no such combination, they are coming out independently of each other.

So, now, when we look at the pinnate square, we have only 1 kind of ova and only one kind of sperm and so we have only 1 kind of individuals that is heterozygous for both these alleles. So, capital P and small p and capital G small g, let the genotype is the same for all the individuals and the phenotype is also same for all the individuals.

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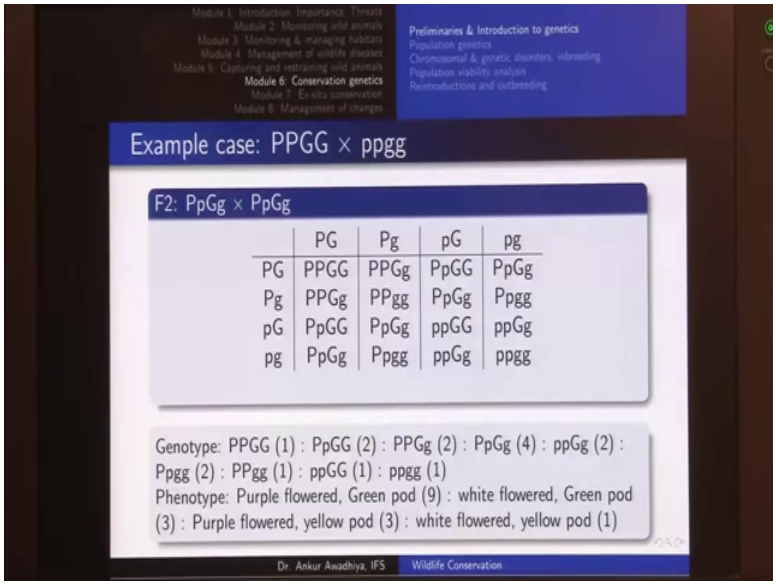

So, capital P dominates the small p. So, we gets purple pod and capital G dominates the small g, we get green pod for all out them, now in the F 2 generation, we are crossing this individuals with each other.

So, we have capital P and small p capital G and small g cross with a capital P small p capital G small g. Now in the case of this individual, what kinds of sperms of will get? Because these alleles are assorting independent of each other. So, we can have capital P with capital G or capital P with small g or small p with capital G and small p with small g. So, we have written all these 4 combinations here. So, these are the 4 different kinds of sperms that will be formed. So, we have capital P, capital G, capital P, small g, small p

with capital G and small p with small g, now if these alleles were not assorting independently of each other.

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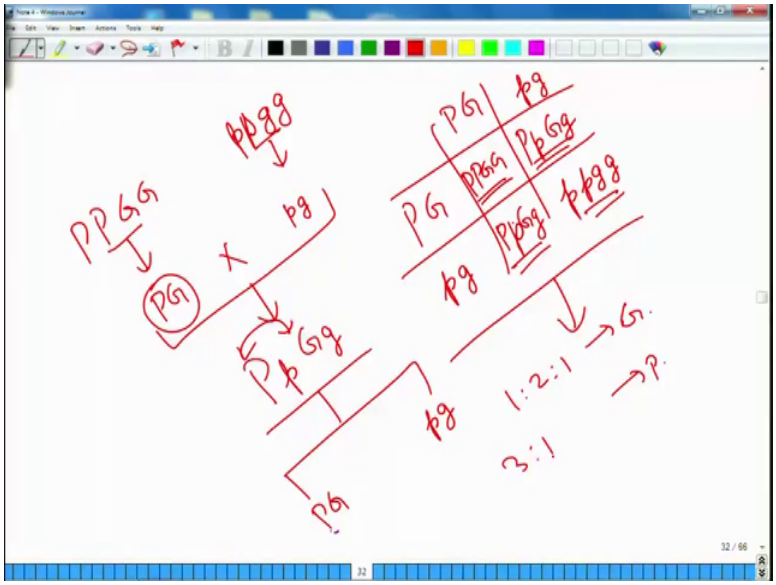

So, in that situation we would have a case in which in the first generation The suppose these 2 come together always. So, we would be having capital P and capital G and these would give us small p and small g. Now when we have across, we get an individual that is capital P small p capital G with a small g, but in the next generation, this would not give us 4 different kinds of sperms, but would only 2 different kinds of sperms because, capital P and capital G always come out together. So, at least give us capital P capital G and small p small g and similarly and the case of the mother plant as well.

So, if that with the situation, we would be getting capital P, capital G, small p, small g, capital P, capital G, small p and small g. So, making out the Punnett square will have, these individuals that are completely homozygote and these are the 2 individuals that are heterozygous and in this case, we would be getting genotypic ratio of 1 is to 2 is to 1. So, you have 1 of this, 1 of this and these 2 are the same as the genotypic ratio and the phenotypic ratio will be given by 3 is to 1, but if these alleles are separating independently of each other, we will get these 4 different combinations; so, these 4 hours for the father, these 4 hours for the mother.

Now we can make all of this combination back again. So, this individual is getting capital P from here and capital from P from here, capital G from here and capital G from

here. Similarly take any other individual, let us take this individual. So, this individual is getting small p from father's small p from mother capital G from father, capital G from mother. So, we can make all of these combinations and in this case, they are genotype will be 1 is to 2 is to 2 is to 4 is to 2 is to 2 is to 1 is to 1 is to 1. If we add up all of these and the phenotype will be given by all of these individuals are we will show the phenotype of capital P and capital G, this one, this one, this one, this one. So, will have 4 of these so, 1 plus 2 is 3, 3 plus 2 is 5, 5 plus 4 is 9.

So, we have 9 individuals that have purple pods and green pods, then the once with white pods and yellow pods is only 1. Now the ones the white pods and green pod, the white flowered will be given by small p small p of this is small p small p and this is small p small p and this is small p small p, but when we say green pod it should have a capital G. So, this are the capital G and this are the capital G this does not have a. So, 1 plus 2 is 3.

So, there are 3 individuals that have white pods and green pods and similarly there are 3 individuals that has, purple flowered and yellow pods. So, yellow pod will mean that it has small g small g. So, this one and this one so, there are 2 of these and both of these are having purple pods, because they have capital P. So, 2 plus 1 is 3. So, we have this ratio of this 9 is to 3 is to 3 is to 1.

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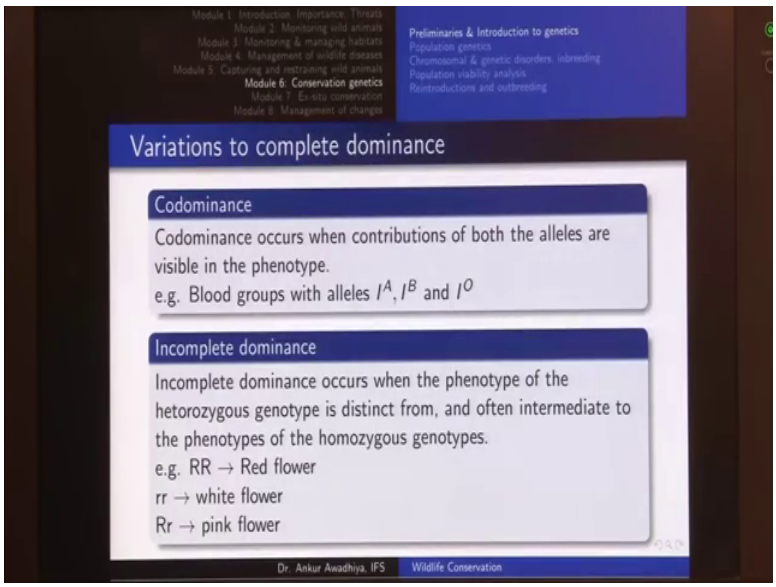

So, this ratio explained by the law of independent assortment. Now, these are the example cases, but then we also see some variations to complete dominance in some cases.

So, we will have a greater look at reason the next lecture, but just to go with the definitions, co dominance occurs when the contributions of both alleles are visible in the phenotype and the common examples in the blood groups. So, AB and O.

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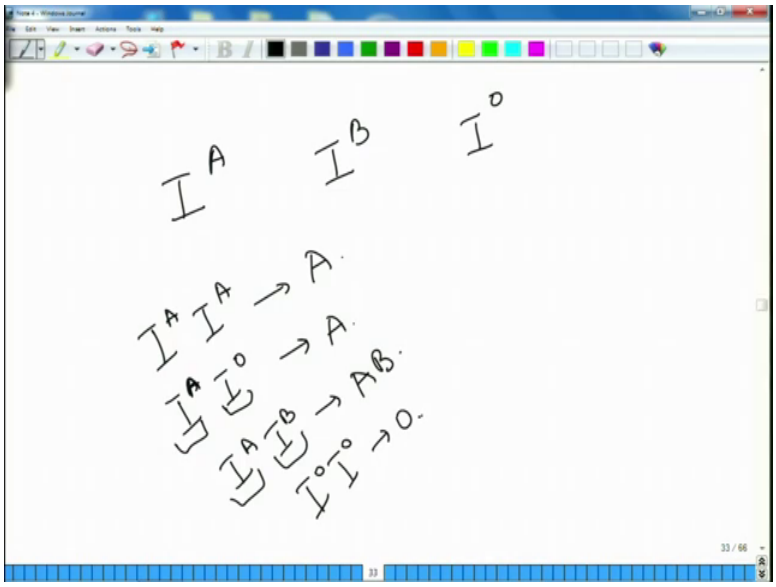

Now in this system, we represent are alleles. As IA IB and IO, now if there is an individual that gets in IA and IA from father and mother will call that, this individual has a blood group of A, if you have IA and I 0 or IO.

So in this case, this allele is expressing, the proteins that are represented by A and this allele is not representing any protein. So, in the red blood cells will get only 1 shot of protein, which will be a now similarly, if you have IA and IB will be getting this allele is representing proteins for a this allele is representing proteins for B. So, in this is case, we will get AB and in the case of IO will be getting in O phenotype.

So, in the case of co dominance, what happens? Is that there is no recessive allele and there is no dominant allele, but depending on what combination you are getting both of these will be able to express themselves, so, in the case of co dominance both of these are equally dominant in the case of incomplete dominance, what happens? Is that the

phenotype of the heterozygous 0 type is distinct from and often intermediate to the phenotypes of the homozygous genotypes.

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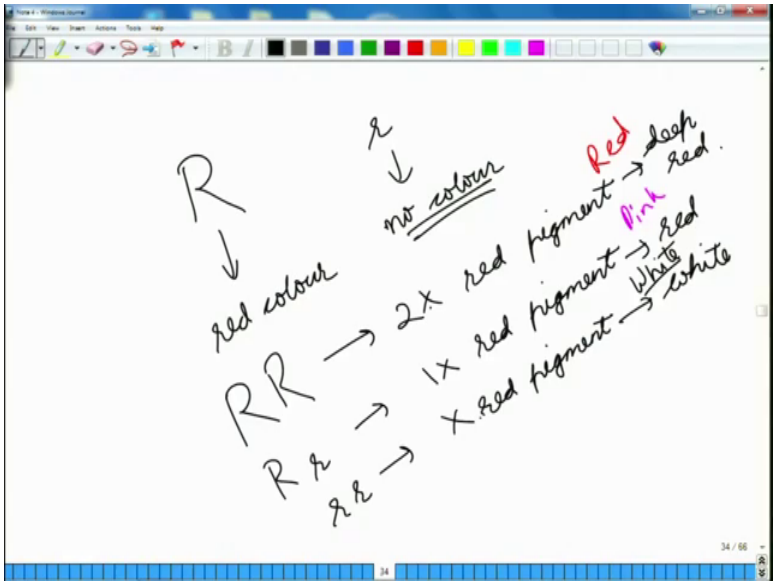

So, what happens in this case? Is that suppose you have an allele that is capital R. The capital R codes for a red color.

So, suppose it gives you a red pigment in the pod and there is a small pod R that does not code for any color. So, this does not give you any color. So, there are no pigment here, So, if you have a capital R capital R, you have a double production of the red pigment. If you have a capital R and small r, you have one time production of a red pigment, because small r is not coding for a red pigment, it is not coding for any color and if you have small r small r than there is no red pigment. Now in this case, this would look whiten color, because there is no pigment in the flowered, this would appear say it red in color and this would appear it deep red in color or in circumstances this would look like a red color, this would look like a pink color and this would look like a white color.

So in the case of incomplete dominance, these alleles are not completely dominant that somewhat dominant. So, if you have a capital R and a small r, than you can see cases of R or the capital R in the form of red pigments, but then these red pigments are not enough to provide a complete dominance phenotype. So, it provide in intermediate phenotype, which one look like pink or which one look like a light red color.

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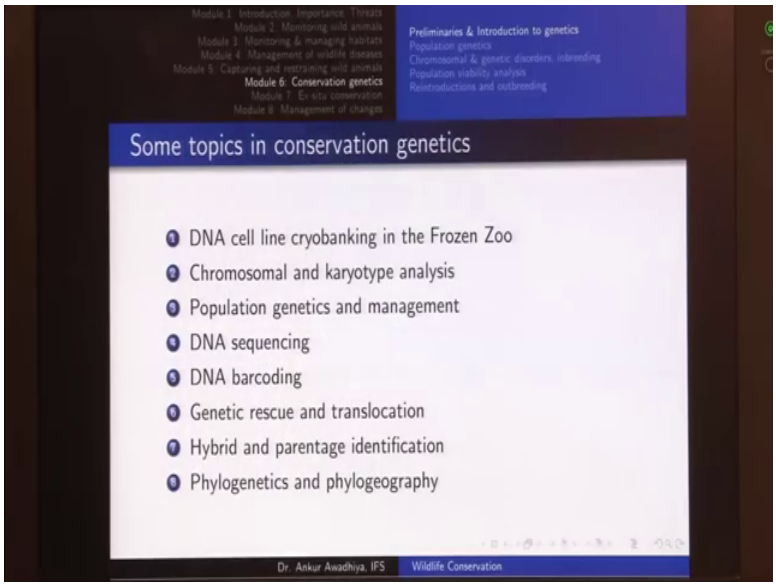

So, these were the definitions that we had to deal with and why do we use conservation genetics in the field of conservation? So, these are some things that we do in conservation genetics, we can go for a DNA cell lines cryo banking in the frozen Zoo. So, this is something that will look in are x into conservation module, what is a frozen zoo? Then chromosomal and karyotype analysis.

So, chromosomal and karyotype analysis will come in our chromosomal and genetic disorders, then population genetics and management it will come in the next lecture then, we have DNA sequencing. So, we saw that in the chromosomes, we have all the information and if you read out this information we get a sequence that goes by the name of DNA sequence. So, we can read out what is written in all of the chromosomes? Now DNA barcoding stands for selecting some regions of the chromosome.

So, as to be able to identify the species for instance, if you look at a human being, if you look at me, you can a very clearly make out that I belong to the species homosapiens, but suppose you only got a hair from my body. So, whether this hair belongs to an individual of homosapiens of whether it is here belongs to some other species, how do you make out? So, we make use of genetic analysis that goes by the name of DNA barcoding. So, we have identified certain reasons in the chromosome, that are different between different species and just by reading that small portion or just by using some ways of

identifying, what that small portion says will be able to tell what species it is? So, just like a barcode is used in different products in a supermarket.

So, just reading the barcode, you can tell what the product is? Similarly in the case of DNA barcoding, just paid in a small portion of the DNA will be able to tell what species it is? Or if we want to go into even greater detail, we can even say which population does this individual belong to? And so on. Next we go for genetic rescue and translocation. So, genetic rescue a something that, we saw before as well it is a way of overcoming inbreeding and will located in more details in this lecture reintroductions in out breeding. Next is hybrid and parentage identification. So, we can. So, suppose you have a situation in which you have wolf and you also have dogs living in the nearby.

So, you could have situations in which, both of these species made together and come out with an offspring. Now this offspring may or may not be a viable offspring and this offspring may or may not be a fertile offspring, but then if you get some hair, you can make out with this hair comes from one parent of whether, this hair is coming from a hybrid processes of analysis and even parentage identification can also be done and parentage identification becomes, important in the case of small populations in which case, you want to prevent inbreeding as much as population. So, this is something also that will discuss in the population viability analysis and then we also a phylogenetics and phylogeography. Now phylogenetics tells us how evolutionarily all these different species are arranged?

So, essentially when we say that all the life came out of say single living cells or cells like that bacteria, how do we make out such kind of analysis? In the case of phylogeography with we want to answer the question, what sort of species and how is there interrelatedness, when they are found in different geographical areas of the earth? So, all are all of these are different topics, that we deal with in conservation biology. So, that is all for today.

Thank you for your attention. [FL]