Bioelectricity
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Module No. #01
Lecture No. #30

Good morning, and welcome back to lecture, series on bioelectricity today, we will start the misrule number plan bioelectricity that is we have discuss in you remember first lecture, we talked about we have divide the course in to different modules animal bio electricity plant bio electricity insect bio electricity, and few other some of the ascent molecules we dealing with. So, holding that pattern. So, today we initial the plant bio electricity. So, remember we will studying plant at three different level.

So, even if I go about the plant. So, whenever we will talk about. So, the way I have module this section in this I introduce, you about the plant, and well really fixing the eco system, and how the biologist on the floor of this earth is driven by plants in the overall anatomy of the plant from. There we will move on to three different accepts of plant to which in which involve transfer charging for transfer of electrons, and which eventually leads to two important things one is the movement of the plant, and the other one is the energy harvesting. So, come back. So, I forgiving the background tell you. So, plants.

Before leave back in the eco system or in the whole food chain or with the whole life is depends on sun ultra solar energy that is very fundamental. So, the sun solar energy are been cheap by the green leaves by the very similar way the by which the solar cell cheap the solar energy, and eject the electrons, and generate power that mean the same analytic a plant cheap the solar energy ejects the electron from, these electron further helps in the syntactic high energy rich molecules, and these energy molecules are fully utilize by the plant for sanitizing energy storing molecules, and once the energy storing molecules are found.

The next level of life found in the animals which they not sanitize which cannot sanitize food directly from the sun light, and from the air, and soil they eat the plant, and eventually when they die their dab the summer plant mix in the soil, and the food cycle goes on.

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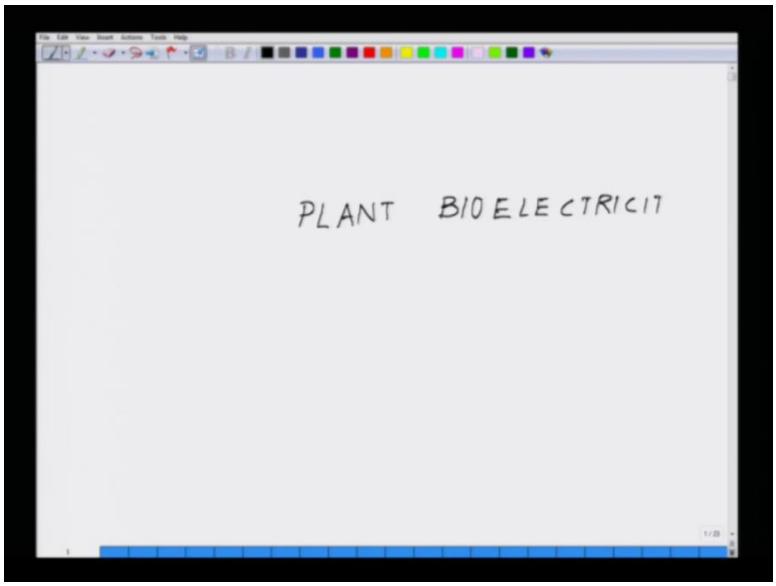

So, just give you graphical presentation of this to get an idea to this get back. So, here it is these structure in plant, bioelectricity as I mention we have divide this whole thing into different competent first of all the.

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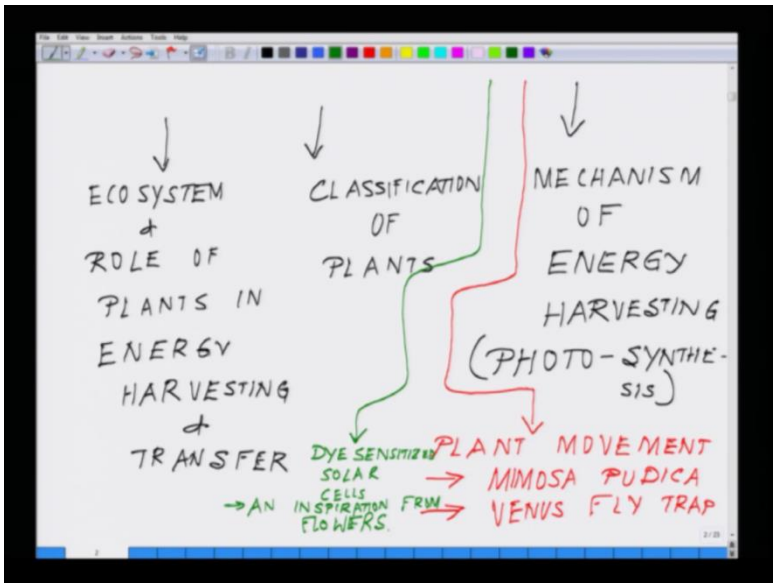

We talk about the eco system, and role of plants in energy harvesting, and transfer when we are talking about classification of plants classification of plants after this w will talking about mechanism of energy harvesting, which essentially called photo synthesis photo means light synthesis synthesising the energy rich molecules using light. So, then

from there move on to the part of the photo synthesis section of it which will be plant movement, and in this section. We will be talking about mimosa pudica touch me not plant, and venus fly tra apart from, it we are taking the another small section within this which is dye sanitizes solar cells. So, this is essential, and an inspiration from flowers. So, this is the overall outline what we are going to dealt with which I was trying to tell you verbally these are accepts what we are going to deal with. So, coming back to the eco system part. So, essential eco system happing is that would you sun major course of energy.

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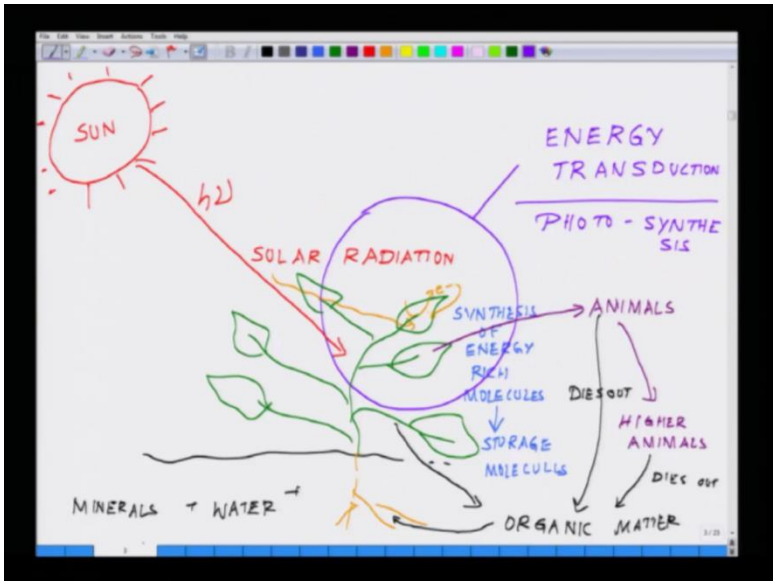

So, solar radiation reaching the earth the solar radiation is been picked up by the land plants, and the water plants. So, it is coming form of itching, and within this isnary we are in the this surfaces there is an ejection of electron out here, this electron essentially leads to the synthesis of energy rich molecules, this energy rich molecule leads to the photo synthesis of different store molecules, as I telling you this plants are eventually consumed by the animals, and again within the array by these animals are consumed by hioker animals, and eventually what say that all these dies out dies out, and if the dies outs of the soil, and get transform in to organic matter.

And these are matters essentially by the plants again along with organic matter plus water plus minerals, and in the presence of sun light the way process is on, and on what will be dealing essentially is in this zone were this whole energy transduction taking

place which is essentially the process of photo synthesis. So, from here if I refer back to pervious line, I sue to tell you this is the part just know I discuses with you the overall idea of eco system this is very essential to get a global picture, that were we are really heady. So, what was the inspiration of whole process well I coming back to this line.

So, this whole electron transfer, what is happing in the on the surface of the leaves essentially you can contract the vegetated cover on the floor of earth is in the water wither in the land they are very similar to the solar panels essentially. Whole earth what. So, ever the percentage of earth cover with vegetation is essentially function as mechanism of nature by which solar energy is been cap, and this perfect molecules which has the ability to capture the sun light, and eject electron are inspiration for developing the assassination solar cells.

So, what we essentially understand structure of molecule, the process which revealing the electrons transfer change within the nature, and the process by which synthesis the energy rich molecule. So, to understand the process we will draw inspiration from the current researcher, while people are trying to emulate or unit this kind of systems in order to develop next generation of energy harvesting devices next generation of power source. So, coming back to specific minarabin. So, next what we do we start with this part the classification of the plants this is very essential. So, you could understand where this all these things fix it.

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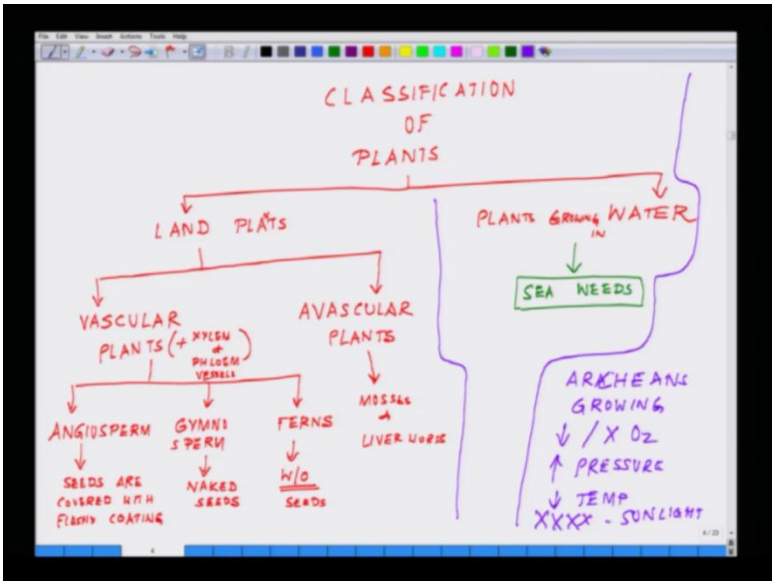

So, coming back to the classification of plants. So, plants could be brightly very full full manner the plants could be classified into two groups, these are the plants growing in land these are the plants growing in the water. This is the promise of all classification land plants, and plants growing in water, and this land plants could be further classified into two categories vascular plant, and a vascular plant the vascular plants avascular plant this is more means within the plants the plants pick up water plants pick up nutrients the plants synthesize different things.

So, these happens though the specific channels, it just like within our body there are blood vessels which carries blood. There are link vessels which are carrying the link exactly the same acknowledge holds true for plants while the plants are vessels are carrying water, and nutrient, those are called sailing vessels, and they have the vessels which carries energy rich synthesize energy rich molecules, which also called plants sac those are carry thought another series of vessel called fem vessels sailing vessels.

I will write these are separated from the fem vessels by series of dead tissues, which in short the sailing vessels pretty much of water purifier the whole tube thought which the water moves thought is kind of water purifier for all the sides. So, the vascular plants are the one which have very specialize xylum specify vessels which are even the small plants are the one which does not have the xylum in following vessel. So, essentially the vascular plants like it have a smaller shape smaller size, because they do not have any mechanism to distribute the nutrients.

So, they can only do by a definably process within a very small area or within the a very small space as compare to was as compare to vascular plant, which has specialize is to transport any kind of nutrients or water or nutrient to all plants of the system. So, coming back the vascular plants avascular plants. So, vascular plants are further classified into three groups those three groups are called angiosperms gymnosperms ferns.

So, angiosperms are the once which in which the seeds are cover with freshly coating. So, these are the plants like mango apple where is see the seeds deep inside, and it is covered by a complete with freshly eatable matter. So, these follows in the angiosperms than we have gymnosperms these have naked seeds there is no covering on the seeds than you have the ferns ferns are thou they have vascular system, but they are lead out

seeds, and yet you have avascular plants they do not have a xylum vessels. So, these have a xylum, and phloem vessels.

A vascular plants these into muscles, and liver woris, and this was classified as with the different plants which are found in a land where in the other side well. We are talking about plants growing in water, they are mostly calling under the sea weeds. So, do after this plants have one common further which is in a previous life when I specking to you guys that this whole process of photo synthesis.

So, they all have chlorophyll, and they all synthesis food from the sun light, and this remain our central somatic for a long period of time in the world where we live. So, we all of we believe this, but certain extraordinary discoveries from the last century change the way we think. So, what I have drawn you is sun plants, and synthesising energy animals are consuming, it all of them are dyeing I think it would not be any matter. So, this whole process depends on sun light yet this whole mechanism is not down the way by which life is called during 1970 specially with the 1977 some of the teams of national geography, and some other expects nationography they were exploring see pretty much deep down in the core within the floor of the ocean, and they found there are several places at least the first discovery was made in carabao island.

Deep inside where there is no sun light reaches, where there are existents of high pressure low temperature situation. There is something called hydro thermal vents these are the species or of the are the gaps thought, which the from the inner core heat is kind of ejected out on to the floor of the ocean, and that is why they found that complete dark especially low temperature, they found life is thieving what I will do in this context I will send you some of the links of the videos, which were available online which help you to appreciate, and it was amazing to see how the life thieve in those hydro thermal vents hydro thermal vents, and in around vents series of sulphide related molecules iron disulphide iron copper sulphide like wise, and several there is no sun light.

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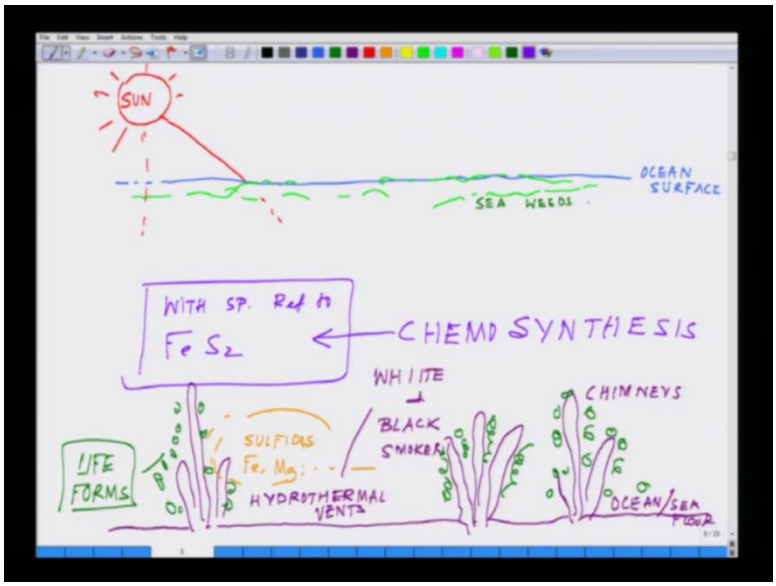

So, let, let again rewrite pervious graph, we are talking about the situation say if this is the ocean flow ocean surface, and if the sun is sitting here out here most of the life from the sea what you see growing here either on the top of this, and that is it after may be after this maximum feed seeds on there, but sun light never reaches sun light never reaches beyond it that is it maximum the sun light reach here otherwise you see the light. So, this could be label you are understanding ocean surface, and this green once are the sea weeds.

And now, we are talking about the situation deep inside somewhere around here several weeds under this is where this is almost 6000 to 7000 or been more this is the sea floor or the ocean floor, and from here comes out all the hydroids here is the formation of hydro thermal vents out here, these are the black smoker white, and black smokers while give you the all those videos link of the videos hydro thermal vents white, and black smokers these are also called as chinmneys, and this is the zone which is kind of you know very lack of sulphides iron magnesium series of them. So, very hot environment here you see series of live is growing thought.

And, then whether these life forms now, compare to the situation where there no life is reaching. So, how the electrons is taking place. So, there is no photo synthesis taking place in the situation, if we compare this picture with this picture where there is sing the sun directly heating up on the leaves, and if you this picture now, there is no sun which is

heating up on the surface. So, these kind of life found leads to ninety seventy seven change our way we think, and this leads to new form of synthesis new form of electron transport or electron transfer that follows under another life another form called chemo synthesis, and this part of chemo synthesis.

Follows under all the asiant molecules, dealing with specially with special reference to iron bi sulphide, and other molecules we dealing with the whole chemo synthesis where solar energy is not essential criteria for electron transfer for synthesis, and chemo synthesis you know coming back to the classification of plants, where as classified. So, sea weeds. So, now, putting one more seed classification within the sea very deep inside you could not see the plants there is another group of organism called archeans growing with no no oxygen very high pressure very low temperature, and rest in the part no sun light deep inside the ocean floor these life forms thieves.

So, these life forms essentially what we are dealing with the asiant molecules, what I have discuses in the global scheme of real in the begging there are molecules, which are not dependent in nature on solar energy all the form of light accepts. So, coming back to classifications this is include into just to give you overall picture. That is not always the sun light which involves in the electron transport. So, talking about the inspiration what we are drawing of course, the way it go is, and there is one more thing. So, look at the let us diss let discuss the anatomy of plant in very brief. So, I do want to come back to this. So, I given you the classification plants. So, in that this is what we are trying to do classification of plant.

So, this is eco system clear with me add one more thing of the classification of plants where we dealing with, and very brief anatomy of plants. So, eco system of plants. So, we talked about this plant as of now, apart from all classification of plants now, we talking about anatomy of plant in this class. So, coming back to the anatomy of plants. So, the plants has like, if of course, we talking about mostly the classic angiosperm plants which have seeds, and everything. So, look at the plant structure almost like this.

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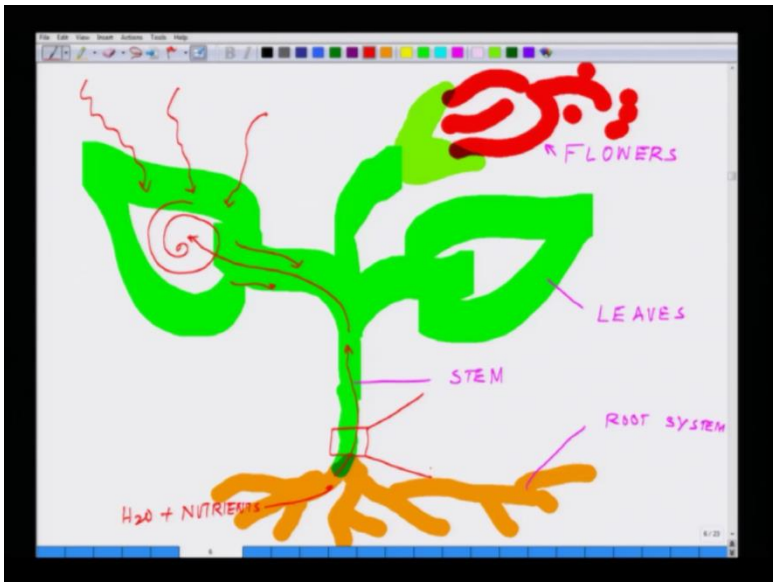

So, and down we have like that all the root system, and we common feathers theory about followers which leads to the seeds, and everything there we have the leaves here we have the main stem, and here we have the root system. So, the way it seems like sun light is following on the these surfaces, and water plus nutrients travelling around this, and all the simulation take place out here, and energy rich molecules stored here along the another series of seeds.

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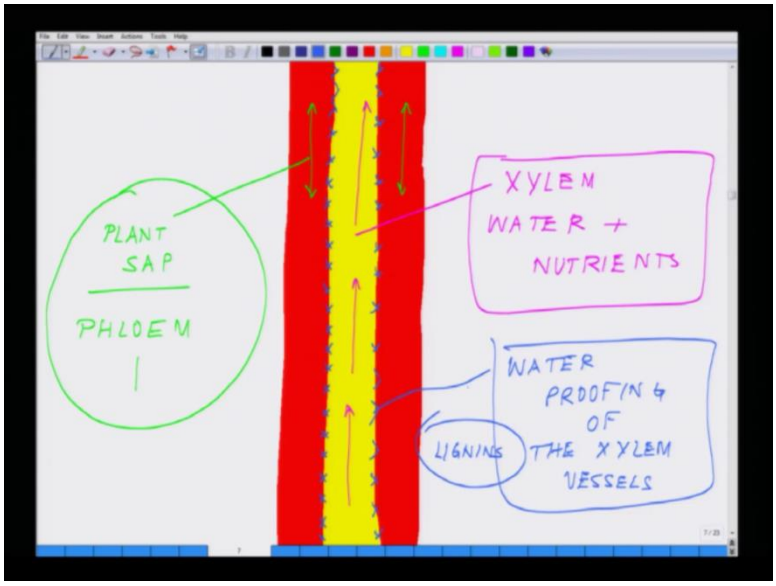

So, now, what we will do we have the cross section the stem, and the root if you see the cross section cross section of the cross section, cross section like this cross section as. So, this is not the right let me just draw normally just like that. So, you see subcuitinal which I have drawn in you know it is the one which is starting ha xylemsis that is carrying the water up in to the from the roots. So, this xylemsis, and phloem over up to the tip of root all over the tip of the shoot, and they travel all around. So, the pipe is travelling.

So, it is something like I show you right. Simple choke pieces which are here here like this this vessel, and holding by the phloem centre surrounded by the xylemsis image there are other choke switches around, and the other xylemsis vessels. So, the centre once are the is xylem which is grained by the water all the way up water, and nutrients, and we can see the phloem vessels on the other side, these are the once which are ensuring that plants sac or phloem. So, whatever the molecules which are the synthesis by the by the plants energy rich molecules or the storing molecules they remain in the phloem, and between the xylem, and phloem.

There is pretty much water proofing molecules, which ensures know the water is in a kind of lost it gives some water proofing. So, you can see just putting the crosses on ha in-between xylem, and phloem vessels. So, this is kind of a water proofing of the xylem vessels. So, this is very essential that you know, water is not going lost from the xylem vessels otherwise there will be a absolute mix up, and this water proofing done by series of molecules called vgnins vgnins are the once which ensures that it is not been lost. So, if you see the cross section of this if you cut the cross section what you see essentially something like this.

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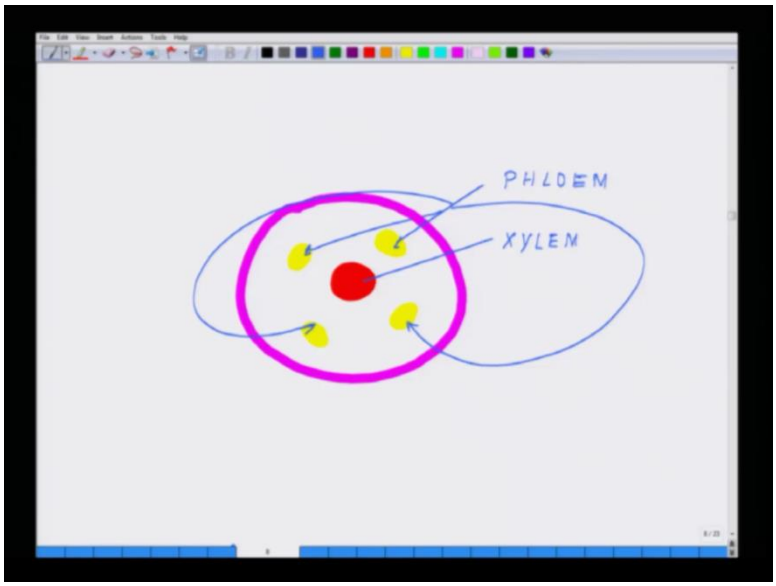

And the centre will be seeming the xylem vessels, and the puerperal yellow just am giving the colour no ha. So, this is the cross section view here we have the xylem, and here we have the phloem vessels the multiple phloem, vessels which are travelling all around the, and this could very handily while we are talking about the plant movement, and coming back to the start with the leaves here, we discuss the something called ethical which is clear these are the vents from the leaves which are carrying the nutrients, and the water at the different parts of this.

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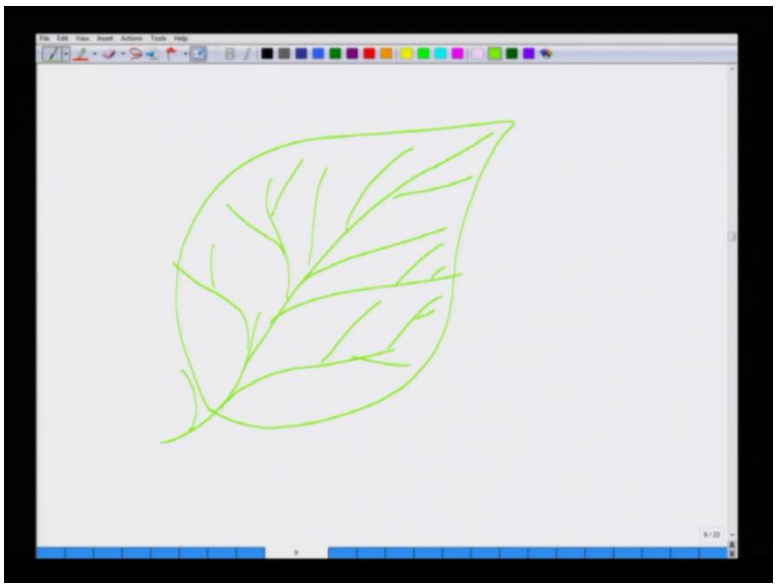

So, harvesting mechanism apart from, it what is what is the important to you people to understand is more I have drawn the flowers r. So, this flowers are been inspiration for first slide of that dye synthesizes solar cells all this different dye present on the follower they all have ability to track sun light, and eject the electron only different from these, and the major molecule, is for synthesis is called chlorophyll is that the other dye have a have low molar observe coefficient.

We come to all these things molar observe coefficient, and that is why they do not directly the take part in photo, synthesis instead they trying to contracted the solar energy on the leaves, and have that chlorophyll molecule to move ahead, and perform the function of trapping the sun light, and eject the electron, but those molecules, are inspiration for last almost three decade since 1918 it has started with discovery followed.

Defining by gratzel we are talking about gratzel here, which are directly inspiration from the structure of flowers all the dyes of flowers, which are direct come here I used for colourful silver dyes synthesis after getting inspiration from the flowers dyes. So, over all in this module, we talking in this module, we talking about after getting you the brief outline the anatomy classification. So, back to the second page. So, I talked about anatomy the eco system brief idea talked about the classification of plant.

We talk about brief anatomy of the plant well of course, from where the inspiration of dyes solar cells. So, now, what we will do after this brief introduction about plant systems, and how they are transfer the electrons, and everything I move on to the real classes where the plants are harvesting the sun light, and ejecting electrons, that will fall under cells I will not come back to all these things in further.

So, know, and I will about in the next class I will starting it I will talking about overall photo synthetic machinery chlorophyll molecule, the different types there spatter properties when we are talking about ha different transport chain, and enquirers. So, am closing here, and in the next class we will continues with this, then we will be directly talking about energy harvesting four photo system on photo system two, and c three c four plan, and the inspiration drawn out of this photo synthesis in terms of water making complex, and chlorophyll for developing next the nature energy harvesting devices, and from, then we move on to the plant movements. Where we could concentrate the

regimentally of the nervous system of plant, and the tail piece of this section we will move on to the dye sensitized solar cells.

Thanks a lot.