Animal Physiology
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Module - 1
Lecture – 1

Hello everybody. So, let us start this course on animal physiology. So, this is 40 lecture module and we have divided the course into 15 different components. So, just to start the course, let us talk about the different sections what we will be covering. We will start with introduction to physiology, cellangino physiology. We will be having two lectures followed by membrane physiology. I have nerve and muscle, which will constitute of three lectures followed by talking about the heart, the pumping machine of our body, another three lectures and then we will be talking about the blood circulation all over the body which will cover another three lectures.

Then, we will be talking about the fluid purification machinery of the body, which constitute of kidney and some supporting organs, which will cover another three lectures followed by the structure of the blood cells and the immunity, and the blood clotting which will cover another three lectures. And then we will move on to respiration which will cover another three lectures, and then we will talk about some specialized situation like aviation, the problem people faces while they are traveling at high altitude space, deep sea diving, physiology. That will cover two lectures. From there, we will move on to the nervous system. There are two aspects of the nervous system.

We will be talking about the general nervous system and the sensory physiology which constitutes two lectures, and then we will be talking about the special senses which include your eyes, ear, nose, tongue and all these things. That will constitute another three sets of lectures and from there, we will move on to the motor systems of nerve physiology and integrative nerve physiology which will constitute three lectures. From there we will move on to gastro intestinal physiology which will constitute your whole digestive mechanism, and the control system which will constitute another three lectures. From there will move onto metabolism and temperature regulation which will constitute two lectures and then we will move on endocrinology and reproduction which will constitute three lectures and then we will conclude with the sport physiology and sports

medicine which will constitute two lectures. In sum total, we will be having 40 lectures in this animal physiology module.

What I expect from this is once we are done with the course, you should be aware about your own body and the surrounding and how we react. Let us take a simple example. What do I expect? We all go to the doctors and at time doctors give us some prescription, they give certain medicines or sometimes we go for check up of our heart and they ask us to do an EKG or ECG - electro cardiogram. We see some traces and most of us are kind of at the mercy of the doctor. Whatever the doctor says we believe it. We really never analyze what it meant.

They recommend us a medicine and then we take it. So, our objective will be that to understand about your body, about how things are happening, how your whole physiological machinery is functioning. This is what I expect after going through all these lectures that you should be able to analyze, or sometime we hear in sports medicine that people have taken certain drugs. We charge sports performance enhancing drugs. What really they do is most of us do not have an answer. So, these are some of the issues pertaining issue in the modern day today life. If our life styles are changing, we need to understand our own body. Sometime we say we should do yoga. What does that mean? How yoga really helps? How it helps? In physiology, all these different worried things, we are going to deal in this course before I get into the real course. So, we will have the first two lectures we will be talking about.

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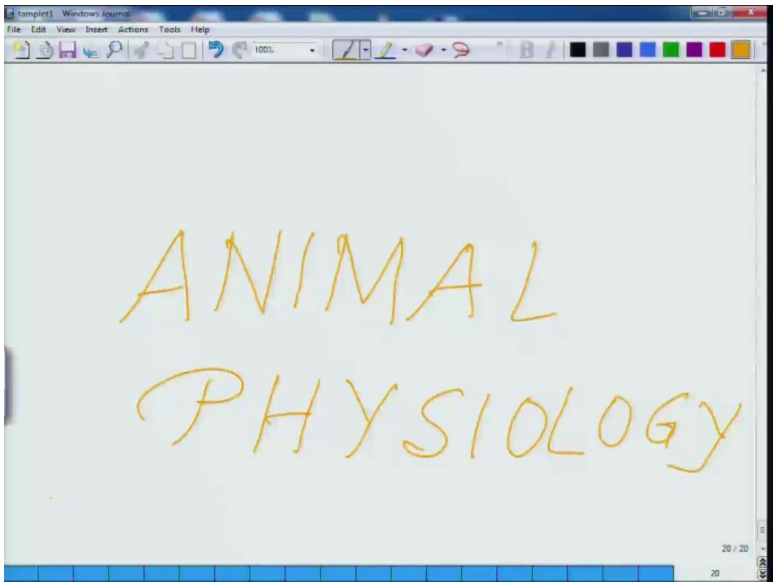

So, this is the title of that course. We will have animal physiology. It is the story of ourselves how we function.

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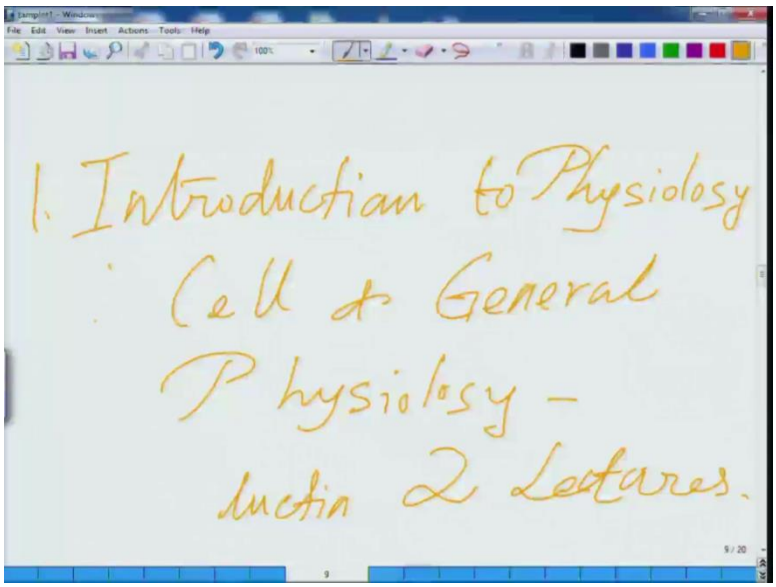

So, the first topic what I will be dealing here which will be your topic. One will be, the first two set of lectures will be introduction to physiology, which includes cell and general physiology. This is the first topic in which we will be discussing two lectures. I will be dealing on this. So, let us talk what physiology is all about. Our body, whenever

we look at our body, this is the head, these are two arms, this is our face, we have the eyes. We look through our eyes, and the rest of the body.

So, this whole body acts like a coordinated machine. So, we think something and then we do something. Sometimes your heart is beating. Really do not think the heart is beating on its own. The story of our own cells, the way the body functions, the way everything functions falls under the purview of physiology. It is a machine and how this machine is functioning. Now, the first question arises what are the components of this machine? So, let us ask the first question out here. So, regarding this machine, our body what it is made up of. That is the first question.

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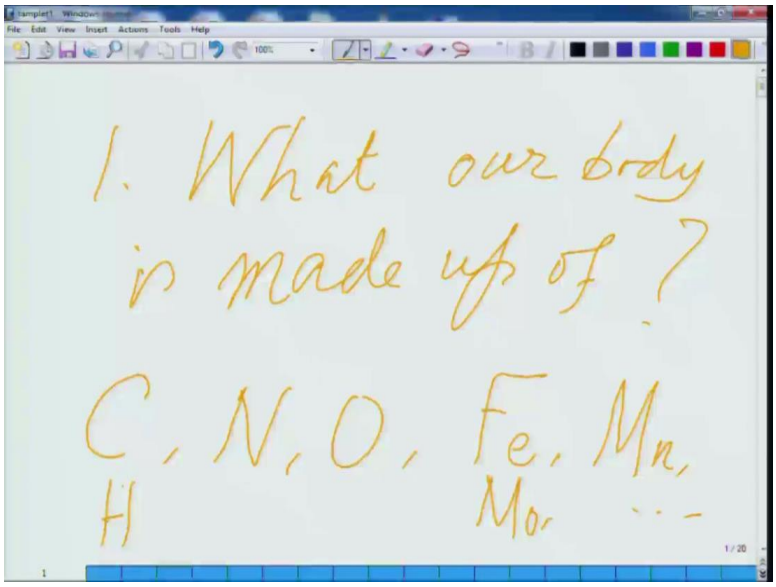

The first question, let us put it body is made up of, if we go down if you burn the whole body, it will lead to some of the elements which mostly our body is made up of carbon, nitrogen, oxygen. This is iron, may be some other elements like you know manganese, molybdenum and few others and of course, hydrogen. Our body is made up of elements. So, the elements hanging out like that it is not like really like that.

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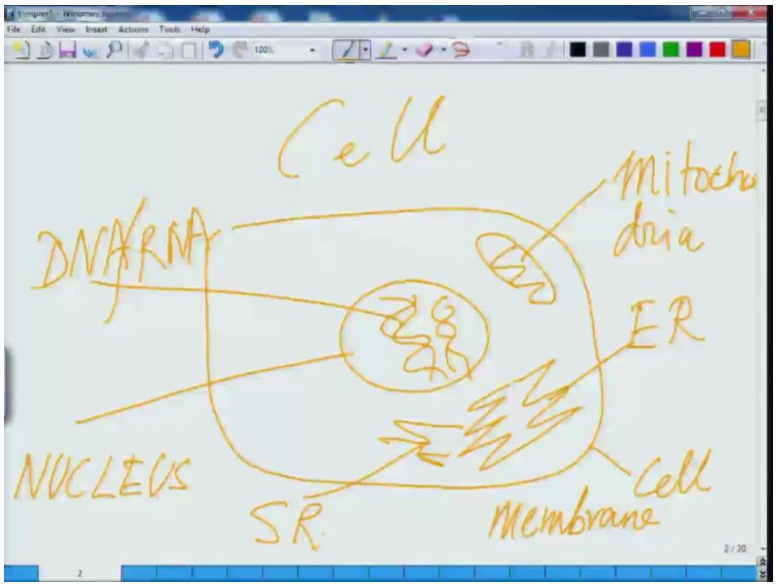

So, this smallest functional unit of our body is called a cell. What is a cell? Cell is a enclosed structure something like this which has a membrane, and it has a nucleus which contains a molecule called DNA and outside this cell, there are several organelles. This is called the nucleus. These are the DNA or slash RNA deoxidized nucleic acid, rhyclonuclic acid cell membrane. Here have mitochondria, here have something called endoplasmic reticulum, in short reputed as ER. Then, we have something called SR, sarcoplasmic reticulum likewise, but what these cells are made up of and how this self assembly has happened.

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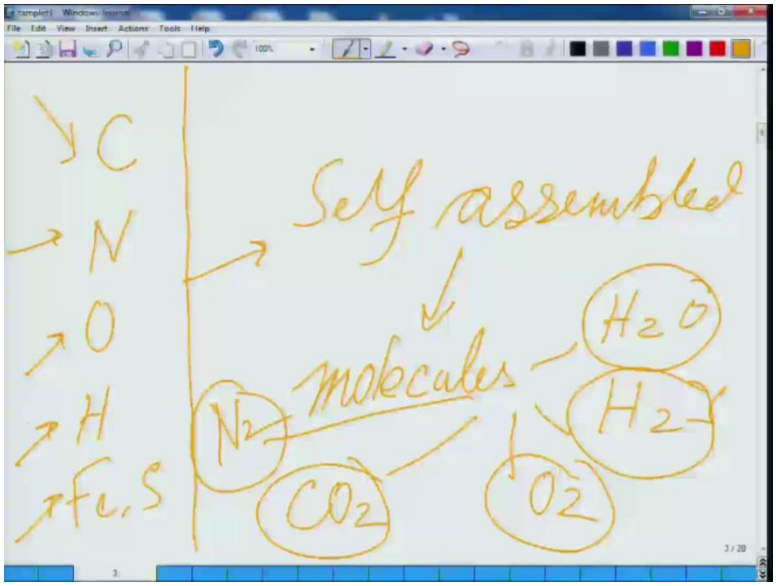

So, we look at nature, probably in a distant past. When the earth was formed, the first probable reaction which took place is different elements. What we discussed about carbon, nitrogen, oxygen, hydrogen, iron and likewise, these elements, someone or others have self-assembled. They have self-assembled to form something called molecules. Molecules like water H2S or of course, the sulfur, oxygen, CO2, likewise this was the first self-assembly of molecules which lead to the formation of very simple molecules like water, hydrogen sulfide, oxygen carbon dioxide and nitrogen. Likewise now even a bigger question comes before this. How these elements have originated?

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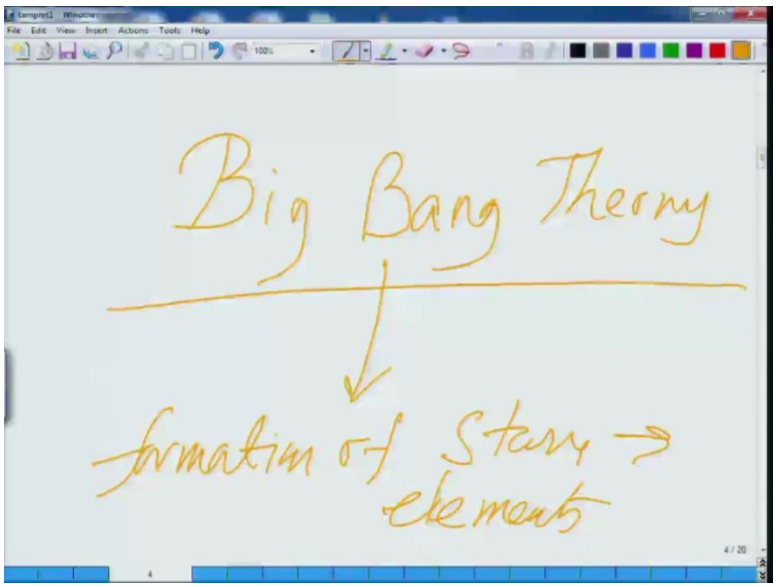

There are several theories here how those elements have originated. One of the theories there is something called a Big bang theory. The theory explains or tries to explain the origin of the universe itself. The big bang theory, it is believed to lead to the formation of stars, and these stars led to the formation of different elements which we talk about. So, we will not deal with this part, but this is how probably most of the elements have formed.

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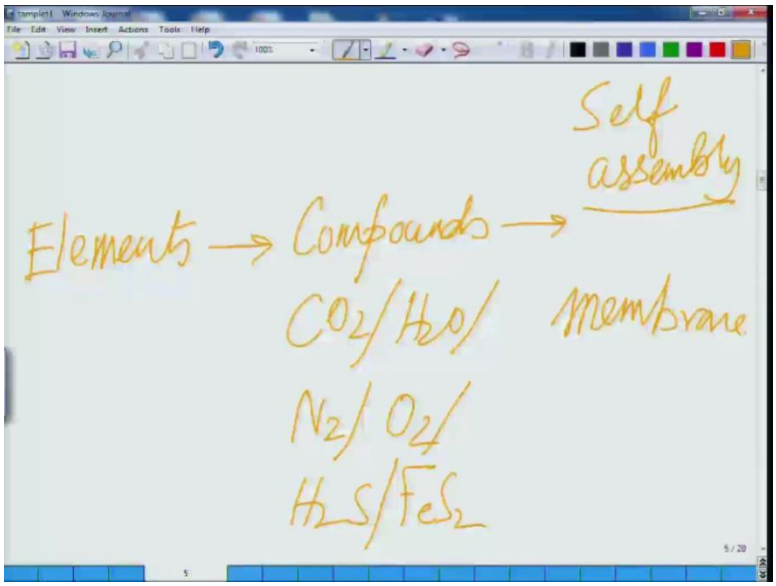

So, if you look at it assuming somewhere or the elements are formed, these elements lead to the formation of small compounds like just we discussed compounds like CO2, water (H2O), nitrogen, oxygen, hydrogen sulfide, likewise then FeS2 iron disulfide, likewise these compounds led to a self-assembly process and probably form the first membrane like its structure.

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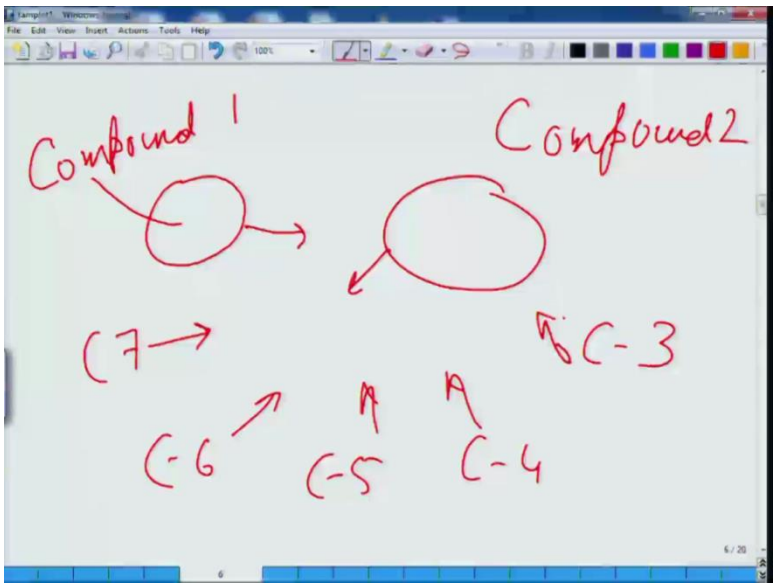

What you mean by membrane? There is something like this say for example, there is one compound here say we represent it by compound 1. Another compound like this, compound 2, likewise compound 3, C3, C4, C5, C6, and C7.

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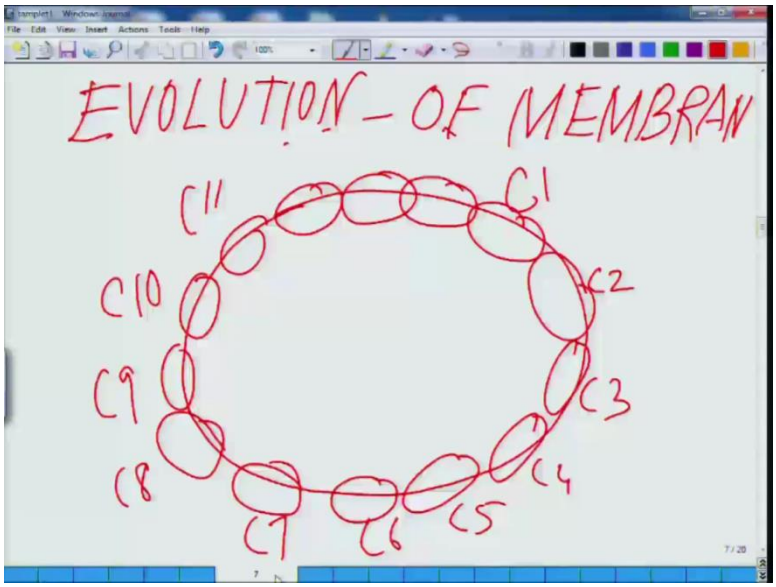

So, they come close together and form something like a structure like this, an enclosed structure where there are lot of these compounds, C1, C2, C3, C4 and likewise an enclosed structure. This enclosed structure is the beginning of the first membrane structure compound 1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11 and likewise fourth. So, this was probably the evolution of membrane. It is still not clear how this first membrane have formed.

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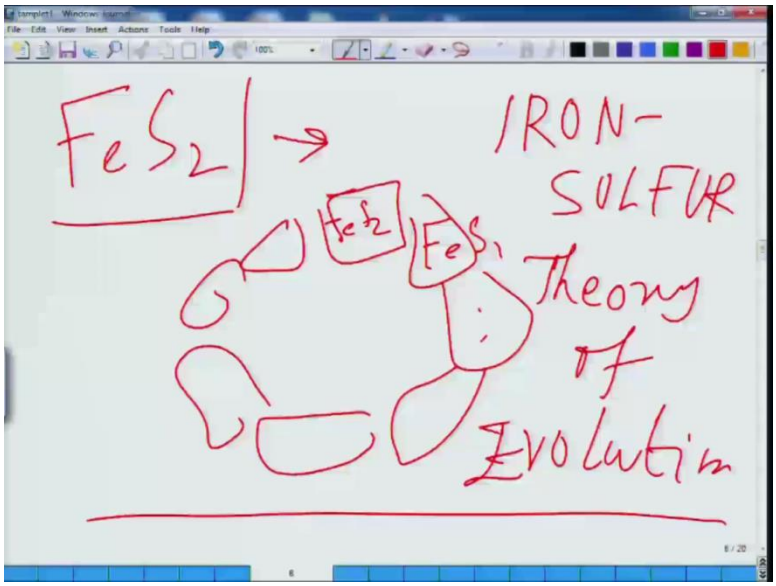

There are theories which says the first membrane may have been formed of the first membrane have been formed of one of the very primitive compound called iron disulfide. There are lots of contradictory theories on that. They say the first membrane was like you know iron disulfide molecule forming a membrane which falls under iron sulfur theory of evolution, but what is over may have happened. These must have happened long time back in the evolution.

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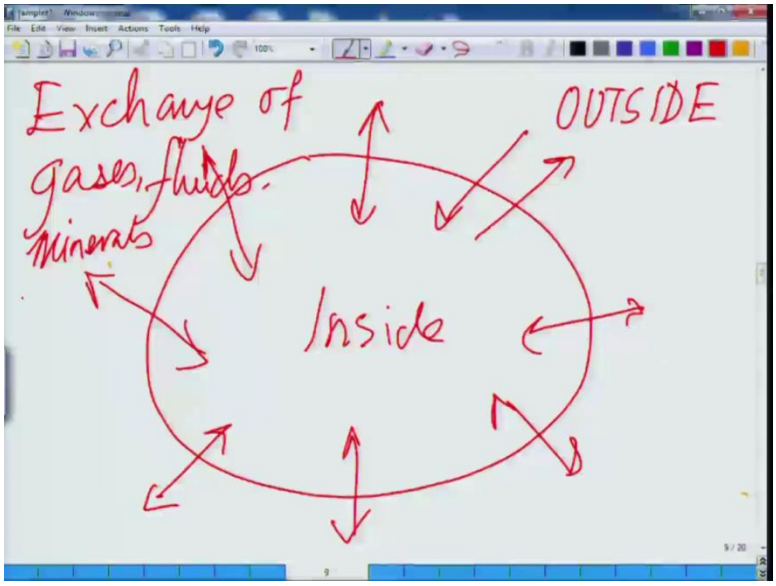

So, once the membrane is formed, the next thing was that it has to develop certain form of transport mechanism across it something like these arrows are showing. It should have the ability to exchange fluids or any kind of (()) from inside to outside. So, this is inside the membrane and this is outside the membrane. So, exchange of gases fluids and minerals, this is how probably first cell may have formed.

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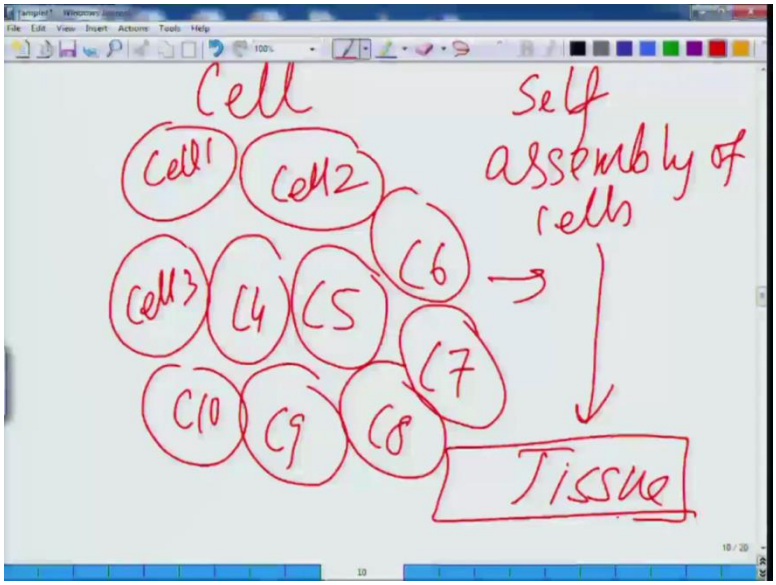

The next step in this evolution process was individual cells. If these circles are individual cells, they came close to each other and started forming a self-assembled structure which we called. So, these are individual cells, cell 1, cell 2, cell 3, likewise c4, c5, c6, c7, c8, c9, and c10. They form something, self-assembly of self cells forming something called a tissue.

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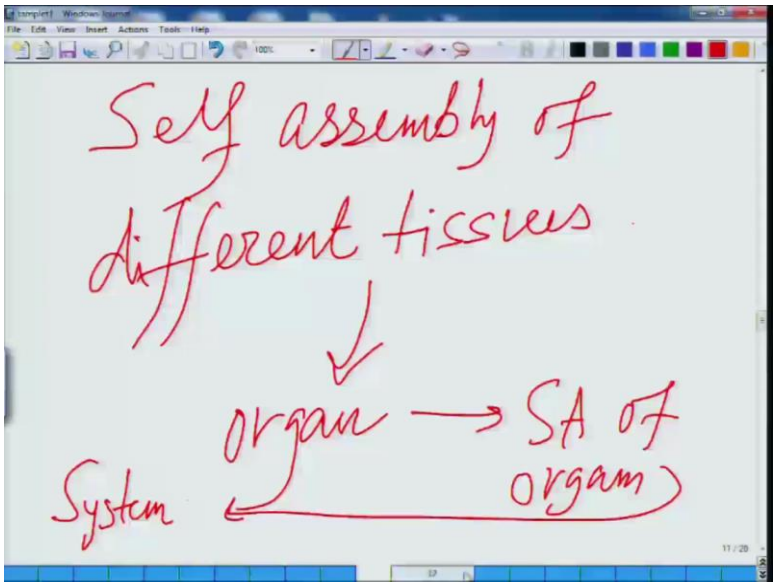

The steps in it comes self-assembly of tissues, self-assembly of different tissues forming something called an organ and self-assembly. If I just represent self-assembly as SA of organ making something called a system.

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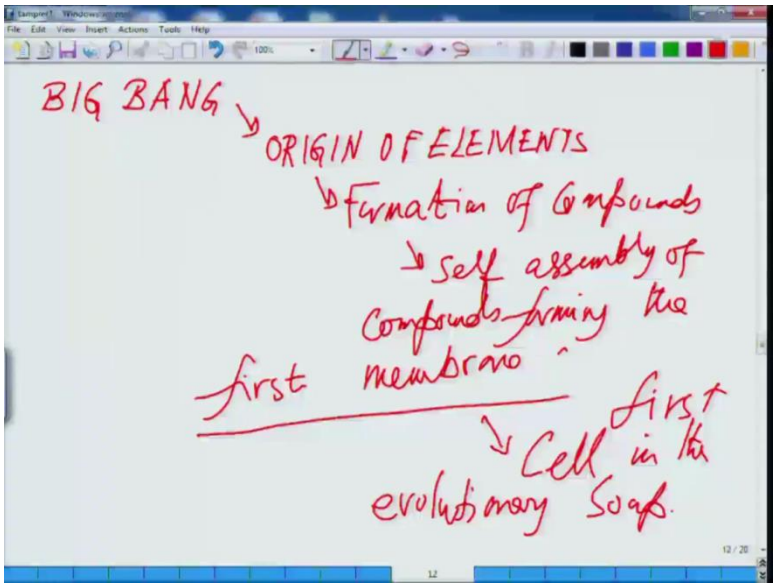

So, as to summarize this, it looks like this. Now, we started with the big bang. Let us summarize. Now, I just talked to you about big bang origin of elements, formation of compounds, self-assembly of compounds, forming the membrane, forming rather the

first membrane, then this membrane forming something called a cell, the first cell in the evolutionary soup.

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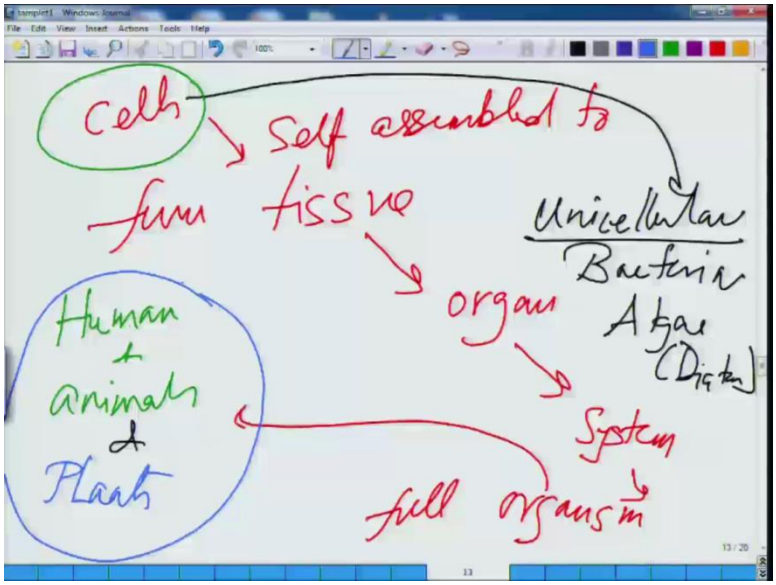

These cells self-assemble to form tissue, tissue self-assemble to form organ, organ self-assemble to form system and system self-assemble to form a full organism which includes all different life forms like starting from human and animals, and at the cellular level, we have single unicellular organism. They have single cell which includes bacteria, some algae specially diatom. So, these are single cell organisms and this also includes the plants too. They are also multi cellular organisms seen.

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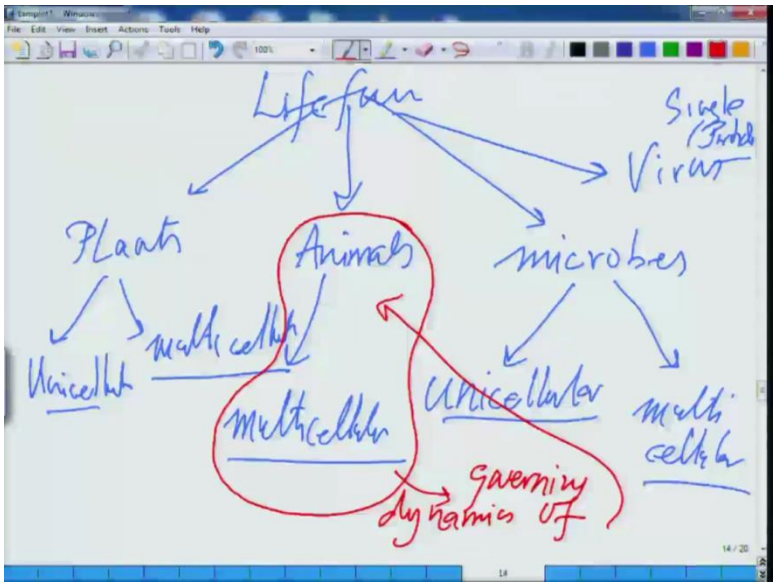

Now, you can classify it as plants, animals, microbes and within them, you have unicellular means we are having single cells multi cellular animals. Mostly multi cellular plants could be unicellular having single cell or multi cellular. This is how life forms on earth survive, and yet there are something within the microbes something like virus which is single particle. I would not call cell purposefully. May be at some other point I will discuss why I am not calling them a cell. So, here what we will be discussing in this course is this part, this is the region which is part of the course animals.

We will be talking about multi cellular animals and the machinery which governs it. In other words, it is governing dynamics of multi cellular organisms. So, this is the pattern parcel of this course where we will be starting to understand that. So, with this brief background of explaining you how the cells may have formed, we have not gone in depth with any of the structure, but just give you an idea how it looks like. So, if I start from here, so what is our body made up of and again, let us summarize. It is made up of carbon, nitrogen, oxygen, iron and few other components hydrogen, and we talked about how the cell, how the basic structure of the cell looks like.

Then we talked about different components, different elements are formed like carbon, nitrogen, oxygen, iron, sulfur and they self-assemble to form the different molecules like water, hydrogen, oxygen, carbon dioxide and nitrogen, then the big bang theory which

talks about the formation of the stars which eventually leads to the formation of elements.

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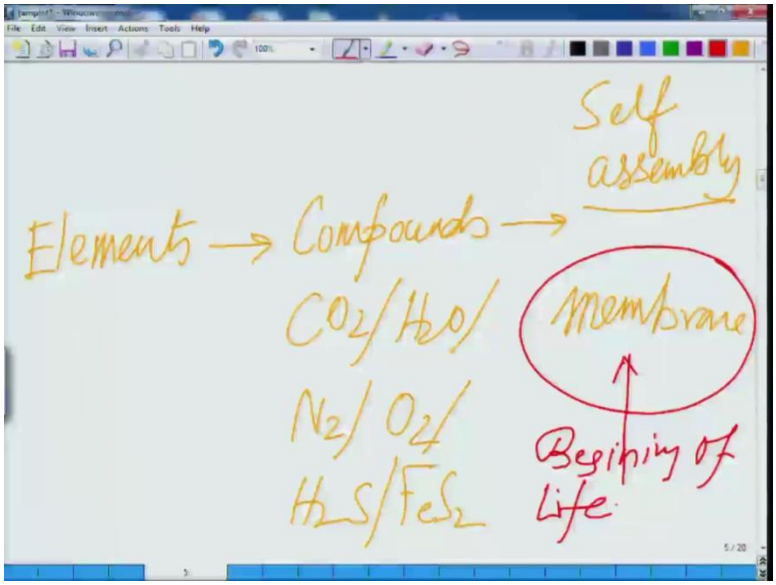

Then, we talked about how the elements joins together from the compound and then the self-assembly and formation of the membrane, the first membrane and this is the beginning of life form.

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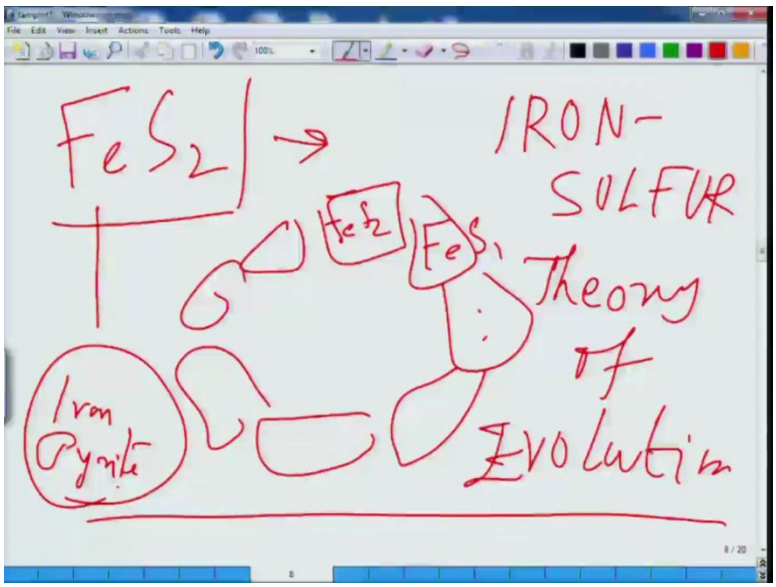

From there we talked about how the different compounds come close, come together and from the first membrane, likewise C1, C2, C3, these are the different compounds coming

close to each other. Then, we talked about one of the most probable theories may be iron disulfide membrane of this is also called as iron pyrite. It is one of the very primitive molecules which have believed to form the first membrane.

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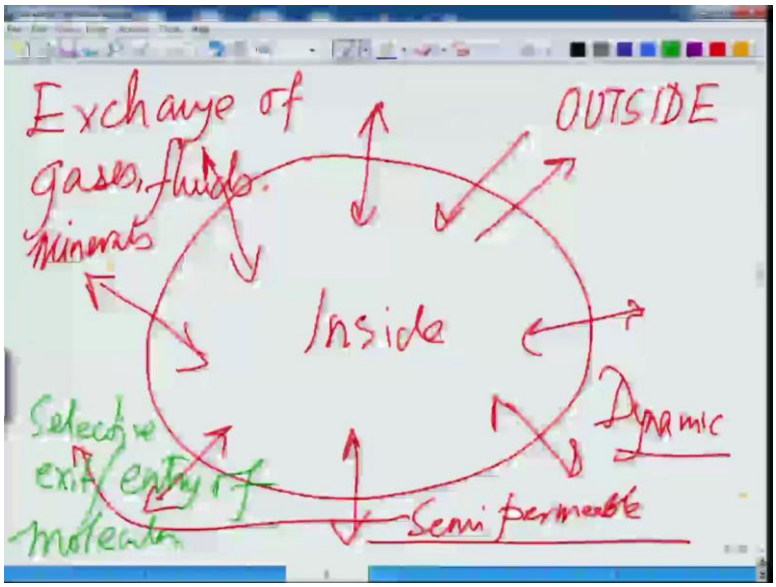

From there we talked about this membrane should have, I should be a dynamic membrane, dynamic semi-permeable membrane. In other words, what I do mean by semi-permeable is it means that not everything is going in out of it. There are selective entry and exit. In other word, selective exit and entry of molecules from there we move on to how the different cells assembled and form something called as a tissue, and from there we talked about from the tissues, we move on to self-assembly of different tissues forming organs and self-assembly of the organ forming this system. So, there we summarize the whole thing, cells and their self-assembly of tissue and then we classify them into as unicellular and multi cellular organisms.

So, this is where we did the classification could have plant system, plant kingdom, then we have the animal kingdom, we have microbial systems, you have the virus and here in this course, we are talking mostly or everything about the animal systems. With this brief idea or brief introduction, let us move on to our own cells which all systems we are going to study. So, what I will do now? I will draw a picture of human being and in this course mostly we will be talking about the human systems. We will take human system as a reference and with respect to human system; we will be talking about any other

rumen system like cows or buffalos or anything, tiger or anything. At times we will do some degree of comparison that where we differ from the cows in terms of the systems what we have, but our reference will be always human system.

For your knowledge who are interested from excite studies? These are some of the books I will recommend you. One of the very good books is text book of Medical Physiology by A.C. Gyton. This is of course now it has two others Johny Hall. It is W.B. Sounder's company. There is another book which is very nice for those who love to have very nice pictures. There is The Fundamentals of Anatomy and Physiology by Page Marteny. This is a Prentis Hall publications and long. As we will move through the course, I will recommend you some of the additional material which will help you to understand the content that how where all additional information you can obtain. Now, after talking about this we will be talking about, I will give you a general idea. Our body structure and anatomy will help you to understand how we will be talking the course to. So, what I will do?

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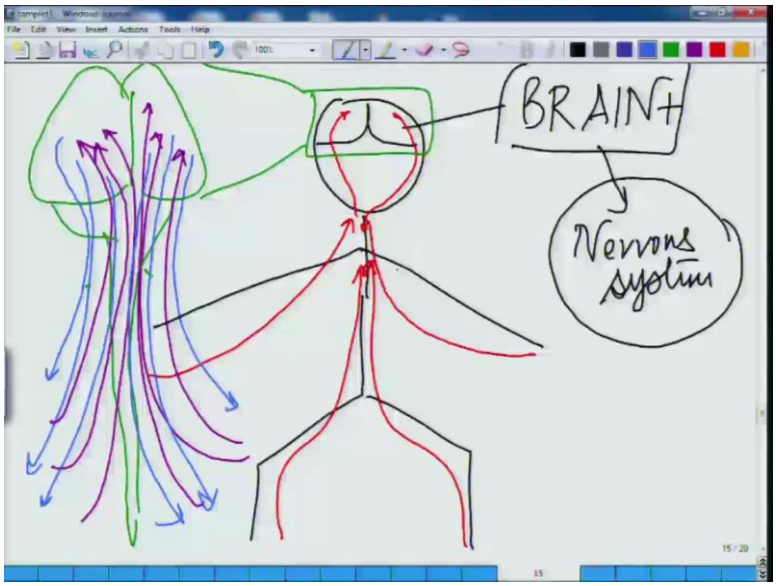

Now, I will draw a simple human being first. Just for your understanding we will keep it simple. So, our body if you look at it is governed by we think whenever we think, we think from this is what we believe and this brain is controlling rest of our body. So, this brain falls under the nervous system. This is one of the systems we will be studying. Brain plus how the brain is commanding rest of the body. Brain receives and sends the

signals from all over the body like this. All signals goes to brain from all over the body along a tube and they all reach the brain.

If to draw the brain in a real life, then this I show it looks like this. This is how your brain looks like and this is the spinal cord through with all the signals have been carried to the brain. Likewise you see these arrows are showing the information being sent to brain, and the brain guides and ask us and these signals are brought back from different areas of the brain based on which we coordinate, and we do all the actions in our body. Some of these functions are dependent on our thought process; some of these functions are not dependent on our thought process. They are exclusively governed by autonomic unit or autonomous unit.

We usually do not think. For example, you look at me. I can decide that I am going to move my hand. This is in my control fine, but I do not decide. You can look here my heart is beating. I do not decide how my heart is beating. That is completely under autonomic control. They are autonomous. I cannot control. I cannot say you know what your heart you beat slower or your heart you beat fast. I cannot control it, but I can control this. This I can control. This motion I can control. I can do like this, I can do like this. These things I can control, but I cannot control this. Yet both of these are controlled by your nervous system. So, part of the nervous system controls which are within your thought process.

The other one is, you do not have to think. It is already tuned, it is already programmed. It will happen like this. So, this is one of the most fundamental systems. So, the next system what we will be talking about this in our body if you look at it is all those which are effecter systems which includes your.

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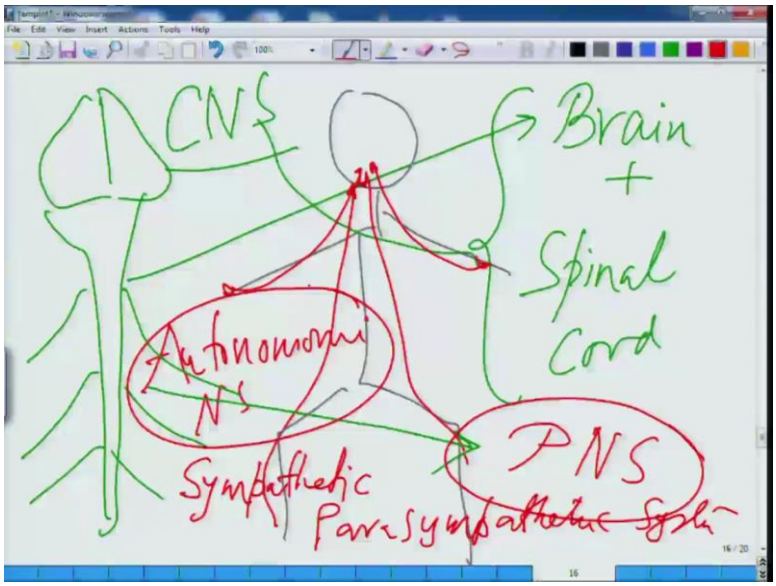

So, let me move on to the next day. Again let me draw the human picture. That will help you to understand, just missed something. Sorry people, it is when you drew the brain. So, the nervous system we will be discussing. We will be discussing it in two levels. We will be talking about the nervous system mostly consists of the brain plus the spinal cord. Brain and the spinal cord constitute your CNS or central nervous system, and all the information which are carried out from the other part of the body to the brain and wherever, those fall under peripheral nervous system. That falls under PNS, peripheral nervous system. On top of that we will be discussing about sympathetic and I will come to that. You do not have to worry because once we will be picking up this topic, sympathetic and parasympathetic system and we will be talking about the autonomous nervous system. This is what we will be covering in the nervous system and the different modes to control different things.

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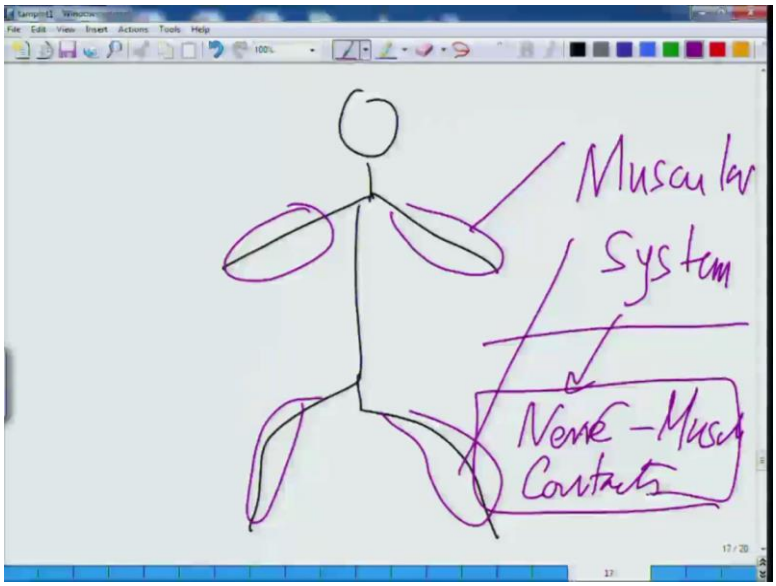

Next thing what will be talking about is let me again draw the picture. That will help you to understand what we will be talking about is all these different organs which are taking care of, stuff that falls under your muscular system. There we will be talking about nerve muscle contacts, where the nerves controlling your muscles. They are regulating through two different junctions. So, this is another system we will be talking about.

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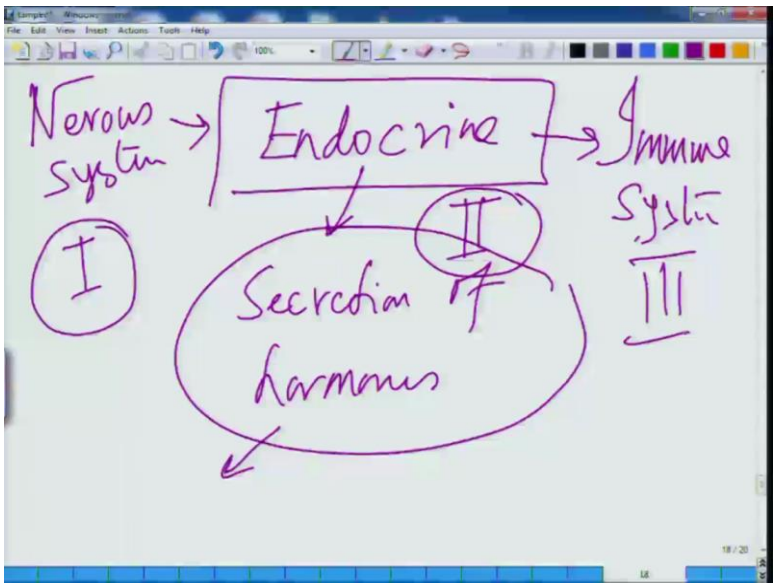

Then, we will be talking about something called another level system called endocrine system. So, the body consists of three level of control mechanism. One is the nervous

control which is the highest control of the unit. This control soothing called endocrine system which controls your secretion of hormones, and the third level and this we will be talking about different hormones which are responsible for regulating your growth puberty and several other reproductive system and all those things. There is a third level of control if this control system one and if I consider endocrine system two, there is a third level control which is called immune system which will be talking in the part of immunity. This is the third level of control. These are the different level of controls which we will be dealing at different part of the course.

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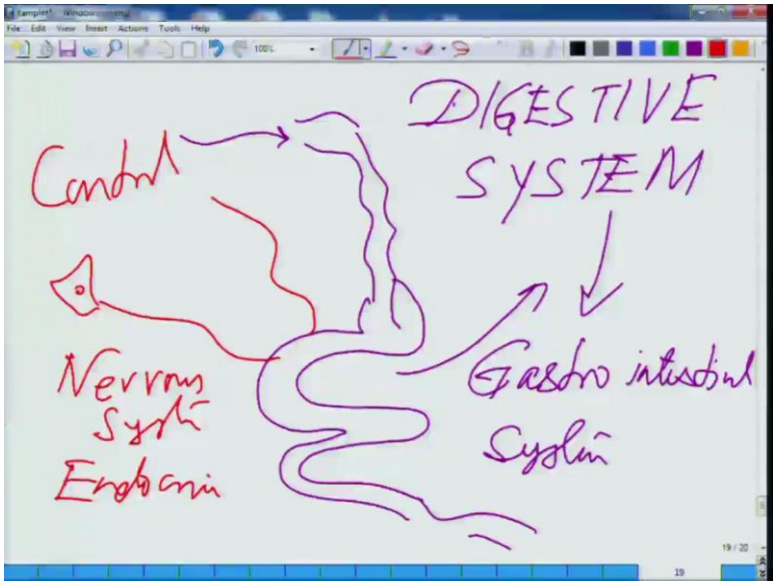

Then, we will be talking about if you look at, we take the food, you eat the food and food goes through the digestive track likewise and at different level, all kind of food getting digested and everything, and then of course part of the energy is derived that falls under. We will be discussing about digestive system. This also falls under gastrointestinal system. These are also under the control of the different nerves which are controlling another nervous control as well as these are the control systems, nervous control and endocrine control. So, we will be talking about the digestive system. So, we started with the brain at the head which is controlling along with the spinal cord, your central nervous system. Then, we talk about all our muscles of our body which are controlled, which are continuously under the control of the nervous system and move onwards digestive system.

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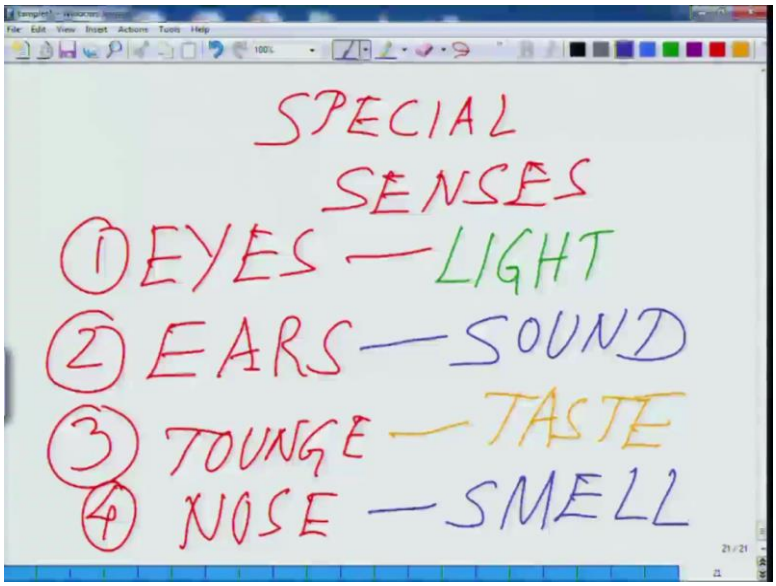

Then, we will talk about some of the special senses. Give me a second. We will talk about the special senses. Your special senses include your eyes by which you see and which is the part of the nervous system, your ear by which you listen to the sound and eye is responding to light. These are very important because these help you to survive sound. Then, you have your tongue which is taking care of your taste, then you have your nose which is taking care of your smell, then you have some of your skin senses and all those things we will be talking about in the special senses section, ok. Then, we will from here will talk about this whole body is of different parts. You look at it.

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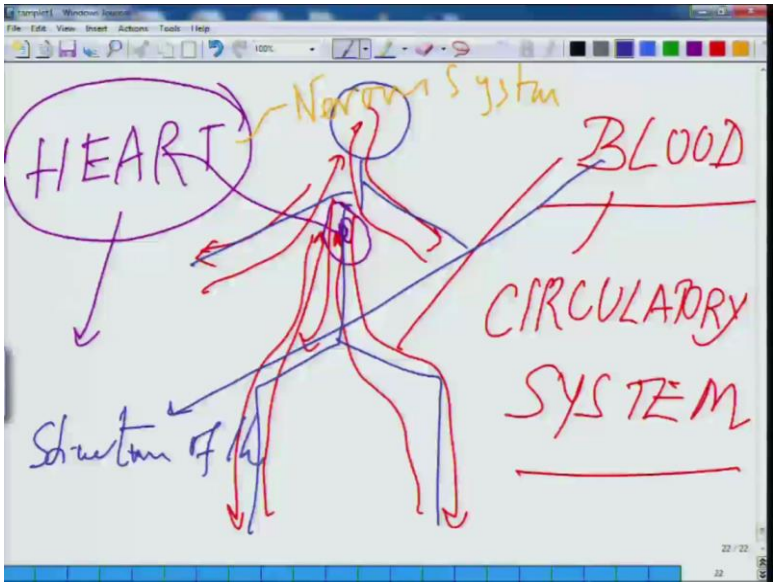

So, if this is the human being. So, this body continuously needs to communicate from one point to another. In other words, there should be a continuous inwards communication from here to here, here to here, likewise here to here. The molecules have to travel all along the body and come back to the body, and this is taken care by the fluid called blood. We will be talking about the blood. Blood is the one which ensures that all along the body everything flows and all the information are reached all over the body and nutrition is being sent. So, this falls under circulatory system, but then you need a regulatory system which will govern the blood is being sent all over the body that is taken care by.

If you look at me like here, it is your heart which pumps the blood all over your body. So, this is where lies your whittle organ, the heart. So, in this section, we will be talking about the control mechanism which ensures that the blood travel all over your body. You take a drug and that drug has to travel all over your body. Otherwise, it does not make any sense. So, only taking about the heart here, then who is controlling the heart? Again we will come back to the nervous system, part of the nervous system which is controlling your heart and part of the system by which the nerve is autonomous. It controls it all by itself, and then in terms of the blood, we will have to talk about the structure of the blood cells. Let us move on to the slide.

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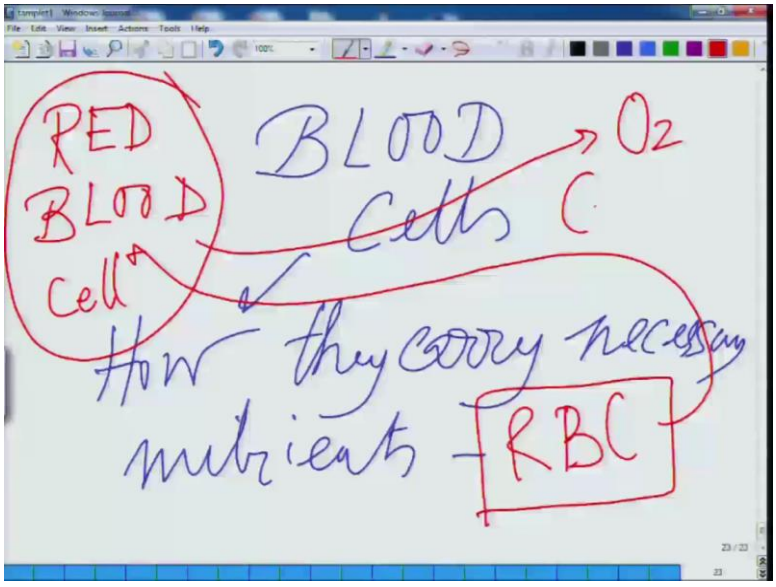

So, that will help you. We will talk about the blood cells. In that what we will be dealing with how they carry necessary nutrients. So, let me tell you here we are living in an oxygen environment. So, all the part of the body needs oxygen. So, in order to ensure that all the parts of the body needs oxygen, we have to ensure that there should be some cells which can carry oxygen to all your body, and stuff which carries oxygen in your body falls under something called RBC. If you go to a doctor, they give you a count. You know what there we will see this RBC. RBC stands for red blood cell.

So, remember we discussed about cell in the beginning. They are your oxygen carrier as well as every part of the body is involved in generating some. Suppose something is working. So, it generates some waste. That waste has to be thrown out of the body. So, you need something just like in your colony. We dump trash; we dump some kind of garbage. So, there should be a truck which comes and takes the garbage out of that colony, just seemly in different part of the body like here, here, here, wherever in my body. So, there are lot of trash which is our garbage in the form of carbon dioxide and other molecules that have been generated. So, you need something that carries it and through out of the body that is taken care by these RBC.

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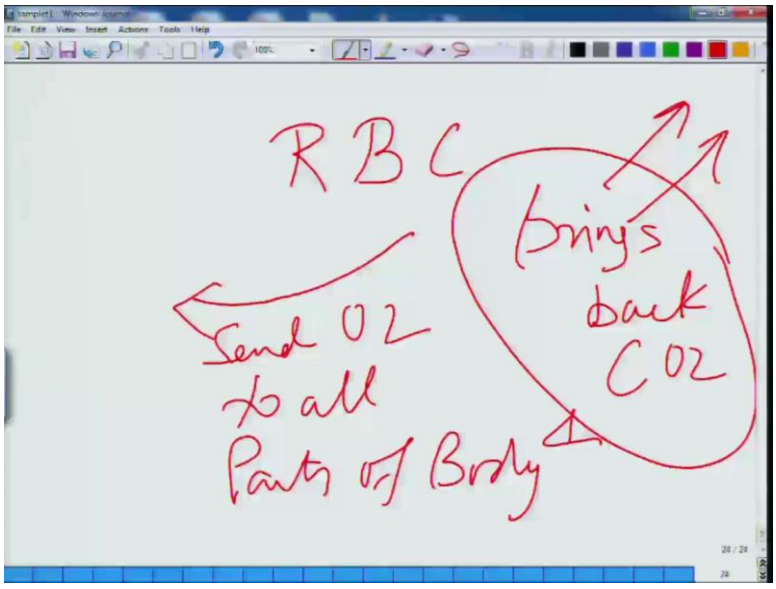

They ensure that the oxygen is sent to all parts of the body, and brings back CO2. It has to be thrown out of the body. So, this is what RBC does.

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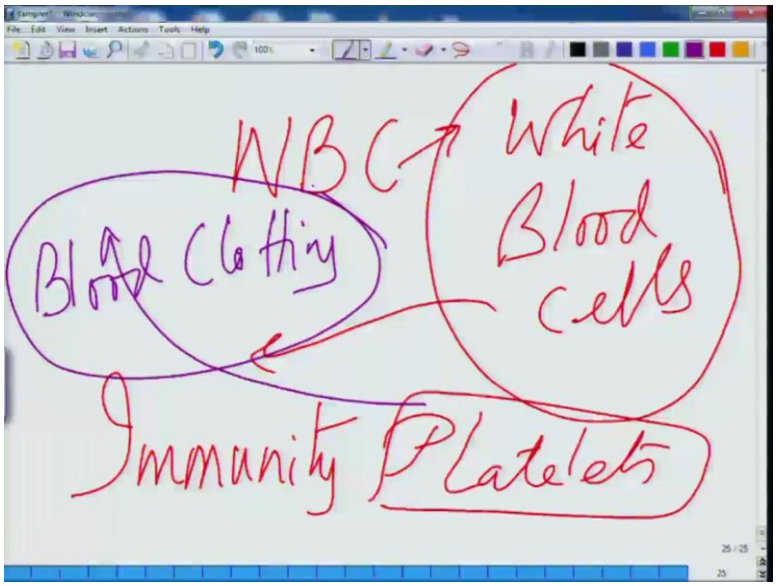

Yet there is another set of molecules within blood which ensures which are called WBC. These are called white blood cells. These are the molecules for example all of you got a cut somewhere or the other. Whenever you get a cut, after some days you see there are pus cells which form, ok. What are those? Because those are the ones which are called white blood cell. These white blood cells ensure they are involved in immunity. They help you to fight against any kind of disease. Those are called immune cells of the body. Yet there is another kind of cell. Whenever you get a cut, you see after sometime the blood stops floating out of there. It heals. That is taken care by another set of cells within the blood and those are called platelets. They are involved in a process called blood clotting.

So, all these different controls which takes place when the clotting mechanism will be functioning, when the body has to activate its white blood cells, when the immunity has to be triggered on these, all falls under the umbrella of blood and its functions. So, if you look at blood, it is involved in carrying oxygen to different tissues removing the waste from the different tissues. There are white blood cells which get activated when the body is fighting against any kind of pathogen. Yet there is another kind of blood cells which are called as platelets. They are involved in ensuring that whenever there is a cut in the blood vessel or anywhere and blood is losing, so it is just like there is a pipe. It is something like this if you will just imagine.

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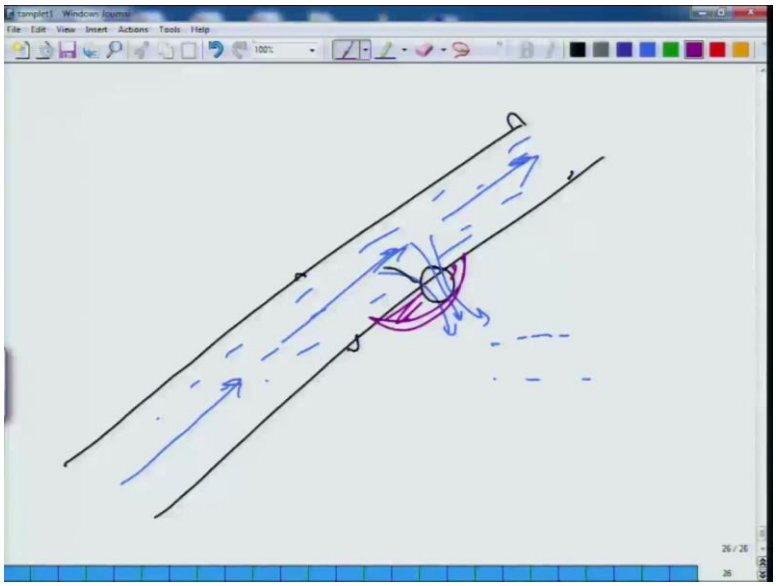

This is a water carrying pipe. This is a pipe which is carrying water. So, think of it. It is a pipe and think this is the water is moving. So, water is moving like this, ok. So, suppose there is a hole out here. For example, there is whole water. Sorry. So, let me draw it. So, for example, there is a hole out here. So, what will happen? The water will start coming out. So, you need to put something like this to ensure the hole is taken care of same way suppose instead of this what I do I just now imagine.

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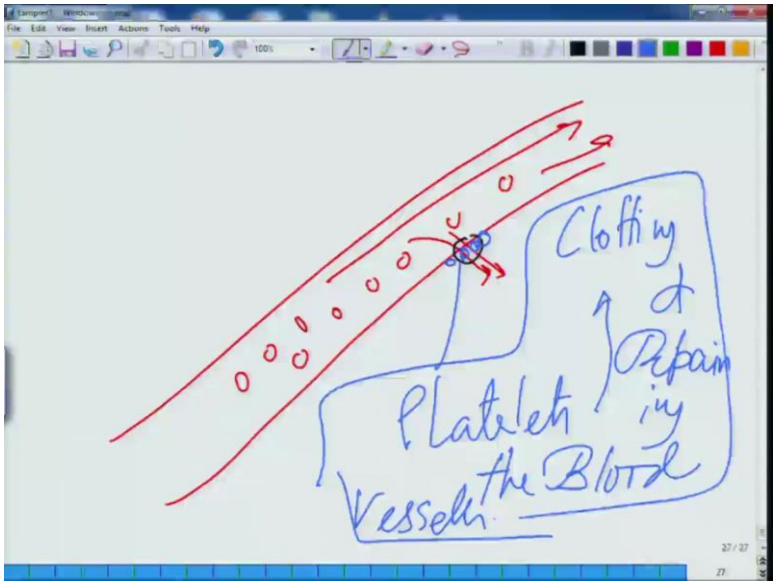

This is a blood vessel like this. This is my blood vessel and these are the blood cells which are flowing through it. This is a blood vessel in red and there is some kind of a puncture like this in a blood vessel. So, what will happen? Blood will start coming out and as soon as that happens, there are series of cells which are called as platelets. They will come here and these platelets will ensure clotting and repairing of the blood vessel, ok. So, this is what the platelets do. Now, once we do with the heart and its control mechanism, then we move on to the blood and everything. Yet there are many other wastes in the body which needs to be taken care of and not only carbon dioxide.

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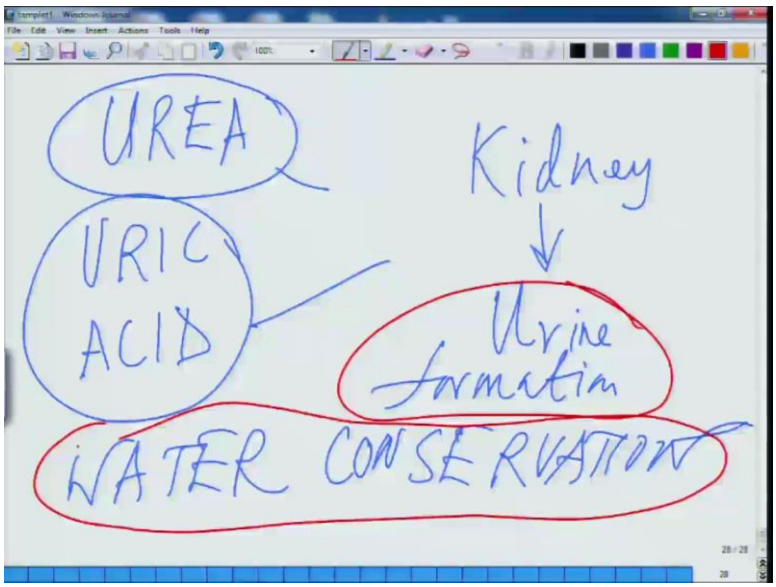

There are several minerals, urea, uric acid and several other things which have to be taken care of, and water has to be conserved inside the body because there is continuously water coming out of the body. So, water conservation is essential. We cannot afford to lose lot of water. Otherwise, we will suffer from dehydration. Water conservation, this water conservation and getting rid of urea and uric acid is taken care by organ called kidney which ensures your urine formation and water conservation.

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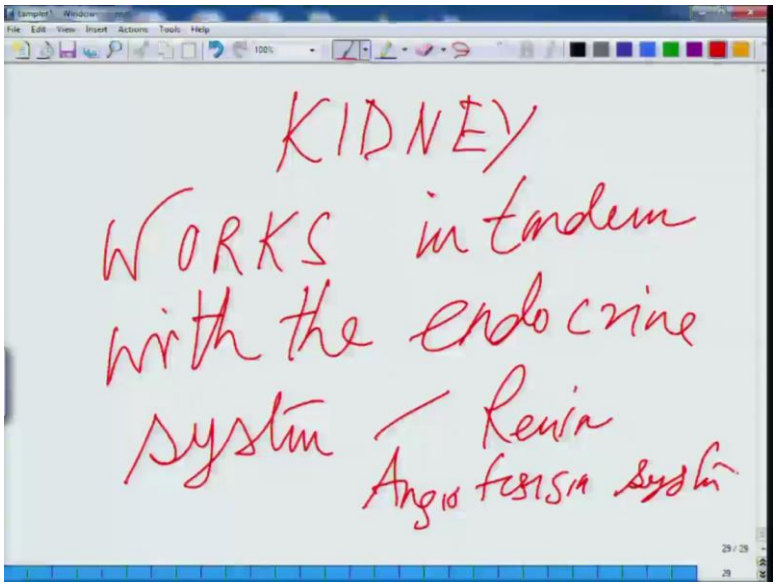

Kidney works in tandem with the endocrine system which we will be talking about something called a renin angiotencin system and within the kidney.

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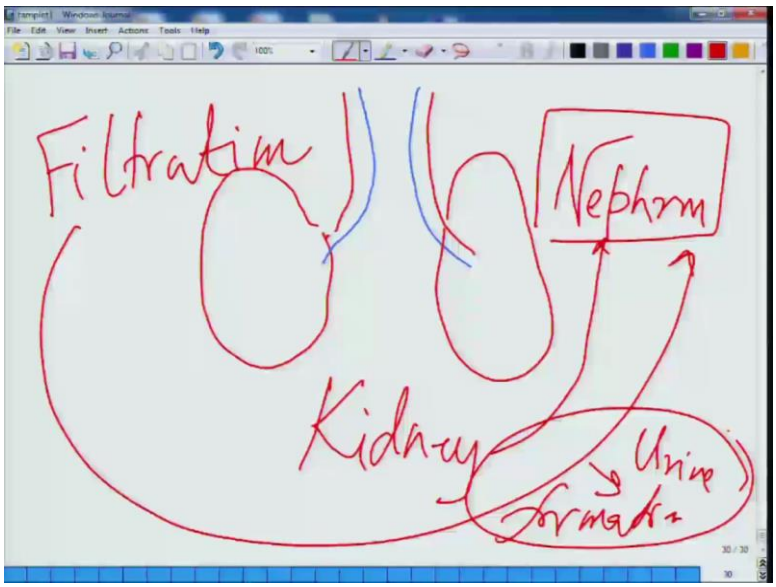

So, kidneys are something like a structure like this located at lower part of your body. I draw it through something like this. Kidney is smallest functional unit called nephron filtration, and several of these structures, thousands and thousands of these structures ensure this leads to urine formation. Once we do with the urine, our next thing comes is

how we ensure when we take oxygen and all those things, and throwing out carbon dioxide. Of course, the blood is carrying them, but how we throw it? How we take?

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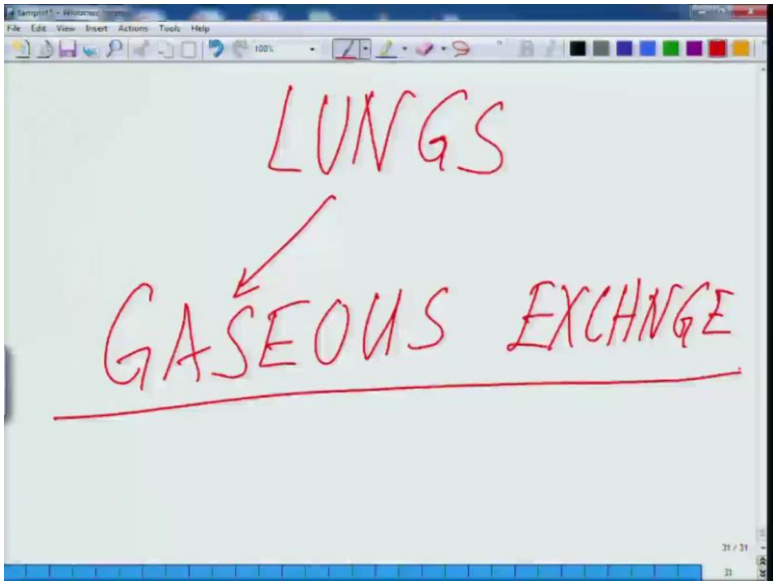

So, that is taken care by our lungs which are involved in exchange of gases or in other words, gaseous exchange within our body.

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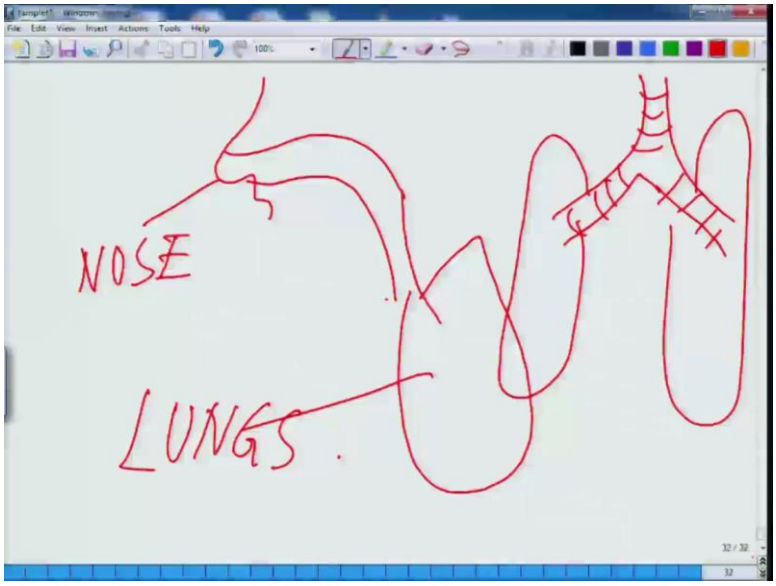

What this does is something like if you would lungs are like this. So, if this is your nose. From here it comes and it is a side view and if you have to have a front view, it is like this. There are two lungs out there and this is called trachea through which the air is

being pumped into our lungs through the nose. This is the nose and this is the side view of the lungs. We have two lungs. They ensure, give me one second, 33.

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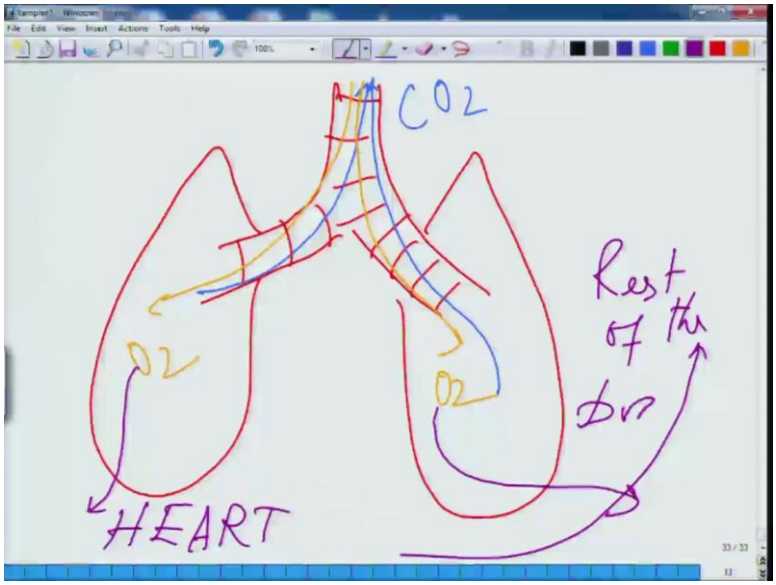

Let me redraw for you guys. Give an idea about. So, this ensures that we throw away the carbon dioxide and we take fresh oxygen all the time, and from here this oxygen is being sent. This oxygen is sent to the heart through the blood and this heart then ensures that this is sent to the rest of the body.

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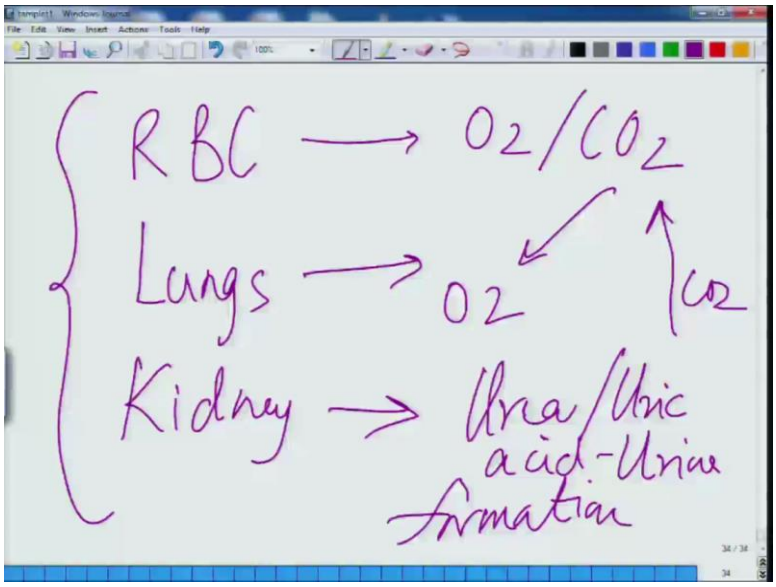

So, if I have to summarize the three different form where we are kind of getting rid of the things is that RBC ensures oxygen and CO2 transport, lungs ensures oxygen intake and throwing away CO2, kidney which is exclutery system which ensures urea, uric acid and urine formation. Apart from it, there are few other systems which ensure that we get rid of the necessary unnecessary things from the body and clean up our systems, and take the necessary good stuff into our system. From there we will move on to see the digestive system.

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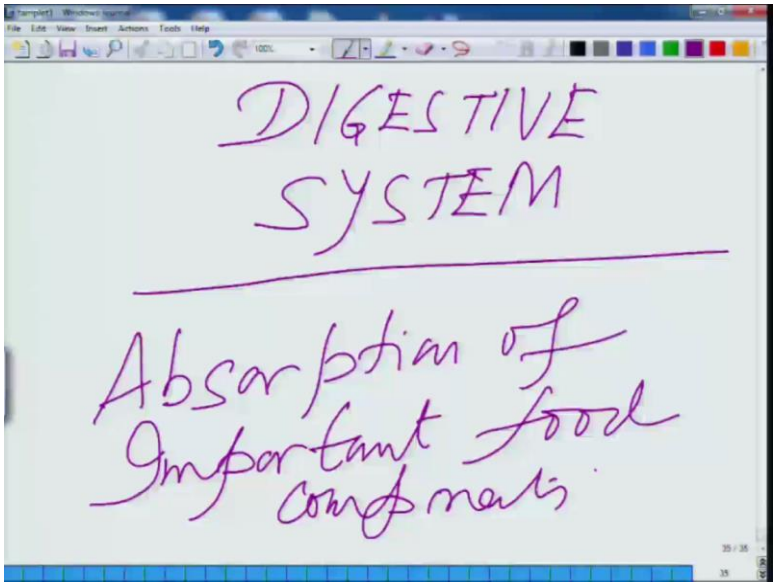

So, we all know we take food. Now, food has several components. We talk about that very soon in the next lecture. So, we have to ensure that we absorb all the important components from the food and that is taken care here by the digestive system. Absorption of important component, we will talk about the components very soon. Do not worry. So, that falls under the digestive system.

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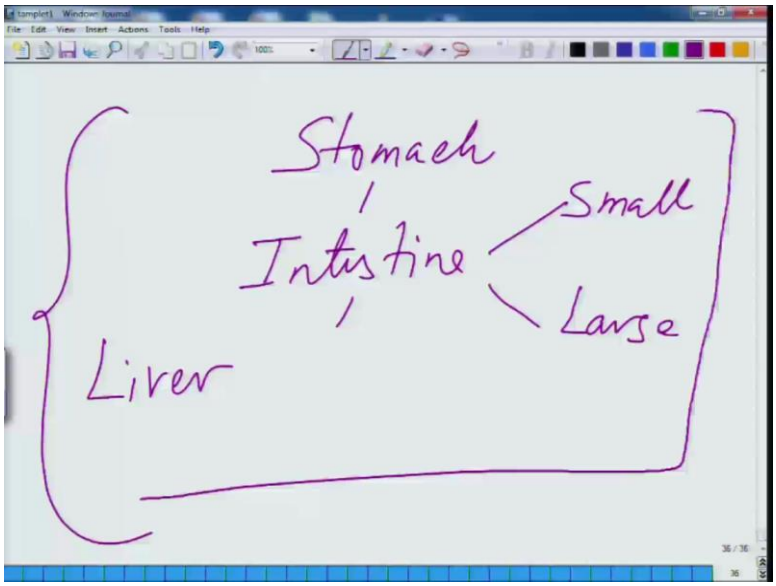

So, this includes your stomach, intestine and we will talk about this structure and we have the liver. Then, we have small intestine and large intestine and few other organs which ensure that our major thing out here is absorbing the food for energy which is needed for functioning of our body.

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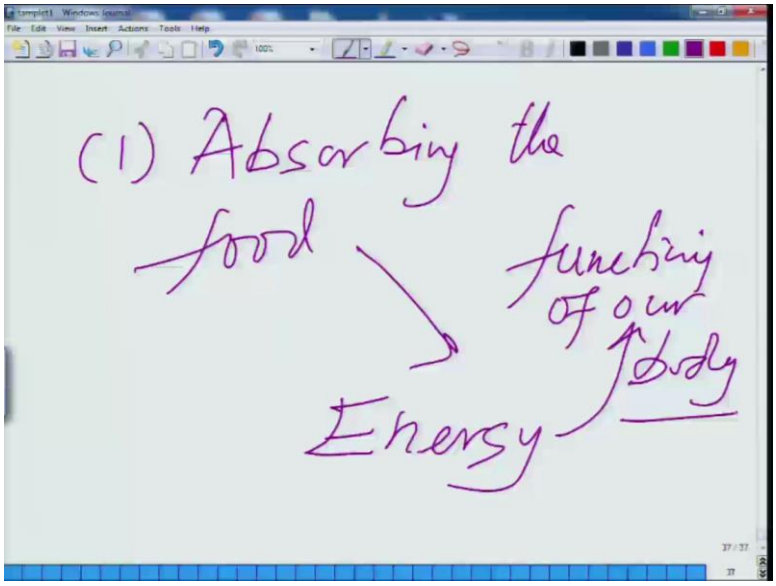

So, all these different systems what we talked about are the ones which ensures that the whole machine, this whole machine what I drew in the beginning, functions smoothly and the study of physiology is all about that.

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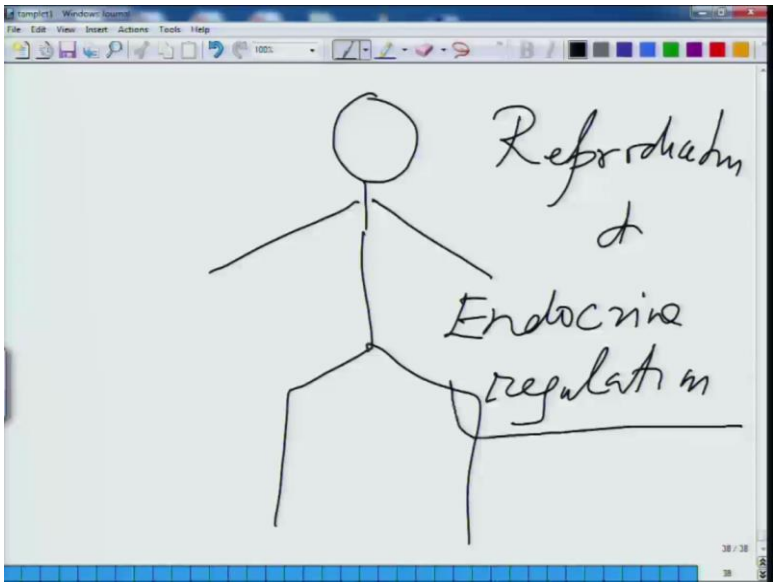

There is something which I have not touched is this among the different systems is called reproduction because we have to ensure that from one generation to next generation, we reproduce, we grow, otherwise we will become extinct. So, that is the part which will be dealing with reproduction and endocrine system, endocrine regulation.

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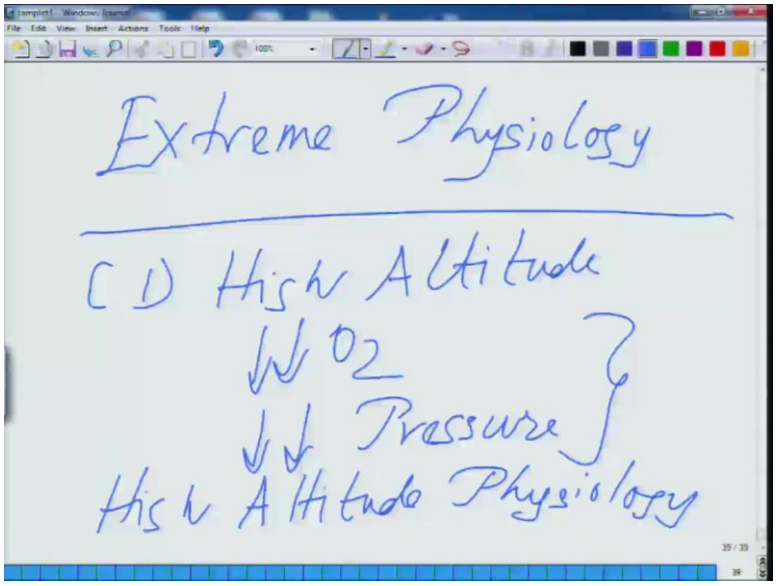

From there we will talk about two different situations which fall under the term called extreme physiology. In other words, all these studies what we will be doing is in a normal condition just say for example, they are at a high altitude, very high altitude, but

which is like something like very low oxygen and very low pressure, ok. How our body is going to react to this, we will study this in high altitude physiology because mind it large number of our soldiers are stationed in places of Ladakh, Leh, Arunachal and all these places, where we really need to understand the physiology because the body behaves in a different way.

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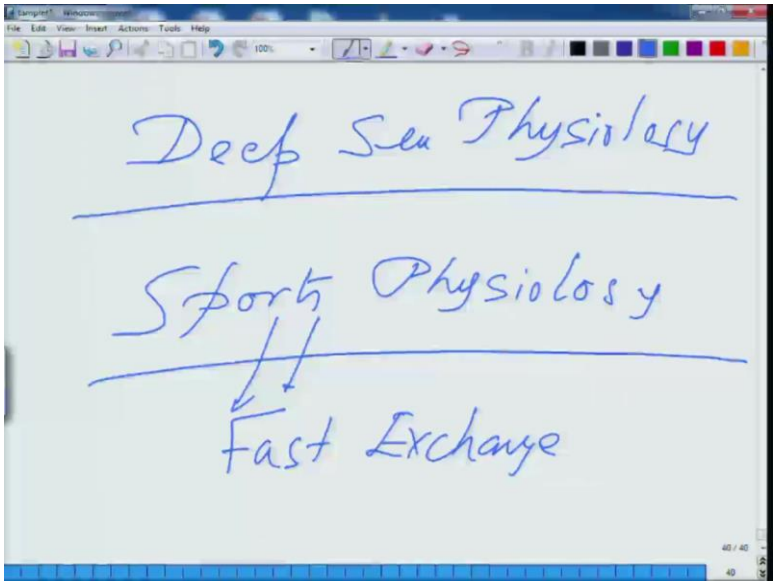

Then, we will be talking about deep sea physiology, where the pressure is very high. How our body reacts to these extreme situations? Manually talking about sports physiology, especially these are the situation where you have to exchange very fast. Exchange gases are essential. Why some people are good runners and some are not? So, we will be talking all these in the end.

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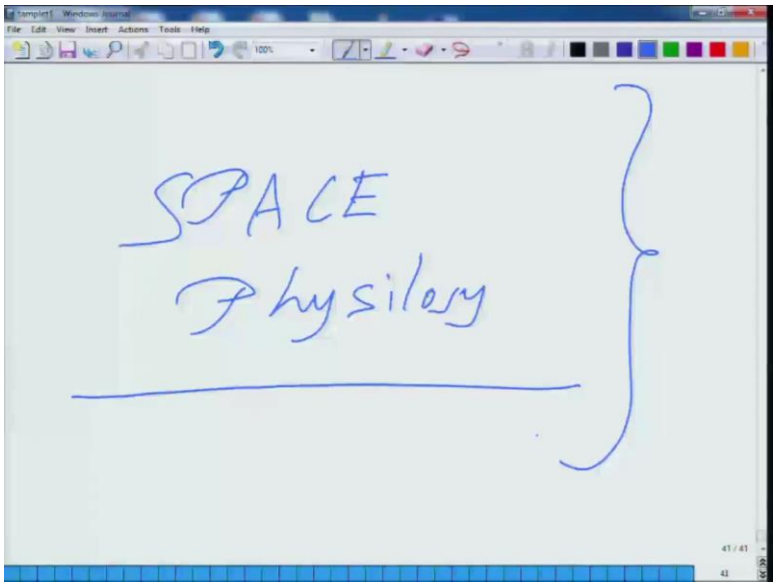

On top of this, we will be talking a little bit about space physiology. So, that will pretty much cover whole spectrum of deferent systems that will be covering in this and I believe the end of it people will have a fairly good idea of whenever you see, for example, let us take before we conclude this first lecture.

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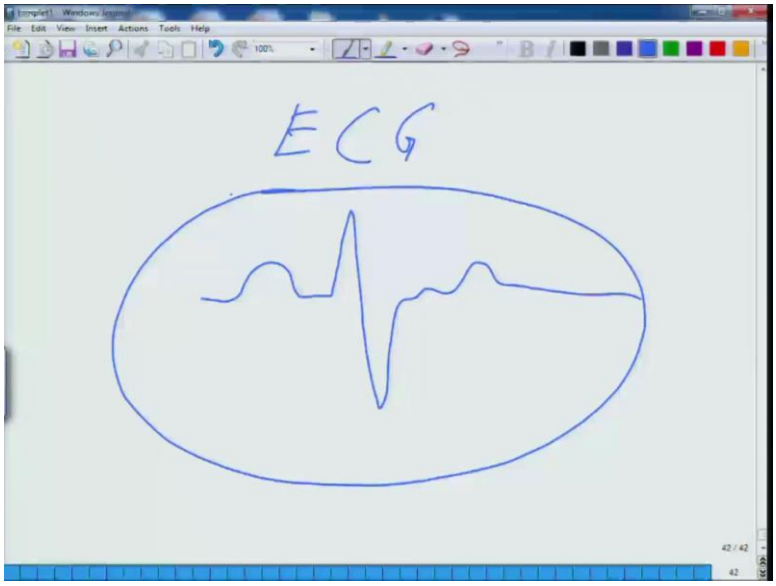

Let us think about when you go to a doctor, they give you something like ECG trace which looks something like this. You know most of us do not even understand what does that mean.

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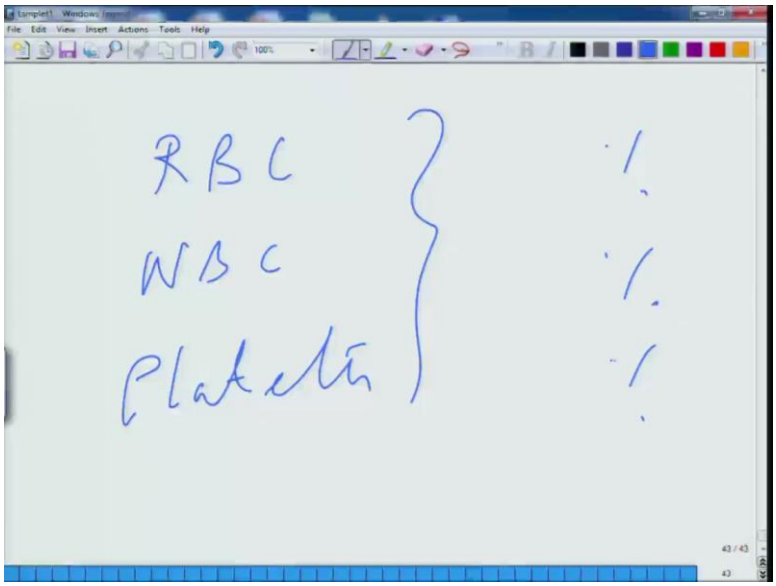

I expect that you people after the course is over, you should be able to interpret this, or we go to a doctor says you know your RBC count is this, your WBC count is this, your platelet is this, some percentage value. Most of us do not even understand what does that mean. I expect that you people should be able to understand that what does that mean.

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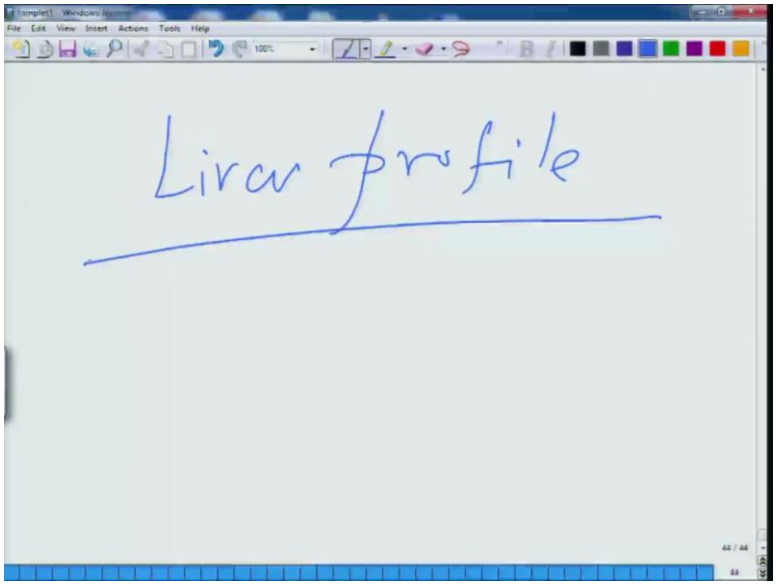

Then, we sometime go to a doctor and they give us something called a liver profile. You know doctor ask to get a liver profile done. We do not understand it what liver profile means. Then, some time doctor suggest you some drug and we have no clue what that

drug he is talking about. So, these are the things what I expect once the course is over, you should be able to ask. On top of this, another thing which will be touching up on the course about says for example, doctor says you know your parents need a pacemaker. What is a pacemaker? It is basically where it fits in our things. We will be talking about this in the circulatory in the cardiac system. So, these are the things which I expect once the course is over, you should have a basic understanding about yourself and you should be able to answer these simple things, or you should be able to understand about your own body. So, with this first lecture, I am closing the first lecture if I really get to go back again.

So, this is what where we started. What our body is made up of and we move on to, it is made up of different kind of you know, sorry we talked about the basic structure of the cell. Anyways, we will come back to this. Then, we talked about the big bang theory and the formation of elements, and then we talked about the formation of different compounds and self-assembly of the compounds. One second. Then, we talked about the different compound which are formed and the compounds self-assembly and formation of the first membrane and then evolution of the membrane.

Then, we talked about one of the iron sulfur membrane out there, then we talked about the self-assembly of the cells and the tissues, then we talked about the formation of the tissues to the organs to different systems, then we talked about the tissue organ systems are varying in plants, animals and the microbes and the virus. Then, we talked about the nervous system which will be going in depth. From there we talked about the three control units of the body, the nervous system, endocrine system, the immune system and then we talked about how the nervous system is controlled and the heart discussing about this and the blood and the circulatory system.

Then, we talked about the different roles of the blood cells in ensuring that it is taking care of the oxygen to all the tissues, and ensuring carbon dioxide out of the body and we talked about the white blood cells. How they play a role in immunity and we talked about the platelets, how they help in repairing the blood vessels which are damaged, and the clotting mechanism. From there we talked about the kidneys, where the urine formation takes place to ensure your body remains clean. Then, we talked about how the kidney works in tandem with endocrine system, and we talked about basic structure of the nephrons which run the kidney. We talked about the lungs.

We discussed how the oxygen and carbon dioxide is being exchanged in the body and talked about gastro intestinal system, where we have stomach, intestine, liver and all other organs which ensure how much energy we derive from it absorbing all the energy molecules. Then, we talked about the special physiology which includes the deep sea physiology, sports physiology and space and high altitude physiology, and all these things and then what I expect you should be able to understand what ECG trace is, what is a liver profile, what is a blood profile and all these things.

Thank you. So, we will start with the next lecture after this.