Cell Culture Technologies
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Lecture – 01
Introduction of Cell Culture Technology

Good evening, and welcome you all to this new course which will be starting today on cell culture technology. So, the name cell culture, whenever it comes gross people have the first feeling that well, it is a lab training or a kind of a technique which is used by most of the labs, who worked at the interface area biology chemistry environmental sciences and all other allied fields might metabolic sciences say for example. So, it is just a simple technique what most of the kind of understand that you know cells which are cultured in an synthetic or artificial environment at least that is what the commoner or you ask any graduated student or under graduate student that is what they will answer why we really want to offer a course on this area.

So, and as a matter of fact when I floated this course there are people has been that that is a practical training how really want to you know put a cross a course which is mostly a practical training people have cell culture labs. So, for me to put it across is though the name is just cell culture, but there is a philosophy behind this, whole thing, there are some basic rules and moreover, there is tremendous amount of science and art involved in it and if somebody who wants to do cell culture or wants to learn cell culture.

Appreciates these basic philosophy or the paradigm or the mile stones, then it will be easy for that individual to design the problems in better and most importantly to appreciate; how far they can go. Say for example, in mathematics there are several techniques, right or in physics there are several techniques, similarly in chemistry, there are several techniques say spectroscopic technique, but we have course; the basic logics behind the spectroscopy; whether it is a Raman spectroscopy, whether it is a FTIR, whether it is a NMR, if you know those; at least the basics, then you know with your problem, what all you can derive using this spectroscopy or say for example, crystallography.

Similarly, several mathematical tools similarly like statics there are these are tools, but if you know the tools and the origin of the tools and the power of the tools, it will help you

to become much more wiser in designing our problem. Similarly cell culture is a tool, but tool whose journey if you look back is now more than 100 years old and there are handful of books, you will come across and some of them; I have already mentioned like M (Refer Time: 04:11) tissue cultured book or few other books like gorsline bankers, neural cell culture book and there are manuals published by companies like Gibco Invitrogenor; currently which is known as life science technologies and they are really nice guide.

But one thing which I personally have felt is that somewhere these books are more or less like a protocol book, but cell culture has such as not just a mere protocol is definitely, there is a significant part of it which is protocol driven just like an molecular biology in a (Refer Time: 05:01) manual, even you can go through it, but a still molecular biology has a subject has tremendous amount of chemical logics and unless you understand that you will be working like a blind person; that is precisely what happens in cell culture that my young student or young enthusiast take under graduate or a post graduate; just embraces that this is technically just let follow it.

Without putting logics and place that why am I doing it what is the basic reason behind it. So, in this course, what we will do; try to do of course, we will talk about the techniques, but mostly we will be talking about the philosophy and what drives us and what are the possible options some explored some unexplored, as I mentioned, just a couple of minutes back; the history of cell culture is now more than 100 years old and if you look back like if you are an good historian or if you are interested in scientific history, if you look back the very first paper which at least known to us which were published in this field were around 1908; 1912; it is that back even much earlier than the first world war; first world war started in nineteen fourteen right.

So, this was the paper from Harrison; one of the pioneer and what he did for the first time, he grew a explants; explant means part of a some animal systems body or a matrix and a matrix was very interesting thing it was a spider net he did not know where to grow. So, if we break up this problem what he was trying to do, but before what is trying to do let us go back a little? So, if this field which has its first set of publication coming almost 117 years back, then for most what we will try to do? We will try to appreciate this whole history of 100 years; what is happened, how things are progressed and where this can take us.

So, there were points and it is not that in just 1 or 2 classes, we are going to finish this off as we will be proceeding through the course time to time, we will try to go back and see you know where it all started that will kind of give me an idea that where to go, if you do not know the history; if you do not know the time; how it is it has been progressing it is very tough to build up a story what will be the next landmark thing which is going to come up there.

So, on one hand as I; when I started the lecture today, I told you that this is used as a technique for certain people, yet there are a lot many people who have spend their life time in or devoted their life time in discovering or making this field to march ahead. So, keeping this mind, let us go little back to 18th century, when the cellular theory was which was given. So, one of the theory was (Refer Time: 09:07) means cell existing form preexisting cells.

Here, I will just take a slight (Refer Time: 09:16) for you course title is cell culture technology and in this particular next series of 40 lectures, we will be exclusively concentrating on animal cells, this is just for your note; we are not taking plant cells into consideration here because that will become way too diverse we will talk only about animal cells. So, cell culture technology; you can put it within bracket animal cells and of course, we will be talking about all sorts of animals, we starting from myelin cells, even human cell culture to mammalian cells like rats mice all the way to amphibians like lower order including fishes.

This is the range the spectrum; what will be covering coming back to the basic fundamentals cell arises from preexisting cells so; that means, each one each of our cells in our body arises from the previous one, if this is true, then could we do this thing outside the system; what is that mean; that means, say for example, at these you know epidermal cells growing all over the skin I take a small part of it. So, what I will be taking out will be a small tissue?

So, all of you are aware about the organization; you have cells cluster of cells performing a common function. It is called a tissue; I take a tissue. So, each cell is adhering to the other cell with a cementing matrix I dissolve the cementing matrix. So, what I have are individual cells and if I take this cell outside the system. So, no more in part of body now

and plate it somewhere will it behave the same way as it happens in my body is it making sense let me just put it now graphically for you to appreciate it.

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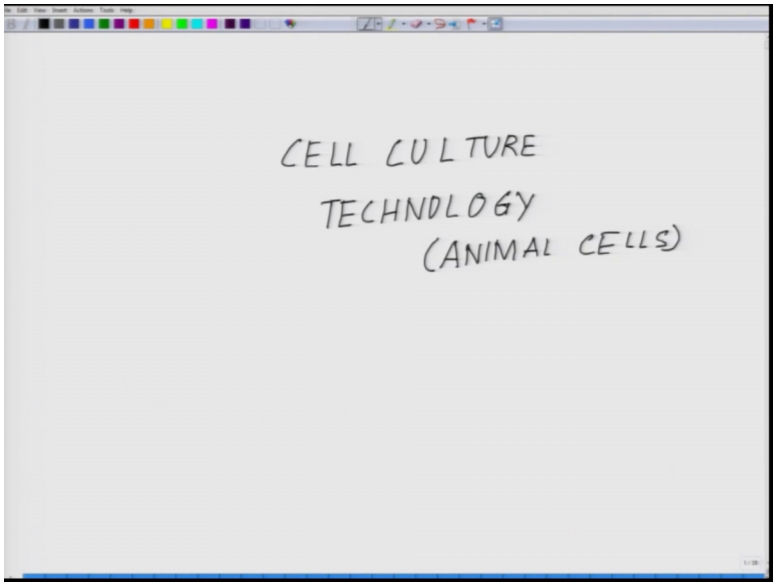

So, we start off with; so, our cell culture technology and we will be dealing as I mentioned exclusively with animal cells and what I am trying to tell you is that say for example, from an animal.

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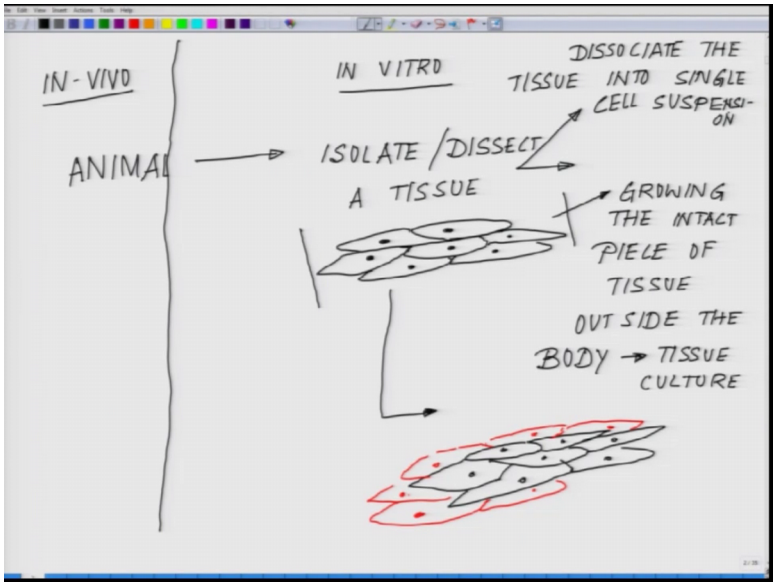

I isolate or dissect a tissue. Now once I dissect the tissue. So, it will be something like this. Now for example, it is a mass of cells which I have isolated. Now once I isolate this

I have 2 options, either I just grow them as it is which we will call as outside the system now up to this, this was all inside which is in vivo. So, there is a term which is used for this if you directly studying within the animal is called in vivo. Now I have in a in vitro conditions which is outside the system. Now I directly grow this piece of tissue; growing the intact piece of tissue outside the body.

In that situation, I will call it a tissue culture. Of course, if this is a dividing cell then I will be expecting my expectation with this in a tissue cultured dish will be these are the old cells which are present then going by the theory of omni cellule cellule cells existing arriving from preexisting cells, I should be able to see the development of the new cells, the one which I have shown in red. So, there will be dividing and there will be forming a mass kind of a structure, right, this red ones are the ones which are growing outside the system all what I do I dissect this tissue and I follow another route where I dissociate the tissue into single cell suspension.

What does; that means, let me suspension; that means, so, I have this tissue, here the original tissue which I took out from the animal.

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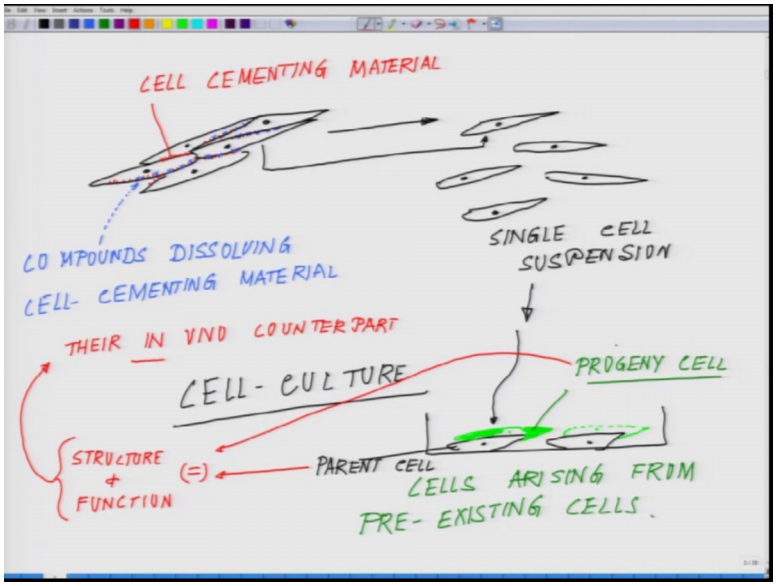

So, this tissue as multiple cells and each one of the cells are anchor to each other where I am putting these small-small red stumps, these are the extra cellular matrix or the cementing material which are making these cells to adhere to each other. Now what I do

I take some kind of an enzyme or some kind of a system by which I break down or chew away those cementing materials? So, let me introduce that.

So, I introduce some form of a compound which will start to nullify them. So, once this cementing material is dissolved, what I will be leaving behind will be after this; let me put this is the cell cementing material and I am not introduce any technical terminology at this point, we will come later on to all those thing cell cementing material and so these are compounds dissolving cell cementing material. What we will be getting after that will be suspension single cells like this which are no more adhere to each other. They are suspension and this is called the word which I used in the previous slide; single cell suspension. So, this is called single cell suspension.

Now, if this single cell suspension is given a right environment to grow; say for example, in a day short somewhere and let me introduce this complexity, let me finish this then I will introduce this complexity what is that and where I stopped, if I allow them to grow on a synthetic environment and they should be able to exactly behave like they should be able to divide like this. So, this is green is showing the dividing which is proving the point omni cellule cellule cell arising from pre existing cells. Now second situation what I told you is called cell culture; the first one is tissue culture second one is called cell culture.

So, there will be these 2 words have been used very oppositely in the literature because when Harrison, I told you that 1903; the first paper by Harrison when Harrison did actually, what Harrison did was something like a tissue culture he took a explants, this is that is why it is called an explants. He took a explants or part of the tissue and grew it on a spider net. So, it was; I think it was a neural tissue and it shows the extension of the neural cell bar; neural cell process is moving along the threads of the spider net. So, essentially the term which is coined was tissue culture, but over period of time; what we will be talking mostly about cell culture because the reason is there are different terms for all this things when you start with single cell you allow it to grow to form a mass or form a tissue; there is a next level, if you allow the tissue to in a three dimension that is called a plant sometime people directly get the explants. So, here we will be dealing at deferent level.

So, to start off with in order to since course title is cell culture, I told you; this is purely what is the cell culture, but we will be covering the whole spectrum from cell culture to tissue culture to its plant culture, all those things we will be covering, but for the basics, it should be very clear to you; what you are doing and now we are into 21st century. So, you should not use the wrong because it is not the wrong; it is just the confused. So, it is better to use the right terminology; what I am doing? I am doing cell culture; am I doing tissue culture, am I doing explants culture, it should be very clear to you there should not be any room for any ambiguity.

Now, coming back if it is omni cellule cellule; cell arises from the pre existing cell by Rudolf Virtue, when he proposed this, it just part of the basic principles of cell theory. Now the question is yes indeed what here when I am drawing that yes from the pre existing cell, I am getting another cell sure, sorry, I mean out here; out here, yeah definitely, from cell this green one, this is the new cell. Now the question is how much closely this new cell which arose from the pre existing cell is similar to its parent.

So, if this one is the parent, this is the parent cell, this is the parent cell and this is the progeny cell, yes, they look similar, but are they truly similar in terms of structure. So, if I have to compare between these 2, what I will be comparing is structure and function are they same not only that are their structure function same as their in vivo counterpart, what is the in vivo counterpart, here are these cells say for example, if I just add little bit more here, like you know if I talk about the cell culture here, if these individual cells which are growing instead of the tissue and if these are there next generation forming are these cells properties of these cells, these cells are they equal to the properties of these cells.

If it is; so, there are 2 options hypothetically one, they all behave exactly the same behave the same way means all their expression profile of different proteins all other parameters are same or being outside the system because when they are inside the system, any cell which is growing here, it is exposed to blood vessels, it is exposed to other tissue, it is exposed to n number of things, but the very moment I take this part or any part of the body and growing it outside the system, it is in a totally different environment, it is in totally synthetic totally different thing it may do many blizzard things which inside the body it cannot do.

Say for example, a cell which is growing here, it is under normal control of several parameters, it can their own be any out growth or anything, but same cell, there is a possibility if I take it and grow it outside, it may behave like a cancer cell, it may behave like something else which we have no clue because it does not have any restriction boundaries it can grow. So, how close when we are growing something outside the system, how close we are to the in vivo set up because that will determine a lot of things that how what you are interpreting you experimental interpretation of using a technique based on this and you wanted to extra polite and claim that this is what is happening in an animal will depend whole lot on how close these 2 systems are, if they are not close enough how far they are. So, say for example, now let us draw the lines. So, what will be doing in the next class? We will start to draw the lines that how close are these cells to their in vivo counter parts.

So, let us close in here for the first class and we will go to the next where we will be discussing this similarity and this similarity and we will come to a conclusion that where all the real challenges lies.

Thank you for a patience listening.