**Cell Culture Technologies**
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**Lecture – 21**
**Introduction to Define System**

Welcome back to the lecture series in Cell Culture Technology. We have finished 4 weeks halfway through the course and there are quite a lot we have discussed and shared regarding how to grow the cells outside the system.

If you recollect in the last class where we concluded we talked about a very specific example where we talked about how the rods and cone cells or the rod and cone neuron or the photoreceptors of the retina preferentially attached to a Concanavalin substrate as compared to a commonly known substrate called Poly D Lysine. Where most of the interactions are electrostatic interactions because Poly D Lysine having a positive charge interacts with negatively charged moieties on the cell surface and by virtue of which the attachment happens.

On the contrary when we talked about the Concanavalin, what we appreciated about it is Concanavalin is a carbohydrate binding protein, and if you coat the substrate with the carbohydrate binding protein with the assumption that the cells what you are isolating are having a lot of carbohydrate moieties decorated on it is substrate surface then automatically the cell will get trapped or will get attachment points with Concanavalin right. So, this is where we kind of closed on the last week lectures.

Today before we proceed further since we are halfway through we will just take a stock of what all we have covered and how we are going to proceed further. Let me tell you one aspect as I told you in the beginning like whenever you wanted to offer a course like this is the question always come this is a practical course, how you can teach a course like that in the classroom. So, my answer to this is yes indeed it is a practical course, but there are aspects because before you do a practical a lot of things goes in the brain and jot down on the table and if one is systematically knows the power of a technique then one really can go back to the bench or go back to the lab as a much more well equipped and a wise individual to design experiments.

Today we will take a stock of the situation and from there we will slowly divulge or diverse doubt and we will travel at different dimensions for us to the course which we have another 20 or lectures ahead of us, we will see what all different things what we can think which are going to make a difference.

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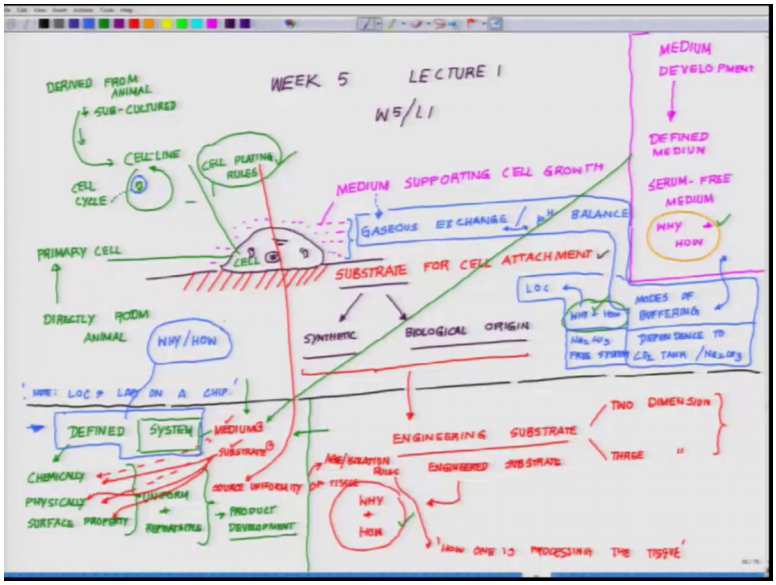


So, we are into Week 5 and today is Lecture 1 so, W5 L1. Whenever we talked about a cell, this is say for example, a cell the nucleus and the organelle. So, we talked about first is a substrate where the cell will adhere and we have extensively talked last week about it substrate for cell attachment, then we talk about the medium supporting cell growth of course, I mentioning it, so this is the cell. And cell could be of 2 sources it could directly come from an animal which we call as Primary Cell directly from animal where is you have cell line, which are derived from animal and subculture derive from animal and here animal I even mean human being to derived from animal and subculture they are almost like generations after generations you are growing them unlimited or you cannot call it unlimited cell cycle.

So, there is one more thing very critically here though it is part of this whole ballgame how to maintain the Gaseous Exchange which is part of actually the medium part of the medium how you are doing it and ph balance. There are these are that key aspects what we dealt in cell culture whenever we talk about it. Now part of it substrate we have talked if you remember this we have talked about different kind of Synthetic and

Biological Origin substrate synthetic and biological origin and we have this whole detailed list what we have already worked out.

But from this substrate concept starts the concept of a newer concept. This is our stock taking that this is all what we have done as of now. What will do? We have talked about what we have done as of now, from there we will move on to what all we have to do which are derivatization of these fundamental concept which we have already discussed are some of the concepts which we are about to discuss.

In terms of the substrate the next level of advancement where several people in the world are working for last 2 to 3 decades and the field is really taking a different dimension is called substrate engineering. This is the next level advancement what we are going to deal. We talked about substrate and now we will talk about Engineering Substrate and what does that mean an Engineering Substrate when we talk about we will talk about Engineering Substrate in 2 Dimension Engineering Substrate in 3 Dimension we will come to this. There is this next aspect if we have talked about substrate there is next level of advancement what we will be dealing with is out here of course, we havent still talked about medium development you will be talking about medium development, but what is critical about medium development is defined medium.

Sometimes people call it also very close to I would not say that this is the exact meaning, but very close to something we call as serum free medium, and here also there are a couple of questions which comes is why and how? In terms of the medium will have to deal with this whole thing we still have not really started the concept of medium. Now exactly in the same way when we ask this question how, why and how here. The same thing holds true when we have to talk about engineering substrate or engineered substrate whichever way you love to put it engineered substrate the question is still the same why and how.

Now, in terms of there is a third component if you look at it you see this we curved out a niche out here Gaseous Exchange and PH balance let us curve that nation neatly. Now when we talk about the Gaseous Exchange you have to understand the gaseous exchange is directly linked to PH. And that comes as nodes of buffering which is directly linked to this medium development concept they are all linked here, modes of buffering and in that line come dependence to CO 2 tank which here to tank is used using sodium bicarbonate

buffering and it was CO 3. We will talk about this detail, but just keep a track on it or NA 2 CO 3 free system, and why these are significant these are significant because as we are moving towards more of an engineered systems. This is very essential that we miniaturized the stuff growing cells on a chip, growing cells on very small substrate, we miniaturized it and if we have to miniaturize it we may prefer to have either CO 2 independent systems to grow, where you do not have to have a bulky cylinder along with it and a huge incubator or we miniaturize the whole setup.

This is again very neatly if we have to say why and how. So, I just put a word here lab on a chip loc that is where most of these modern techniques are going just a note here in case you forget lab on a chip the name of the journal to. For that concept we have to really think about some of these aspects which otherwise is kind of overlooked. Now next thing where we will not real like as one cluster rather will be no touching in and out about it is cell plating rules and which varies to cell type to cell type.

These are the aspects what we are going to deal with in coming sessions of 20 lectures what we will be dealing out here in this course having said this. I designed a different module for this how to approach this because otherwise if you look at it these are fairly drab things like you know I say a medium is like this you add that and like which does not make sense because the question comes when we talk about medium or we talk about engineered substrate. We have to talk about the first the concept of why and how; why and how for engineered substrate cell plating rules how again how and why similarly how and why in terms of the buffering.

But before I get into the individual component in terms of whether it is a engineered substrate, whether it is a medium development or a defined medium or whether it is a lab on a chip I want to introduce the concept of defined system, this is the emerging concept of all the different cell culture rules or cell culture techniques we are working. Which includes in terms of the system what we meant is we said defined when you talked about defined we mostly mean Chemically, Physically, Surface Property Uniform and Repeatable.

It is more or less like product development, and in terms of the system we talked about whenever we talk about such a defined system, we talked about medium it should be very well defined and it should define in terms of chemically it is physical properties

then we have substrate again same way chemically, physically and surface properties. So, medium have substrate fine and then you have these rules source of tissue, source uniformity of tissue, what does that mean say for example, I am obtaining tissue at from an animal for a certain age that should be fixed, like if I change then I have to really mention that you know this is the change I made Age Isolation rule how you are isolating the tissue especially this holds true for when we talk about primary culture where the variations comes the maximum isolation rules not only that how one is processing the tissue.

These points have to be taken very very seriously while we are talking about a design or a defined system. Now, this week onward whatever we will be talking about we will be talking about a defined system and the need for such defined system. Our next lecture what we will be talking about is again the same why and how. So, we will talk about why we needed a defined system and how we can create a defined system again the why and the how of this ball game will start.

What I will do I will close in here because I do not want to start the defined system just now in the next class we will talk about what led to the development of defined system and how we can achieve a defined system. So, thank you for your patience listening next lecture will resume from here define system, and define substrate, define medium, and define techniques of cell culture and their processing.

Thank you.