

Cell Culture Technologies
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Lecture – 07
Layout(s) & Design(s) of Cell Culture Facility

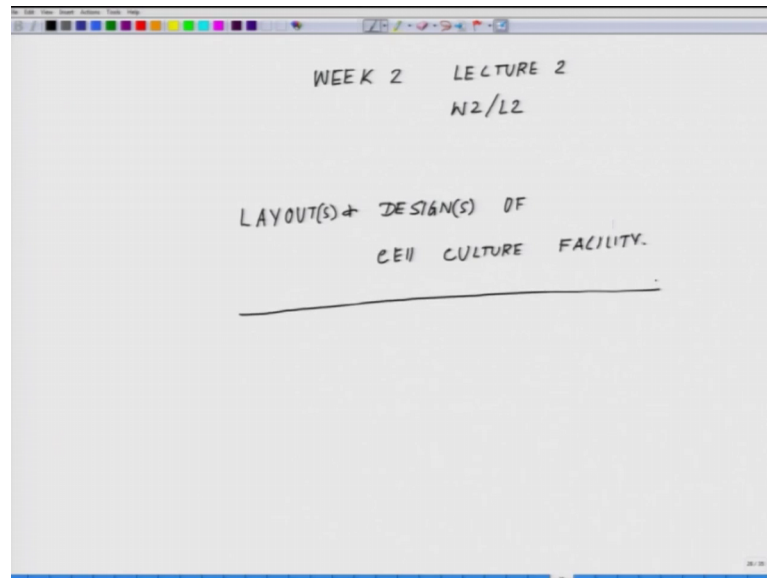
Welcome back to the lecture series in Cell Culture Technology. So, we are into the second week and today we are starting the second lecture of the second week. So, the thrust area of this lecture will be mostly layout and design of a cell culture facility. So, as you go through the text books about different kind of layouts and designs there are certain salient features which will be highlighted. So, today's lecture I will be talking exclusively from my personal experience of setting up cell culture facilities in different parts of the world under different financial constraints and for different kind of purpose.

So, the first and foremost important thing which occurs to me should be taken into account that what level of facility are we looking forward to, what is the objective and I am not talking about like you know how big, how small what is the objective? Say for example, to tell you this if we or if you are setting up a facility in a lab which is working on say cell biology or you know some like the velum biology or something and you want to have a small cell culture facility, the requirements will be different as compared to say for example, if a biosensor lab you just use the cell as just to maintain some kind of a cell to put it on some kind of sensor device cell based biosensors of course, I am talking about.

Then your requirements will be kind of different, similarly if it is a tissue engineering lab where cell tissue interaction with the materials are being tested, again the requirements will be of different type yet if you are a chemistry department which wants to a nurse cream different kind of fluorescent molecule, different kind of anti cancer drugs, a different kind of newly formulated compounds your requirements will be different.

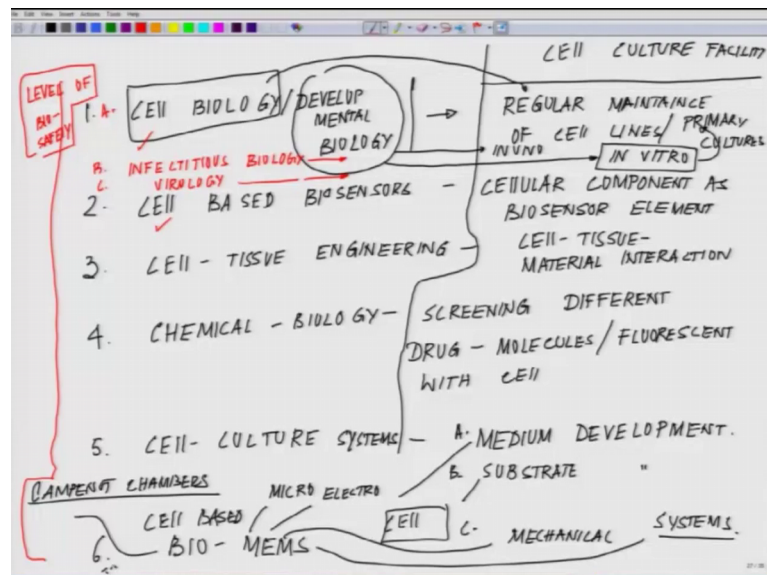
So, you see or say for example, so let me jot down these points ok.

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So, we are into week 2 lecture 2. So, W 2, L 2 and so what we are dealing today is layout and designs, layout and design of cell culture facility, facility. So, now, I told you that there are different kinds of you know facility say for example, what are the, what are the major kind of objectives?

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So, one we talked about if it is a cell biology lab and it wants to have a facility whose major work are cell biology or in our development biology lab and I will come later, what are the specification, say for example, a lab working on cell based biosensors or a

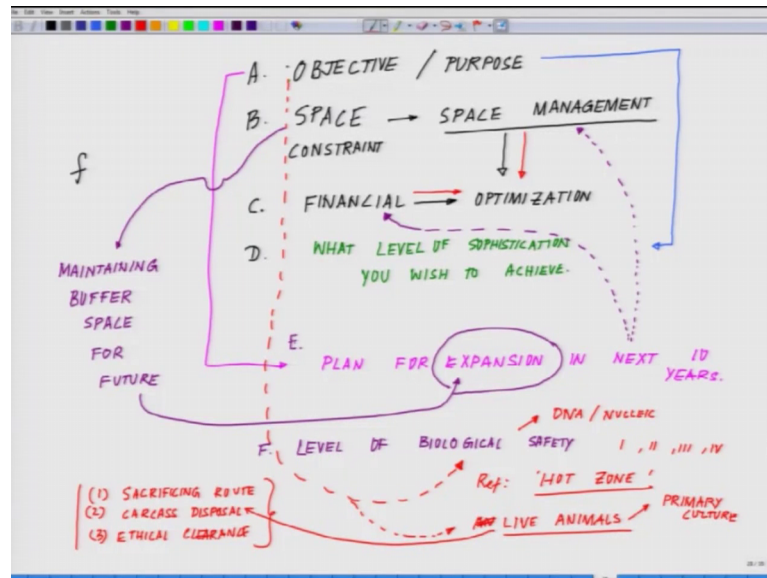
lab working on cell tissue engineering or chemical biology lab where, essentially the idea is the screening different drug molecules, the interaction with cells with cell or not only drug molecule different say fluorescent molecules. Similarly cell tissue engineering the major thrust area is cell tissue material interaction, cell based biosensors is mostly cellular component as biosensor element.

Similarly, cell and development biology, if they want to have a cell culture facility. So, they have something you know regular maintenance of cell line and again it depends on what kind of diploma biology you are doing, you could be could have in vivo where you are exclusively dealing with animals and histology or you have an in vitro development biology where you are doing everything outside the system with isolated cells then definitely cell lines and primary cultures.

I will come later what does that mean and of course, in a point of cell biology there you are doing with different kind of cell lines and all the stuff. So, I mean this list can go on what all you can do similarly there is another fifth group which exclusively work on developing cell culture systems itself, these are the labs which exclusively work on medium development, medium for cell culture of course, they work on substrate development, substrate for culturing the cells these are all for the. Then they do a different kind of or let us put it like this, there is another emerging area where there is a area of bio mems, cell based bio mems structure mems here stands for micro electro mechanical S stand for systems ok.

So, there are cell based bio mems structures which are being developed for say for example, history goes back to like things like campaign or chambers will come later, what are those different aspects are something like you know modified, one second. Campaign or chambers and several other things people work on bio robotics and all those areas. So, first and foremost thing what has to be understood is what is the objective? because there are constraints what are the constraints what one comes across. So, first what is the objective and what is the purpose.

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So, let us get all the functions right, what are the functions what are important to understand.

So, the major is objectives or the purpose slash purpose. So, we have already talked about the purpose in the previous slide. You see, these are the different kind of purpose we are telling. So, you should know what is your purpose what kind of lab you really wanted it to be after the purpose comes the constraints, what are the constraints? the first constraint which we see all over the world a common constraint respective of the fact whether you have money, where you do not have money, how much money?

Is space, space is a huge constraints all over the world, like if you go to places like a national institute of health at Maryland, better stuff you will be surprised like you know you have seen the office cubicles most of you have seen some time or other small office cubicles, it is almost that is the size of the facility you get for cell culture. And there people will be crammed in like you know three or four groups sharing such facilities. So, all over the world this is very critical because getting a space getting designated space with all the, like you know the vacuum systems and all those things it is not easy because you need certain special things if you want to make in more and more sophisticated.

So, space is a big constraint and the next constraint come, if your space is a constraint related to it is space management and that is where the whole design layout comes very handy space management. This is very very critical because first of all you are

constrained by space. So, let me put it like that space constraint and then you have to manage the space and if you talk about the manage the space, then we have to talk about what will be the kind of equipments or the size of the equipments you wanted to get for such constrained space point 2, we will again come back to this space constraint point 3 is your financial constraint because wherever you set up a lab you will always have a financial constraints and optimization.

So, this arrow now I am again redoing that arrow a space and a finance these has to be optimized very neatly and then come based on your objectives, what are the objectives you have set for yourself? You have to decide what level of sophistication you wish to achieve, what does that mean? say for example, your lab regularly maintains a particular cell line I have already talked about cell line right at the first week and you just your job on these to maintain the cell line and you just passage them every week after week, subculture them and grow them in and then you just take them and do your experiment.

You probably may not need a very high end microscope for that purpose and then you just have to observe the cells they are doing fine, if that is the objective then you are not going to spend on a very high end microscope right, on the other hand if your lab does a lot of cell biology work and that completely relies on your cell culture and probably you may need a very high end microscope facility and you may prefer to have a microscopic facility then and there adjacent to your working bench.

So, these decisions are very critical provided you are very sure what is the purpose and what is the objective and adding to the purpose and the objective is there is another thing which comes is plan for expansion in next 10 years. Because, unless you have a very clear cut plan this is how you want to explore or say for example, you are not very sure suppose your new faculty starting something, you are not very sure here I may do this, I mean that happens with all of us right. You know when I set up my lab I still remember and as a matter of fact when I set up blast for my for my employers I always told them this simple thing like at this point I do not know like I may love to you know explore this areas.

So, what do you do you do not consume the whole area, you kind of cover the idea by somewhere or other it should not look like that you are not utilizing that area, but it should have a buffer space. So, tomorrow say 5 years down the line you wanted to

explore that site and I wanted to do this, but where I am having a space because I have got all this big giant stuff and have covered up everything, that should not happen that farsightedness is very very critical that we all grow, our desire changes, our scientific problem demands us to explore areas how you do it. So, that brings you to that critical point what I was mentioning earlier is both this is a direct function of your space management as well as your, at that point financial management, these 2 are very critical and I used another one word.

I am just before we forget and I forget maintaining and this is I believe each one of us should you know keep in mind, maintaining buffer space for future expansion this is very critical. So, unless you have that buffer space you will kind of you know realize that like, I should have you know save that space I could have utilized it later that comes the next. What level of sophistication you want to achieve and what are the, what are your plans for expansion. Next thing if I put this as E next important thing is that what is the level of biosafety are we talking about say and this of course, comes in the objective in the beginning level of once again biological safety, what does that mean?

So, before I get into that, so this is of course, a very very direct aspect. So, say for example, I wanted to work with a very deadly virus called Ebola which is a bioterrorist agent or in order to work with Marburg virus, hell I mean this is like something if I am not wrong there are handful of labs, maybe across the world there will be 3 or 4 labs who can handle that level or you want to work with a very deadly strain of TB tuberculosis which is common in India are we kicked to do so? Because the person, the user suppose I am using this. So, first of all I am putting myself into a threat I may you know get the infection the other person who are working they may get an infection and not only that and if we cannot contain it then the whole area the whole community will get an infection and these are deadly stuff.

So, first and foremost the power of the objective, when I talk about the purpose if we remember the purpose out here what are you working on. So, now, I add a few more points are you working on say, now I am adding few other points out here say one a is this then, are you working on infectious biology, are you working on virology, infectious biology virology. So, that brings us to the point of level of biosafety, the country if you are using a kind of regular cell lines it really does not matter, I know I mean nobody really bothers, I mean it its perfectly fine or using some kind of you know some

straightforward materials directly derived from biology your system should not be a problem. Then comes another interesting aspect, since we are living in an era of, so add up to that in cell biology section develop biology section, are we working on transgenics does it involves d n a transfer are you working on knockouts are you working on R N A I.

So, that demands different level of precautions which has to be taken, because the very moment you are handling with the DNA material or any kind of genetic material there are certain rules and regulation or the law of the land wherever you go, whether you were in India whether you are abroad any country, every chronic country has very very stringent rules extremely stringent. So, one has to know those rules and regulations a priori or much beforehand for your design. So, you know I want to do this and then you realize that that in that particular building you really do not have the proper kind of exhaust or you do not have a proper way to you know contain the building you do not have a proper run away or escape route and you wanted to open up facility which kind of put others in hazard.

So, these are very critical, exceptionally critical and you have to be very very clear that what are my because you are dealing with systems which not only is hazardous to you, could be hazardous to others unless you are sure unless you are very clear in your mind you should not lay down, first of all think over it that is why I am jotting down this point, what is the objective and these are the points which textbooks will not say, but when you will go to the day to day life (Refer Time:23:51) take any textbook I mean they will kind of you know brush aside this things. Where the practical reality is this, these are you come to know once you go to job, once you have to set up a lab then oh no no you cannot do this, oh no no no this is not allowed or in this building we cannot do this and I completely understand their point.

Because certain buildings are not even made for that purpose as a matter of fact so these things you should keep very very clear in your mind what level because based on that we have these levels called biosafety levels 1, biosafety level 2, biosafety level 3, biosafety level 4 and for those who are little inquisitive to learn about much of these dangers should read a very nice book the hot zone. If you find it online or I will try to you know someone of if cant contact me if I, if I have a e copy I will forward this, you should read this book this is a very interesting book about virus deadly viruses escaping out and how

that could influence our life big way ok.

So, next is biosafety level, what you have to be very very critical and in that of course, I have already mentioned you have to very very clear are you working with DNA are you working with, you know other forms of nucleic acids and what is so on and so ever. Then you have to realize in that objective line, am I going to use live animals? in other word say for example, I wanted to work on primary cultures. So, primary cultures are essentially when for culturing you directly derive the tissue from live animal, you have to kill animal or if the tissue is just take a small part of the skin then you can you know give the animal necessary first aid and you know and exercise the animal, take the tissue and you know give the animal necessary first aid and you know good to go or you want to sacrifice the animal.

Now, if you want to sacrifice the animal and you want to pull the tissue out of that animal that demands different kind of facility support, because when we are talking about sacrificing the animal what we are essentially talking about. If you have animal sacrificing facility right not only that the biological waste which are coming out, first of all any animal killing has to be done in a humane manner, in an ethical manner, it is one underlying prerequisite. So, first how you are killing the animal, will come in depth here are different ways to do. So, then how many you wanted to kill, then once you take out your desired tissue how you dispose the animal? Where you bury it or where you know put it to rest? These are very ethical and very human aspects which one has to be very clear and how really want to do it because then there are every institute across the world, recognized institutes have animal ethics committees then you have to take ethical clearances, you should know what all ethical clearances we needed to know.

Barring aside some animals like you know, it can work with fishes without any ethical clearances and there are few lower animals you can work with possibly drosophila and all those small systems where you do not need a ethical clearances. But apart from it the very moment you move to the rodent's guinea pigs they all need ethical clearances. So, what sort of ethical clearances you will be needing? So, whenever we are talking about live animal or you know primary culture from right live animal. So, all these points will come to play that, sacrificing method, sacrificing root calchas or the cadaver disposal and most important they all fall under do you have to have an ethical clearance.

So, you realize even much before I hit upon the topic of the how the layout of a lab will be, there are other things which one has to take into account. So, close in here we will continue, we will resume our journey of understanding what all basic prerequisites one has to take before one think of developing one of the state of the art facility so bonded upon it think over it.

And thanks for your patience.