Fabrication Techniques for Mems-based Sensors: Clinical Perspective

Prof. Hardik J Pandya
Department of Electronic Systems Engineering
Indian Institute of Science, Bangalore

Lecture - 48
Introduction to Equipments: Incubator

We will see a very very important equipment for a lab that deals with biology related applications. So, this is a microfabrication course, but in the micro fabrication technology using microfabrication technology we will be making different types of sensors. And these sensors will have practical applications as we have time and again discussed. One of the major applications that this lab focuses on as you would as it would be clear from the title slide of this video is that it is a biomedical and electronic engineering systems lab. So, we tried to work at the interface of electronics and biology, or engineering and biology.

So, we make sensors using microfabrication technology, and use those sensors to test with biological samples like tissues, cell clumps, cultured cells, cells from cell lines extra. So, for such a scenario, it is very important that you have the facility to culture cells. What is culturing cells? It means you start off with a very small sample number of cells that you obtain from either a patient or an animal or borrowed from some other cell bank or tissue bank.

These cells then you have to provide them medium for growing, growth factors using serum, fetal bovine serum it is called FBS, and you add this chemicals basically to the cells, and give them conditions for them to grow. Once you give them the conditions to grow, they will start multiplying and dividing through their normal cell cycle. Once they divide they from sufficient numbers and start attaching to dishes like Petri dishes. So, this is the overall idea.

Now, how do we grow cells? It when we are growing cells it is very important that we avoid this cell growth process or cell culturing process to be technically correct, cell culturing process or tissue culturing process which also you can tell. Cell culturing process is a very very critical process, and it is very prone to contamination. What is contamination? Foreign bodies that are not supposed to be there getting into the dish where you culture cells is called contamination. So, for you to avoid such things, you

need to you need a special facility or an equipment to grow the cells. This is where the equipment that we are going to discuss comes into picture. Today we are going to see what is called a incubator or usually it is called as CO 2 incubator.

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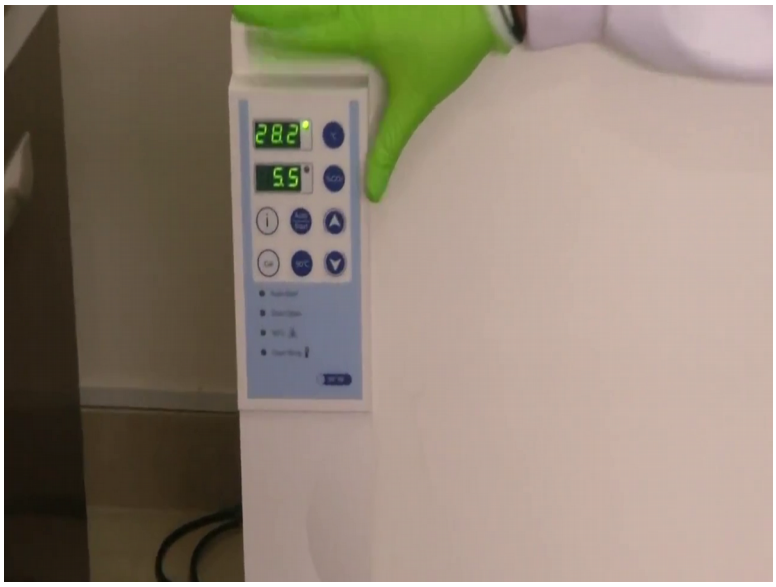

For so this is the CO 2 incubator you can see correct. So, for a CO 2 incubator, for cells to grow in an incubated environment, the major parameters that are required is that you should provide 37-degree Celsius ambient temperature, 5 percent carbon dioxide level and 95 percent relative humidity. So, this equipment will make sure that these parameters are provided to the cell, and they can grow without any contamination. So, first let us see what is the control panel. So, this incubator is now running. So, we have kept it on the floor, so we have set the temperature to 37 degree Celsius, we have set the temperature to 37 degree Celsius.

But because we have turned it on only short a while short while ago, the control system inside it is still ramping up to the temperature. But we can always see what is the temperature to which this is set by; see here see you see buttons these are all touch panel buttons this is degree Celsius. So, what is a temperature that you have set? This is percentage CO 2 what is the percentage CO 2 that you have mentioned set. And autostart, how do you want to set it auto? Then 90 degree Celsius what is this 90 degree Celsius?

This is for routine as I said contamination is a very important thing. So, we have to routinely sterilize our incubator inside. So, this 90 degree Celsius if you click, what will it do is, it will create 90-degree Celsius environment inside the incubator, and kill any bacteria that might be present. So, this is used for cleaning incubator, right now we will not use it cal is for calibrating everything properly so that if we set for 5 percent CO 2 actually 5 percent CO 2 should be maintained inside so, that calibration it will set.

So, let us press the degree Celsius button. So, if we press you will see that it is set to 37 degree Celsius. See, it is very clearly visible. If you release it will show the current temperature that it is about to reach, it is slowly slowly ramping up to 37 degree Celsius it is. Likewise, if you press percentage CO 2, you will see that it is set to 5 percent CO 2. If you release it right now you will see that it is around 5.2 percent CO 2 is there which is roughly equal to what we have set.

Now, 95 percent relative humidity is maintained through another mechanism inside the incubator which we will see shortly. So, these are the major controls in the incubator. So, these up and down arrows are used for setting this temperature. Let us say I press this and you can; if you press this you will see the temperature right 37 degree Celsius is what is set for if you press up down you can actually change this temperatures like this. So, you can change the values. So, this is how the different values are set and the temperature is everything set like this. Now let us see how the carbon dioxide is coming to the incubator. For that we have a CO 2 incubator which is, now let us see what it is.

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So, that the so tank CO 2 we have a cylinder, CO 2 cylinder that is kept at the edge. So, you can see the cylinder. So, we see the cylinder which has a pressure valve that is kept at the edge. So, let us see that now. So, there is a pressure valve at the top, there is a tube coming out of the cylinder, that tube effectively comes and reaches the incubator.

So, you can set, you can see what how much CO 2 is left in the cylinder through gauges and valves that are there in the cylinder, and there are safety mechanisms to open and close a cylinder to make sure there are no unnecessary explosions or any issues. So, from that outlet valve the tube will come and it will enter the incubator. Now let us see how the inside of the incubator looks like. We already have few dishes with cells kept inside the incubator, let us see how they look like. So, I am opening the incubator door now.

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So, you see this is how the inside looks like, we cannot keep it open for that much time. So, we will quickly see the inside of it. So, I am opening another door, that is a first safety door there. So, this is what then these are compartments that you have, you have multiple 4 compartments. See at the bottom compartment, you see liquid which is water. So, we have water here. See, so, this water you have we have to always fill water here up to this mark; where the water is there. See, there is water, we have to fill up to here. This is the water that will maintain 95 percent relative humidity. So, always make sure that we fill it with water up to this level.

Now, we have cells dishes here which are being grown. So, this is a Petri dish 35 mm Petri dish with cells that are growing inside. It is pink in color, because it is put in media and growth factors like serum. So, this is DM Dulbecco's minimum essential medium, DMEM with FBS fetal bovine serum added to it and cells are growing in it. We are seen these cells in our microscope lectures how they look like. So, there are a different different dishes which we have kept.

There is another dish that we have kept. This is 100 mm, we got and there is one more dish. So, we are growing cells in this. So, we should not keep it open for so long because the control system will change the temperature and other parameters. So, we have closed it, we have close this window also. As it is visible there are 3 compartments to this. So, you can put lot of dishes inside, and all these dishes will consumes CO 2. So,

accordingly it will consume from the cylinder. Lesser the number of dishes, lesser the resources it will consume, it is just like as growing only.

So, when the cells grow, they will consume contents, just like we grow. So, more the number of dishes that will be inside the incubator more will be the CO 2 that will be consumed. So, this is the basic working of a CO 2 incubator. So, as I told before, 3 main parameters 37-degree Celsius ambient temperature inside, 5 percent carbon dioxide and 95 percent relative humidity. Carbon dioxide is maintained through the carbon dioxide cylinder, 37 degree Celsius is maintained through thermostats that are inside the incubator which is maintain the temperature. And the 95 percent relative humidity is maintained through the water and by maintaining it at that level which I showed you inside. And the 90-degree Celsius option is for routinely cleansing the incubator so that contaminations are eliminated.

So, there is no scope for even less contamination. Contaminations has to be eliminated there should not be as no contamination as much as possible. So, this is how the incubator works. This is a very important equipment in a lab that deals with biology or cultured cells.

And so, hope you understood how the incubator looks like, and what is its functioning and how cells are kept inside. So, this is this is something that you need to know, because you need to know what where your sensors that you fabricate are applied. So, if you are looking at some other field; like transportation, like security, gas sensing and all, different types of equipment will be used. This for a biology application, for that a CO 2 incubator will be used to grow the cells. Hope this was useful to you.

Thank you.