Stem Cells 101, Part 2 of 3: What is the purpose of stem cell research?

Transcript

What's the point of research on stem cells in general?

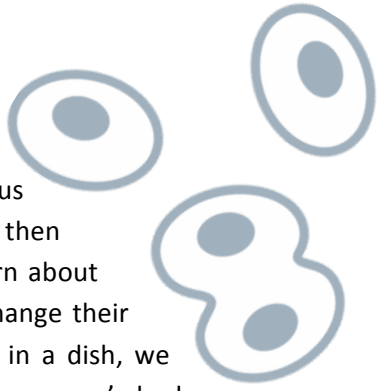
Well, one is that we want to understand more about development, about aging, about disease; and we can do that using experimental models. We have these cells that we can use in a dish that we can actually utilize for – we can make little hearts if we can make these cells turn into heart cells – we can ask interesting questions like, how do those heart cells develop?

Eventually, we'd like to be able to use these cells to treat disease and injuries: regenerative medicine strategies, trying to repair organs and tissues that are lost or damaged. We can do this by developing some cell-based therapies, like transplanting the cells or activating the cells in the human body, or we can even do it by perhaps designing new drugs and molecules that could enhance the recovery, based on what we know about the stem cells that reside within the human body.

Certainly, the promise of stem cells and what I just spoke about is easy to imagine if we do it in culture, in the dishes. So we can test toxicity of drugs, for instance: we could take these cells, throw on drugs of interest, and take a look at what they do to these cells. Do they make them into certain cell types? Do they kill them all? Do they make them proliferate faster? We can identify the targets: what are the cellular receptors? What are the targets of these cells? What are they activating within these cells? We can do a lot of analysis at gene level: what are the genes being expressed? We can also study differentiation. What are the factors that will make this homogeneous population of pluripotent stem cells? We want them to all be hematopoietic stem cells, so we can cure leukemia. Or, we want them all to be cardiac cells, so we can repair the heart. Of course, also, we want to use them for regenerative medicine: perhaps what that will require is, again, taking these cells, and looking at their development into specific cell lineages. We can make pancreatic cells, in the case of diabetes; cardiac muscle cells; nerve cells for the treatment of diseases such as Parkinson's and Alzheimer's disease; and again, bone marrow cells for leukemia and response to chemotherapy.

Let's just talk about the two types of regenerative medicine, and the two strategies we could use for cell replacement. So we have a damaged or injured tissue, or a diseased organ, and one possibility is that we take a stem cell, we expand it in culture, and then we could do one of two things: we could differentiate that cell into a specific cell type, and then we transplant that cell type to wherever the cell is needed. Of course, the other possibility is that we take a single cell, a stem cell, we expand them, make lots of them, and we transplant those directly into the patient. Depending on what you were trying to do, you could let the environment, where you're transplanting the cells, dictate what these cells should turn into.

Stem Cells 101: Video Transcript, Part 2



The other option is to try to stimulate the cells that are already present in the body. This is a relatively new idea, and the only way you can do this endogenous stimulation is if you have a pretty good idea of where those cells are. The idea then would be to go back to what we learned in culture, looking at the cells and learn about what growth factors, what drugs, what practices can enhance those cells and change their behaviour. Then we would give those particular drugs that we found (worked) in a dish, we would administer those to a patient to induce those cells that are present in the person's body, stimulate them so they would migrate to a site of lesion or injured organ, they would expand perhaps in response to a different drug, they would expand and then differentiate into an appropriate cell type in the appropriate organ. So this is a very interesting and exciting area of research that's also going on.