Stem Cells 101, Part 3 of 3: What are other types of stem cells?

Transcript

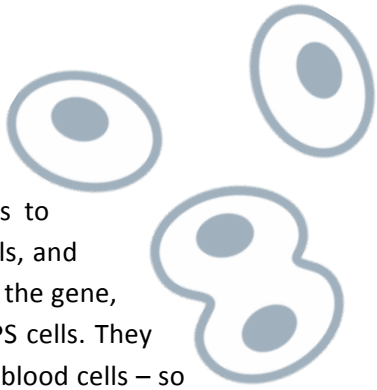
Are the multipotent stem cells that are found within our adult body useful? I would have to say yes. Adult stem cells (AS cells): (they) were originally found in the blood, and since then they've been found in all of these tissues. Now, some of these tissues people are still working on, maybe a little controversy as to whether these cells are there, but there is certainly an enormous array of tissues that have stem cells, that allow the tissues to make new cells under baseline conditions, and sometimes in response to injury.

So, which cell type is better? People usually think that we need to do research on both: that would be the general consensus. Neither one is perfect, but we can learn a lot by looking at both of these populations. Each of them has advantages: embryonic cells being pluripotent, able to make all the cell types, and adult ones, which are multipotent and more lineage-restricted. These [embryonic stem cells (ES cells)] can be readily expanded in culture, and that's just not true of all the different stem cell populations. Some more than others, but certainly not all of our adult stem cells derived from the adult body can be easily expanded in a dish – at least at this point; more research is needed. We can easily obtain these [ES cells] from a blastocyst, in the sense that we know exactly where to find them and how to culture them. These ones [AS cells] are more difficult to obtain: for instance, if they're in the middle of your brain where we know they are, it's not so easy to access those and throw them in a dish. Ethical concerns, however, surround our embryonic stem cells. The idea of using human embryos and destroying a blastocyst to get these cells is controversial. And, for the most part, with adult (stem cells), if you can give consent for someone to use your own stem cells, these are outside of ethical concerns. So, they both have advantages and disadvantages in terms of their use.

What if we could -- and this is something that's more, very recently described – what if we could somehow get a pluripotent ES cell population by using a differentiated cell type? This is precisely what a group, the Yamanaka group, did. Dr. Yamanaka is a scientist and a physician in Japan, and what he was able to show was that we can take a differentiated cell type, a fully differentiated cell type, and by giving it specific factors, we can take that cell and de-differentiate it – make it go back – and become a pluripotent-like ES cell [termed "induced pluripotent cells", or iPS cells]. Are these the future of stem cell biology? They get around all the controversies of having to destroy an embryo; not only that, you can use these cells as they come from your own body! Are these really the ultimate source for regenerative medicine strategies? That hasn't been established yet, but it's certainly a very exciting prospect. In 2007, his group was able to show that not only could this work in mouse fibroblasts, he could also get it to work in human fibroblasts.

There was a mouse with a disease, and the disease was sickle cell anemia. So this animal has misshapen red blood cells that can't carry enough oxygen to all the different tissues of the body; they're anaemic.

Stem Cells 101: Video Transcript, Part 3



So what they did with this mouse was that they took his skin cells, they grew them in a dish, and they transfected them with these viruses to get the cells to express these pluripotent genes. They reprogrammed them into these ES-like cells, and then they modified them and made a correction: they knew what was wrong with the gene, so they did a genetic manipulation to repair the gene within the new ES cell – iPS cells. They corrected the mutation, they grew them up, and then they had to turn them into blood cells – so we got an ES cell, we must make them into a blood cell still – and they took the blood cell that they generated, they transplanted them back into the sickle cell anemic mouse and recovered the mouse. His own cells were taken back early into development. They corrected what was wrong, made them into the cell type of choice and transplanted them back – this was done in 2007.