From stem cells to organs: The bioengineering challenge

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For more than a decade, Peter Zandstra has been working at the University of Toronto to rev up the production of stem cells and their descendants. The raw materials are adult blood stem cells and embryonic stem cells. The end products are blood and heart cells – lots of them. Enough mouse heart cells that they form beating tissue.

To do this, he has been applying engineering principles to stem cell research – work that has just earned him recognition by the American Association for the Advancement of Science (AAAS). The society will induct him as a Fellow during its Annual Conference, being held in Boston from February 14 to 18.

Starting with computer models of stem cell growth and differentiation (the process by which a stem cell matures into its final form), Zandstra has moved on to develop more sophisticated culture methods that fine-tune the microenvironments to guide the generation of the different cells types that make up the mature cells in our tissues: heart cells for the heart or blood cells for blood.

"If you describe something mathematically, you have a much better understanding of it than if you just observe it," he says. "And it's also a powerful way to test many different hypotheses in silico before going into the lab and doing the much more difficult experiments in vitro."

Dr. Zandstra, the Canada Research Chair in Stem Cell Bioengineering, also held a prestigious NSERC Steacie Fellowship. The Steacie prize -

which goes to six select Canadian professors annually – allowed Zandstra to extend his work from mouse to man.

“There's only so much we can do with mouse cells,” notes Dr. Zandstra. “Now if we can also figure out how to get human embryonic stem cells to differentiate on command to generate functional adult-like cells, you can begin to think about the kinds of medical conditions you could treat with them.”

Source: Natural Sciences and Engineering Research Council

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