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Insights from the Network

An Interview with Dr. Gordon Keller, the 2023 Till & McCulloch Awardee

This month's Insight's Blog features an interview with Dr. Gordon Keller from the University Health Network. In September, Gordon was presented with the 2023 Till & McCulloch Award in recognition of his contribution to global stem cell research through his paper published in Cell Stem Cell entitled, *Modeling human multi-lineage heart field development with pluripotent stem cells.* Gordon recently had the opportunity to engage in a conversation with Joanna Valsamis, the Director of Knowledge Mobilization. Their discussion delves into Gordon's career, the valuable life lessons he's learned, and his forward-looking predictions for the sector.

Tell us about how your career commenced. What attracted you to stem cells as an area of research in the first place?

I became interested in stem cells during my PhD studies at the University of Alberta. At the time, I was working on a developmental hematopoiesis project which introduced me to the concept of hematopoietic stem cells. I was fascinated by these stem cells that could regenerate an entire blood cell system and wanted to know more. To pursue this new-found interest, I moved to the Ontario Cancer Institute for postdoctoral studies. Here I had the opportunity to interact with leaders in the field, including Jim Till and Ernest McCulloch and work on a project aimed at understanding the regulation of hematopoietic stem cells in culture.

Over the course of your career, you must have encountered all kinds of interesting situations and met many people who made an impact: colleagues, mentors, trainees, and more. If you had to pick one, what would you describe as the most significant moment in your own research career?

My moment of inspiration came from a seminar I attended in 1984 while working at the Basel Institute for Immunology. Dr. Rolf Kemler was visiting the institute and presented work showing that mouse embryonic stem cells could differentiate in culture and give rise to a spectrum of cell types including hematopoietic cells, vascular cells and most notably beating cardiomyocytes. This was only three years following the discovery of embryonic stem cells, so the concept that they could generate these cells in vitro was new and exciting. I was so impressed by these findings that I decided to immediately try a few preliminary experiments to see if I could repeat them. The experiments were successful, so I continued and when I returned to North America to a faculty position in Denver in 1990, I focussed my entire research program on embryonic stem cell differentiation, a subject I continue to work on today.

The work of scientists and researchers is often centered on discovery and innovation. What is one thing (personally or professionally) that you still like to do the old-fashioned way?

I like to go to the lab as much as possible and look at cells under the microscope. You can tell a lot about the state of pluripotent stem cells by simply looking at them. There is nothing more rewarding than seeing a dish full of cardiomyocytes or a methylcellulose culture of red blood cell colonies made from these stem cells. I consider this my ‘cell therapy.’

What is something you think everyone should do at least once in their lives?

Live and work in another country. The experience will broaden your horizons and the memories will be with you forever.

Your career has taken you across the globe, from Alberta to Switzerland, Austria, New York, and more. What is something you learned from this journey that might help a trainee looking to establish themselves in the field?

The world is full of opportunities. Doing research in different environments in different countries is inspiring and exciting. You are exposed to new ideas, technologies and ways of thinking and you establish an international group of life-long colleagues and friends. You do not have to stay in one place your entire career – don’t be afraid to challenge yourself.

Innovations are always around the corner. For the sake of speculation, what are your predictions for stem cell advances in the next 5 years and 10 years?

5 years: Protocols for the generation of many more cell types from human pluripotent stem cells (hPSCs) will be established and optimized. With access to these cells, tissue engineering and organoid biology will advance to a stage at which the hPSC-derived tissues accurately recapitulate human organ function and disease states in vitro. Extensive screens using these models will be ongoing and new drug candidates for specific diseases will be identified. Genome editing approaches will provide the next generation of hPSC-derived cells that can function better than those in our own body. Safe universal hPSCs that can escape immune destruction will be available and used in clinical trials. Large numbers of clinical trials will be ongoing to test different pluripotent stem cell-derived cell types in different patient groups. The safety and efficacy of several populations will have been demonstrated, opening the door to the development of new cell-based therapies.

10 years: Functional tissues with the same cell composition as the organs in our body will be routinely produced through engineering and 3D printing strategies. These tissues will provide the most advanced models for studying human development, organ function and disease processes. Transplantation of these tissues will offer new opportunities to repair damaged organs and treat patients suffering from different types of organ failure. Clinical trials will continue to test the efficacy of different hPSC-derived cells for different diseases. Several hPSC-derived cell therapies will be in the clinic for the treatment of specific diseases.