Researchers find key players for building and repairing the brain

May 16 2018

Research by Dr. Freda Miller and her team at the Hospital for Sick Children and the University of Toronto has determined how brain stem cells and the environment they live within collaborate to build brain circuits during development, discoveries that have led to a better understanding of neurodevelopmental disorders in children. The Miller lab and her basic research collaborators work closely with their clinical colleagues to harness this information and develop new approaches for treating brain injury. These results were presented at the 2018 Canadian Neuroscience Meeting, in Vancouver, May 15th, 2018.

During development, the mammalian brain starts life as nothing more than a collection of stem cells that then must generate the neurons and glial cells that form the complex network of connections required for proper brain functioning and cognition. One cause of neurodevelopmental disorders such as autism spectrum disorder is thought to be the failure of stem cells to correctly build the brain. Dr. Miller's team investigates how stem cells accomplish this task, and to understand how this process goes wrong in neurodevelopmental disorders. Since these same brain stem cells also persist into adulthood, this has led to the idea that it might be possible to manipulate these brain-resident stem cells to behave as they did during development, and in so doing to promote brain repair. Importantly, recent work from Dr. Miller and her collaborators suggests that this may indeed be the case, thereby identifying a new approach for treating the damaged or degenerating human brain.

"Neural stem cells are like "parent" cells that generate their children, the neurons and glia that build brain circuits, in a precisely controlled fashion in response to signals from their environment. These signals ensure that there are enough stem cells to build the brain, to make the correct amounts of neurons and glial cells at the right time and place in the developing brain, and that some stem cells persist into adulthood where they can participate in brain repair. If we can understand what these signals are, and how stem cells respond under normal circumstances, then that information will not only allow us to understand what happens in neurodevelopmental disorders such as autism spectrum disorder but will also provide us with the information we need to activate stem cells in the mature brain to promote repair" says Freda Miller.

To understand brain stem cells and their environment, Dr. Miller is using approaches that range from stem cell biology to transcriptomics and proteomics that identify the proteins and RNA molecules that enable stem cells to build the brain and computational modeling, with the idea that understanding brain development and repair requires an interdisciplinary and highly collaborative approach.

"The key to doing the best science is to ask big questions such as "how do you built functional brain circuits during development" or "how can you repair an injured brain" and then to seek out collaborators who are willing to work with you to answer those questions in an integrative and interdisciplinary fashion. This type of high-level collaboration is equally important when your discovery research unveils a potentially novel therapeutic strategy. This collaborative approach has been the key to all of our major discoveries" says Freda Miller.

Provided by Canadian Association for Neuroscience

Citation: Researchers find key players for building and repairing the brain (2018, May 16)