Scientists gain new understanding of adult stem cell regulation

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Forsyth Institute scientists have discovered an important mechanism for controlling the behavior of adult stem cells. Research with the flatworm, planaria, found a novel role for the proteins involved in cell-to-cell communication. This work has the potential to help scientists understand the nature of the messages that control stem cell regulation - such as the message that maintain and tells a stem cell to specialize and to become part of an organ e.g.: liver or skin.

In recent years, planarians have been recognized as a great model system to molecularly dissect conserved stem cell regulatory mechanisms in vivo. Planarians have powerful regeneration capability that makes them ideal for studying this process. The Forsyth team uses planarians and other animal models to study development and regeneration.

The Forsyth team will publish this research in the August 16 issue of *Development*. According to the paper's lead author, Néstor J. Oviedo, a postdoctoral fellow in the Forsyth Center for Regenerative and Developmental Biology, this work, highlighting the importance of direct cell-cell transfer of small molecules between stem cells and their neighbors, provides an important roadmap for learning about regeneration. "These findings suggest that similar mechanisms may be extraordinarily relevant for controlling the behavior of migratory, plastic cells. Further analysis in both planarians and in vertebrates will provide crucial opportunities for understanding what drives stem cell behavior and may help medical science identify novel therapeutic targets."

The Forsyth team previously found that communication through gap-junctions (microscopic tunnels directly linking neighboring cells) controls the left-right asymmetric positioning of the internal organs during embryonic development. In this study, they turned to the role of gap junctional signals as regulators of adult stem cells in repair of injury.

Drs. Oviedo and Levin focused on direct cell-cell transfer of small molecules and ions as crucial signals that determine behavior of adult stem cells in vivo. They showed that when one of many specific gap junction channel types was abolished, the adult stem cell pool disappeared along with the regenerative capabilities, suggesting that gap junction-permeable signals are necessary to maintain stem cell state and tissue regeneration. This research demonstrates a novel role for gap-junction proteins and suggest gap junction-mediated signaling as a new and tractable control point for adult, somatic cell regulation

Most recent work in the stem cell field has focused on the secreted protein factors that control embryonic stem cell differentiation. However, no specific gap junction protein had been functionally linked to adult/somatic stem cell behavior in vivo or to organ regeneration. This work demonstrates that gap junction channels providing direct cell-to-cell communication are a critical component for development and normal physiology.

Source: Forsyth Institute