Study demonstrates the importance of protein Akt3 in stem cell growth and survival

By Alyssa Condon

As the functionality of embryonic stem cells (ESC) is studied more, the understanding of cell development as well as regeneration continues to advance. Dr. Young Tang and his lab recently released a study in *Biology Open* that explained the importance of the different isoforms of the protein Akt in the phosphatidylinositol 3-kinase (PI3K)/protein kinase B (PKB/Akt) signaling pathway in mouse embryonic stem cells. It is known that this pathway plays an important role in the survival and proliferation of stem cells, but the different forms of Akt, had not been studied to understand the distinct function of each form. Importantly, the expression of these isoforms is not uniform in the body, with Akt1 and Akt2 found in most tissues, but Akt3 is found mostly in the central nervous system, testis, lung, mammary gland, and fat. By inhibiting each isoform, the researchers were able to show exactly which form affects the growth and proliferation of stem cells and how these processes work.

The authors found that the inhibition of Akt3, but not Akt1 or Akt2, resulted in stem cell death. These results demonstrate that Akt3 specifically is responsible for stem cell survival. Based on their results, the researchers concluded that Akt3 regulates stem cell survival through its kinase activity. Additionally, the study showed that Akt3 was responsible for transitioning cells from stage G1 to stage S in the cell growth cycle. When Akt3 was inhibited, there were significantly more cells stuck in the G1 stage of the cell cycle, but blocking Akt1 or Akt2, or both at the same time, had no significant effect on cell cycle regulation. Finally, the authors observed that the depletion of Akt3 led to the activation of p53, a protein that plays a role in cell growth arrest and cell death. These results further prove the role of Akt3 in stem cell survival.

The authors indicated that this research will be important in understanding how the central nervous system functions and develops, as well as the understanding of potential abnormalities. According to Dr. Tang, “This study revealed a unique role played by Akt3, a member of the Akt kinase family, for ESC survival and proliferation. This is important as ESCs are the cells residing in early embryos that will eventually give out a whole body. Mice with depleted Akt3 expression have obvious abnormal brain development. Defining the role s of Akt3 in ESCs will help us understand important developmental questions, such as how the formation of central nervous system in early embryos is regulated. Further research on the mechanisms played by Akt3 here may open new avenues for treatment of developmental brain abnormalities as well as cancers.”

The article can be found at:

Ling Wang, Delun Huang, Zongliang Jiang, Yan Luo, Carol Norris, Ming Zhang, Xiuchun Tian, Young Tang. Biology Open 2017 6: 850-861; doi: 10.1242/bio.024505