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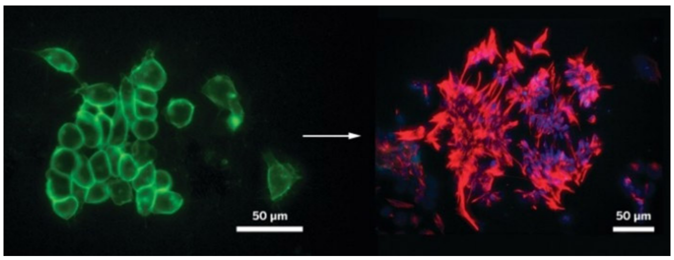
Sugar mimics guide stem cells toward neural fate



Embryonic stem cells (left) transform into neural rosettes (right). Credit: JACS

Embryonic stem cells can develop into a multitude of cells types. Researchers would like to understand how to channel that development into the specific types of mature cells that make up the organs and other structures of living organisms.

One key seems to be long chains of sugars that dangle from proteins on surfaces of cells.

Kamil Godula's group at the University of California, San Diego, has created synthetic molecules that can stand in for the natural sugars, but can be more easily manipulated to direct the process, they report in the *Journal of the American Chemical Society*.

A variety of growth factors influence the fate of embryonic stem cells. All bind to specific receptors on the surface of the cell, but many must also bind to these sugars to exert their influence.

The natural sugar structures are difficult to manage, so Godula's group strung small sugar fragments together to create synthetic versions. They used these 'glycopolymers' to figure out how specific growth factors recognize sugars on the surface of cells.

By tagging individual glycopolymers, they were able to identify sugar substructures with the greatest affinity for fibroblast growth factor 2, one of the growth factors involved in neural development.

To test their mimetic molecules in a living system, they slipped successful versions into the into membranes of mouse embryonic stem cells that lack the natural form of the sugar. Six days later, these cells transformed into 'neural rosettes,' precursors of many types of mature neural cells. Untreated cells didn't.

Godula's group is working on a number of similar molecular mimics to explore a variety of developmental pathways.

Mia Huang, Alex Smith and Greg Trieger, all members of Godula's research group, co-authored the paper. UC San Diego and the National Institute of Biomedical Imaging and Bioengineering supported this work. The synthesis of glycopolymers was carried out, in part, at the Molecular Foundry, Lawrence Berkeley National Laboratory, supported by the Department of Energy's Office of Basic Energy Services.

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