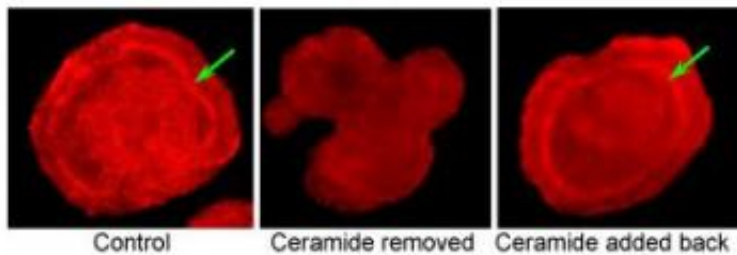


Lipid plays big role in embryonic development

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The series of images shows an embryoid body with ceramide, a malformed body with ceramide deleted and a healthy body when ceramide is restored. Credit: Medical College of Georgia

A little-known lipid plays a big role in helping us grow from a hollow sphere of stem cells into human beings, researchers have found.

They found that in the first few days of life, ceramide helps stem cells line up to form the primitive ectoderm from which embryonic tissues develop, says Dr. Erhard Bieberich, biochemist at the Medical College of Georgia.

Probably 90 percent of ceramide gathers at the top or apical end of these early stem cells, literally helping cells have direction. "We have cell polarity, an up and down, a head and foot of the cell, and that is what ceramide most likely regulates," says Dr. Bieberich. "Cell polarity is

absolutely essential for differentiation; otherwise you have a ball of cells, not organized tissue."

In fact, we start out as a wad of cells, but within 24 hours, some cells die and others become part of the hollow sphere with an inner layer -- the primitive ectoderm -- that will further differentiate into an embryo, and an outer layer -- the primitive endoderm -- that sustains the embryo during development.

"Ceramide distributes to the apical end of the cell," says Kannan Krishnamurthy, MCG graduate student and first author of the study published in the Feb. 2 issue of the Journal of Biological Chemistry. "In this case, the basal end, or lower end, is attached to the outer layer while the apical end points toward the sphere's cavity."

Cells make ceramide, which researchers are finding has many different jobs in the developing and mature body. Like other lipids, it helps make up membranes throughout the body, it has an insulation role in the skin and it is a precursor for the protective coating of nerves, called myelin.

"There is more and more evidence that ceramide not only is a structural lipid but a messenger involved in signal transduction, in telling proteins what to do," says Dr. Guanghu Wang, MCG research assistant scientist who shares first authorship.

In 2003, Dr. Bieberich and his colleagues reported ceramide teams up with the protein PAR-4 to eliminate useless cells in developing brains.

Now his team reports that ceramide plays a key role in establishing cell polarity by attracting proteins involved in polarity to the top of the cells then triggering a series of interactions between them.

When researchers inhibited ceramide production, polarity proteins didn't

gather at the top of cells, cells died and primitive ectoderm formation was impaired; all processes worked like a charm when ceramide was restored.

They plan to study what unknown roles ceramide may play in mature cells and if it plays a role in some cells losing their direction and becoming cancerous.

"There are conditions where a lot of cells die by what we call apoptosis and, in these cases, it could be that ceramide is elevated and that causes good cells to die," says Dr. Bieberich. Ultraviolet radiation, says Mr. Krishnamurthy, is a good example of what may increase ceramide levels.

To study the quantity and location of ceramide, the researchers first developed an antibody that binds to it so it could be seen and counted. Previously, chemical studies have documented its presence but nothing more.

Source: Medical College of Georgia

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