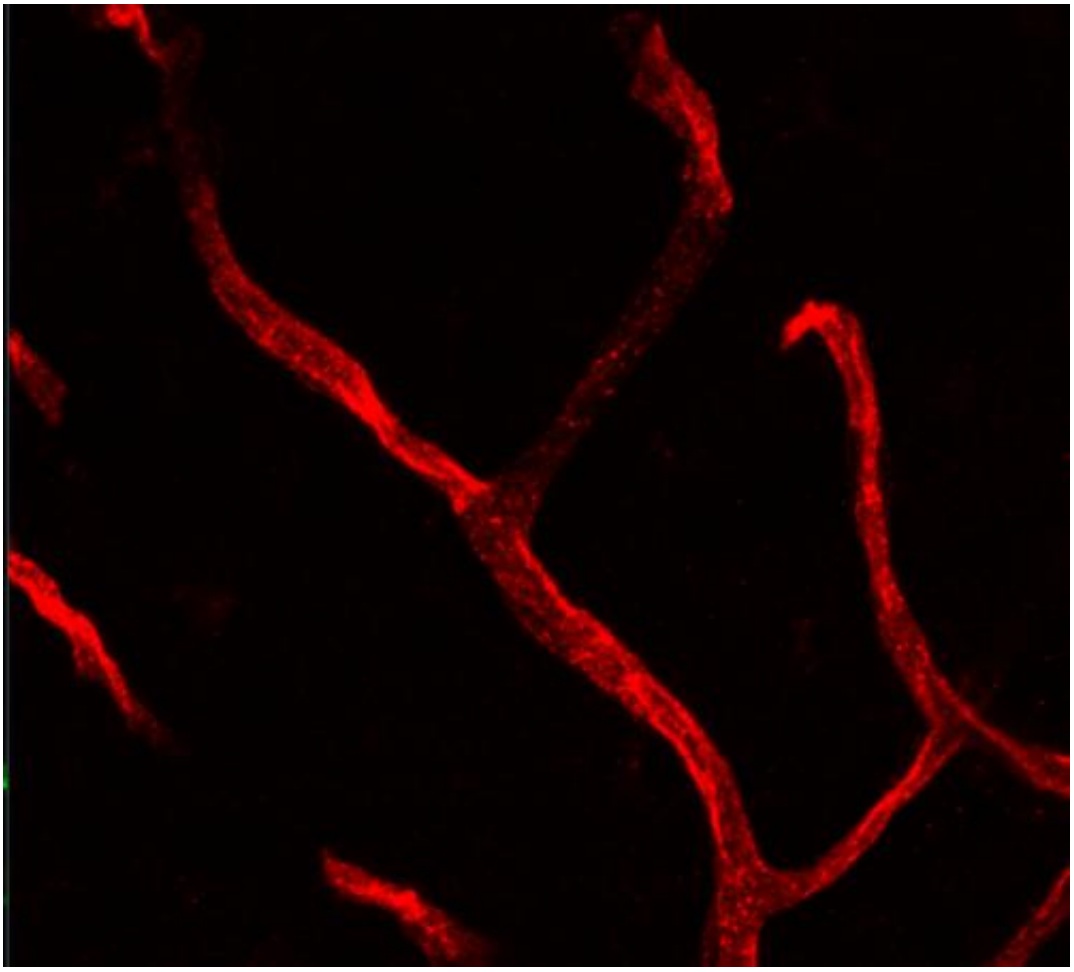
Researchers discover how DHA omega-3 fatty acid reaches the brain

May 14 2014



Omega-3 fatty acid DHA transporter protein Mfsd2a is shown here as red fluorescence along mouse brain capillaries. Credit: Long N. Nguyen

It is widely believed that DHA (docosahexaenoic acid) is good for your

brain, but how it is absorbed by the brain has been unknown. That is - until now. Researchers from Duke-NUS Graduate Medical School Singapore (Duke-NUS) have conducted a new study identifying that the transporter protein Mfsd2a carries DHA to the brain. Their findings have widespread implications for how DHA functions in human nutrition.

People know that DHA is an essential dietary nutrient that they can get from seafood and marine oils. Baby formula companies are especially attuned to the benefits of DHA, with nary a baby formula marketed without it.

DHA is an omega-3 fatty acid most abundantly found in the brain that is thought to be crucial to its function. However, the brain does not produce DHA. Instead, DHA uptake in the brain happens in two ways. The developing brain receives DHA during fetal development, from a mother to her baby. The adult brain gets it through food or DHA produced by the liver.

Though DHA is postulated to benefit the brain, the mechanics of how the brain absorbs the fatty acid has remained elusive. Senior author of the research, Associate Professor David L. Silver of Duke-NUS explained the importance of unlocking this mystery.

"If we could show the link by determining how DHA gets into the brain, then we could use this information to more effectively target its absorption and formulate an improved nutritional agent."

In the study, led by post-doctoral fellow Long N. Nguyen of Duke-NUS, researchers found that mice without the Mfsd2a transporter had brains a third smaller than those with the transporter, and exhibited memory and learning deficits and high levels of anxiety. The team recognized that the learning, memory and behavioral function of these mice were

reminiscent of omega-3 fatty acid deficiency in mice starved of DHA in their diet.

Then, using biochemical approaches, the team discovered that mice without Mfsd2a were deficient in DHA and made the surprising discovery that Mfds2a transports DHA in the chemical form of lysophosphatidlycholine (LPC). LPCs are phospholipids mainly produced by the liver that circulate in human blood at high levels. This is an especially significant finding as LPCs have been considered toxic to cells and their role in the body remains poorly understood. Based on this surprising new information, Dr Silver's team showed that Mfsd2a is the major pathway for the uptake of DHA carried in the chemical form of LPCs by the growing fetal brain and by adult brain.

The findings, published online in *Nature* the week of May 12, 2014 marks the first time a genetic model for brain DHA deficiency and its functions in the brain has been made available.

"Our findings can help guide the development of technologies to more effectively incorporate DHA into food and exploit this pathway to maximize the potential for improved nutritionals to improve brain growth and function. This is especially important for pre-term babies who would not have received sufficient DHA during fetal development," said Dr Silver, who is from the Cardiovascular and Metabolic Disorders Program at Duke-NUS.

More information: Paper: Mfsd2a is a transporter for the essential omega-3 fatty acid docosahexaenoic acid, DOI: dx.doi.org/10.1038/nature13241

Provided by Duke-NUS Graduate Medical School Singapore