

Mechanism outlined by which inadequate vitamin E can cause brain damage

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Sunflower seeds and oil are a particularly good dietary source of vitamin E.
Credit: Bruce Fritz, U.S. Department of Agriculture

Researchers at Oregon State University have discovered how vitamin E deficiency may cause neurological damage by interrupting a supply line of specific nutrients and robbing the brain of the "building blocks" it needs to maintain neuronal health.

The findings - in work done with zebrafish - were just published in the *Journal of Lipid Research*. The work was supported by the National Institutes of Health.

The research showed that zebrafish fed a diet deficient in vitamin E throughout their life had about 30 percent lower levels of DHA-PC, which is a part of the cellular membrane in every [brain](#) cell, or neuron. Other recent studies have also concluded that low levels of DHA-PC in the blood plasma of humans is a biomarker that can predict a higher risk of Alzheimer's disease.

Just as important, the new research studied the level of compounds called "lyso PLs," which are nutrients needed for getting DHA into the brain, and serve as [building blocks](#) that aid in membrane repair. It showed the lyso PLs are an average of 60 percent lower in fish with a vitamin E deficient diet.

The year-old zebrafish used in this study, and the deficient levels of vitamin E they were given, are equivalent to humans eating a low vitamin E diet for a lifetime. In the United States, 96 percent of adult women and 90 percent of men do not receive adequate levels of vitamin E in their diet.

DHA is a polyunsaturated fatty acid, or PUFA, increasingly recognized as one of the most important nutrients found in [omega-3 fatty acids](#), such as those provided by fish oils and some other foods.

"This research showed that vitamin E is needed to prevent a dramatic loss of a critically important molecule in the brain, and helps explain why vitamin E is needed for brain health," said Maret Traber, the Helen P. Rumbel Professor for Micronutrient Research in the College of Public Health and Human Sciences at OSU and lead author on this research.

"Human brains are very enriched in DHA but they can't make it, they get it from the liver," said Traber, who also is a principal investigator in the Linus Pauling Institute at OSU. "The particular molecules that help carry it there are these lyso PLs, and the amount of those compounds is being greatly reduced when vitamin E intake is insufficient. This sets the stage for [cellular membrane](#) damage and neuronal death."

DHA is the needed nutrient, Traber said, but it's lyso PLs which help get it into the brain. It's the building block.

"You can't build a house without the necessary materials," Traber said. "In a sense, if vitamin E is inadequate, we're cutting by more than half the amount of materials with which we can build and maintain the brain."

Some other research, Traber said, has shown that the progression of Alzheimer's disease can be slowed by increased intake of vitamin E, including one study published last year in the *Journal of the American Medical Association*. But that disease is probably a reflection of years of [neurological damage](#) that has already been done, she said. The zebrafish diet used in this study was deficient in vitamin E for the whole life of the fish - as is vitamin E deficiency in some humans.

Vitamin E in human diets is most often provided by dietary oils, such as olive oil. But many of the highest levels are in foods not routinely considered dietary staples - almonds, sunflower seeds or avocados.

"There's increasingly clear evidence that vitamin E is associated with brain protection, and now we're starting to better understand some of the underlying mechanisms," Traber said.

More information: Novel function of vitamin E in regulation of zebrafish (*Danio rerio*) brain lysophospholipids discovered using

lipidomics, [DOI: 10.1194/jlr.M058941](https://doi.org/10.1194/jlr.M058941)

Provided by Oregon State University

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