

Monkeys that eat omega-3 rich diet show more developed brain networks

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Monkeys that ate a diet rich in omega-3 fatty acids had brains with highly connected and well organized neural networks—in some ways akin to the neural networks in healthy humans—while monkeys that ate a diet deficient in the fatty acids had much more limited brain networking, according to an Oregon Health & Science University study.

The study, published today in the *Journal of Neuroscience*, provides further evidence for the importance of [omega-3 fatty acids](#) in healthy [brain](#) development. It also represents the first time scientists have been able to use functional brain imaging in live animals to see the large-scale interaction of multiple brain networks in a monkey. These patterns are remarkably similar to the networks found in humans using the same imaging techniques.

"The data shows the benefits in how the monkeys' brains organize over their lifetime if in the setting of a diet high in omega-3 fatty acids," said Damien Fair, PA-C, Ph.D., assistant professor of behavioral neuroscience and assistant professor of psychiatry in the OHSU School of Medicine and senior author on the paper. "The data also shows in detail how similar the networks in a monkey brain are to networks in a human brain, but only in the context of a diet rich in omega-3-fatty acids."

Omega-3 fatty acids are considered essential fatty acids for the human body. But while they are needed for human health, the body can't make them—it has to get them through food.

The study measured a kind of omega-3 fatty acid called docosahexaenoic acid, or DHA, which is a primary component of the human brain and important in development of the brain and vision. DHA is especially found in fatty fish and oils from those fish—including salmon, mackerel and tuna. Research by a co-author on the paper, Martha Neuringer, Ph.D, an associate scientist in the Division of Neuroscience at OHSU's Oregon National Primate Research Center, previously showed the importance of DHA for infants' visual development—a finding that led to the addition of DHA to infant formulas.

The scientists studied a group of older rhesus macaque monkeys—17 to 19 years of age—from ONPRC that had been fed all of their lives either a diet low or high in omega-3 [fatty acids](#), including DHA. The study found that the monkeys that had the high-DHA diet had strong connectivity of early visual pathways in their brains. It also found that monkeys with the high-DHA diet showed greater connections within various brain networks similar to the human brain—including networks for higher-level processing and cognition, said David Grayson, a former research assistant in Fair's lab and first author on the paper. Grayson is now studying at the Center for Neuroscience, University of California-Davis.

"For example, we could see activity and connections within areas of the macaque brain that are important in the [human brain](#) for attention," said Fair.

Now that those measurements and monitoring are possible, Fair said, the next step will be to analyze whether the monkeys with deficits in certain networks have behavioral patterns that are similar to behavioral patterns in humans with certain neurological or psychiatric conditions—including Attention Deficit Hyperactivity Disorder and autism.

Fair, who was among the 102 people given the 2013 Presidential Early Career Award for Scientists and Engineers by President Barack Obama, is a leader in using the same kind of brain imaging to explore [brain networks](#) in children with ADHD and autism. He said he hopes to use these non-invasive brain imaging techniques to provide an important link between research in humans and animals in order to better characterize, treat, and prevent these types of developmental mental health issues.

Fair added that another longer-term goal would be to study brain development in the monkeys fed various diets from birth into maturity.

"It would be important to see how a [diet](#) high in omega-3s might affect [brain development](#) early on in their lives, and across their lifespan," Fair said.

Provided by Oregon Health & Science University

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