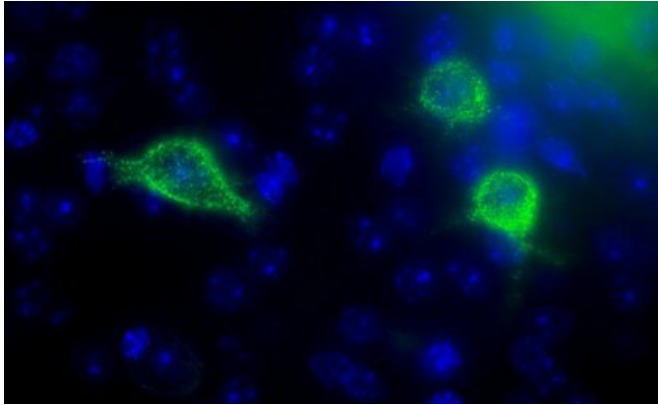


Potential link between vitamin D deficiency and loss of brain plasticity

20 February 2019



Perineuronal nets (bright green) surround particular neurons (blue). Fluorescence labelling reveals just how detailed these structures are. Credit: Phoebe Mayne, UQ

University of Queensland research may explain why vitamin D is vital for brain health, and how deficiency leads to disorders including depression and schizophrenia.

Associate Professor Thomas Burne at UQ's Queensland Brain Institute led the studies, which provide the groundwork for research into better prevention and treatments.

"Over a billion people worldwide are affected by [vitamin D](#) deficiency, and there is a well-established link between vitamin D deficiency and impaired cognition," Dr Burne said.

"Unfortunately, exactly how vitamin D influences [brain](#) structure and function is not well understood, so it has remained unclear why deficiency causes problems."

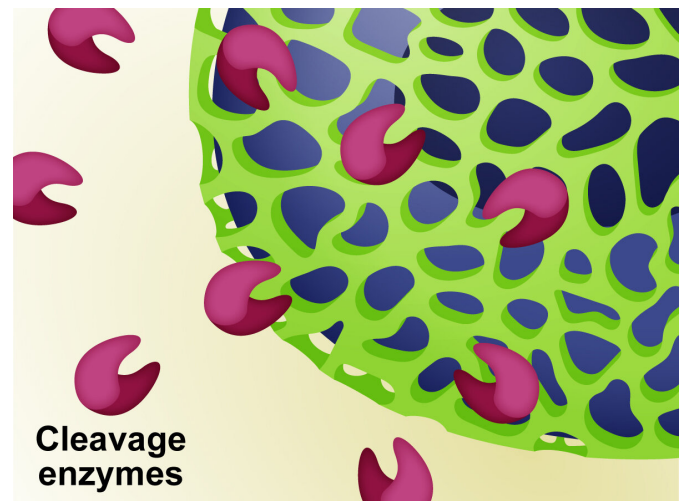
Dr Burne's team found that vitamin D levels affect a type of 'scaffolding' in the brain, called perineuronal nets.

"These nets form a strong, supportive mesh around certain neurons, and in doing so they stabilise the contacts these cells make with other neurons," he said.

Researchers removed vitamin D from the diet of a group of healthy adult mice, and after 20 weeks found a significant decline in their ability to remember and learn compared to a control group.

Dr Burne said the vitamin D deficient group had a pronounced reduction in perineuronal nets in the hippocampus, the brain region crucial to memory formation.

"There was also a stark reduction in both the number and strength of connections between neurons in that region."



Credit: University of Queensland

Dr Burne's team propose that vitamin D plays an important role in keeping perineuronal nets stable, and that when vitamin D levels drop, this 'scaffolding' is more easily degraded by enzymes.

"As neurons in the hippocampus lose their supportive perineuronal nets, they have trouble maintaining connections, and this ultimately leads to a loss of cognitive function."

Provided by University of Queensland

Associate Professor Burne said the hippocampus may be most strongly affected by vitamin D deficiency because it is much more active than other brain regions.

"It's like the canary in the coalmine—it might fail first because its high energy requirement makes it more sensitive to the depletion of essential nutrients like vitamin D.

"Intriguingly, the right side of the hippocampus was more affected by vitamin D deficiency than the left side."

Associate Professor Burne said loss of function in this area could be an important contributor to the hallmarks of schizophrenia, including severe memory deficits and a distorted perception of reality.

"The next step is to test this new hypothesis on the link between vitamin D deficiency, perineuronal nets and cognition," he said.

"We are also particularly excited to have discovered these nets can change in adult mice.

"I'm hoping that because they're dynamic there is a chance that we can rebuild them, and that could set the stage for new treatments."

The research is published in *Brain Structure and Function* and *Trends in Neuroscience*.

More information: Md. Mamun Al-Amin et al. Adult vitamin D deficiency disrupts hippocampal-dependent learning and structural brain connectivity in BALB/c mice, *Brain Structure and Function* (2019). [DOI: 10.1007/s00429-019-01840-w](https://doi.org/10.1007/s00429-019-01840-w)

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APA citation: Potential link between vitamin D deficiency and loss of brain plasticity (2019, February 20) retrieved 1 June 2022 from <https://medicalxpress.com/news/2019-02-potential-link-vitamin-d-deficiency.html>

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