Scientists Find Vessels That Connect Immune System and Brain

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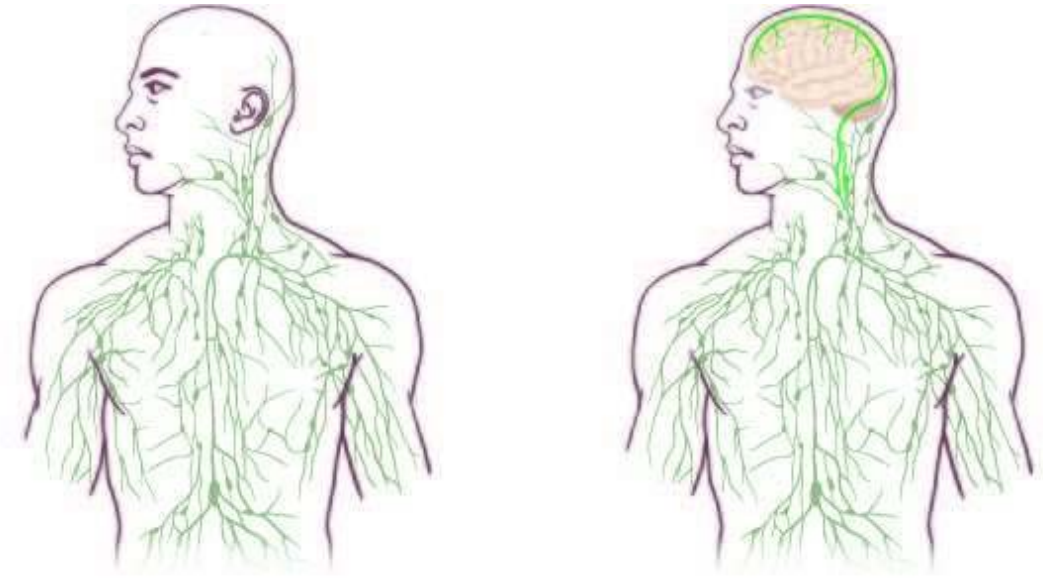
Photo credit: Topic / Shutterstock. It used to be thought that the lymphatic system stopped at the neck, but it has now been found to reach into the brain

In contradiction to decades of medical education, a direct connection has been reported between the brain and the immune system. Claims this radical always require plenty of testing, even after winning publication, but this could be big news for research into diseases like multiple sclerosis (MS) and Alzheimer's.

It seems astonishing that, after centuries of dissection, a system of lymphatic vessels could have survived undetected. That, however, is exactly what Professor Jonathan Kipnis of the University of Virginia claims in *Nature*.



Old and new representations of the lymphatic system that carries immune cells around the body. *Credit*: *University of Virginia Health System*

"It changes entirely the way we perceive the neuro-immune interaction," says Kipnis. "We always perceived it before as something esoteric that can't be studied. But now we can ask mechanistic questions."

MS is known to be an example of the immune system attacking the brain, although the reasons are poorly understood. The opportunity to study lymphatic vessels that link the brain to the immune system could transform our understanding of how these attacks occur, and what could stop them. The causes of Alzheimer's disease are even more controversial, but may also have immune system origins, and the authors suggest protein accumulation is a result of the vessels failing to do their job.

Indeed, Kipnis claims, "We believe that for every neurological disease that has an immune component to it, these vessels may play a major role."

The discovery originated when Dr. Antoine Louveau, a researcher in Kipnis' lab, mounted the membranes that cover mouse brains, known as meninges, on a slide. In the dural sinuses, which drain blood from the brain, he noticed linear patterns in the arrangement of immune T-cells. "I called Jony [Kipnis] to the microscope and I said, 'I think we have something,'" Louveau recalls.

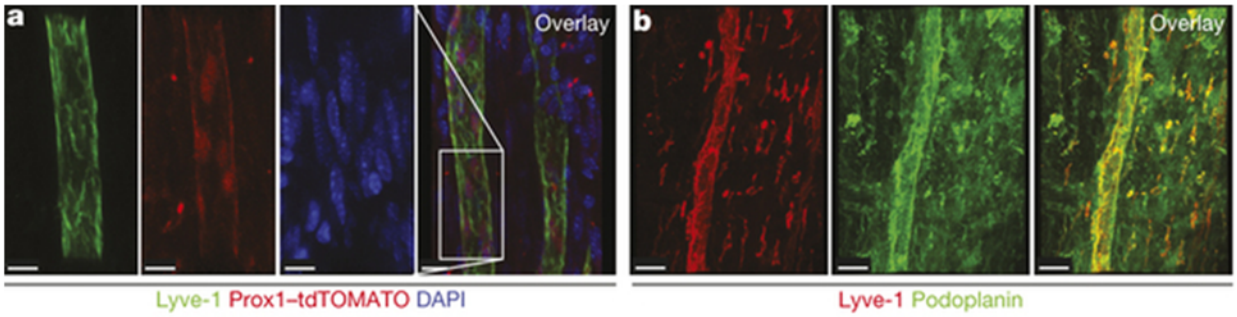
Kipnis was skeptical, and now says, "I thought that these discoveries ended somewhere around the middle of the last century. But apparently they have not." Extensive further research convinced him and a group of co-authors from some of Virginia's most prestigious neuroscience institutes that the vessels are real, they carry white blood cells and they also exist in humans. The network, they report, “appears to start from both eyes and track above the olfactory bulb before aligning adjacent to the sinuses.”

Kipnis pays particular credit to colleague Dr. Tajie Harris who enabled the team to image the vessels in action on live animals, confirming their function. Louveau also credits the discovery to fixing the meninges to a skullcap before dissecting, rather than the other way around. This, along with the closeness of the network to a blood vessel, is presumably why no one has observed it before.

The authors say the vessels, “Express all of the molecular hallmarks of lymphatic endothelial cells, are able to carry both fluid and immune cells from the cerebrospinal fluid, and are connected to the deep cervical lymph nodes.”

The authors add that the network bears many resemblances to the peripheral lymphatic system, but it “displays certain unique features,” including being “less complex [and] composed of narrower vessels.”

The discovery reinforces findings that immune cells are present even within healthy brains, a notion that was doubted until recently.



Meningial lymphatic vessels in mice. *Credit: Louveau et al, Nature.*

http://www.iflscience.com/brain/vessels-found-connect-immune-system-and-brain/