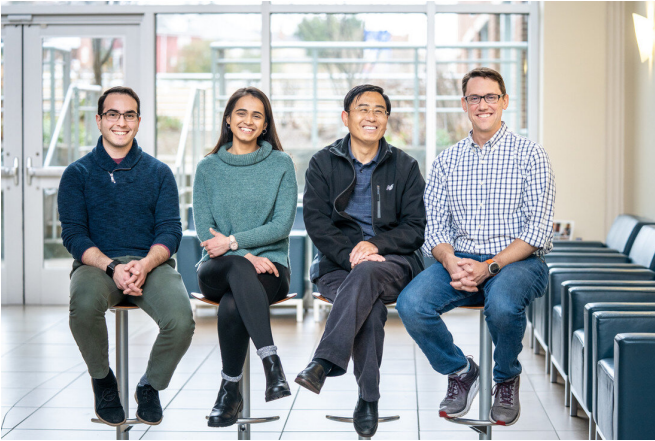


# Scientists shed light on surprising visual development patterns

20 January 2020



Fralin Biomedical Research Institute at VTC scientists discovered that retinal cells recruit astrocytes to facilitate growth in visual processing brain regions. The research team included Ubadah Sabbagh, Rachana Somaiya, Jianmin Su, and Michael Fox, pictured above. Credit: Virginia Tech

Long before a baby opens its eyes for the first time, the brain is ready to start decoding visual stimuli.

In a new study published this week in the *Proceedings of the National Academy of Sciences*, Fralin Biomedical Research Institute at VTC neuroscientists reveal a surprising clue about how this intricate visual processing system forms during [early brain development](#).

It starts with retinal cell growth. These [cells](#) line the back of the eye and process and transmit light-derived signals along their axons, which make up the optic nerve. The axons grow from the eye to various brain regions, including a visual processing region of the brain's thalamus called the lateral geniculate nucleus (LGN).

Previous studies show that signals from retinal cell

influence the LGN's cellular and molecular structure. But this new research describes how retinal cells recruit star-shaped [glial cells](#) called astrocytes to facilitate inhibitory neuron growth into the LGN.

Inhibitory neurons play crucial roles in refining visual processing, but their development in the LGN is not yet well understood.

Led by co-authors Michael Fox, professor and director of the Fralin Biomedical Research Institute at VTC's Center for Neurobiology Research, and William Guido, chair of the University of Louisville School of Medicine's Department of Anatomical Sciences and Neurobiology, the research team started with a broad question: What happens to the LGN if retinal inputs never develop?

The scientists used transcriptomic profiling to compare changes in ordinary mice and mice lacking retinal connections.

The latter group had lower levels of an essential growth protein, called fibroblast growth factor 15, which is secreted by astrocytes. The scientists also noticed stark changes in the LGN's cellular composition—the mice without retinal inputs also lacked inhibitory interneurons, which ordinarily migrate over long distances into the LGN during development.

This discovery shows for the first time that without retinal inputs, astrocytes do not secrete the growth protein and, in turn, [inhibitory interneurons](#) do not grow into the LGN.

Previous studies have described how astrocytes, the brain's most abundant type of cell, have numerous functions—from regulating [electrical impulses](#) to providing nutritional and immune support.

"Astrocytes are a hot topic in neuroscience right now, and although a lot of scientists are

researching them, not many people have looked at how these cells are implicated during development of the visual thalamus," said Fox, who is also a biological sciences professor in Virginia Tech's College of Science.

Fox said that these findings open up even more questions, including how retinal ganglion cells signal astrocytes in the first place.

One possibility is that astrocytes pick up glutamate signals released by retinal cells during neurotransmission. Alternatively, retinal ganglion cells are known to create and secrete bio-active factors that could signal astrocytes independently from neural activity. Fox's team is starting to examine and test these possibilities.

**More information:** Jianmin Su et al., "Retinal inputs signal astrocytes to recruit interneurons into visual thalamus," *PNAS* (2020).

[www.pnas.org/cgi/doi/10.1073/pnas.1913053117](http://www.pnas.org/cgi/doi/10.1073/pnas.1913053117)

Provided by Virginia Tech

APA citation: Scientists shed light on surprising visual development patterns (2020, January 20) retrieved 24 November 2020 from <https://medicalxpress.com/news/2020-01-scientists-visual-patterns.html>

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