

Video shows the traffic inside a brain cell

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Using bioluminescent proteins from a jellyfish, a team of scientists has lit up the inside of a neuron, capturing spectacular video footage that shows the movement of proteins throughout the cell.

The video offers a rare peek at how proteins, the brain's [building blocks](#), are directed through [neurons](#) to renew its structure.

"Your brain is being disassembled and reassembled every day," said Don Arnold, associate professor of molecular and computational biology at the USC Dornsife College of Letters, Arts and Sciences, and corresponding author of an article about the research that appeared in *Cell Reports* on July 26.

"One week from today, your brain will be made up of completely different proteins than it is today," Arnold said. "This video shows the process. We've known that it was happening, but now we can watch it happen."

The new imaging technique was used to cast new light on how proteins are directed to one of the two types of compartments inside the neuron: the axon or the [dendrites](#).

The axon is the region of the cell responsible for transmitting [electrical signals](#) to other cells, while the dendrites receive signals from other cells.

"It's been known for many decades that proteins are specifically targeted to one compartment or the other. However, we couldn't understand how

the targeting occurs until we could actually watch the proteins traveling to one compartment or to the other," said Sarmad Al-Bassam, USC Ph.D. student and lead author of the *Cell Reports* article.

Since the mid-1990s, scientists have been able to illuminate the proteins inside of [cells](#), including neurons, by attaching a protein isolated from [jellyfish](#)—known as GFP (green fluorescent protein)—that fluoresces bright green when exposed to blue light.

Martin Chalfie of Columbia University, Roger Tsien of the University of California-San Diego, and Osamu Shimomura of Boston University were awarded the Nobel Prize in Chemistry in 2008 for the discovery and development of GFP.

The problem with studying the flow of illuminated proteins inside of neurons is that there are several different overlapping pathways within the cell, making it difficult to study the traffic through just one.

Al-Bassam and his colleagues solved this issue by developing a new technique that involves damming up a single pathway, which creates a backlog of transport vesicles (little bubbles that travel up and down neurons carrying membrane [protein](#) cargo) impregnated with the illuminated proteins. They then use a small-molecule drug to release the backlog all at once in a bright pulse.

"Our result was very surprising," said Don Arnold, associate professor of molecular and [computational biology](#) at the USC Dornsife College of Letters, Arts and Sciences and corresponding author of the *Cell Reports* article. "We found that rather than being targeted specifically to the dendrites, vesicles carrying proteins initially enter both compartments, but then are stopped and prevented from moving beyond the initial segment of the axon."

Provided by University of Southern California

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