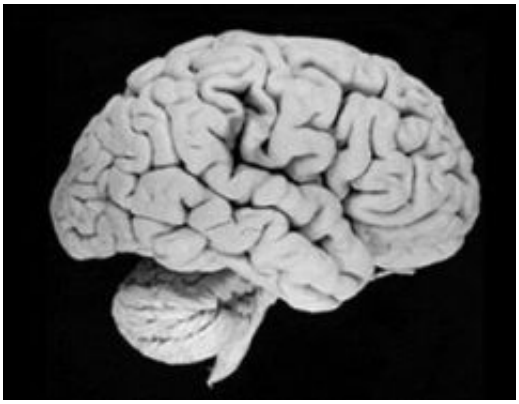
# Autopilot guides proteins in brain

April 21 2009



Modern human brain. Credit: Univ. of Wisconsin-Madison Brain Collection.

Proteins go everywhere in the cell and do all sorts of work, but a fundamental question has eluded biologists: How do the proteins know where to go?

"There's no little man sitting there, putting the protein in the right place," said Don Arnold, molecular and computational biologist at the USC College of Letters, Arts and Sciences.

"Proteins have to have in them encoded information that tells them where to go in the cell."

In a study appearing online this week in Nature Neuroscience, Arnold and collaborators solve the mystery for key proteins in the brain.

Neurons have separate structures for receiving signals (dendrites) and for sending them (axons). The electrical properties of each depend on different proteins. But the proteins travel in bubbles, or vesicles, powered by motors known as kinesins that travel along tiny molecular paths.

Even though the paths point to both axons and dendrites, dendritic proteins end up in dendrites, and axonal proteins go to the axons. How?

Arnold's group discovered a crude but effective sorting mechanism. At first, kinesins blindly carry both types of proteins towards the axon.

However, dendritic proteins enable the vesicles transporting them to bind to a second motor, known as myosin, that literally walks them back into the dendrite.

This filter ensures that only axonal proteins make it into the axon. The others are caught by the second motor and diverted to the dendrite.

"This mechanism fishes these things out of the axon," Arnold said.

Once in the dendrite, the proteins either land in a place where they can do their electrical work or they move back towards the axon, only to be fished out again.

On its face, the process is inefficient, Arnold said, "but it is very effective."

The discovery may enable finer control over neurons for basic research or for treatment of neurological disorders. Potentially, scientists could target only dendrites or axons in a neuron so as to study its outgoing or incoming impulses.

In addition to these potential applications, the study is notable for its contribution to the understanding of the brain and of protein transport in general.

"It's a very basic question, something people have been wondering about for a long time," Arnold said.

Source: University of Southern California (news : web)