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Scientists at UC Santa Barbara Make Important Discovery That Increases Understanding of Multiple Sclerosis

Scientists at the University of California, Santa Barbara have made an important discovery that will increase the understanding of multiple sclerosis, a debilitating disease of the central nervous system in which the myelin sheath, an insulating membrane surrounding the nerve cells in the brain and spinal cord, start to unravel for reasons as yet unknown.

In a paper appearing in today's issue (Sept. 14) of the Proceedings of the National Academy of Science, several UC Santa Barbara researchers describe the results of a study that shows why the unraveling occurs.

The myelin sheath is made up of a lipid bilayer (similar to those making up the cell membrane) wrapped many times around the nerve axon---the part of a nerve cell through which impulses travel away from the cell body.

One specific protein, called myelin basic protein, acts to hold the myelin sheath together tightly around the axon.

The axons serve as the electrical wires that connect the nerve cells, and the myelin serves as the insulation to keep the electrical impulses flowing quickly and reliably.

"If the myelin breaks down, for whatever reason, the nerve electrical impulses leak out, slow down, and generally don't work very well," says Joe Zasadzinski, professor of chemical engineering at UCSB.

Zasadzinski, with co-authors Jacob Israelachvili, professor of chemical engineering, graduate student Yufang Hu and postdoctoral fellow Ivo Doudevski, and Cynthia Husted, director of UCSB's Center for the Study of Neurodegenerative Disorders write that "We have discovered that in the progression of MS, there are small changes in the lipid composition of myelin.

There is less negatively-charged lipid in the membrane and more neutral, or uncharged, lipids.

Myelin basic protein is positively charged and gets in between the bilayers to link up the negatively-charged lipids and glue the myelin sheath together."

The scientists explain that the tightest seal occurs when the amount of negative charge from the lipids just match the amount of positive charge from the protein.

If there is too much of either one, then the bilayers start to repel each other rather than bind.

"Although we can't say why the lipid composition changes, now with this new knowledge, perhaps we can suggest methods of trying to treat the unraveling before it gets too far along," Zasadzinski says.

Zasadzinski, Husted and Israelachvili also discovered that the myelin basic protein acts as a patch to fill in any holes in the myelin bilayers.

"It is similar to the stuff you put in your tires to fix punctures," Zasadzinski explains.

"The myelin basic protein floats around until it finds a hole, binds to the edge of the hole and then pushes the lipids to fill in the hole, insuring good insulation from the myelin sheath."

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