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Chemist receives NIH funding to unravel tricks of neuronal wiring

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Joshua Maurer, Ph.D., assistant professor of chemistry in Arts & Sciences, has received a four-year, $1,216,000 grant from the National Institute of Mental Health for research titled "Unraveling Development: New Materials for Understanding Neuronal Wiring."

Maurer's long term objective is to develop methodology that allows the study of a variety of neuronal wiring processes. He is starting by unscrambling a phenomenon known as midline crossing using zebrafish. During development, neurons from the right eye cross the midline of the brain to make a connection in the left hemisphere.

"Our goal is to build a substrate that looks like what a growing neuron would encounter in the brain as it goes from the eye to where it has to make its final connection in order to do a feedback response," Maurer explained. "We want to replicate the interactions (in the brain) on a glass surface by laying down a series of molecules with nanoscopic control. Then we can watch in real time, with a microscope, how a neuron is guided through this pattern."

Their findings could help explain more about the fundamentals of nerve damage and enable better nerve repair some day.

They are developing strategies that give "robust, stable" surfaces that can be studied for weeks. Current techniques give surfaces with limited stability, around 5 days. "We have recently published new patterning techniques that allow us to build protein patterns directly on glass and are just starting to meet our goals of building complex systems," Maurer said.

Traditionally, to elucidate a protein's role in a known pathway, scientists make a "knockout" animal by inactivating the gene that codes for the protein and observing the resulting effect in the animal. However, this technique cannot be used to study proteins involved in development because these proteins can have multiple functions.

"If you knock out a developmental protein, there is a potential that you affect some upstream event so you never do the event you are interested in," Maurer said.

Maurer's neuronal "road map" overcomes this problem by isolating the guidance system from the zebrafish's neurobiological milieu. By watching the neuron grow in real time, he will be able to determine exactly which proteins tell the neuron to turn left, right, or stop.

Knowledge gained in these studies could be applied to reconnecting severed nerves in humans. "This eye crossing event happens in every organism with two eyes. Last time I checked that was all of them. I don't see any cyclopses wandering around," Maurer said.

Source: Washington University in St. Louis

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