CORNELL CHRONICLE

Researchers receive prestigious NIH grants, including two $2.5 million Pioneer awards

By Krishna Ramanujan | September 24, 2009

With new grants, neurobiologist Joseph Fetcho will explore why sleep is necessary and reproductive biologist Alexander Travis will try to harness sperm's locomotive power to deliver drugs. They both have received five-year, $2.5 million Director's Pioneer Awards from the National Institutes of Health (NIH).

MEDIA CONTACT

Claudia Wheatley

caw43@cornell.edu (mailto:caw43@cornell.edu)

607-216-7724 (tel:607-216-7724)

In addition, biochemist Shu-Bing Qian has won a five-year, $1.5 million NIH Director's New Innovator Award, which is supported in part by federal stimulus funding; and Professors John Lis and Harold Craighead and Assistant Professor Moonsoo Jin have received an NIH Transformative R01 grant, as has Dr. Samie Jaffrey of Weill Cornell Medical College.

Fetcho, professor of neurobiology and behavior, and Travis, associate professor of reproductive biology, are among 18 researchers to be given a 2009 Pioneer Award; the awards were announced Sept. 24 at the NIH Director's Pioneer Award Symposium in Washington, D.C.

The prestigious Pioneer awards support "scientists of exceptional creativity who propose pioneering -- and possibly transforming approaches -- to major challenges in biomedical and behavioral research," says the award Web site. The award guidelines stipulate that researchers pursue an entirely new line of research.

Sleep research

"One of the biggest questions in neurobiology is why we need sleep, which you'd think we would have answered by now," said Fetcho.

He plans to test a theory that animals with nervous systems have a limited number of possible connections, called synapses, between their nerve cells. Certain synapses get strengthened during the day with learning and function, while they weaken at night to create space for new connections for the next day.

As synapses scale down during sleep, the theory proposes, stronger connections remain, while the weakest connections dissipate. There is evidence that performance goes up after sleep as the brain recalibrates and makes room for new connections, Fetcho said.

Also, children learn at astounding rates and have a tremendous need for sleep, while in older individuals, the brain's plasticity, ability to learn and need for sleep all decline, Fetcho said.

To test the sleep theory, Fetcho plans to use larval zebrafish, which have transparent bodies, allowing researchers to see their cells. By introducing fluorescent proteins that attach to nerve cells and light up based on the strength of a synapse connection, Fetcho hopes to test the levels of nerve connections during the day and night.

"All of them [synapses] should get less intense at night," he said.

Drug-delivering bio-machines

Travis will work to harness the power in a sperm's tail to drive tiny drug-delivering bio-machines. By breaking down the individual steps in the biological pathway that sperm use to generate energy, Travis and his research team plan to reproduce that pathway for use in a human-made device.

If the entire pathway can be reproduced and made to bind to nickel ions on a manufactured chip, a device could use freely circulating glucose as fuel. These hypothetical devices could potentially deliver drugs precisely to where they are needed, such as at a tumor.

"We're borrowing the sperm's strategy for locomotion," said Travis, who conceived the idea after noting that many proteins on sperm tails are tied down to solid structures within the cell but still function.

New Innovator Award

Qian, assistant professor of nutritional sciences, will use his New Innovator Award -- given for "highly innovative projects that have the potential for unusually high impact" -- to study the accumulation of misfolded proteins in cells, a leading cause of neurodegenerative disorders and other human diseases. Qian and colleagues aim to engineer an enzyme that tags proteins to be destroyed to investigate protein aggregation and neurodegeneration.

Transformative R01 grants

The Transformative R01 grants are awarded for "exceptionally innovative, high-risk and unconventional research projects that have the potential to create or overturn fundamental paradigms." The amounts of these five-year awards will be announced at a later date.

Lis, in molecular biology and genetics; Jin, in biomedical engineering; and Craighead, in applied and engineering physics, will use their grant to develop protein-capture reagents that can specifically or selectively recognize, bind and "capture" a broad spectrum of human proteins that may then be adapted for diagnostic and therapeutic purposes.

Jaffrey, associate professor of pharmacology at Weill Cornell, is developing RNA molecules that light with fluorescence when they bind to specific small molecules. The technique could be used to detect cancer biomarkers and levels of proteins expressed by cells.

STORY CONTACTS

Krishna Ramanujan

ksr32@cornell.edu (mailto:ksr32@cornell.edu)

607-255-3290 (tel:607-255-3290)