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RESEARCH NEWS

AUGUST 03, 2007

College Students Contribute to Teamwork at Janelia Farm

Four college students spent their summers participating in a pilot program for undergraduate research at the Howard Hughes Medical Institute's Janelia Farm Research Campus, less than a year after its opening.

Janelia Farm's interactive, highly collaborative atmosphere offers a unique opportunity for inquisitive, motivated undergraduates to conduct research. This year's students arrived at Janelia Farm with varying degrees of research experience; each is now pursuing an independent project that contributes to Janelia Farm's broad goals of developing new imaging technologies and understanding how neural circuits process information. Some are new to neuroscience, and others are new to biology altogether, but their passion and motivation, combined with diverse skills such as computer programming and robotics, make them the perfect candidates for learning in a community where interdisciplinary approaches are lauded.

Julie Simpson, one Janelia Farm group leader who has welcomed a student into her lab, emphasized the importance of having a valuable and positive research experience early on to hook future scientists. Simpson's own summer research experience as an undergraduate at Princeton University sold her on a career in science, and she hopes that the undergraduate program will help Janelia “convert smart young minds to neuroscience.”

> "Everybody benefits when a talented undergraduate is given the tools needed to succeed on an important project."
> **- Michael B. Reiser**

This year's summer students are participating in a pilot program for undergraduate training, which will be refined and expanded in the coming year. A formal online application process will open in fall of 2007 for students interested in spending 10 weeks of their summer of 2008 at Janelia Farm. This year's students are:

Arjun Bharioke is a student at the University of Toronto who is studying how the brains of mice are rewired during learning. Working in the lab of Janelia Farm group leader Karel Svoboda, Bharioke has trained mice to push a lever in response to a puff of air on their whiskers. Bharioke employs a new technique to activate specific neurons by expressing a light sensitive protein in the brains of mice and then administering a pulse of light. By stimulating the neurons involved in whisker movement, Bharioke hopes that the mouse will go for the water, even though the whisker was not actually deflected by an air puff. This means that the sensory neuron was triggered by the pulse of light, confirming the targeted neural circuitry. According to Bharioke, his goal is to "try and fool [the mouse] and stimulate the brain to see if he does what he's supposed to do." In contrast to his previous research experiences, Bharioke finds working at Janelia refreshing, because lab heads are directly involved in the hands-on aspects of their research.

Chelsea Trengrove spent her first weeks at Janelia plowing through textbooks to get a better understanding of how her project could improve imaging techniques in the brain. The lab she works in is run by group leader Loren Looger, a mathematician and chemist who has devoted himself to building better tools to study the brain. Trengrove's work focuses on glutamate, the primary excitatory neurotransmitter in the brain. Visualizing glutamate allows scientists to trace neural activity, but existing glutamate sensors have less than ideal brightness and signal change. Trengrove is striving to make the sensors brighter and more photo-stable, allowing for clearer imaging. Trengrove, who attends the University of Colorado, Boulder, was surprised to discover the strong sense of community at Janelia Farm. The dining room is often abuzz with scientists sharing new hypotheses, stories about their successes and setbacks, she says, noting that she's "trying to listen and understand."

Jonathan Yoke is a computer engineering student at the University of Virginia with more experience building robots than with geotaxis, movement oriented by the force of gravity. But Janelia fellow Michael Reiser has assigned him the task of developing a novel assay to determine how fruit flies respond to gravity. "Everybody benefits when a talented undergraduate is given the tools needed to succeed on an important project," Reiser says. In the completed assay, flies will be placed in a tube mounted on a wheel. The wheel will turn automatically according to a computer's instructions—effectively changing which way is "up." A camera spins with the wheel so that researchers can record the flies' reactions. Yoke hopes to go to graduate school and study brain-computer interfacing, possibly to develop methods that enable patients to overcome paralysis. "Their brains work fine, but they can't control their limbs," Yoke says. "It seems to me there's a way to fix it."

Livia Zarnescu is a mathematics major at the University of Arizona who is the liaison between the labs of two Janelia Farm group leaders: Julie Simpson, who maps the neural circuitry of motor behavior in fruit flies, and Eugene Myers, who develops software and algorithms to build atlases of complex biological systems. The two labs are collaborating to develop a functional map of the fly brain. Zarnescu, whose desk is scattered with computer programming books and printouts on *Drosophila* genetics, executes the entire process—from dissection and staining with fluorescent antibodies to programming the computer algorithm needed to overlay images from thousands of different samples. She has the valuable ability, Simpson notes, to "speak computer, and then come back and speak English to us." Zarnescu says she feels very lucky to be at Janelia because "everybody is so smart and enthusiastic about what they do."