Passport to Knowledge

GSAS STUDENTS WIN FUNDING THAT SUPPORTS BIOMEDICAL RESEARCH AS A GLOBAL ENTERPRISE

HHMI International Student Research Fellowships

Five Harvard PhD students — the most from any university — are among the 30 winners of a national fellowship competition sponsored by the Howard Hughes Medical Institute that awards full-time funding to exceptional international students in the third, fourth, and fifth years of their graduate programs in science and engineering. The HHMI's 2012 International Student Research Fellowships will allow these talented students to devote their full attention to research at a critical time during their professional development. The awards serve a particularly important role, according to the HHMI, since much of the available funding for graduate education is reserved for US citizens. "Biomedical research is a global, collaborative enterprise," says HHMI President Robert Tjian, PhD '76. "HHMI has a long history of supporting highly promising international scientists, and this program is designed to nurture the career development of scientists who have the potential to become international scientific leaders."

Guo-Liang Chew

Guo-Liang Chew, a native of Singapore and a PhD candidate in Alex Schier's lab in molecular and cellular biology, says he was drawn to developmental biology in part because of how visual it is. Exploring questions of how gene expression is regulated in a developmental context — in particular, how the process of making proteins from RNA is regulated — "you can actually see the processes happening over time," he says. That is especially true in the case of the zebrafish, where researchers can observe the organisms growing from a single cell into a recognizable animal within 24 hours.

"Of course, the process of development itself is absolutely fascinating," Chew adds. "The concurrent control of the expression of over 20,000 genes over the time and space of development, with multiple layers of control, to yield a single coherent organism — that's just a beautiful problem that's aching to be solved."

And working to do so at Harvard is "fantastic," he says, "because I'm simply not restricted in the directions that I want to take my research. I have all the resources I need to tackle my research project, with the support of a great community with expertise in a wide variety of topics."

Wendy Liu

Wendy Liu, a PhD candidate in the Division of Medical Sciences who came to Harvard from Australia, works in Rachel Wilson's neurobiology lab to discover how the brain perceives and processes sensory information, and how these perceptions are transformed from one brain region to another. "Ultimately, we are interested in how these sensory representations give rise to behavior," Liu says. "I study the role of interneurons in modulating the activity of the olfactory circuit in Drosophila and how diverse interneuron types may shape the response to olfactory stimuli." The fly is an ideal model in which to ask the kinds of fundamental questions about brain processes that interest her, Liu says. She was drawn to electrophysiology because "I get instant feedback in real time; I deliver a sensory stimulus and can immediately see how the cell is responding, and that's extremely exciting," she says. Doing that work at Harvard is valuable "because everyone around me is so smart and talented, and it's great to be able to learn so much from your colleagues."

Mingjie Dai, a PhD candidate in biophysics who is originally from China, is working with Peng Yin at the Wyss Institute for Biologically Inspired Engineering to develop novel ways to use DNA as a tool for drug delivery and other molecular interventions. "Although DNA is commonly understood as a media of inheritance, in this field we explore the precise Watson-Crick base pairings to perform molecular computation and construction, and trigger biological signaling and regulation," Dai says. "I was personally fascinated by this ability of DNA when I was an undergrad, and, as a physicist by training with great interest in understanding biology and the meaning of life in general, I was deeply attracted by the ability to rapidly prototype biological matter with nanometer precision."

At Harvard, he says, "the vibrant environment and super-supportive community" has helped him hone his once-theoretical ideas. "I have been involved in more realistic and application-relevant projects, including the single-stranded tile assembly method that uses engineered-like modular bricks to build and write on a tobacco canvas, building scaffolds and engineering metabolic pathways in cells, and trying to enhance resolution of optical microscopy via programmable binding kinetics — each of which has great potential and wide biomedical applications."

Sandeep Koshy

Sandeep Koshy, a PhD candidate in engineering and applied sciences who came to Harvard from Canada, is working on an implantable cancer vaccine in David Mooney's lab at the Wyss Institute for Biologically Inspired Engineering. Koshy's work builds on significant results that Mooney's lab announced in 2009, when researchers described an implant that could carry vaccine material into the body and then pull in immune cells, program them against the tumor, and release them to communicate with other immune cells to combat the tumor. The approach was earlier shown to successfully eliminate tumors in mammals, and the group has recently demonstrated success against a melanoma tumor model in mice. Koshy is currently trying to pinpoint the mechanism of exactly how the vaccine works and to test its interactions with human immune cells. "This work will give us clues if our work in animal models will translate to humans and serves as a critical bridge between bench and bedside for our technology," he says.

Koshy finds daily motivation just outside his door: "I walk out and see Children's Hospital Boston, where Sidney Farber tested the first chemotherapies on children with leukemia more than 60 years ago. Being in a place with such a history of individuals who dared to fight this ‘unsolvable’ disease is truly inspirational. Harvard continues to be at the forefront of research in cancer biology and therapy, and I'm glad I can be a small part of it."

Ghazaleh Ashrafi

Ghazaleh Ashrafi, a PhD candidate in the Division of Medical Sciences who came to Harvard from Canada, is working in Thomas Schwarz's lab in molecular and cellular biology, and there is currently no method to halt its progressive, and devastating, course. Ashrafi, who hails from Canada, says that the loss of muscle control that Parkinson's gradually inflicts is due to the death of a subset of brain neurons, but the mechanisms underlying that process are not well understood. Expanding on previous work that suggests that cells' mitochondria play a role, Ashrafi will investigate two genes, PINK1 and Parkin, which are mutated in the inherited form of the disease, and which — when functional — can remove damaged mitochondria and promote the survival of brain neurons. She hopes to "shed more light on the molecular mechanisms that are potentially lost in PD."

Ashrafi is excited at the opportunity to "study a fundamental cell biological question — namely, mitochondrial dynamics — in the unique context of a neuron." And she finds satisfaction in the fact that her work "is directly relevant to neurodegenerative diseases."

Mingjie Dai

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