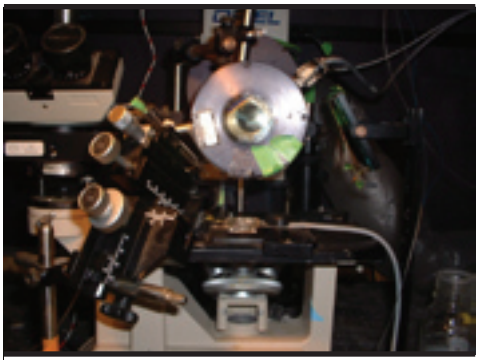
Provost's Undergraduate Research Award (PURA)

The PURA program began in 1993 to encourage undergraduate research. This program was founded on the belief that involvement in research not only enhances a student's learning experience but teaches them important skills in writing, carrying out a project, and reporting results. The award provides funding for research expenses incurred by students, faculty, and/or departments. In addition to research expenses, students who receive the award may choose a stipend or academic credit for their work. New projects and projects that are in progress are eligible for consideration of the award. The project is awarded for the fall or the summer and any freshman, sophomore, or junior is eligible to apply. Each year, students receive awards in amounts up to $2,500. This scholarship is funded by the Hodson Trust. Each spring, results of the previous year's work are presented in a poster session and recognition ceremony.

Understanding Heterologous Lipid Bilayer Interactions

Hanh Ho

Hanh Ho is a junior at Hopkins who has been investigating various aspects of lipids for the past 2 years. Currently, she is studying the "Atomic Force Microscopy Studies of Heterologous Lipid Bilayer Interactions," or, in other words, the physiological parameters of the membrane contacts of lipid bilayers. She explained the importance of interactions between lipid bilayers and how they play a central role in such as biological functions that include vital cellular processes such as endocytosis, exocytosis, and synaptic function. In most cases, these processes involve fusion between membranes, which is in itself a process that is not well understood. Hanh explained one of the potential benefits of understanding this process and related it to the emerging importance of liposomes as an important drug delivery vehicle. The ability of liposome to fuse with target membranes is critical for their function and she hopes that her research will provide new insight into the nature of these initial contacts.



Experimental apparatus for Rougee's experiments

Using an atomic force microscope (AFM), Ho explored the heterologous lipid bilayer interactions. The AFM is a sophisticated instrument that allows for imaging of single biological molecules and macromolecular complexes in real time and also allows measurements of biological systems. Previous work had been done on homologous lipid bilayer interactions, but this research is limited in its application to real life situations where the compositions of lipids in membranes are much more complex. Her research consisted of forming supported lipid bilayers with one lipid type (L1) and then incubating it with small unilamellar vesicles of a second type (L2) to form heterologous membrane complexes. These complexes were then studied using the AFM. The AFM allowed her to assess the interaction energy between two lipids. She also explained how she could change certain parameters like lipid chemistry and solution properties to explore the nature of the membrane-membrane contact. The role of headgroup charge was also investigated by using salt to screen electrostatic interactions.

The research is still in progress and not enough data has been collected yet to draw any conclusions. Ho hopes that this research will someday help to formulate an assay where one would be able to know when membranes fuse and measure certain properties of this process. Ho works with Dr. Jan Hoh and Dr. Alex Hodges in the Physiology Department at the Johns Hopkins Medical School.

The Effects of Nitric Oxide Preconditioning on Cardiac Ischemia

Luc Rougee

For the past two years, Luc Rougee has been doing research on "Association of Nitric Oxide Neuronal Chronic Preconditioning Against Cardiac Ischemia." According to Rougee, over 1 million Americans suffer, of which 460,000 die, from a heart attack every year. Most people mistakenly link the initial cardiac trauma to the cause of death, but the lack of oxygen to the brain after a heart attack is the actual cause of death. Seeing that this condition strikes so many Americans and there are no ways to cure or prevent this type of injury aside from a healthy lifestyle, he decided to study this condition and find ways to help diminish and possibly reverse the effects of ischemia or lack of oxygen to the brain.

Previous work had been done on the significance of nitric oxide in neuronal rapid preconditioning but Rougee decided to focus on neuronal chronic preconditioning to compare it with the preceding research. The preconditioning consisted of subjecting the rat to a sub-lethal ischemic insult for a period of 40 minutes. This meant placing a rat in a chamber where the atmosphere changed to 92% nitrogen and 8% oxygen. This was done to simulate the low levels of oxygen that would arrive in the brain during this condition. The rat was then left alone for a period of 24 hours compared to 30 minutes in rapid preconditioning. Rougee then took hippocampal

brain slices and recorded the tissue swelling using optical scatter imaging. In rapid preconditioning, diminished swelling was observed compared to the brain slices that received no preconditioning. From this, he hypothesized that there would be a higher swelling reduction in chronic preconditioning compared to the rapid preconditioning. Preliminary experiments from his lab showed a decrease in the amount of swelling. However, more data and research must be done before any conclusions can be made.

Rougee hopes to elaborate on a further project that would explore different methods of preconditioning and perhaps discover medicinal drugs that may counteract the ischemic injury. He is currently working in Dr. Nitish Thakor's lab in the Biomedical Engineering Department at the Johns Hopkins School of Medicine.

Gene Analysis of Trophoblastic Carcinoma

Rob Oldt

Rob Oldt is a junior at Hopkins who has been studying trophoblastic tumors for the past year. Trophoblastic tumors occur when tissues grow uncontrollably and progressively. Except for choriocarcinoma, a common cancer in females, most tumors are poorly characterized and very little is known about where they are formed. He has been researching the placental site and epithelioid trophoblastic tumors using molecular gene analysis. What got him so interested in such a complex field of study was his interest in cancer that arose from personal reasons. His interest led him to the Bond Street building at the Hopkins medical school where he met Dr. Shih and was enthusiastically received.

His research involved performing a molecular genetic analysis of placental site trophoblastic tumors and epithelioid trophoblastic tumors (PSTT and ETT), in order to confirm their trophoblastic origin. Basically, he analyzed the paternal genomic contribution using a recently developed genotyping technique. This unique technique uses polymerase chain reaction (PCR) to evaluate single-nucleotide polymorphisms. His study provided the first molecular evidence that PSTT and ETT were gestational tumors (trophoblastic) meaning that these cancer cells grow in the tissue that is formed following conception. This has significant applications clinically because distinguishing the gestational tumor from the nongestational tumor will allow doctors to prescribe different treatments.

Rob Oldt has completed this research project and has already published a paper on this topic in the American Journal of Pathology. He is currently studying ovarian cancer, specifically examining K-ras and B-ras genes in the same signaling pathway. ■

Contributed by Andrew Kim