



DANIEL FU, Park Tudor School, Indianapolis, Indiana, and **PATRICK TAN**, Carmel High School, Carmel, Indiana
HOMETOWN: Carmel, Indiana
PROJECT: Chaos and Robustness in a Single Family of Genetic Oscillatory Networks
FIELD: Mathematics
MENTOR: Dr. Alexey Kuznetsov and Dr. Yaroslav Molkov, Indiana University-Purdue University Indianapolis

“As the world continues to shift and develop into a technologically and scientifically-dependent community, the importance of math, science and technology will also grow, leading to more jobs, more collaboration, and (most of all) more innovation.”

In their project, Daniel Fu and Patrick Tan researched new techniques for mathematically analyzing genetic oscillatory networks. The team developed a method for reducing infinitely-dimensional delay differential equations (DDEs) to three-dimensional systems of ordinary differential equations (ODEs). Their work could lead to better treatments of diseases with irregularities in the cell cycle, such as cancer, or the circadian rhythm, such as sleep disorders. They were inspired by the movie *Inception*, which explores the mysteries of sleep. “Following the theme of the movie, we decided to go as deep as possible into the innermost workings of sleep. This eventually led us to study the Circadian rhythm and genetic oscillatory networks.”

Daniel Fu

“My favorite subject is history because I like seeing all the brilliant complexity in the world and seeing how every event throughout history has shaped the world to what it has become today.”

Daniel, a junior, is a member of USA Computing Olympiad Silver Division and won fourth place in the American Chemistry Society exam, Indiana section. Secretary of the student council in 2011, Daniel is editor of his school newspaper and junior editor of the literary art magazine. He volunteers in cancer clinics and mentors other students in STEM. Daniel is considering a major in computer science or political science and hopes to either be a research professor or politician. In the near future, he is most excited about attending The Hague International Model United Nations in the Netherlands.

Patrick Tan

“My favorite subject is chemistry because I find discovering how the natural world works at a fundamental level fascinating.”

Patrick, a junior, is secretary of Key Club, president of Chemistry Club and a member of Top Symphonic Band. He volunteers with Habitats for Humanity and runs cross country. He is especially proud of co-founding the DPY Math Contest for middle school students, which helps prepare them for the MATHCOUNTS competition. Patrick plans to study biochemistry, applied mathematics and finance in college and aspires to have a career where he can combine math and science with his desire to help people.