



JIAYI PENG

Horace Greeley High School, Chappaqua, New York

HOMETOWN: Chappaqua, New York

PROJECT: A Cellular Automaton Model for Critical Dynamics in Neuronal Networks

FIELD: Physics

MENTOR: John M. Beggs, Indiana University

"I like how interdisciplinary mathematical modeling can be. Its basis may be in mathematics and/or physics, yet it can be used to solve real-world problems."

In her research, Jiayi Peng built a cellular automaton model that combined short-term synaptic plasticity with long-term metaplasticity to investigate how these two mechanisms contribute to attaining and maintaining operation at a critical point. Jiayi's research could help determine how distinct neurological mechanisms can differentiate a healthy brain from one with a devastating neurological disorder such as epilepsy, autism or Alzheimer's disease. Jiayi became interested in mathematical modeling after reading an article in *Scientific American* about mathematicians and computer scientists modeling terrorist group structures and predicting their behavior. She spent over 1,200 hours on her project.

A member of the Cum Laude Honor society, Jiayi is her school's top scorer in the American Mathematics Competition. This high school senior is a National Merit Semifinalist and the recipient of a Moody's Math Challenge National Honorable Mention and US Navy and Marine Corps Science Award. A pianist, Jiayi has won an award in the Golden Key Piano Competition. Actively involved in community service, as a tenth grader she founded Kits4Kids, a club dedicated to raising money for children, especially girls, to continue their education. "We've recruited over 40 members and have raised over \$2,000." She is also an executive of SHARE, her school's largest club, and has organized school-wide collection drives for health centers in Haiti. Jiayi's research paper, "Attaining and Maintaining Criticality in a Neuronal Network Model," which was co-written with Dr. John Beggs, has been accepted for publication in *Physica A: Statistical Mechanisms and its Applications*. She plans to major in physics or mathematics and aspires to be a researcher or professor in one of these fields.