Davidson Institute for Talent Development

Davidson Fellow

Jonathan F. Li

$10,000 Scholarship Recipient

Personal Info

Age: 17
Laguna Niguel, California

School, College and Career Plans

A rising senior at St. Margaret's Episcopal School, Jonathan plans to major in applied mathematics and applied physics in college, and pursue a career in medical research.

Davidson Fellows Submission (Mathematics)

In his project, "Effects of Motility and Contact Inhibition on Tumor Viability: A Discrete Simulation," Jonathan developed a mathematical model and computer simulation to analyze tumor growth and is the first to study motility and contact inhibition, a mechanism that limits cell growth when pressured by neighboring cells. His research also revealed an inherent flaw of the Cellular Potts Model, used to simulate cellular structure behavior. Jonathan's work provides a method to predict the effects of motility on tumor development and can be used to identify cancer phenotypes that chemotherapy drugs can target, potentially improving treatment.

Biography

In his elementary school years, Jonathan began to accelerate in mathematics. By the time he was in 7th grade, he was taking Advanced Placement calculus and physics. He then moved on to University of California, Irvine (UCI) to take 15 math and physics classes where he discovered the field of mathematical biology.

Most of the subjects Jonathan needed to pursue his Davidson Fellows research were not taught directly in high school so he reached out to a mentor at UCI who was the Mathematics Department Chair and began teaching himself computer programming. He also read as many research papers and books on tumor cell biology as he could. Jonathan traveled to Indiana for a technical workshop and interned at City of Hope Cancer Research Lab to gain hands-on mastery of the biological aspects of tumor cell growth. Another challenge Jonathan overcame was that of time. He developed automation tools using Macros and Python programs to allow CompuCell3D to operate independently and collect data more efficiently.

Jonathan is a varsity athlete on his school's soccer and golf teams and plays the cello in a chamber music group. He is the president of the JETS and Mu Alpha Theta clubs.

Please see next page.

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cont.

Honors/Awards

- 2010 Davidson Fellow
- 2010 United States Physics Team
- 2010 American Mathematics Competition (AMC 12) Perfect Score, State Winner
- 2010 Intel International Science and Engineering Fair Karl Menger Award of Excellence, American Mathematical Society
- 2010 Society for Mathematical Biology Annual Meeting Presenter
- 2010 Mathematical Association of America MathFest Presenter
- 2010 American Regional Mathematics League Division A, Team National Second Place
- 2010 Orange County Science and Engineering Fair Senior Sweepstake Award
- 2010, 2009, 2008 USA Mathematics Olympiad Qualifier
- 2010, 2009 USA Chemistry Olympiad National Exam Qualifier
- 2010 Cum Laude Society, Harvard Book Prize, Rensselaer Polytechnic Institute Medal
- 2009 National Advanced Placement Scholar
- 2009, 2007 American Mathematics Competition (AMC 10) Perfect Score, State Winner
- 2009, 2008 The Mandelbrot Competition Second Place, Western Region
- 2009 California All-State Honor Orchestra
- 2009 California Interscholastic Federation (CIF) Soccer State Semifinals
- 2008 USA Mathematics Olympiad Summer Program (MOP) Participant
- 2006 Raytheon MathMovesU Merit Scholarship

Community Activities

Jonathan believes that age, gender and socio-economic background should not pose barriers to learning. He founded Orange County Math Circle (OCMC), www.ocmathcircle.org, a student-led organization dedicated to helping under-represented and under-privileged students. In three years OCMC has grown and reached thousands of students from various schools in Orange County.
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