MATHEMATICS OF PLANET EARTH

Public Lectures

Math 2013

**Medical Sciences Auditorium
1 King's College Circle**

June 24, 2012 • 2:30 p.m.

MOTILITY: MOLECULES, MECHANICS, MATHEMATICS AND MACHINES

L. Mahadevan, *Harvard University*

Life is almost synonymous with autonomous motion. The varied solutions invented by nature to accomplish movement beg the question: What general principles are used? Using examples that range from the dynamics of macromolecular springs and molecular motors in cells, to water driven movements in plants, and muscle driven movements in animals, I hope to show how understanding these special cases allows us to sharpen the general question while providing lessons for biomimetic machines. I will close with a description of some recent experimental and theoretical studies of the collective dynamics of bristlebots—simple autonomous movers that interact only sterically.

June 24, 2012 • 4:00 p.m.

PUZZLES IN THE PATTERNS OF PLAGUES

David Earn, *McMaster University*

Over the last century, there has been tremendous progress in understanding the transmission of infectious diseases in human populations. However, most historical outbreaks have not been studied in detail because data that might permit such investigations are buried in thousands of handwritten records. In recent years, my research group has digitized a large number of these historical records and begun to dissect the epidemic patterns. Modern computers allow us to visualize these patterns, and mathematical methods are helping us unravel the biological mechanisms that gave rise to the outbreaks. I will discuss our ongoing work, focussing on outbreaks of plague, from the Black Death in the 14th century to the Great Plague of London in the 17th century.

June 25, 2012 • 6:00 p.m.

USING MATHEMATICS TO COMBAT CLIMATE CHANGE

Ron Dembo, *Zerofootprint*

Climate change is probably the largest problem ever faced by mankind—we have literally arrived at a point where we could feasibly destroy our own habitat. So what role can mathematics play in helping address this challenge? I believe that mathematics will play a central role in the solutions that will help us adapt to the climate change already occurring and prevent runaway climate disaster. This talk touches on a few areas where math is playing a central role today and addresses the roles it might play. In some cases, as mathematicians, we will find ourselves married with psychologists to solve behavioral problems. We will be paired with farmers to solve agricultural problems. We will be minimizing energy and carbon in our supply chains. We will be building models for massive data analysis. We will be modeling the planet, and so on.

Held in conjunction with the Annual Meeting of the Canadian Applied and Industrial Mathematics Society, June 24–28, 2012

For more information, please visit: www.fields.utoronto.ca/programs/scientific/11-12/CAIMS_SCMAI