Department of Mathematics and Statistics

Colloquium Announcement

Friday, November 18 2016 | ARTS 214 @ 3:30 PM

Mathematical problems from cryobiology

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Abstract:

Cryopreservation is a foundational technology based in interdisciplinary fundamental science. It facilitates basic research through genetic resource repositories and cell-line distribution, enables animal and plant endangered species conservation, is crucial to billion dollar industries in animal and plant agriculture, and plays a critical role in veterinary and human transplantation and transfusion medicine. However, in spite of these myriad applications and nearly a century of research, few cells, fewer tissues, and no organs thrive after cryopreservation. My research is guided by the accepted central hypothesis that cryopreservation can be well understood as a series of heat and mass transport systems in non-ideal and non-physiologic conditions. The governing multiscale transport models and their controls provide a rich subject at the intersection of mathematical, engineering, and biological research. In this talk I frame the main problems of cryobiology, and discuss a collection of interesting mathematical problems, approaches, and solutions associated with cryopreservation. These include the solution of a 90 year old nonlinear transport model, applications of optimal control theory and inverse function theory, development and testing of cell-based models.

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