

Biotransport Special Issue

Important applications of bioheat and mass transfer include biopreservation (molecular, cellular and tissue) and thermal therapies (high temperature—laser, radiofrequency, microwave, high intensity ultrasound heating of cells and tissues, and low temperature—cryosurgery). These applications in turn support the growing fields of tissue engineering, cell therapeutics, drug stability and delivery, and minimally and non-invasive disease detection and treatment (i.e., cancer, cardiovascular and neural). The frontiers of biopreservation and thermal therapies are increasingly defined at the cellular and molecular level. This special issue focuses on these frontiers in areas of emphasis including thermodynamics (molecular and cellular stability), multi-scale mass transport (sub-cellular to tissue level transport), multi-scale heat transport (nanoparticle to bulk tissue heating), and extreme biology (anhydro and thermal physiology). The papers assembled in this special issue show the breadth of this activity with a series of invited reviews and original contributions in the area.

The special issue is organized into two main sections. The first section is composed of a number of invited reviews and the second section includes a series of contributed technical briefs and papers that are broadly in the current and evolving areas of emphasis in Biotransport. The reviews were invited to show activity both within and outside of ASME. First, Aksan et al. present a review entitled “Frontiers of Biotransport: Water Transport and Hydration,” which describes a molecular level approach to biopreservation and thermal therapies, followed by Shen et al. with a review entitled “Insights Into Crowding Effects on Protein Stability From a Coarse-Grained Model,” which probes changes in hydration of proteins relevant to biopreservation. In describing multi-scale mass transport, Pangburn et al. offer a review entitled “Peptide and Aptamer Functionalized Nanovectors for Targeted Delivery of Therapeutics,” and Masamoto and Tanishita present a review of challenges in measuring “Oxygen Transport in Brain Tissue.” Day et al. present a topical review of “Nanoparticles for Thermal Cancer Therapy,” and finally Grahn et al. present a review of a new paradigm for enhanced heat loss and control in “Heat Loss Through the Glabrous Skin Surfaces of Heavily Insulated, Heat-Stressed Individuals.” The remaining papers in the issue consist of both technical briefs and contributed full papers from a variety of groups showing the breadth of activity mostly within the “Biotransport” committee of ASME.

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The Guest Editors wish to thank all of the authors and reviewers for their participation and help making this special issue a success and hope that these papers will act to stimulate further work at the frontiers of our field. Finally, a special thanks to Dr. Michael Sacks, the Journal Editor, and ASME for their support and encouragement in the production of this special issue.

Sincerely the Guest Editors,

Alptekin Aksan
Ph.D.

Assistant Professor
e-mail: aaksan@me.umn.edu

Allison Hubel
Ph.D.

Associate Professor
e-mail: hubel001@umn.edu

John Bischof
Ph.D.

Professor
e-mail: bischof@umn.edu