**Society of Engineering Science 51st Annual Technical Meeting**

**1–3 October 2014**

**Purdue University, West Lafayette, Indiana, USA**

# Theoretical study of biological membrane response to temperature gradients at the single cell level

Atia, Lior, lioratia@technion.ac.il; Givli, Sefi, Technion, Israel

## ABSTRACT

Recent experimental studies provide evidence for the existence of a spatially nonuniform temperature field in living cells and in particular in their plasma membrane. These findings have led to the development of a new and exciting field: thermal biology at the single-cell level. This study examines theoretically a specific aspect of this field, i.e. how temperature gradients at the single cell level affect the phase behavior and geometry of heterogeneous membranes. We address this issue by utilizing the Onsager reciprocal relations combined with a simple model for a binary lipid mixture. We demonstrate that even small temperature variations along the membrane may introduce intriguing phenomena, such as phase separation above the critical temperature and unusual shape response. These results also suggest that the shape of a membrane can be manipulated by dynamically controlling the temperature field in its vicinity. Experimental verification of these results could mark the beginning of a new line of research in the field of biological membranes. We report our findings with the hope of inspiring others to perform such experiments.