Contribution ID: **83** Type: **keynote**

Ice Binding Proteins and Their Interaction With Ice Crystals

Thursday 11 January 2018 13:55 (45 minutes)

We investigate the interactions of ice-binding proteins, IBPs, with ice surfaces. In particular, we investigate the dynamic nature of the protein&ice interaction using fluorescence microscopy techniques combined with temperature-controlled microfluidic devices. The results show that binding of IBP to ice is irreversible and that the freezing temperature depression is sensitive to the time allowed for the proteins to accumulate on ice surfaces. This time sensitivity changes dramatically between different types of IBPs. Our results relate the dynamics and level of activity of various types of IBPs to their ability to bind to specific ice orientations, in particular to the basal plane of the ice. These results contribute to the understanding of the mechanisms by which IBPs act that will be critical for the successful use of IBP in cryobiological applications.

References:
Ice-Binding Proteins and Their Function, M. Bar-Dolev, I. Braslavsky, and P.L. Davies, Ann. Rev. Biochem. 2016
Cryoprotective effect of an ice-binding protein derived from Antarctic bacteria M. Mangiagalli, et al. FEBS 2016
Putting life on ice: bacteria that bind to frozen water, M. Bar-Dolev et al. R. Soc. Interface 2016
Microfluidic Cold-Finger Device for the Investigation of Ice-Binding Proteins, L. Haleva et al. Biophysics J, 2016
When are antifreeze proteins in solution essential for ice growth inhibition? R. Drori et al. Langmuir, 2015
Experimental Correlation between Thermal Hysteresis Activity and the Distance between Antifreeze Proteins on an Ice Surface, R. Drori, P.L. Davies and I. Braslavsky, RSC Adv., 2015
Ice-Binding Proteins that Accumulate on Different Ice Crystal Planes Produces Distinct Thermal Hysteresis Dynamics, Drori, R., et al., R. Soc. Interface 2014.
LabVIEW-operated Novel Nanoliter Osmometer for Ice Binding Protein Investigations, I. Braslavsky, and R Drori,
Journal of Visualized Experiments 2013.
Microfluidic experiments reveal that antifreeze proteins bound to ice crystals suffice to prevent their growth, Y Celik et al. PNAS 2013.
New Insights into Ice Growth and Melting Modifications by Antifreeze Proteins, M. Bar-Dolev et al. R. Soc. Interface 2012
Superheating of ice crystals in antifreeze protein solutions, Y Celik et al. PNAS 2010.

Supported by the European-Research-Council (ERC), the National-Science-Foundation (NSF), and the Israel-Science-Foundation (ISF).

Significance statement

Our results show that binding of IBPs to ice is irreversible and that the freezing temperature depression is sensitive to the time. These results contribute to the understanding of the mechanisms by which IBPs act that will be critical for the successful use of IBP in cryobiological applications.

Author: Prof. BRASLAVSKY, Ido (The Hebrew University of Jerusalem)

Presenter: Prof. BRASLAVSKY, Ido (The Hebrew University of Jerusalem)