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Proteins that bind ice and their control on freezing

Ice-binding proteins (IBPs) are proteins that include antifreeze proteins (AFPs) on the one hand and ice-nucleating proteins (INPs) on the other hand. IBPs are found in organisms that live under subfreezing temperature conditions. IBPs depress the freezing point of the body fluids that prevents freezing of the organism in supercooled conditions, inhibits ice recrystallization, enable adhesion to ice and promote nucleation depending on their size. We are investigating the interactions of IBPs with ice surfaces. For example, we study 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, that the freezing temperature depression is sensitive to the time allowed for the proteins to accumulate on ice surfaces, and the distance between the proteins to be down to few nanometres. Our studies also revealed that IBPs can function in temperatures as low as -100°C, thus suitable for cryopreservation. We also found that the small IBPs adhere to ice and inhibit its growth, while the big IBPs nucleate new ice crystals. These results contribute to an understanding of the mechanisms by which the nanometric IBPs control ice growth and are critical for the successful use of IBP in cryobiological applications.

Speaker Biography

Ido Braslavsky is currently working as an associate professor at The Hebrew University of Jerusalem, Israel. He is also the head of BSc Program in Biochemistry and Food Science, Institute of Biochemistry, Food Science, and Nutrition. He is also the member of the Governors of the Society of Cryobiology. His research mainly focuses on ice growth and its control. His PhD studies were on Ice Physics at the Israel Institute of Technology. After postdoc positions at the Weizmann Institute of Science and at Caltech, where he conducted biophysics studies on DNA –proteins interactions and developed single-molecule DNA sequencing method, he initiated a study on ice-binding proteins biophysics at Ohio University Physics department. In the last ten years, his group published more than 30 papers on ice-binding proteins and ice growth control. His research has been supported by the National-Science-Foundation (NSF) and the Israel-Science-Foundation (ISF) and the European-Research-Council (ERC).

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