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Identification of hyperactive AFPs, their production, purification, characterization, and testing their antifreeze properties.

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Psychrophiles produce antifreeze proteins which acts as a survival strategy for them in very low temperature especially in ice. Antifreeze protein (AFPs) inhibit ice crystal growth and lower the freezing point of water in a process that results in stabilizing ice crystals and inhibiting ice re-crystallization. Moreover it is still unclear how Antarctic bacterial AFPs interact with ice, so more research needs to be conducted to determine how these proteins behave at the water/ice interface. It is thought that pore water phase changes in a seasonally frozen ground are interconnected with a variety of regional and global problem, including damages to payments and foundations due to frost-heave and thawing. Using a biomimetic and bio-mediated approach, we propose a more sustainable way to control phase changes in pore fluids of seasonally frozen ground in order to mitigate these impacts and enhance the resiliency of civil infrastructure in cold regions. Research on this topic is focused on developing a freeze thaw resistant bio-mediated ground improvement technique that uses minimal energy and no chemicals, different types of AFPs control frost susceptibility by inhibiting the formation of ice and thus, controlling the volume change in soils. By enhancing the moisture storage in subsurface media and implementing this technique, this technique can be used to improve foundations for buildings, towers, pavements and many more structures as well as to promote sustainable next-generation foundation techniques.

Primary authors: TIKU, Aditya; Dr SANI, Rajesh

Presenter: TIKU, Aditya

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