

HOW CAN NANOPARTICLES IMPROVE CRYOPRESERVATION OF BIOLOGICAL SYSTEMS ?

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Abstract – This talk will provide an overview of several new breakthrough technologies that rely on nanoparticles to quickly and uniformly “nanowarm” cryopreserved biological systems. These and other approaches are being developed in our new NSF Engineering Research Center (ERC) for Advanced Technologies for the Preservation of Biological Systems (ATP-Bio). Our goal is to “stop biological time” and radically extend the ability to bank and transport cells, tissues, organoids, organs, and organisms. Plasmonic and magnetic nanoparticles can be designed to absorb and heat under specific electromagnetic light and radiofrequency fields. Using this principle, we address a long-standing barrier in the cryopreservation field to rewarm both fast and uniformly to avoid crystallization and cracking in cryopreserved vitrified systems. This work impacts both temporal and physical scales achieving rates of 10,000,000 °C/min in μL cellular or organismal droplets to 100s °C/min in L scale organ systems.

Bio: John Bischof works in the area of thermal bioengineering with a focus on biopreservation, thermal therapy, and nanomedicine. His awards include the ASME Van Mow Medal, and Fellowships in societies including Cryobiology, JSPS, ASME, and AIMBE. He has served as the President of the Society for Cryobiology and Chair of the Bioengineering Division of the ASME. Bischof obtained a B.S. in Bioengineering from U.C. Berkeley (UCB) in 1987, an M.S. from UCB and U.C. San Francisco in 1989, and a Ph.D. in Mechanical Engineering from UCB in 1992. After a Post-doctoral Fellowship at Harvard in the Center for Engineering in Medicine, he joined the University of Minnesota in 1993. John Bischof is a Distinguished McKnight University Professor, Kuhrmeyer Chair in the Department of Mechanical Engineering, and the Medtronic-Bakken Endowed Chair and Director of the Institute for Engineering in Medicine at the University of Minnesota. John Bischof is also Director of the NSF Engineering Research Center Advanced Technologies for Preservation of Biological Systems (ATP-Bio), which launched on September 1, 2020.