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Thermal conductivity measurements in vitrifying solutions combined with synthetic ice modulators

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Thermal conductivity of the cryoprotective agents (CPAs) cocktail DP6 (3M DMSO and 3M propylene glycol) is measured in this study, in combination with a battery of synthetic ice modulators (SIMs). The DP6 is investigated as a vitrification promoting cocktail, while the SIMs are added to suppress ice growth and, thereby, to widen the thermal conditions applicable to cryopreservation by vitrification. Key SIMs under investigation are 6% 1,3 Cyclohexanediol, 6% 2,3 Butanediol, and 12% PEG400. In addition, the thermal effects of EuroCollins as a vehicle solution on the CPA-SIM cocktail are also investigated. Thermal properties data for CPAs and SIMs are key ingredients for simulations of cryopreservation by vitrification of large-size specimens. Such simulations can be used for thermal analyses of experimental results, as well as for the design of new solutions and protocols which favor glass formation. A typical thermal protocol for thermal conductivity measurements in the current study combines a cooling rate in the range of -2.5°C/min to -50°C/min, a storage temperature at either -130°C or -180°C, and rewarming in an average rate of 3°C/min above glass transition. Thermal conductivity measurements are taken during rewarming, using a hot wire technique. Vitrification was verified by means of a scanning cryomacroscope-a proprietary device used for visualization of large-scale cryopreservation. In general, the thermal conductivity during vitrification monotonically and moderately decreases with the decreasing temperature, while during crystallization the thermal conductivity increases with decreasing temperature.

Biography

Lili E Ehrlich is a PhD student in the Department of Mechanical Engineering at Carnegie Mellon University, and is advised by Professor Jonathan A Malen and Professor Yoed Rabin. She has completed her BS from The Cooper Union, New York, NY. and MS from Carnegie Mellon University, Pittsburgh, PA.

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