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Xeropreservation (drying without freezing) as the viable alternative to lyophilization (freeze-drying)

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Biostabilization (a.k.a. biopreservation) is a process that leads to cessation of the basic chemical and biological reactions so the bio samples can be pooled and stored (biobanked) for long time. There are 5 basics ways of achieving long-term storage, which all essentially lead to vitrification of cells. Three of them, namely slow freezing, equilibrium and kinetic vitrification are cryogenic, i.e., they require cryogenic (far below above 0°C) stable storage of the bio samples. The other two: freeze-drying lyophilization (LPh), and vacuum/air flow drying at temperatures above 0°C (xeropreservation, XP), don't require cryogenic storage if sufficiently high amount of water has been removed. In this presentation, we compare lyophilization vs. xeropreservation and show that XP is far more advantageous both from its far lesser damage, especially for cry sensitive items like mammalian cells, and from the practical point of view of its scalability and ability to stably store at substantially higher than 0°C temperatures, which is beneficial for many applications. We will also present the glass transition temperature (Tg) diagram and show that the Tg of the sample cannot be higher than the highest temperature of drying in the cycle to the contrary to very often reported otherwise. The sources of the error in the estimation Tg will be discussed. In regards to the scalability of XP, the three major approaches, namely drying in a thin layer, spraying and foaming will be compared. We will then show the advantages of foaming over the other two.

Recent Publications:

1. Katkov II and Levine F (2004) Prediction of the glass transition temperature of water solutions: comparison of different models. Cryobiology 49:62-82.
2. Katkov II et al. (2006) Low- and high- temperature vitrification as a new approach to biostabilization of reproductive and progenitor cells. International Journal of Refrigeration 29:346-357.
3. Katkov II (2014) Stopping biological clocks: The science and art of biopreservation. BioProcess International 12(4):42-52.

Biography

Igor L Katkov is a trained biophysicist with 30+ years of experience in cryobiology and cryogenic engineering. His last years of research have been focused on the fundamental aspects of kinetic vitrification (K-VF) as well on designing the practical system for K-VF KrioBlast™ (in cooperation with V F Bolyukh). Currently, the Head of the Laboratory of the Amorphous state at the Belgorod National Research University BelSU, Russia. He has recently accepted a Professor level position as the Head of the Laboratory of Cryobiology at the V I Kulakov Research Center of Obstetrics, Gynecology and Perinatology (RCGOP), Moscow, Russia and Chief Scientific Officer of Celltronix, San Diego, CA, USA.

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