Igor L Katkov, J Biotechnol Biomater 2018, Volume 8
DOI: 10.4172/2155-952X-C5-099

21st European Biotechnology Congress

October 11-12, 2018 | Moscow, Russia

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Stopping biological time: Science and art of biostabilization

Biostabilization (a.k.a. biopreservation) is a process that leads to cessation of the basic chemical and biological reactions so the biosamples 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, namely: slow freezing (SF), equilibrium vitrification (E-VF), kinetic vitrification (K-VF), freeze-drying (lyophilization) and vacuum/air flow drying at temperatures above 0°C (xeropreservation). Different combinations of the 5 basic biopreservation technologies such a preliminary drying before cryogenic slow freezing or vitrification is also possible. Author will discuss a phase diagram that shows all 5 basic ways of biostabilization and will discuss pros and cons of all approaches. A special emphasis will be put on the kinetic vitrification as it does not require the high concentrations of (or does not need at all) potentially toxic and osmotically damaging exogenous permeable intracellular vitrificants (also called cryoprotectants). Author will also present KrioBlast-2, a pilot version of the KrioBlast™ platform for cryopreservation by K-VF. Preliminary experiments on K-VF of human pluripotent stem cells and spermatozoa, which showed an equally excellent (80-90% of the untreated control) will be also discussed. A more advanced version KrioBlast-3 will be discussed in the concurrent presentation.

Recent Publications

1. Katkov II, Bolyukh A F, Chernetsov O A, Dudin P I et al. (2012) Kinetic Vitrification of Spermatozoa of Vertebrates: What Can We Learn from Nature? In: Current Frontiers in Cryobiology, Eds: I I Katkov. DOI: 10.5772/34784.
2. Katkov II (2014) Stopping biological clocks: The science and art of biopreservation. BioProcess International 12(4):42-52.
3. Katkov II, Bolyukh V F and Sukhikh G T (2017) KrioBlastTM as a new technology of hyper-fast cryopreservation of cells and tissues, Part I. Thermodynamic aspects and potential applications in reproductive and regenerative medicine. Bulletin of Experimental Biology and Medicine 164:230-235.

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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