# Laser warming of cryopreserved samples at the water absorption wavelength: From global to local approaches

**K. Rolle***

*Institute of Automation and Electrometry SB RAS*

**E-mail: krolle@iae.nsk.su*

**DOI:10.31868/RFL.2024.123**

Rewarming of biological samples from the cryopreserved state needs to be rapid enough to prevent ice crystal growth, which is the main mechanism compromising viability. The highest warming rates can be achieved with the help of lasers, however, common welding lasers that have been used up to now do not match the wavelength of water absorption. Moreover, laser warming protocols are thought to be most efficient for samples > 0.2 [mm], typically oocytes of aquatic species; these however are often distinguished by high fecundity and hence, potentially high demands on laser repetition rates. In the latter regard, fiber lasers seem preferable for operation at the water absorption wavelength, as they combine high duty cycles with ease of attaining the relevant near-infrared band by means of Raman conversion [1]. Beyond their interest for a global ('whole sample') approach, however, lasers for use at these wavelengths can also enable targeted ('local') reheating of samples. This treatment can performed in cold storage before distribution to an end user, who can hence dispense with specialized laser equipment. We will present our recent work [2] on how such a strategy can be used to reverse eutectic crystallization in frozen samples and thereby relax constraints on the warming rate. We will also discuss prospects of fiber lasers both for achieving crystallization reversal itself and for verification in a laboratory context.

This work was supported by the Russian Science Foundation (Grant No. 21-72-30024).

## References

[1] E.A. Evmenova, A.G. Kuznetsov et al, *Bull. Lebedev Phys. Inst.* **50 (S12)**, S1383-S1390 (2023)

[2] K. Rolle, K.A. Okotrub et al, *J. Chem. Phys.* **160**, 184506 (2024)