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Warming of Cryopreserved Biomaterials using Laser Assisted Gold Nanorods

Technology No. 20160148

IP Status: US Patent Issued # 11,311,008

Gold nanorods and coupled laser heating improves cryopreservation

A new platform technology uses laser assisted gold nanorods (GNRs) to warm cryopreserved zebrafish embryos, germplasm and other millimeter-sized tissues and biomaterials. Biocompatible gold nanorods absorb pulsed laser energy to generate rapid and uniform warming (up to 14,000,000 °C/min) in frozen biomaterials. Laser assisted GNR heating is the only method able to generate such high heating rates uniformly inside a millimeter-sized embryo, and it can also be used in cryopreserving a myriad of other germplasm, model systems, and other similar and smaller sized biomaterials into which GNR can be disbursed. This technology can positively impact translational medicine (which uses embryos as a genetic model of disease), embryology and toxicity as well as aquaculture and biodiversity preservation. The high warming rates allow much lower concentrations of cryoprotectants to be used, thereby reducing cryoprotectant toxicity and opening the way for a myriad of different biomaterials to be preserved and used in the future.

Increased efficiency, uniform of heating and low toxicity

Ice formation during warming of zebrafish embryos is the most challenging barrier to successful cryopreservation. Research has shown that ice formation during rewarming can be minimized with high heating rates (up to14,000,000 °C/minute). Currently, no reproducible methods exist that can warm vitrified zebrafish embryos (and other similar sized cells or organisms) this rapidly or uniformly. A common warming method uses India ink (carbon black) as a laser absorber, but this ink is toxic when injected inside zebrafish embryos. The GNRs used in this technology are ten times more efficient for heating—and heating uniformly across an embryo—without toxicity.

BENEFITS AND FEATURES:

- Gold nanorod (GNRs)
- Laser assisted gold GNR heating
- Cryopreserved zebrafish embryos, germplasm, model systems and other millimeter-sized tissues and biomaterials
- Rapid (up to14,000,000 °C/min) and uniform warming; faster speeds may be possible in the future
- Lower concentrations of cryoprotectants needed
- Non-toxic

APPLICATIONS:

- Zebrafish embryos
- Germplasm centers; germplasm stock centers and banking
- Research
- Biopsy preservation
- Translational medicine (which uses embryos as a genetic model of disease)
- Embryology and toxicity
- Model systems
- Aquaculture and biodiversity preservation

Phase of Development - Proof of concept. Live zebrafish embryos, human dermal fibroblasts cells and coral larvae have been recovered using the process.

Researchers

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Publications

Gold Nanorod Induced Warming of Embryos from the Cryogenic State Enhances Viability
ACS Nano, 2017, 11 (8), pp 7869–7878

Interested in Licensing?

The University relies on industry partners to scale up technologies to large enough production capacity for commercial purposes. The license is available for this technology and would be for the sale, manufacture or use of products claimed by the issued patents. Please contact us to share your business needs and technical interest in this technology and if you are interested in licensing the technology for further research and development.

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