CRYO2025 ABSTRACT CATEGORIES AND TOPICS

Please see separate abstract instructions for information on how to format your abstract for submission.

1. REGENERATIVE AND TRANSFUSION MEDICINE AND CRYOSURGERY

KEYWORDS: organ perfusion and preservation/vitrification, tissue-engineered constructs, cartilage regeneration, blood preservation, cryosurgery

DESCRIPTION: Freezing protocols play a central role in medicine, i.e., cryopreservation in regenerative and transfusion medicine, and cryosurgery using ultralow temperatures to ablate tissues. Regenerative medicine focuses on treatments to heal and restore malfunctioning tissues and organs. In contrast, transfusion medicine focuses explicitly on donor blood transfusions to treat anemia and trauma patients and to assist in surgery procedures.

2. CELL AND GENE THERAPIES

KEYWORDS: translational medicine: from the lab to the clinic; stem cells, CAR T cells

DESCRIPTION: Cell therapies aim to treat diseases by restoring or altering cells in patients, whereas gene therapy aims to treat diseases by replacing, inactivating, or introducing genes in or ex vivo. Here, cryopreservation strategies are needed to bridge the time between cell culturing and/or modification and therapeutic use. Moreover, this involves making ready-to-use products with minimal processing in the clinic.

3. REPRODUCTIVE MEDICINE AND FERTILITY PRESERVATION

KEYWORDS: preservation of sperm, oocytes, embryos, testicular and ovarian tissue, reproductive technologies

DESCRIPTION: Preserving gametes and reproductive tissues secures gene reserves, which play a central role in animal breeding and human reproductive medicine. Work in this field includes cryopreservation and vitrification approaches for sperm, oocytes, testicular and ovarian tissues; studies on osmotic properties and oxidative damage; protective mechanisms; and associated reproductive technologies like selection and fertilization approaches.

4. BIOMEDICAL ENGINEERING

KEYWORDS: mass and heat transfer analysis, mathematical modeling, microfluidics, bioprinting, robotics, devices/construction

DESCRIPTION: Using biomedical engineering approaches, rational design, and high-throughput preservation strategies can be achieved. Insights in water and protectant fluxes in materials, as well as temperature gradients during cooling and warming, allow the development of simulation models. Moreover, novel constructed devices can ease and automate the various processing steps in preservation processing.

5. DRYING TECHNOLOGIES

KEYWORDS: freeze-drying, convective drying, rehydration, liposomes, pharmaceutics, vaccines, foods

DESCRIPTION: If biologics can be dried, this would facilitate room temperature storage, avoiding cold chain logistics associated with cryopreservation. Drying technologies include freeze-drying, vacuum- and spin-drying. Protective formulations, sample packaging and storage conditions significantly impact sample stability. Examples of dried biologics include therapeutics, vaccines, cell products, and tissue-engineered constructs. Further applications include samples for cohort studies and disease diagnostics.

6. COOLING/WARMING TECHNOLOGIES

KEYWORDS: supercooling, controlled rate freezing, isochoric freezing, nano-warming, electromagnetic warming

DESCRIPTION: The application of defined cooling and warming protocols is essential for reproducible cryopreservation outcomes. This involves using and developing controlled rate freezers, ice nucleation and growth control, and emerging technologies like supercooling and isochoric freezing. Furthermore, novel technologies include nano- and electromagnetic warming approaches for the reconstitution of preserved samples.

7. BIOPHYSICS AND CHEMICAL ENGINEERING

KEYWORDS: water/ice biophysics, membranes, liquid-liquid phase separation, natural deep eutectic solvents, novel cryoprotective agents, ice recrystallization inhibitors

DESCRIPTION: Interactions between solvent and solutes change during phase and state transitions and upon molecular crowding, which have implications for cryopreservation design and outcome. Important topics include controlling ice crystal size and growth, e.g., via natural antifreeze proteins and chemically synthesized ice recrystallization inhibitor molecules. Furthermore, in the case of drying, liquid-liquid phase separations of biomacromolecules (e.g., polypeptides and nucleic acids) and the formation of membraneless organelles may play a role.

8. NATURAL ADAPTATION TO STRESS AND SURVIVAL IN EXTREME ENVIRONMENTS

KEYWORDS: anhydrobiosis/desiccation tolerance, cold/freezing tolerance, osmolytes, plants, extremophiles

DESCRIPTION: Anhydrobiosis is the remarkable ability of certain organisms (e.g., tardigrades, nematodes, rotifers, crustaceans, and plants) to survive almost complete dehydration. Natural cold adaptation mechanisms include freezing avoidance and tolerance strategies in animals and plants. A reduction in water availability is a characteristic of both challenges and requires a coordinated series of events to prevent osmotic and oxidative damage while maintaining the native structure of biomolecules and cellular structures.

9. CHALLENGES OF CRYOPRESERVING COMPLEX ORGANS AND ORGANISMS

KEYWORDS: organoids/culture systems, organ preservation, model organisms (drosophila, aquatic embryos/larvae, amphibians, corals)

DESCRIPTION: Complex organs and organisms have larger dimensions and more diverse compositions, which makes them more challenging to cryopreserve. Homogeneous loading of protective agents is difficult due to size and natural diffusion barriers, while toxicity effects must be avoided. Furthermore, temperature gradients during cooling and warming are an issue. Zebrafish and drosophila are widely used as model organisms serving as genetic resources. Preservation of aquatic species, amphibians, and corals is needed to combat biodiversity decline.

10. BIOBANKING AND BIODIVERSITY PRESERVATION

KEYWORDS: biorepositories, gene and agricultural reserves, regulations and ethical considerations

DESCRIPTION: Biobanks and repositories come in various forms, playing an essential role in conserving biospecimens. Examples include seed banks, culture collections, genetic/biological resource centers, and human and veterinary biobanks. Specimens vary from whole organisms to tissue, cells, and extracts. This requires developing custom-designed preservation strategies and involves standard operating procedures, regulations, and ethical considerations.