

# Monday Morning, December 9, 2024

## Biomaterial Surfaces & Interfaces

### Room Naupaka Salon 5 - Session BI-MoM

#### Biomaterials/Interfaces - 3D Systems

Moderator: Jenny Malmstrom, University of Auckland

10:20am **BI-MoM-8 Development of Joint Organoids for the Study of Tissue Integration and Immune Responses**, *Gabriella Lindberg, M. Hofmann, N. Shchotkina, S. South, N. Willett*, University of Oregon **INVITED**

Despite significant advancements in the design of cell-instructive hydrogels to help repair damaged joint tissues with low metabolic activity, such as cartilage, challenges persist in translating these technologies to clinical applications. This presentation will address two key clinical hurdles in cartilage tissue engineering, focusing on articular conditions, particularly osteoarthritis. The first challenge involves insufficient lateral integration between implanted tissue engineered samples and host cartilage, limiting structural integrity and long-term success. The second challenge is reproducing whole-joint disease conditions *in vitro* with patient-specific inflammatory conditions to accelerate the study of immunomodulatory hydrogels therapies.

To tackle these long-standing translational challenges, we've firstly designed a 3D-model to study tissue integration at the surface between mature cartilage tissues. Herein, we designed ECM-hydrogels that enhance integrative cartilage repair strategies using Vitreous humor, Lysyl-oxidase-like-2, and copper to bridge the two tissue surfaces. Secondly, we have employed modern biofabrication tools, including microfluidic technologies and volumetric printing, to recapitulate dynamic interactions between inflammatory cells and diseased cartilage tissues in the joint space, especially at the surface of the tissue. Utilizing our biobank of human cells and tissue samples together with these organo-typic models has allowed us to study demographical factors (age and sex) that may contribute to differences in OA disease pathogenesis and recovery. Cellular health, tissue formation, multiplexed proteomics assays, and spatial transcriptomics have been used to analyze the biological outcomes across our hydrogel platforms.

This series of studies allowed us to develop hydrogels proficient to guide cartilage repair across a variety patient-centric condition. Ultimately, this talk will highlight some of the important advances in hydrogel design for more clinically-relevant cartilage repair and precision medicine, including integrative hydrogels and immunomodulatory hydrogels together with biofabricated 3D-models to inform regenerative needs in catabolic joint environments.

11:00am **BI-MoM-10 Metrology of 3D Cell Culture Systems**, *Sally McArthur*, Deakin University, Australia

In developing 3D cell culture systems for evaluating biomaterials we need to create the matching metrology systems that are reproducible as well as giving us insights into the cells, matrices and biomaterials responses. This talk will explore the challenges, solutions and remaining issues associated with creating versatile, scalable and measurable systems.

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