Video Article

October 2015 - This Month in JoVE: tuberculosis infection modeling, telemetric temperature pills, bioengineered cartilage, and 3D neuronal networks

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Abstract

Here's a look at what's coming up in the October 2015 issue of JoVE: The Journal of Visualized Experiments.

In JoVE Immunology & Infection, we feature a method for studying tuberculosis (TB), which affects 9 million people and causes 1.5 million deaths every year. The bacteria that cause TB spread through the air and set up infection in the lungs, and may spread to other organs. TB infection is a complex process and difficult to model in vitro. Braian *et al.* present a novel 3D human lung tissue model that recapitulates the dynamics that occur during TB infection, and provides a useful tool for studying this deadly infectious disease.

In JoVE Medicine, 80% of the energy used for muscle contraction is released as heat, so physical activity can increase the body's core temperature. If core temperature gets too high, it may decrease physical performance or cause heat-related disorders. So it's important to monitor core temperature during prolonged and strenuous exercise. Bongers *et al.* describe a telemetric temperature pill that can be swallowed so it noninvasively measures gastrointestinal temperature during exercise. This pill is useful for monitoring core temperatures in laboratory and field-based settings.

In JoVE Bioengineering, articular cartilage is particularly difficult to repair, and remains an unmet challenge for biomedical engineers. Promising approaches for regenerating cartilage include cell-based therapies. And this month, Smeriglio *et al.* describe a method for isolating articular chondrocytes and fabricating biomimetic hydrogels. These provide physiologically relevant microenvironments for chondrocyte expansion and maturation. The engineered cartilage tissue can then be assessed for regenerative potential.

In JoVE Neuroscience, *in vitro* recordings of electrophysiological activity are mostly done in two-dimensional (2D) neuronal networks. This month, Tedesco *et al.* present a novel 3D platform that couples neuronal networks to planar micro-electrode arrays (MEAs). Scaffolds made of glass microbeads allow neurons to form complex 3D assemblies. The greater morphological complexity allows a wider range of electrophysiological patterns compared to standard 2D networks, and more closely approximates *in vivo* neural networks.

You've just had a sneak peek of the October 2015 issue of JoVE. Visit the website to see the full-length articles, plus many more, in JoVE: The Journal of Visualized Experiments.

Video Link

The video component of this article can be found at https://www.jove.com/video/5750/

Protocol

Interfacing 3D Engineered Neuronal Cultures to Micro-Electrode Arrays: An Innovative *In Vitro* Experimental Model

Mariateresa Tedesco[1], Monica Frega[1,2], Sergio Martinoia[1], Mattia Pesce[3], Paolo Massobrio[1]

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In this work, a novel experimental model in which 3D neuronal cultures are coupled to planar Micro-Electrode Arrays (MEAs) is presented. 3D networks are built by seeding neurons in a scaffold made up of glass microbeads on which neurons grow and form interconnected 3D structures.

3D Hydrogel Scaffolds for Articular Chondrocyte Culture and Cartilage Generation

Piera Smeriglio*[1], Janice H. Lai*[1,2], Fan Yang[1,3], Nidhi Bhutani[1]

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Cartilage repair represents an unmet medical challenge and cell-based approaches to engineer human articular cartilage are a promising solution. Here, we describe three-dimensional (3D) biomimetic hydrogels as an ideal tool for the expansion and maturation of human articular chondrocytes.

A 3D Human Lung Tissue Model for Functional Studies on *Mycobacterium tuberculosis* Infection

Clara Braian[1], Mattias Svensson[2], Susanna Brighenti[2], Maria Lerm[1], Venkata R. Parasa[1,2]

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Human tuberculosis infection is a complex process, which is difficult to model *in vitro*. Here we describe a novel 3D human lung tissue model that recapitulates the dynamics that occur during infection, including the migration of immune cells and early granuloma formation in a physiological environment.

Using an Ingestible Telemetric Temperature Pill to Assess Gastrointestinal Temperature during Exercise

Coen C.W.G. Bongers, Maria T.E. Hopman, Thijs M.H. Eijsvogels

Radboud Institute for Health Sciences, Department of Physiology, **Radboud University Medical Center**

This study describes an accurate, reliable and non-invasive technique to continuously measure gastrointestinal temperature during exercise. The ingestible telemetric temperature pill is suitable to measure gastrointestinal temperature in laboratory settings as well as in field based settings.

Disclosures

No conflicts of interest declared.

