Video Article

January 2015: This Month in JoVE - Introducing JoVE Developmental Biology

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Abstract

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

JoVE has been revolutionizing scientific publishing since 2006, when we released our first video articles in JoVE Biology. We've grown over the years-adding sections in Neuroscience, Immunology & Infection, Clinical & Translational Medicine, Bioengineering, Applied Physics, Behavior, Chemistry, and Environment.

We are now pleased to introduce a new addition to the JoVE family: JoVE Development, which covers the entire field of developmental biology from the underlying genetic and epigenetic mechanisms to the growth and differentiation of single cells into organs and whole organisms.

In many species, developmental processes offer clues about evolution. For example, the European lancelet (*Branchiostoma lanceolatum*) has many features of modern fish, but it doesn't have a backbone-so it's emerging as a useful model for studying the divergence of vertebrates from invertebrate ancestors. Hirsinger *et al.* have developed a method for visualizing embryonic development in the European lancelet. They inject oocytes with mRNAs that encode fluorescent proteins, and following fertilization, developmental processes can be visualized in vivo.

Development also explores interactions between different cell types, and these interactions are fundamental for repairing and regenerating damaged or diseased tissues, like muscle. To study these interactions, Agley *et al.* take human skeletal muscle biopsies then purify and culture different cell types. They also characterize the cells using immunocytochemical methods that can be adapted to other cell types.

One of the most exciting topics in developmental biology is the engineering of stem cells for experimental and clinical applications. This month we feature two stem cell protocols: Zielins *et al.* describe the isolation and purification of human adipose-derived stromal cells for bone engineering, and Lei *et al.* demonstrate how to differentiate embryonic stem cells into embryoid bodies, and then derive cardiac progenitor cells that further differentiate into cardiomyocytes and smooth muscle cells.

Above all, developmental processes are fascinating to visualize, and JoVE Development features techniques for optimizing real-time imaging, such as this protocol for live-imaging of the *Drosophila* pupal eye. Using image-stabilization techniques, Hellerman *et al.* compensate for tissue movement and uneven topology to enhance the visualization of the developing *Drosophila* eye.

You've just had a sneak peek of JoVE's new Development section in the January 2015 issue. Visit the website to see the full-length articles plus our other scientific sections in JoVE: The Journal of Visualized Experiments.

Video Link

The video component of this article can be found at http://www.jove.com/video/5637/

Protocol

Derivation of Cardiac Progenitor Cells from Embryonic Stem Cells

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In this protocol, derivation of cardiac progenitor cells from both mouse and human embryonic stem cells will be illustrated. A major strategy in this protocol is to enrich cardiac progenitor cells with flow cytometry using fluorescent reporters engineered into the embryonic stem cell lines.

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Expression of Fluorescent Proteins in *Branchiostoma lanceolatum* by mRNA Injection into Unfertilized Oocytes

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We report here the robust and efficient expression of fluorescent proteins after mRNA injection into unfertilized oocytes of *Branchiostoma lanceolatum*. The development of the microinjection technique in this basal chordate will pave the way for far-reaching technical innovations in this emerging model system, including *in vivo* imaging and gene-specific manipulations.

Isolation and Quantitative Immunocytochemical Characterization of Primary Myogenic Cells and Fibroblasts from Human Skeletal Muscle

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The main adherent cell types derived from human muscle are myogenic cells and fibroblasts. Here, cell populations are enriched using magnetic-activated cell sorting based on the CD56 antigen. Subsequent immunolabelling with specific antibodies and use of image analysis techniques allows quantification of cytoplasmic and nuclear characteristics in individual cells.

Isolation and Enrichment of Human Adipose-derived Stromal Cells for Enhanced Osteogenesis

Elizabeth R. Zielins*[1], Ruth Tevlin*[1], Michael S. Hu[1], Michael T. Chung[1], Adrian McArdle[1], Kevin J. Paik[1], David Atashroo[1], Christopher R. Duldulao[1], Anna Luan[1], Kshemendra Senarath-Yapa[1], Graham G. Walmsley[1], Taylor Wearda[1], Michael T. Longaker[1,3], Derrick C. Wan[1]

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The transcriptional heterogeneity within human adipose-derived stromal cells can be defined on the single cell level using cell surface markers and osteogenic genes. We describe a protocol utilizing flow cytometry for the isolation of cell subpopulations with increased osteogenic potential, which may be used to enhance craniofacial skeletal reconstruction.

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