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

Ieng Lam Lei1, Lei Bu2, Zhong Wang1

1Cardiac Surgery, University of Michigan, 2Leon H Charney Division of Cardiology, New York University School of Medicine

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

Estelle Hirsinger¹, João Emanuel Carvalho², Christine Chevalier¹,³, Georges Lutfalla⁵, Jean-François Nicolas¹, Nadine Peyriéras⁴, Michael Schubert²

¹Département de Biologie du Développement et Cellules Souches, Institut Pasteur, ²Laboratoire de Biologie du Développement de Villefranche-sur-Mer (UMR7009 CNRS/UPMC Univ Paris 06), Sorbonne Universités, ³Equipe Epigenetic Control of Normal and Pathological Hematopoiesis, Centre de Recherche en Cancérologie de Marseille, ⁴Plateforme BioEmergences IBISA FBI, CNRS-NED, Institut de Neurobiologie Alfred Fessard, ⁵Unité de Dynamique des Interactions Membranaires Normales et Pathologiques, CNRS UMR5235/DAA/ cc107/Université Montpellier II

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

Chibeza C. Agley¹,², Anthea M. Rowlerson¹, Cristiana P. Velloso¹, Norman L. Lazarus¹, Stephen D. R. Harridge¹

¹Centre of Human and Aerospace Physiological Sciences, King’s College London, ²Wellcome Trust-Medical Research Council, Cambridge Stem Cell Institute

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. Hu¹, Michael T. Chung¹, Adrian McArdle¹, Kevin J. Paik¹, David Atashroo¹, Christopher R. Duldulao¹, Anna Luan¹, Kshemendra Senarath-Yapa¹, Graham G. Walmsley¹, Taylor Wearda¹, Michael T. Longaker¹,³, Derrick C. Wan¹

¹Hagey Laboratory for Pediatric Regenerative Medicine, Department of Surgery, Division of Plastic and Reconstructive Surgery, Stanford University School of Medicine, ²Stem Cell and Biomaterials Engineering Laboratory, Department of Bioengineering, Stanford University School of Medicine, ³Institute for Stem Cell Biology and Regenerative Medicine, Stanford University

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.