Video Article

February 2016 - This Month in JoVE: Photoconvertible Proteins, Gold Nanoparticles, PET Principles, and Bone Marrow Microenvironments

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Abstract

Here's a look at what's coming up in the February 2016 issue of JoVE: The Journal of Visualized Experiments.

In JoVE Developmental Biology, the transparent, rapidly developing zebrafish embryo is ideal for visualizing developmental processes. When cells of interest are labeled with fluorescent photoconvertible proteins, they allow precise tracking of defined structures-highlighting specific cells while leaving other transgenic cells in the dark. Beretta et al. have established the photoswitchable monomeric orange (PSmOrange) system for zebrafish. This protein's orange-to-red spectrum allows it to visible in existing transgenic lines expressing green fluorescent protein (GFP). Microinjection of nuclear-targeted PSmOrange mRNA labels all cell nuclei with orange/red fluorescence, and targeted photoconversion switches its emission spectrum to far red. The quantum efficiency and stability of PSmOrange makes it a superb cell-tracking tool for living zebrafish during embryonic development and disease.

In JoVE Chemistry, few materials have found as many uses in so many diverse fields as gold nanoparticles. Their applications range from biological sensors to radio frequency-based cancer treatments. Gold nanoparticles are valued for their unique structural, optical and electronic properties. These special attributes caught the interest of Oliver Smithies, who won the Nobel Prize in Physiology or Medicine in 2007. This month, he and his colleagues describe a simple method for producing highly stable oligomeric clusters of gold nanoparticles, and present models that can predict particle size with great accuracy.

In JoVE Engineering, we look at the principles of positron emission tomography (PET), a non-invasive technique for imaging the body's inner tissues and organs. Montaño-Zetina and Villalobos-Mora present a guide for constructing a simple, homemade PET system for fully characterizing its basic working principles. This prototype demonstrates the primary functions of PET, and serves as an elegant model for teaching its principles to the academic public.

In JoVE Medicine, it is well established that the bone marrow microenvironment provides a haven for hematopoietic diseases. This month, Slone et al. use cell types from the bone marrow niche in an *in vitro* co-culture model. This supports the generation of a subpopulation of chemoresistant tumor cells. These calls can be used to investigate the underlying pathways of tumor development and to test novel therapeutic strategies.

You've just had a sneak peek of the February 2016 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 http://www.jove.com/video/5769/

Protocol

A Simple Method for the Size Controlled Synthesis of Stable Oligomeric Clusters of Gold Nanoparticles under Ambient Conditions

Marlon Lawrence[1], Anze Testen[1], Tilen Koklic[2], Oliver Smithies[1]

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We describe a simple method for producing highly stable oligomeric clusters of gold nanoparticles via the reduction of chloroauric acid ($HAuCl_4$) with sodium thiocyanate (NaSCN). The oligoclusters have a narrow size distribution and can be produced with a wide range of sizes and surface coats.

A Basic Positron Emission Tomography System Constructed to Locate a Radioactive Source in a Bi-dimensional Space

Luis Manuel Montaño-Zetina, Omar Villalobos-Mora

Physics Department, **Centro de Investigacion y de Estudios Avanzados del IPN (Cinvestav)**

We present a simple but well-constructed Positron Emission Tomography (PET) system and elucidate its basic working principles. The goal of this protocol is to guide the user in constructing and testing a simple PET system.

Tracking Cells in GFP-transgenic Zebrafish Using the Photoconvertible PSmOrange System

Carlo A. Beretta[1,2,3], Nicolas Dross[2], Ulrike Engel[2], Matthias Carl[1]

[1]Medical Faculty Mannheim, Department of Cell and Molecular Biology, **Heidelberg University**, [2]COS and Nikon Imaging Center at the University of Heidelberg, **Heidelberg University**, [3]University of Heidelberg, **Excellenzcluster CellNetworks**

We established the photoconvertible PSmOrange system as a powerful, straight-forward and cost inexpensive tool for *in vivo* cell tracking in GFP transgenic backgrounds. This protocol describes its application in the zebrafish model system.

Modeling Chemotherapy Resistant Leukemia *In Vitro*

William L. Slone*[1], Blake S. Moses*[1], Rebecca Evans[1], Debbie Piktel[1], Karen H. Martin[1,2], William Petros[1], Michael Craig[1], Laura F. Gibson[1,3]

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The current report summarizes a protocol that can be utilized to model the influence of the bone marrow microenvironment niche on leukemic cells with emphasis placed on enrichment of the most chemoresistant subpopulation.

Disclosures

No conflicts of interest declared.

