Video Article

JoVE 2013: The Year in Review

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Abstract

In this Year in Review, we take a look at some of the biggest moments from the year 2013 in JoVE: The Journal of Visualized Experiments.

January featured two articles that used optical methods to selectively control individual neurons genetically encoded with light-sensitive proteins. These optogenetic techniques were used to study how specific neurons control certain behaviors, such as the escape response in fruit flies (de Vries and Clandinin) and the touch response in zebrafish larvae (Palanca and Sagasti).

In February we launched JoVE Chemistry, with subjects ranging from complex biochemistry, to assay development, to chemical engineering, and organic synthesis. This section also includes the design and preparation of materials for advanced biomedical applications.

In March, in the Applied Physics section, Truscott *et al.* demonstrated techniques for three-dimensional imaging of fluid flow fields, such as the airflow passing over a set of synthetic vocal folds, and other pressing questions in the area of fluid mechanics.

April brought the launch of JoVE Science Education, a revolutionary video database dedicated to teaching the fundamentals of scientific research. including General Laboratory Techniques, Basic Methods in Cellular and Molecular Biology, and Model Organisms like yeast, *Drosophila* and *C. elegans*.

In the May issue, Mata-Martínez *et al.* showed several fluorometric techniques to monitor Ca^{2+} dynamics in human sperm. Sample collection was not included in this procedure for obvious reasons, so viewers will just have to improvise.

June brought another new section: JoVE Behavior, which explores various behavioral aspects of humans and animals. These include addiction, learning & memory, social interaction, and emotion.

July's Bioengineering section showcased the incredible ability of nucleic acids to self-assemble into two-dimensional and three-dimensional structures, with Ben-Ishay, *et al.* designing DNA origami nanorobots that harness the remarkable features of DNA.

In August, in the JoVE Behavior section, Morris *et al.* presented a method for studying the brain's response to cigarette smoking.

In September, Gfrerer *et al.* used zebrafish to study cleft palate and related developmental malformations, observing the formation of craniofacial structures through time-lapse confocal microscopy.

October was when we launched JoVE Environment, a multidisciplinary section devoted to research methods in areas like biofuels, oceanography, atmospheric sciences, and natural resources.

In November's Clinical and Translational Medicine section, Ebinger *et al.* featured the STEMO, or stroke emergency mobile, an ambulance with specialized equipment to allow vital diagnostics and interventions to be performed during patient transport.

In December, from JoVE Applied Physics, a technique called digital fringe projection was demonstrated by Ekstrand *et al.* to provide dense, superfast 3D measurements of dynamic surfaces.

This Year in Review was just a sampling of more than 700 video articles that JoVE offered in 2013. Browse the JoVE archives for thousands of other videos, and come back each week to see brand-new material in JoVE: The Journal of Visualized Experiments.

Video Link

The video component of this article can be found at https://www.jove.com/video/5199/

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Protocol

Optogenetic Stimulation of Escape Behavior in *Drosophila melanogaster*

Saskia E.J. de Vries, Tom Clandinin

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Genetically encoded optogenetic tools enable noninvasive manipulation of specific neurons in the *Drosophila* brain. Such tools can identify neurons whose activation is sufficient to elicit or suppress particular behaviors. Here we present a method for activating Channelrhodopsin2 that is expressed in targeted neurons in freely walking flies.

Optogenetic Activation of Zebrafish Somatosensory Neurons using ChEF-tdTomato

Ana Marie S. Palanca, Alvaro Sagasti

Department of Molecular, Cell, and Developmental Biology, **University of California, Los Angeles**

Optogenetic techniques have made it possible to study the contribution of specific neurons to behavior. We describe a method in larval zebrafish for activating single somatosensory neurons expressing a channelrhodopsin variant (ChEF) with a diode-pumped solid state (DPSS) laser and recording the elicited behaviors with a high-speed video camera.

Determining 3D Flow Fields via Multi-camera Light Field Imaging

Tadd T. Truscott[1], Jesse Belden[2], Joseph R. Nielson[1], David J. Daily[1], Scott L. Thomson[1]

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A technique for performing quantitative three-dimensional (3D) imaging for a range of fluid flows is presented. Using concepts from the area of Light Field Imaging, we reconstruct 3D volumes from arrays of images. Our 3D results span a broad range including velocity fields and multi-phase bubble size distributions.

Measuring Intracellular Ca^{2+} Changes in Human Sperm using Four Techniques: Conventional Fluorometry, Stopped Flow Fluorometry, Flow Cytometry and Single Cell Imaging

Esperanza Mata-Martínez[1], Omar José[1], Paulina Torres-Rodríguez[1], Alejandra Solís-López[1], Ana A. Sánchez-Tusie[1], Yoloxochitl Sánchez-Guevara[1], Marcela B. Treviño[2], Claudia L. Treviño[1]

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Intracellular Ca^{2+} dynamics are very important in sperm physiology and Ca^{2+}-sensitive fluorescent dyes constitute a versatile tool to study them. Population experiments (fluorometry and stopped flow fluorometry) and single cell experiments (flow cytometry and single cell imaging) are used to track spatio-temporal [Ca^{2+}] changes in human sperm cells.

Designing a Bio-responsive Robot from DNA Origami

Eldad Ben-Ishay, Almogit Abu-Horowitz, Ido Bachelet

Faculty of Life Sciences and the Institute for Nanotechnology & Advanced Materials, **Bar-Ilan University**

DNA origami is a powerful method for fabricating precise nanoscale objects by programming the self-assembly of DNA molecules. Here, we describe how DNA origami can be utilized to design a robotic robot capable of sensing biological cues and responding by shape shifting, subsequently relayed to a desired effect.

Creating Dynamic Images of Short-lived Dopamine Fluctuations with lp-ntPET: Dopamine Movies of Cigarette Smoking

Evan D. Morris[1,2,3,4], Su Jin Kim[1,3], Jenna M. Sullivan[1,3,4], Shuo Wang[3,4], Marc D. Normandin[5], Cristian C. Constantinescu[6], Kelly P. Cosgrove[1,2,3]

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We present a novel PET imaging approach for capturing dopamine fluctuations induced by cigarette smoking. Subjects smoke in the PET scanner. Dynamic PET images are modeled voxel-by-voxel in time by lp-ntPET, which includes a time-varying dopamine term. The results are 'movies' of dopamine fluctuations in the striatum during smoking.

Visualization of Craniofacial Development in the sox10: kaede Transgenic Zebrafish Line Using Time-lapse Confocal Microscopy

Lisa Gfrerer, Max Dougherty, Eric C. Liao

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Center for Regenerative Medicine, **Massachusetts General Hospital**

Visualization of experimental data has become a key element in presenting results to the scientific community. Generation of live time-lapse recording of growing embryos contributes to better presentation and understanding of complex developmental processes. This protocol is a step-by-step guide to cell labeling via photoconversion of kaede protein in zebrafish.

Disclosures

No conflicts of interest declared.

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