

Video Article

December 2014: JoVE's Year in Review

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Abstract

In this Year in Review, we showcase some of our favorite video articles of the year 2014 in [JoVE: The Journal of Visualized Experiments](#).

In [January](#), [JoVE Chemistry](#) revisited one of the most famous experiments of the 20th Century. Stanley Miller and his thesis advisor, Harold Urey, made scientific history in 1953 when they showed that under the right conditions, simple compounds in a flask could spontaneously form the building blocks of life. Over six decades later, [Parker et al.](#) have demonstrated how to recreate the classic Miller-Urey experiment-combining water with various gases, and subjecting the mixture to sparks to simulate Earth's conditions 3 ½ billion years ago. The resulting primordial soup contains various amino acids that are fundamental to life on earth.

[February's Neuroscience](#) section featured the nematode worm *C. elegans*. This simple organism is easy to manipulate genetically. And it's sensitive to various compounds, so [Hao and Buttner](#) [scientists can] use them in chemical genetic screens to study the mechanisms of antipsychotic drugs.

In [March](#), [JoVE Clinical and Translational Medicine](#) had an article on amyotrophic lateral sclerosis (ALS). This neurodegenerative disease affected baseball legend Lou Gehrig, and in 2014, inspired millions of people to dump ice buckets on their heads to raise money and awareness for ALS. An early sign of ALS is weakness in specific hand muscles, so [Menon and Vucic](#) showed how recording motor responses from hand muscle groups can help diagnose this disease.

[April's](#) edition of [JoVE Environment](#) featured a technique for expressing recombinant genes in plants. [Mattozzi et al.](#) delivered special expression constructs using a gene gun to specifically target recombinant genes to different subcellular organelles in plants.

In [May](#), [JoVE Clinical & Translational Medicine](#), [Thompson et al.](#) used coordinate mapping to analyze the pharyngeal phase of swallowing, a technique that can be useful for studying swallowing disorders.

In [June](#), [JoVE Applied Physics](#) took us back in time again with a protocol that approximates conditions in the early Solar System. [Blum et al.](#) examined collision forces between particles, which can aggregate over hundreds of millions of years to form planets.

In the [July](#) edition of [JoVE Behavior](#), [Tung et al.](#) demonstrated standard behavioral tests for noninvasively assessing balance performance in mice.

In [August](#), [Malide et al.](#) demonstrated in [JoVE Biology](#) how to label hematopoietic precursor cells with different fluorescent markers so the cells can be tracked as they differentiate and engraft into bone marrow after transplantation.

In our [September](#) issue, [JoVE Bioengineering](#) featured innovative methods for treating the cornea, the clear front window of the eye. [Ortega et al.](#) engineered membranes that could potentially regenerate the corneal epithelium and preserve vision in certain eye diseases.

In [October](#), [JoVE Immunology & Infection](#) featured a technique for analyzing glycoprotein spikes on viral surfaces, which many viruses use to penetrate host cells. [Huiskonen et al.](#) use a computational approach to study the precise, 3D structures of these spikes, which can guide the design of antiviral drugs and vaccines.

[November's](#) edition of [JoVE Biology](#) took [flow cytometry](#) to a whole new level with a protocol that can be performed in space. [Phipps et al.](#) demonstrate the procedure on a parabolic flight, also known as a "vomit comet," which creates a weightless environment and presents a whole new set of challenges to laboratory research.

And coming up in [December](#), we pinch off 2014 with an article describing fecal transplantation. When stool from a healthy donor is transferred to a patient infected with *Clostridium difficile* through a standard colonoscopy, it is a highly effective therapy for infections that don't respond to other treatments.

This Year in Review was just a sampling of [more than 900 video articles](#) that JoVE produced for 2014. 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 <http://www.jove.com/video/5613/>

Protocol

Fecal Microbiota Transplantation via Colonoscopy for Recurrent *C. difficile* Infection

Jessica R. Allegretti, Joshua R. Korzenik, Matthew J. Hamilton

Division of Gastroenterology, Hepatology and Endoscopy, **Brigham and Women's Hospital**

Fecal Microbiota Transplantation via colonoscopy is a safe and effective treatment for recurrent and refractory *C. difficile* infection. A systematic approach to patient and donor screening, preparation of stool, and delivery of the stool during the colonoscopy will maximize therapeutic success.

Conducting Miller-Urey Experiments

Eric T. Parker¹, James H. Cleaves^{2,3}, Aaron S. Burton⁴, Daniel P. Glavin⁵, Jason P. Dworkin⁵, Manshui Zhou¹, Jeffrey L. Bada⁶, Facundo M. Fernández¹

¹School of Chemistry and Biochemistry, **Georgia Institute of Technology**, ²Earth-Life Science Institute, **Tokyo Institute of Technology**, ³**Institute for Advanced Study**, ⁴Astromaterials Research and Exploration Science Directorate, **NASA Johnson Space Center**, ⁵Goddard Center for Astrobiology, **NASA Goddard Space Flight Center**, ⁶Geosciences Research Division, Scripps Institution of Oceanography, **University of California at San Diego**

The Miller-Urey experiment was a pioneering study regarding the abiotic synthesis of organic compounds with possible relevance to the origins of life. Simple gases were introduced into a glass apparatus and subjected to an electric discharge, simulating the effects of lightning in the primordial Earth's atmosphere-ocean system. The experiment was conducted for one week, after which, the samples collected from it were analyzed for the chemical building blocks of life.

Methods for Studying the Mechanisms of Action of Antipsychotic Drugs in *Caenorhabditis elegans*

Limin Hao^{1,2}, Edgar A. Buttner^{1,2}

¹Department of Psychiatry, **Harvard Medical School**, ²Mailman Research Center, **McLean Hospital**

Approaches for testing the effects of antipsychotic drugs (APDs) in *Caenorhabditis elegans* are demonstrated. Assays are described for testing drug effects on development and viability and on pharyngeal pumping rate. These methods are also applicable for pharmacogenetic experiments with drug classes other than APDs.

Utility of Dissociated Intrinsic Hand Muscle Atrophy in the Diagnosis of Amyotrophic Lateral Sclerosis

Parvathi Menon^{1,2}, Steve Vucic^{1,2}

¹Department of Neurology, **Westmead Hospital**, ²Sydney Medical School, **University of Sydney, Australia**

Dissociated atrophy of intrinsic hand muscles, termed the split hand, appears to be a specific feature of amyotrophic lateral sclerosis (ALS). Consequently, a novel neurodiagnostic test, termed the **split hand index**, was developed to quantify the clinical phenomenon of the split hand, which differentiated ALS from mimic disorders.

Transient Gene Expression in Tobacco using Gibson Assembly and the Gene Gun

Matthew D. Mattozzi^{1,2}, Mathias J. Voges^{1,2,3}, Pamela A. Silver^{1,2}, Jeffrey C. Way^{1,2}

¹Synthetic Biology Platform, Wyss Institute for Biologically Inspired Engineering, **Harvard University**, ²Department of Systems Biology, **Harvard Medical School**, ³Department of Biotechnology, **Delft University of Technology**

This work describes a novel method for selectively targeting subcellular organelles in plants, assayed using the BioRad Gene Gun.

Coordinate Mapping of Hyolaryngeal Mechanics in Swallowing

Thomas Z. Thompson¹, Farres Obeidin¹, Alisa A. Davidoff², Cody L. Hightower¹, Christopher Z. Johnson¹, Sonya L. Rice¹, Rebecca-Lyn Sokolove¹, Brandon K. Taylor¹, John M. Tuck¹, William G. Pearson, Jr.^{3,4}

¹Medical College of Georgia, **Georgia Regents University**, ²Department of Communicative Sciences and Disorders, **New York University**, ³Department of Cellular Biology & Anatomy, **Georgia Regents University**, ⁴Department of Otolaryngology, **Georgia Regents University**

Coordinate mapping is a method of documenting salient features of hyolaryngeal biomechanics in the pharyngeal phase of swallowing. This methodology uses image analysis software to record coordinates of anatomical landmarks. These coordinates are imported into an excel macro and translated into kinematic variables of interest useful in dysphagia research.

Laboratory Drop Towers for the Experimental Simulation of Dust-aggregate Collisions in the Early Solar System

Jürgen Blum, Eike Beitz, Mohtashim Bukhari, Bastian Gundlach, Jan-Hendrik Hagemann, Daniel Heißelmann, Stefan Kothe, Rainer Schräpler, Ingo von Borstel, René Weidling

Institut für Geophysik und extraterrestrische Physik, **Technische Universität Braunschweig**

We present a technique to achieve low-velocity to intermediate-velocity collisions between fragile dust aggregates in the laboratory. For this purpose, two vacuum drop-tower setups have been developed that allow collision velocities between <0.01 and ~10 m/sec. The collision events are recorded by high-speed imaging.

Behavioral Assessment of the Aging Mouse Vestibular System

Victoria W. K. Tung¹, Thomas J. Burton², Edward Dababneh¹, Stephanie L. Quail¹, Aaron J. Camp¹

¹Discipline of Biomedical Science, **University of Sydney**, ²The Bosch Institute Animal Behavioural Facility, **University of Sydney**

Motor control and balance performance are known to deteriorate with age. This paper presents a number of standard noninvasive behavioral tests with the addition of a simple rotary stimulus to challenge the vestibular system and show changes in balance performance in a murine model of aging.

In vivo Clonal Tracking of Hematopoietic Stem and Progenitor Cells Marked by Five Fluorescent Proteins using Confocal and Multiphoton Microscopy

Daniela Malide¹, Jean-Yves Métais², Cynthia E. Dunbar²

¹Light Microscopy Core Facility, **NHLBI/NIH**, ²Hematology Branch, **NHLBI/NIH**

Combinatorial 5 fluorescent proteins marking of hematopoietic stem and progenitor cells allows *in vivo* clonal tracking via confocal and two-photon microscopy, providing insights into bone marrow hematopoietic architecture during regeneration. This method allows non-invasive fate mapping of spectrally-coded HSPCs-derived cells in intact tissues for extensive periods of time following transplantation.

Combination of Microstereolithography and Electrospinning to Produce Membranes Equipped with Niches for Corneal Regeneration

Ílida Ortega¹, Farshid Sefat¹, Pallavi Deshpande¹, Thomas Paterson¹, Charanya Ramachandran³, Anthony J. Ryan², Sheila MacNeil¹, Frederik Claeysens¹

¹Department of Materials Science and Engineering, **University of Sheffield**, ²Department of Chemistry, **University of Sheffield**, ³**L. V. Prasad Eye Institute**

We report a technique for the fabrication of micropockets within electrospun membranes in which to study cell behavior. Specifically, we describe a combination of microstereolithography and electrospinning for the production of PLGA (Poly(lactide-co-glycolide)) corneal biomaterial devices equipped with microfeatures.

Averaging of Viral Envelope Glycoprotein Spikes from Electron Cryotomography Reconstructions using Jsubtomo

Juha T. Huiskonen, Marie-Laure Parsy, Sai Li, David Bitto, Max Renner, Thomas A. Bowden

Oxford Particle Imaging Centre, Division of Structural Biology, Wellcome Trust Centre for Human Genetics, **University of Oxford**

An approach is presented for determining structures of viral membrane glycoprotein complexes using a combination of electron cryotomography and sub-tomogram averaging with the computational package Jsubtomo.

Reduced-gravity Environment Hardware Demonstrations of a Prototype Miniaturized Flow Cytometer and Companion Microfluidic Mixing Technology

William S. Phipps^{*1}, Zhizhong Yin^{*1}, Candice Bae¹, Julia Z. Sharpe¹, Andrew M. Bishara², Emily S. Nelson³, Aaron S. Weaver³, Daniel Brown⁴, Terri L. McKay³, DeVon Griffin³, Eugene Y. Chan¹

¹**DNA Medicine Institute**, ²**Harvard Medical School**, ³**NASA Glenn Research Center**, ⁴**ZIN Technologies**

Spaceflight blood diagnostics need innovation. Few demonstrations have been published illustrating in-flight, reduced-gravity health diagnostic technology. Here we present a method for construction and operation of a parabolic flight test rig for a prototype point-of-care flow-cytometry design, with components and preparation strategies adaptable to other setups.

Disclosures

No conflicts of interest declared.