

Video Article

June 2014: This Month in JoVE - 3D Virtual Navigation in the Human Brain, Simulation of Planet Formation, and Bioprinting Cultured Cartilage Grafts

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Abstract

Here's a look at what's coming up in the [June 2014 issue](#) of [JoVE: The Journal of Visualized Experiments](#).

The human brain has been called the next frontier of scientific discovery. In coming years scientists will greatly advance our understanding of how the brain works, leading to new methods of diagnosis, prevention, and intervention for many neurological disorders. [This month in JoVE](#) we feature two new techniques that can help scientists navigate through uncharted territories of the human brain.

In the [Clinical & Translational Medicine](#) section, [DaSilva et al.](#) analyze changes in neurological processes that occur during migraine headaches. They scan the brain of a migraine patient using two methods: magnetic resonance imaging (MRI), which uses the magnetic properties of water molecules to image living tissues; and positron emission tomography (PET), which detects gamma rays emitted by a radionuclide tracer. The neuroimaging data are displayed in a special format, so through special shutter glasses, users can see the images in a three-dimensional, virtual-reality environment. This technique allows real-time interaction and navigation through the brains of patients with migraines, and can be applied to other neurological disorders such as neuralgia, depression, and addiction.

In the [Behavior](#) section, [Bathelt et al.](#) map the sources of cognitive activities in a child's cerebral cortex. Brain activity is assessed with electroencephalography (EEG), which measures electrical changes caused by neural activity, and the sources of the EEG recordings are mapped using head models based on MRI scans. These maps show different cortical regions of activation in response to different cognitive stimuli. This technique can help scientists understand the foundations of complex cognitive skills in the developing brain.

In [JoVE Applied Physics](#) we examine a very large developing system in a protocol that approximates conditions in the early Solar System so scientists can examine how planets form. Planet formation is thought to begin when microscopic dust particles accumulate to form fragile aggregates. Over a few thousand years, these aggregates can grow to around 1cm in diameter. When they collide, these aggregates may bounce off each other or break apart into fragments-but if the collision velocity is just right, the aggregates will stick to each other, gradually forming planets over millions of years. [Blum et al.](#) developed laboratory setups that generate the collision velocities thought to promote planet formation, and record these collisions with high-speed imaging. With these studies, they hope to shed light on the physical forces that created our Solar System.

In the [bioengineering](#) field, 3D printing is an exciting technology with many potential biomedical applications ranging from printing microfluidic arrays for cellular assays to producing physical models of imaging data. It can also be used to engineer actual tissue structures, which [Cui et al.](#) demonstrate this month in [JoVE Bioengineering](#). They convert a commercial inkjet printer into a bioprinter that can build tissue structures out of cells and biomaterials. They use this technology to print cultured cartilage grafts, which show excellent cell viability and production of proteoglycan, a component of connective tissue. This technique holds the potential to repair and regenerate multiple tissue types.

You've just had a sneak peek of the [June 2014 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 <https://www.jove.com/video/5407/>

Protocol

Human Cartilage Tissue Fabrication Using Three-dimensional Inkjet Printing Technology

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The methods described in this paper show how to convert a commercial inkjet printer into a bioprinter with simultaneous UV polymerization. The printer is capable of constructing 3D tissue structure with cells and biomaterials. The study demonstrated here constructed a 3D neocartilage.

Cortical Source Analysis of High-Density EEG Recordings in Children

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In recent years, there has been increasing interest in estimating the cortical sources of scalp measured electrical activity for cognitive neuroscience experiments. This article describes how high density EEG is acquired and how recordings are processed for cortical source estimation in children from the age of 2 years at the London Baby Lab.

3D-Neuronavigation *In Vivo* Through a Patient's Brain During a Spontaneous Migraine Headache

Alexandre F. DaSilva^{*1,2,3}, Thiago D. Nascimento^{*1}, Tiffany Love^{*3}, Marcos F. DosSantos¹, Ilkka K. Martikainen^{1,3}, Chelsea M. Cumming³, Misty DeBoer¹, Sarah R. Lucas¹, MaryCatherine A. Bender¹, Robert A. Koeppe⁴, Theodore Hall⁵, Sean Petty⁵, Eric Maslowski⁵, Yolanda R. Smith⁶, Jon-Kar Zubieta³

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In this study, the authors report for the first time a novel 3D-Immersive & Interactive Neuronavigation (3D-IIN) through the impact of a spontaneous migraine headache attack in the μ -opioid system of a patient's brain *in vivo*.

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

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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.

Disclosures

No conflicts of interest declared.