Video Article

September 2015 - This Month in JoVE: Measuring Greenhouse Gases and Herbicide Resistance, Bioengineering Bone, and Analyzing the Neuromuscular Junction with Virtual Reality

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URL: http://www.jove.com/video/5748
DOI: doi:10.3791/5748

Keywords: This Month in JoVE, Issue 103

Date Published: 9/1/2015

Citation: Chao, W., Kolski-Andreaco, A. September 2015 - This Month in JoVE: Measuring Greenhouse Gases and Herbicide Resistance, Bioengineering Bone, and Analyzing the Neuromuscular Junction with Virtual Reality. *J. Vis. Exp.* (103), e5748, doi:10.3791/5748 (2015).

Abstract

Here's a look at what's coming up in the September 2015 issue of JoVE: The Journal of Visualized Experiments.

In JoVE Environment, we've had a pretty warm summer in the northern hemisphere, so we can't help but think about all the greenhouse gases in our atmosphere that keep our planet nice and warm. These days, livestock are a major source of greenhouse gas emissions, especially methane. Livestock contribute anywhere from 7 to 18% of global emissions-depending on who you ask. Naturally, climate scientists are interested in controlling enteric methane from livestock. This requires accurate and precise measurement techniques, so Hristov *et al.* present a method using the Automated Head-Chamber System (AHCS), which monitors methane (CH_4) and carbon dioxide (CO_2) mass fluxes from the breath of ruminant animals (e.g., cattle). This system produces repeatable and accurate emission results, and can help efforts to curb greenhouse gas emissions.

In JoVE Environment, we're also concerned about herbicide resistance in weeds, which poses a serious threat to food and fiber production. Plants can gain resistance to herbicides through genetic mutations or through enhanced activity of enzymes that metabolize and detoxify chemicals. In order to determine rates of herbicide metabolism in certain weeds, Ma *et al.* developed an excised leaf assay, which allows them to take experiments from the greenhouse into the lab so they can perform radiolabeled herbicide experiments more efficiently. As more and more plants become resistant to herbicides, this method will be useful for investigating the metabolic basis of herbicide resistance.

In JoVE Bioengineering, one of the ultimate goals of tissue engineering is to regenerate large bone defects using synthetic scaffolds or templates. Most available scaffolds don't allow appreciable cell infiltration or distribution to achieve significant bone regeneration, so Oh *et al.* have developed a highly porous bone-like template with micro-channels and nanopores. Cells can be seeded into the biogenic templates through capillary action, and grow to confluence within days. This concept can help advance the repair of large bone defects.

In JoVE Behavior, the human neuromuscular junction can be studied using a variety of noninvasive techniques, including electromyography (EMG), 3D motion capture, and transcranial magnetic stimulation. This month, Talkington *et al.* add the unique aspect of virtual reality to this test battery, and describe a customizable circuit that synchronizes data sampled from all of these techniques.

You've just had a sneak peek of the September 2015 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/5748/

Protocol

Multifunctional Setup for Studying Human Motor Control Using Transcranial Magnetic Stimulation, Electromyography, Motion Capture, and Virtual Reality

William J. Talkington, Bradley S. Pollard, Erienne V. Olesh, Valeriya Gritsenko

Department of Human Performance and Applied Exercise Science, Division of Physical Therapy, **West Virginia University**

Transcranial magnetic stimulation, electromyography, and 3D motion capture are commonly used non-invasive techniques for investigating neuromuscular function in humans. In this paper, we describe a protocol that synchronously samples data generated by all three of these tools along with the unique addition of virtual reality stimulus presentation and feedback.

The Use of an Automated System (GreenFeed) to Monitor Enteric Methane and Carbon Dioxide Emissions from Ruminant Animals

Alexander Hristov[1], Joon Oh[1], Fabio Giallongo[1], Tyler Frederick[1], Holley Weeks[1], Patrick R Zimmerman[2], Michael T. Harper[1], Rada A Hristova[3], R. Scott Zimmerman[2], Antonio F. Branco[4]

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Accuracy and precision of the techniques used to measure methane emissions from ruminant animals are critically important for the success of greenhouse gas mitigation efforts. This manuscript describes the principles and operation of an automated system to monitor methane and carbon dioxide mass fluxes from the breath of ruminant animals.

Measuring Rates of Herbicide Metabolism in Dicot Weeds with an Excised Leaf Assay

Rong Ma, Joshua J. Skelton, Dean E. Riechers

Department of Crop Science, **University of Illinois**

This manuscript describes how herbicide metabolism rates can be effectively quantified with excised leaves from a dicot weed, thereby reducing variability and removing any possible confounding effects of herbicide uptake or translocation typically observed in whole-plant assays.

Distinctive Capillary Action by Micro-channels in Bone-like Templates Can Enhance Recruitment of Cells for Restoration of Large Bony Defect

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A step-by-step generic process to create a bone-like template with engineered micro-channels is presented. High absorption and retention capabilities of the template are demonstrated by capillary action via micro-channels.

Disclosures

No conflicts of interest declared.

