

Video Article

August 2014: This Month in JoVE - Chemical Sensing Robots, Tracking Blood Cell Development, Rodents on the Treadmill, and Simulating Urban Runoff

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Abstract

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

The ability to detect scent is the most sensitive of all animal senses. Insects have highly sensitive olfactory systems, and rely on odor perception for many daily activities. Certain species (e.g., moths) can find their mates over hundreds of meters using olfaction. Like dogs, insects can be trained to sniff out explosives, illegal drugs, and even diseases in humans and plants.

In insects, olfactory perception starts in the antennae, and this month in [JoVE Neuroscience](#), [Martinez et al.](#) combine the powers of moth antennae with robots to create olfactory searching machines. This whole-insect setup can provide a day's worth of stable recordings, and can distinguish individual odor pulses much better than artificial chemical sensors. This robotic platform may not only advance our knowledge of olfactory coding, but may also improve strategies for automated olfactory searches.

In [JoVE Biology](#), we examine the production of blood cells, a process called hematopoiesis. All the different blood cells are derived from hematopoietic stem and progenitor cells (HSPCs). [Malide et al.](#) use 5 different fluorescent markers, delivered by lentiviral vectors, to label different cells. Using confocal/two-photon hybrid microscopy, they can then noninvasively track the cells as they undergo hematopoiesis in vivo. This produces high-resolution 3D images for studying tissue regeneration and other applications in regenerative medicine.

In some behavioral studies, electric footshock is used to study fear conditioning in mice. It is also used in exercise studies to force the mice to run. But it's possible that the shock-induced stress can confound the results. This month in [JoVE Behavior](#), [Connor et al.](#) demonstrate a non-invasive method of studying exercise endurance in mice. They allow the mice to become familiar with the treadmill apparatus, and use gentle tapping to encourage sedentary mice to keep running. Soon the mice will voluntarily run by themselves. This procedure takes the stress and fear out of experimental exercise for mice. Who knows - maybe this can be applied to sedentary humans some day.

In [JoVE Environment](#), a major concern with the increasing urban landscape is poor irrigation of runoff water, which can release unwanted chemicals and sediments into the environment. This month, [Wherley et al.](#) design and construct a 1000m² landscape facility with individual plots of grass that simulate home lawns. An irrigation system allows runoff samples to be collected and analyzed for volume and chemical composition. Facilities like this can help guide best practices to minimize the environmental impact of urban living.

You've just had a sneak peek of the [August 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 <http://www.jove.com/video/5431/>

Protocol

Using Insect Electroantennogram Sensors on Autonomous Robots for Olfactory Searches

Martinez, D., Arhidi, L., Demondion, E., Masson, J. B., Lucas, P.

UMR 7503, Laboratoire Lorrain de Recherche en Informatique et ses Applications (LORIA), Centre National de la Recherche Scientifique (CNRS), UMR 1392 IEEs-Paris, Institut d'Ecologie et des Sciences de l'Environnement de Paris, Physics of Biological Systems, Institut Pasteur

We describe a protocol for using insect antennae in the form of electroantennograms (EAGs) on autonomous robots. Our experimental design allows stable recordings within a day and resolves individual odor patches up to 10 Hz. The efficiency of EAG sensors for olfactory searches is demonstrated in driving a robot toward an odor source.

Assessment of Murine Exercise Endurance Without the Use of a Shock Grid: An Alternative to Forced Exercise

Conner, J. D., Wolden-Hanson, T., Quinn, L. S.

Research Service, VA Puget Sound Health Care System, Seattle Institute for Biomedical and Clinical Research, Division of Gerontology and Geriatric Medicine, Department of Medicine, University of Washington, Geriatric Research, Education, and Clinical Center, VA Puget Sound Health Care System

A method to assess exercise endurance in laboratory mice without the use of a shock grid is demonstrated. This method is a humane refinement that can decrease the confounding effects of stress on experimental parameters.

Design and Construction of an Urban Runoff Research Facility

Wherley, B. G., White, R. H., McInnes, K. J., Fontanier, C. H., Thomas, J. C., Aitkenhead-Peterson, J. A., et al.

Soil and Crop Sciences Department, Texas A&M University, The Scotts Miracle-Gro Company

This paper describes the design, construction, and function of a 1,000 m² facility containing 24 individual 33.6 m² field plots equipped for measuring total runoff volumes with time and collection of runoff subsamples at selected intervals for quantification of chemical constituents in the runoff water from simulated home lawns.

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

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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.

Disclosures

No conflicts of interest declared.