Concepts and Methods for Controlling Chemical Reaction Kinetics and Interaction Time in Large Systems
Technology #18377

Applications

The ability to finely control kinetics and molecular interactions in large systems can be applied to any sort of experiment where proteome analysis is invaluable. It is especially useful in any experiment where preservation of the structural and antigenic integrity of the tissue is crucial.

Problem Addressed

Many proteome analysis technologies, such as array tomography, that are used to label and visualize 3D pieces of tissue do not allow for the joint measurement of many molecular and anatomical traits in the same piece of tissue, or are difficult to implement in most labs. In recent years, tissue-clearing techniques, such as CLARITY, have enabled scientists to pass each piece of tissue through a few rounds of labeling, in order to visualize the interactions between different cell types and molecules in the same sample. However, the tissue loses structural integrity upon repeated rounds of relabeling. A simple tissue-clearing technique that preserves the structural integrity of tissue after many rounds of relabeling will greatly improve upon current 3D tissue imaging techniques.

Technology

This invention comprises the SWITCH system (System-Wide control of Interaction Time and kinetics of Chemicals), to tightly control a broad range of chemical reactions in tissue processing and proteomic labeling. A SWITCH-On buffer facilitates chemical reactions between exogenous chemicals and endogenous biomolecules, and a SWITCH-Off buffer suppresses the reactions. These buffers can be used easily to turn tissue into a transparent, heat- and chemical-resistant, architecturally preserved, molecularly labeled structure without needing to fix it with traditional methods. SWITCH can be used to control the rate at which probes penetrate through tissue to label the molecules of interest; thus, it can be used to clear very thick tissue, such as an entire rat brain. The SWITCH system has been used to successfully pass postmortem human tissue through a minimum of 22 rounds of SWITCH labeling with more than 100 targets, all visualized at subcellular resolution. In addition, it has also been used successfully label myelinated axons in intact mouse brain hemispheres. Finally, it has been used successfully to label 1-mm-thick mouse brain blocks with antibodies. The fact that this system is inexpensive and experimentally simple allows for its implementation in most labs.

Advantages

- Simple, scalable, broadly-applicable tissue proteome labeling system
- High-dimensional, multi-scale labeling
- Subcellular resolution of dyes, antibodies, and myelination
- Easy implementation in most labs
- Virtually unlimited rounds of relabeling possible without disrupting the structural integrity of tissue

Categories For This Invention:

Life Sciences
Biotechnology
Proteomics
Research Tools
Protein & Protein Chemistry

 Intellectual Property:

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Publications:

Simple, Scalable Proteomic Imaging for High-Dimensional Profiling of Intact Systems
Cell
December 3, 2015

External Links:

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http://www.chunglab.org/

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