Expansion Technology
Technology #16900-17875-18127-18129-18384

Applications

This invention is an optical imaging method for biological specimens based on physically expanding the specimen.

Problems Addressed

Microscopy has facilitated the discovery of many biological insights by optically magnifying images of structures in fixed cells and tissues. However, the resolution to a light microscope is limited. The existing super-resolution techniques are limited in three aspects: imaging depth, throughput, and complexity/cost. High resolution in conventional imaging techniques is only achieved in thin layers. Additionally, in super-resolution imaging techniques based on single-molecule imaging, the throughput is not high enough to image a large specimen, such as an entire organ. Lastly, super-resolution imaging techniques generally require relatively expansive and complex optical systems. The Inventors addressed these issues by developing Expansion Microscopy, which physically expands the specimen, resulting in physical magnification.

Technology

The Inventors have developed a method for optically imaging biological specimens with a resolution better than predicted by the classical diffraction limit, based on physically expanding the specimen. Expansion microscopy involves embedding a tissue into a swellable material that is formed by infusing the tissue with reactive monomers which then undergo polymerization. Expansion microscopy can be performed repeatedly on the same sample, essentially enabling arbitrary magnification. Additionally, proteins, nucleic acids, and other biomolecule types can be visualized within the specimen by labeling them with fluorophores before or after expansion. To adapt the expansion microscopy technology in the clinical setting, the Inventors have designed variants of expansion microscopy that incorporate de-paraffinization, antigen retrieval and aggressive protease digestion into a comprehensive workflow to expand various common clinical specimens. De-paraffinization and antigen retrieval address the recovery of archived clinical samples for immunohistochemistry.

Advantages

- Swollen material with embedded biological specimen can be imaged on any optical microscope
- Allows for effective imaging of features below the classical diffraction limit
- Provides a feasible and a robust way to homogenously expand clinical tissue samples

Categories For This Invention:

- Materials
- Polymers (Materials)
Intellectual Property:

Expansion microscopy
US Patent Pending
2016-0116384
Expansion microscopy
PCT
2015-127183
Iterative expansion microscopy
US Patent Pending
2016-0305856
Nanoscale imaging of proteins and nucleic acids via expansion microscopy
US Patent Pending
2017-0067096
Nanoscale imaging of proteins and nucleic acids via expansion microscopy
PCT
2017-027367
Protein retention expansion microscopy
US Patent Pending
2017-0089811
Protein retention expansion microscopy
PCT
2017-027368
Three-dimensional nanofabrication by patterning of hydrogels
US Patent Pending
2017-0081489
Three-dimensional nanofabrication by patterning of hydrogels
PCT
Methods for expanding clinical tissue specimens
PCT
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Publications:

Protein-Retention Expansion Microscopy of Cells and Tissues Labeled Using Standard Fluorescent Proteins and Antibodies
Nature Biotechnology
September 1, 2016
Nanoscale Imaging of RNA with Expansion Microscopy
Nature Methods
August 1, 2016
Expansion Microscopy
Science
January 30, 2015

External Links:

Expansion Technologies
http://www.extbio.com/

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