Analytical Instrumentation, Methods & Materials


# Optimized Economical and Modulatable Isotropic Expansion Microscopy

View U.S. Patent Application Publication No. US-2022-0074829 in PDF format.

**WARF: P200189US02**

Inventors: Aussie Suzuki, Mark Burkard, Roshan Norman, Emma Recchia

**The Wisconsin Alumni Research Foundation is seeking commercial partners interested in developing an optimized set of protocols for better expansion of expansion microscopy (ExM) samples. This method allows for 4 to 10-fold expansion of tissue cells and human organoid without expensive equipment or materials.**

## Overview

Light microscopy is a well-established tool to study protein dynamics and protein functions in fixed and living cells. One limitation of light microscopy is that its diffraction limit (optical resolution limit) is larger than many cellular systems and protein architectures, making it a challenge to study these structures. To overcome this limitation, researchers mainly use either electron microscopy or super-resolution light microscopy.

Unfortunately, electron microscopy requires difficult sample preparation, works only with fixed samples and can be difficult to use when labeling a target protein. Super-resolution light microscopy requires mathematical image processing, suffers from very high signal to noise ratio images, requires specific dyes and uses very expensive equipment.

Expansion microscopy (ExM) is a sample preparation tool for biological samples that allows investigators to identify small structures by expanding them using a polymer system. This enables super-resolution imaging by standard microscopy. Published protocols claim a 4-fold expansion; however, many groups are unable to reproduce this performance. Additionally, these protocols require expensive, specialized equipment and have issues in 3-D imaging.

## The Invention

UW-Madison researchers have developed an optimized set of protocols for better expansion of ExM samples. The modified protocols have resulted in two expansion microscopy methods that allow for expansion between 4 and 10-fold, reproducibly and isotopically in 3-D, without expensive equipment. The solution is limited to fixed samples and allows for stable imaging.

The new protocols require easy-to-obtain off-the-shelf chemicals, mounting media and two specifically designed parafilm molds. The first mold is for incubation, and the second keeps expanded gels stable for imaging and to reduce photo bleaching. The modified digestion protocol now reproducibly provides real 4 and 10-fold expansion. The new 10-fold method also eliminates the need for expensive oxygen removal equipment. In addition, the researchers have optimized the imaging methods to obtain better images.

## Applications

- Expansion microscopy (ExM), which is used for a wide range of biological and medical research

## Key Benefits

- Allows for 4 to 10-fold expansion of tissue cells and human organoid without expensive equipment and expensive materials

- Uses readily available off-the-shelf chemicals
- All regents and imaging materials may be provided as a kit, allowing researchers to do reproducible expansion easily
- Inexpensive compared to electron microscopy or super-resolution light microscopy

## Stage of Development

The inventors have successfully expanded human tissue culture cells, other mammalian cells and human organoids. They conclude this can be applied more broadly. The current 4 to 10-fold expansion methods can reach 30~100 nm resolution even with economical regular wide-filed microscopy (most standard in science and clinical) and 5~20 nm. With super-resolution microscopy, this allows for the study of most protein architectures in the cell.

## Additional Information

**For More Information About the Inventors**

- Aussie Suzuki

**Tech Fields**

- Analytical Instrumentation, Methods & Materials : Microscopy

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854