

Researchers add swept illumination to open-top light-sheet microscope

March 20 2024

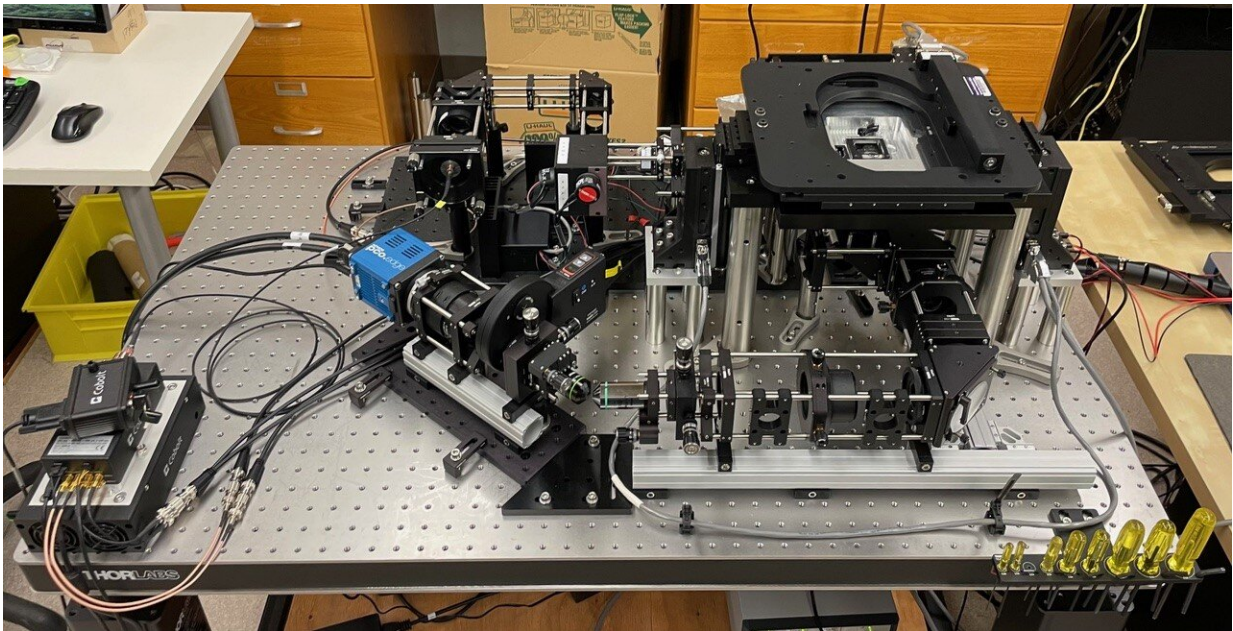


Image of an open-top light-sheet microscope. Credit: Kevin W. Bishop, University of Washington

Researchers have incorporated a swept illumination source into an open-top light-sheet microscope to enable improved optical sectioning over a larger area of view. The advance makes the technique more practical for nondestructive 3D pathology.

3D [pathology](#) is being explored as an alternative to traditional slide-

based histology because it can provide detailed 3D insights into pathological structures and cellular interactions without altering the [tissue](#). This approach makes it possible to analyze complex 3D tissue structures and to image thick tissues, which is not possible with slide-based methods.

The researchers used their improved open-top light-sheet microscope to capture images of densely labeled clinical specimens, showing its potential for nondestructive 3D pathology. Kevin W. Bishop from the University of Washington will detail the work at the [Optica Biophotonics Congress](#) being held in Fort Lauderdale, Florida, 7–10 April 2024. Bishop's presentation is scheduled for Tuesday, 9 April from 13:45–14:00 EDT.

For certain diseases, like [prostate cancer](#), it can be challenging to determine which patients need aggressive treatment and which patients do not. 3D information could ultimately help clinicians better determine the best course of treatment for each patient.

Open-top light-sheet microscopy is used to rapidly acquire 3D images of fluorescently labeled tissues that have been treated in a way that makes them transparent or translucent. The typical setup uses a fixed thin sheet of light to illuminate and image the sample from below, much like a flatbed document scanner. This enables high-resolution imaging of large areas at much faster speeds than are possible with other 3D imaging approaches (e.g. [confocal microscopy](#)).

Although many types of labels can be used with this microscopy technique, 3D pathology samples typically use dyes that mimic the hematoxylin and eosin (H&E) staining used in traditional histology slides. Because this type of staining is much denser than highly targeted stains, the microscope's optical-sectioning capability—its ability to visualize a thin slice within a 3D sample—becomes key to achieving

good [image quality](#).

Although better sectioning is possible by using a higher illumination [numerical aperture](#), this creates a shorter depth of focus that reduces the system's usable field of view. To overcome this challenge, the researchers developed a new open-top light-sheet microscope that incorporates an axially swept illumination arm.

Compared to their previous microscope design with a fixed light sheet, the new system quadrupled the field of view and doubled the optical sectioning ability without compromising volumetric imaging speed. The researchers demonstrated its usefulness by imaging a densely labeled cleared mouse kidney. They also acquired other datasets from clinical tissues to further show that the optimized system can deliver the image quality and field of view necessary for 3D pathology studies.

"We plan to use this platform to run large-scale [clinical studies](#) that will help us understand where 3D pathology can have the greatest clinical impact," said Bishop.

Provided by Optica

Citation: Researchers add swept illumination to open-top light-sheet microscope (2024, March 20) retrieved 27 April 2024 from <https://phys.org/news/2024-03-swept-illumination-sheet-microscope.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.