INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

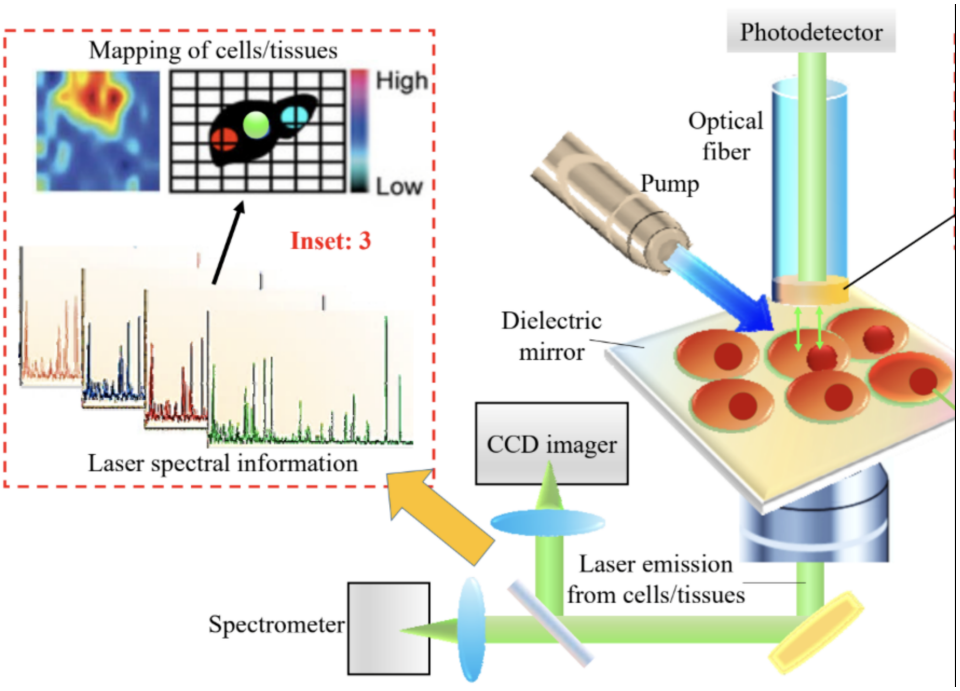
Laser Emission Microscope (LEM) for Histopathology

TECHNOLOGY NUMBER: 4778, 7174, 2019-408

Accelerate Blue Foundry - 2025 (Life Sciences)

OVERVIEW

The Laser Emission Microscope (LEM) is a new device for imaging of cells and biological tissues. In contrast to widely used imaging systems based on fluorescence, the LEM uses laser emission from the samples. The increased optical sensitivity provides advantages in biomedical and R&D applications, including histopathological analysis of cancerous and non-cancerous tissues.



DESCRIPTION

The LEM utilizes a specially designed microcavity to amplify an optical signal from the gain medium (a commercially available tissue stain), resulting in the emission of laser light from the sample. Because the system relies on optical amplification, small differences in the underlying biological sample result in significant differences in the laser output characteristics. In addition, the laser emission is fundamentally different from fluorescence, in terms of, for example, emission mode, spectrum, linewidth, and threshold behavior. Thus, laser emission provides information about a sample that is not revealed by fluorescence. An integrated microscope that utilizes both LEM and fluorescence can provide even more informative images.

Technology ID
4778

Category
Hardware
Life Sciences
Engineering & Physical Sciences
Accelerate Blue Foundry - 2025/Life Sciences

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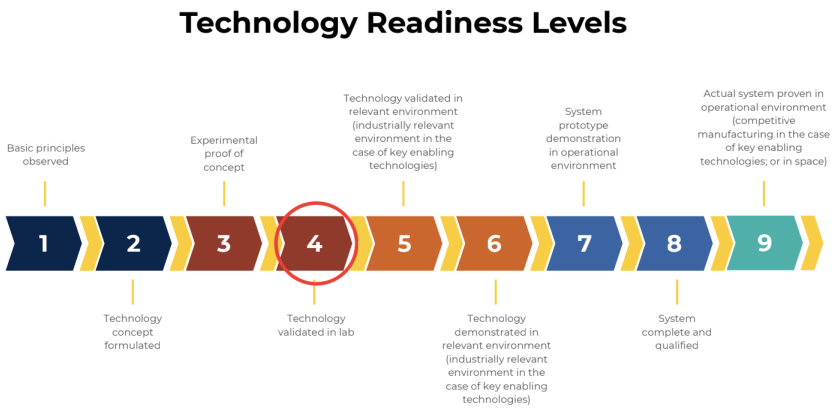
VALUE PROPOSITION

- **Unparalleled sensitivity**: Achieves a 20–100x increase in molecular detection sensitivity over standard fluorescence-based microscopy, crucial for capturing weak or rare biological phenomena.
- **High-speed, robust, multi-color imaging**: Simultaneous detection of multiple spectral signals without moving parts, yielding faster operation, higher throughput, and longer instrument life.
- **Simultaneous detection** of both laser emission and fluorescence.

TECHNOLOGY READINESS LEVEL



INTELLECTUAL PROPERTY STATUS

ALL ISSUED PATENTS:

- US9151713
- J007003
- ZL2017800872986
- US11536659

Other patent applications pending.

MARKET OPPORTUNITY

There is a significant demand in genomics, pathology, and biomedical research for rapid, highly sensitive cell and tissue analysis—areas where more precise and throughput-friendly imaging translates directly to better diagnostics, drug discovery, and clinical outcomes. LEM is especially suited for histopathological analysis and high-content cell screening, enabling quantitative imaging and faster results in both clinical and research laboratories.

A particularly promising application of LEM is in the screening for early stage cancer. Although heamatoxylin and eosin (H&E) stains are a current gold standard, histopathological analysis with such stains requires subjective interpretation. This can lead to improper diagnoses, particularly for cases with nearly indistinguishable morphologies, such as early-stage cancers. Utilizing a custom algorithm that counts the number of lasing spots under a fixed excitation, LEM provides an objective, quantitative assessment that more accurately distinguishes between cancerous and healthy tissues.

REFERENCES

- "Laser-emission imaging of nuclear biomarkers for high-contrast cancer screening and immunodiagnosis"
- "Antigen-independent single-cell circulating tumor cell detection using deep-learning-assisted biolasers"
- "Micro/Nano lasers for biomolecular sensing and cellular analysis"
- "The potential of optofluidic biolasers"