OPTICAL TRAP METHODS TO DETERMINE THE VISCOELASTIC PROPERTIES OF BIOLOGICAL MATERIALS

SUMMARY

The National Cancer Institute seeks licensees and/or co-development partners for methods that provide significant improvements in examining clinically relevant tissue samples, by improving spatial resolution and tissue depth using optical trapping.

REFERENCE NUMBER

E-251-2015

PRODUCT TYPE

- Diagnostics

KEYWORDS

- optical trapping, viscoelastic
- microrheology

COLLABORATION OPPORTUNITY

This invention is available for licensing and co-development.

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DESCRIPTION OF TECHNOLOGY

Optical traps (optical tweezers) have a focused laser beam able to trap a small bead at its focus, and are used to measure the microrheology of gels and other materials. They have recently been used to characterize properties of living cells, however issues of image spatial resolution and limited depth of interrogation have prevented application of an optical trap to measure microrheological (flow of matter) properties in complex (non-uniform) materials, such as multi-cellular systems or living organisms.

Scientists at the National Cancer Institute have developed optical trapping procedures that provide significant improvements in spatial resolution and tissue depth when measuring the microrheology of living cells such as clinically relevant tissue samples. The viscoelastic measurements obtained using the disclosed systems and methods have a surprisingly high contrast-to-noise ratio compared to prior methods of obtaining viscoelastic measurements for complex materials. The increased contrast-to-noise

ratio allows for more sensitive detection of changes in viscoelastic properties across materials than what was possible using prior methods. Thus, the disclosed systems and methods can be used to measure the properties of a wide variety of complex materials (such as biological materials), from 3D tissue culture models to tissue in or from living zebrafish to mammals, such as mice and humans.

POTENTIAL COMMERCIAL APPLICATIONS

- Microrheological measurements can increase knowledge of the cancer microenvironment.
- Diagnosis and/or treatment of a condition or disease associated with tissue/cell remodeling, including tumor state.
- Determine the effectiveness of a particular compound or treatment or regimen (e.g cosmetic products for reducing wrinkles, scarring, etc.).
- Evaluate wound healing.

COMPETITIVE ADVANTAGES

- Increased sensitivity in the detection of changes in viscoelastic properties across materials.
- Improvements in spatial resolution and tissue depth.
- Localized, precise application of force compared to magnetic bead microrheology.
- Greater dynamic range and can probe outside the thermal energy range compared to passive, thermally driven techniques.
- Selection of multiple probe sites at once allows for increased throughput.
- Automated probe selection reduces assay time.
- Personalized patient treatment.

INVENTOR(S)

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DEVELOPMENT STAGE

- Basic (Target Identification)

PUBLICATIONS

Blehm BH, et al. In vivo tissue has non-linear rheological behavior distinct from 3D biomimetic hydrogels, as determined by AMOTIV microscopy. Biomaterials. 2016 Mar;83:66-78.

PATENT STATUS

- **U.S. Provisional:** US Provisional Application 62/198,554 (HHS Reference No. E-251-2015/0-US-01) filed July 29, 2015 entitled “Optical Trap for Rheological Characterization of Complex Materials”.

THERAPEUTIC AREA

- Cancer/Neoplasm