Fluidic Device and Methods of Use for Processing Tissue for Pathology

This technology offers a method to process intact core biopsies or large tissue biospecimens for 3D imaging. A microfluidic device flows formalin fluid in an enclosed chamber to completely fix the tissue and allow high throughput processing at a faster rate.

What is the Problem?

To determine a diagnosis for various diseases, pathologists typically obtain biopsies from patients, which are first processed in large-scale pathology laboratories and then assessed after specimens are observed in two-dimensions (2D) through a microscope using white light. Thinly sectioned 2D core biopsies, which are chunks of biological tissue, contain the most information that best represents the in vivo condition of a disease state. However, 2D slides are inherently distorted and disorienting when observed by pathologists, hence significant tissue architectural information is lost. Three-dimensional (3D) imaging aids pathologists by providing an even more complete picture of the disease state, which promotes rapid on site evaluation and enhances diagnostic accuracy. However, manual handling of bulk biological tissue samples required for 3D imaging is difficult due to tissue viscoelasticity. Consequently, fixing, staining, and optical clearing of such biological tissue samples is inherently time intensive. These factors have been raised by clinicians as major limitations for the rapid processing and throughput of intact, 3D biological tissue samples to be used for diagnosis and study. Therefore, a fluidic device and methods of use for processing such 3D biological tissue samples for pathology may be desirable.

What is the Solution?

In order to process intact core biopsies, or large tissue biospecimens for 3D imaging, a microfluidic device was developed to accept tissue cores directly procured from the patient via coring needles. A key procedure prior to the deposition of the core biopsy into the device is the attachment of a formalin-filled syringe to the coring needle. In this fashion, the fixative is continuously diffusing into the tissue while the coring needle's contents are gently positioned into the initial stage of the microfluidic device using formalin fluid flow. If tissue is incompletely fixed, specimens are exposed to microwave (or other radiation), or mechanical sonication, to encourage diffusion of fixative while the tissue remains within an enclosed chamber. A one-way septum provides a sealed interface between the microfluidics device and the coring needle, and thus prevents backflow, or leakage. This all promotes human-free handling of the core biopsy; by preventing exposure to the human environment, tissue cores can also be processed without fixation. Through this method, diagnostic versatility is expanded since biomarkers for various

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Category

Device/Other

Selection of Available Technologies

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diseases may be employed with molecular specificity.

What Differentiates it from Solutions Available Today?

Existing 2D approaches provide a distorted image that takes a significant amount of time to prepare. Existing 3D approaches are limited by the current lack of rapid processing and throughput. This method provides high throughput and processing of 3D tissues samples, which can provide more data at a faster rate than existing solutions.

Patent Information:

US10852291B2

References

1. David J. Cooper, Chuqin Huang, Dylan A. Klavins, Mark E. Fauver, (44562) , https://escholarship.org/content/qt3678r52c/qt3678r52c_noSplash_fc370f01b872f9cec74849d36d0a426e.pdf, Lab on a Chip