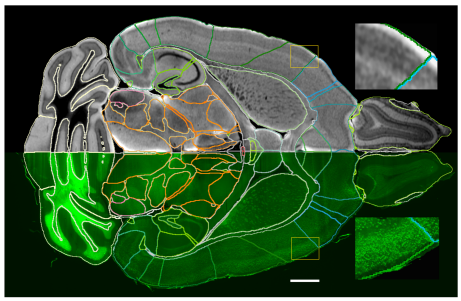
MRHistology complement to light sheet microscopy

Unmet Need

Brain researchers frequently rely on mouse models to conduct basic research on brain structure/function, pathology, connection, and a host of mouse models of neurologic disease. Light sheet microscopy is an emerging technology that can produce 3D whole brain images at cellular resolution, though the clearing and staining process causes significant distortion which is usually addressed by mapping images to the Allen Brain Atlas. Unfortunately, many different strains, ages, and sexes of mice are used for research, each with nuanced variation in brain structure. The Allen Brain Atlas used as a reference is an adult male C57BL6 mouse. There is a need for MRI reference atlases that cover the diversity of mouse models used for research, so that light sheet microscopy can be accurately applied regardless of the of the mouse strain, age or gender studied.

Technology

Duke inventors have developed a technique for obtaining mouse brain MR images that provide an accurate anatomic reference for light sheet microscopy images in the same specimen. This is intended to enable researchers to accurately correct for distortion in light sheet images of the mouse model being studied by referencing those images to labeled MRI images from the same mouse rather than to an arbitrary reference model that may be a different strain, age, and/or sex from the specimen studied. Specifically, before the light sheet images are collected, MR images are obtained from the animal. The inventor’s proprietary pipelines generate 3D anatomic reference volumes and connectomes in the specimen of interest with the brain in the skull and segment those images with labels derived from the common coordinate



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Meet the Inventors

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Department

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Publication(s)

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External Link(s)

• From the lab of Dr. G. Allan Johnson, PhD

framework (CCF3) defined on the ABA that have been transferred to the MRI. Light sheet images acquired from the same brain after removal from the skull are mapped back to the MRI volumes to correct geometric distortion and provide accurate segmentation/labeling. As a result, researchers receive accurately labeled light sheet volumes that have been corrected for distortion using the same specimen. This has been demonstrated through the development of coherent atlases across more than 20 different mouse brains.

Other Applications

The underlying datasets could also be used with future imaging modalities that require a live tissue reference and is not restricted for use with light sheet microscopy.

Advantages

- Enables accurate light sheet microscopy reference for strains besides C57BL6
- Mapping algorithm requires no manual label alignment
- Some strains already in dataset and require no additional MRI imaging