Studies aiming to obtain information on the microstructure of brain tissue by using MRI often need to be validated by comparing MRI and histology results. To obtain robust alignment between MRI and histology of specific brains, a recent study proposed ex-vivo MRI prior to slicing the tissue for histology. The MRI data is then used to create a 3D printed model of the bottom part of the specific brain, where the brain is placed during slicing.

Here we present two improvements to this method. In the first, before creating the 3D model, we align the MRI data of the specific brain to an MRI digital template reference atlas of a brain from the same species. This makes it possible to eventually cut histology slices from planes that are parallel or orthogonal to the 3 main standard stereotaxic axes of the atlas, and thus facilitate comparisons to other MRI contrasts and/or histology stains. In the second, we introduce a design with which the 3D printed model is complete, surrounding the entire brain. By supporting not only the bottom part but also the upper part of the brain, the complete model makes it possible to perform smooth and accurate slicing of lightly fixed brains.

MRI-based template of specific brains makes it possible to cut the entire brain smoothly and precisely, thus facilitating histology of complete brains. Importantly, it enables comparisons of spatially aligned histology to the corresponding MRI data.