

Optimizing ADRDs Brain Sample Preparation For Ex Vivo MR Image Acquisition

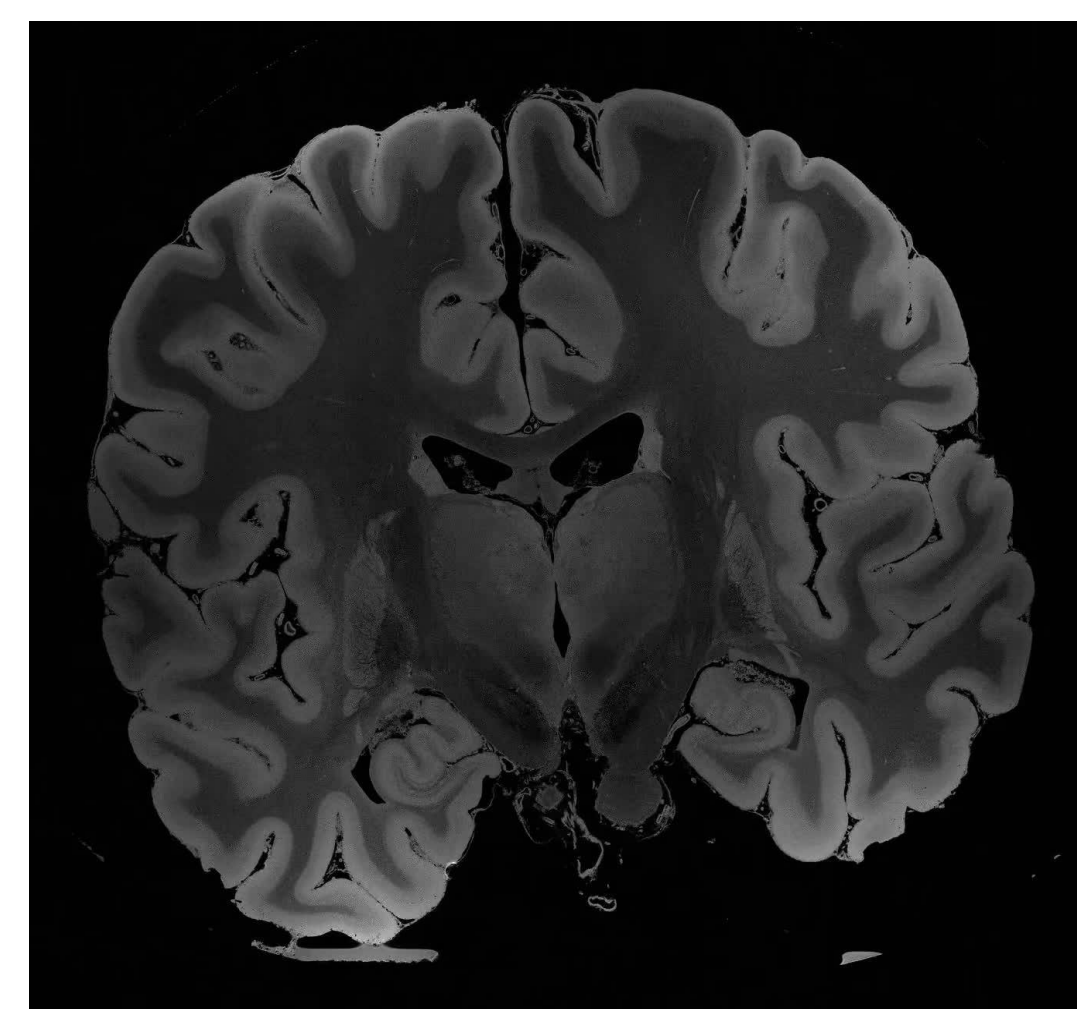
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The Problem

- Ex vivo magnetic resonance imaging (MRI) is a useful technique for imaging post-mortem brains of Alzheimer's disease and related dementias (ADRDs) patients¹
- Ex vivo MRI requires placing brain sample in proton-free fluid with equal volume magnetic susceptibility to brain tissue (e.g., fomblin)²
- However, fomblin is problematic for two reasons
 - (1) It warps brain tissue during MR image acquisition, reducing image resolution
 - (2) It retains air bubbles at the brain-fomblin interface, interfering with volume magnetic susceptibility and blurring images of the brain²



Coronal View of Post-Mortem Brain in Ex Vivo MRI

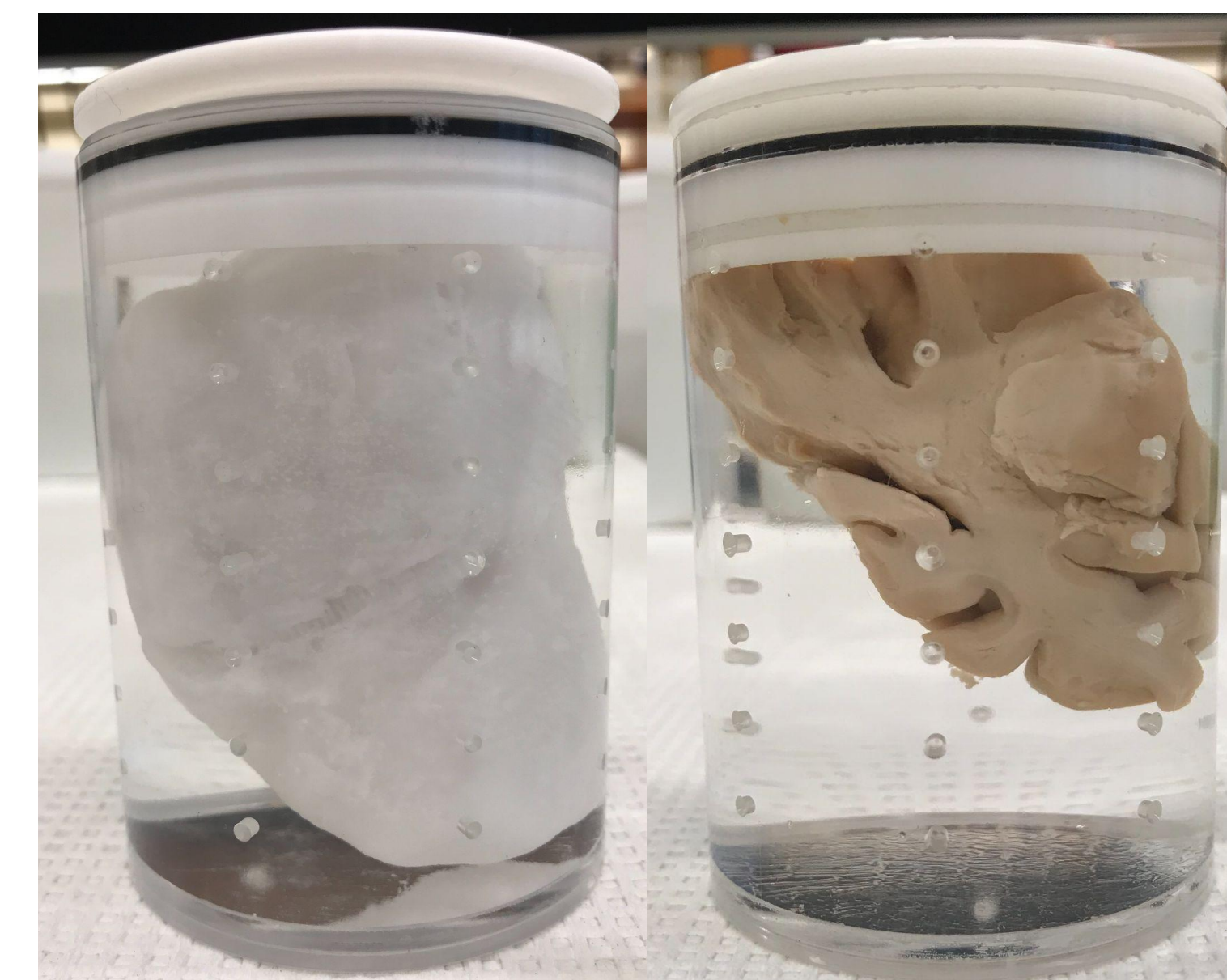
Inspiration to Solve Problem

- Mwale et al. stabilized spinal disk segments for ex vivo MRI by **encapsulating them in paraffin**³
- Our group drew inspiration from Mwale et al. and experimented with encapsulating post-mortem brain samples in paraffin
- Benefits of paraffin:
 - Melting point is 55°C, allowing us to easily liquify and solidify the paraffin (versatile material)
 - Solid paraffin is invisible in MRI⁴

Investigating Potential Solutions to Problem

Investigation 1: Dip-Paraffin Packing

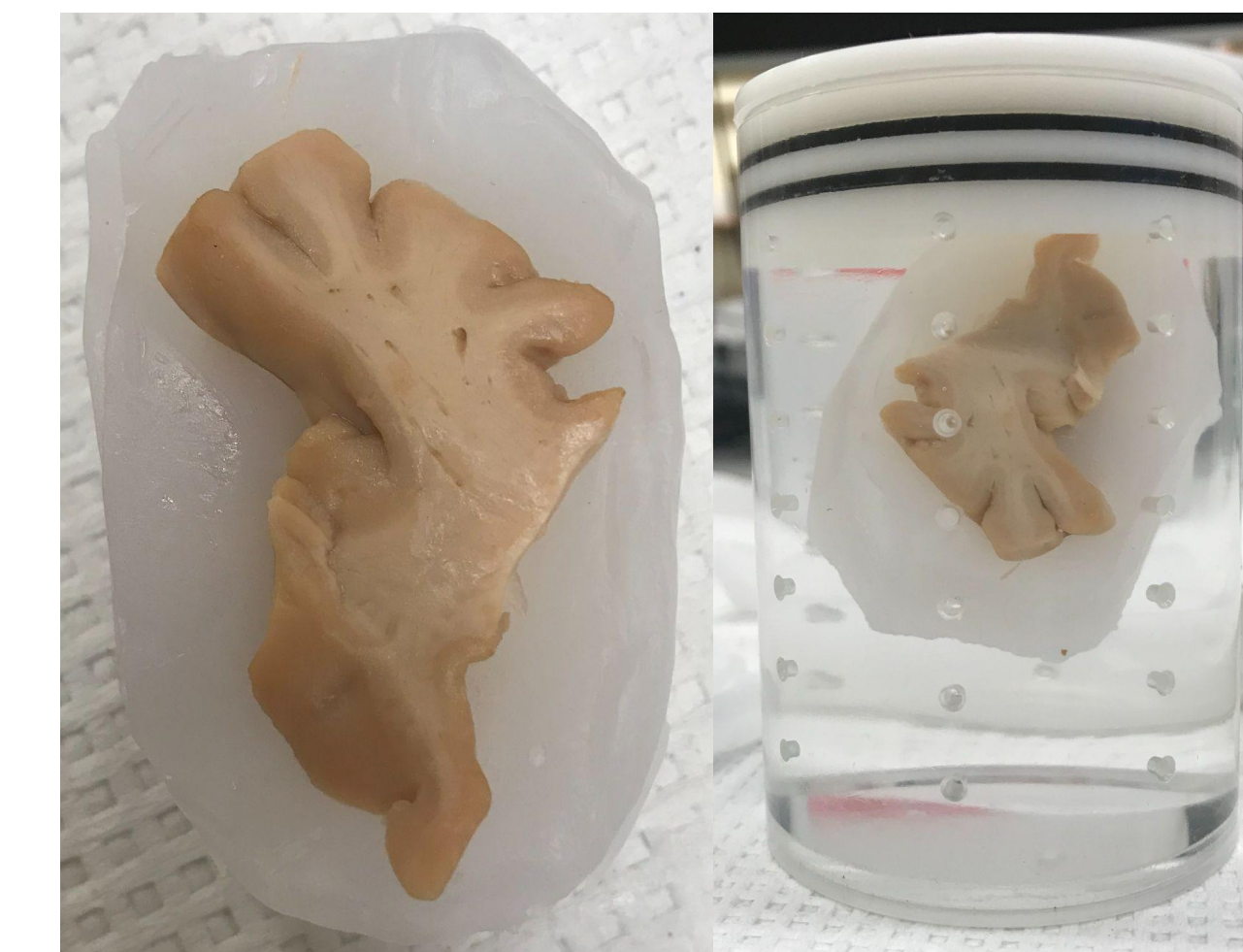
- Dipped brain sample in liquid paraffin multiple times
 - Created multiple thin coatings of solid paraffin around sample



(Positive Control)

Investigation 2: Slow-Cool Packing

- Placed brain sample in liquid paraffin for extended period of time, and then used syringe to locally evacuate air bubbles
- Slowly solidified paraffin around the brain sample by lowering temperature



Investigation 3: Vacuum Packing

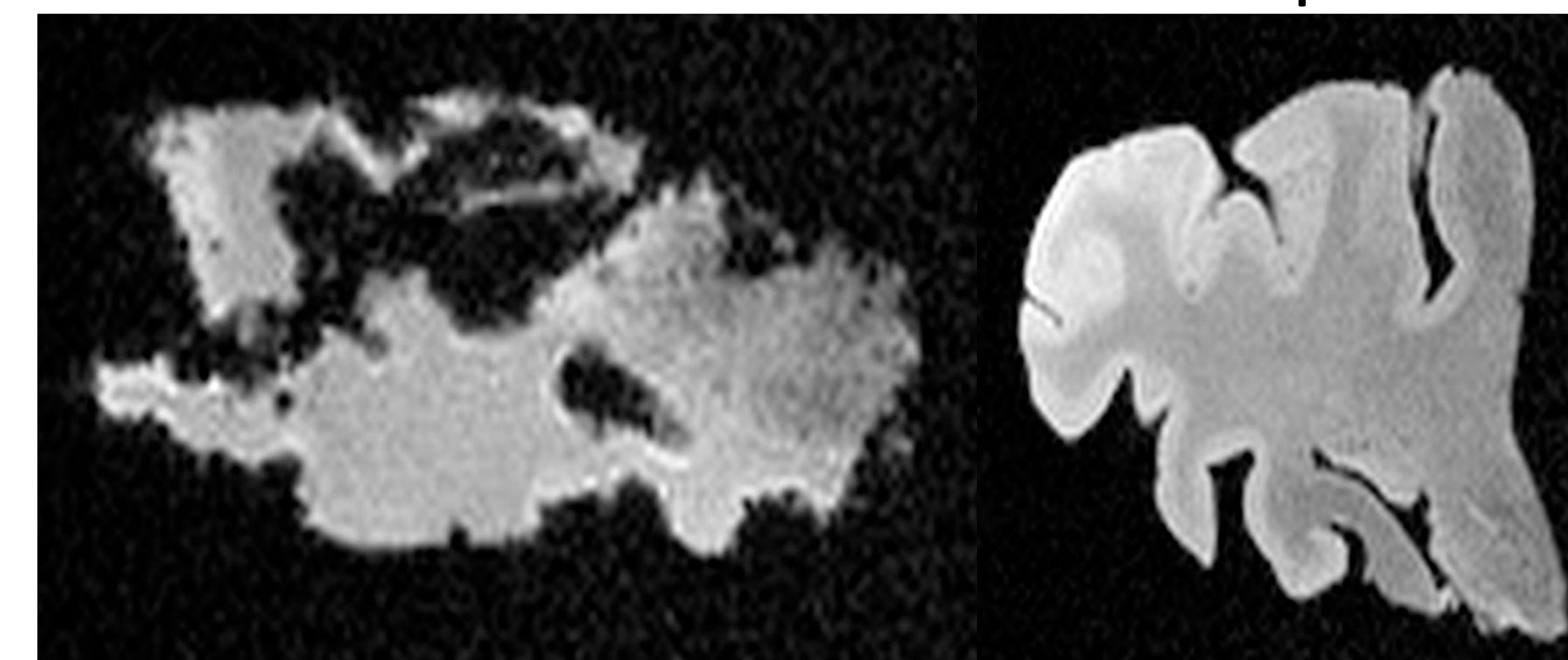
- Same procedure as Slow-Cool Packing with one difference: system was placed in global vacuum (food-grade vacuum bag)
- **Fomblin was not used in this setup**



Imaging Results of Investigations (MRI T2-Weighted)

Investigation 1

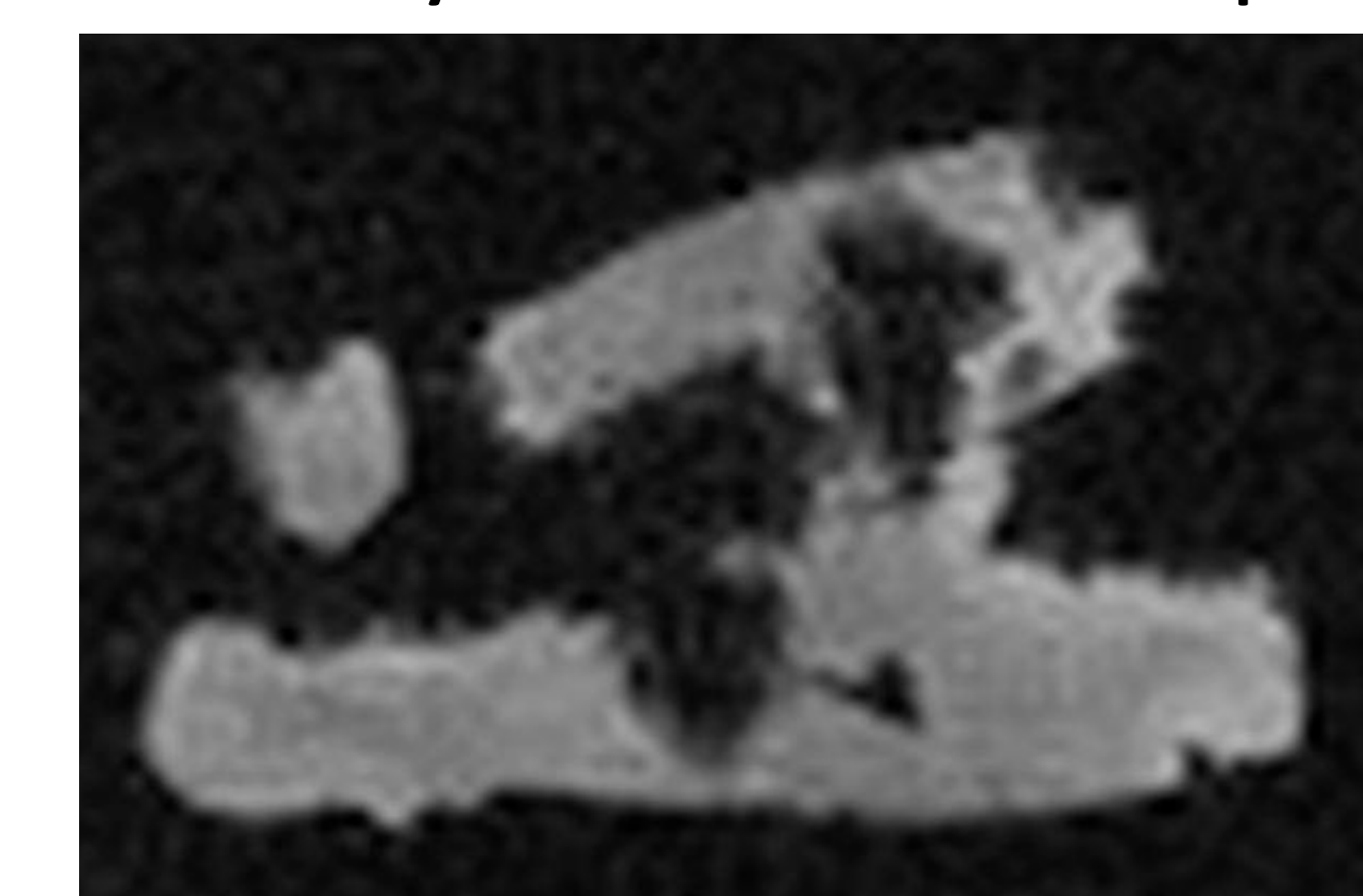
- **Unclear MR image**
 - Excess air bubbles at the brain-paraffin interface



(Positive Control)

Investigation 2

- **Slight improvement**
 - Many air bubbles still present



Investigation 3

- **Substantial improvement**
 - Air bubbles substantially decreased at interface



Conclusions

- Our group demonstrated that solid paraffin has the potential to replace fomblin as a sample preparation material for ex vivo MRI
 - It appears possible to evacuate air bubbles out of paraffin, unlike fomblin, using a slow-cooling and vacuum procedure
- Future directions
 - Our group will continue to optimize and standardize the vacuum procedure
 - Our group will conduct immunohistochemistry on these paraffinized brain samples
 - Want to investigate if vacuum paraffinization disrupts subsequent chemical staining

References

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- [4] Macura, S., Mishra, P. K., Gamez, J. D., & Pirko, I. (2014). MR microscopy of formalin fixed paraffin embedded histology specimens. *Magnetic Resonance in Medicine*, 71(6), 1989-1994. doi:10.1002/mrm.25225

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