Novel Light Scattering Technique to Detect Neuronal Activity

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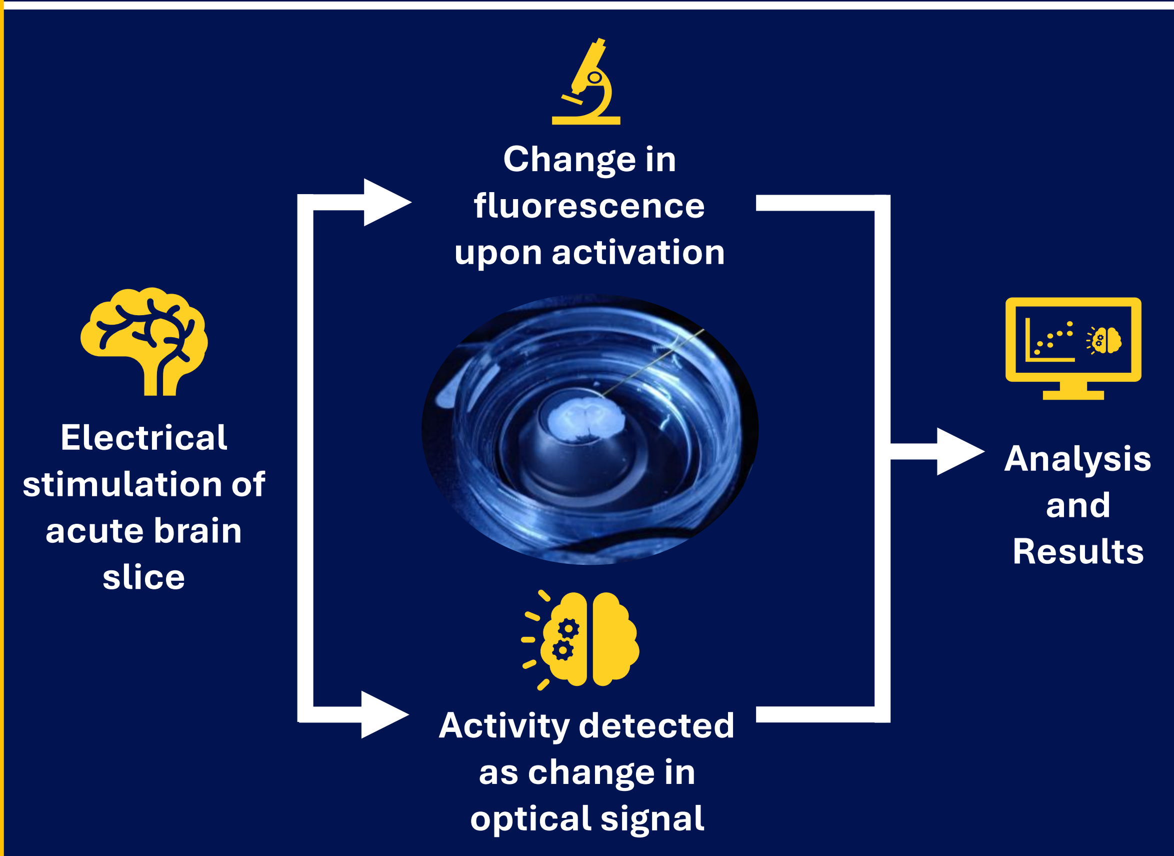
Introduction

Neurons are known to undergo mechanical contractions during the propagation of an action potential[1,2]. We aim to detect these contractions as a measure of neuronal activity based on the intrinsic optical signal measured as light undergoes multiple scattering by a cluster of active neurons. We then validate this optical signal against conventional calcium imaging techniques.

Establishing an optical signature of neuronal activity could be the next step in developing tools that are less invasive, do not interfere with the innate neuronal physiology, and offer a real-time readout of neuronal signalling.

Experimental Pipeline



Preliminary Results

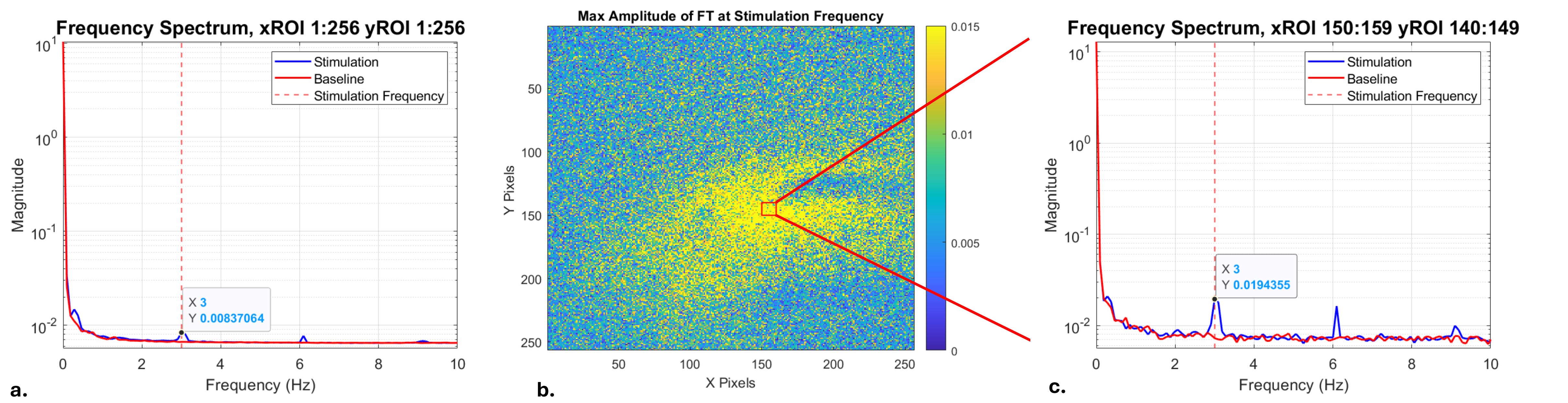


Fig 1 (a). Frequency spectrum of calcium dynamics recorded while stimulating the brain tissue at 3 Hz, (b). Visually mapping regions with maximum amplitude of the stimulation frequency 3 Hz. The red box marks the region of highest activity near the electrode, 10x10 pixels, (c). Fourier transform of the 10x10 pixels with the highest amplitude of calcium activity. 1 pixel = 6.9 μm x 6.9 μm

Next Steps

1. **Processing Pipeline:** Further analysis to distinguish and refine the optical signal.
2. **Origins of the Signal:** Determine the precise origin and timescale of the optical signal.
3. **Derive Applications:** Establish practical biomedical applications of this technique, paving the way for future neurotechnologies.

References

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