fMRI Tests for Neural Gravity: Analysis

Aman Chawla

January 19, 2025

Abstract

In this note the authors provide a proposal for an fMRI test for g-wave induced modulation of neural activity in nerve tracts. Extending prior work, they provide analytical details related to the causal chain of events that can be detected via the fMRI.

It was shown mathematically in [1, 2, 3] that metric perturbations impinging on an axon tract will impact the time coded neural information carried by the tract. In this note we suggest how this modulation might be detectable in fMRI studies of the tract.

Consider a tract of ephaptically coupled axons[1]. A metric perturbation modulates the action potential profiles. This changes the extracellular medium's charge distribution dynamics which in turn impacts the boundary or epineurium potential. A modified epineurium potential leads to interaction with neighboring pericytes. These pericytes interact with blood cells and this ultimately generates an impact on the fMRI signal from this region.

If the fMRI of blood vessels in say a mammalian olfactory bulb is recorded and all known modulators of the fMRI are accounted for, then one may be able to isolate a disturbance whose primary cause will be the gravitational waves impinging on the bulb. This fascinating study seems to be within the reach of present-day technological capabilities.

As a first step in the analytical study of this problem so far described, one can summarize the daisy chain of events as follows. A low frequency metric wave causes $V(x,t)$ to change to $V'(x,t)$. The modified transmembrane potential causes the epineurium potential to change from $E_\phi(\vec{r},t)$ to $E'_\phi(\vec{r},t)$. Note that potassium channels are dominant in pericytes [5], at least in brain capillaries. The modified epineurium potential will change the voltage environment seen by these potassium channels, thereby altering their open/close state and effectively the pericyte transmembrane potential $V_p(x,t)$, which will change to $V'_p(x,t)$. Next, note that via gap junction signaling mechanisms, pericytes interact with endothelial cells and so the modified pericyte potential $V'_p(x,t)$ will impact the endothelial cells vis-a-vis their proliferation. We quote [6],

> Pericyte-endothelial interactions lead to the activation of the latent TGF-beta signaling pathway, which promotes the differentiation and

[1] Background reading for this note is [4] and the references therein.

proliferation of ECs and pericyte through its receptors ALK1, ALK5, and endoglin, as well as driving extracellular collagen secretion and CTGF expression by pericytes and astrocytes through Smad 2/3.

This impact on the endothelial cell is a direct impact on the vasculature which carries blood. If the frequency of the gravitational radiation is slow enough, this impact can be seen plausibly in slow oscillations of the fMRI signal from the vasculature.

References

[1] Aman Chawla, Salvatore D. Morgera, and Arthur D. Snider. Fields, geometry, and their impact on axon interaction. *Journal of Applied Mathematics and Physics*, 9(4):751–778, 2021.

[2] Aman Chawla. A gedanken experiment on the brain as a quantum computer. *ResearchGate Preprint*, 2022.

[3] Aman Chawla and Salvatore Domenic Morgera. Mechanism of universal quantum computation in the brain. *Journal of Applied Mathematics and Physics*, 12(2):468–474, 2024.

[4] Aman Chawla, Salvatore Morgera, and Arthur Snider. On axon interaction and its role in neurological networks. *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, 2019.

[5] Ashwini Hariharan, Nick Weir, Colin Robertson, Liqun He, Christer Betsholtz, and Thomas A Longden. The ion channel and gpcr toolkit of brain capillary pericytes. *Frontiers in Cellular Neuroscience*, 14:601324, 2020.

[6] Hu Huang. Pericyte-endothelial interactions in the retinal microvasculature. *International journal of molecular sciences*, 21(19):7413, 2020.