



# Designing and implementing an experimental set-up for testing Gut-Brain interaction using Capsule-Induced Mechanosensation and ERP Markers in IBS

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## Introduction

Interoception is the perception of internal bodily signals, and it plays a central role in gut-brain communication and homeostatic regulation. Altered interoceptive processing has been implicated in various clinical conditions, including Irritable Bowel Syndrome (IBS), which is characterized by visceral hypersensitivity and dysregulated autonomic responses. To investigate this, we developed a multimodal experimental framework combining EEG, EGG (electrogastrogram), GSR (galvanic skin response), and behavioral measures.

## Goals

Using a minimally invasive vibrating capsule, we aim to examine whether individuals with IBS exhibit heightened perceptual, neural, and physiological sensitivity to gut mechanosensory stimulation compared to healthy controls.

Figure 1. Components of the experimental setup

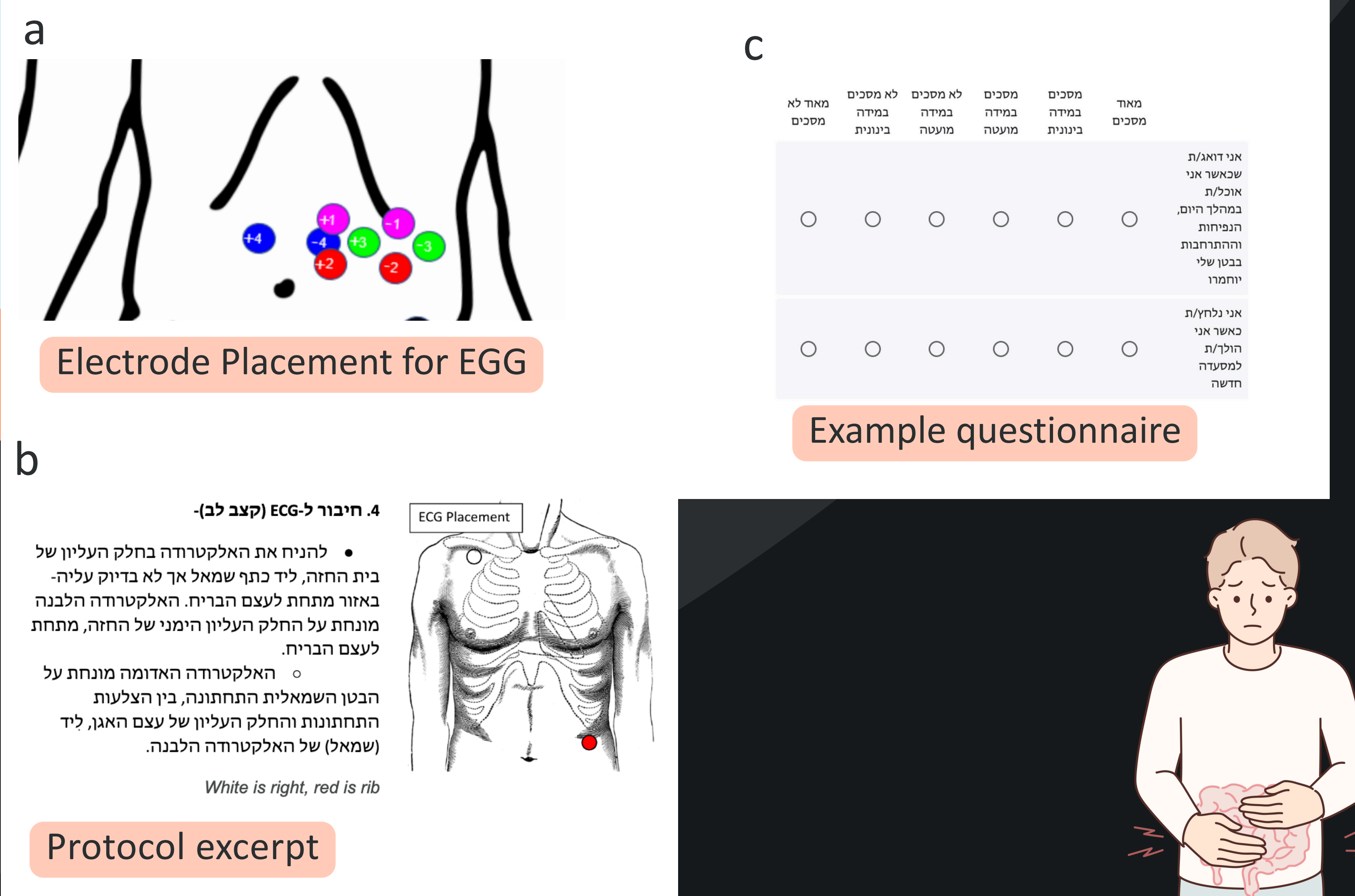
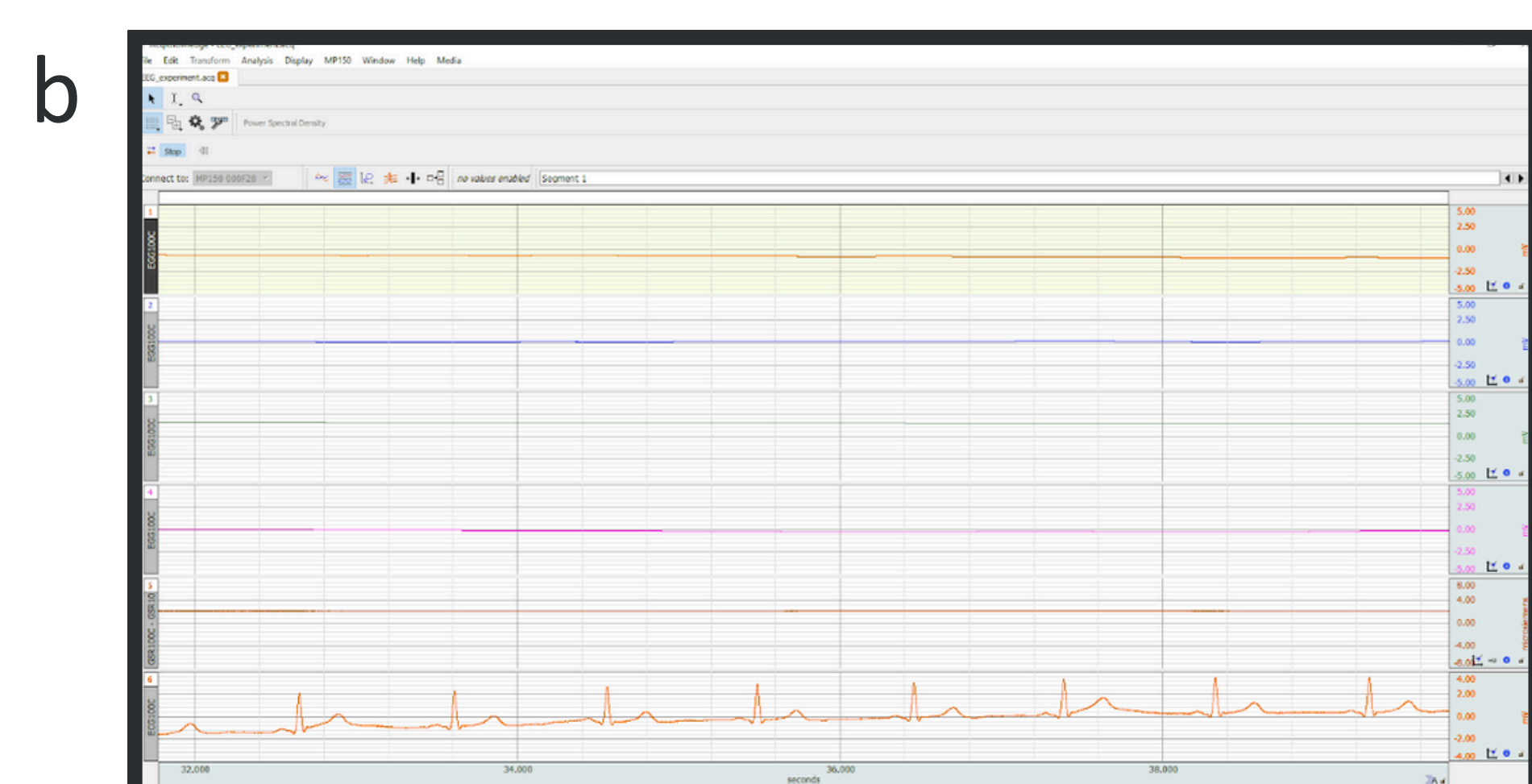
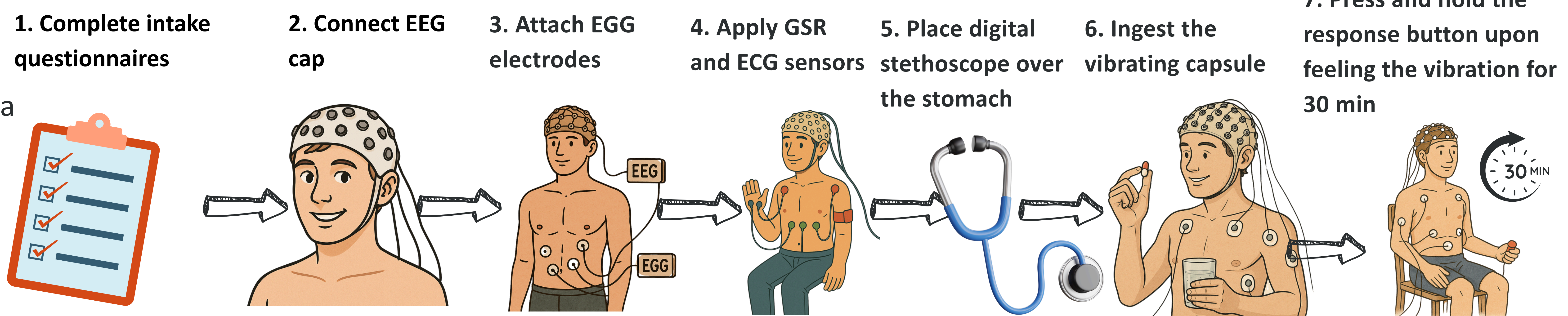


Figure 2. Methodology.



Example of raw physiological recordings collected during lab testing. The orange trace reflects rhythmic gastric activity (EGG), used to assess stomach response. Other channels represent cardiac (ECG), electrodermal (GSR), and reference signals.

## Expected Results

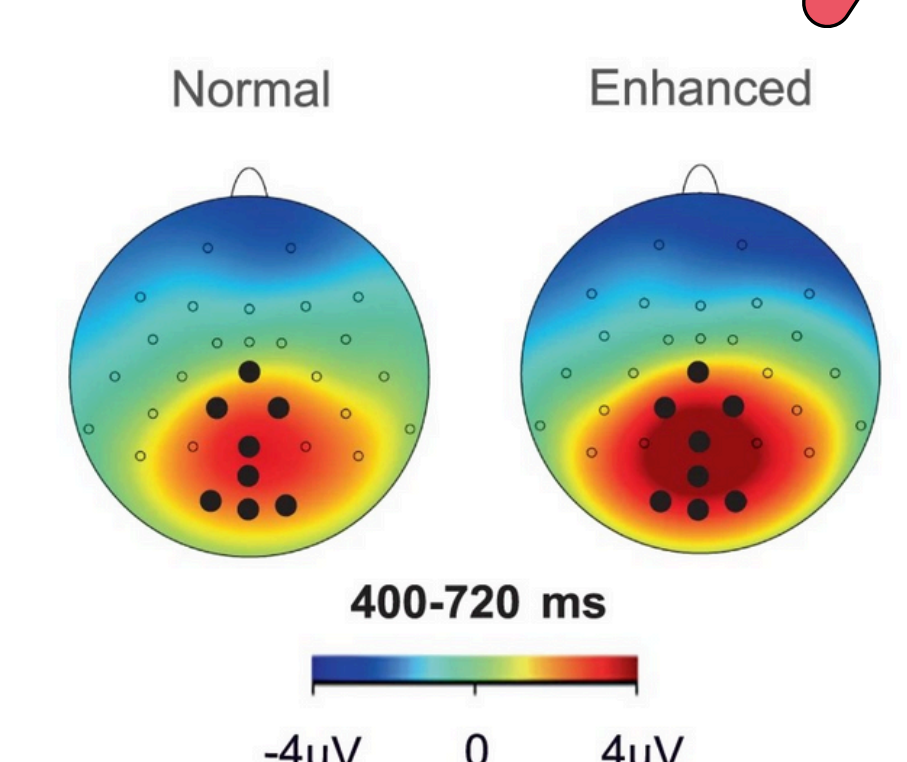
Individuals with IBS are expected to exhibit overall stronger perceptual, neural, and autonomic responses than controls, particularly under enhanced stimulation:

**EEG:** Higher LPP amplitudes in IBS (Late Positive Potential- a neural marker of sustained attention to internal sensations)

**EGG:** Increased gastric power under enhanced stimulation in IBS only

**GSR & ECG:** Stronger autonomic reactivity in IBS.

Fig. 3



EEG topographies (400-720 ms) are expected to reveal stronger parieto-occipital LPPs in the enhanced vs. normal gut stimulation condition. Figure adapted from Mayeli et al. (2023), Nature Communications.

## References

- Mayeli, A., Al Zoubi, O., White, E. J., Chappelle, S., Kuplicki, R., Morton, A., Bruce, J., Smith, R., Feinstein, J. S., Bodurka, J., Paulus, M. P., & Khalsa, S. S. (2023). Parieto-occipital ERP indicators of gut mechanosensation in humans. *Nature Communications*, 14, Article 3398
- Mayer, E.A., Ryu, H.J. & Bhatt, R.R. The neurobiology of irritable bowel syndrome. *Mol Psychiatry* 28, 1451–1465 (2023).

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