



Wolfson Department of Chemical Engineering Seminar

Monday, October 27th, 2025 at 19:30 (China Time)/13:30 (Israel Time)

Zoom: <https://technion.zoom.us/j/2884793963?omn=94602738796>

**Long-term Continuous Simultaneous EEG–ECG Monitoring with
Paintable Permeable Hydrogel for Meditation Training**

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MSc Seminar

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Meditation, an ancient mind–body practice, has been shown to regulate autonomic nervous system activity and promote neuroplasticity. However, conventional electrophysiological monitoring systems often rely on bulky equipment and rigid electrodes, limiting their ability to track brain and heart activity during meditation training continuously.

To overcome these limitations, a paintable, breathable, and durable conductive hydrogel electrode was developed and integrated with a custom wireless electroencephalogram (EEG)-electrocardiogram (ECG) synchronous monitoring system. The hydrogel is based on a tannic acid–ferric ion coordination network within a thermoreversible gelatin matrix, enabling rapid gelation, strong adhesion, and high comfort. By tuning ionic components and introducing a mechanically foamed macroporous structure, gas permeability and interfacial wettability were further enhanced, ensuring biocompatibility and long-term stability.

Using this system, continuous and simultaneous electrophysiological evidence shows that meditation, unlike simple rest, induces more coherent and beneficial brain–heart states. Notably, even five days of meditation training led to significant neuroplastic improvements, including enhanced brain functional connectivity and heart rate variability, which together strengthen executive control attention. This work demonstrates a comfortable, durable, and reliable platform for continuous long-term EEG–ECG monitoring, supporting meditation as an accessible and effective self-regulation practice.