IoB Minimally Invasive

Moonshot Research and Development Program Goal 1 Kanai Project

IoB Minimally Invasive Technology Development of Wearable Devices for Long-Term Measurement

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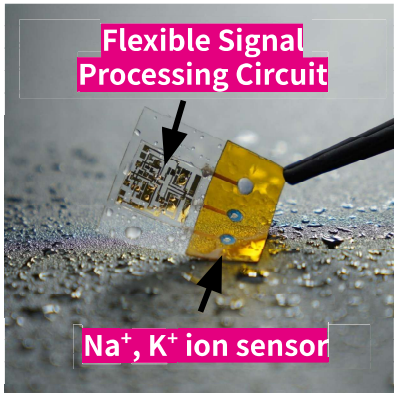
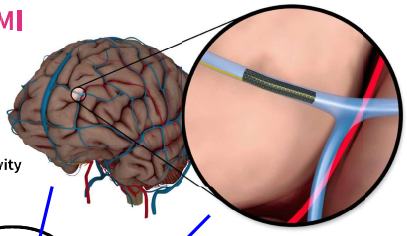
Overview

In the development of minimally invasive IoB technologies, we are creating a new BMI technologies that achieves both high precision and safety - goals difficult to realize with existing technologies. This involves developing BMI technologies that are more advanced than invasive approaches, which requires surgical procedures, and non-invasive approaches, which capture information from the body's surface, with minimal invasiveness. Specifically, we are developing technology to acquire EEG signals from within cerebral veins using intravascular treatment techniques involving catheters, a form of minimally invasive therapy. This research involves fundamental studies for the long-term use of chemical sensors to **realize wearable sensors capable of continuously measuring bio-derived chemical quantities such as ions and molecules over extended periods**. The goal is to quantitatively measure ions and various molecules secreted into the blood or outside the body as a result of human physiological responses. **By simultaneously achieving the measurement of physical quantities such as brain waves and the composition of secretions from the body, we aim to realize the expansion of physical, cognitive, and perceptual abilities at a more advanced level.**



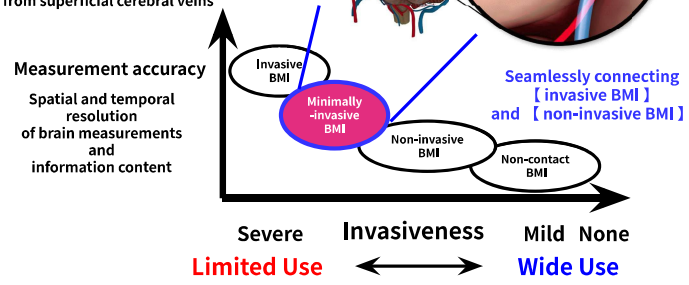
IoB Minimally Invasive Technology

Minimally Invasive BMI



Ultra-Fine Soft Intravascular Device

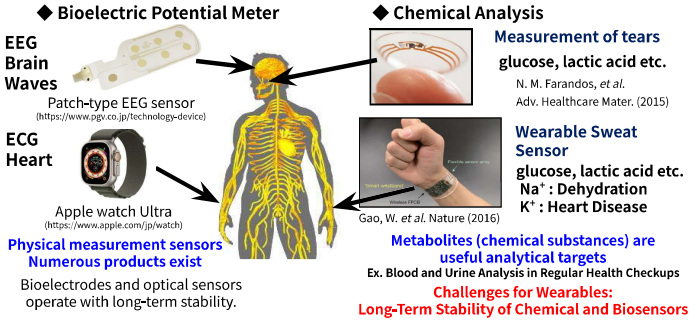
Long-term measurement of brain activity from superficial cerebral veins



Two Devices for an Ultra-Minimally Invasive BMI System

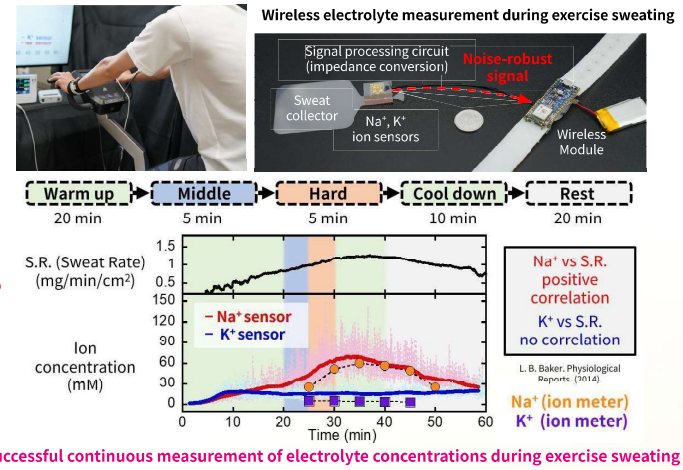
- An 【Minimally Invasive BMI System】 using an Ultra-Fine, Flexible Intravascular Device
- An 【Intravascular EEG Measurement Device】 Functioning as a BMI Transporter

Current State of Wearable Devices



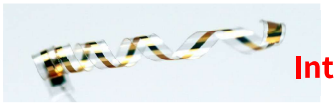
【Goal】 Develop stable biosensors for use in intravascular measurement

Continuous measurement of electrolyte concentration during exercise sweating

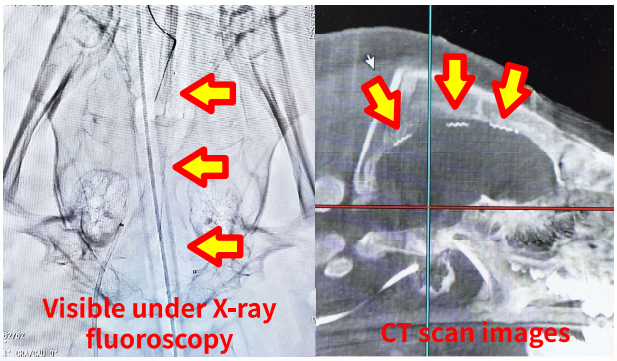


Successful continuous measurement of electrolyte concentrations during exercise sweating

Utilization of Flexible Electronics Technology



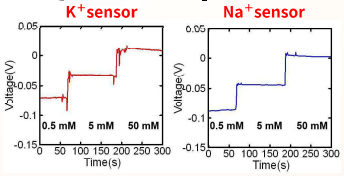
Diameter: 1 mm
Intravascular electrode



A spiral-shaped electrode is placed in the cerebral venous vessels, enabling electroencephalogram (EEG) measurement.

Toward the Measurement of Chemical Quantities in Blood

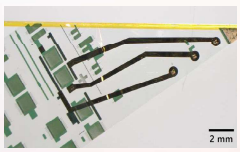
Investigate sensor response after immersion in blood (15 minutes)



Antithrombotic polymer (inhibits protein adsorption) coating confirmed sensor response maintenance

Future Prospects

We have achieved EEG measurement by placing flexible electrodes within cerebral venous vessels. Moving forward, we aim not only to measure EEG but also to realize quantitative chemical measurements, including electrolytes. Additionally, we plan to integrate thin-film flexible electronic circuits into the vessels, as shown in the right figure, to achieve high-quality biological signal measurement.



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Internet of Brains