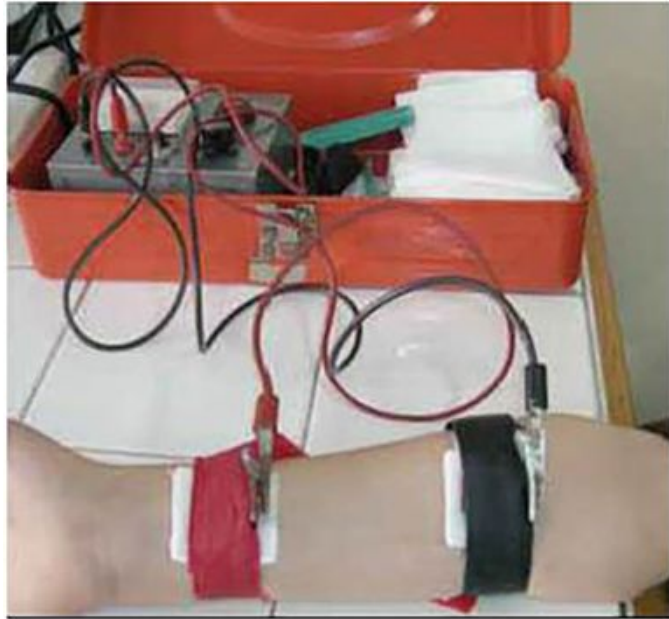


Machine-Learned Electrodes and Reusable Smartwatch Potentiostat for Cystic Fibrosis Screening

Eric Gu, Nikita Lukhanin, Akshay Shivkumar, Lucas Leonard, Claire Lin, Liwei Lin
Berkeley Sensor and Actuator Center

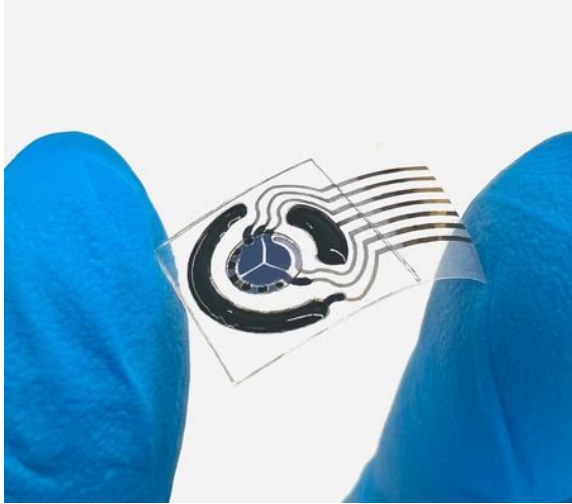


Modern Cystic Fibrosis Screening



Iontophoresis and sweat collection by Gibson-Cooke method.
Gokdemir, Y. and Karadag, B., 2021

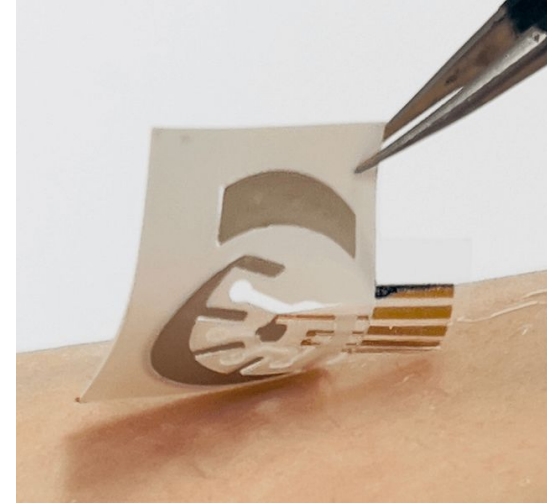
Current Wearable Sweat Sensing Methods



Inkjet printed molecule-selective nanoparticles
Wang et al., 2025

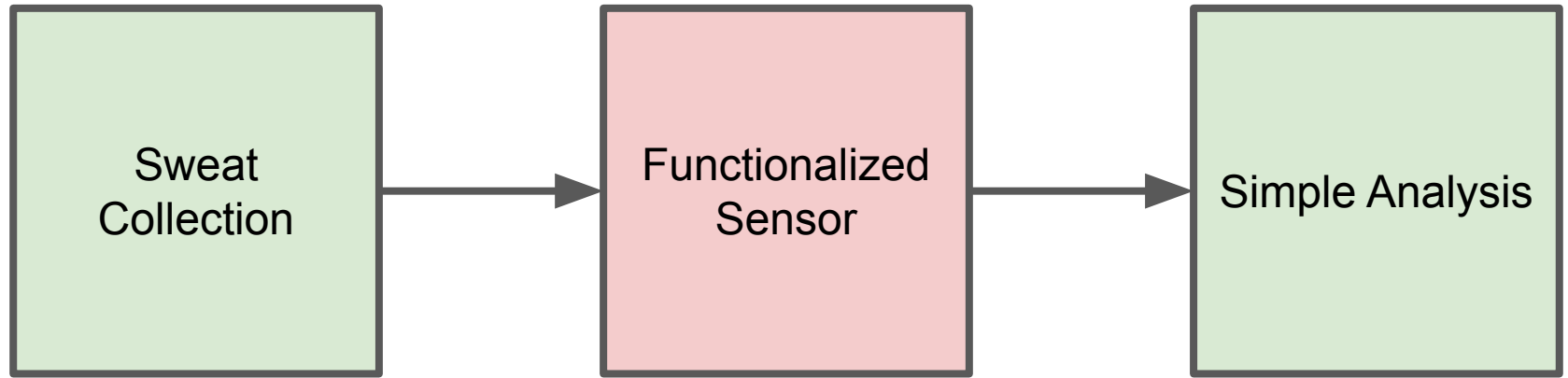


Colorimetric reagents in microfluidic patch
Epicore Biosystems Gx



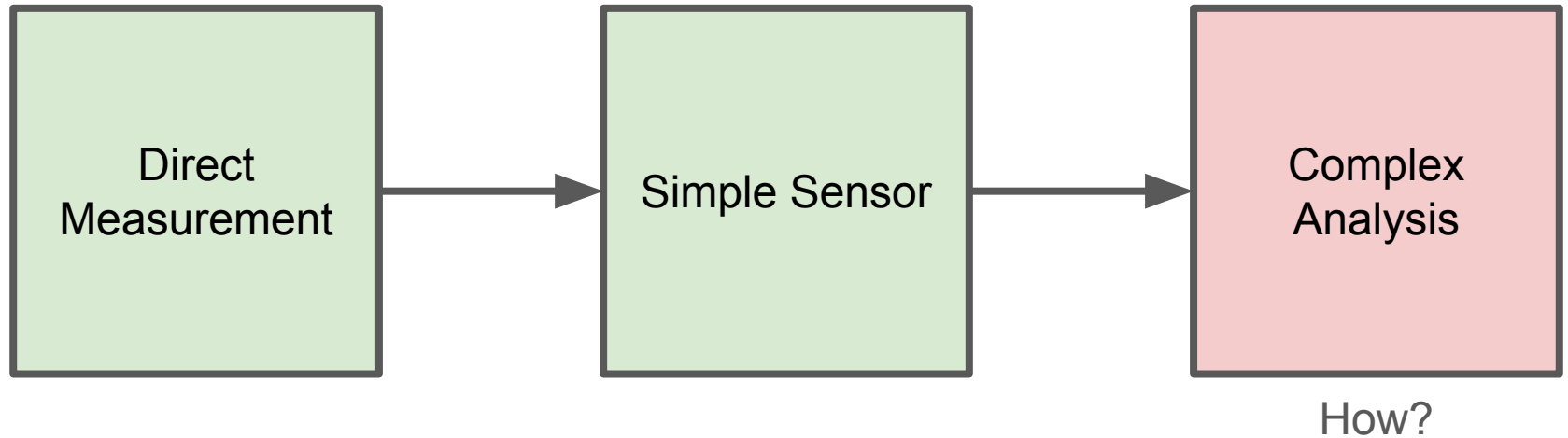
Ion-selective membrane gated OECT
Islam, et al., 2025

Wearable Sweat Sensing

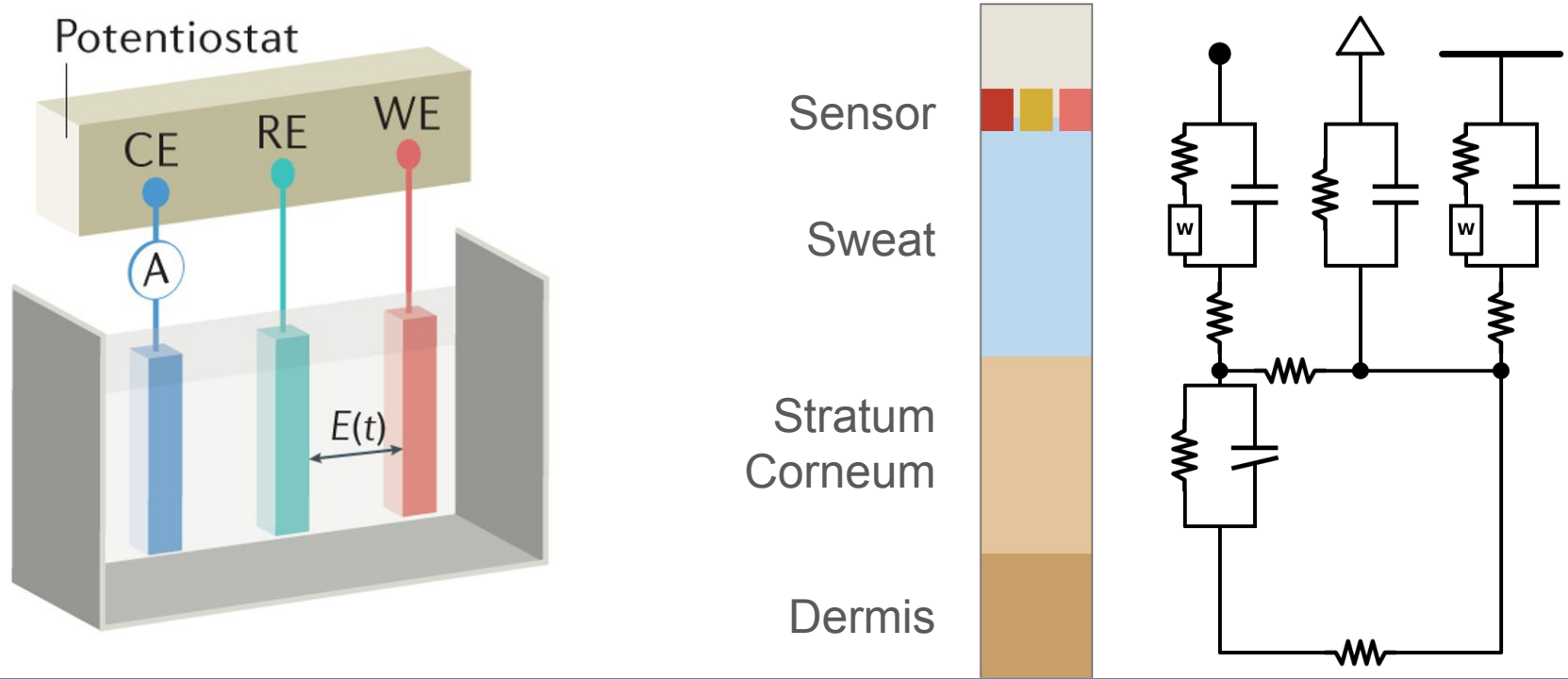


Limited reusability

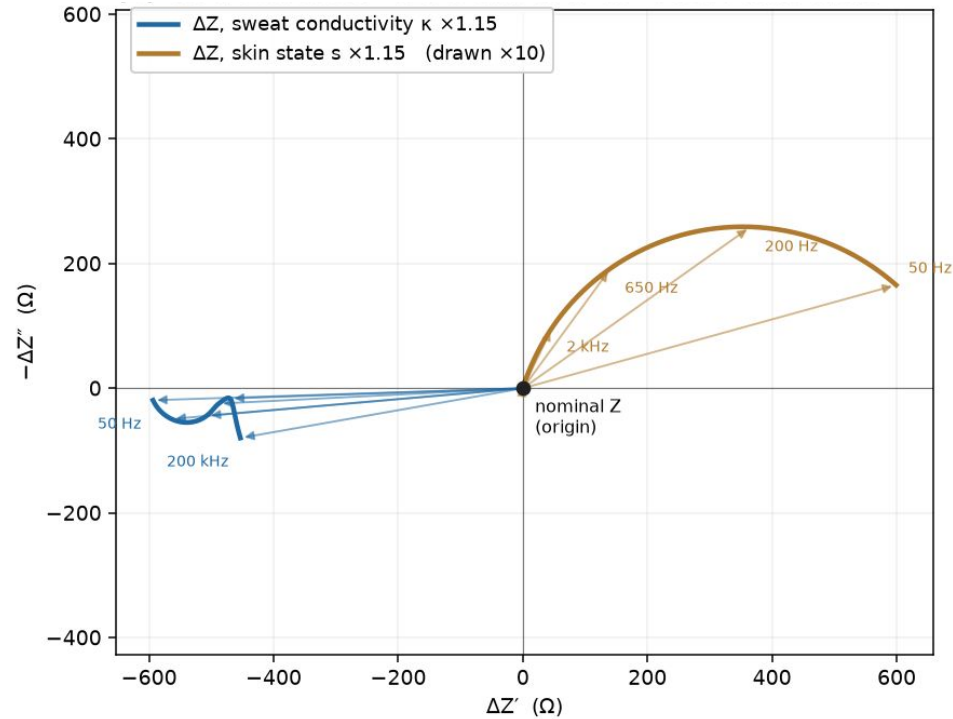
Wearable Sweat Sensing



Electrochemical Impedance Spectroscopy



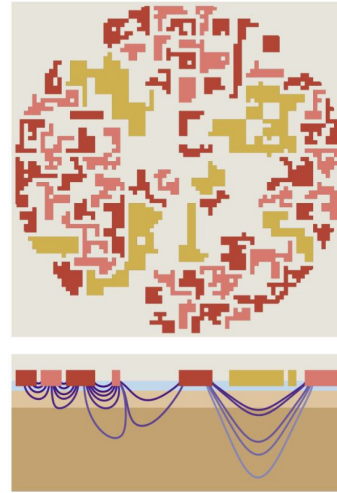
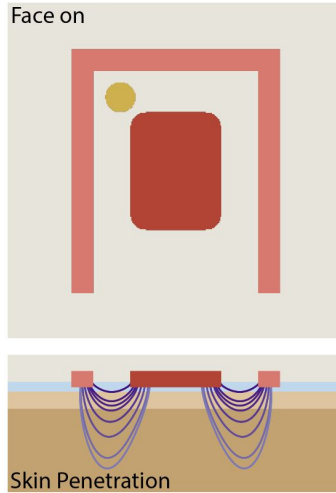
Sweat-Skin Separation



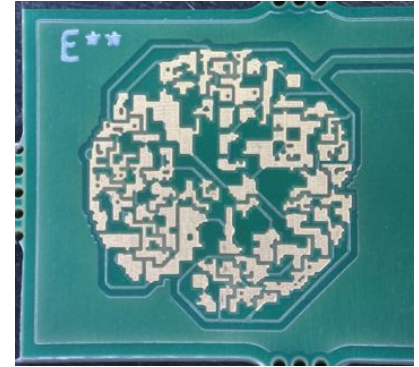
Optimization Through Geometry



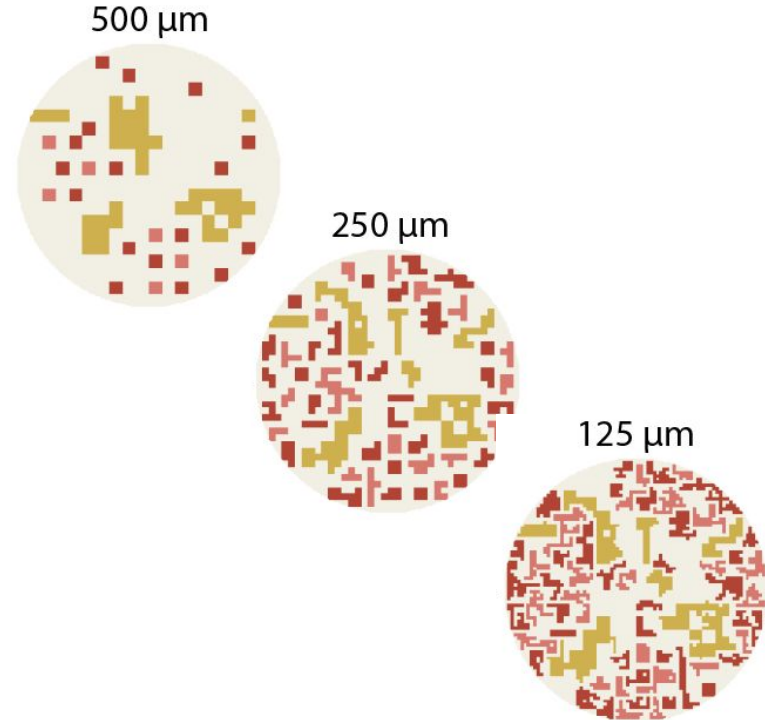
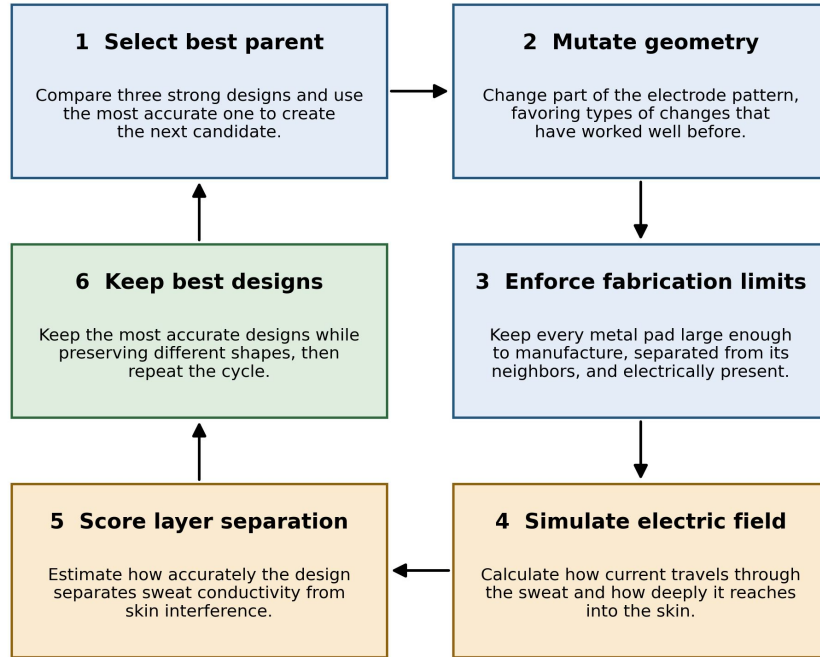
Commercial SPE



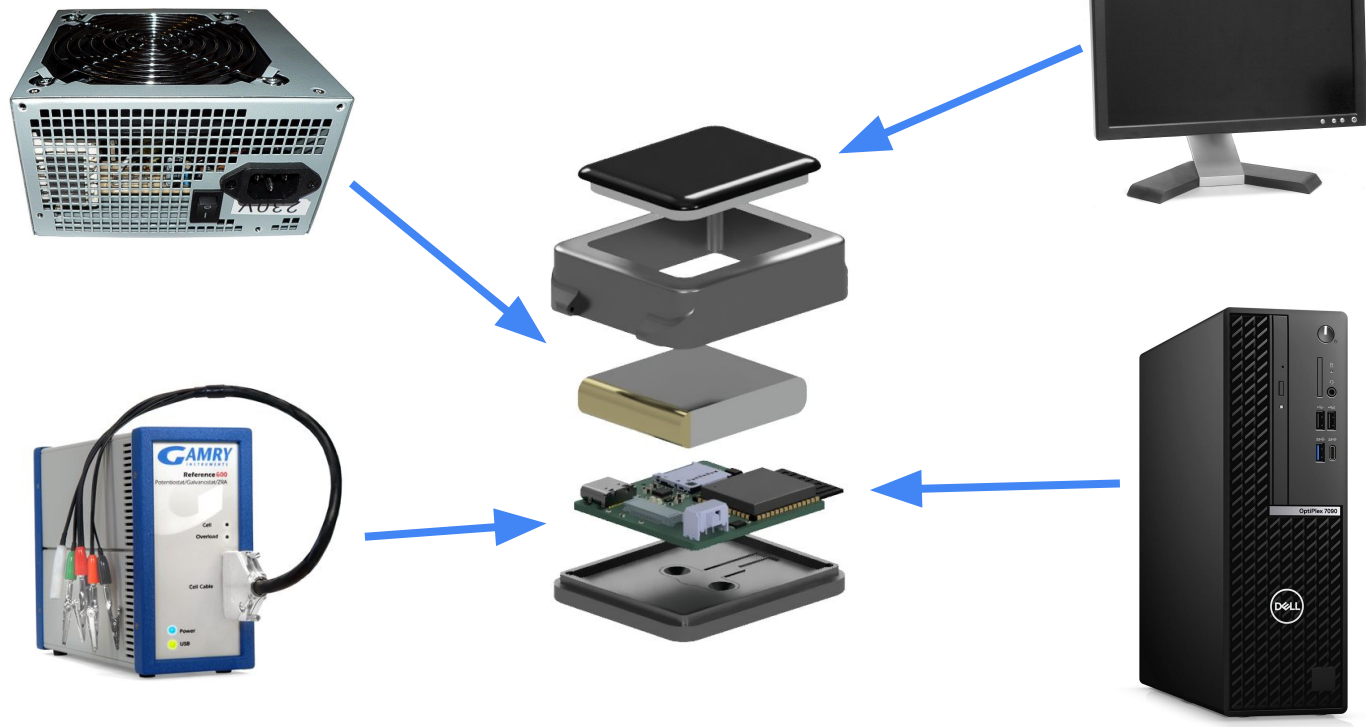
Learned electrodes



Optimization Through Geometry



Lab on Your Wrist



Lab on Your Wrist



Hardware Implementation

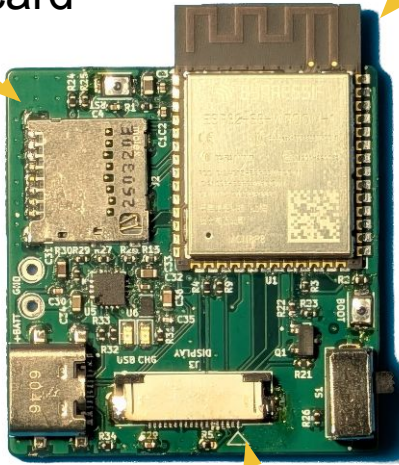
FRONT

MicroSD card reader

ESP32 MCU

USB-C port

Touchscreen display
FPC connector

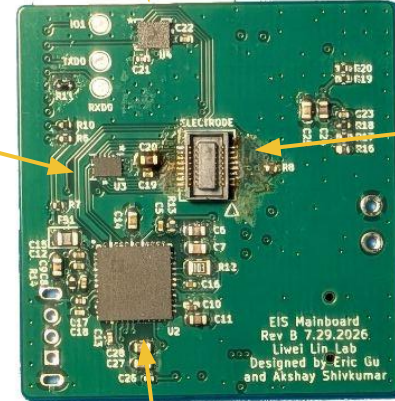


BACK

IMU

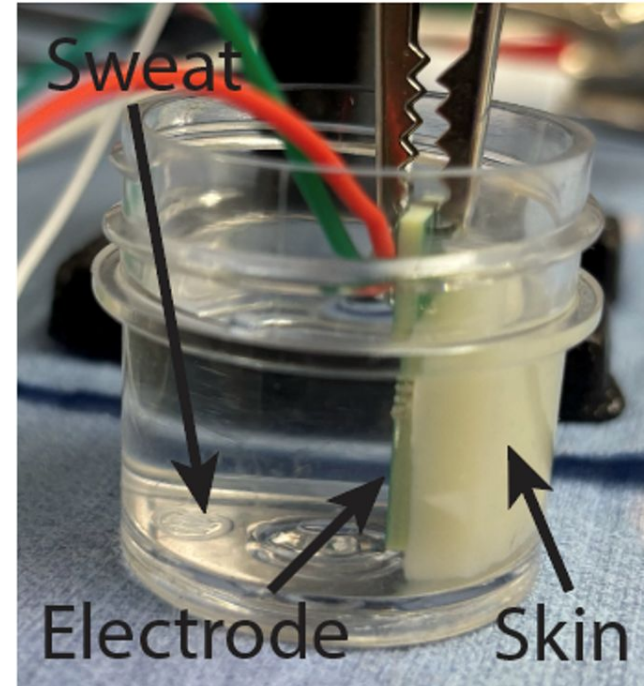
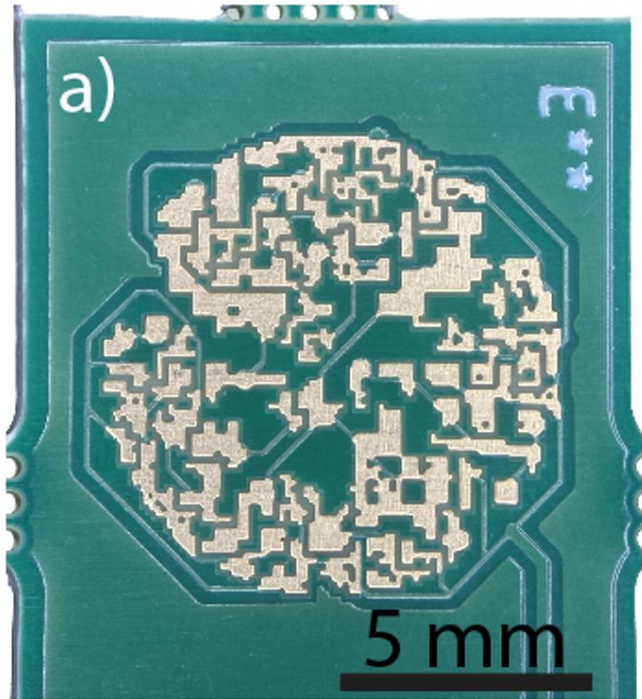
4Way 2Ch
MUX

Electrode
daughterboard
connector

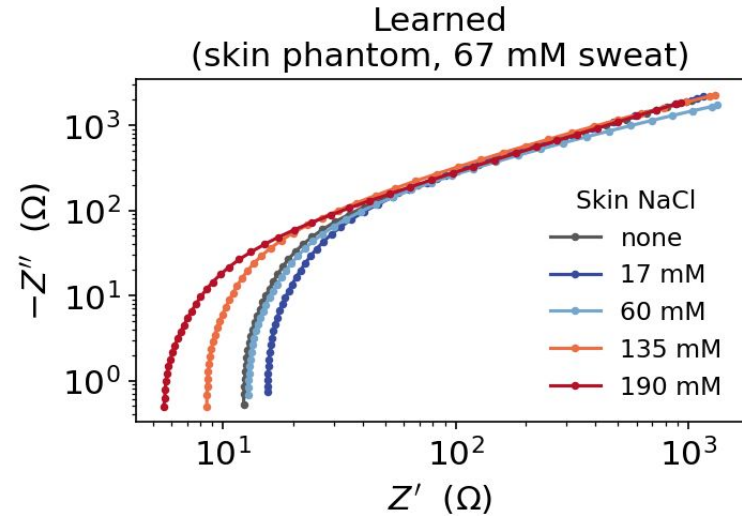
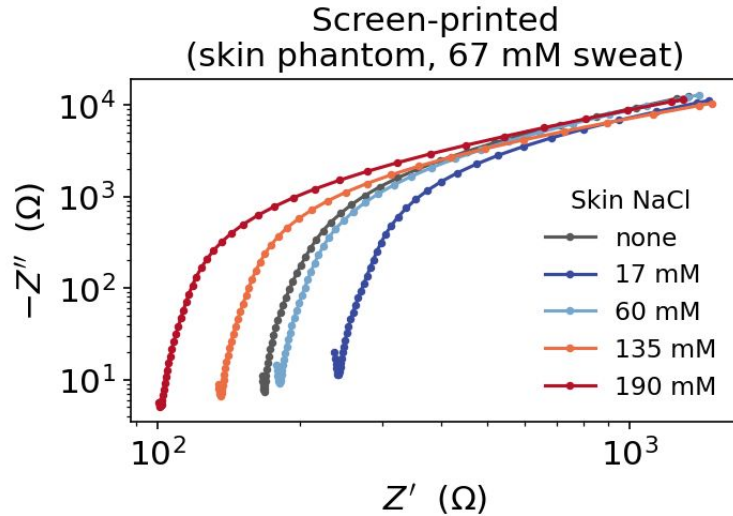


AD5941 AFE

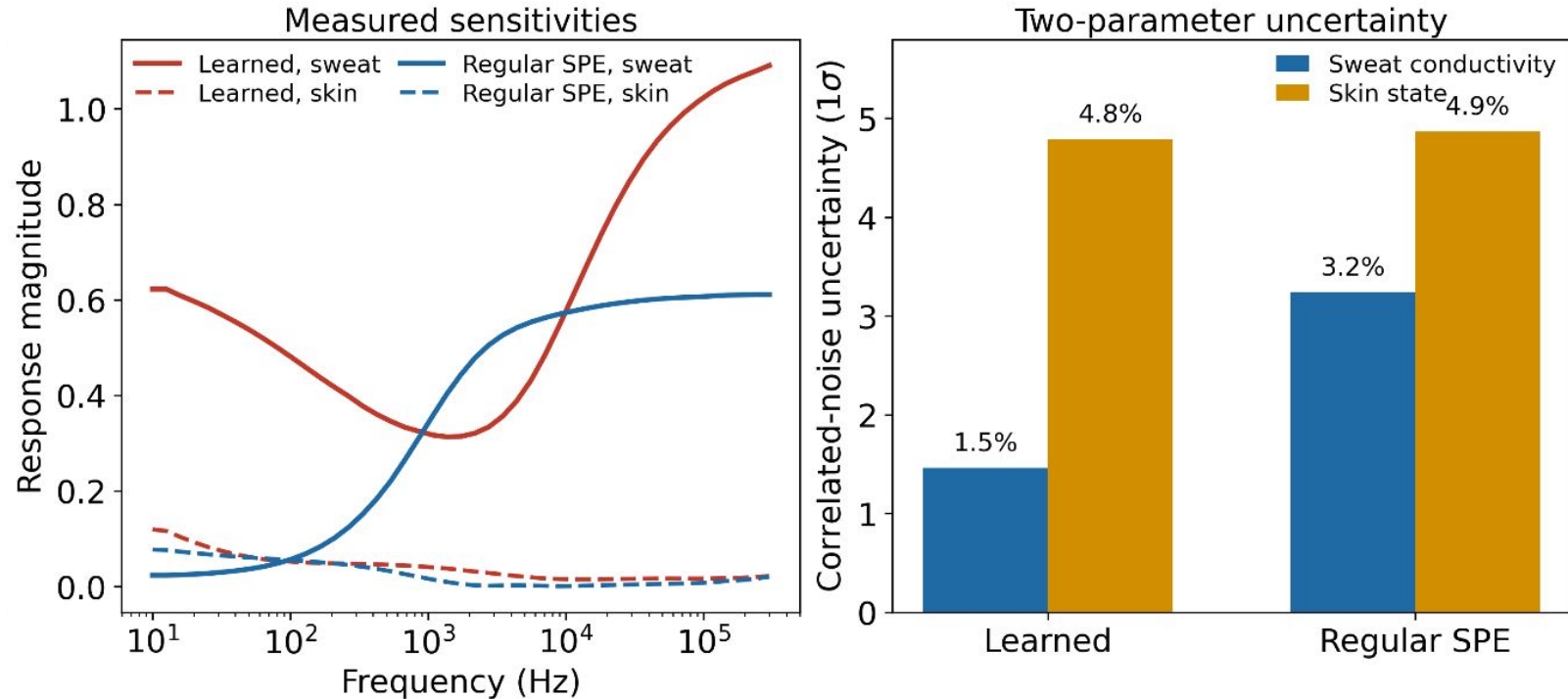
Validation Against Phantoms



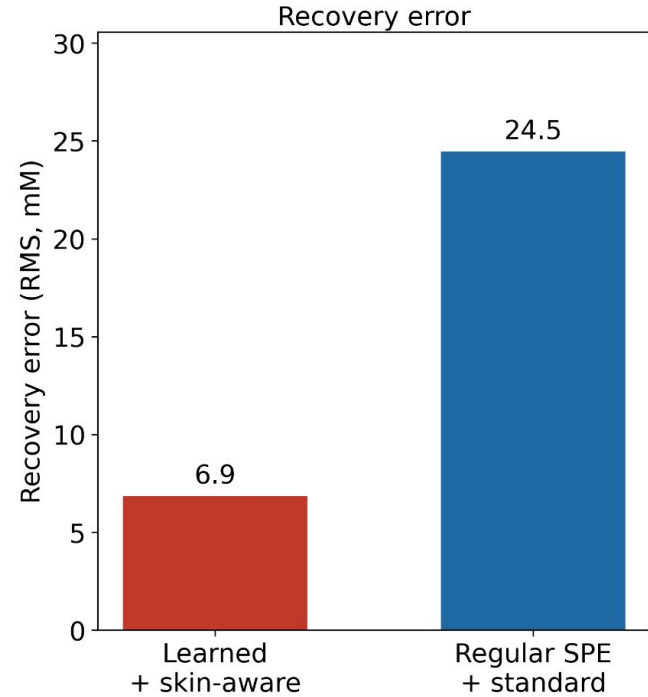
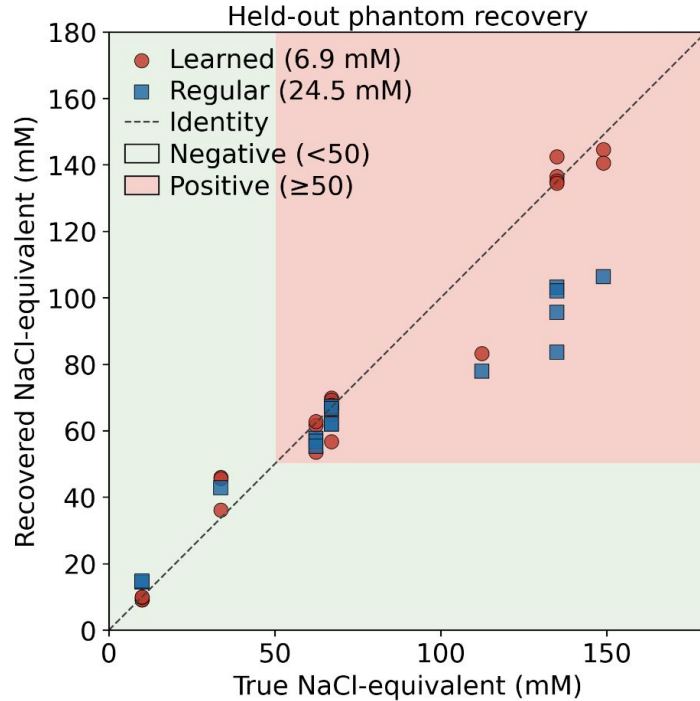
Validation Against Phantoms



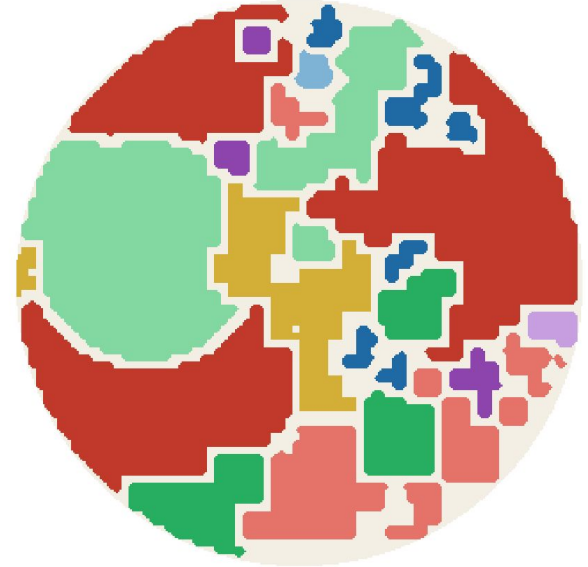
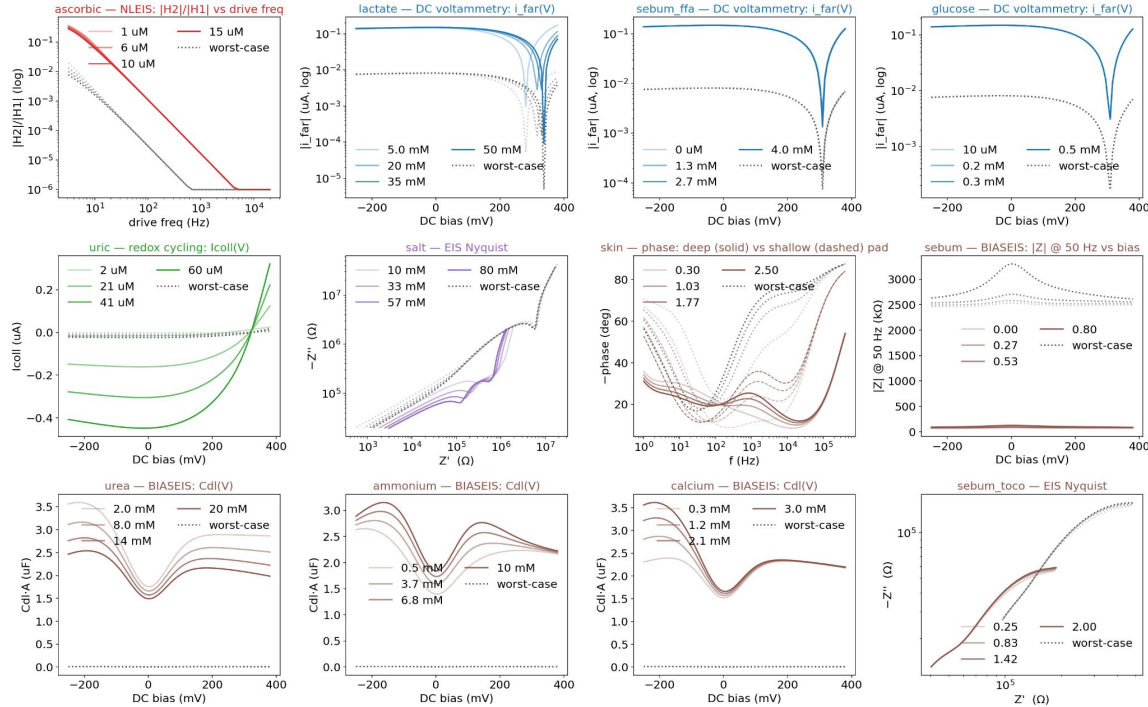
Validation Against Phantoms



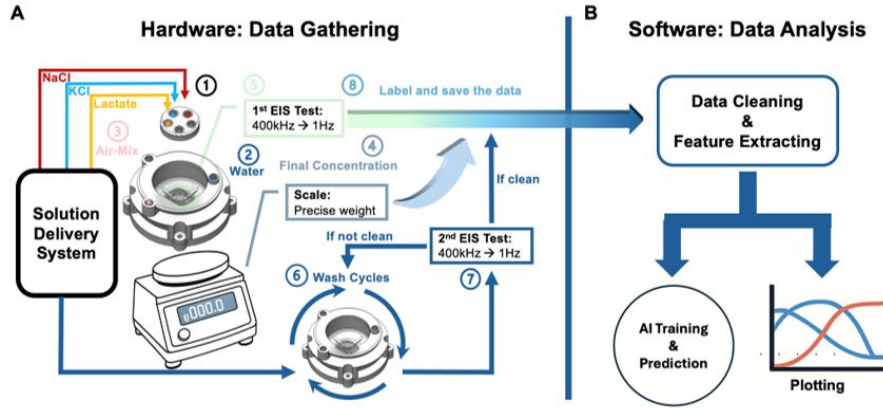
Validation Against Phantoms



Future Work



Future Work



Automated simulated data
collection to train algorithm

Berkeley
UNIVERSITY OF CALIFORNIA

Committee for Protection of Human Subjects (CPHS)
Office for Protection of Human Subjects (OPHS)

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NOTICE OF APPROVAL FOR HUMAN RESEARCH

DATE:

June 25, 2026

TO:

Liwei Lin

CPHS PROTOCOL NUMBER:

2025-10-19012

CPHS PROTOCOL TITLE:

Wearable Noninvasive Sweat Sensing

FUNDING SOURCE(S):

Funding Type: BSAC General Fund

Human testing of wearable

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