**Lab-on-chip (LOC) based on memristive biosensor for project “in-memory sensing”**

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**Introduction:**

Silicon nanowire (SiNW) based biosensors offer exceptional sensing capabilities. When configured in a back-to-back diode structure, SiNWs exhibit diverse memristive behaviors in the current-voltage (I-V) characteristics. These distinct memristive behaviors have a significant impact on the sensing ability of the biosensor. This project is aim to integrate an optimized memristive biosensor with a microfluidic channel, creating a COMS-compatible lab-on-chip system.



Fig. 1: (a) Schematic of the memristive biosensor, SiNWs are anchored between back-to-back Schottky diodes, bio-modified with antibodies. (b) Equivalent circuit with capacitor shunted to the memristor.



Fig. 2: Voltage gap resposne after biofunctionalization. (a) Simulation result . b) Representative experimental measurement of I-V curve after biofunctionalization.

**Objective:**

The primary objective of this master project is to conceive, design, and showcase a portable memristive biosensor system. This system will feature a Silicon Nanowire (SiNW)-based memristive biosensor seamlessly integrated into a user-friendly microfluidic platform. The integration will be accomplished in conjunction with a COMS-compatible circuit, culminating in the development of a lab-on-chip system tailored for point-of-care applications.

Student 1: Circuit and Instrument implantation to demonstrate the memristive behavior (Current amplifier, sinus input).

Student 2: Microfluidic channel development, integrating the SiNW based biosensor and electrodes.

**Requirement:**

For student 1: Basic knowledge on sensors,

Basic knowledge of electronics

Interest, Motivation, and Commitment to the project

For student 2: Knowledge in micro/nano technology, experience in the clean room better.

Interest, Motivation, and Commitment to the project

**What can you get probably:**

1. Knowledge about memristive behavior and memristive biosensor.
2. Open-mind colleagues and excellent group.
3. 1~2 journal paper together, or 1 conference paper each.

**References**

1. **Tzouvadaki, Ioulia, et al. "Portable memristive biosensing system as effective point-of-care device for cancer diagnostics." 2018 IEEE International Symposium on Circuits and Systems (ISCAS). IEEE, 2018.**
2. **Vallero A, Tzouvadaki I, Puppo F, et al. Memristive biosensors integration with microfluidic platform[J]. IEEE Transactions on Circuits and Systems I: Regular Papers, 2016, 63(12): 2120-2127.**