ScuDo

Scuola di Dottorato ~ Doctoral School

WHAT YOU ARE, TAKES YOU FAR

XXXV Cycle

A platform for stimulation and pH sensing of lung cancer cells

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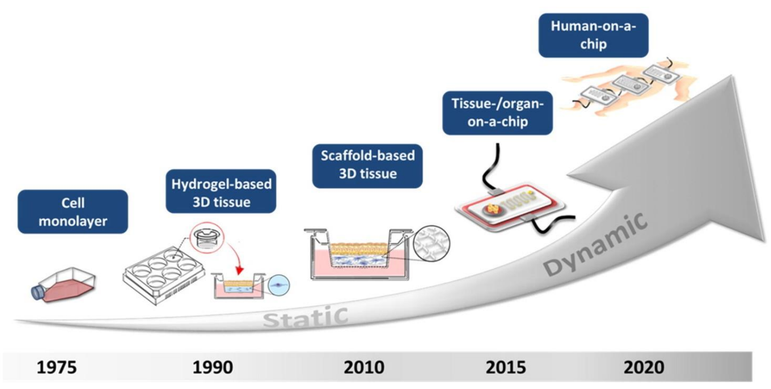
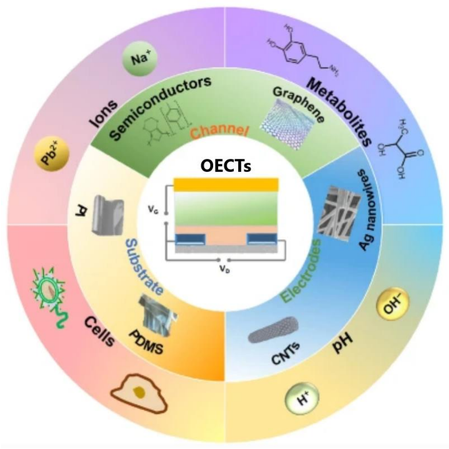
Supervisors: Prof. Fabrizio Pirri, Prof. Matteo Cocuzza

Research context and motivation

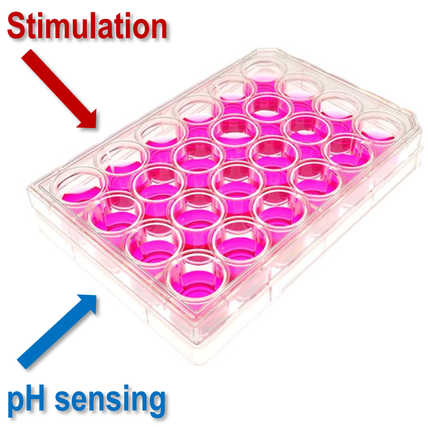


- Growing research interest in increasing the complexity of **standard cell cultures**, trying to recreate **organ-specific microenvironments**
- **O**rganic **E**lectro**C**hemical **T**ransistors are an emerging **biocompatible** technology capable to **detect** biological, chemical and physical quantities during cell growth



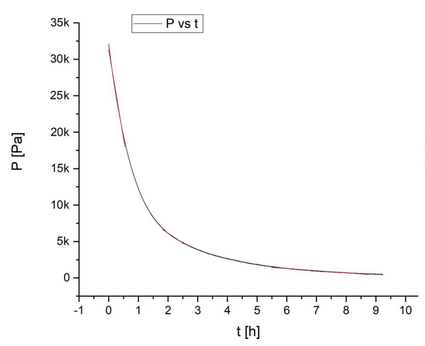
Addressed research question/problems

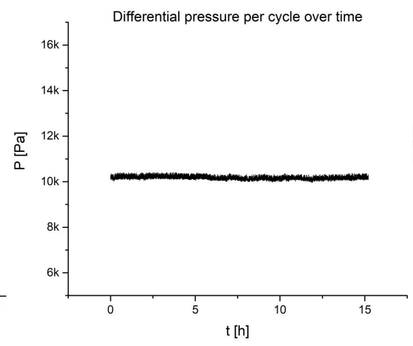
- From a **static** 2Dcell culture to a **dynamic** one through **cyclic hydrostatic stimulation**
- Compatibility with **standard multi-well plate** culture protocols
- Development of **pH** sensitive **OECTs**
- **pH monitoring** during dynamic cell culture development

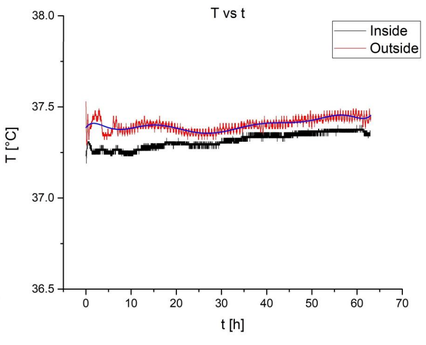


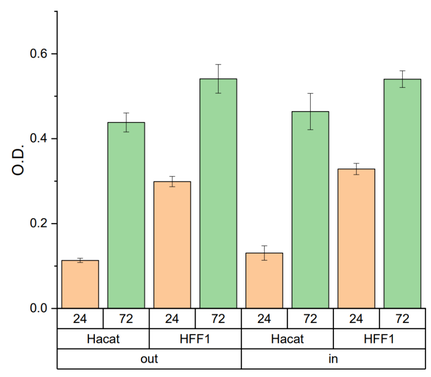
Novel contributions

Platform characterization



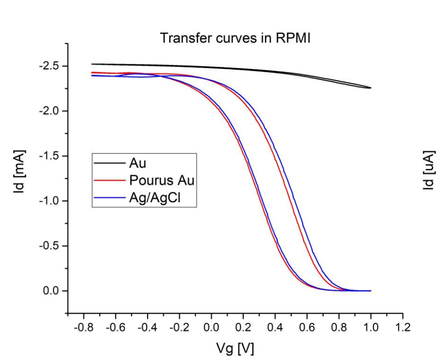


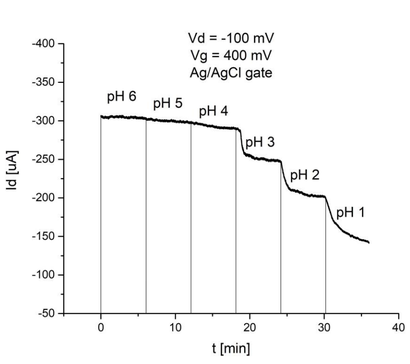


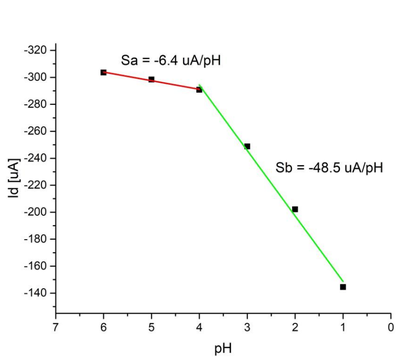


- **Profileration** test with **HaCaT** and **HFF1** cells shown an **identical behaviour** compared to control cultures
- The **feasibility to grow a cell culture** inside the system has been **verified**

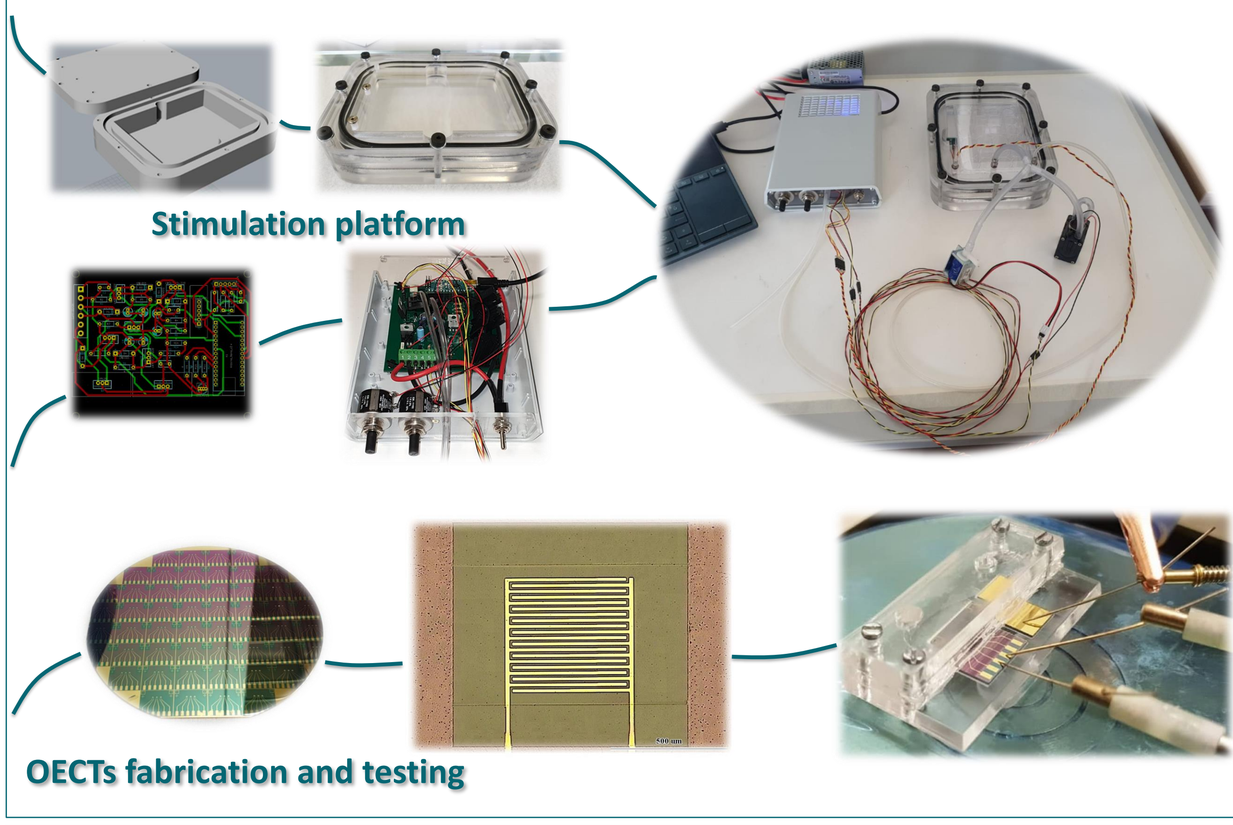
- **Different gate materials** have been tested with OECTs working in **cell culture media**
- Solutions with **different pH** values have been tested, showing a **drain current modulation**







Adopted methodologies



Future work

- Since no effect have been observed on **proliferation**, further cell growth tests will be performed inside the system, checking **cytoskeletal stiffness/rearrangements**
- Tests with **basic pH** solutions will be performed, monitoring the drain current response
- The possibility to fabricate **OECTs** on a **flexible substrate** will be evaluated, to make them suitable for working on the curved walls of a multi-well plate
- Electrodeposition of **porous gold and silver** on the gate will be explored, to **improve the electrical response of flat gold gates**

List of attended classes

- 01SIHRV – Bio Nano Electronics and BioMolecular Computing (17/07/2020, 4)
- 02LCRKG – Fisica di superfici ed interface (23/10/2020, 3)
- 01LXBRW – Life Cycle Assessment (08/06/2020, 5)
- 01MLHKG – Microscopia a scansione di sonda per la fisica e l'ingegneria (28/07/2021, 6)
- 01RPVKG – Plasma physics (10/08/2020, 6)
- 02LWHRV – Communication (18/04/2020, 1)
- 01SHMRV – Entrepreneurial Finance (24/04/2020, 1)
- 03LCLRV – Epistemologia della macchina (01/09/2020, 3)
- 08IXTRV – Project management (28/04/2020, 1)
- 01RISRV – Public speaking (02/12/2019, 1)
- 01SYBRV – Research integrity (03/12/2019, 1)
- 01SWQRV – Responsible research and innovation, the impact on social challenges (27/04/2020, 1)
- 02RHORV – The new Internet Society: entering the black-box of digital innovations (05/12/2019, 1)
- 01SWPRV – Time management (02/12/2019, 1)

Submitted and published works

- N.Cacocciola, M.Parmeggiani, S.Villata, "*A programmable culture platform for hydrostatic stimulation and in situ pH sensing of lung cancer cells with organic electrochemical transistors*", Micro and Nano Engineering, vol. 16, August 2022
- L.Vigna, M.Gottschalk, N.Cacocciola, "*Flexible and reusable parylene C mask technology for applications in cascade impactor air quality monitoring systems"*, Micro and Nano Engineering, vol. 14, June 2022
- N.Cacocciola, M.Parmeggiani, M.Segantini, "*A programmable culture platform for stimulation and in situ sensing of lung epithelial cells*", L'era delle 3R: modelli in silico, in vitro e in vivo per promuovere la ricercar traslazionale, Online, 30 September 2021 – 1 Ottobre 2021

Politecnico di Torino

PhD program in

Electrical, Electronics and Communications Engineering