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Aydogmus, H.; van Ginkel, H.J.; Mastrangeli, M.; Zhang, Kouchi; Sarro, P.M.

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# FET-BASED CHARGE SENSOR FOR ORGANS-ON-CHIP WITH IN-SITU ELECTRODE DECORATION

Hande Aydogmus, Hendrik Joost van Ginkel, Massimo Mastrangeli, GuoQi Zhang, Pasqualina M. Sarro

Electronic Components, Technology and Materials
Department of Microelectronics
Delft University of Technology

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## *Cell culturing in petri dishes*

Retrieved from https://www.dfg.de/download/pdf/dfg_im_profil/geschaeftsstelle/publikationen/tierversuche_forschung_en.pdf

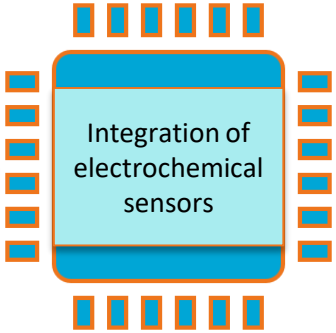
## *Animal Models*

Retrieved from https://www.shutterstock.com/image-photo/culturing-cells-tissue-culture-plates-216981568

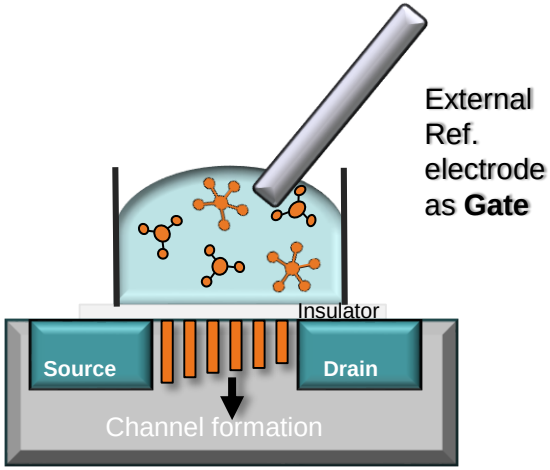
## *Organs-on-Chip*

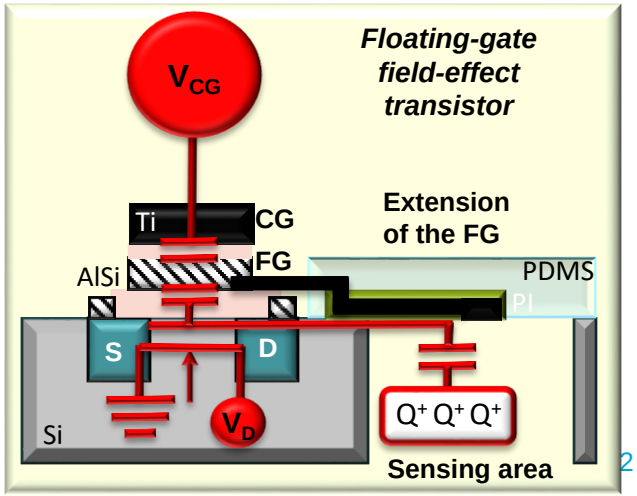
Dynamic tissue culturing devices mimicking human (patho)physiology

Source: Wyss Institute at Harvard University




## Ion-sensitive FET



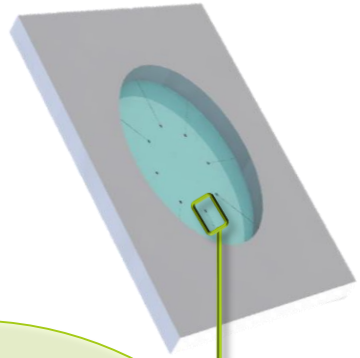



# Silicon-Polymer hybrid OoC device

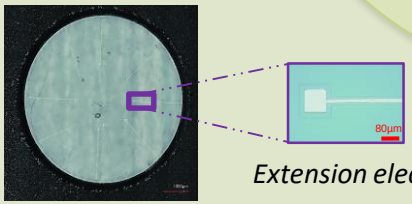
- X External ref. electrode
- ✓ Control-Gate
- ✓ CMOS-compatible
- ✓ Transparent
- ✓ Bio-compatible
- ✓ Electrical performance

*Front side*

*Back side*

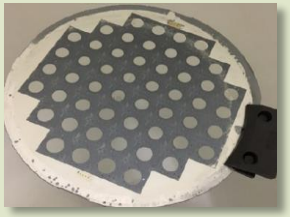


## CMOS-Compatible Fabrication



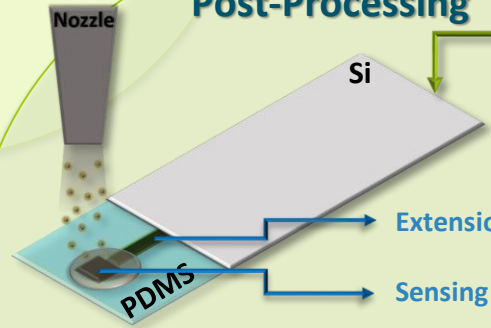

*Back side of 1 chip*

*Extension electrode*



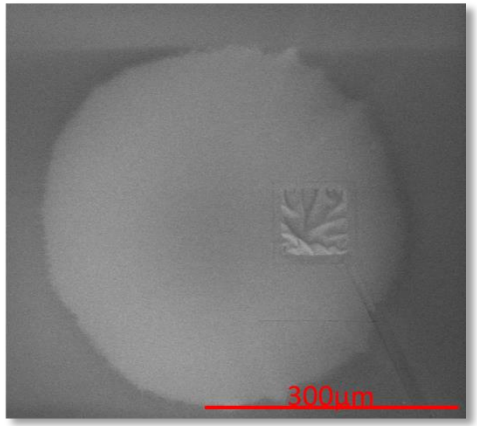
*Wafer-scale fabrication*

## Post-Processing



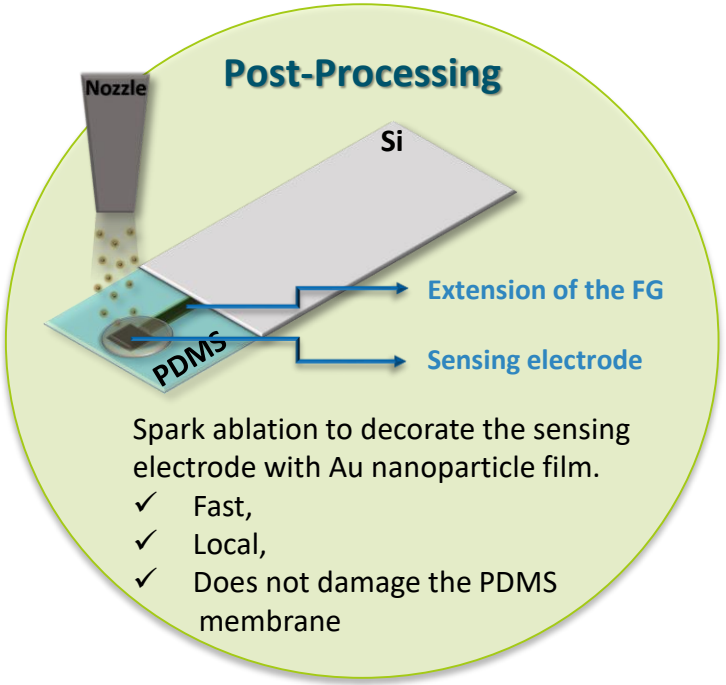

**Spark ablation to decorate the sensing electrode** with Au nanoparticle film.

- ✓ Fast,
- ✓ Local,
- ✓ Does not damage the PDMS membrane



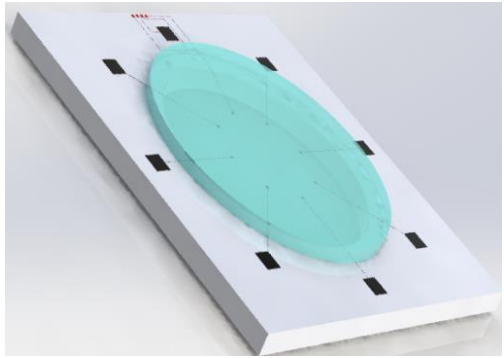

SEM micrograph of the locally deposited Au film of one of the sensing electrodes.

- Up to **3-fold better sensitivity** for poly-l-lsine compared to electrodes without Au decoration.



# Conclusion





- **A novel and extremely compact FG-FET-based electrochemical sensor for OoC applications** [1]:
  - No need for external reference electrode
  - Combines benefits of silicon and polymers
  - Ability to work as a biosensor
- **Spark ablation successfully amplified the surface of the sensing electrodes with thin nanoporous Au films**
  - Fast post-processing
  - Spatially-selective patterning
  - No need for lithography
  - No damage to the polymer membranes (tissue culturing area)

[1] H. Aydogmus et. al., In IEEE Sensors 2020, 2020.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Thank you!
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