

A microneedle-based, integrated smart patch for continuous biomarker monitoring

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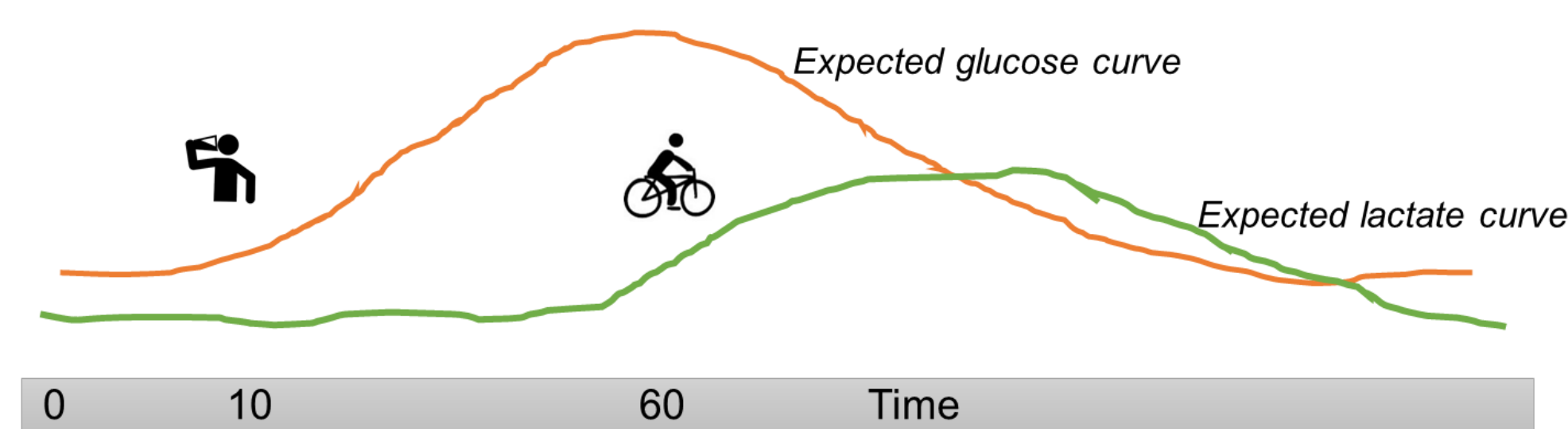
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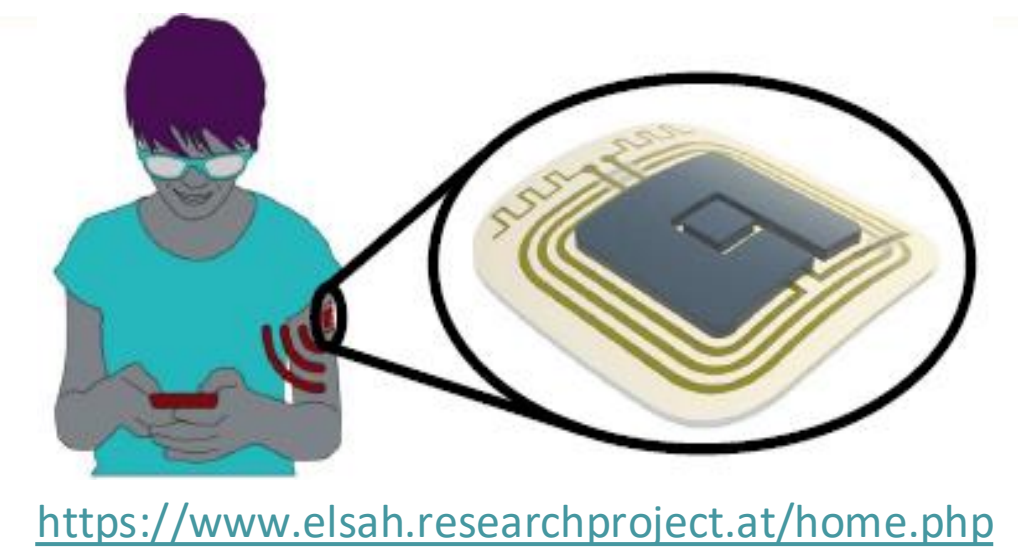
Why Monitoring...

- Diabetes, cardiovascular diseases and high blood pressure have a tremendous social cost.
- Evidence-based support is key to decrease their occurrence.
- Molecular biomarkers are the best predictors to use as support.
- Interstitial Fluid (ISF) is rich in biomarkers and easy to access.
- Microneedles (MNs) offer a pain-free option for IF monitoring.

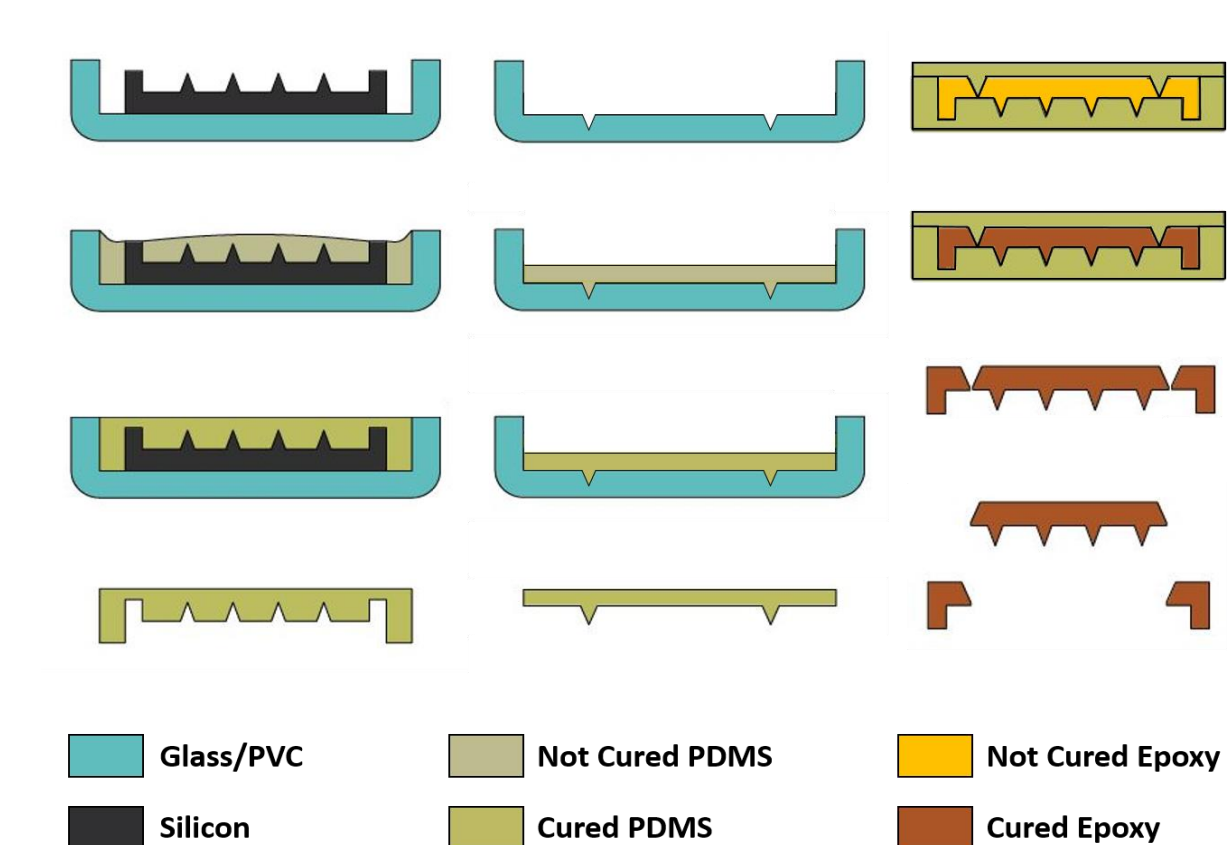


The ELSAH Project...

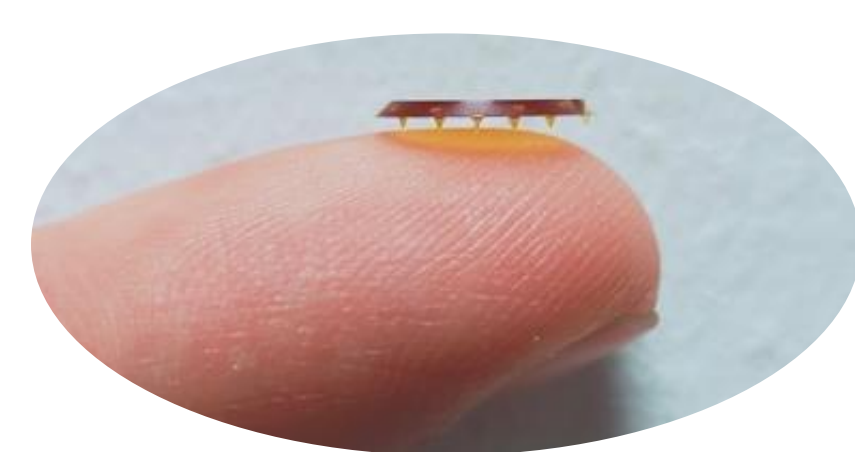
- Consortium of several research institutes together with small, medium and large enterprises.
- Goal to integrate MNs technology in a smart, patch-based wearable sensor system.
- Glucose and lactate continuous monitoring functionalising the MNs.
- Exploitation plan to bring the patch to the market.



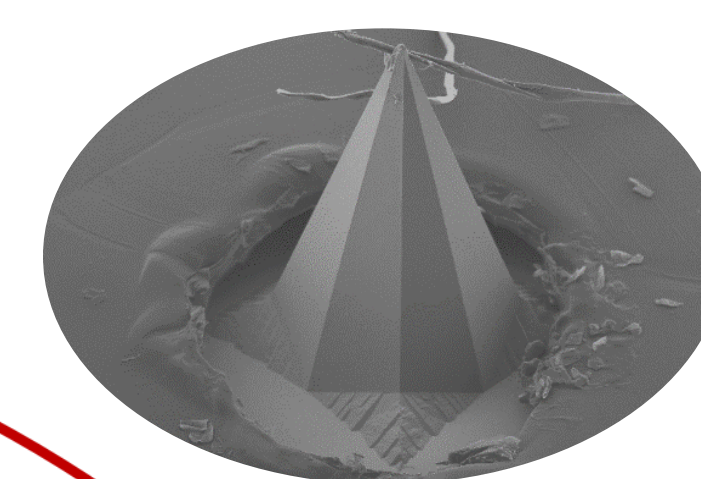
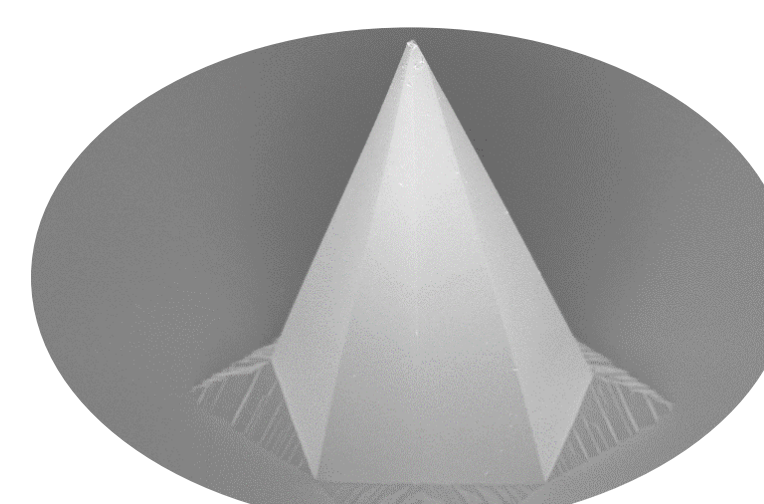
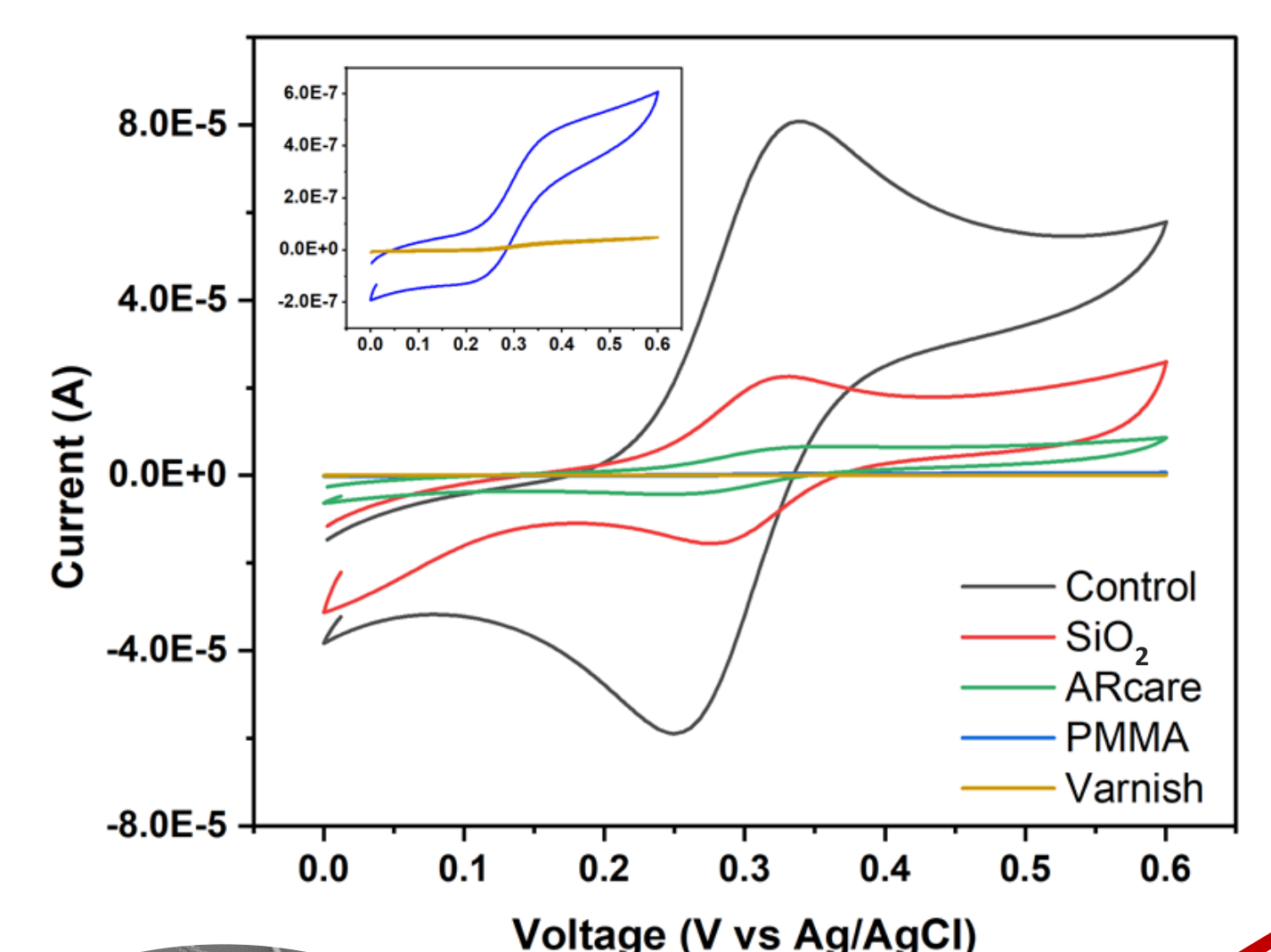
<https://www.elsah.researchproject.at/home.php>



- Replica moulding process used to fabricate cheap polymer MN wafers.
- Through-vias and ebeam metallization to achieve front to back electrical connectivity.
- Ag/AgCl Reference Electrode (RE), Pt Counter (CE) and Working Electrodes (WEs) for simultaneous biomarkers detection.



- Passivation needed to increase the precision of the sensor.
- Several passivation methods tested and compared.
- Medical grade tape (ARcare) proved to be the best combining flexibility, good mechanical stability and high insulating capabilities.



Passivation...

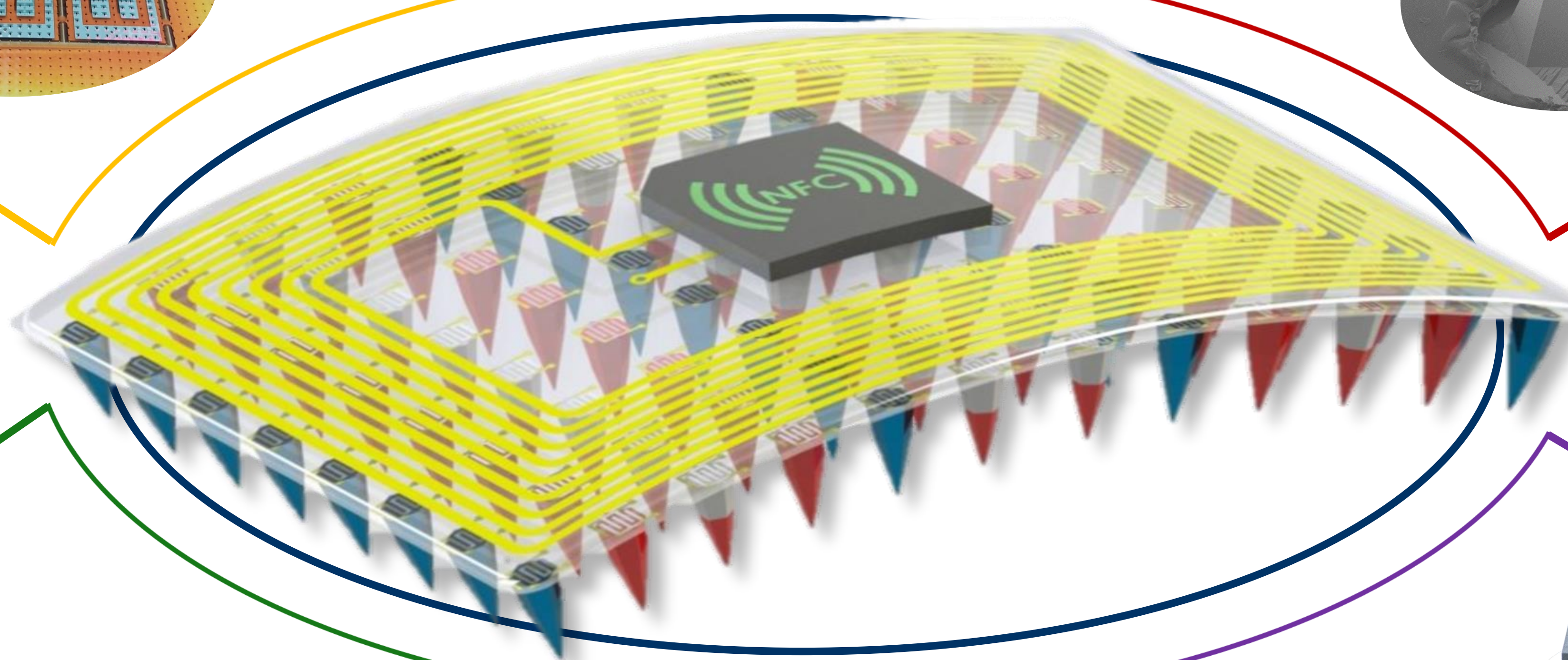
Publications

Modification...

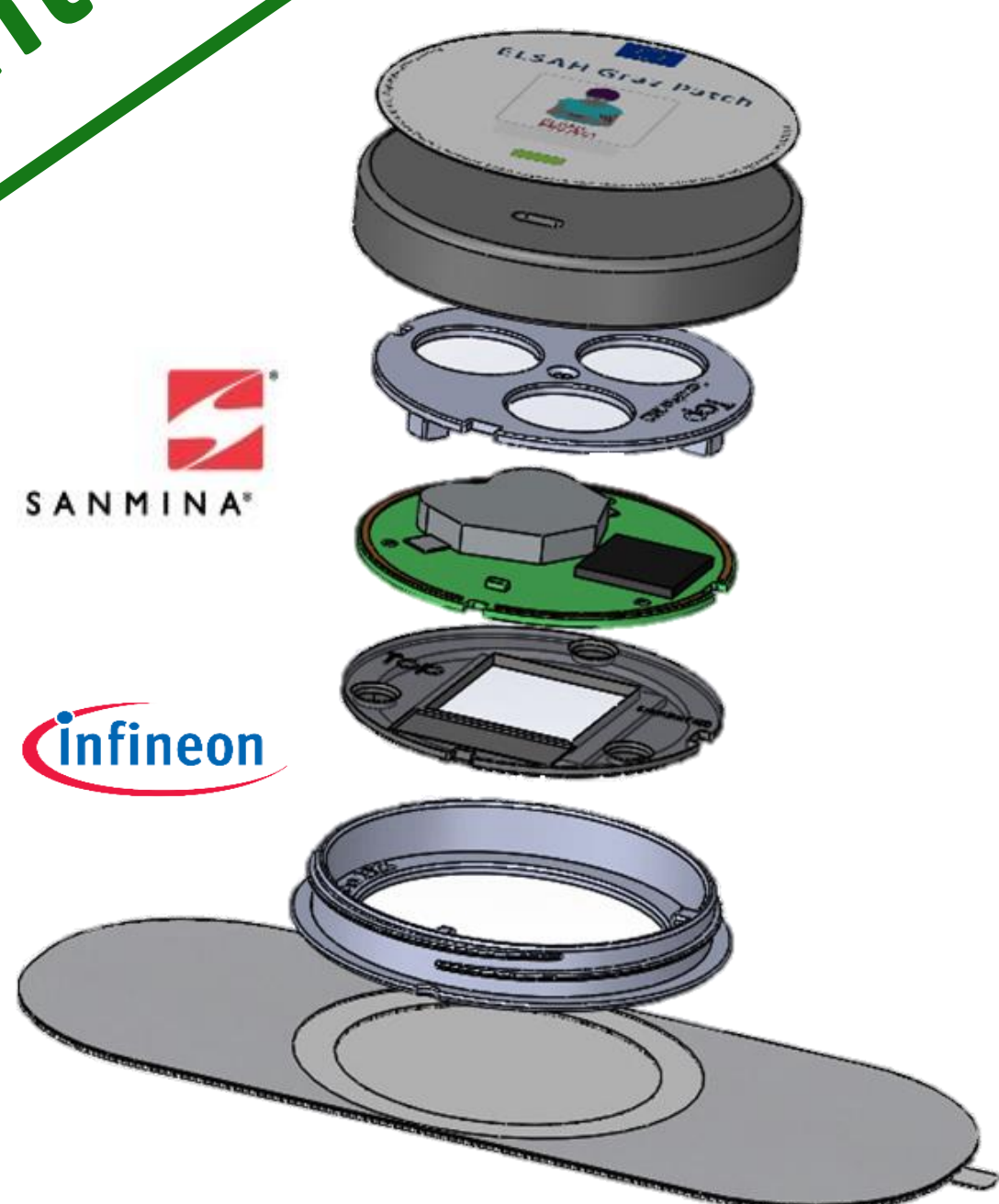
Fabrication...

Publications

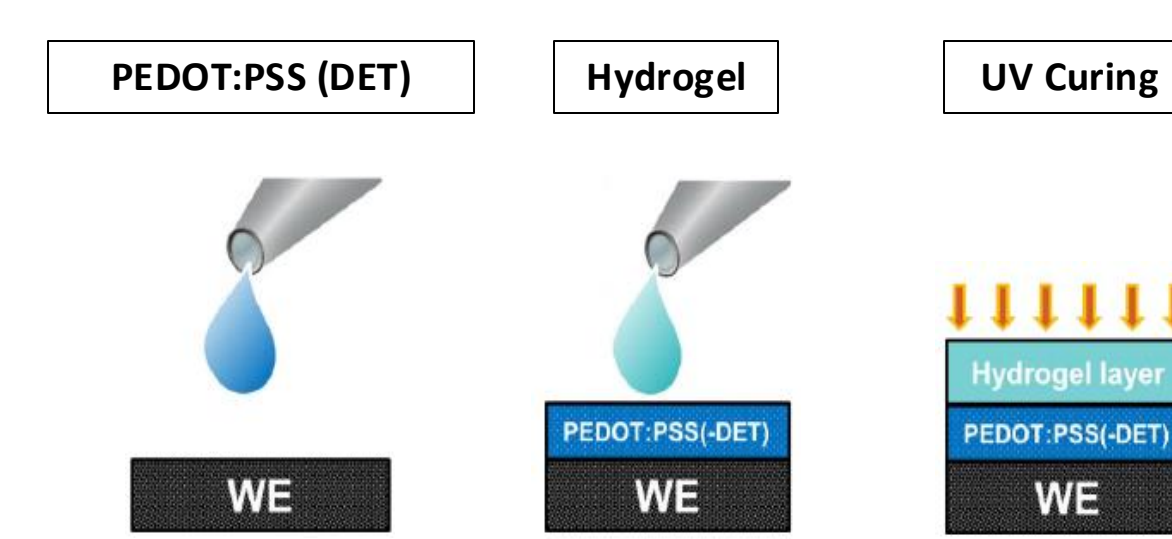
Integration...



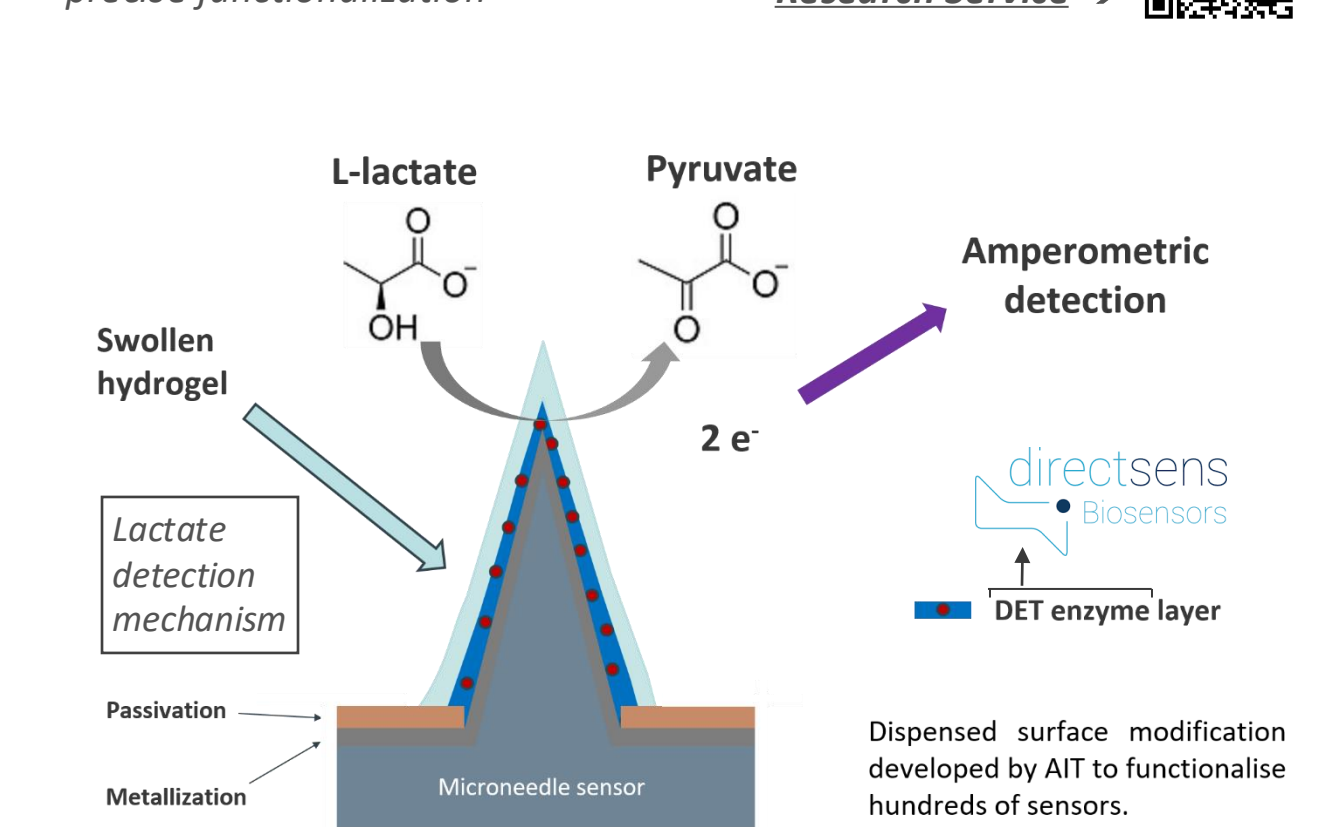
- Infineon's on-chip potentiostat, microcontroller and UHF/NFC communication integrated.
- Custom mobile phone app developed to record data from the device.
- Coin-like device built integrating skin compatible case (Sanmina), sterilized biosensor, electronics, and batteries.



- PEDOT:PSS inks formulated by AIT with direct electron transfer (DET) enzymes (GlucOzyme and LactaZyme from DirectSens) to functionalize the WEs.
- Hydrogel protects the enzymes during insertion and improves biocompatibility.
- Over 100 biosensors fabricated.

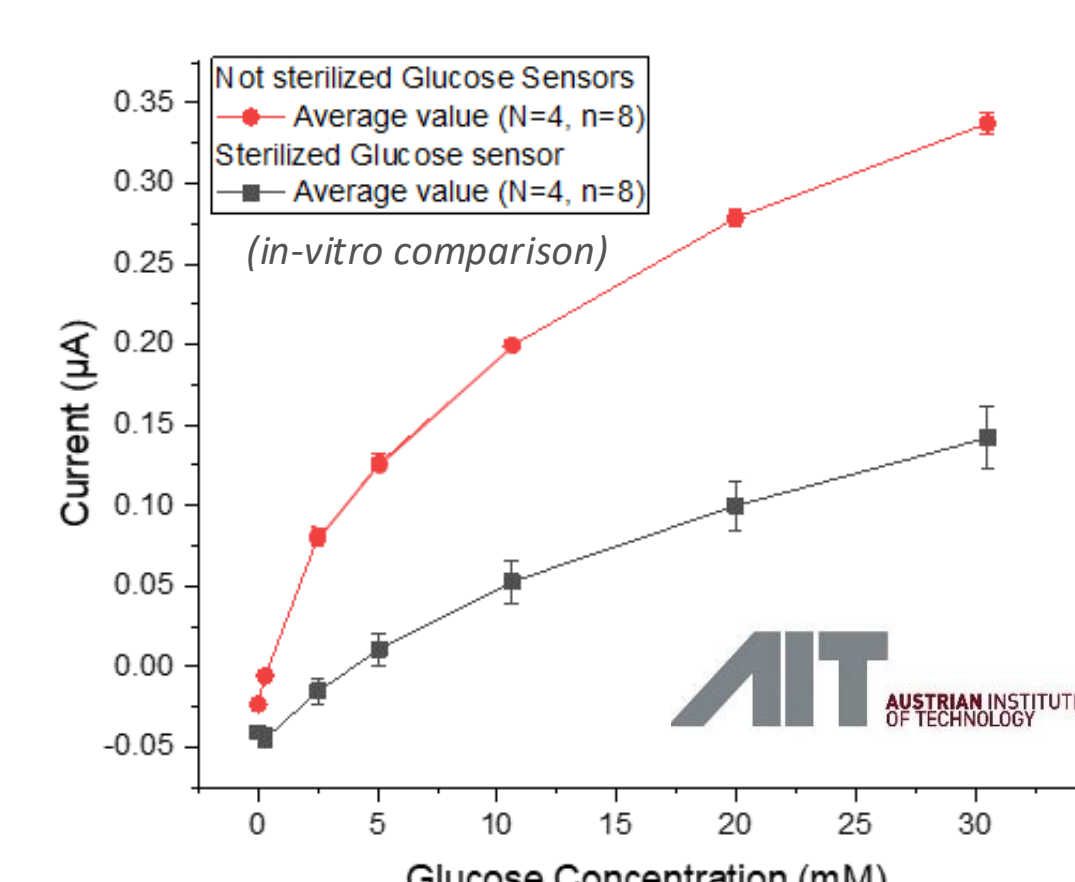
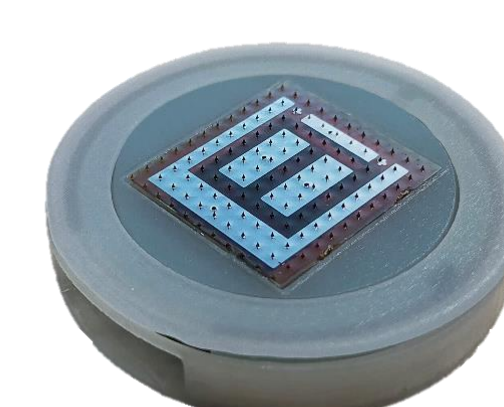


Surface modification of Sensors & Microfluidics Research Service



Conclusions...

- Scalable production process for the entire system developed.
- Coin-like device: Glucose and Lactate continuous detection built.
- In-human 30 volunteers study performed at Medical University of Graz.
- Tested for cytotoxicity, skin sensitization and skin irritation (ISO10993-5/-10/-23 standards).



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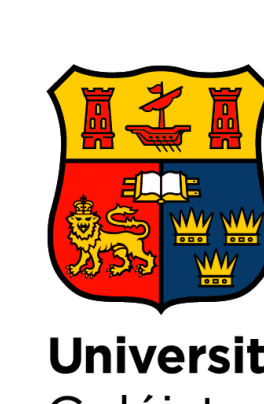
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European Union
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ELSAH PROJECT
ELECTRONIC SMART PATCH
SYSTEM FOR
WIRELESS
MONITORING OF
MOLECULAR
BIOMARKERS FOR
HEALTHCARE AND
WELL-BEING



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