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Textil-basierte Wearables

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Swiss Engineering / Tage der Technik

25.09.2025

Biomimetic Membranes and Textiles

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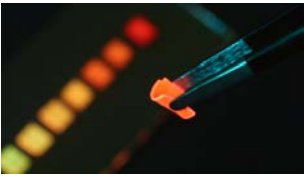
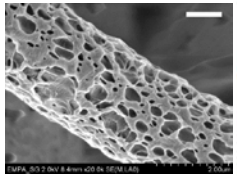
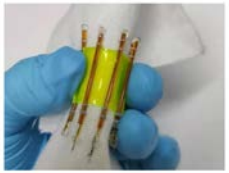
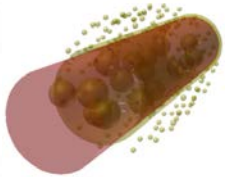
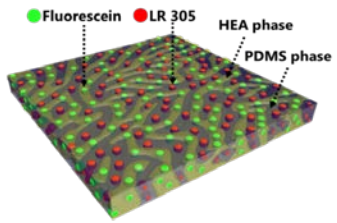
We design soft materials to monitor and support body functions

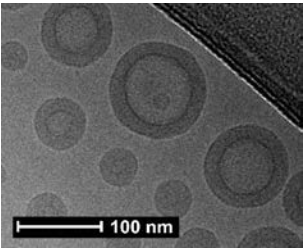


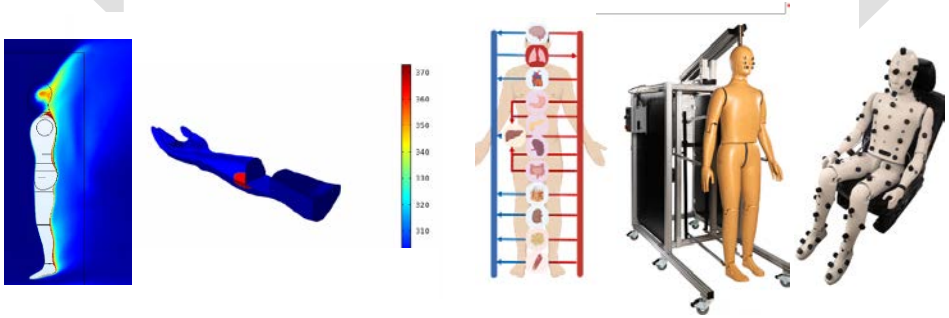








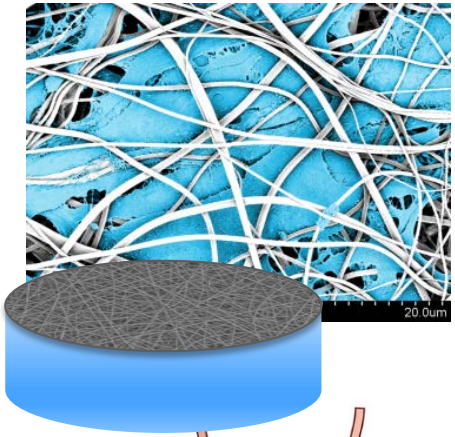


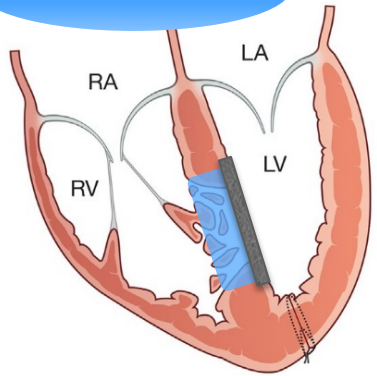


We pioneer manikins and digital twins for tailoring biomimetic solutions

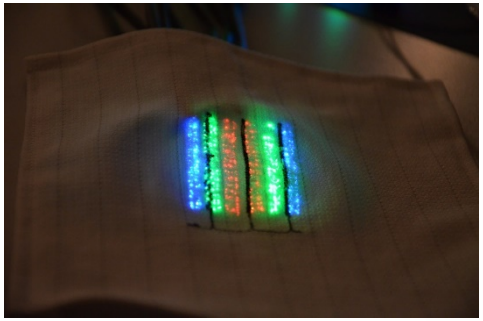
Forschungsschwerpunkte (2025 – 2028)

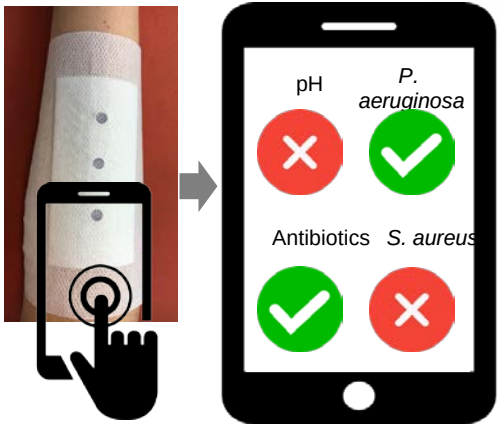
Functional Hydrogels



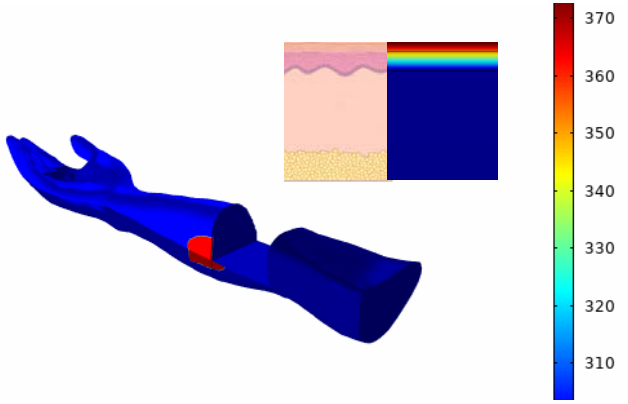


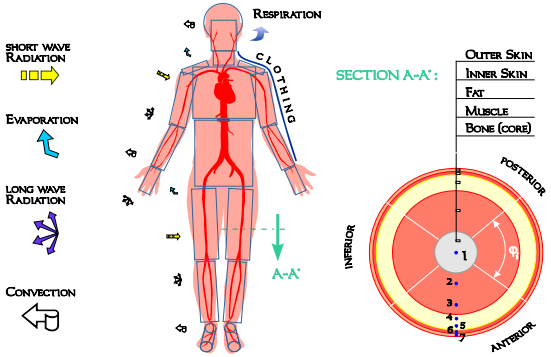
Wearables and Biosensing





Digital Health Solutions





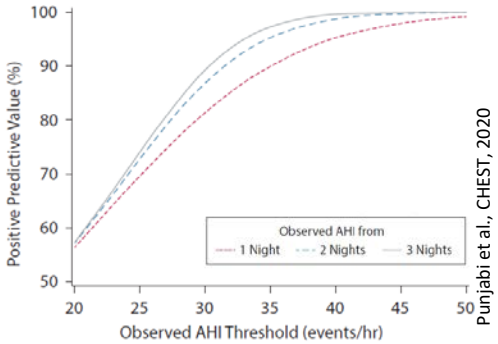
Continuous Patient Monitoring

Fields of application

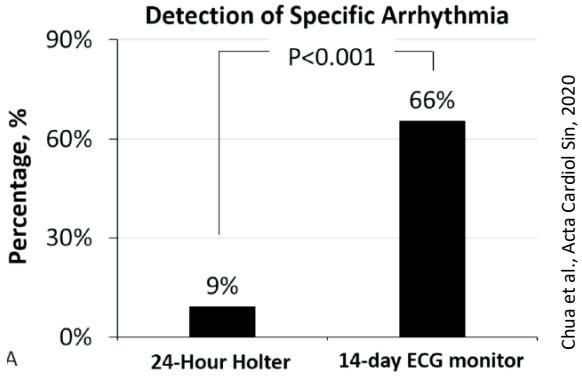
- Out-patient screening
- In-patient therapies at high risk of infection (sepsis)
- Acute post-operative phase
- Out-patient follow-up

Benefits

- Appropriate assessments
- Early detection of adverse effects
- Evaluation of therapeutic efficacy



Punjabi et al., CHEST, 2020



Chua et al., Acta Cardiol Sin, 2020

Textile-based Sensors

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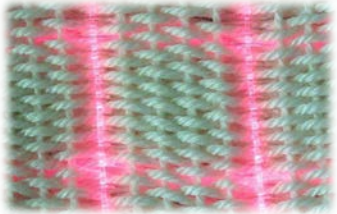
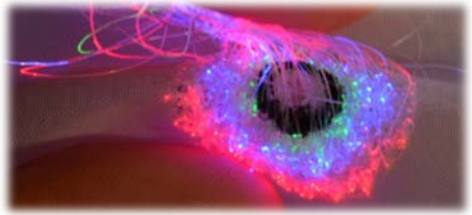
Opportunities

- Integration in (existing) textile systems (disappearable)
- Unrestricted wearing comfort (comfortable)
- Applicable for continuous monitoring (permanent)







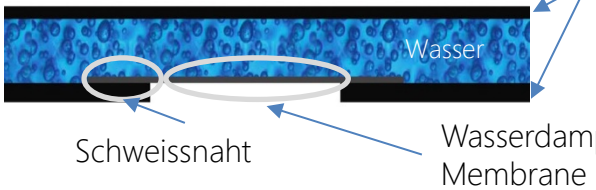

Challenges

- Resilience during demanding use
- Reliability in demanding conditions
- Accuracy despite demanding operation

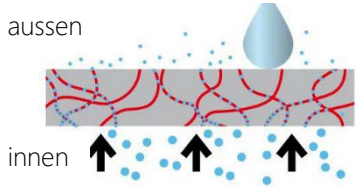
Conductive Fibres (E-Fibres)

Textile ECG sensor for long-term monitoring

Die Befeuchtungseinheit

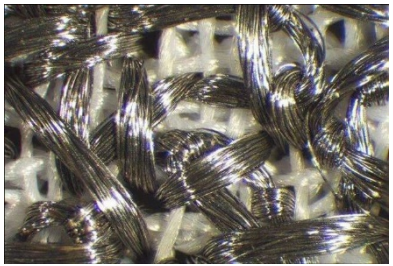


Die wasserdampfdurchlässigen Membrane



www.sympatex.com/membrane/18/performance

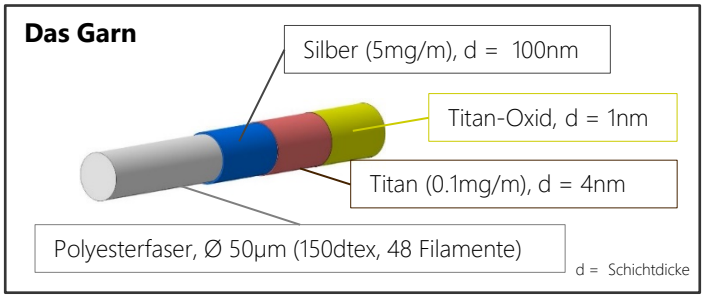
Die Textile Elektrode



Textile Eigenschaften der Elektrode

- flexibel
- porös
- hohes Oberflächen-Volumen Verhältnis
- gewohnt, auf der Haut zu tragen

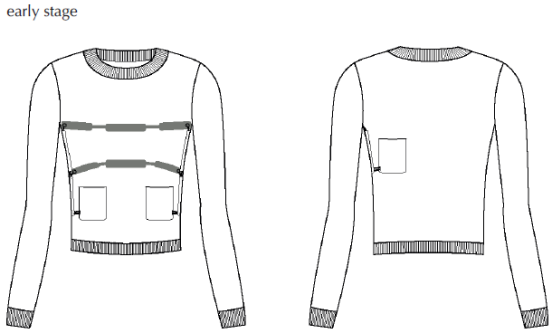
Das Garn

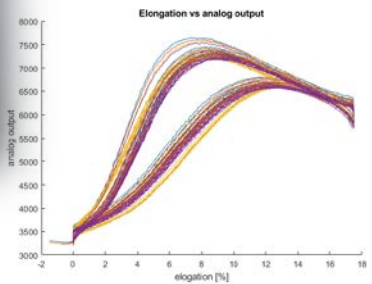


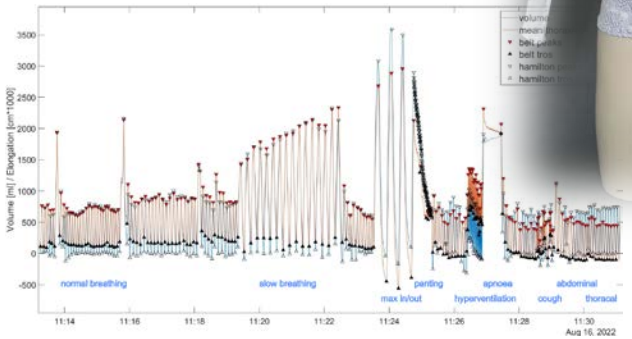
Weder, Rossi, et al., Sensors, 2015, 15 (1), 1750 - 1759

Conductive Fibres (E-Fibres)

Textile breathing sensor

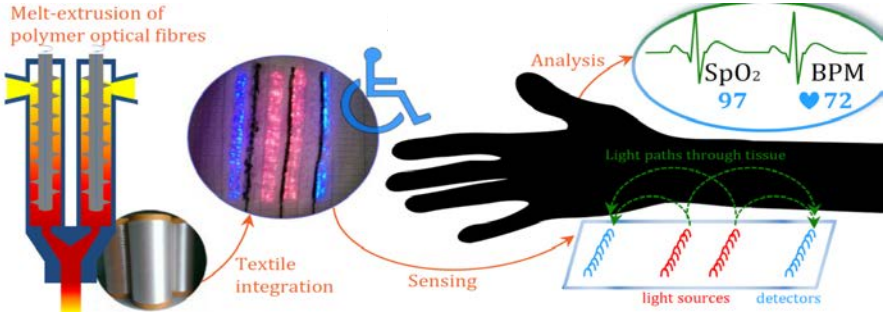


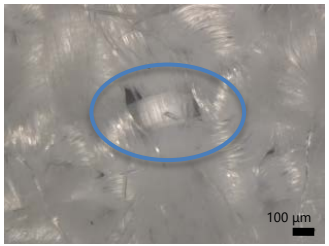


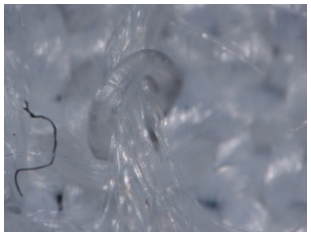


Light applications on the skin (O-fibres)

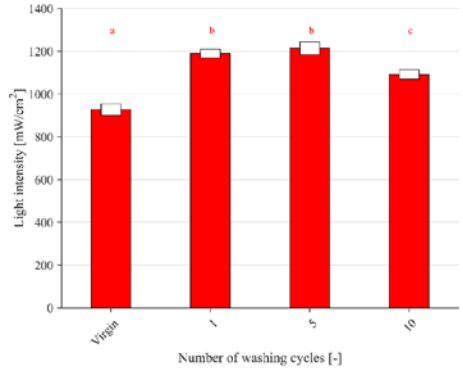
Fibre development and textile integration for local light applications and monitoring



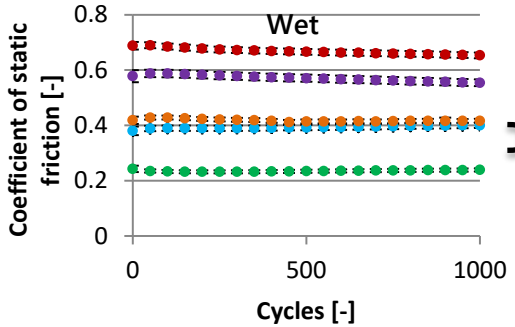




Washability



Wearing comfort



Textile photoplethysmography sensor

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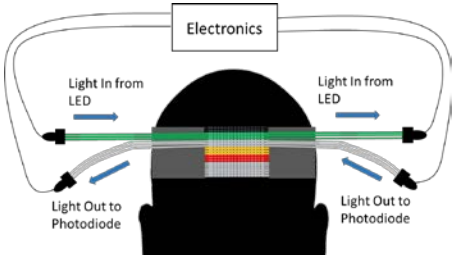
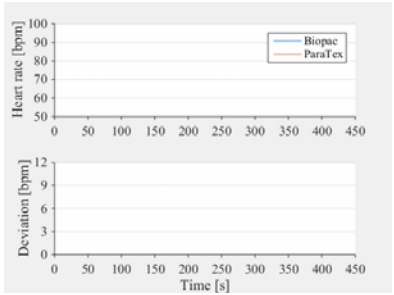
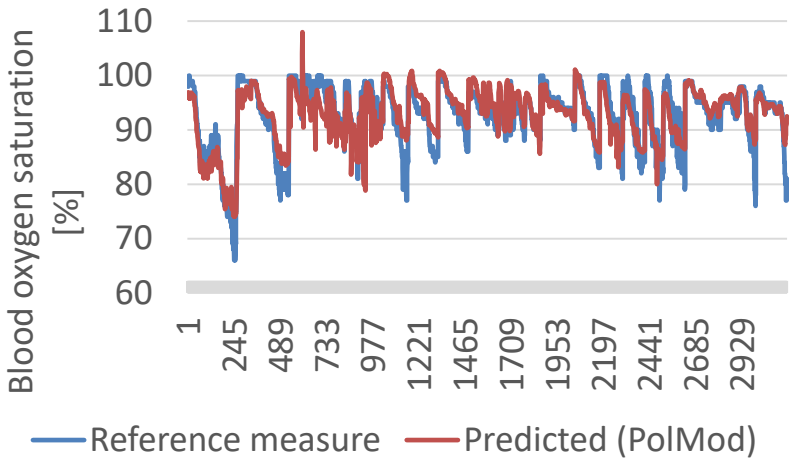
Validation lab trial





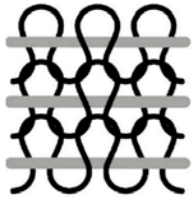


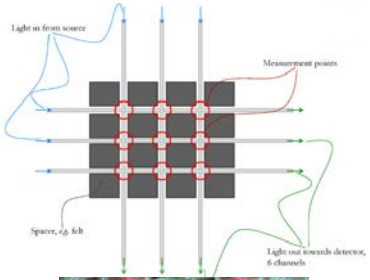
Applications of interest

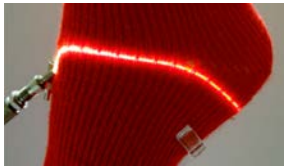
- Sleep monitoring (sleep apnea)
- Continuous in-patient monitoring (sepsis)
- Continuous monitoring of newborns (SpO_2, bilirubin)

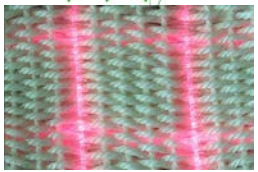
Textile pressure sensor

Fibre development and textile integration
for pressure sensitive light extraction

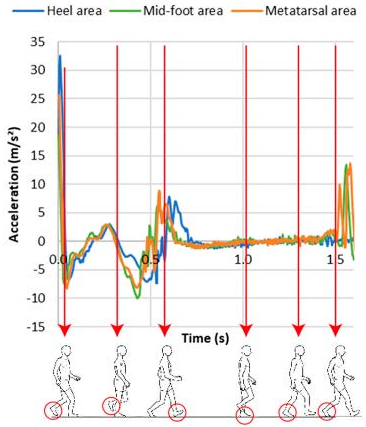


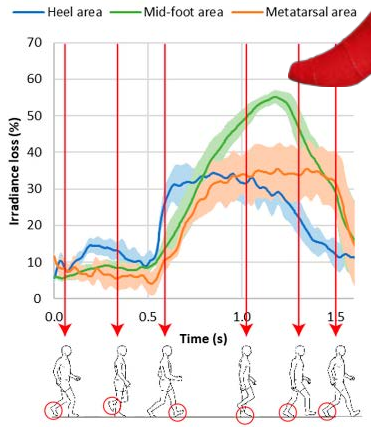






Proof of concept study

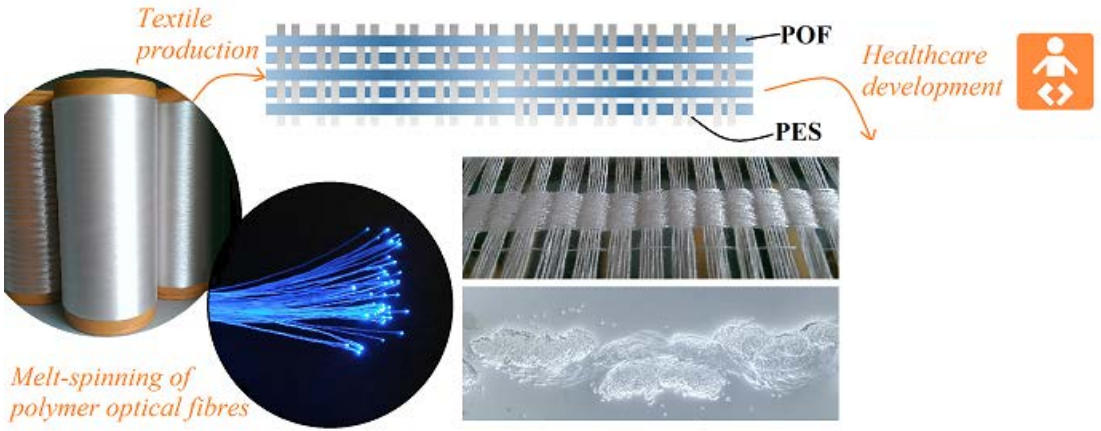




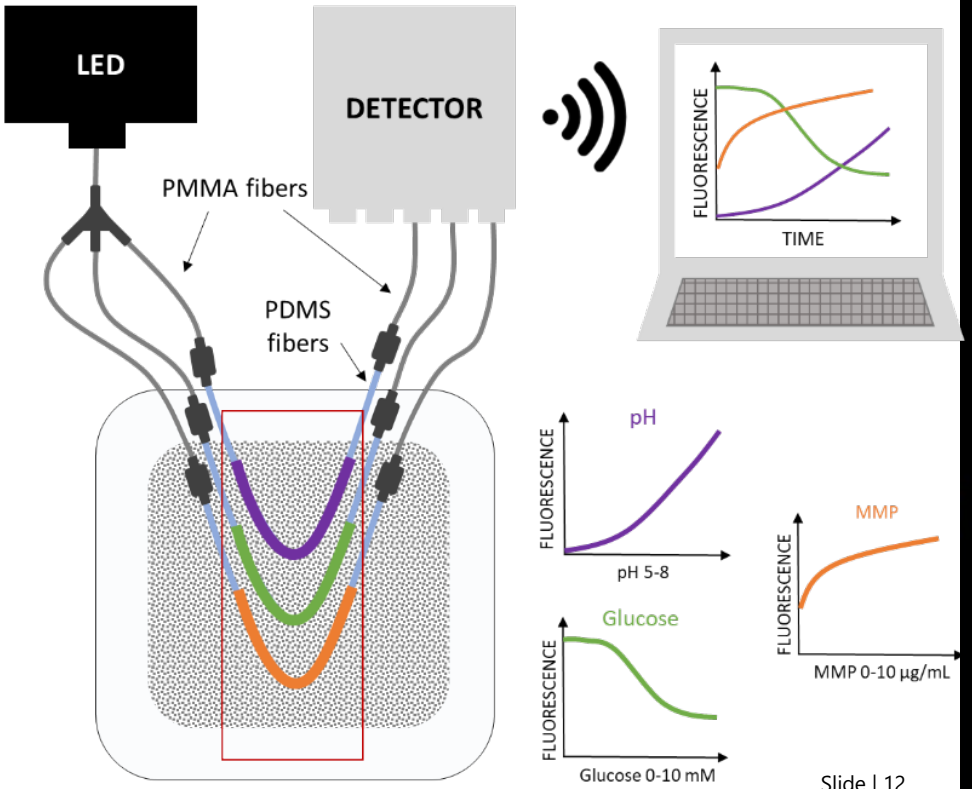
Applications of interest

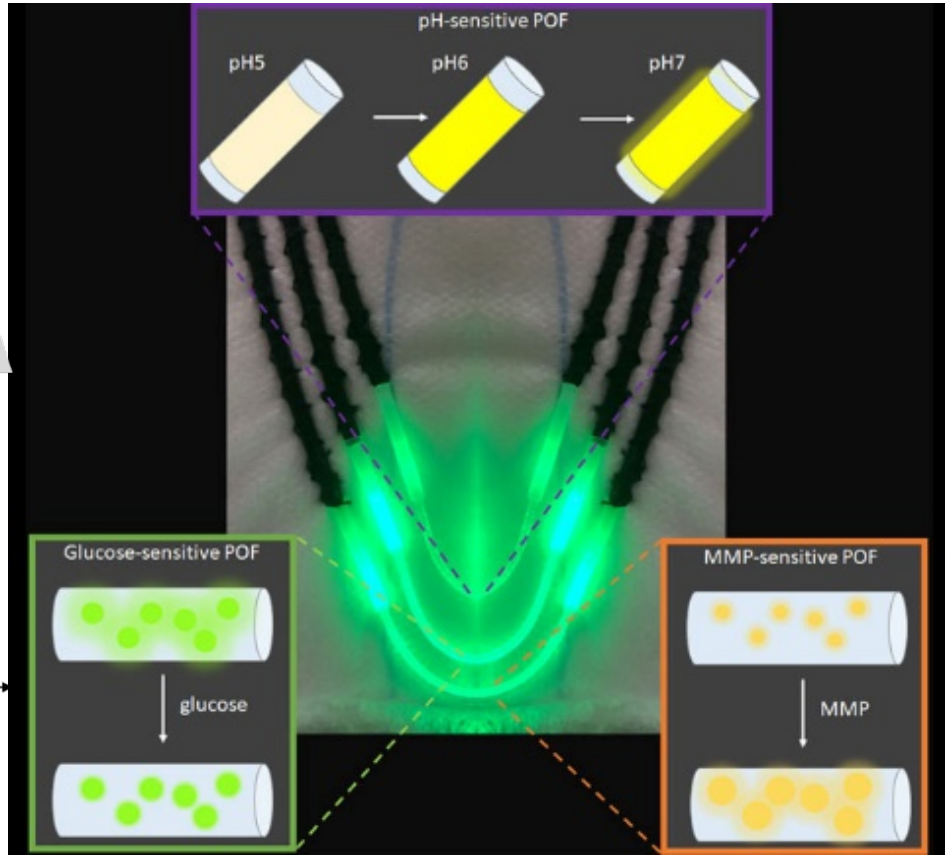
- Detection risk for pressure injuries (paraplegics, neuropathies, newborns)
- Pressure monitoring in supporting structures and robotics (casts, exoskeleton, gloves)

Wearable phototherapy

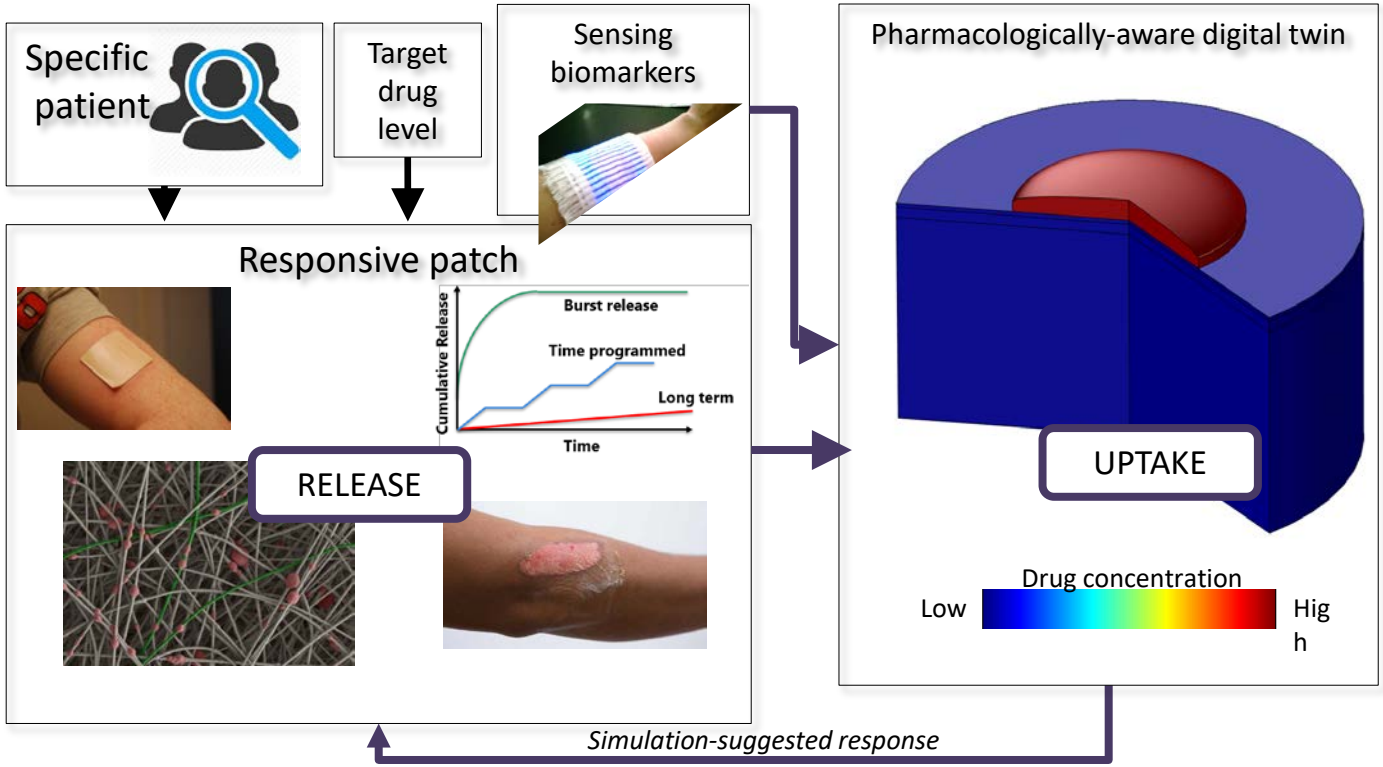


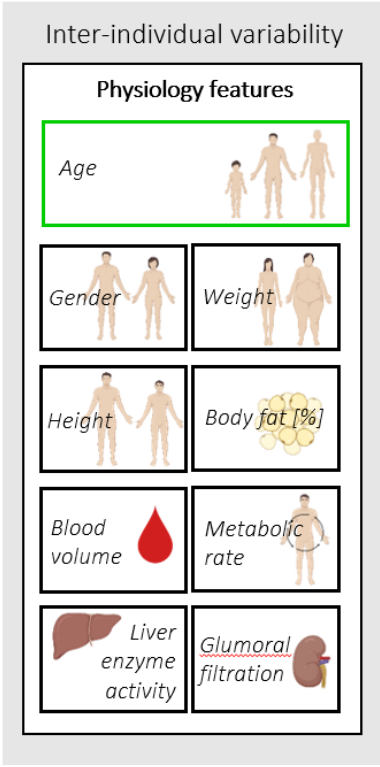
F-fibres: Multimodal biosensors for wound monitoring



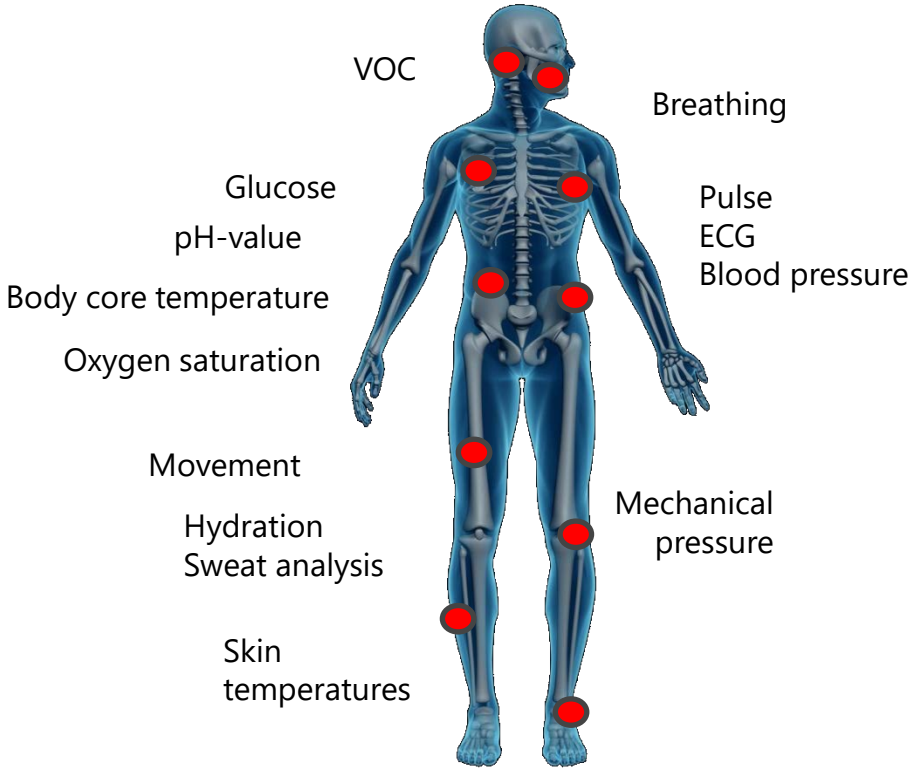


Digital twins for patient-specific therapies





Future textile-based monitoring opportunities



Textile-based sensors for digital health solutions

- **Key success factors**
  - Reliability and accuracy of signals
  - Biocompatibility of sensors
  - Unobtrusive nature and high wearing comfort
  - Applicability for telemedical applications
- **Early detection** due to continuous monitoring
- **Appropriate assessments** due to screening at home
- **Individualized therapies** due to patient follow-up at home

Vielen Dank für Ihre Aufmerksamkeit!

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