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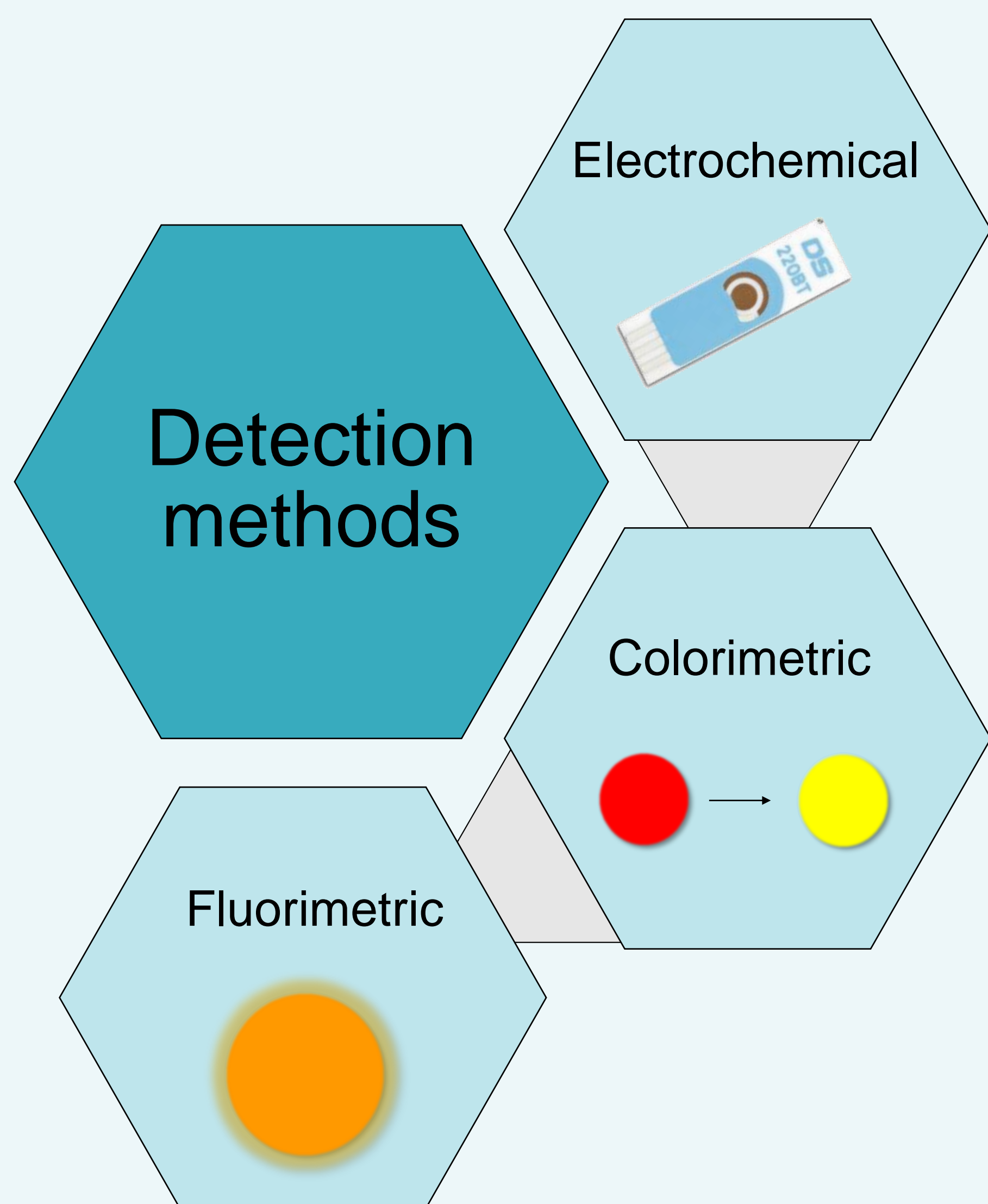
Abstract

Wound infections pose a significant threat to the healing process, being one of the most serious complications that can occur in wounds. Current methods of infection diagnosis rely mostly on clinical inspection or microbiological analysis. Both of these approaches present serious limitations, such as a high degree of inaccuracy and long analysis times. A promising alternative for the early diagnosis of wound infection is represented by the detection of certain biomarkers, such as bacteria metabolites, enzymes, inflammatory mediators, physio-chemical parameters (pH, oxygenation, temperature changes) or even the detection of pathogen bacteria itself. An ideal way to reduce patient discomfort during the diagnostic procedure would be to integrate sensors for biomarker detection directly into the dressing used for wound protection and treatment. To this aim, wearable and disposable sensors have been developed in recent years.

In this contribution we will be discussing the latest achievements in the field of wearable and disposable sensors for wound infection biomarker monitoring.

Target analytes

- Uric acid
- Lactate
- H₂O₂
- Nitric oxide
- pH
- Oxygen
- Pyocyanin
- Bacteria



Fabrication techniques

Electrochemical sensors

- Screen-printing of electrodes onto commercial wound dressings
- Inkjet printing of electrodes onto flexible substrates
- Laser carbonizing
- Laser scribing

Colorimetric sensors

- pH sensitive dye incorporation into commercial wound dressings or mesoporous particles

Fluorimetric sensors

- Fluorescent dye incorporation into lipid vesicles
- Fluorescent polymer attached to fibers

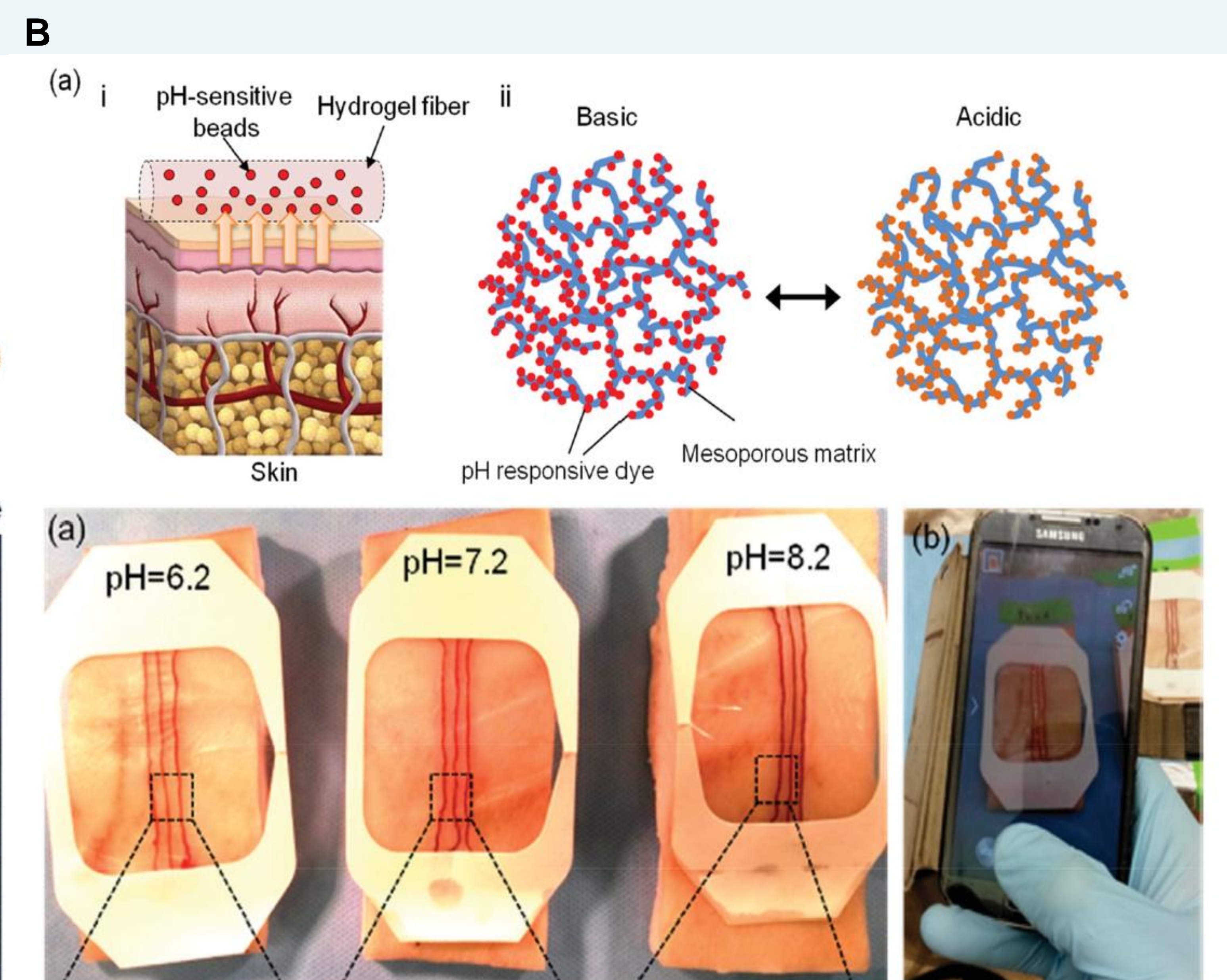
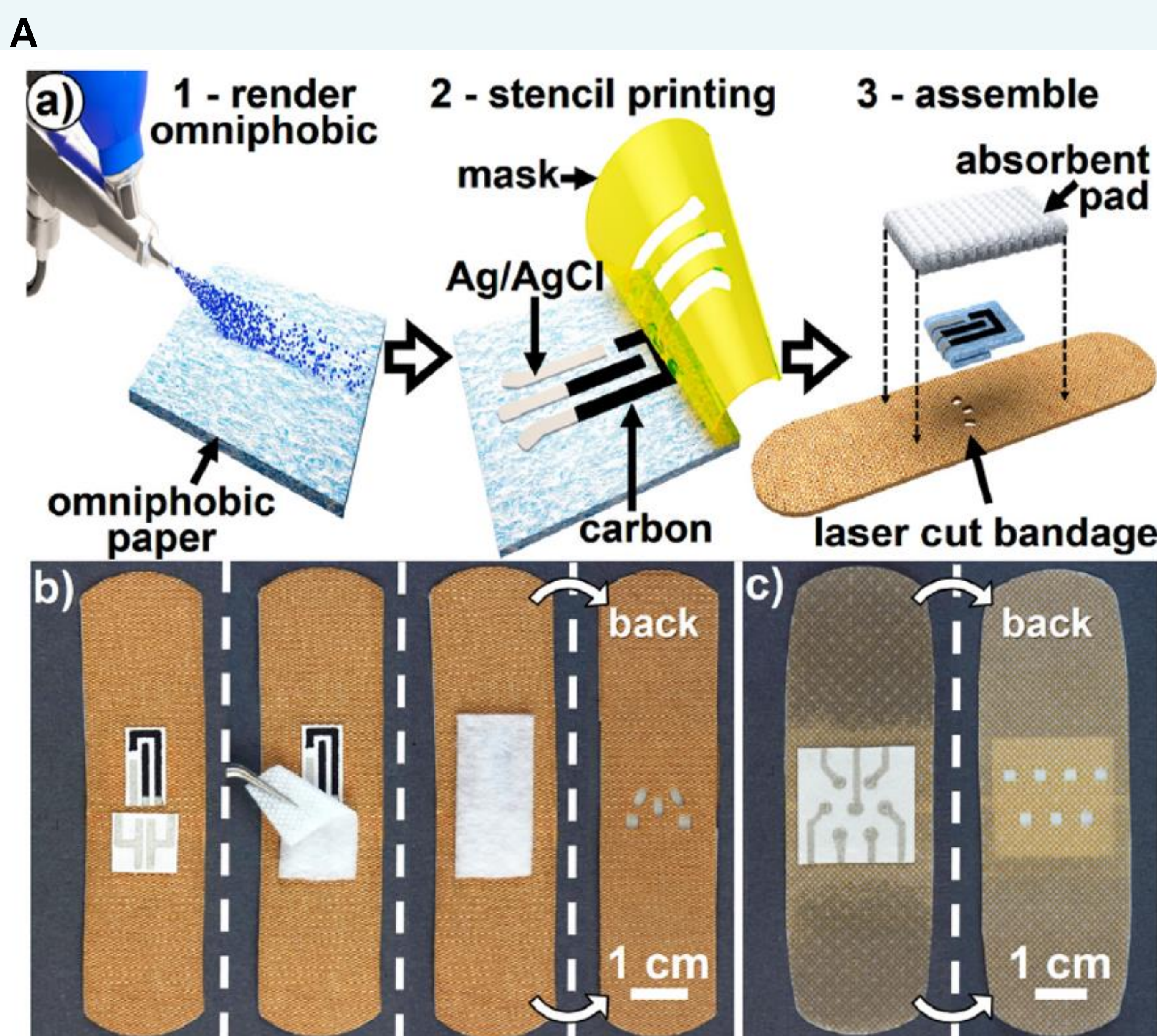
Wireless data transfer

- Wireless data transfer – helps patients and healthcare workers monitor wound status using smartphones or laptops
- Different strategies (near field communication, radio-frequency identification, Bluetooth technology) are used in proof-of-concept designs for wearable sensors

Examples

A. "Smart bandage" for the simultaneous electrochemical detection of wound pH and uric acid

B. "Smart bandage" for the colorimetric detection of wound pH



Conclusions

- Wearable and disposable sensors represent promising alternatives for wound infection detection and monitoring
- Miniaturization of sensors and wireless data transfer are major challenges for the large-scale application of wearable sensors
- Further efforts are required to achieve the full potential of wearable sensors and to allow their implementation in clinical settings

References

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Acknowledgements

A. Pusta acknowledges UMF internal grant no. 1032/57/13.01.2021