Next-Gen Wearable Sensors: Wireless, Battery-Free Technology Using Bio-Adhesive Membranes

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The rise of wearable technologies offers new possibilities for continuous, real-time health monitoring, but many current devices remain bulky due to their reliance on batteries and rigid electronics. In this school workshop, we present a novel solution: a battery-free, wireless sensor network designed for monitoring critical physiological parameters such as temperature, humidity, and muscle contraction. This network is created using inkjet printing of nanofunctional inks onto a semipermeable substrate, offering a lightweight, flexible alternative to conventional wearables.

Our system utilizes Near Field Communication (NFC) technology for seamless data readout via smartphones, removing the need for external power sources. Additionally, two of the sensors are integrated into a bioinspired adhesive membrane, modeled after the adhesive properties of mussel proteins. This ultra-conformable membrane, developed through an eco-friendly process, ensures optimal skin contact for reliable, continuous data collection.

This approach addresses the growing need for advanced monitoring systems, particularly for high-risk populations exposed to heat stroke. As climate change increases the prevalence of heat-related health risks, our system offers a timely solution for real-time field monitoring, ensuring that critical parameters are tracked effectively, potentially preventing life-threatening incidents.

References:

[1] Gabriel Maroli et al. 2024. “Wearable, battery-free, wireless multiplexed printed sensors for heat stroke prevention with mussel-inspired bio-adhesive membranes. https://doi.org/10.1016/j.bios.2024.116421