

# Sensor Systems for a Healthier and Safer Society

## On-body Sensors, Integrated Systems, Smart Sensors at Home

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### SweatSens: Electrochemical Sensors for Therapeutic Drug Monitoring

Personalized dosing of medication by means of therapeutic drug monitoring (TDM) can greatly improve the effectivity of a treatment. In SweatSens, it is investigated whether continuous sweat analysis can be used as a non-invasive alternative for TDM, classically performed via blood analysis. A multiparameter sweat sensor patch is developed, that can be used in the clinic as well as at home to monitor the excretion of pharmaceuticals in sweat. The patch will enable analysis of the target drugs continuously via the collection of voltammetric fingerprints for the first time. A major challenge in real-time sweat analysis is that sweat rate, salinity, pH and skin temperature change over time. The patch will measure these parameters continuously as well.

### Sweat Rate Sensors

Together with a master thesis student, we developed a novel ultrasonic flow rate sensing modality for microfluidic sweat rate sensors. His literature review was published in Lab on a Chip (fig 1).<sup>1</sup>

### Algorithms for voltammetry in sweat

In another thesis project we developed smart algorithms to compensate for pH changes and interfering substances in sweat, when detecting the drug Methotrexate. The algorithms were tested on real sweat samples (fig 2).

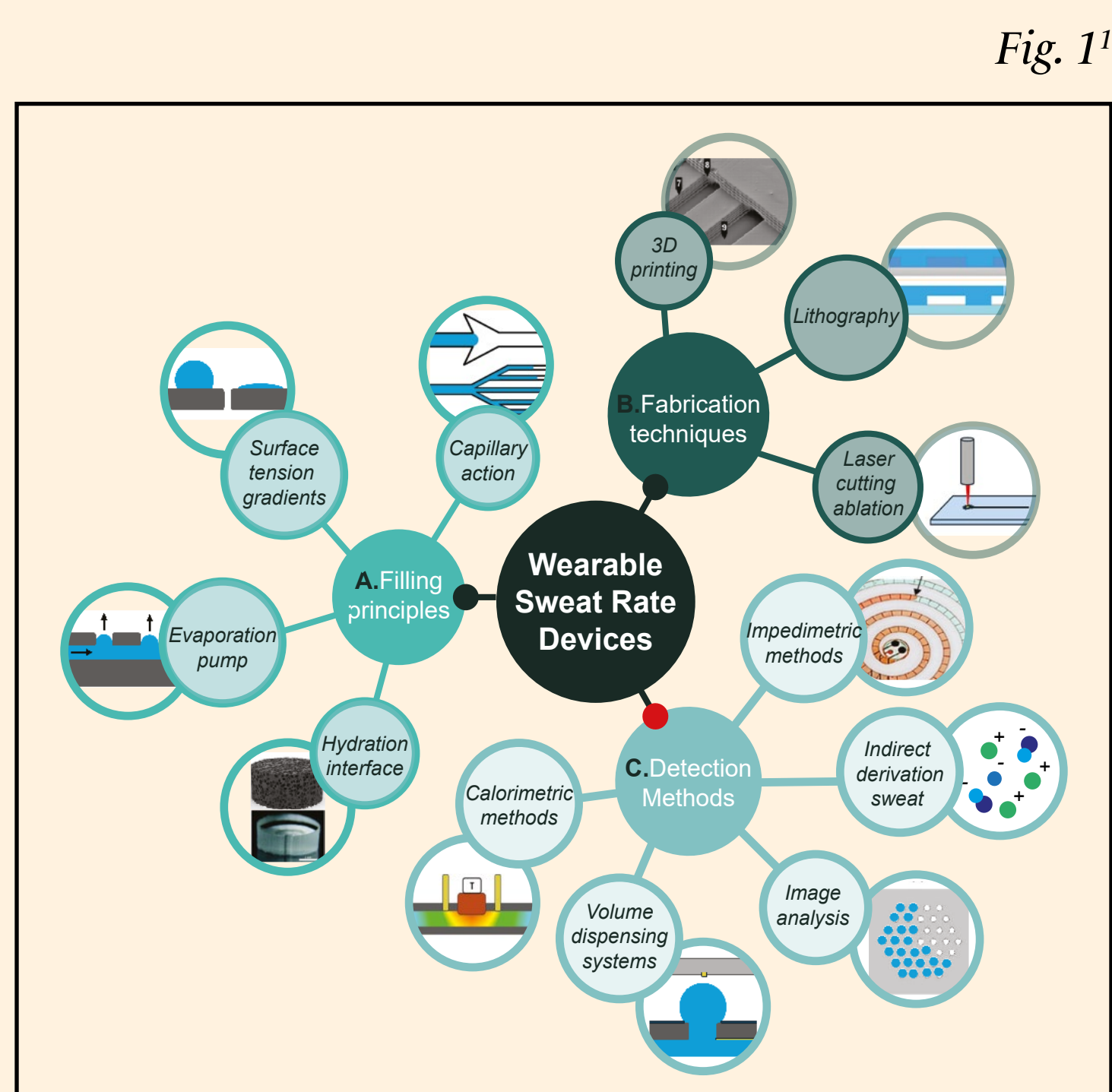


Fig. 1<sup>1</sup>

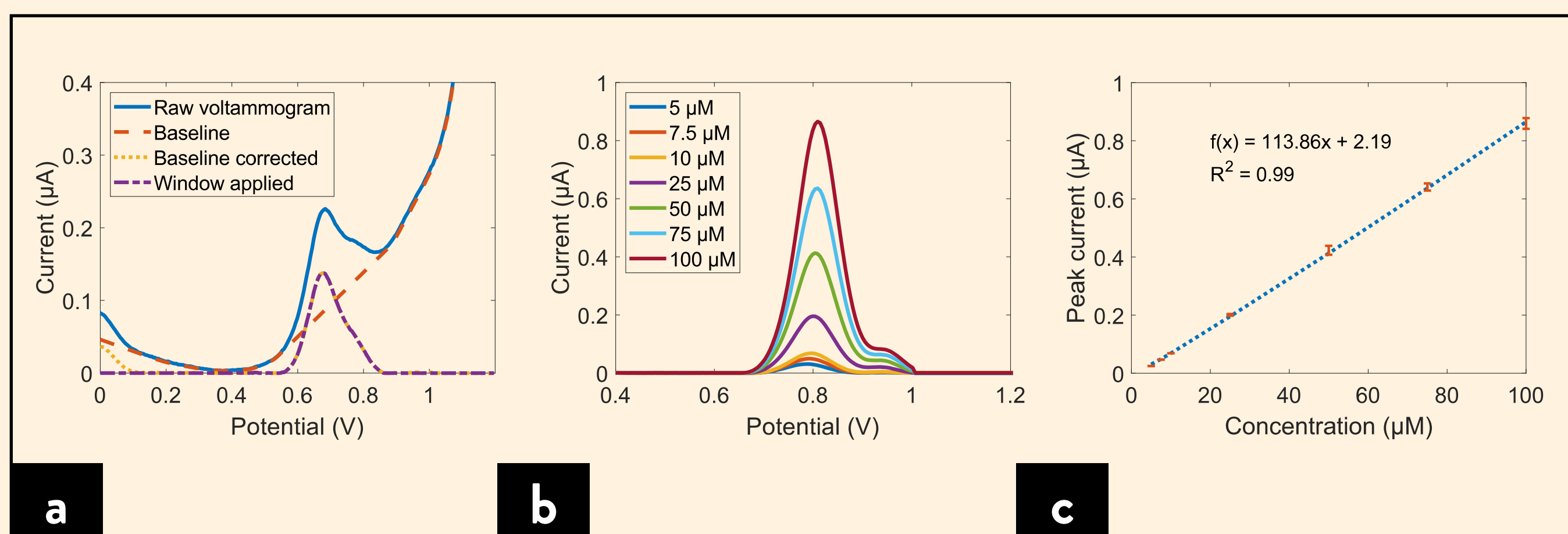


Fig. 2

### Wearable Sensors for Unobtrusive Athlete monitoring

Playing sports is healthy. In a large research consortium we worked together to make injury-free exercise available for everyone. During a four-year project we developed a large range of sensor systems for injury prevention.

Sweat sensors were developed to monitor the hydration status of athletes (fig 3).<sup>2</sup> Furthermore, we developed sensor tights with integrated inertial measurement units to monitor the movements of football players at the Dutch Soccer Association (fig 4).<sup>3</sup> Large physiological experiments were executed for on-body validation of the new sensors (fig 5).<sup>2</sup>

### Publications

- 1) Ursem, R. F. R., A. Steijlen, M. Parrilla, J. Bastemeijer, A. Bossche and K. De Wael (2025). "Worth your sweat: wearable microfluidic flow rate sensors for meaningful sweat analytics." Lab on a Chip.
- 2) Steijlen, A., B. Burgers, E. Wilmes, J. Bastemeijer, B. Bastiaansen, P. French, A. Bossche and K. Jansen (2021). "Smart sensor tights: Movement tracking of the lower limbs in football." Wearable Technologies 2: e17.
- 3) Steijlen, A. S. M., K. M. B. Jansen, J. Bastemeijer, P. J. French and A. Bossche (2022). "Low-Cost Wearable Fluidic Sweat Collection Patch for Continuous Analyte Monitoring and Offline Analysis." Analytical Chemistry 94(18): 6893-6901.

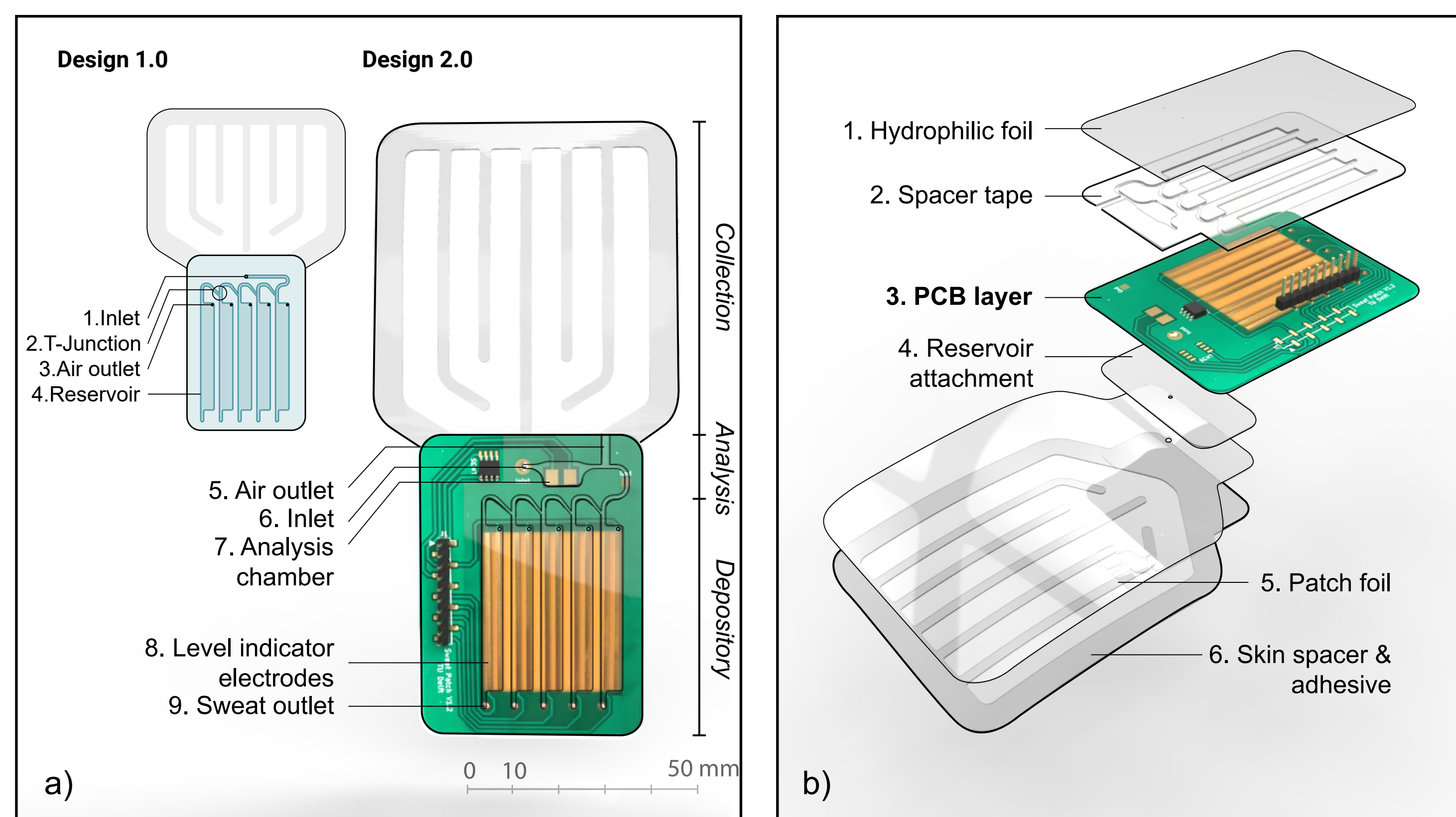


Fig. 3<sup>2</sup>

### 1 Smart Sensor Tights to prevent injuries in football

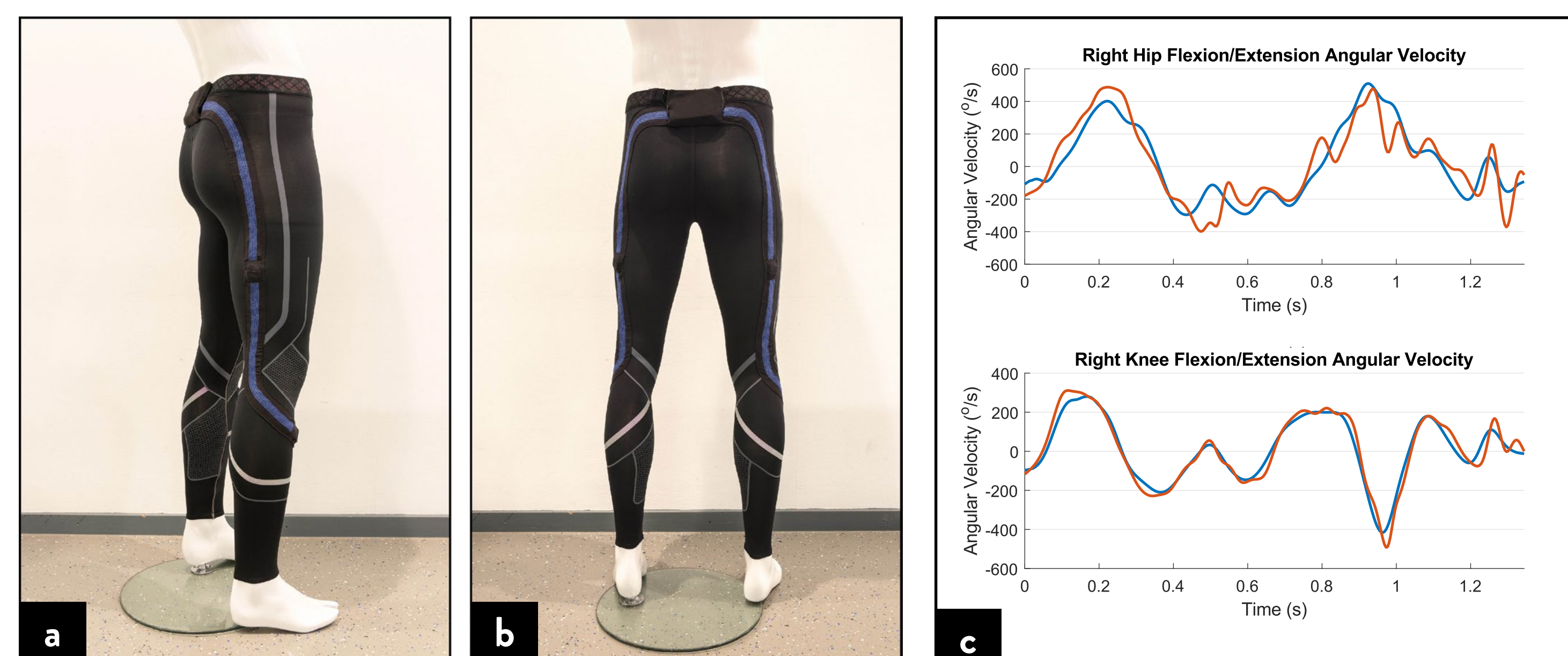


Fig. 4<sup>3</sup>

### 2 Sweat Sensors for monitoring hydration status and electrolyte balance

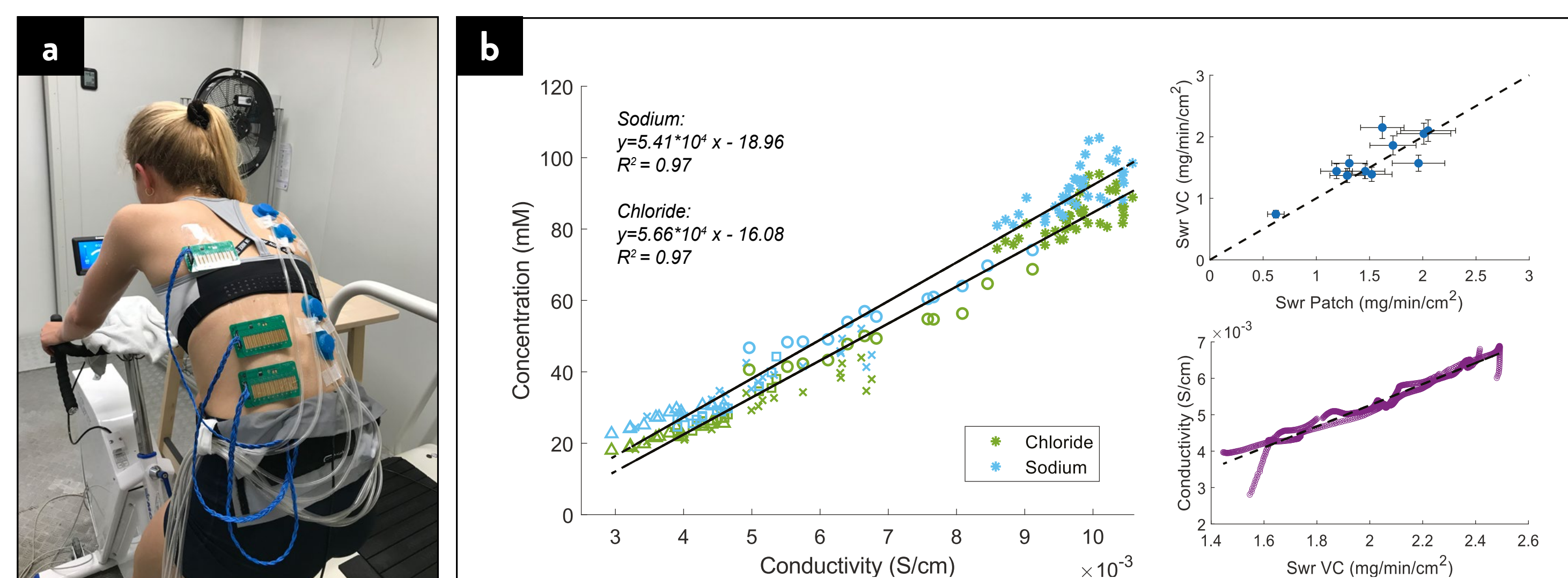


Fig. 4<sup>2</sup>