

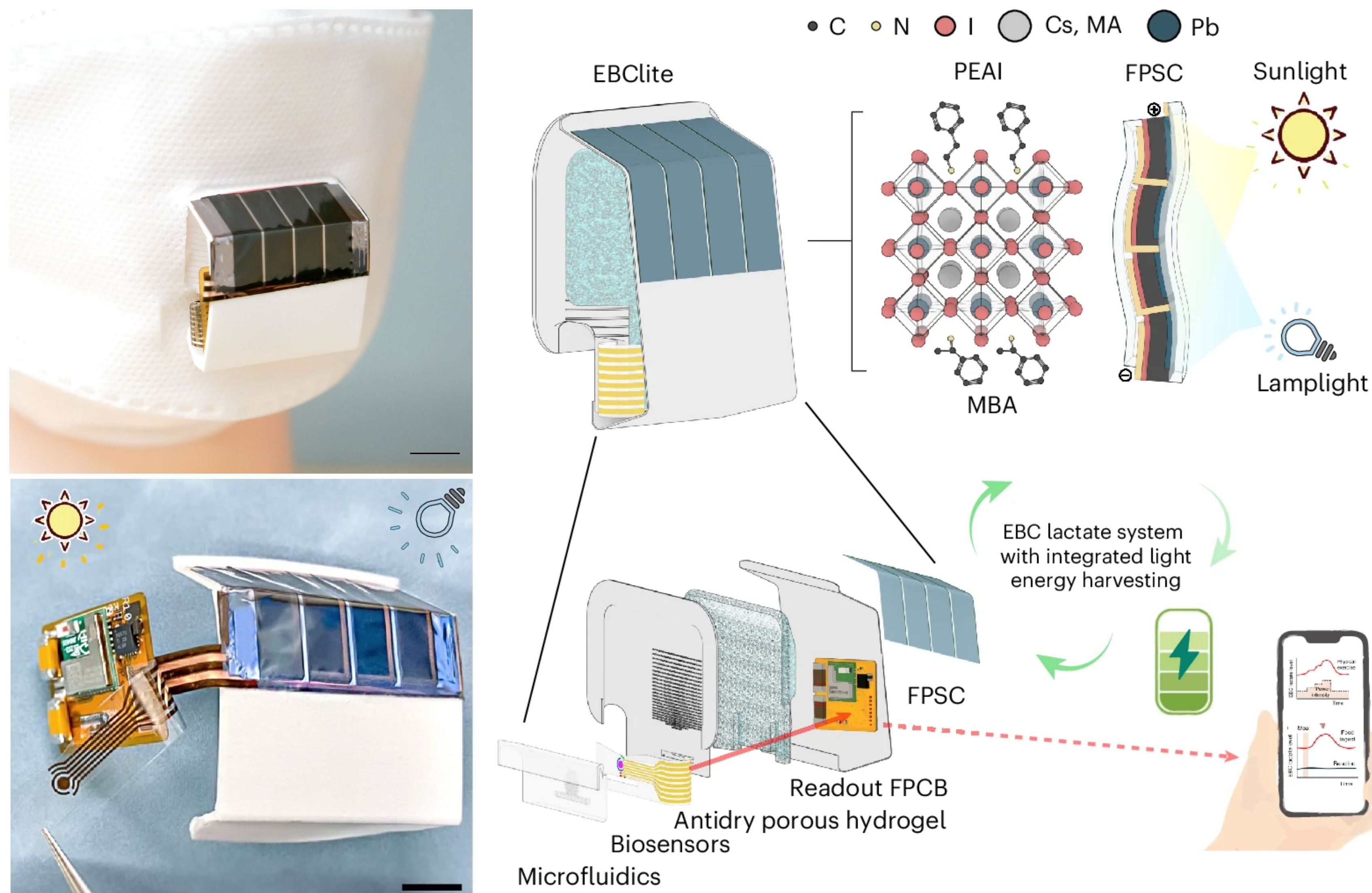
A Battery-free Smart Mask for Long-term Exhaled Breath Biochemical Sensing

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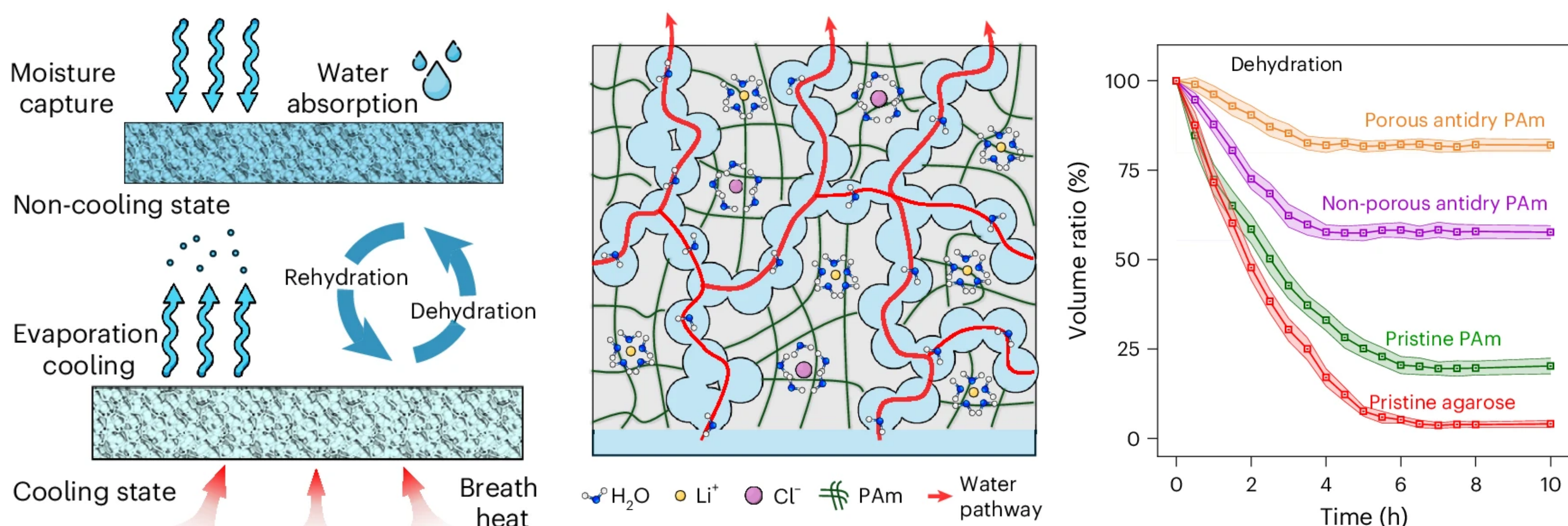
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EBClite Platform



Exhaled breath condensate (EBC) offers a non-invasive window into respiratory and systemic metabolism. Here we present EBClite, a battery-free smart mask for multiday EBC biomarker monitoring, using lactate as a model analyte. The platform integrates a regenerable anti-drying porous **hydrogel for breath condensation**, a long-term stable **sensing patch for EBC analysis** and an ultrathin **perovskite solar cell for power harvest**.

Porous Rehydration-Activated Hydrogel



- The hydrogel remains semi-dry yet structurally intact during storage and reactivates upon water addition to enable sustained evaporative cooling for EBC collection.
- The hydrogel integrating LiCl within the crosslinked PAM network conferred both structural stability and high water retention.

See next column

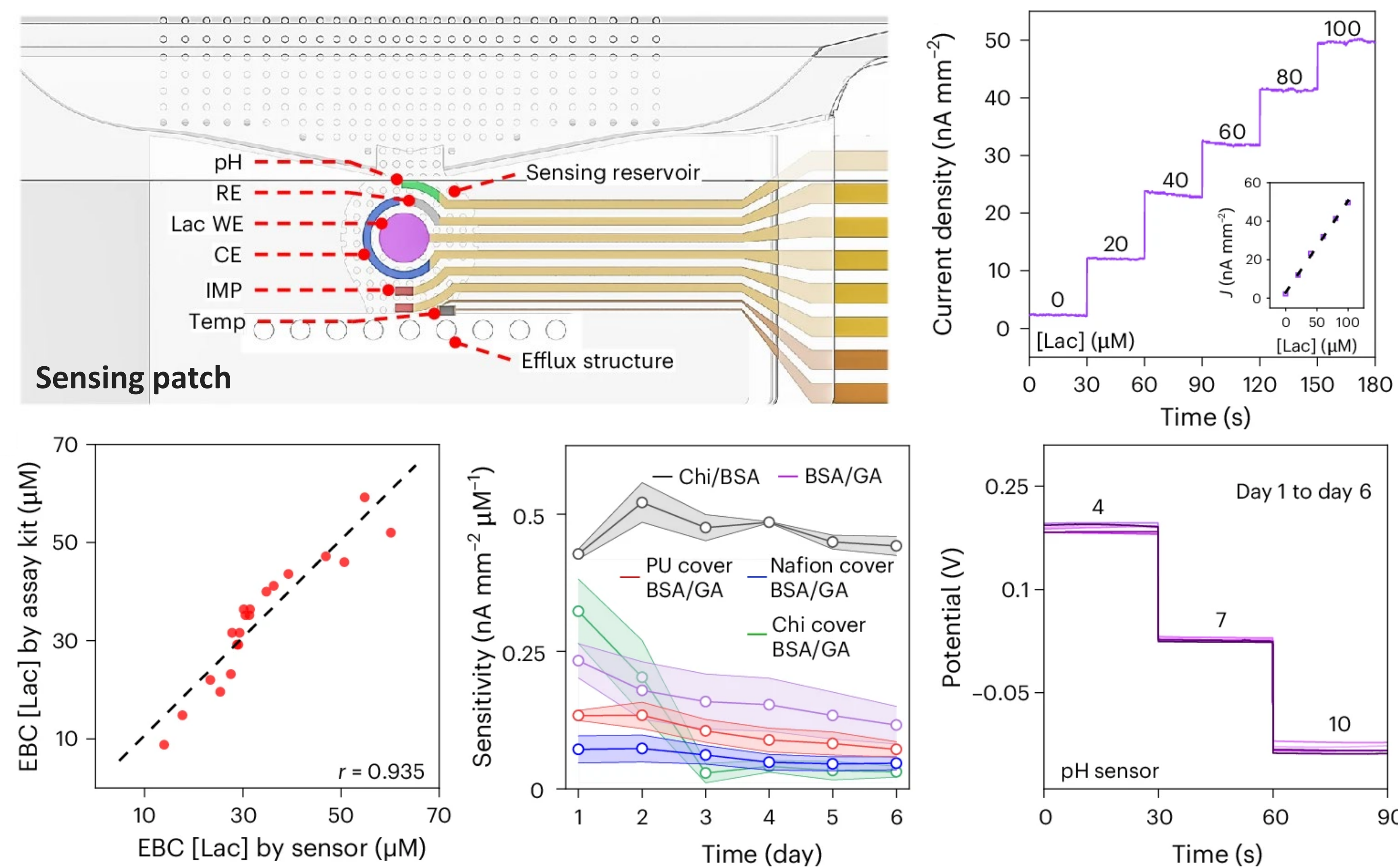
Conclusion

EBClite platform provides a battery-free, sustainable, user-friendly platform for continuous respiratory and metabolic monitoring.

Organizers

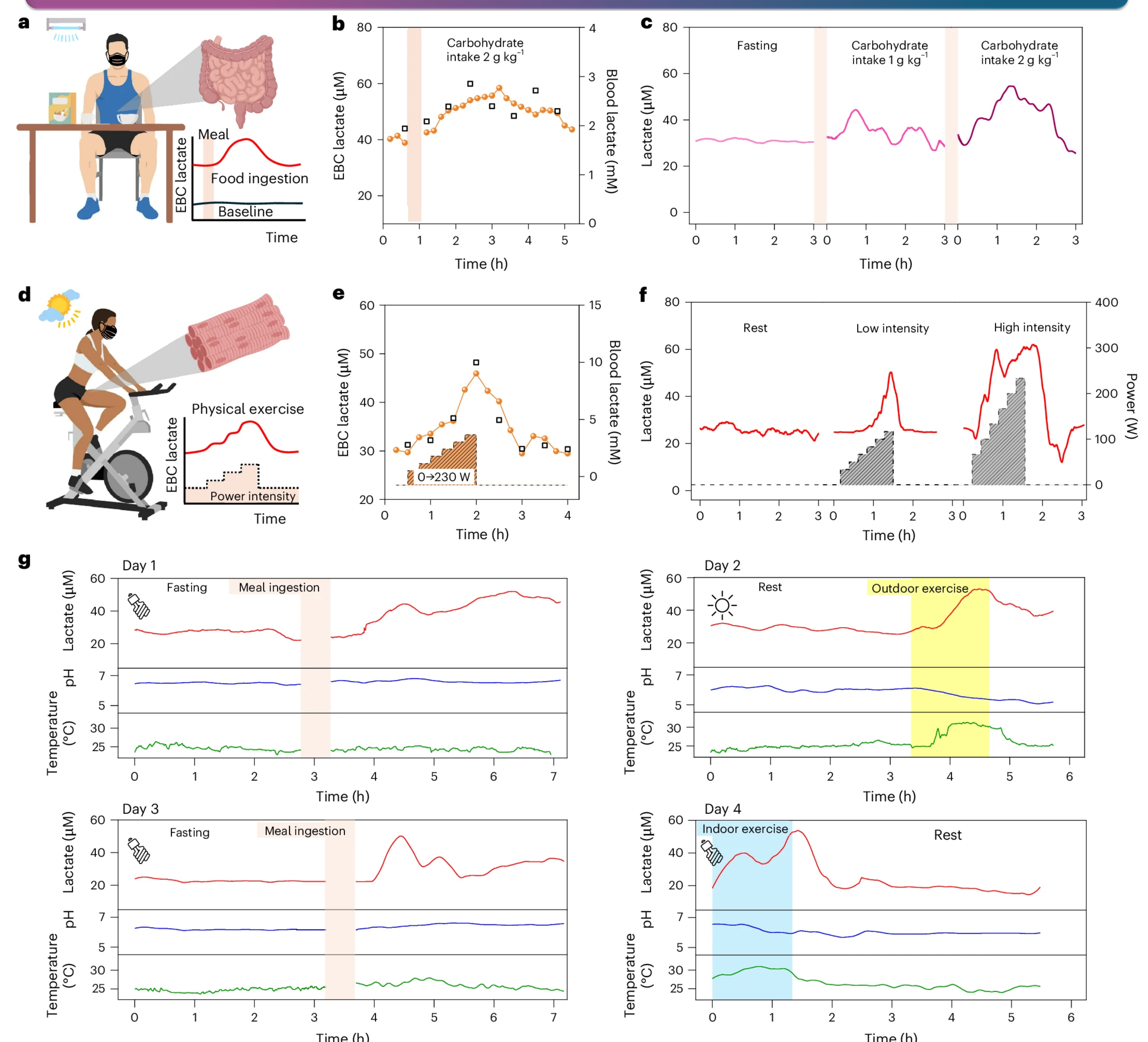


Long-Term Stable Sensing Patch



- Sensing patch: an enzymatic lactate sensor, a pH sensor, an ionic strength sensor and a temperature sensor.
- The lactate sensor shows a linear response in targeted range and strong linear correlation with commercial fluorescent assay toward identical EBC samples.
- The sensors on the sensing patch demonstrated long-term operational stability over 6 days.

Human Studies



- There are strong correlations between EBC and blood lactate levels during carbohydrate intake and exercise.
- EBClite platform can reveal carbohydrate intake quantity and exercise intensity.

Heng, W., Putz, C., Tang, W. *et al.* *Nat. Sens.* **1**, 328–340 (2026)