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A Wearable, Continuous Biofluid Monitoring System with Electromagnetic-Pneumatic Pumping

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-Background Current glucose monitoring solutions include minimally invasive continuous blood glucose monitoring using implantable enzymatic sensors. However, biomacromolecule binding can cause foreign body reactions, and long-term implanted sensors can give rise to biocompatibility issues. These drawbacks make difficult the clinical promotion of such implantable products. Non-invasive analyses, such as sweat analysis, can provide a viable alternative. Nonetheless, continuous sweat acquisition may require additional conditions brought on by sports or drug activation, for example. Additionally, sweat glucose is not sufficiently correlated with blood glucose as to enable reliable monitoring in clinical settings. One solution to these challenges may include continuously extracting, moving, and testing interstitial fluid (ISF) from the human body. Invention Description Researchers at Arizona State University have developed a wearable, continuous biofluid monitoring system that features a microneedle array layer used to extract interstitial fluid (ISF) from the epidermis of the skin. Electromagnetic-pneumatic pumping/valving technology (EPPT) is used to move extracted ISF through various chambers. This is achieved by the orchestrated charging and uncharging of magnets which modulate pneumatic chamber configurations, creating air pressure differences between chambers. Once the ISF arrives in the collection chamber, it moves to the metering chamber where the sample volume is determined. Then the sample is moved to the testing chamber to undergo an electrochemical reaction. Finally, the sample is moved to the waste chamber, completing the testing cycle. Potential Applications • Glucose monitoring • Biomedical microfluidics