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A Bio-inspired Lateral Flow Assay for Improving the Sensitivity of Low Volume Samples

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Abstract:

Lateral flow assay (LFA) is a point-of-care bioanalytical application with outstanding characteristics. However, sensitivity is the major limitation of current LFAs development. Recently, several studies have shown that the detection pad between the test line (T line) and the conjugate pad is the critical component of the LFA strip, which can increase the interaction time and improve the sensitivity of LFA [1]. Many efforts have been made to increase the detection sensitivity by modifying the detection pad [1]. However, it is challenging to experiment with materials other than nitrocellulose membrane (NC membrane). We present an artificial surface inspired by moisture-harvesting lizards whose skin can collect and transport water directionally via channels between the scales [2, 3]. Here, we use PDMS formed with the shape of lizard skin instead of the detection pad between the T line and the conjugate pad. We examined our platform using human chorionic gonadotropin (hCG) as a biomarker, realizing signal enhancement by approximately 64.92% with a 40μl small amount. The bio-inspired LFA will facilitate multi-item infant and anemic patient testing on low-volume samples.

Key words: point-of-care, lateral flow assay, paper microfluidics, sensitivity enhancement, bio-inspired flow channels

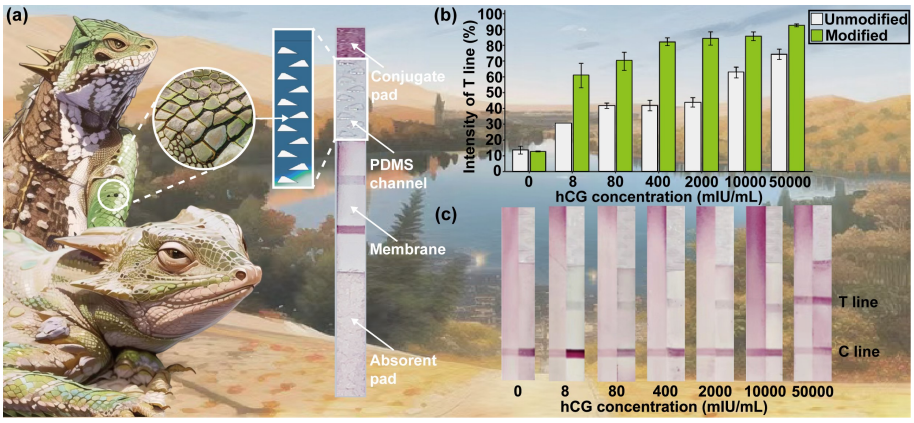

Fig.1. (a) General view of the bio-inspired LFA platform modified by PDMS instead of a part of NC membrane. (b) LFA for hCG detection using an unmodified and modified membrane (n=3). (c) The results of hCG test strips with different concentrations.

References

[1] Díaz-González, M., & de la Escosura-Muñiz, A. (2021). Strip modification and alternative architectures for signal amplification in nanoparticle-based lateral flow assays. *Analytical and Bioanalytical Chemistry*, *413*(16), 4111-4117. doi:10.1007/s00216-021-03421-5

[2] Comanns, P., Buchberger, G., Buchsbaum, A., Baumgartner, R., Kogler, A., Bauer, S., & Baumgartner, W. (2015). Directional, passive liquid transport: the Texas horned lizard as a model for a biomimetic 'liquid diode'. *Journal of the Royal Society Interface*, *12*(109), 20150415. doi:10.1098/rsif.2015.0415

[3] Wu, M., Shi, R., Zhou, J., Wong, T. H., Yao, K., Li, J., Huang, X., Li, D., Gao, Y., Liu, Y., Hou, S., Yu, J. & Yu, X. (2022). Bio-inspired ultra-thin microfluidics for soft sweat-activated batteries and skin electronics. *Journal of Materials Chemistry A*, *10*(37), 19662-19670. doi:10.1039/D2TA01154A