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Research Highlights

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Microfluidics: Introducing the chemistrode

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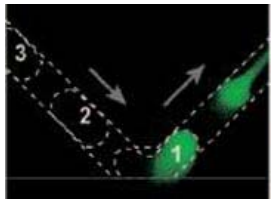
A microfluidic 'chemistrode' device has been developed for stimulating, recording and analysing molecular signals



Microelectrodes have long been used to study signalling in living cells and tissues. Their capability to stimulate and record electrical signals has improved scientists' understanding of the spatiotemporal dynamics of such systems. However, biological signalling pathways are intrinsically chemical rather than electrical and although electrochemical studies are helpful, they cannot tell the whole story. Now, Rustem Ismagilov and colleagues at the University of Chicago have developed[1] a microfluidic device they call a 'chemistrode'. This device is analogous to an electrode but is able to stimulate, record and analyse molecular signal.

The device consists of a V-shaped tube, with an opening at the point of the V that enables its (flowing) contents to interact with a substrate. Thus a solution can be delivered to the substrate by one arm of the V and a sample removed by the other arm after a simple exchange of molecules at the substrate–chemistrode interface. Previous attempts to sample pulsed molecular signals have been hindered by the rapid dispersion of the sampled molecules through the flowing solution, resulting in a loss of concentration and time resolution. The chemistrode avoids this by using fluidic 'plugs' — aqueous droplets separated by a fluorocarbon carrier fluid.

The complexity of molecular signals necessitates the use of several techniques to understand their time-resolved composition. After sampling, the chemistrode is able to use splitting junctions to create daughter arrays of the original signal, which can then be analysed in parallel by techniques such as fluorescence microscopy or mass spectrometry. Ismagilov and co-workers demonstrated the chemistrode's ability to follow live-cell experiments by measuring the response of insulin-secreting mouse cells to glucose stimulation.

** In the version of this highlight initially published online, the author name in the reference was incorrectly cited as Chena, D. The correct name is Chen, D.*

Reference

1. Chen, D. *et al*. The chemistrode: A droplet-based microfluidic device for stimulation and recording with high temporal, spatial, and chemical resolution. *Proc. Natl Acad. Sci. USA* **105**, 16843–16848 (2008) | **Article** | **PubMed** | **ChemPort** |

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