EDITORS' CHOICE | BIOMATERIALS

Electronics, freshly squeezed

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The dream of seamless integration between artificial electronics and human organs has inspired countless science fiction audiences. However, these bioelectronic interfaces have been challenging to implement and maintain in the real world. Conventional electrodes are relatively large compared with cells and must be implanted invasively. Also, the mismatch in mechanical properties between rigid materials and soft biological tissues can result in poor device performance over time.

Liu *et al.* developed a flexible mesh of electronic nanosensors that could be syringe-injected into tissues. Their design consisted of an array of protruding metal nanowire electrodes connected by plastic ribbons. A crucial design feature was to angle the plastic ribbons to bend easily when passing through the syringe opening, similar to the hinged masts used to insert model ships into a bottle. In this fashion, a 1.5-cm-wide mesh could be injected intact through a syringe with a 33-fold narrower orifice. After injection, the mesh unfolded, conformed to the tissue cavity, and was infiltrated by healthy neurons. Sixteen independent channels were used to read out electrical activity at various locations, corresponding to reasonable action potentials. Last, minimal chronic tissue response was observed after 5 weeks, likely due to the low stiffness and subcellular size of the electrodes.

An important next step will be to incorporate wireless functionality to avoid wired

connections for power, data acquisition, and storage. Moreover, given the uncontrolled placement of the mesh, careful characterization will be needed to understand how these electrode arrays sample the complex neuronal connectivity within the brain. This approach could enable multiplexed electrical measurement and stimulation for mapping brain activity, cardiac electrophysiology, or neuroprostheses for the spinal cord. Flexible mesh electronics injected for patient monitoring and treatment could well be the shape of things to come.

J. Liu *et al*., Syringe-injectable electronics. *Nat. Nanotech.* **10** 629–636 (2015) [Abstract]

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