HUMAN-MACHINE INTERFACES

Connecting to the brain with bundled microwires

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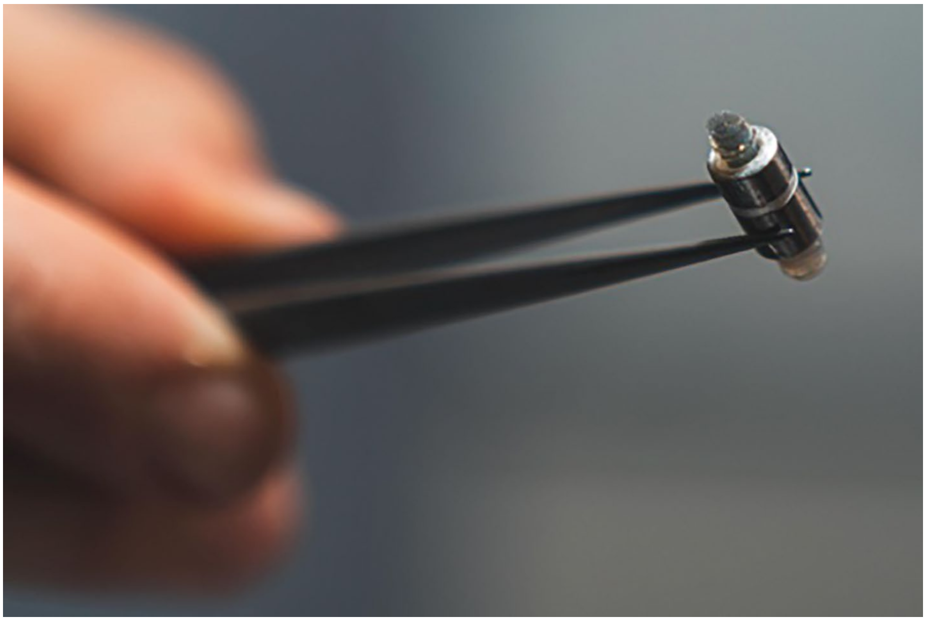

Andrew Brodhead / Stanford News Service.

Bioelectronic interfaces that can connect the neurons of the brain to digital devices could be useful in medical technologies such as prosthetics. One approach for probing neural activity is to use silicon microelectrode arrays, but these can only measure activity from a relatively small number of neurons and are invasive. Large, planar microelectrode arrays that are compatible with complementary metal–oxide–semiconductor (CMOS) processes have been developed, but scaling these interfaces is challenging because of the complexity of the interconnections. Andreas Schaefer, Nicholas Melosh and colleagues have now developed a three-dimensional neural interface based on arrays of bundled microwires that can be easily combined with CMOS hardware and causes minimal tissue damage.

The researchers — who are based at Stanford University, the Francis Crick Institute in London, University College London, and ETH Zurich — arranged insulated microwires into bundles, before connecting them perpendicularly to a CMOS array. The tips of the bundles were etched to expose the bare metal microwire before being pressed onto the array to achieve an electrical contact. Measurements showed that the bundle contact added very little noise to the system. By adjusting the depth of each microwire etch, it was possible to create various lateral and vertical probing profiles. To illustrate the capabilities of their approach, Schaefer, Melosh and colleagues took in vivo measurements of the motor cortex region of the brains of awake moving mice. In contrast to other in vivo imaging techniques, the CMOS-bundle devices can record spiking activity from hundreds of neurons and from deeper brain areas, while minimizing damage to the brain areas above.

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