IMPLANTABLE ELECTRONICS

Touching a nerve

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Microchannel neural interfaces (MNIs), which connect the peripheral nervous system with integrated circuits, could allow prostheses to be controlled with biological signals, offering potentially life-changing assistance to amputees or individuals with sensorimotor impairments. One of the key challenges with such technology is the development of interfacing devices that enable the stimulation and recording of nerve axons with good selectivity and a compact form factor. MNIs typically use conductive electrodes placed in microchannels, which require individual wire connections, making miniaturization difficult and leading to limited resolution and selectivity.

Nick Donaldson and colleagues at University College London have now developed an alternative approach based on application-specific integrated circuits (ASICs). Here the on-chip bonding pads act as the stimulation and recording electrodes, and are placed directly in the microchannels. The researchers stack seven ASICs each with seven electrodes, allowing forty-nine microchannels to be addressed, and potentially the same number of axon bundles. Each ASIC contains a bidirectional multiplexing circuit, which allows the entire MNI to be controlled by a five-line parallel bus, reducing the number of wire connections required while simultaneously increasing the number of channels. Though the MNI system is yet to be tested in vivo, electrical characterization shows biologically relevant performance with sub-milliwatt power consumption and an electrode density of 5.25 per mm^2.

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