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# Climbing-inspired twining electrodes using shape memory for peripheral nerve stimulation and recording

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## Abstract

Peripheral neuromodulation has been widely used throughout clinical practices and basic neuroscience research. However, the mechanical and geometrical mismatches at current electrode-nerve interfaces and complicated surgical implantation often induce irreversible neural damage, such as axonal degradation. Here, compatible with traditional 2D planar processing, we propose a 3D twining electrode by integrating stretchable mesh-serpentine wires onto a flexible shape memory substrate, which has permanent shape reconfigurability (from 2D to 3D), distinct elastic modulus controllability (from ~100 MPa to ~300 kPa) and shape memory recoverability at body temperature. Similar to the climbing process of twining plants, the temporarily flattened 2D stiff twining electrode can naturally self-climb onto nerves driven by 37 ºC normal saline, and form 3D flexible neural interfaces with minimal constraint on the deforming nerves. *In vivo* animal experiments, including right vagus nerve stimulation for reducing the heart rate and action potential recording of the sciatic nerve, demonstrate the potential clinical utility.

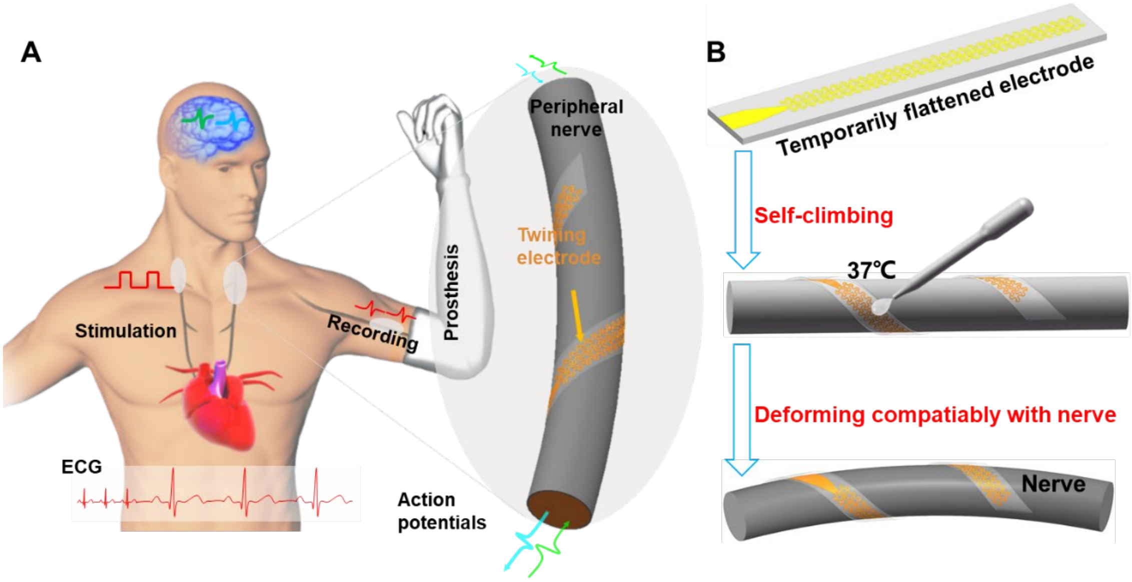


**Figure 1: Twining electrode for peripheral nerve system. (A)** Schematic diagram of the conceptual peripheral nerve stimulation and recording (left), and the electrode-nerve interface (right). **(B)** Schematic illustrations of the surgical implantation processes of the twining electrode with the aid of the shape memory effect.

## References


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