

Reflex arc

The [reflex](#) arc is a special type of [neural circuit](#) that begins with a sensory neuron at a receptor (e.g., a pain receptor in the fingertip) and ends with a motor neuron at an effector (e.g., a skeletal muscle).

An artificial [reflex arc](#) (ARA) and artificial [pain modulation](#) system (APMS) are proposed to imitate the [unconscious behaviors](#) of the [spinal cord](#). Gdx Oy - and Alx Oy -based charge-regulated [field-effect transistors](#) (CRFETs) with a monolayer [graphene](#) channel were fabricated and adopted as inhibitory and excitatory synapses, respectively, under the same [pulse signals](#) to mimic the biological reflex arc through a connection with a poly(vinylidene fluoride-co-trifluoroethylene)-based actuator. Additionally, a memristor was integrated with a CRFET as the [interneuron](#) to regulate the Dirac point by controlling the [voltage](#) drop on the graphene channel, analogous to the [descending pain pathway](#) in the spinal cord, to prevent excessive [pain](#) perception. The proposed ARA and APMS have provided a significant step forward to realizing the functions of the nervous system, giving promising potential for developing future intelligent alarm systems, [neuroprosthetics](#), and [neurorobotics](#) ¹⁾.

¹⁾

Fu Y, Chan YT, Jiang YP, Chang KH, Wu HC, Lai CS, Wang JC. Polarity-Differentiated Dielectric Materials in Monolayer Graphene Charge-Regulated Field-Effect Transistors for an Artificial Reflex Arc and Pain Modulation System of the Spinal Cord. Adv Mater. 2022 May 26:e2202059. doi: 10.1002/adma.202202059. Epub ahead of print. PMID: 35619163.

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