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Graphene oxide as nanotool to target dysfunctional neuronal plasticity: a synaptic approach to anxiety disorders.

Giada Cellot, Audrey Franceschi Biagioni, Elisa Pati, Neus Lozano, Kostas Kostarelos and Laura Ballerini
International School for Advanced Studies (SISSA), Via Bonomea n. 265, Trieste, Italy
cellot@sissa.it

Small graphene oxide nanosheets (s-GO) were previously reported to reversibly down-regulate the excitatory synaptic activity of rat hippocampus *in vivo* [1], suggesting a translational potential of these nanomaterials in the field of precision nanomedicine as specific modulators of glutamatergic synapses. Synaptic communication between neurons is dynamically regulated, phenomenon known as synaptic plasticity and fundamental for brain functions such as memory and learning. However, dysfunctional synaptic plasticity has been observed recently also as a pathological mechanism characterizing several brain diseases, including anxiety disorders. In details, overactivity of glutamatergic synapses in the lateral nucleus of the amygdala (LA) is a hallmark of an aversive memory acquisition induced by stressful events involved in post-traumatic stress disorder (PTSD). By using an animal model of PTSD, we showed the ability of s-GO, when stereotaxically administered into the LA, to rescue the pathologically potentiated glutamatergic transmission and to prevent the anxiety related behavior due to long-term aversive memory. In addition, we dissected *in vitro* the mechanisms through which s-GO revert amygdala glutamatergic plasticity, that could be involved in the nanomaterial induced rescue of PTSD pathological aspects [2]. The interference of s-GO with the pathological excitatory plasticity might find applications for the treatment of a broad spectrum of neuro-pathologies.

References

[1] Rauti, Medelin, Newman, Vranic, Reina, Bianco, Prato, Kostarelos, Ballerini. Nano Letters 19 (2019) 2858-2870.
[2] Franceschi Biagioni, Cellot, Pati, Lozano, Ballesteros, Casani, Coimbra, Kostarelos, Ballerini L. Biomaterials 271 (2021) 120749

Figure

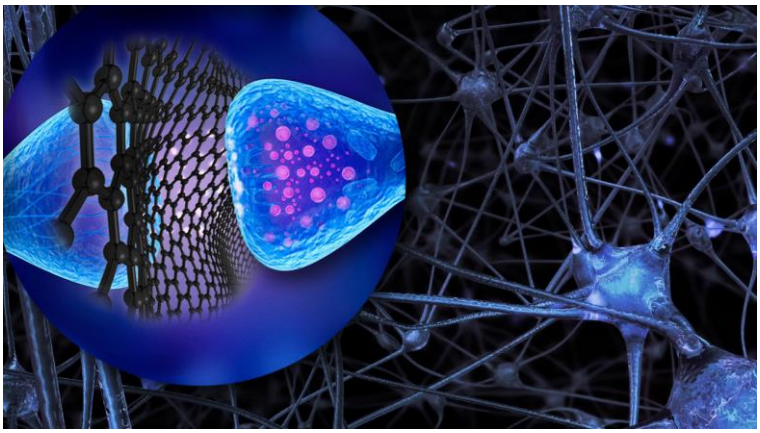

Figure 1: s-GO interfere with glutamatergic neuronal transmission at synaptic level.