Biocompatibility and conductivity of flexible graphene electrodes for neural electrophysiology

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Abstract

Its conductivity and inert chemical composition make graphene an ideal material for engineering recording and stimulation electrodes in electrophysiology (1-4). If spray-coated onto microchannel devices or embedded into a polydimethylsiloxane (PDMS) matrix, graphene or its derivatives can be structured into microelectrode arrays (MEAs) with flexible electrodes, tracks and contact pads. Similarly, PDMS soft lithography allows for the patterned transfer of graphene materials onto cell culture substrates for cytotoxicity studies. We exemplarily tested a few graphene-family materials for their physicochemical and biological properties depending on their deposition method and their surface functionalities. Electrical impedances of solvent-deposited graphene electrodes with diameters of around 100 µm were found to stay below 1 MΩ and constant over a range of 1 Hz to 1 kHz. Murine neurons differentiated and survived on such graphene electrodes Figure 1 and on dip-coated control transparencies for more than four weeks.

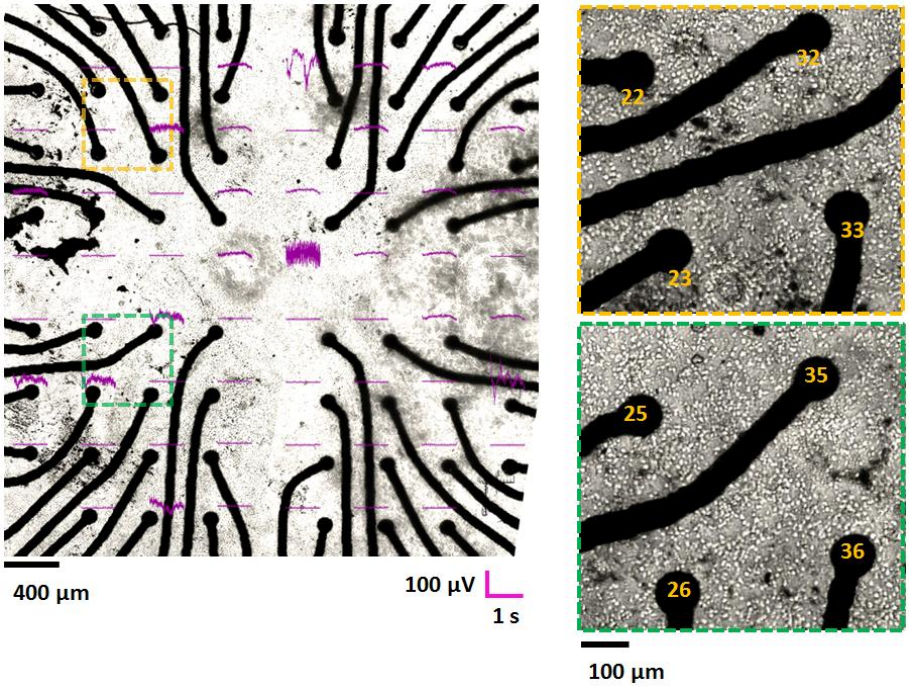

Figure 1 Neural signals (purple traces) recorded from a microelectrode array made from PDMS and solvent-deposited multilayer graphene electrodes and tracks (left) with differentiated murine neurons after 8 days *in vitro* (DIV) (right insets).

References

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