Interaction of graphene and WS_2 with neutrophils and mesenchymal stem cells: implications for peripheral nerve regeneration

Domenica CONVERTINO – *IIT, Pisa*

Recent advances in tissue engineering have harnessed the potential of graphene (G) and 2D materials for nerve tissue repair and regeneration. These materials offer unique combinations of electrical, optical, and tribological properties, making them particularly promising for peripheral neural interfaces. However, the use of these innovative materials has raised questions about their interaction with the other players involved in nerve regeneration, including neutrophils, whose immune response affects the regenerative outcome, and mesenchymal stem cells (MSCs), a novel therapeutic avenue for peripheral nerve regeneration. In this study, we investigate the interaction between G and tungsten disulfide (WS_2) with neutrophils and MSCs. We examined WS_2 on sapphire and various graphene substrates, namely graphene on SiC, both as-grown and H-intercalated, graphene on sapphire and graphene grown on copper and transferred on glass, to understand the effect of the production methods on neutrophils and MSCs. Neutrophil activation was characterized, along with the influence of material properties on NETs production and adhesion. Graphene's resistance to NETs-induced degradation was also studied and compared with the results reported for graphene oxide. Additionally, we assessed the cytocompatibility of 2D materials with MSCs, evaluating cell viability, morphology, and mitochondrial health. Overall, our results aimed at understanding the interface between 2D material and some of the players involved in nerve injury, a critical point for regenerative medicine.