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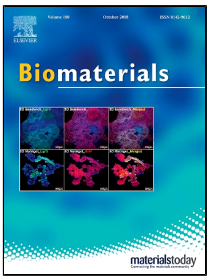

The role of oligodendrocytes and their progenitors on neural interface technology: A novel perspective on tissue regeneration and repair

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The role of oligodendrocytes and their progenitors on neural interface technology: A novel perspective on tissue regeneration and repair

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Abstract: Oligodendrocytes and their precursors are critical glial facilitators of neurophysiology, which is responsible for cognition and behavior. Devices that are used to interface with the brain allow for a more in-depth analysis of how neurons and these glia synergistically modulate brain activity. As projected by the BRAIN Initiative, technologies that acquire a high resolution, robust sampling of neural signals can provide a greater insight in both the healthy and diseased brain and support novel discoveries previously unobtainable with the current state of the art. However, a complex series of inflammatory events triggered during device insertion impede the potential applications of implanted biosensors. Characterizing the biological mechanisms responsible for the degradation of intracortical device performance will guide novel biomaterial and tissue regenerative approaches to rehabilitate the brain following injury. Glial subtypes which assist with neuronal survival and exchange of electrical signals, mainly oligodendrocytes, their precursors, and the insulating myelin membranes they produce, are sensitive to inflammation commonly induced from insults to the brain. This review explores essential physiological roles facilitated by oligodendroglia and their precursors and provides insight into their pathology following neurodegenerative injury and disease. From this knowledge, inferences can be made from the impact of device implantation on these supportive glia in order to engineer effective strategies that can attenuate their responses, enhance the efficacy of neural interfacing technology, and provide a greater understanding of challenges that impede wound healing and tissue regeneration during pathology.

Keywords: Glial pathology; Microelectrode array; Brain injury; Inflammation; Demyelination; Foreign body response