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Microglial Cells and Their Role in Neuropathic Pain: A Review

Microglial cells are specialized macrophages of the central nervous system (CNS), playing a crucial role in the innate immune defense of the brain and spinal cord. They protect neural tissue from pathogens, trauma, demyelination, and help eliminate defective neurons and other cellular debris. To fulfill these roles, microglia possess a wide array of receptors and chemical mediators that allow for rapid and specific communication with other cells in the nervous system. In vivo studies using enhanced green fluorescent protein (eGFP) as a marker for microglial surveillance have demonstrated that microglial cells play a vital and dynamic physiological role. They are actively involved in processes such as synaptic pruning, synaptogenesis, neurogenesis, neuronal apoptosis, and the regulation of neuronal longevity. The involvement of microglia in neuropathic pain has challenged the traditional view that neurons alone are responsible for the pathophysiological changes underlying this condition. Injuries to either the peripheral or central nervous system can trigger maladaptive changes in both neurons and microglial cells. In the context of neuropathic pain, microglia play a pivotal role in both the initiation and persistence of pain and inflammation. Their interactions with neurons are now recognized as essential contributors to the development of chronic pain. Recent research has increasingly underscored the pivotal role of microglia in the structural remodeling of the nervous system, including the spinal cord and the brain's pain pathways. Investigating the individual mechanisms at the spinal and brain levels remains a compelling and evolving area of research. A deeper understanding of the cellular and molecular dialogue between neurons and microglia may uncover new therapeutic avenues, positioning microglial cells as promising targets for the treatment of neuropathic pain. An especially promising development is the creation of new, cutting-edge therapies for chronic neuropathic pain—medications that differ significantly from those used in current clinical practice.

Keywords

Microglia, microglial cells, neuropathic pain, neuroinflammation

Biography

Dr. Miltiades Y. Karavis specialized in Physical Medicine and Rehabilitation in 1995 and earned a Master of Science degree in Algology and Pain Management from the National and Kapodistrian University of Athens (2017–2019). Since 1992, he has served as the Scientific Director of the International Postgraduate Center of Acupuncture – AcuScience – in Athens, and he is also the President of the Hellenic Medical Acupuncture Association. He has been an invited speaker in many universities: Athens, New York (Columbia University), Copenhagen, Sofia, Lithuania, Switzerland, and Barcelona, presenting on the scientific and integrative dimensions of pain management and acupuncture. He has authored numerous articles and six books on topics including medical acupuncture, neural acupuncture, electroacupuncture, and auricular acupuncture. His recent work on neuroinflammation, microglia, and neuropathic pain has drawn particular attention.