Connexin and pannexin-based channels in oligodendrocytes: Implications in brain health and disease

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Oligodendrocytes are the myelin forming cells in the central nervous system (CNS). In addition to this main physiological function, these cells play key roles by providing energy substrates to neurons as well as information required to sustain proper synaptic transmission and plasticity at the CNS. The latter requires a fine coordinated intercellular communication with neurons and other glial cell types, including astrocytes. In mammals, tissue synchronization is mainly mediated by connexins and pannexins, two protein families that underpin the communication among neighboring cells through the formation of different plasma membrane channels. At one end, gap junction channels (GJCs; which are exclusively formed by connexins in vertebrates) connect the cytoplasm of contacting cells allowing electrical and metabolic coupling. At the other end, hemichannels and pannexons (which are formed by connexins and pannexins, respectively) communicate the intra- and extracellular compartments, serving as diffusion pathways of ions and small molecules. Here, we briefly review the current knowledge about the expression and function of hemichannels, pannexons and GJCs in oligodendrocytes, as well as the evidence regarding the possible role of these channels in metabolic and synaptic functions at the CNS. In particular, we focus on oligodendrocyte-astrocyte coupling during axon metabolic support and its implications in brain health and disease. © 2019 Vejar, Oyarzún, Retamal, Ortiz and Orellana.

Connexons

Demyelinating neuropathy

Gap junctions

Hemichannels

Oligodendrocytes

Pannexons

connexin 32

connexin 43

connexin 45

connexin 47

gap junction protein

membrane protein

pannexon

purinergic P2X receptor

purinergic P2X7 receptor

transcription factor Sox10

unclassified drug

brain disease

cell communication

cell proliferation

cerebrospinal fluid

demyelinating disease

demyelination

electron microscopy

experimental autoimmune encephalomyelitis

gap junction

gene expression

human

immunogold labeling

immunohistochemistry

leukodystrophy

multiple sclerosis

nerve cell differentiation

nonhuman

oligodendroglia

pathogenesis

protein expression

Review

syncytium

vasodilatation