Meninges function

The primary function of the meninges and of the cerebrospinal fluid is to protect the central nervous system.

In a study, Wang et al. used single-cell RNA sequencing to perform the first characterization of both non-tumor-associated human dura and primary meningioma samples. First, they revealed a complex immune microenvironment in human dura that is transcriptionally distinct from that of meningioma. In addition, they characterized a functionally diverse and heterogeneous landscape of non-immune cells including endothelial cells and fibroblasts. Through imaging mass cytometry, they highlighted the spatial relationship among immune cell types and vasculature in non-tumor-associated dura. Utilizing T cell receptor sequencing, they showed significant TCR overlap between matched dura and meningioma samples. Finally, they reported copy number variant heterogeneity within the meningioma samples [1)].

Emerging evidence highlights the several roles that meninges play in relevant brain functions as they are a protective membrane for the brain, produce and release several trophic factors important for neural cell migration and survival, control cerebrospinal fluid dynamics, and embrace numerous immune interactions affecting neural parenchymal functions. Furthermore, different groups have identified subsets of neural progenitors residing in the meninges during development and in adulthood in different mammalian species, including humans. Interestingly, these immature neural cells are able to migrate from the meninges to the neural parenchyma and differentiate into functional cortical neurons or oligodendrocytes. Immature neural cells residing in the meninges promptly react to brain disease. Injury-induced expansion and migration of meningeal neural progenitors have been observed following experimental demyelination, traumatic spinal cord and brain injury, amygdala lesion, stroke, and progressive ataxia. In this review, we summarize data on the function of meninges as stem cell niche and on the presence of immature neural cells in the meninges and discuss their roles in brain health and disease. Decimo et al. consider the potential exploitation of meningeal neural progenitors for regenerative medicine to treat neurological disorders [2)].

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Wang AZ, Bowman-Kirigin JA, Desai R, Kang LI, Patel PR, Patel B, Khan SM, Bender D, Marlin MC, Liu J, Osbun JW, Leuthardt EC, Chicoine MR, Dacey RG Jr, Zipfel GJ, Kim AH, DeNardo DG, Petti AA, Dunn GP. Single-cell profiling of human dura and meningioma reveals cellular meningeal landscape and insights into meningioma immune response. Genome Med. 2022 May 10;14(1):49. doi: 10.1186/s13073-022-01051-9. PMID: 35534852.

2)
Decimo I, Dolci S, Panuccio G, Riva M, Fumagalli G, Bifari F. Meninges: A Widespread Niche of Neural Progenitors for the Brain [published online ahead of print, 2020 Sep 16]. Neuroscientist. 2020;1073858420954826. doi:10.1177/1073858420954826