

Editorial: inflammation in the cns: advancing the field using intravital imaging

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Editorial on the Research Topic

Inflammation in the CNS: Advancing the Field Using Intravital Imaging

Inflammation of the central nervous system (CNS) contributes to a diverse array of life-threatening and debilitating conditions. These include autoimmune conditions such as multiple sclerosis (MS), progressive degenerative conditions [Alzheimer's disease (AD)], sterile inflammation as occurs in stroke/cerebral ischaemia, and inflammation stemming from parasitic, fungal, viral, and bacterial infections. Whilst recent developments have led to improved outcomes in some of these conditions, most notably MS ([1](#)), there remains concerns with these approaches ([2](#)). Furthermore, there is an increasing prevalence of AD and stroke among the ageing population in the developed world, whilst in sub-Saharan Africa, cerebral malaria remains a major cause of mortality. These factors mandate a greater understanding of the inflammatory mechanisms in the CNS associated with these conditions. As is the case with all inflammation, inflammatory responses in the CNS involve immune cell entry/migration, complex interplay between resident and circulating immune cells, parenchymal cells, the cellular constituents of the CNS microvasculature, and alterations in immune cell function.

Intravital or *in vivo* imaging has been a critical tool for understanding the mechanisms of inflammation throughout the body, including in the brain ([3-5](#)). Particularly, the advent of two-photon intravital microscopy (2P-IVM) has allowed researchers to directly examine the role of multiple immune cell populations in the initiation and regulation of inflammation within the CNS.

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2P-IVM has become a critical tool not only for understanding the complex interplay between the cellular components of the immune system and how they act to provide protection against infection and injury but also how the dysregulation of these processes leads to disease.

Whilst application of intravital imaging to the CNS has been technically challenging, several issues have been systematically addressed over the years to facilitate generation of high-quality four dimensional (x, y, z, t) images. These advances have proved pivotal in understanding animal models of CNS inflammation such as EAE. Moreover, the combination of ongoing technical developments in imaging technologies, reporter mice, and novel fluorophores for detection of cellular signalling, in parallel with improved animal models of CNS disease, has meant that the understanding of inflammatory processes in this unique organ is better than ever before.

This *Frontiers Research Topic* brings together studies illustrating how imaging has advanced CNS inflammation and provides an overview of what parameters can be assessed using this approach. A key point that emerges from this collection is that intravital imaging has moved beyond simplistic descriptions of immune cell accumulation at inflamed sites—new approaches allow investigation of the molecular activities of these cells *in situ* in the CNS, in an ongoing inflammatory response, in unprecedented detail.

Activated T cells migrating in non-lymphoid organs play important homeostatic and pathological roles, including in the CNS. Gaylo et al. discuss the mechanisms that control T cell interstitial migration, emphasising that inflammation can cause changes in the composition of the extracellular

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milieu in which T cells navigate. They describe how one of the challenges of using imaging to assess T cell migration in the brain is the difference in the composition of the stromal and parenchymal CNS components relative to other peripheral tissues.

2. Clifford DB, Yousry TA, Major EO. A decade of natalizumab and PML: has there been a tacit transfer of risk acceptance? *Mult Scler* (2017) 23: 934–6.

doi: 10.1177/1352458516670735

3. Miller MJ, Wei SH, Parker I, Cahalan MD. Two-photon imaging of lymphocyte motility and antigen response in intact lymph node. *Science* (2002) 296: 1869–73. doi: 10.1126/science.1070051

4. Mempel TR, Henrickson SE, von Andrian UH. T-cell priming by dendritic cells in lymph nodes occurs in three distinct phases. *Nature* (2004) 427: 154–9. doi: 10.1038/nature02238

5. Abtin A, Jain R, Mitchell AJ, Roediger B, Brzoska AJ, Tikoo S, et al. Perivascular macrophages mediate neutrophil recruitment during bacterial skin infection. *Nat Immunol* (2014) 15: 45–53. doi: 10.1038/ni.2769