



A neuroimmune odyssey

Nature Reviews Immunology has launched a special Series on Neuroimmunology. We hope the articles in this Series serve as guiding lights on what promises to be an exciting scientific journey.

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The field of neuroimmunology has blossomed in recent years. This can be attributed to sophisticated technological advances, as well as to the burgeoning collaboration of neuroscientists and immunologists. What was once considered a ‘no-go’ zone by many immunologists has emerged as one of the most exciting current areas of biological research. Still, the partnering of neuroscience and immunology, which are complex and jargon-heavy fields, poses its own challenges. In launching this dedicated Series on Neuroimmunology, *Nature Reviews Immunology* aims to support the growth of the community by providing an online hub of Review articles written by leaders in the field. We trust that these articles will be informative and inspirational, both to established immunologists and to any junior scientists who are just about to start out on their own voyages of scientific discovery.

Neuroimmunology first emerged as a discipline in its own right in the early 1980s. For many years, the field was dominated by studies of autoimmune disorders that affect the nervous system, such as the demyelinating illness multiple sclerosis and the neuromuscular disease myasthenia gravis. At this time, the brain was considered to be an ‘immune-privileged’ site, with the blood–brain barrier (BBB) thought to prevent immune access and immunosurveillance of the healthy CNS. Immune activity in the CNS was generally considered to be pathological and studies addressing physiological interaction of the immune system and nervous system were few and far between. Despite this, there were some early indications that the two systems were more closely entwined and actively involved in a two-way dialogue. Classic Pavlovian conditioning was reported to suppress antibody production and enhance natural killer cell activity¹. Moreover, various stressors were associated with diminished immune function, and patients who scored high on a loneliness scale demonstrated suppressed lymphocyte activity¹. However, owing to a lack of mechanistic insight, many of these psychoneuroimmunology studies were often disregarded as ‘pseudoscience’.

Almost 40 years on, we have a vastly improved understanding of the intricate crosstalk that takes place between the immune and nervous systems and the relevance of this to host physiology and disease. For instance, the brain is no longer considered an impenetrable

fortress (as depicted on the cover of our 2009 Focus issue!²) but has been demonstrated to have an extensive meningeal lymphatic network that supports immunosurveillance of the CNS under homeostatic conditions. Cytokines produced by immune cells have been shown to affect behavioural and psychiatric responses, while microglia, the resident macrophages of the CNS, are known to actively participate in synapse remodelling and to be vital for immune and many non-immune functions of the brain. It is now clear that inflammatory mechanisms — and in particular ‘inflammaging’ — lie at the heart of neurological conditions such as Alzheimer disease and Parkinson disease that were once considered to be solely neurodegenerative in nature. Several studies have unravelled the molecular basis of how immune cells and nerve cells interact in the periphery to shape tissue immune responses. Emerging work is also highlighting the important influence of the microbiota and its metabolites on cognitive functions and behaviour.

The articles in our Series will address these topics as well as many other aspects of neuroimmunology. In this issue, Huh and Veiga-Fernandes provide an overview of how bidirectional neuroimmune interactions shape distinct aspects of host physiology³. On the online homepage for our Series, we have added relevant recent articles, including the final Review written by the late Ben Barres⁴, who was a true trailblazer in the microglial cell field. We will continue to add new articles over the course of 2020 and beyond.

Finally, as well as looking to the future this month, we also reflect back with the launch of a specially commissioned series of articles on ‘Women in Immunology’⁵. These are short tributes to some of the early pioneering women immunologists who have perhaps not always received the recognition they deserve. We hope these articles help to bring awareness of their incredible scientific achievements to the wider immunology community.

1. Arimura, A. & Katsuura, G. *Nihon Naibunpi Gakkai Zasshi* **65**, 1328–1339 (1989).
2. *Nat. Rev. Immunol.* **9**, 385–456 (2009).
3. Huh, J. R. & Veiga-Fernandes, H. *Nat. Rev. Immunol.* <https://doi.org/10.1038/s41577-019-0247-z> (2020).
4. Li, Q. & Barres, B. A. *Nat. Rev. Immunol.* **18**, 225–242 (2018).
5. Mowat, A. M. *Nat. Rev. Immunol.* <https://doi.org/10.1038/s41577-020-0292-7> (2020).