J Neurol (2007) 254 [Suppl 1]: I/1–I/2
DOI 10.1007/s00415-007-1001-1

INTRODUCTION

This supplement of the *Journal of Neurology* corresponds to the proceedings of *an MS Experts Board* meeting entitled '*New insights into the pathology of multiple sclerosis*' held in Barcelona, Spain on June 24, 2006. During the meeting, the latest research related to the basic mechanisms underlying myelin and axonal damage and repair in multiple sclerosis was reviewed, as well as the consequences of this for characterising new therapeutic strategies aimed at facilitating immunological protection and enhancing repair.

Wolfgang Brück (Göttingen, Germany) addressed the relationship between inflammation and neurodegeneration in disease development. These two processes are closely interconnected from the earliest stages of disease, but their relative contribution may vary between individuals, between disease stages and even between individual lesions. Current knowledge is insufficient to bring together these two aspects of pathophysiology into a unified hypothesis of disease, which remains nevertheless a major goal for multiple sclerosis research.

Lloyd Kasper (Dartmouth, USA) described the role of T regulatory cells in immune homeostasis, and how their activity can be harnessed to prevent, or attenuate, the emergence of autoimmune disease. He presented evidence that glatiramer acetate could stimulate the proliferation and activity of T regulatory cells and suggested that these effects could contribute to its beneficial therapeutic effects in multiple sclerosis.

The failure of remyelination in multiple sclerosis and strategies for promoting remyelination were reviewed from a developmental perspective by Charles ffrench-Constant (Cambridge, UK). He described the complex interplay of humoral and matrix factors that influence proliferation, differentiation and maturation of oligodendrocyte precursor cells, which represents a challenging target for the development of treatments aimed at promoting remyelination.

Gianvito Martino (Milan, Italy) evoked the promise of neural precursor cell therapy for limiting neuronal damage and promoting repair in multiple sclerosis. Recent research has shown that such cells can be isolated from adult mice and inoculated into host mice where they infiltrate the nervous system, target sites of tissue damage and promote neuronal repair through a palette of bystander effects.

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Martin Kerschensteiner (Munich, Germany) discussed the mechanisms whereby neural circuits in the spinal cord can be remodelled following spinal injury. This previously unexpected degree of plasticity is an important determinant of functional recovery after demyelinating or traumatic injury. The development of therapies to facilitate this remodelling represents a promising avenue of research for rehabilitation following spinal injury.

Neurotrophic factors may play an important role in limiting neuronal damage and promoting repair in multiple sclerosis, and inducing their secretion or activity may be of great interest in treatment. Ralf Gold (Bochum, Germany) reviewed the data on growth factors in multiple sclerosis with particular emphasis on BDNF, CNTF and LIF. He described how release of neurotrophins from immune cells infiltrating lesions in multiple sclerosis may contribute to neuronal repair, and indicated that facilitating neurotrophin release would be a potentially useful therapeutic strategy.

The consequences of treatment with glatiramer acetate on repair mechanisms in multiple sclerosis were reviewed by Ruth Arnon (Rehovot, Israel), with particular reference to the rodent experimental autoimmune encephalomyelitis model. Glatiramer acetate treatment generates a specific population of T cells in the periphery which enter the brain. Here, they target lesions and release anti-inflammatory cytokines to suppress inflammation and BDNF, which protects axons and neuronal cell bodies from damage caused by inflammation or demyelination, as well as promoting proliferation, migration and maturation of neural progenitor cells at sites of tissue injury.

The potentially beneficial effects of inflammation in multiple sclerosis were discussed by Reinhard Hohlfeld (Munich, Germany), who described how immune cells infiltrating the nervous system during inflammatory flares can release a variety of trophic factors which allow a dynamic interaction between the nervous and immune systems. This underlies the concept of neuroprotective autoimmunity. Harnessing the beneficial effects of inflammation represents a promising therapeutic approach to improving treatment of multiple sclerosis.

Finally, Massimo Filippi (Milan, Italy) reviewed the different magnetic resonance (MR) imaging techniques and tools which can be used to monitor the disease process in multiple sclerosis and possibly to distinguish between damage and repair mechanisms. He described how the development of non-conventional MR imaging techniques such as magnetization transfer, diffusion tensor imaging, functional MRI and MR spectroscopy has been critical for demonstrating neurodegenerative

activity from the earliest stages of disease and for visualising potential neuroprotective effects of treatments.

The ideas discussed in the symposium revealed the vitality of research into the pathology of multiple sclerosis, with many new concepts and fields of research, such as the control of oligodendrocytogenesis, neuroprotective autoimmunity, immune system homeostasis and the properties of adult neural precursor cells. Exploitation of these different novel biological mechanisms represents so many perspectives for improved treatment of multiple sclerosis. We hope that this supplement of the *Journal of Neurology* will provide readers with an overview of these exciting new developments and stimulate further research to improve the treatment of multiple sclerosis.