**Title:** Agent-based modelling of immune cell activity and myelin regeneration in Multiple Sclerosis

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**Location:** University of Galway, Ireland

**Project description:**

Multiple sclerosis (MS) is a severely debilitating immune-mediated disease that damages myelin in the central nervous system, affecting over 2.5 million worldwide. Efficient myelin regeneration (remyelination) remains an unmet clinical need with potential to be functionally restorative for patients with all types of MS. It has recently discovered that depletion of regulatory T (Treg) cells impedes myelin regeneration. As such, induction of Treg cells for immunotherapy is an interventional goal in MS. Interestingly, such Treg induction may be mechanically controllable; ongoing work from the PI and collaborators focuses on uncovering the mechanism of mechano-sensitivity in Treg cell induction and stability, coupling advanced computational methods with experimental imaging and theoretical biophysics.

This research project will focus on developing computational models to analyse the chemo-mechanical feedback between Tregs, activated T cells, and oligodendrocytes (myelinating cells) in regulating the timescales of myelin remodelling in MS. Advancing on existing models developed by the PI’s research group, agent-based models of cellular interactions will be generated to investigate how specific T cell subpopulations govern the severity of and recovery from a demyelinating event. The specific objectives are to:

* Develop an agent-based model (ABM) of chemo-mechanical interactions between T cell subpopulations and oligodendrocytes;
* Investigate how the presence of Tregs can promote oligodendrocyte differentiation for functional remyelination;
* Characterize how the concentration and spatial arrangement of T cell subpopulations influences the initiation, severity, and recovery from a demyelinating event.

An ideal candidate will have experience with some of the following areas: biomedical engineering, biomechanics, programming, numerical modelling, cell biology, and/or biophysics. Experience in a computational research environment would also be beneficial.