

# FG-003: Triplet Neuro-Immune Repair Framework

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## Abstract

Neuro-immune disorders such as multiple sclerosis (MS) and inflammatory demyelination lie at the intersection of immune dysregulation and failed tissue repair. FG-003 proposes a triplet neuro-immune repair framework integrating CCR5 antagonism, PD-L1 checkpoint recalibration, and remyelination-supportive trophic signaling. The concept is designed to suppress maladaptive trafficking, restore regulatory-effector balance, and promote axonal recovery within inflamed central nervous system (CNS) niches. FG-003 extends FireGate’s triplet architecture into regenerative neuro-immunology, bridging inflammation control with neurorepair.

## 1 Introduction

Neuro-immune disease reflects coordinated dysfunction in leukocyte trafficking, checkpoint signaling, and glial resilience. Persistent CCR5-driven leukocyte entry, PD-1/PD-L1 imbalance, and loss of oligodendrocyte support collectively drive progressive demyelination. Current immunosuppressants reduce relapse frequency but rarely restore immune tolerance or functional repair.

FG-003 is conceived as a modular platform to simultaneously attenuate chemokine-mediated trafficking, stabilize checkpoint tolerance circuits, and reactivate neurotrophic signaling to support myelin restoration.

## 2 Mechanistic Framework

### 2.1 CCR5 Blockade — Trafficking and Microglial Normalization

CCR5 antagonism reduces MCP-1/MIP-1 $\alpha$ -mediated cellular infiltration, limits inflammatory spillover, and shifts microglia away from neurotoxic phenotypes, creating a permissive

environment for regeneration.

## 2.2 PD-L1 Restoration — Re-Establishing Tolerance

Checkpoint axis failure contributes to loss of peripheral and CNS tolerance. Controlled PD-L1 restoration at astroglial and myeloid interfaces may re-balance regulatory and effector T-cell programs without broad immunosuppression. FG-003 emphasizes dynamic tuning rather than chronic blockade, stabilizing immune privilege while preserving repair-associated cytokine networks.

## 2.3 Remyelination Support — Neurotrophic Synergy

Successful neuro-immune repair requires both immune quieting and trophic reactivation. FG-003 incorporates strategies to enhance BDNF, CNTF, and IGF-1 pathways, promoting oligodendrocyte precursor cell differentiation and functional remyelination under stabilized immune conditions.

Taken together, these axes form an integrated network: CCR5 control reduces inflammatory traffic, PD-L1 reset prevents reactivation, and neurotrophic induction finalizes repair.

## 3 Discussion

FG-003 reframes neuro-immune therapy as restoration of tolerance plus resilience, rather than suppression alone. The model suggests sustained remission will require coordinated modulation across chemokine, checkpoint, and trophic domains. Potential applications include MS, neuro-HIV, and autoimmune encephalitis.

Future directions include in-silico pathway mapping, primary glial co-culture assays, and preclinical evaluation of combined CCR5/PD-L1/neurotrophic triplets.

## 4 References

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## **Disclaimer**

This document describes a conceptual, pre-clinical framework. Proposed mechanisms and hypotheses require formal experimental validation and should not be interpreted as clinical claims or medical guidance.