

Neuron-Glial Synapses: Targets for Stimulating Neural Repair

Science City Research Alliance
Away-day

Daniel Fulton

Wednesday 10th November 2010

Career overview

Ph.D.

University of Sussex

Paul Benjamin
2000-2003



Molecular
mechanisms
of memory

Postdoctoral training

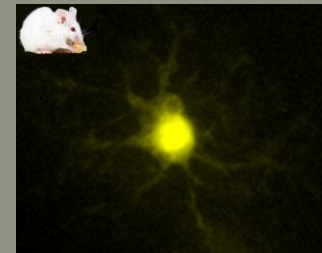
University of California Los Angeles

David
Glanzman
2004-2007



Synaptic
physiology &
plasticity

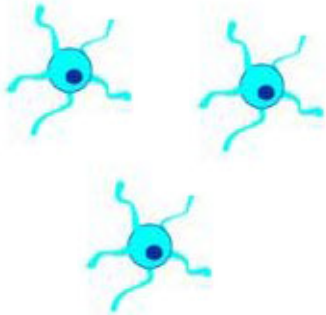
Anthony Campagnoni
2007-Present



Oligodendrocyte
physiology &
function / neuro-
glial synapses

Oligodendrocyte lineage cells are essential for CNS myelination ...

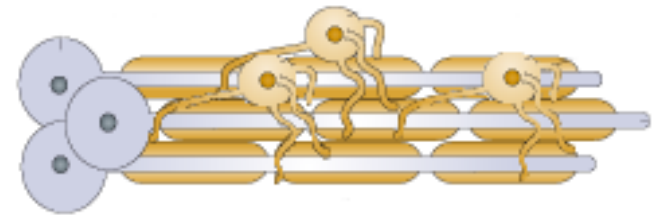
OL precursors



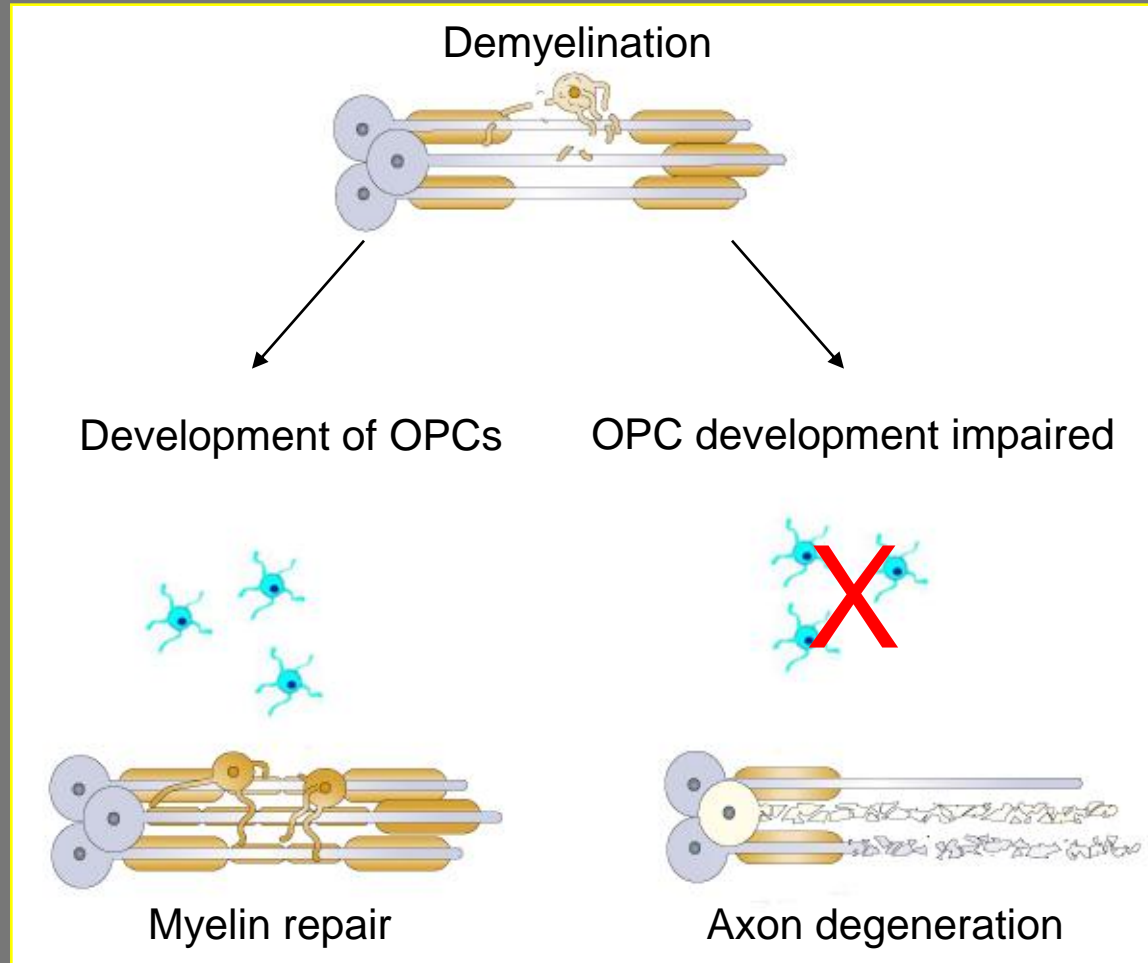
Mature OLs



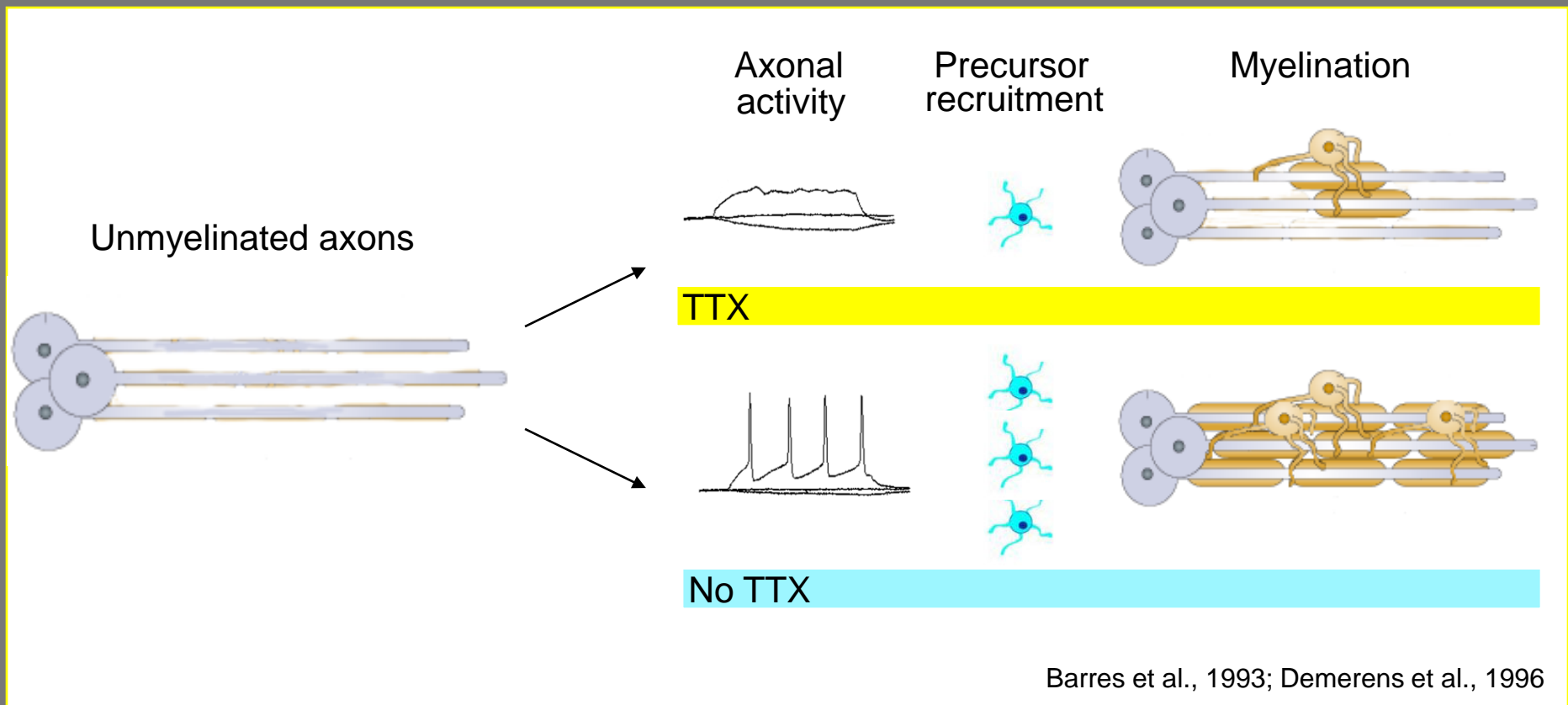
Myelinating OLs



... and myelin repair ...

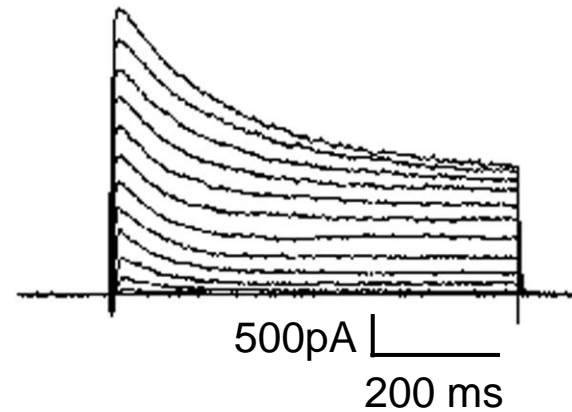
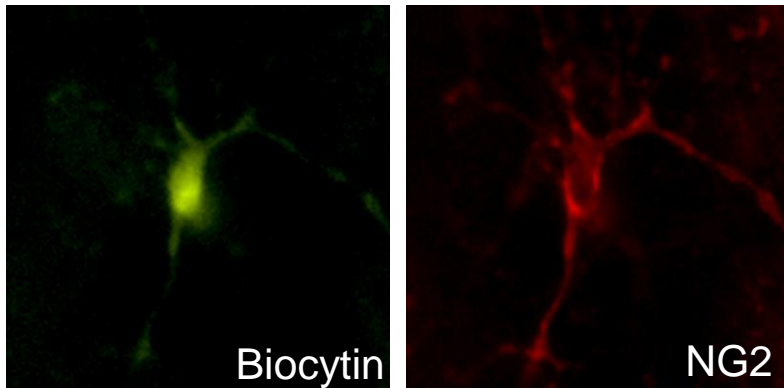


Neuronal activity is required for OL development & myelination

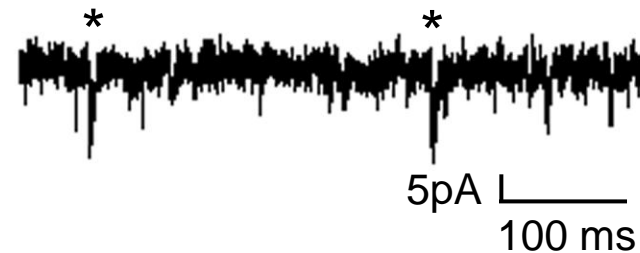
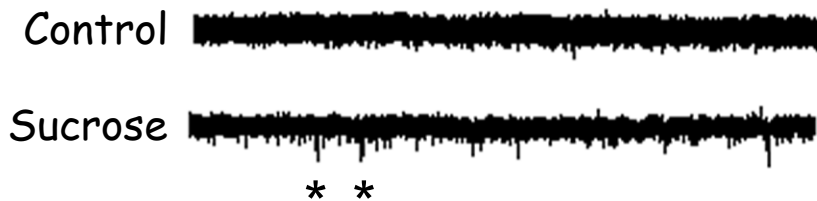


Neuron-glia communication

Identification of patch-clamped glial cells by immunolabeling and physiology



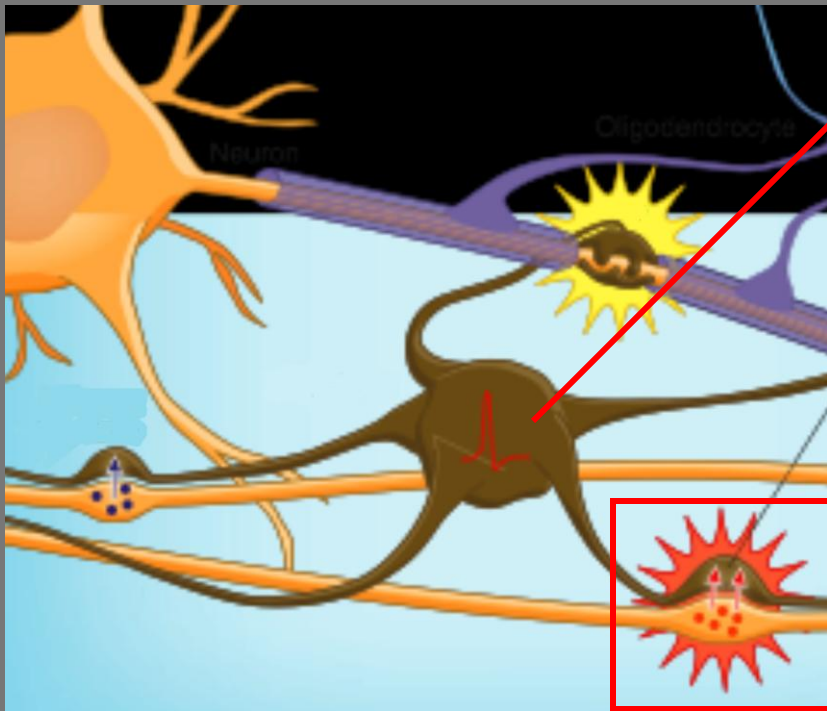
A recording from the cell shown above reveals neuron-glia signals evoked by neurotransmitter release



Fulton, Paez, Colwell & Campagnoni unpublished data

Hypothesis

Neuron-glia signals allow precursors to sense neuronal activity

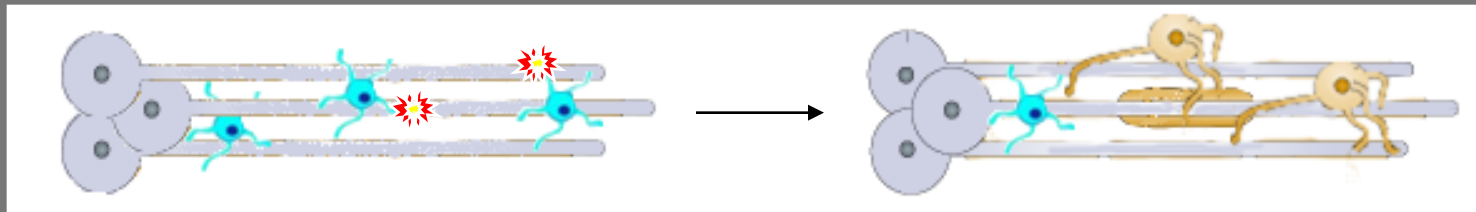


Initiate signals leading to development and eventual myelination

Neurotransmitter receptor activation regulates glial-precursor migration and development

Hypothesis

... sense changes in neuronal activity arising during development ...



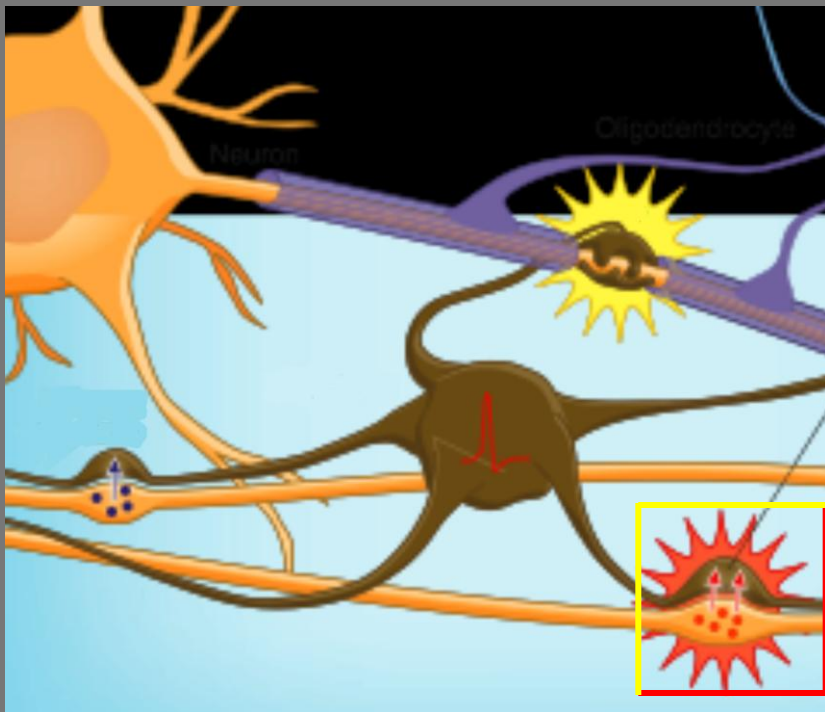
... or in axons demyelinated due to disease

Potential target for therapies aiming to stimulate the repair of myelin and damaged axons

Experimental approach

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Use glial-cell targeted approaches and multi-photon imaging to **decrease** and **increase** receptor functions in glial precursors



Decrease precursor receptor functions with cell specific molecular tools

Increase precursor receptor functions via two-photon / optogenetics and transmitter un-caging

Endpoints: oligodendrocyte development, myelin generation & repair

Initial aims of this SCRA project

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1. Develop novel molecular tools for
Cell-specific control of neuron-glia signals

2. Evaluate the role of neuron-glia signals
in stimulating glial development and myelin
generation and repair

How this project relates to the Science City programme

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Foster collaborations:

- Between groups within Warwick , and between the two partner Universities

Help to develop research capacity and quality:

- Induction of neural repair via neuron-glia synapses is unique
- Initiate regional biotech collaborations to develop these findings into therapies for stimulating repair

Thank you for the opportunity to
present my research proposal

I'd be happy to take your questions