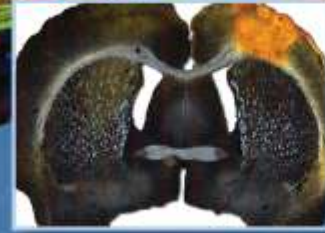




THE UNIVERSITY OF
MELBOURNE

Graeme Clark
Institute



38 APS 2024

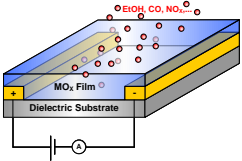
Self-assembled peptide hydrogels to avoid tissue
overgrowth in progenitor cell grafts

Engineering Materials for Future Healthcare

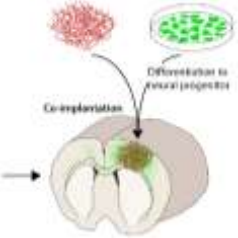
Pathogen resistant Coatings



Medical Diagnostics

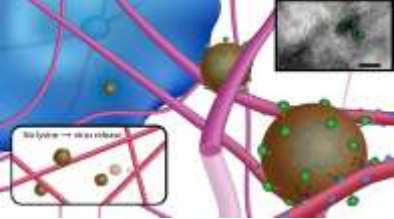


Stem cell transplantation



Multi-Scale Materials & Devices

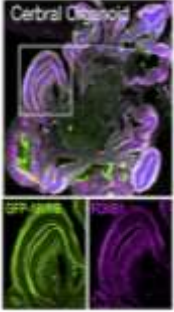
Biomaterials



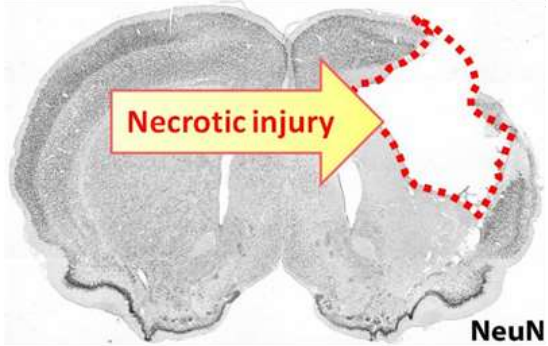
Bionics



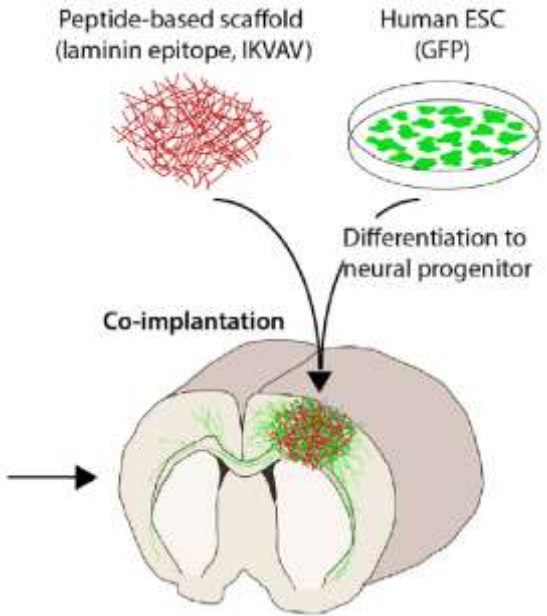
Ex vivo disease models



The Problem



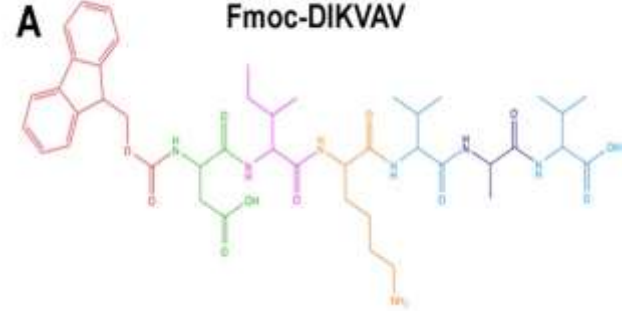
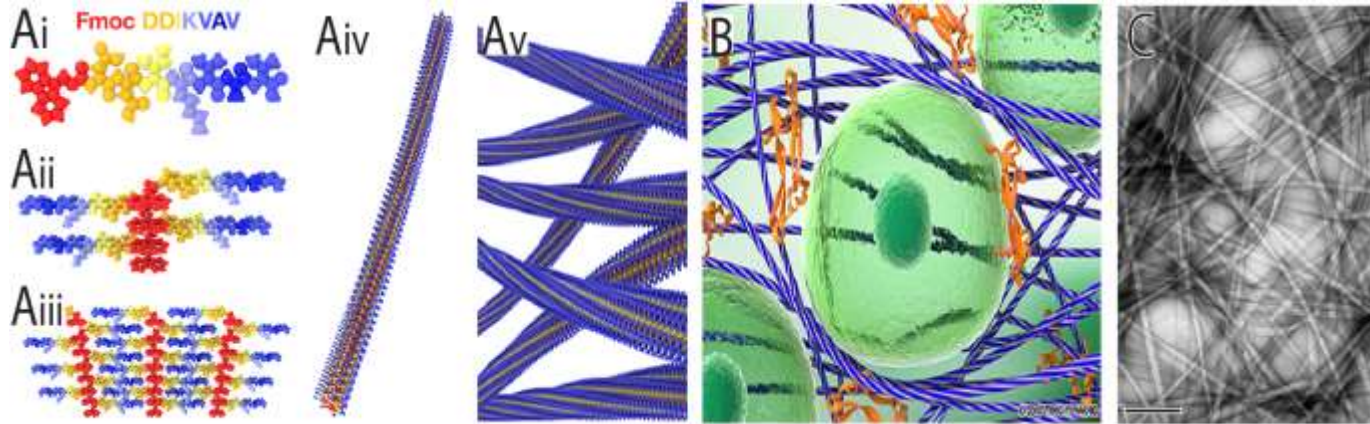
The Cell Transplantation Journey



Self-assembling Peptides

• Laminin

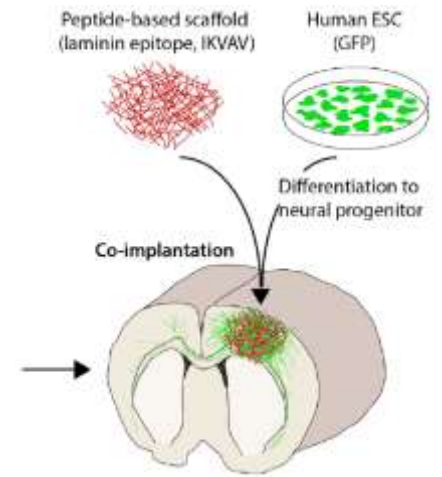
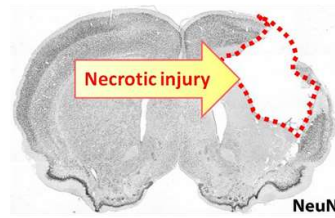
- Epitope for laminin (**IKVAV**: Isoleucine-Lysine-Valine-Alanine-Valine)
- Supports cell positioning, neural differentiation & neurite growth
- Enhanced efficiency



A/Prof. Richard Williams, Deakin

Advanced Materials 30 (50), 1805209, 2018

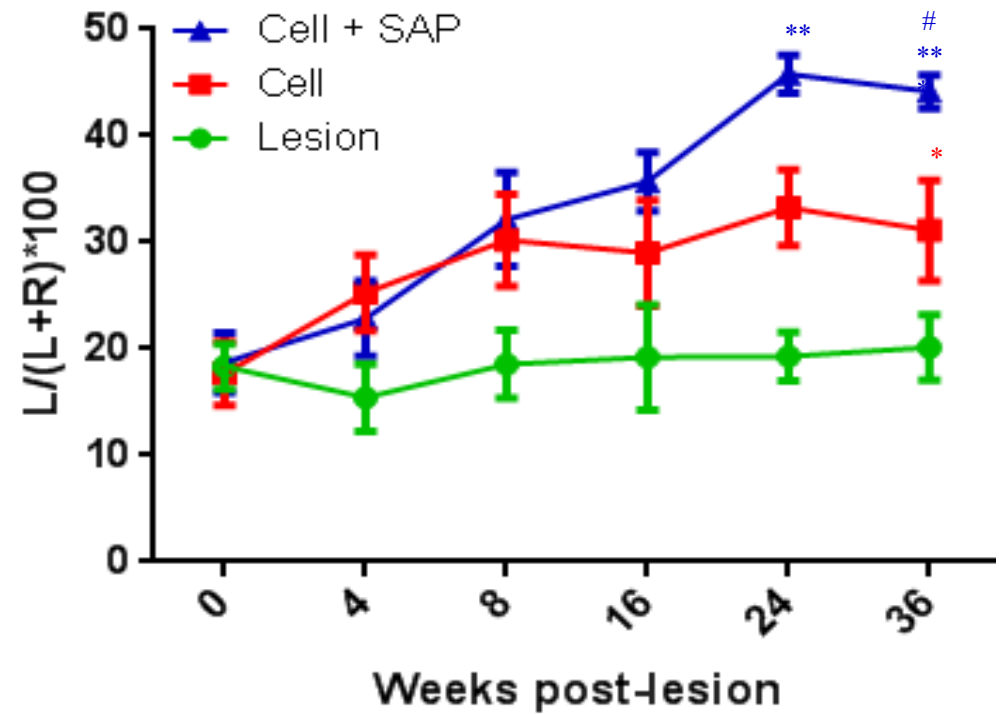
Advanced Functional Materials 30 (9), 1900390, 2020



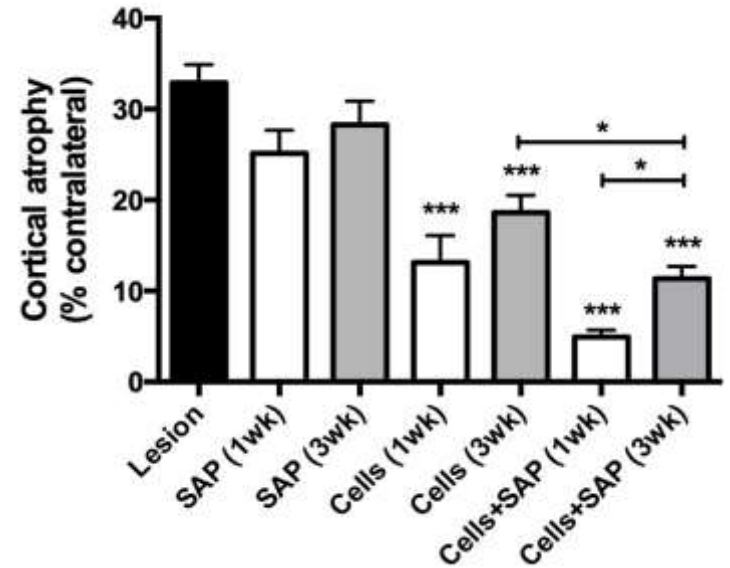
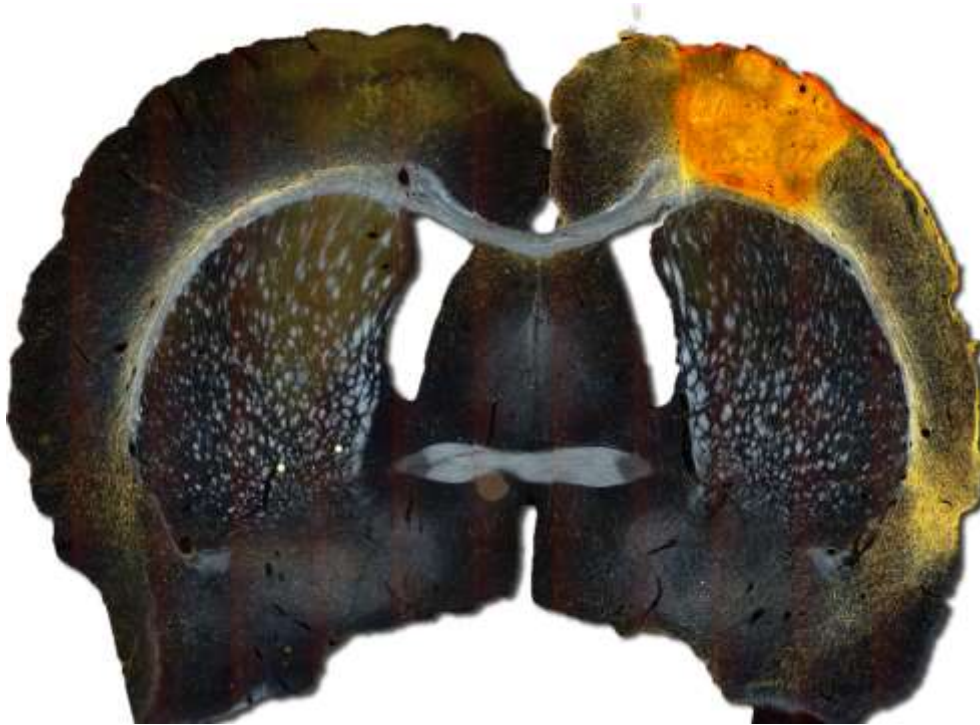
Prof. Clare Parish, Florey Neuroscience Institute



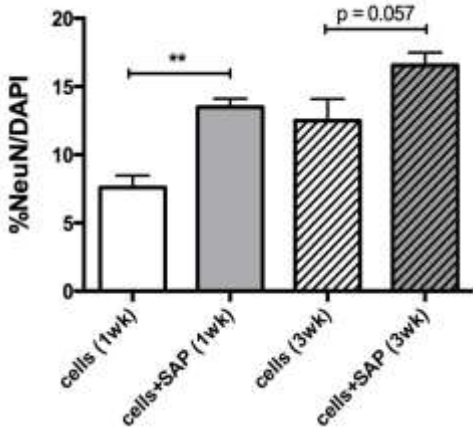
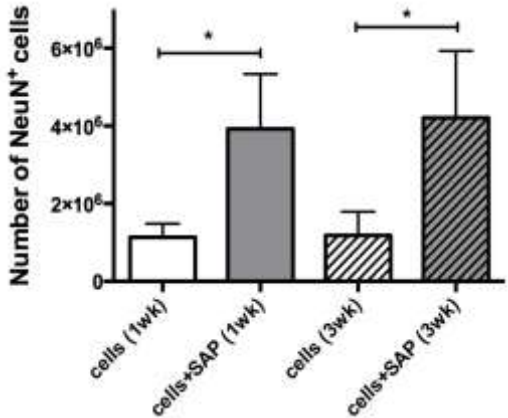
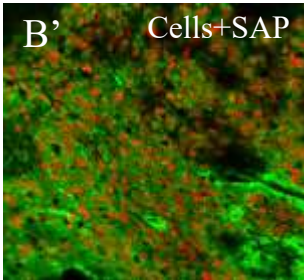
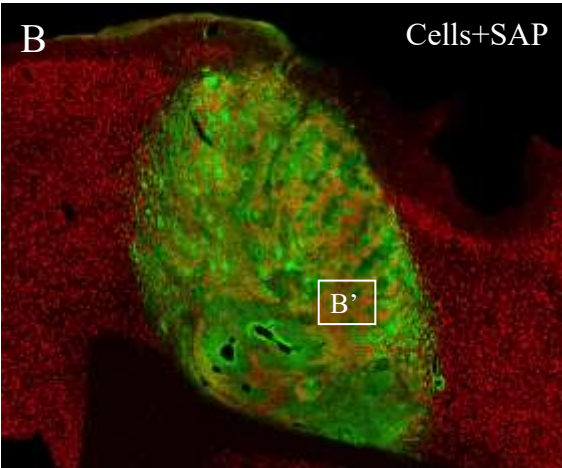
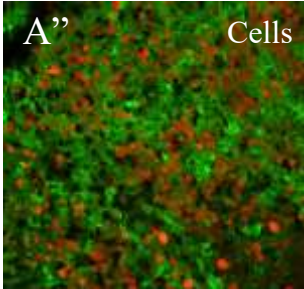
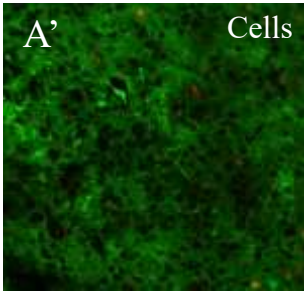
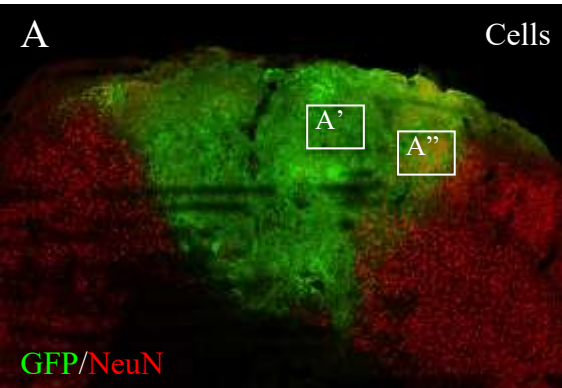
Dr Lachlan Thompson, Florey Neuroscience Institute



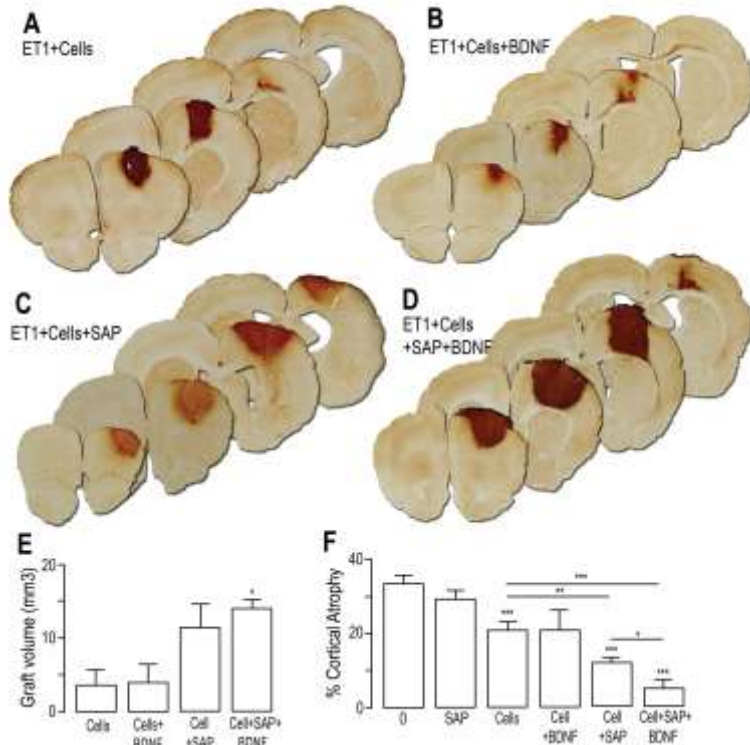
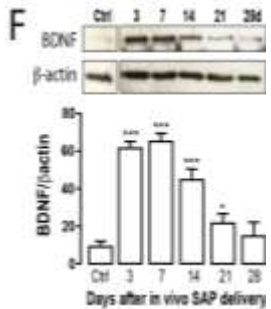
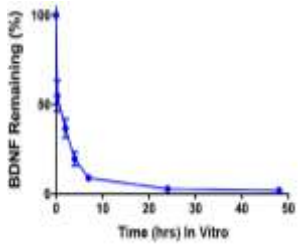
Molecular hydrogels enhance cell integration post stroke.



Controlling neuronal differentiation with engineered materials



Protein engineering to achieve sustained growth factor delivery



Prof. Clare Parish, Florey



Dr Lachlan Thompson, Florey



Dr Richard Williams, Deakin



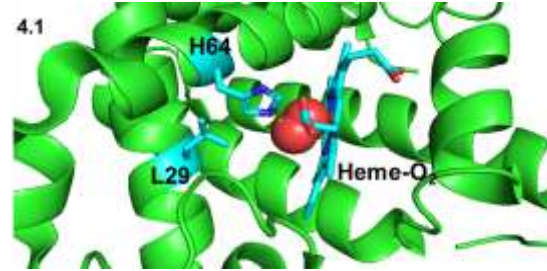
Dr Kiara Bruggeman, ANU



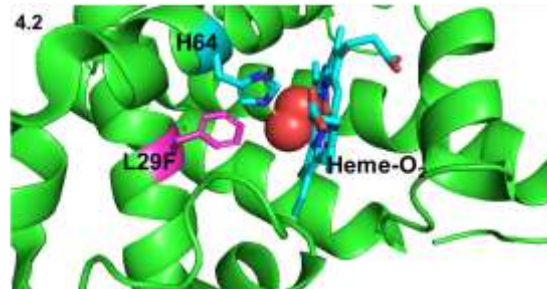
Dr Alexandra Rodriguez, ANU

Optimizing graft size with myoglobin

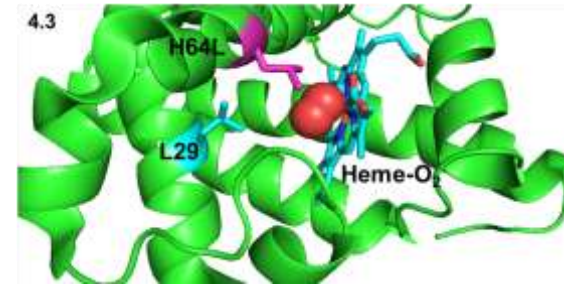
- We can fine-tune the oxygen binding kinetics
- Alter the structure and function of a protein
- 4 different myoglobin variants already tested
- Electrostatic interactions between the myoglobin and SAP are also important.



Structure of wildtype or native sperm whale myoglobin showing important elements for oxygen binding



Structure of high affinity sperm whale myoglobin showing change of leucine amino acid to phenylalanine



Structure of low affinity sperm whale myoglobin showing change of histidine amino acid to leucine



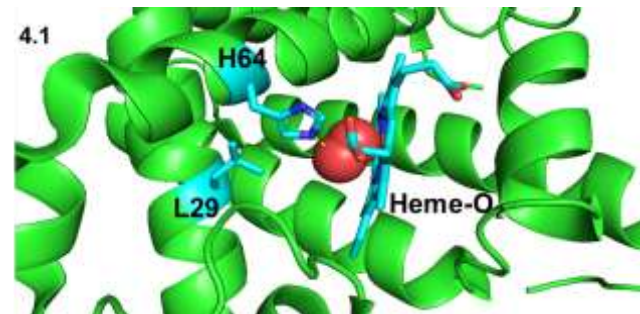
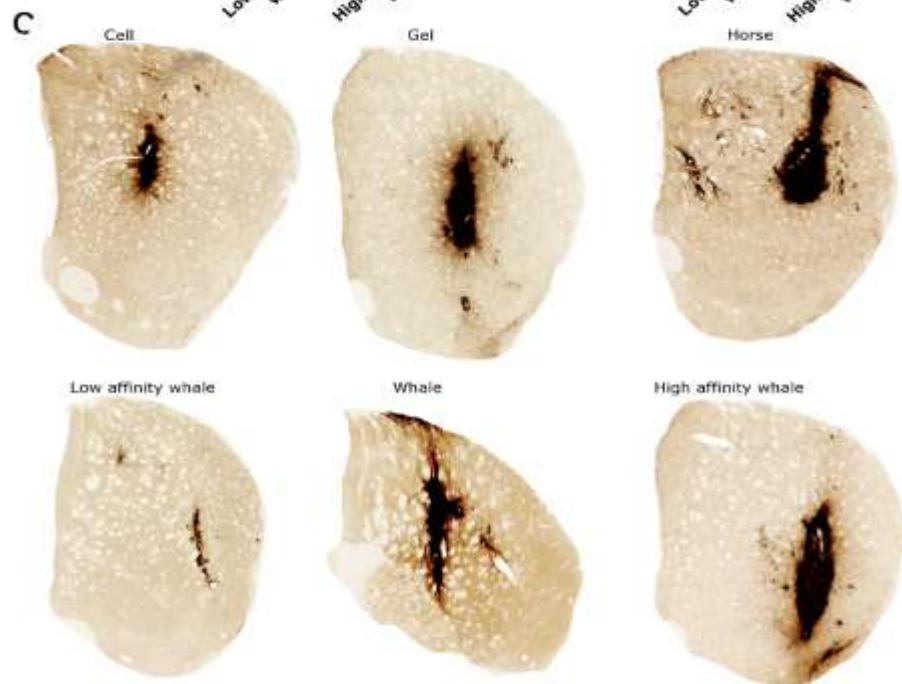
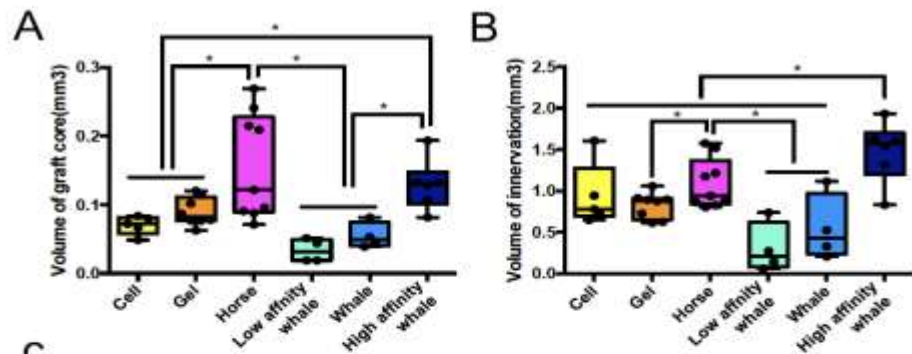
Ms Liz Zoneff,
UOM



Dr Yi Wang,
UOM



Prof. Colin
Jackson, ANU



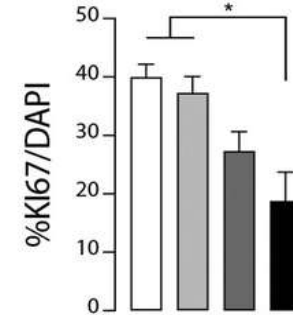
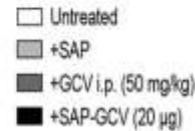
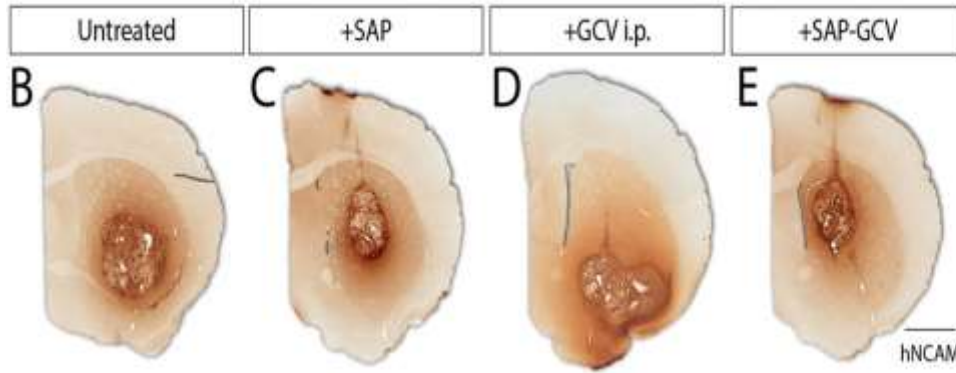
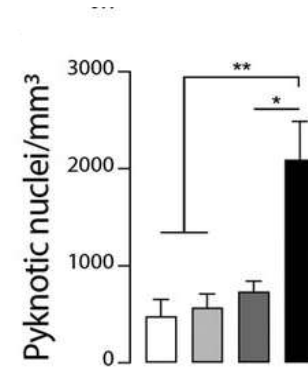
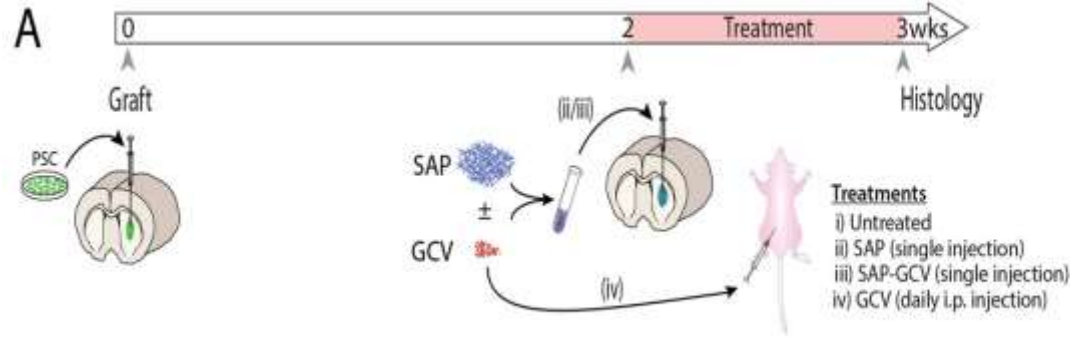
Suicide gene activation

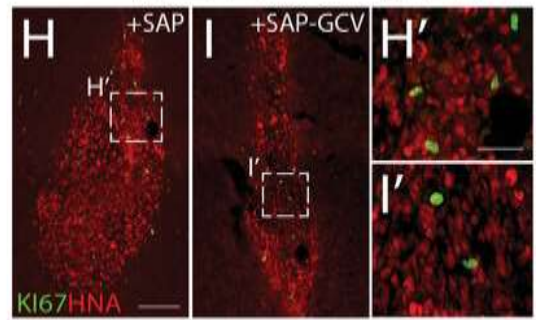
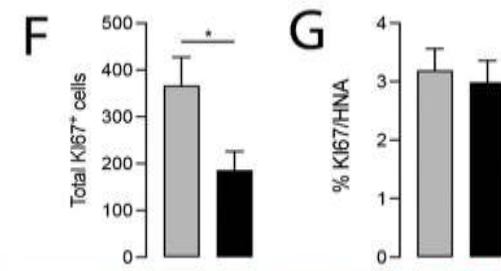
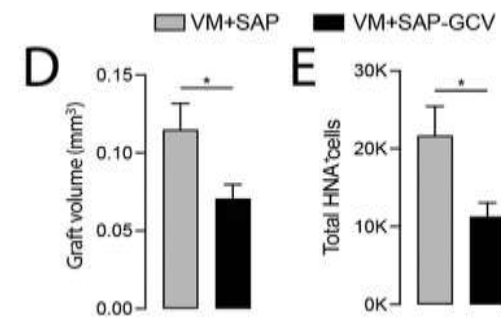
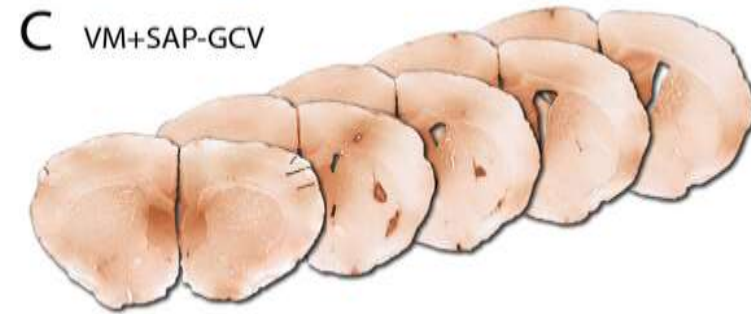
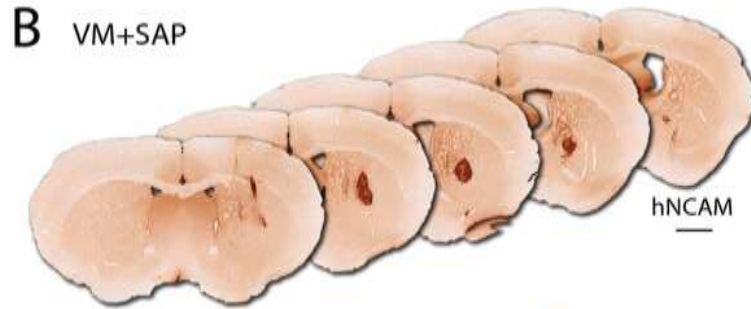
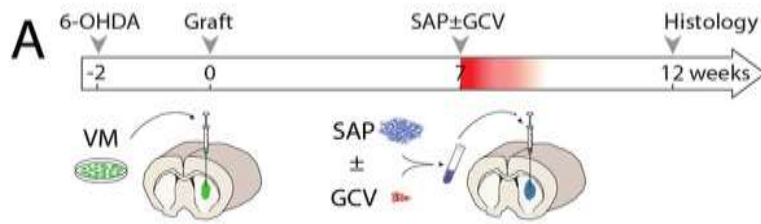


Prof. Clare Parish, Florey



Ms Negar Mahmoudi, ANU





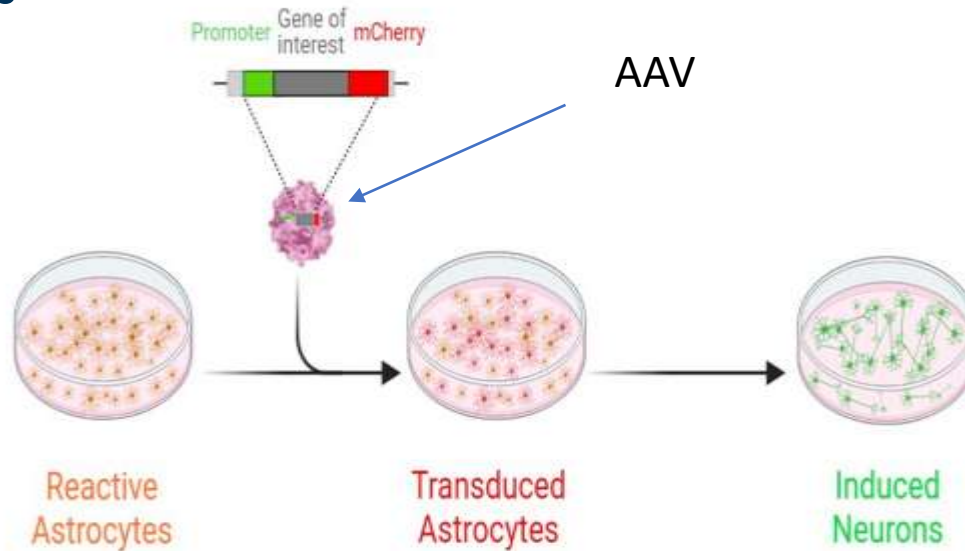


Funding and Support is gratefully acknowledged from



Second Story

Can we achieve this
without cell
transplantation?



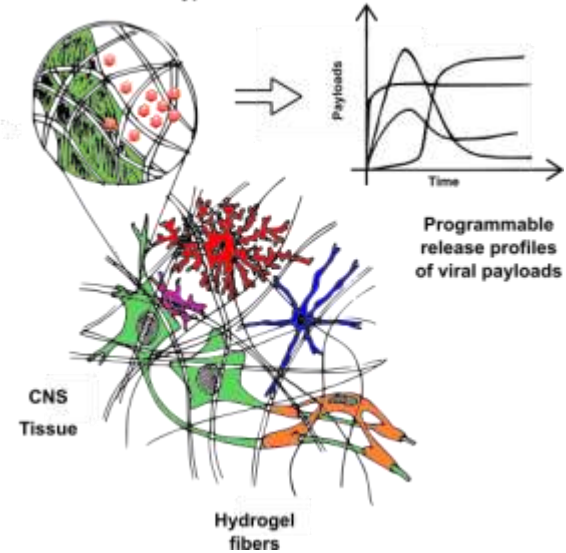
Prof Alan
Harvey, UWA



Ms Negar
Mahmoudi, ANU

What is the best serotype for reprogramming in the brain?

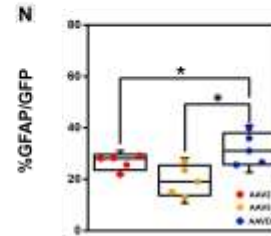
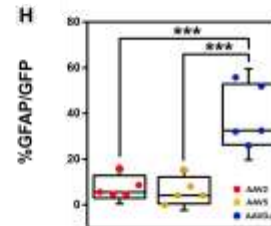
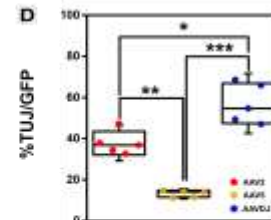
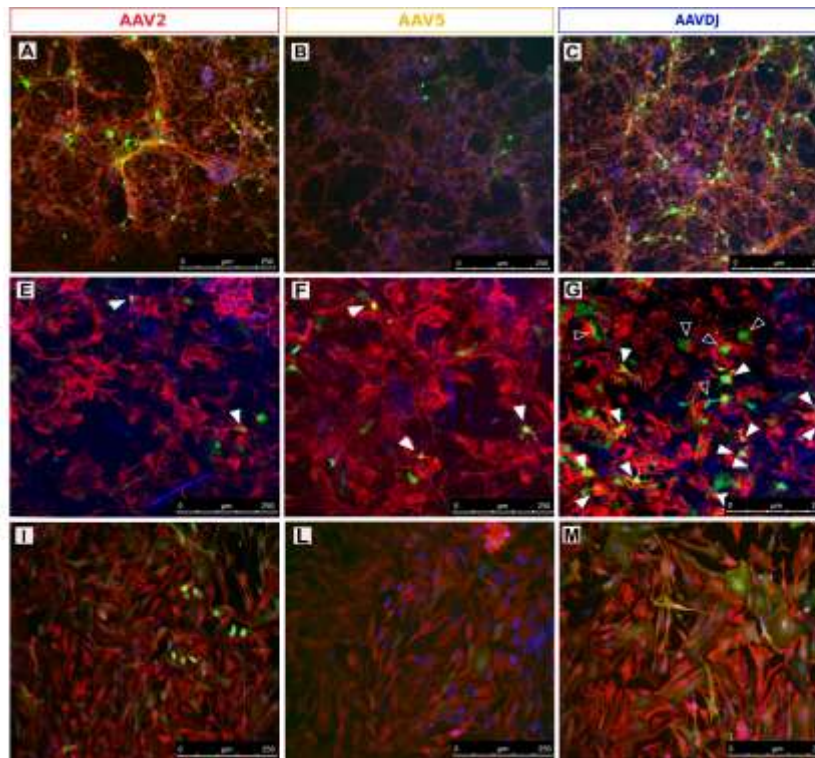
Different AAV serotypes



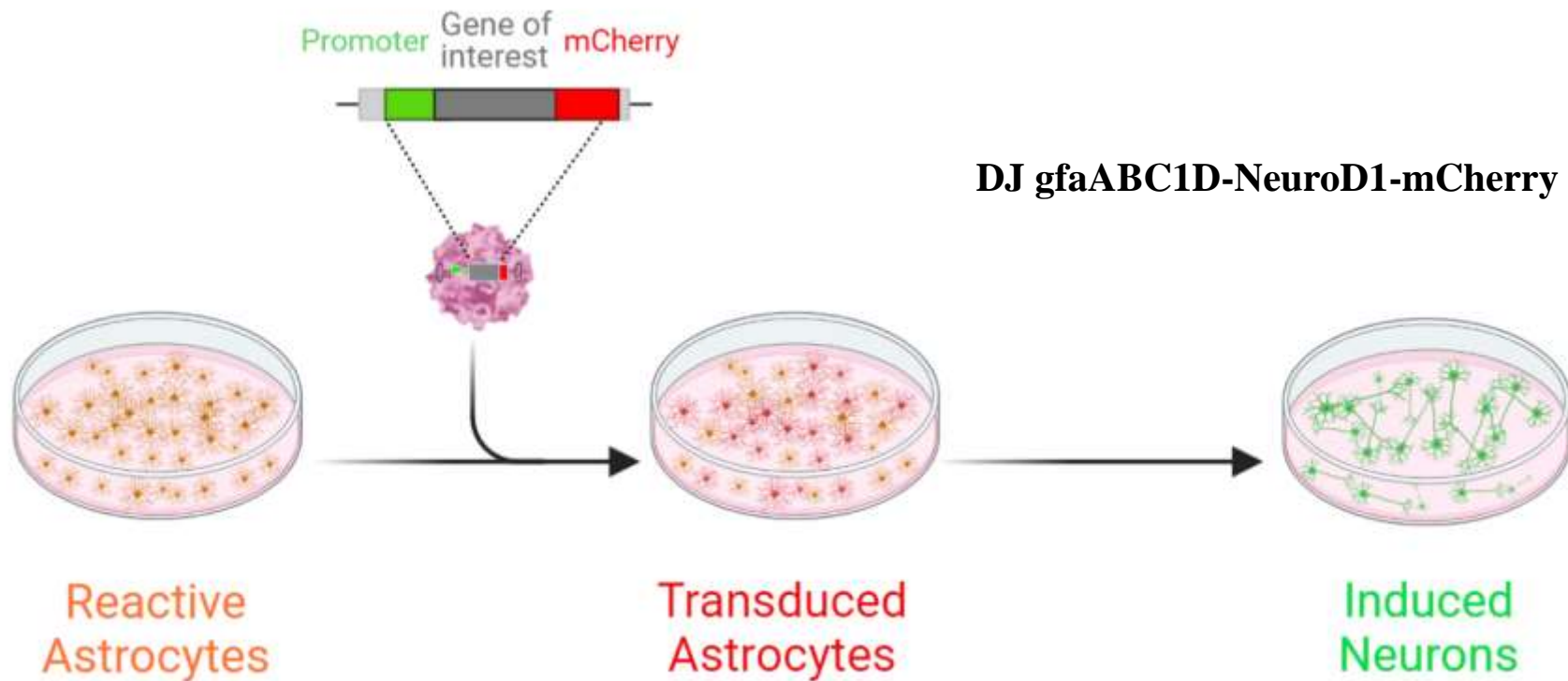
A/Prof Leszek
Lisowski, USyd



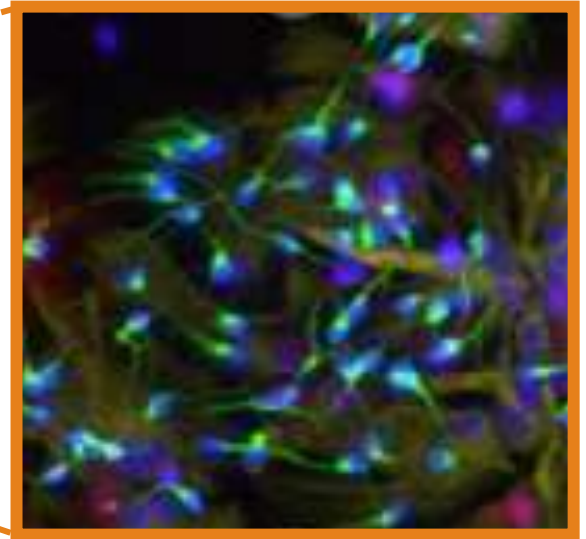
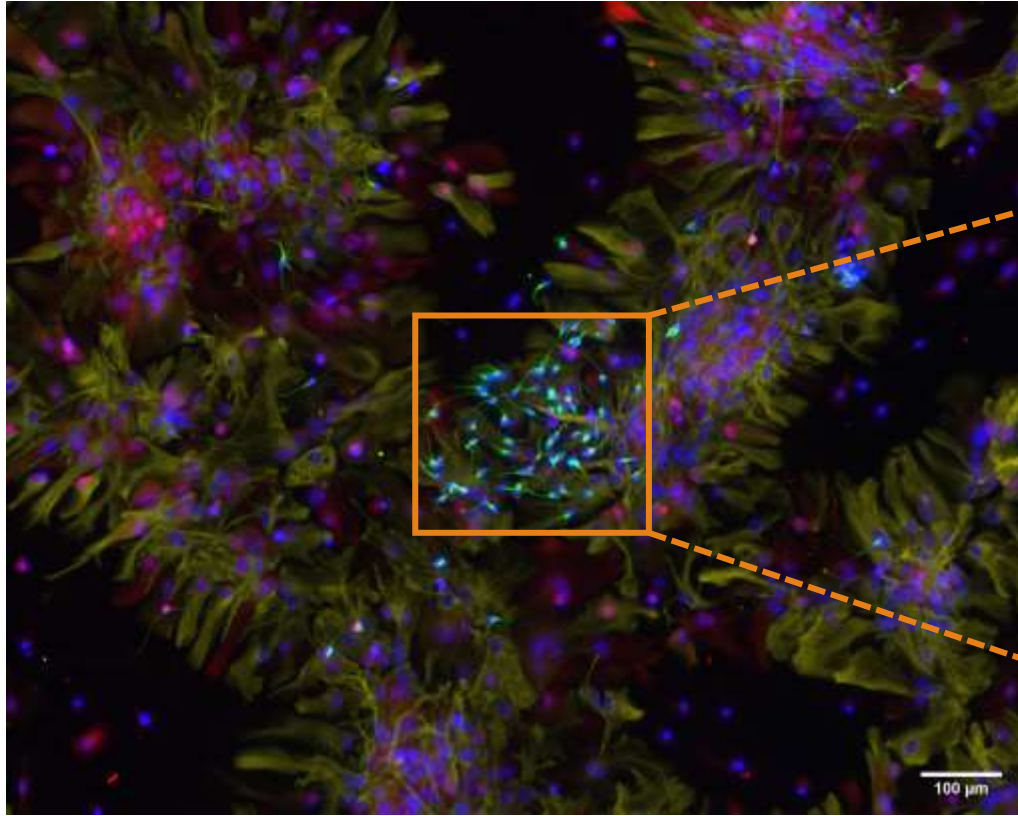
Ms Shiva
Soltani Dehnavi,
ANU



NeuroD1 Transcription Factor



Primary astrocytes infected with DJ gfaABC1D-NeuroD1-mCherry 10 DPI



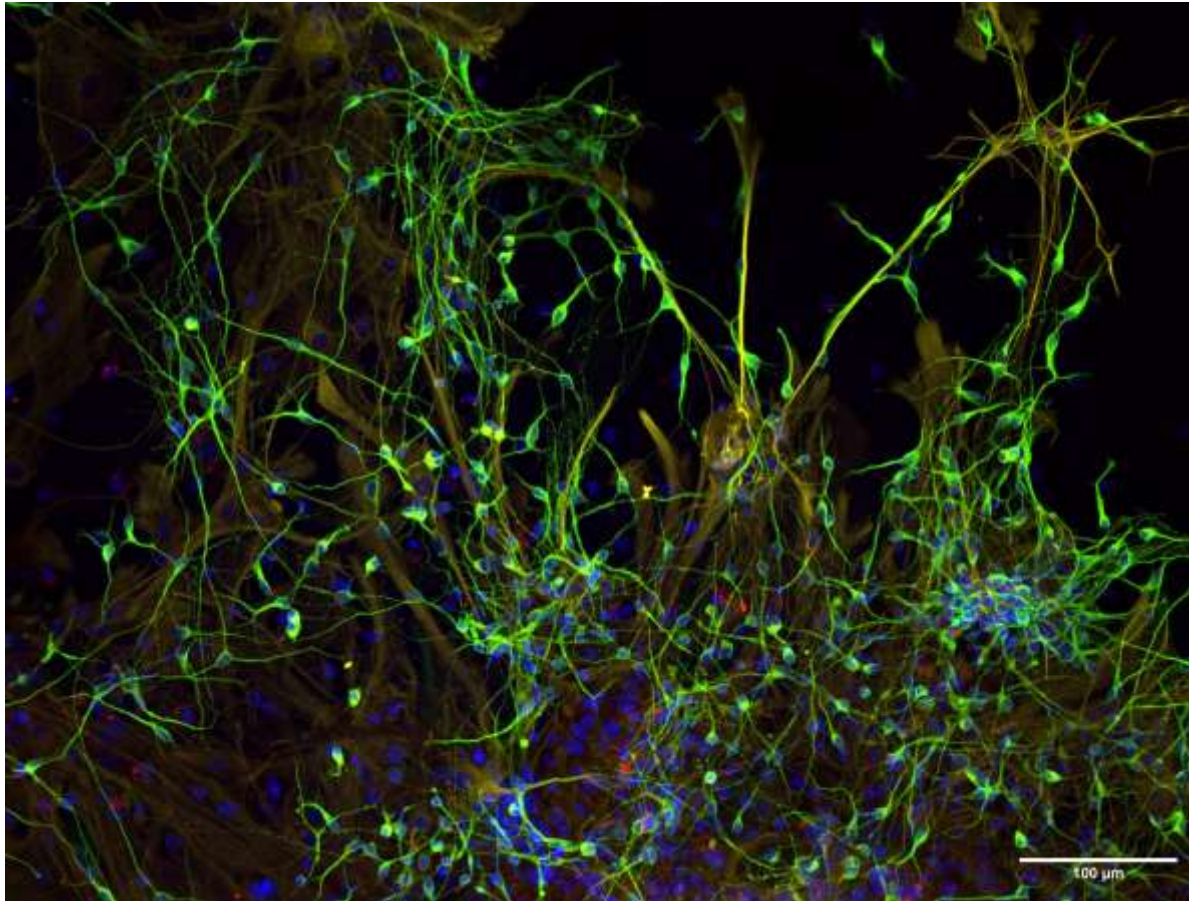
Betatubulin

mCherry

GFAP

DAPI

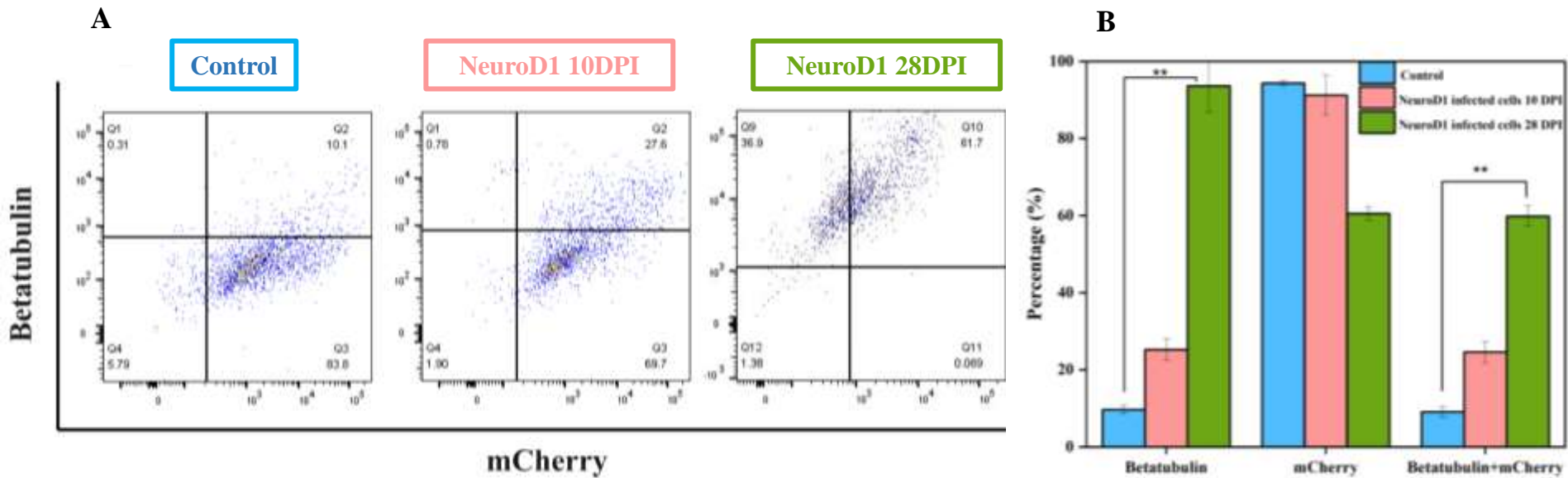
Primary astrocytes infected with DJ gfaABC1D-NeuroD1-mCherry 28 DPI



Betatubulin

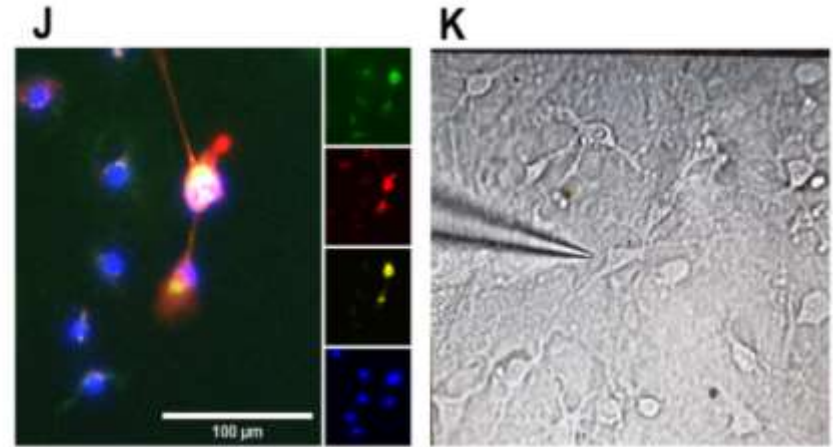
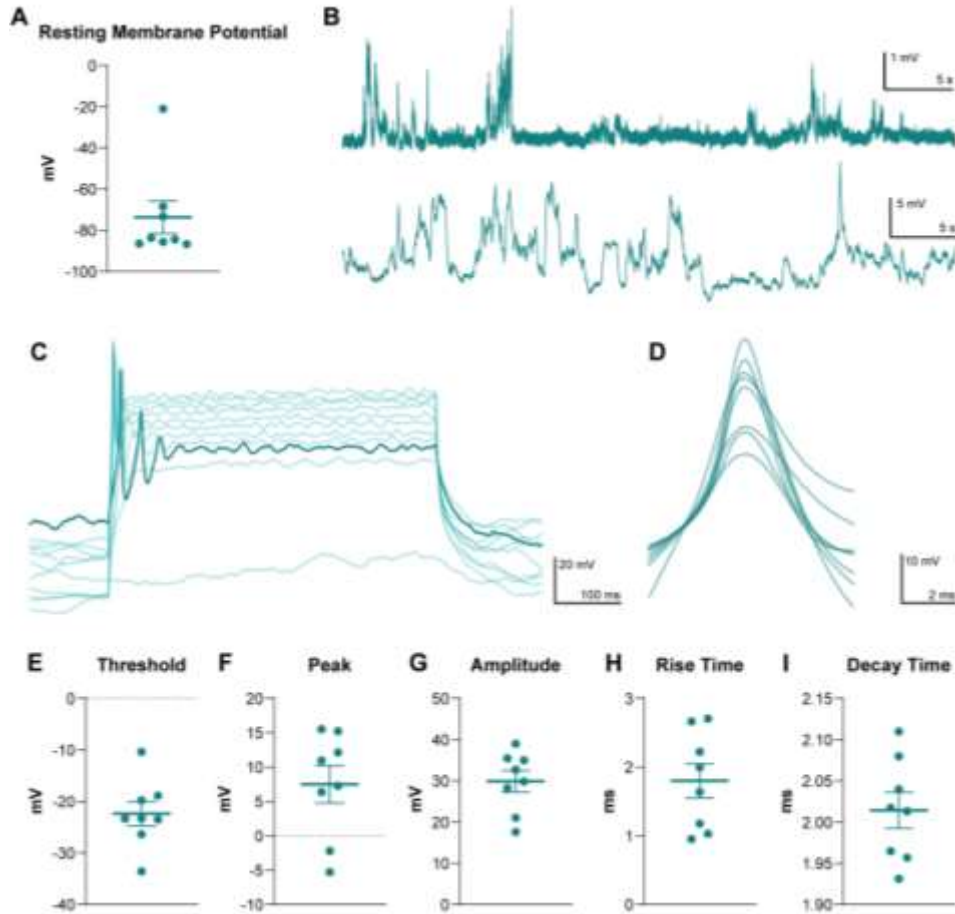
mCherry

GFAP



A) Representative data of FACS for the percentage of Betatubulin+, mCherry+, and Betatubulin+/mCherry+ B) Quantified data for conversion efficiency based on FACS method. ANOVA statistical testing to compare statistical differences between groups where * $p < 0.05$; ** $p < 0.01$.

Electrophysiology



The ND1-mediated astrocytes reprogramming was monitored in vitro and functionally characterized.