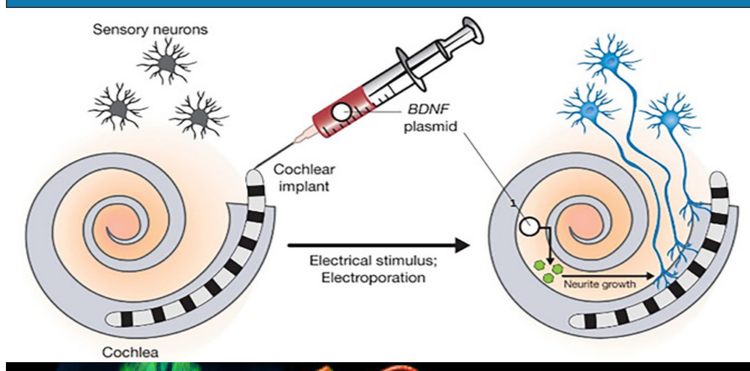
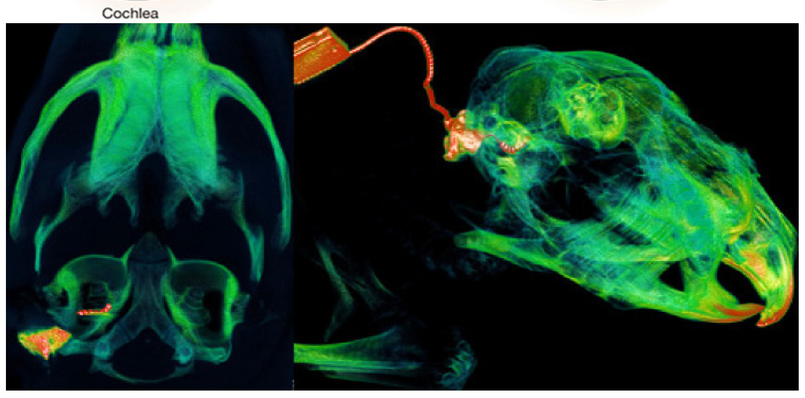
Translational Neuroscience Facility

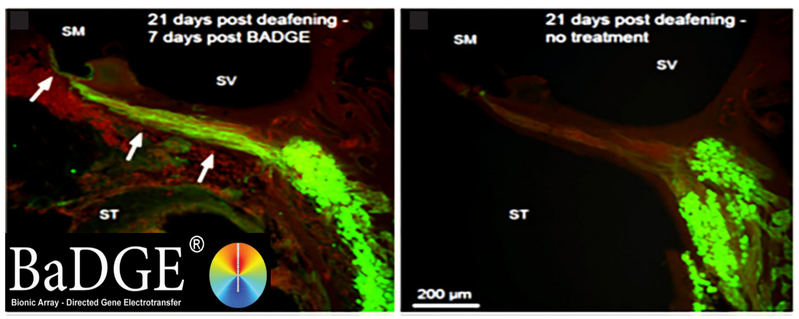
Sensori - Motor Physiology & Therapeutics Group

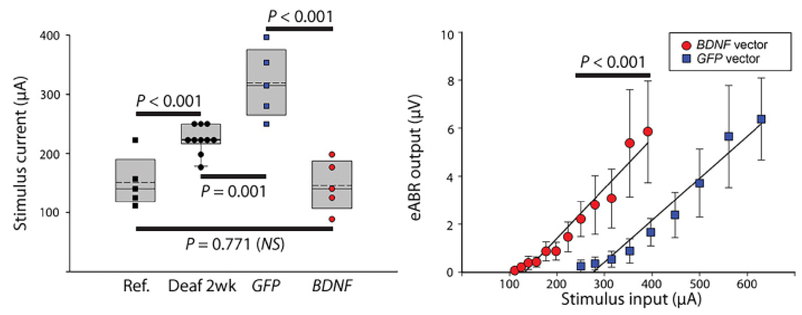
School of Medical Sciences, UNSW Sydney

A novel gene therapy approach enhances cochlear implant performance







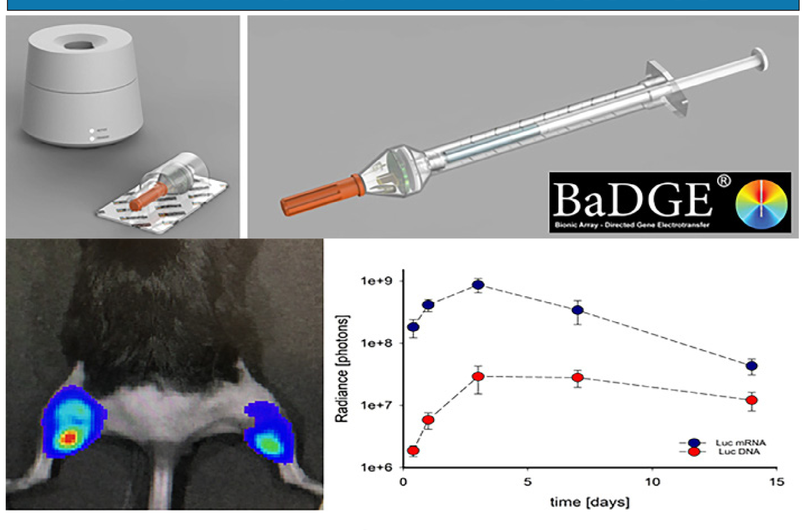


Graphs: Auditory brainstem response measurements of hearing show improved sensitivity following BaDGE® neurotrophin gene augmentation.

Bionic array - Directed Gene Electrotransfer (BaDGE®) is a novel gene delivery device developed in our lab from cochlear implant technology. Cochlear implants are the only option to restore hearing in the profoundly deaf and we have used BaDGE® to achieve precise expression of neurotrophin genes next to cochlear implant electrodes, enabling directed regrowth of the auditory nerve fibres to improve the neural interface. Currently in clinical trial supported by collaborators and Industry Partner (Cochlear Ltd)

For more infomation: www.cingt.info; Pinyon et al (2014) Sci Transl Med.; Pinyon et al. (2019) Hearing Reasearch.

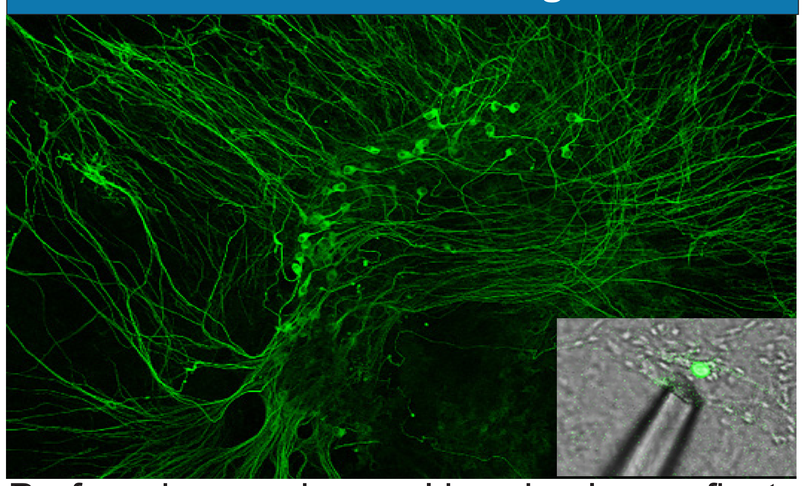
Development of biomedical devices for DNA and mRNA vaccines



Graphics: Concept for BaDGE® DNA / RNA vaccine delivery. Preclinical studies show efficacy of delivery of a luciferase reporter gene (plasmid DNA or mRNA) measured using bioluminescence.

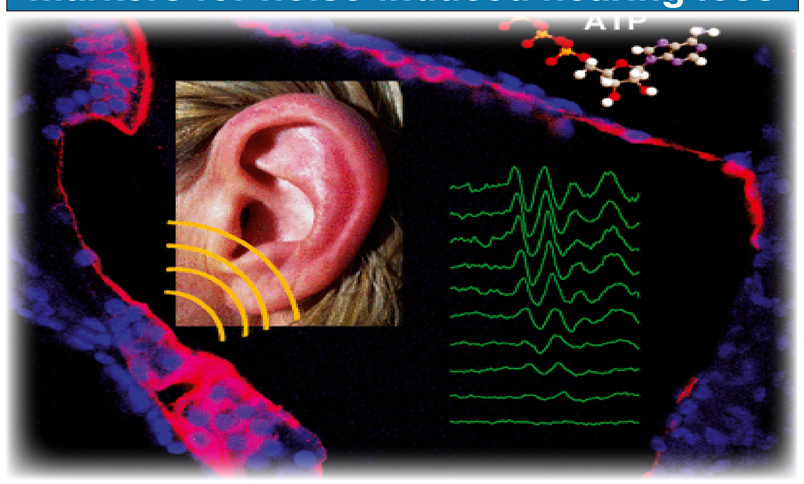
Extension of BaDGE® gene delivery technology to DNA and RNA vaccine delivery.

Auditory neuron mechanosensitivity: Recreate the hearing ear



Profound sensori-neural hearing loss reflects the loss of sensory hair cells in the cochlea that transduce sound. Neurotrophin gene augmentation enables outgrowth of auditory neurites to the vibrating basilar membrane. Inspired by insect hearing, this project seeks to transduce the neurons with mechanosensitive ion channels to render auditory neurons directly responsive to sound induced vibration.

Cochlear purinergic adaptation as a biomarkers for noise-induced hearing loss



Hearing loss is recognised as a primary addressable factor in cognitive decline. Our preclinical research has demonstrated that loss of 'purinergic hearing adaptation' is the predominant contributor towards noise induced hearing loss susceptibility. This program seeks to expand our knowledge in the genetics underlying purinergic hearing susceptibility signature in the human population.

For further infomation: Cederholm et al. Purinergic Sig. (2019); Housley et al. PNAS (2013)

The Team

We are a vibrant team of neuroscientists, cell & molecular biologists and engineers who are passionate about advancing global health through research and education of the next generation of research leaders.

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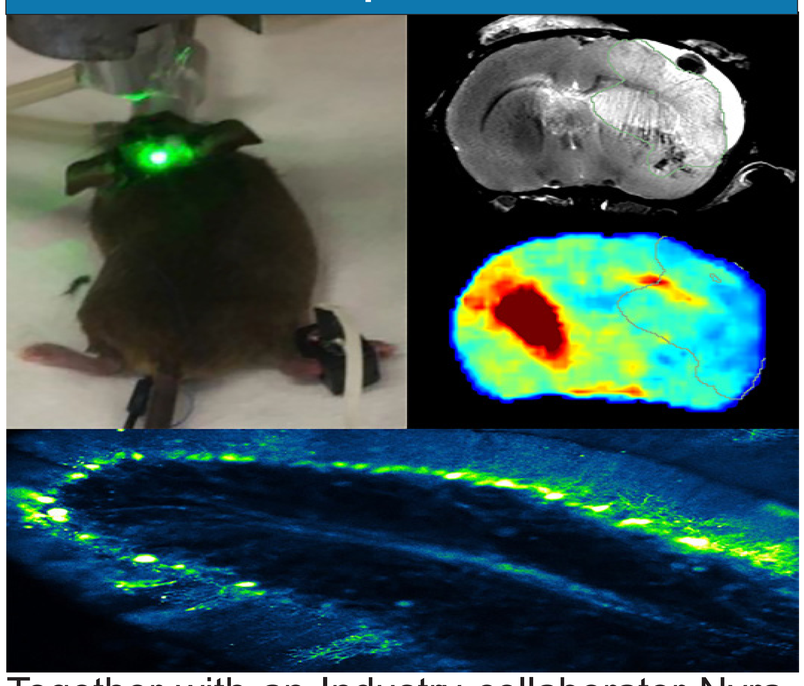
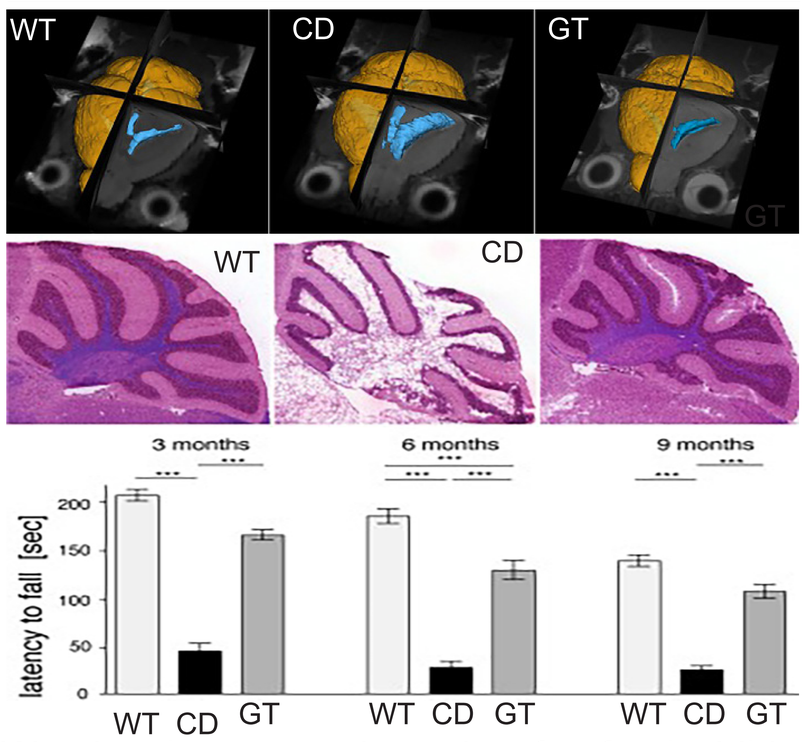
Translational Stroke Research: Neuroprotection



Together with an Industry collaborator Nyrada Inc. we evaluate novel drugs aimed at reducing secondary brain injury in the days following stroke and trauma. Our models include light-guided photothrombotic infarcts, with readout via genetically encoded Ca^{2+} reporters and high field MRI.

Gene therapy for white matter diseases



We develop gene therapies for fatal childhood leukodystrophies like Canavan disease and HBSL. We design and employ Adeno - associated virus vector mediated gene replacement or gene regulation approaches. For our preclinical testing we use CRISPR/Cas9 gene editing to generate accurate rodent models of these neurometabolic disorders. For more infomation: von Jonquieres et al (2018) ACTA Neuropathologica and Frohlich et al. (2021) Front. Cell Neurosci.

Capabilities

- Neurophysiology & metabolomics
- Viral and non-viral gene therapy
- Multiphoton confocal microscopy
- Gene expression & transcriptomics
- Auditory & visual brainstem response
- Mouse transgenics and phenotyping
- Genetically encoded Ca^{2+} imaging
- Electrophysiology & patch clamp
- Biomechanical engineering
- Optogenetics
- Clinical trials

https://medicalsciences.med.unsw.edu.au/research/groups/translational-neuroscience-facility