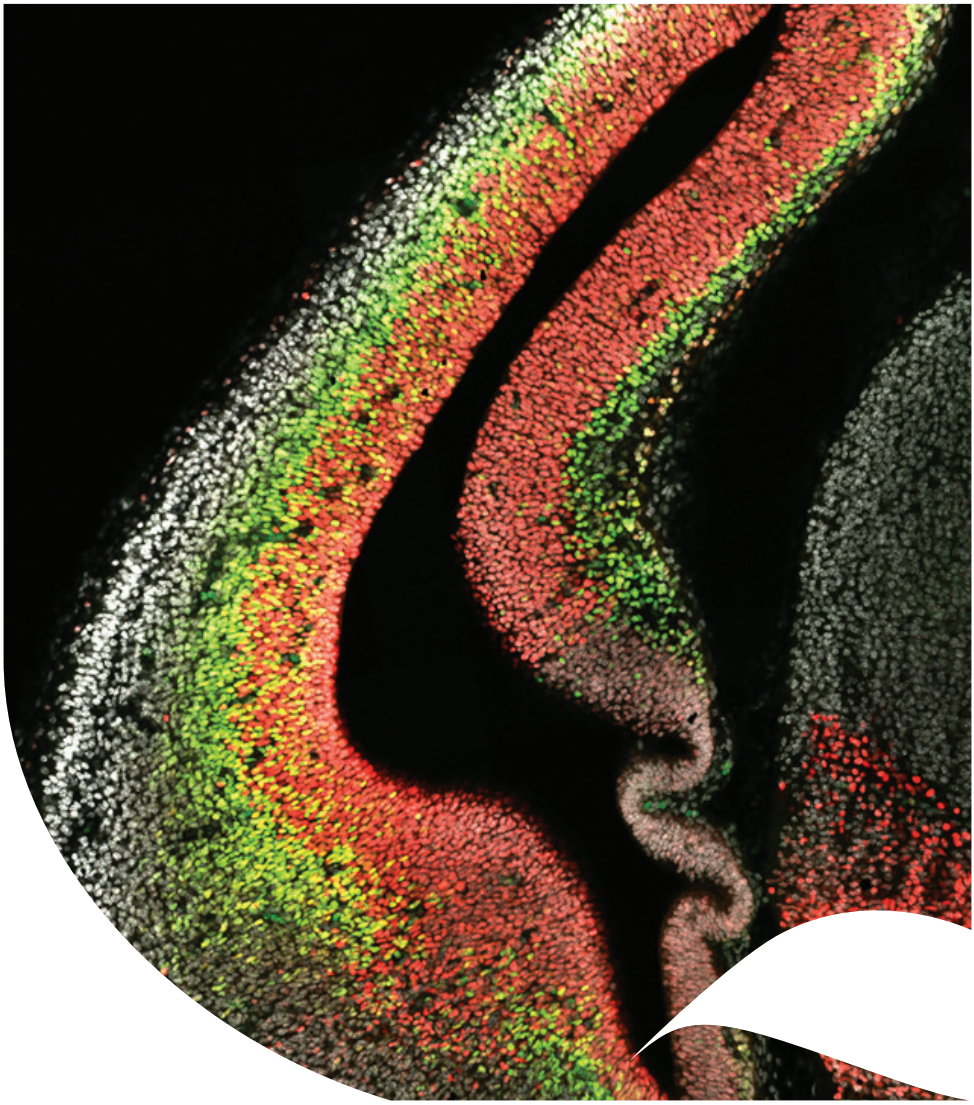
The University Of Queensland
AUSTRALIA

CREATE CHANGE

Biomedical Sciences

Neural stem cells in development and disease laboratory



The central goal of our laboratories is to define the role of abnormal neural stem cell biology in developmental disorders including autism spectrum disorder, macrocephaly, hydrocephalus and hypothalamic dysfunction (e.g. narcolepsy). We have a range of transgenic mouse models in our laboratory to probe neural stem cell dysfunction in development and disease, and can probe neural connectivity using advanced imaging modalities. We also specialize in testing the role for specific gene mutations or variants through their misexpression in vivo within the developing brain. We also have capacity for the use of iPSC-derived neural stem cells for drug screening and disease modelling, and have extensive expertise in transcriptomic (single cell RNA-sequencing) and epigenomic (ChIP-sequencing) analyses of neural stem cells.

Services

Generation of transgenic mice modelling abnormal neural stem cell biology

- We have the capacity to generate novel transgenic mice using CRISPR-Cas9, and to model neural stem cell proliferation and differentiation throughout the developing brain. We also have the ability to test neural function at an organismal level using sophisticated behavioural assays, and at a cellular level using electrophysiology. We can also map neural connectivity within the brain using magnetic resonance imaging. These assays facilitate the mechanistic understanding of genetic mutations or variations that contribute to neurological disorders.

Functional analysis of gene function in vivo

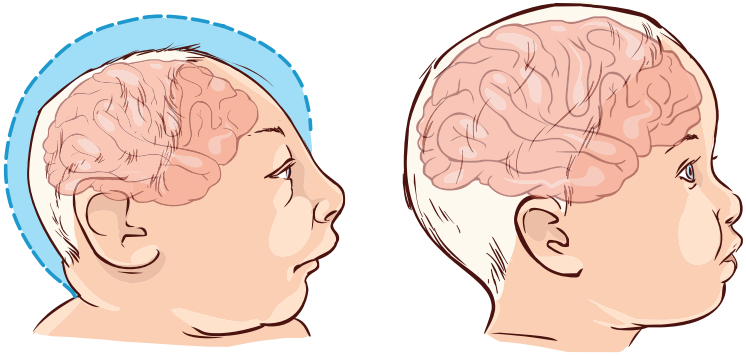
- Our laboratory also has the capacity to perform higher throughput analyses that facilitate the understanding of abnormal gene function in neural stem cells. The use of in utero electroporation enables the rapid analysis of abnormal gene function within the context of the whole animal.

Neural organoids

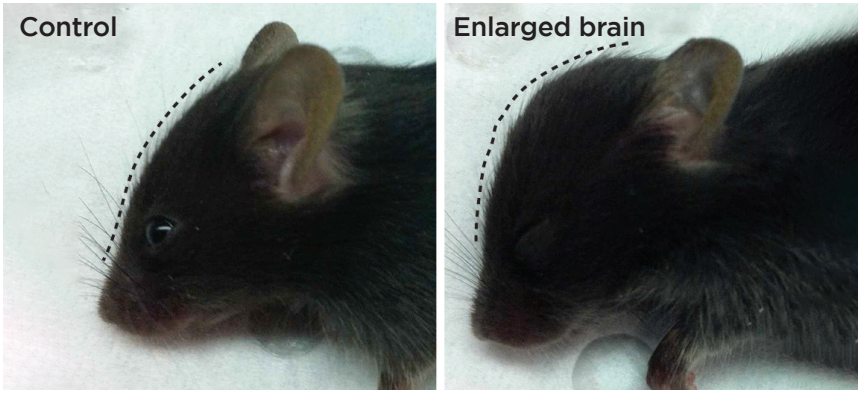
- We have systems in place to enable the study of neural stem cells in vitro, including induced pluripotent stem cell derived organoids. These are cutting-edge technologies that facilitate high-throughput analysis of gene function, as well as providing an avenue for drug screening and disease modelling.

Transcriptomics and epigenomics

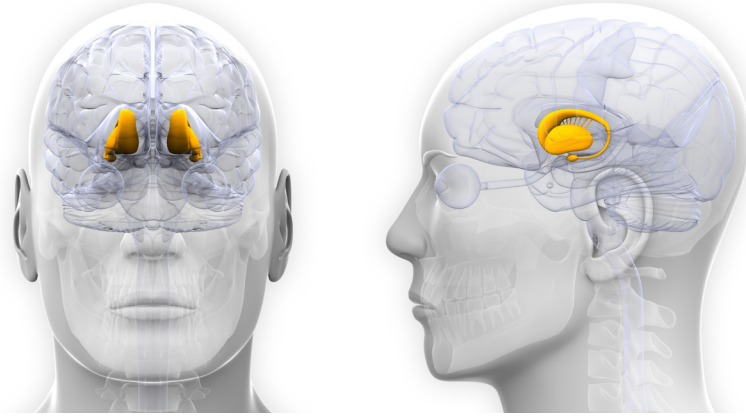
- Our understanding of development and disease has recently been revolutionised by single-cell technologies allowing the assessment of the transcriptional and epigenomic architecture of cells. We are experts in these fields, and have the capacity to perform across the spectrum of the sequencing experimental timeline, from conceptualisation to bioinformatic analysis and interpretation.



Microcephaly



Macrocephaly



Hypothalamus

UQ's School of Biomedical Sciences – mission statement:

By harnessing our diversity across the breadth of biomedical science, we will generate, disseminate and apply foundational biology underpinning health and disease to inspire and empower the next generation of leading researchers, educators, and healthcare professionals to innovate together for better health outcomes globally. Our innovative research encompasses basic discovery through translational pathways to medical solutions:

Cell architecture: We use sophisticated molecular and imaging techniques to explain how various cellular components and pathways contribute to building healthy bodies.

Receptors and signalling: We decipher the passage of external messages from the cell surface, through cytoplasmic signalling pathways, and ultimately to genetic regulatory circuits in the nucleus.

Chronic disease: We characterise the genetic, molecular and cellular microenvironments associated with diseases, such as Alzheimer's disease, cancer, MND and others.

Drug design and development: We identify critical biological targets and design drugs based on structural analyses to develop novel therapies.

Functional and comparative anatomy: Our interdisciplinary studies of structure and function across phylogenetically disparate species advance our understanding of the human body in healthy, aging and diseased states.

Injury and repair: We study fundamental mechanisms of cells in response to stress, consequences of repair processes and how these may be influenced for optimal outcomes.

Musculoskeletal and motor control: We develop and apply novel tools, to investigate muscle function and neural control of muscles in humans.

Neurobiology and brain function: We search for and discover genetic and environmental factors that lead to and maintain healthy nervous systems.

Reproduction: We investigate the genetic and molecular environment during early fetal development to advance reproductive technologies and facilitate healthy pregnancies.

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