








# STUDENT RESEARCH PROJECTS 2023





Research at ARMI is structured along five integrated Discovery Pipelines that allow research groups to explore specific aspects of the regenerative process.

	<p><b>HEART AND MUSCLE DEVELOPMENT AND REGENERATION</b></p> <p>Cardiovascular diseases are the number one cause of death globally: more people die annually from CVDs than from any other cause. An estimated 17.9 million people died from CVDs in 2016, representing 31% of all global deaths. Of these deaths, 85% are due to heart attack and stroke.</p> <p>ARMI researchers are studying animals with highly sophisticated and specific tissue regenerative qualities, to develop cures for heart disease and other muscular disorders including dystrophies that can be translated to the patient bed-side.</p>
	<p><b>IMMUNITY AND REGENERATION</b></p> <p>Soon after birth, our own immune systems mature and we lose our capacity to respond to damage with scar free healing. ARMI scientists are exploring the relationships between immunity and regeneration in the animal kingdom to enhance tissue repair in patients with wounds or degenerative diseases.</p>
	<p><b>STEM CELLS AND REGENERATION</b></p> <p>Stem cells are integral to the development of tissues in the embryo and persist in adults as essential building blocks for our bodies. ARMI studies embryonic stem cells as a window on the mechanisms of human development, and as an essential part of the tool kit of regenerative medicine.</p> <p>ARMI has devised methods for growing stem cells that can be used to repair damaged tissue, investigate particular diseases, test drug candidates for therapeutic safety and effectiveness, and develop ways to enhance the intrinsic mechanisms of stem-mediated repair. ARMI is able to offer IP on specific stem cells for culturing and scale up and models that allow testing of stem cell potency.</p>
	<p><b>NEURAL REGENERATION</b></p> <p>Unlocking the regenerative potential in the central nervous system so it can be harnessed to treat neurodegenerative disorders.</p> <p>ARMI scientists are tackling the fundamental obstacles in neural repair for diseases such as multiple sclerosis and Alzheimer's, by uncovering neural regenerative potential across the animal kingdom.</p>
	<p><b>ORGAN ENGINEERING AND SYNTHETIC BIOLOGY</b></p> <p>ARMI is exploring a number of innovative techniques to enhance function and form that is lost as a consequence of ageing and degenerative diseases.</p> <p>These techniques explore various aspects of tissue engineering including organoid and organ on a chip technology, bioactive biomaterials and biointerfaces that simulate the cellular microenvironment at the micro and nanoscale, functional biomaterials and synthetic and biological matrices for tissue engineering and transplant development.</p>

# DRIVING REGENERATIVE SCIENCE

ARMI was established in 2006 to deliver on this medical research field's promising work of harnessing the healing power of stem cells to unlock the body's own potential to heal and regenerate damaged organs or tissues caused by disease, injury or genetic conditions.

**A research institute of Monash University's Faculty of Medicine, Nursing and Health Sciences, ARMI is located at one of the world's largest regenerative medicine and stem cell research centres at Clayton in Victoria, Australia.**

The Institute was established through a joint venture between Monash University and the Victorian State Government with additional funding from the Australian Federal Government. ARMI today acts as a focus for public engagement in regenerative medicine and is the source of advice for policymakers.

The Institute builds on Monash University's existing strengths in biomedical research, and the work of the University's pioneers in IVF and stem cells, to attract global regenerative science leaders and a new generation of young and creative researchers; to inspire and lead discoveries and developments in this exciting new therapeutic field.

**ARMI's science focuses on delivering the next generation of discoveries in regenerative medicine.**

The Institute is actively engaged in the emerging area of systems biology, or "systems medicine" – the study of biological components, be it molecules, cells, organisms or entire species – which views the dynamic systems of the human body as an integrated whole, incorporating biomedical, physiological, and environment interactions that sustain life.

**This research takes a new approach to clinical problems.**

Some species in the animal kingdom have high regenerative potential. ARMI researchers are learning about this ability for self-repair in order to develop new therapies for conditions such as heart disease, muscular dystrophy, diabetes, multiple sclerosis, Alzheimer's Disease, brain injury and autoimmune disorders.

**The Institute is one of the largest regenerative medicine and stem cell research organisations in the world and Australia's only research institute specialising in regeneration and stem cells;** with a broad program across five overlapping key research streams:

- neural regeneration
- stem cells, cancer and regeneration
- heart and muscle development and regeneration
- immunity and regeneration
- organ engineering and synthetic biology

**The Institute trains the next generation of research and clinical scientists.**

Most ARMI researchers are based at Monash University's Clayton campus with some having joint appointments with other Monash academic department or the CSIRO. Some of the Institute's research is undertaken through participation in national initiatives including Stem Cells Australia and the EMBL Australia Partner Laboratory.

# OUR RESEARCH TEAMS



# HEART AND MUSCLE DEVELOPMENT AND REGENERATION



## **CURRIE GROUP**

The Currie group is curious about the biological mechanisms of the Zebrafish, a fresh water fish that is native to South East Asia. Zebrafish are used in scientific research to understand human genetics and the biological processes of human diseases.

The Currie group use zebrafish embryos to learn about muscle cell types. In particular, they are interested in how specific muscle cell types are determined within the developing embryo, how they grow and how they regenerate after injury, to provide insights into muscle wasting and other diseases including the dystrophies.



## **MCGLENN GROUP**

The McGlenn Group is interested in how genes influence the pattern mechanisms of the vertebrate skeleton. Pattern formation refers to how particular cells develop into final cell types.

The group use the limb bud and axial skeleton as points of study because it helps them understand broader developmental processes. A greater level of comprehension into the limb bud and axial skeleton will allow the group to provide insight into how genetic hierarchies govern how the vertebrate skeleton is formed. This work has developed an understanding of how to grow and shape different tissue for therapeutic benefit.



## **DEL MONTE NIETO GROUP**

The del Monte-Nieto group is interested in the study of the molecular mechanisms and developmental processes orchestrating normal heart development in embryos by integrating all the cellular and non-cellular components involved.

The lab aims to apply multidisciplinary approaches including mathematical modeling and bioengineering to developmental biology studies in order to generate in silico and in vitro models to confirm our biological results and formulate new hypothesis. The group aims to apply multidisciplinary approaches including mathematical modeling and bioengineering to developmental biology studies in order to generate in silico and in vitro models to confirm our biological results and formulate new hypotheses to design novel therapies for heart disease.

# IMMUNITY AND REGENERATION



## LIESCHKE GROUP

The Lieschke group studies the haemopoietic system and leukocytes. The haemopoietic system is a collection of organs and tissues (bone marrow, spleen, lymph nodes etc.) responsible for the production of blood in the body.

Leukocytes (white blood cells) are the key cells involved for counteracting foreign substances and disease. They also play a major role in determining whether tissue repairs and regenerates rather than scars after injury. The group's increased understanding of the role of the leukocytes when the immune system is compromised, eg as in leukemias has helped identify potential target molecules.



## MARTINO GROUP

Dr Mikaël Martino and his group focuses on the immune regulations of stem cells and regeneration, seeking to design regenerative medicine strategies integrating a control of the immune system.

Compounds that can accelerate regenerative processes in a wide range of tissues and organs are being identified and evaluated.

# STEM CELLS AND REGENERATION



## **NAGY GROUP**

The Nagy Group is focused on combining knowledge of developmental biology, stem cells and genetic engineering to create successful therapeutics for regenerative medicine applications.

The group's research program also aims to tackle several major challenges facing the translation of cell therapies to the clinic, such as generating and improving the effectiveness of therapeutic cells and eliminating risks of tumorigenesis.



## **NILSSON GROUP**

The Nilsson Group is currently involved in a number of research projects that focus on understanding haemopoietic stem cells (HSC). Haemopoietic stem cells are responsible for the production of blood and immune cells.

The main objective of the group's research is to characterise the microenvironment in which blood stem cells reside. They also look at blood stem cells at a cellular and molecular level, as well as analysing how they create new blood cells.

This can be used to treat a range of blood diseases including leukemia.



## **ZENKER GROUP**

The Zenker group seeks to understand how a cell's structure and function is regulated by the continuous re-organization of the microtubule network. Live imaging is used to discover the spatio-temporal accuracy of the microtubule dynamics in animal models of developmental and stem cell biology. Understanding the formation of the first stem cells in embryos is leading to insights into how these cells can be harnessed for therapeutic benefit.



# NEURAL REGENERATION



## **KASLIN GROUP**

The Kaslin group is interested in cellular plasticity, which is the ability of cells to take on characteristics of other cells in the body. But rather than study the process throughout the entire body, the group are focused in understanding the molecular and cellular mechanisms that control this process in the intact or injured vertebrate brain.

Understanding the process of cellular plasticity is essential to the development of successful therapies to promote neural regeneration.



## **NILLEGODA GROUP**

The Nillegoda group is probing attractive new proteostasis-based directions for future therapeutic interventions that could potentially slow and/or reverse neurodegeneration and are applicable for a broad range of disorders from Alzheimer's disease to Multiple sclerosis.

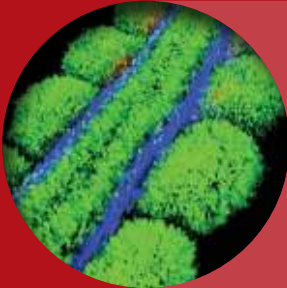
# ORGAN ENGINEERING AND SYNTHETIC BIOLOGY



## **ROSSELLO-DIEZ GROUP**

The Roselló-Díez group studies the signals that operate within the bones and between them and other tissues/organs during development and regeneration. At the local level, they study phenomena such as compensatory proliferation in response to biochemical and mechanical changes in the cell vicinity. At the systemic level, they are exploring the role of the vascular and nervous systems in the bidirectional communication between the bones and the rest of the body. The group has developed insights into growth regulation in the developing body enabling the design of therapeutics for situations where tissue growth and organ repair is perturbed.

# ARMI DISCOVERY PIPELINES



## HEART AND MUSCLE DEVELOPMENT AND REGENERATION

**Currie**  
**McGlinn**  
**del Monte Nieto**

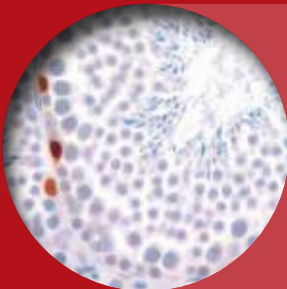
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[www.armi.org.au/research-leadership/mcglinn-group](http://www.armi.org.au/research-leadership/mcglinn-group)  
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## IMMUNITY AND REGENERATION

**Lieschke**  
**Martino**

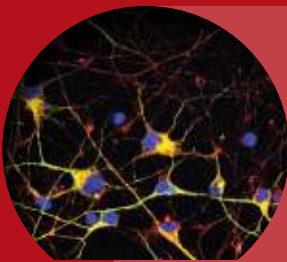
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[www.armi.org.au/research-leadership/martino-group](http://www.armi.org.au/research-leadership/martino-group)



## STEM CELLS AND REGENERATION

**Nagy**  
**Nilsson**  
**Zenker**

[www.armi.org.au/research-leadership/nagy-group](http://www.armi.org.au/research-leadership/nagy-group)  
[www.armi.org.au/research-leadership/nilsson-group](http://www.armi.org.au/research-leadership/nilsson-group)  
[www.armi.org.au/research-leadership/zenker-group](http://www.armi.org.au/research-leadership/zenker-group)



## NEURAL REGENERATION

**Kaslin**  
**Nillegoda**

[www.armi.org.au/research-leadership/kaslin-group](http://www.armi.org.au/research-leadership/kaslin-group)  
[www.armi.org.au/research-leadership/nillegoda-group](http://www.armi.org.au/research-leadership/nillegoda-group)



## ORGAN ENGINEERING AND SYNTHETIC BIOLOGY

**Rossello-Diez**

[www.armi.org.au/research-leadership/rossello-diez-group](http://www.armi.org.au/research-leadership/rossello-diez-group)

# WHY STUDY AT ARMI?

- Our Higher Degree by Research (HDR) and Honours programs attract talented students from Australia and abroad.
- Our students reflect ARMI's international perspective with students from Malaysia, Singapore, The Netherlands, Mexico, Iran and Sri Lanka.
- The highly collaborative, interdisciplinary nature of the ARMI research program exposes students to cutting edge science in our laboratories.
- Students are supported to engage in career building opportunities in Australia and overseas.

**ARMI'S VISION IS  
FOR TODAY'S STUDENTS  
TO BE TRAINED TO AN  
EXCEPTIONALLY HIGH  
STANDARD, TO BE  
THE NEXT GENERATION OF  
SCIENTIFIC LEADERS.**



# HOW TO APPLY FOR HONOURS AT ARMI

Students from the following fields of study are encouraged to apply to do an Honours project at ARMI Biomedical Sciences:

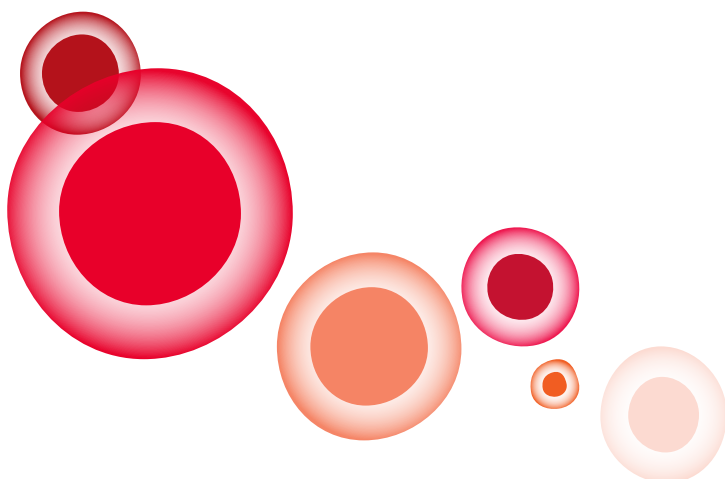
- Science
- Medical Science
- Health Science
- Engineering
- Pharmacy.

The next step is to contact the Group Leaders to discuss the project further.

Current projects are listed below in this booklet or to suggest your concept for a project, please contact one of our research group leaders. All are happy to meet with potential honours students.

Once you and your supervisor have agreed on a project:

1. **Your supervisor will need to fill out an ARMI Honours EOI undertaking to be your supervisor and stating the name of the project.**
2. **Prepare a copy of your transcript highlighting the subjects you wish to be considered for entry.**
3. **Submit completed ARMI Honours EOI, Faculty and transcript to the ARMI Honours Coordinator for approval.**
4. **Complete the relevant faculty's online application form**  
BMS Students: <https://www.monash.edu/discovery-institute/honours>  
Science Students: [www.monash.edu/science/current-students/science-honours/](http://www.monash.edu/science/current-students/science-honours/)



# ELIGIBILITY CRITERIA FOR HONOURS

Completion of a Bachelor's degree in either Science or Biomedical Science.

If you are a BSc student, you need an average of at least 70% in four relevant third year units.

BMS students need an average of at least 70% across BMS3021, BMS3042 and the two highest level 3 electives.

How to apply:

BMS students must enrol directly through the Med Faculty for BMS Hons.

An application form can be found at:  
<https://www.monash.edu/discovery-institute/honours>

BMS Honours Students must enrol for the following units:

- BMS4100 Biomedical science research project
- BMS4200 Advanced studies in biomedical science.

BSc students enrol through the Science Faculty for BSc Hons.

Application details can be found at:  
<http://www.monash.edu/science/current-students/science-honours>

BSc Honours Students must enrol for the following Regenerative medicine units:

- MIS4100 Regenerative medicine research project (36 points)
- MIS4200 Advanced studies in regenerative medicine (12 points).

# RESEARCH GROUPS

## HEART AND MUSCLE DEVELOPMENT AND REGENERATION

### CURRIE GROUP

#### Research Themes:

- Dissecting molecular mechanisms that act to pattern the vertebrate embryo
- Discovering how specific muscle cell types are determined within the developing embryo
- Discovering how different muscle cell types have evolved
- Determining how muscle types cells grow and regenerate after injury
- Large-scale mutagenesis of the zebrafish genome to produce different classes of mutations which disrupt gene function.

<b>Project title</b>	<b>Understanding the mechanisms regulating sarcopenia using zebrafish</b>
<b>Project summary</b>	Sarcopenia, the age-related decline in muscle mass and function, places a great burden on the health care system. Despite this, very little is known about the molecular pathways that drive this process. This project will therefore elucidate the mechanisms that regulates sarcopenia, focusing on the muscle stem cell niche.
<b>Main techniques</b>	Using the advantages of the zebrafish model system combined with live imaging and confocal microscopy, immunofluorescence, CRISPR/Cas9 genome editing, genetic and physiology techniques
<b>Group leader</b>	Prof Peter Currie
<b>Supervisor</b>	Avnika Ruparelia



# RESEARCH GROUPS

## HEART AND MUSCLE DEVELOPMENT AND REGENERATION

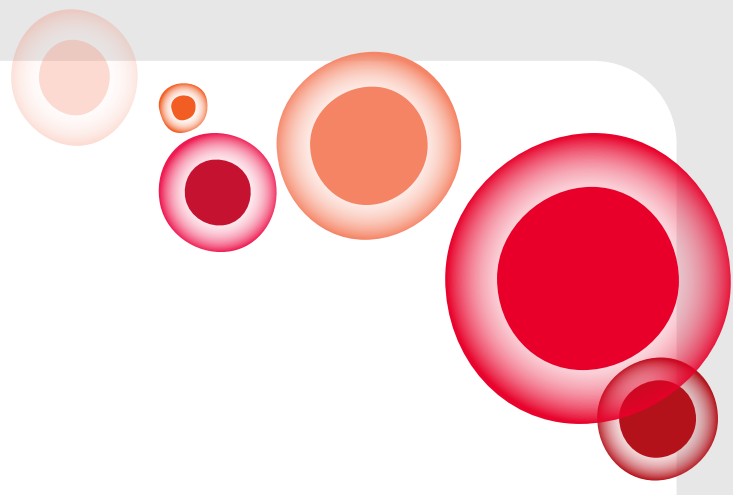
### DEL MONTE-NIETO GROUP

#### Research Themes:

- To study the molecular mechanisms and developmental processes controlling heart development.
- To understand the molecular and cellular etiology of Congenital Heart Disease.
- To study ECM composition/patterning during heart development, adulthood and disease/injury models.
- To develop computational models for the different developmental processes in the heart.
- To apply the knowledge generated from developmental biology to improve heart regeneration, organ-on-a-chip technologies and tissue engineering.







## MCGLINN GROUP

### Research Themes:

- microRNA control of Hox gene networks
- Genomic/epigenomic regulation of axis elongation and vertebral patterning
- Formation and patterning of spinal cord circuitry
- Evolutionary acquisition of microRNAs shapes developmental networks

<b>Project title</b>	<b>Using ES cells to model formation of the vertebral column and spinal cord</b>
<b>Project summary</b>	Our lab is interested in understanding how early progenitor cells of the embryo make lineage choices between neural and mesodermal cell fate. We use mouse genetics, combined with in vitro ES cell differentiation protocols, to understand gene networks and regulatory mechanisms that guide this process.
<b>Main techniques</b>	ES cell differentiation Quantitative PCR Immunofluorescence
<b>Group leader</b>	A/Prof Edwina McGlinn
<b>Supervisor</b>	A/Prof Edwina McGlinn

<b>Project title</b>	<b>Signals controlling formation of the head and face</b>
<b>Project summary</b>	The formation of the head and face is a tightly regulated process, with gene defects and environmental insults both contributing to craniofacial defects. We have established a mouse model of craniofacial malformation that shows cleft lip and cleft palate upon inhibition of the retinoic acid pathway. Strikingly, removing the <i>Gdf11</i> gene in this context is able to rescue these craniofacial defects. We are investigating the mechanisms underlying this genetic interaction, with the aim of harnessing this observation for therapeutic purposes.
<b>Main techniques</b>	Mouse genetics, micro computed tomography ( $\mu$ CT), light-sheet microscopy, <i>in situ</i> hybridisation, embryonic stem cell and neural crest cell cultures, RNA sequencing.
<b>Group leader</b>	Associate Professor Edwina McGlinn
<b>Supervisor</b>	Dr Jan Manent

<b>Project title</b>	<b>microRNA control of developmental haematopoiesis</b>
<b>Project summary</b>	Developmental haematopoiesis, the process by which all blood cell types arise in the vertebrate embryo and are maintained throughout adult life, is a tightly regulated process. We have uncovered a novel and important role for a specific microRNA family in developmental haematopoiesis. We are using state of the art mouse genetics, microscopy, flow cytometry and in vitro stem cell differentiation techniques to characterise the function of this microRNA family, with the ultimate goal to harness this discovery for therapeutic purposes.
<b>Main techniques</b>	Mouse genetics, flow cytometry, confocal and light-sheet microscopy, embryonic and hematopoietic stem cell cultures, RNA sequencing.
<b>Group leader</b>	Associate Professor Edwina McGlinn
<b>Supervisor</b>	Dr Jan Manent

# RESEARCH GROUPS

## IMMUNITY AND REGENERATION

### LIESCHKE GROUP

#### Research Themes:

- Discovery of genes critical for white blood cell development
- How the inflammatory response is regulated
- How modulating the inflammatory white blood cells might tip the outcome to favour regeneration rather than scarring
- Investigating how white blood cells keep out and contain micro-organisms.

### MARTINO GROUP

#### Research Themes:

- Dissecting how the innate immune system affects tissue-resident/transplanted stem cells and growth factors activities.
- Understanding the immune modulations of stem cells and regeneration by T lymphocytes.
- Developing effective systems for delivering stem cells and cytokines/growth factors, using biomaterials and protein engineering.

<b>Project title</b>	<b>Engineering of a T cell-recruiting hydrogel to promote tissue regeneration</b>
<b>Project summary</b>	The goal of this project is to engineer a biomaterial hydrogel (based on fibrin) with molecules (e.g. cytokines) able to induce regeneration by mobilizing pro-regenerative T cells at a site of tissue injury. Using molecular cloning and rational protein engineering methods, cytokines will be engineered and recombinantly produced, in order to be incorporated into the hydrogel. Then, the ability of the newly created hydrogel to recruit T cells will be assessed in vitro and in vivo. Ultimately, the hydrogel system will be tested in mouse models of tissue regeneration such as skin, bone, and muscle defects. The output of this project will be integrated into a larger project aiming at reprogramming the immune system (immunoengineering) to stimulate tissue regeneration. This type of approach has the potential of being the next generation of regenerative therapies and this Master project could evolve into a PhD project.
<b>Main techniques</b>	Molecular cloning; protein engineering
<b>Group leader</b>	Assoc Prof Mikael Martino
<b>Supervisor</b>	Assoc Prof Mikael Martino

# RESEARCH GROUPS

## STEM CELLS AND REGENERATION

### NILSSON GROUP

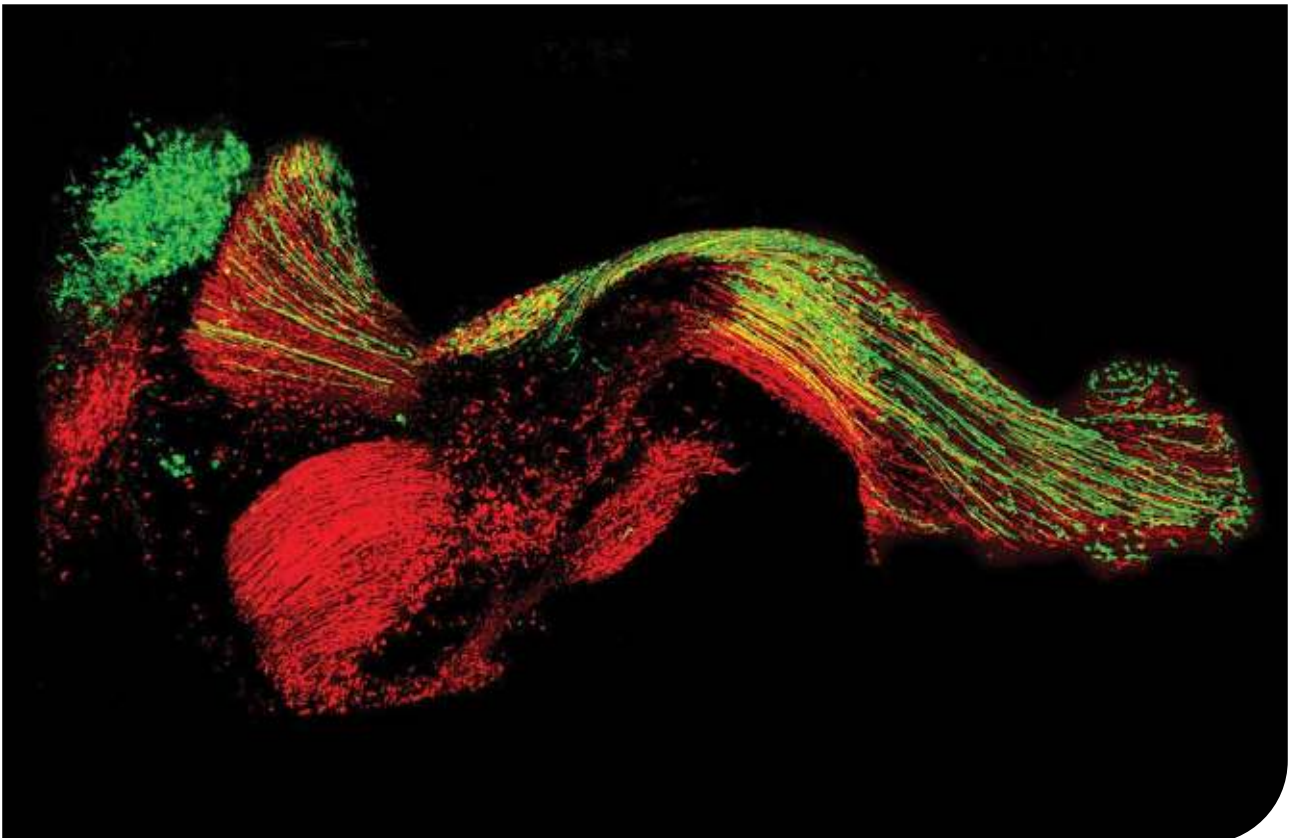
#### Research Themes:

- Understanding the role of the endosteal niche in the regulation and function of haemopoietic stem cells
- Characterising the role of megakaryocytes in the endosteal niche and haemopoietic stem cell regulation
- Isolating bone marrow sinusoidal endothelial cells and characterising their role and potential
- Understanding the role of key extracellular matrix molecules in the adult bone marrow microenvironment in foetal haemopoietic development
- Design and synthesis of novel haemopoietic stem cell mobilisation agents
- Characterising adult cells that have been directly differentiated into hemopoietic stem cells.
- Functionally assessing embryonic stem cell subpopulations whose differentiation has been directed towards hemopoietic stem cells.

### NAGY GROUP

#### Research Themes:

- Transferring and establishing our patented safety and immune “cloaking” technologies in non-human primate pluripotent stem cells
- Developing protocols to differentiate pluripotent stem cells into therapeutic cell types
- Combining cell and gene therapy to target key cytokines involved in central nervous system autoimmunity
- Functional validation of cells engineered with our immune “cloaking” system
- Testing designer cells in pre-clinical models of stroke and multiple sclerosis



# RESEARCH GROUPS

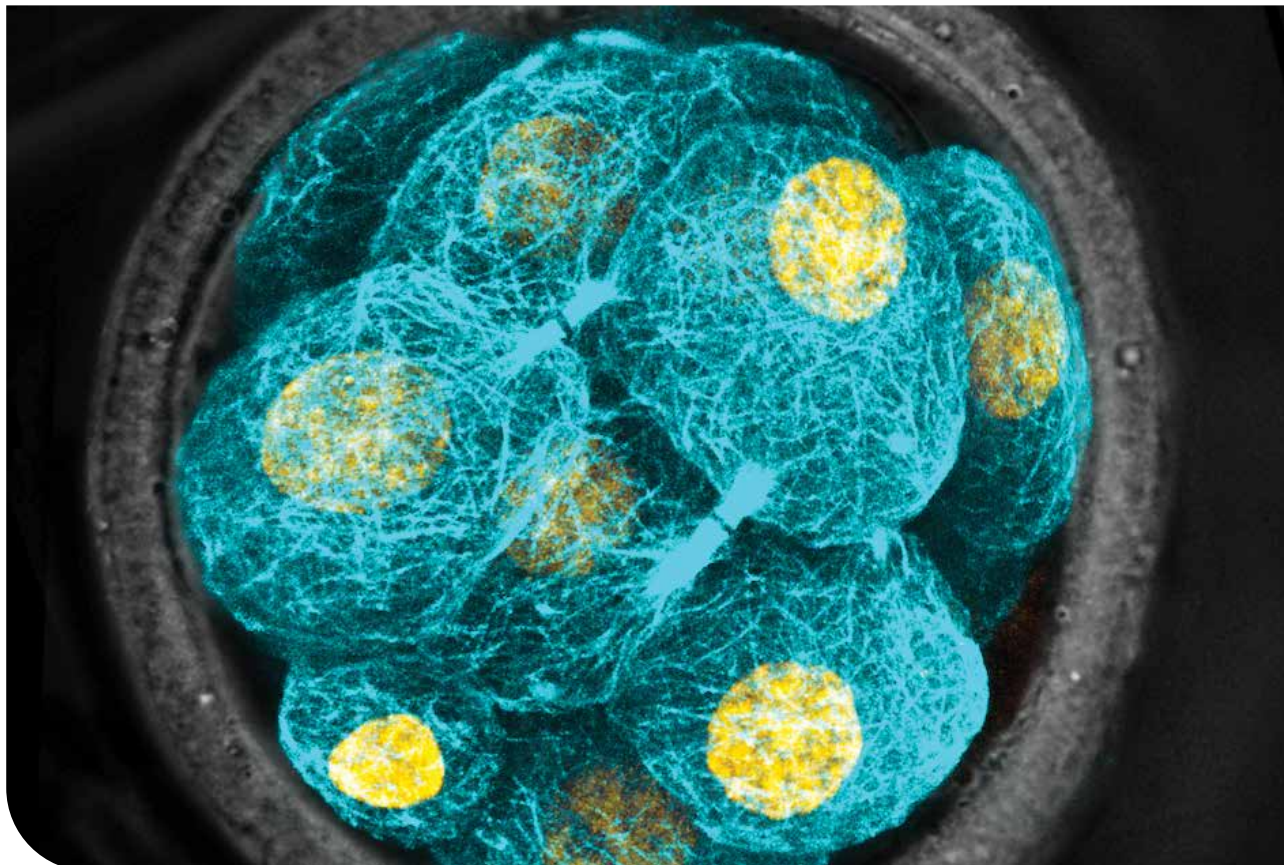
## STEM CELLS AND REGENERATION

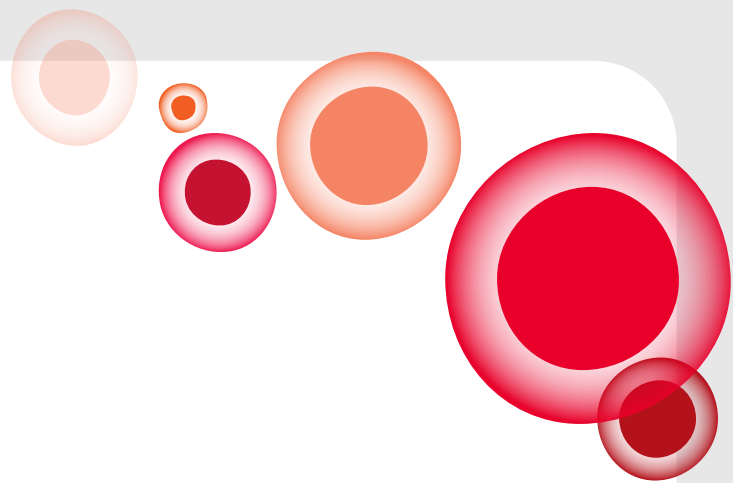
### ZENKER GROUP

#### Research Themes:

- The establishment of new methods to visualize and manipulate the microtubule dynamics in complex 3D model systems
- To determine how the microtubule architecture regulates early embryonic development
- To uncover the role of the inner skeleton in stem cell plasticity

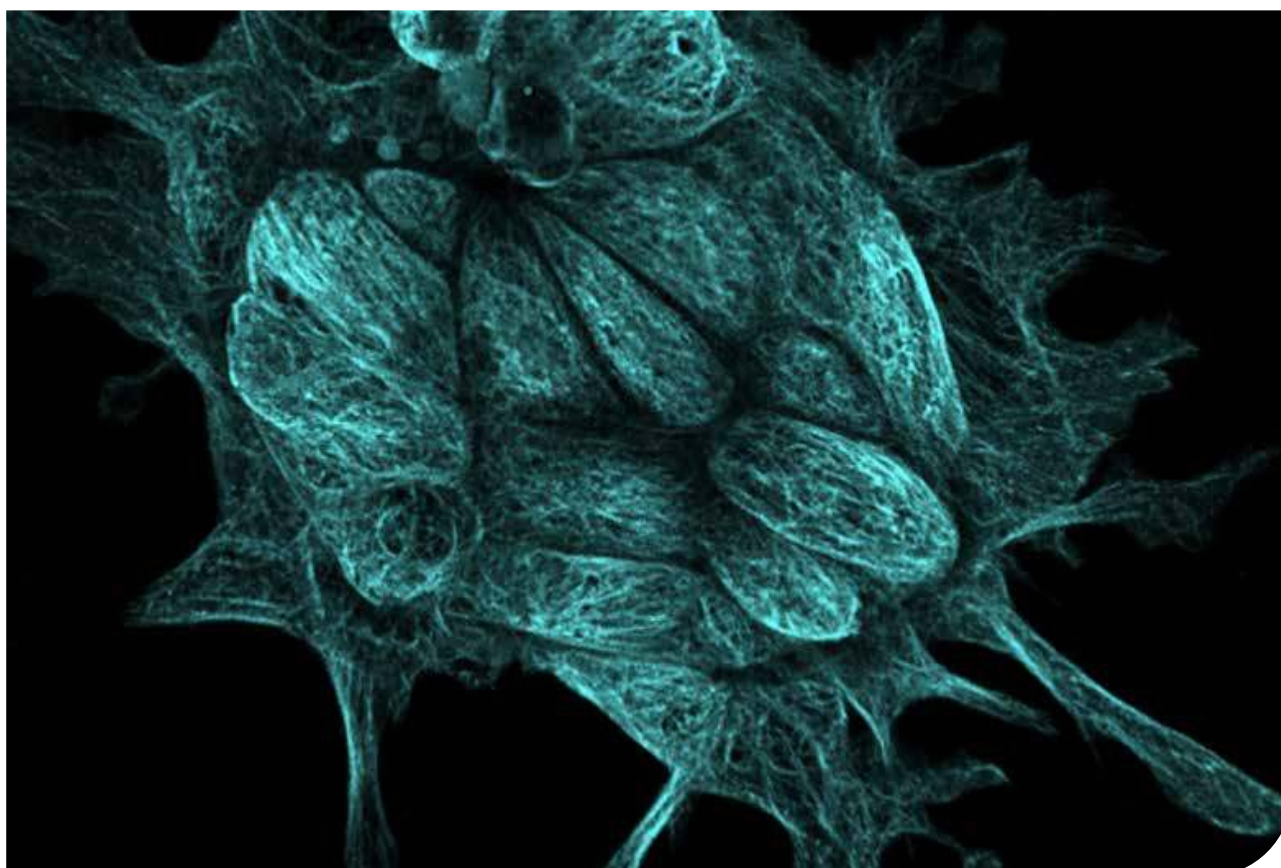
<b>Project title</b>	<b>Real-time effects of embryo-microbe interactions on mammalian embryo implantation</b>
<b>Project summary</b>	The effect of the reproductive tract microbiome on embryonic development and the initiation of a healthy pregnancy is not well understood. A unique data base collected from a case-control cohort of women with recurrent implantation failure undergoing IVF treatment will provide hypotheses as to how different uterine “microbiome contexts” may directly affect the successful implantation of a mammalian embryo. The successful completion of the proposed project will establish a physiological mammalian model system for mechanistic studies of embryo-microbiome interactions in reproductive health.
<b>Main techniques</b>	Mouse embryo handling and imaging, computational data analysis, cloning, cell culture
<b>Group leader</b>	Jennifer Zenker
<b>Supervisor</b>	Jennifer Zenker





## ZENKER GROUP CONT.

<b>Project title</b>	<b>Visualizing microtubule remodelling in differentiating cells</b>
<b>Project summary</b>	Embryonic stem cells and induced stem cells are characterised by their ability to differentiate into all cell types of the adult body, called pluripotency. The overall aim of this project is to unravel how the architecture of the microtubule network regulates the differentiation process of such cells. To address this question, the inner skeleton of pluripotent cells in the living mouse embryo will be fluorescently labelled. The real-time changes of the microtubule network will be imaged as the cells start to differentiate in the developing embryo. The specific aims are to determine the origin, speed and directionality of microtubule growth and the functional consequences in pluripotent versus differentiated cells.
<b>Main techniques</b>	Live imaging, cloning, cell culture, mouse embryo handling, computational image analysis
<b>Group leader</b>	Jennifer Zenker
<b>Supervisor</b>	Jennifer Zenker



# RESEARCH GROUPS

## NEURAL REGENERATION

### KASLIN GROUP

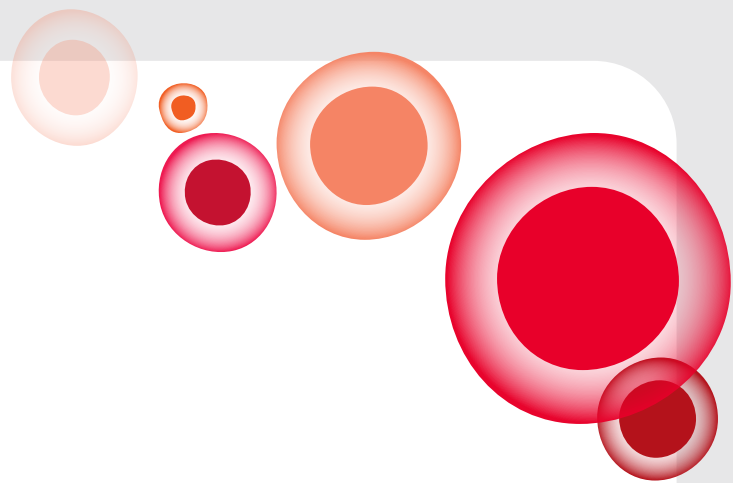
#### Research Themes:

- Understanding the molecular and cellular mechanisms that control cellular plasticity in the intact and injured vertebrate brain
- How neuronal stem cell niches arise and are being maintained, using high-resolution in vivo imaging, novel genetic tools and cellular reprogramming
- Using high-throughput methods to get a comprehensive understanding of the genetic networks that regulate cellular plasticity during homeostasis and regeneration.

<b>Project title</b>	<b>Evolution of spinal cord regeneration in vertebrates</b>
<b>Project summary</b>	In this project we aim to define how the ability to regenerate axons and neurons originated during evolution. In particular, we aim to identify the ground plan by using elasmobranch models (sharks).
<b>Main techniques</b>	Vertebrate models (fish, sharks and avian). Diverse imaging techniques, cloning, in situ hybridisation, immunohistochemistry, genetic tools
<b>Group leader</b>	Dr Jan Kaslin
<b>Supervisor</b>	Dr Mitra Amiri, Dr Frank Tulenko

<b>Project title</b>	<b>Architectural transcription factors in controlling metabolism and neural stem cells</b>
<b>Project summary</b>	In this project we examine how architectural transcription factors control neural stem cells during development and after injury. The architectural transcription factor expression is induced after tissue injury and is pivotal in stem cell control.
<b>Main techniques</b>	Zebrafish model. Diverse imaging techniques, genetic tools and molecular techniques. In vitro models and biochemical assays
<b>Group leader</b>	Dr Jan Kaslin, Dr Minni Anko (Hudson)
<b>Supervisor</b>	Dr Jan Kaslin

<b>Project title</b>	<b>Inflammatory control of neurogenesis in the intact and injured brain</b>
<b>Project summary</b>	In this project we examine how immune cell and glia interaction control neural stem cells during homeostasis and after injury
<b>Main techniques</b>	Zebrafish model. Diverse imaging techniques, genetic tools and molecular techniques. In vitro models
<b>Group leader</b>	Jan Kaslin, Minni Anko (Hudson)
<b>Supervisor</b>	Dr Jan Kaslin



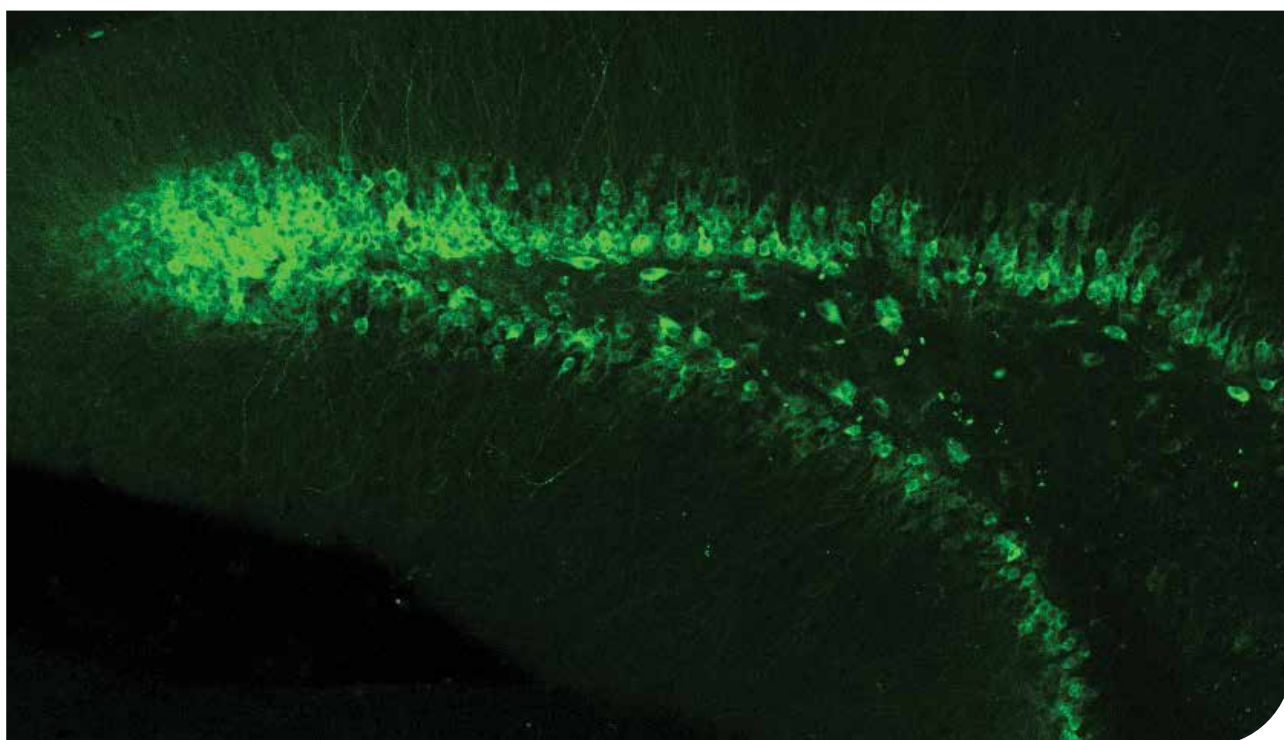
## KASLIN GROUP CONT.

<b>Project title</b>	<b>Investigating genetic components of cerebral palsy</b>
<b>Project summary</b>	In order to elucidate the so far relatively unknown genetic background of cerebral palsy, this project plans to use zebrafish (danio rerio) and methods like CRISPR/Cas to rapidly screen the previously identified candidate genes for their involvement in the disease. This should help to recognise and understand the underlying molecular pathways, which in return hopefully provides opportunities for prevention and treatment in the future.
<b>Main techniques</b>	CRISPR/Cas9 genome editing, molecular cloning, behavioural analysis, diverse imaging techniques
<b>Group leader</b>	Jan Kaslin, Michael Fahey
<b>Supervisor</b>	

## NILLEGODA GROUP

### Research Themes:

- Characterizing the poorly understood role of protein disaggregases in protein conformational diseases in humans
- Dissecting novel regulators of protein disaggregation
- Exploring the J-domain protein (Hsp40)-Hsp70 chaperone networks vital for aggregate clearance in human cells
- Developing methods for capturing molecular dynamics of distinct Hsp70 chaperone machineries in vivo



# RESEARCH GROUPS

## ORGAN ENGINEERING AND SYNTHETIC BIOLOGY

### ROSELLO-DIEZ GROUP

#### Research Themes:

- Characterising the local cell-autonomous and nonautonomous responses to an injury, including the production and role of alarm signal(s) and the response of stem/progenitor cells
- Dissecting the inter-organ communication mechanisms that lead to systemic growth effects upon local injury, with a focus on the role of the vascular and nervous systems
- Exploring the impact of the discovered injury response pathways on the buffering of developmental noise (random perturbations during normal development)
- Exploiting the discovered injury response pathways for the treatment of animal models of dwarfism and fracture repair

<b>Project title</b>	<b>Generating rat-mouse chimeras to study limb growth regulation</b>
<b>Project summary</b>	To determine the control of limb size by intrinsic and extrinsic factors, we plan to generate chimeras in which the limbs are generated from rat pluripotent stem cells injected into mouse embryos that cannot generate the limbs. Anatomical and molecular features of these limbs will be determined and compared with those of normal rat and mouse limbs, to identify key gene regulatory networks that could be used to manipulate limb size in commercial and clinical applications.
<b>Main techniques</b>	Mouse and rat timed mating and embryo collection and dissection, culture of rat embryonic stem cells, histology, immunofluorescence on tissue sections, image analysis
<b>Group leader</b>	Dr Alberto Roselló-Díez
<b>Supervisors</b>	Dr Alberto Rosello-Diez Xinli Qu

<b>Project title</b>	<b>Characterising a transient but highly reparative cartilage progenitor in perinatal mice</b>
<b>Project summary</b>	Long bones grow by forming a cartilage template that provides a scaffold to be replaced by mineralised bone. We have recently identified a cartilage progenitor population that gets mostly extinguished around birth during normal mouse growth, but that expands and lingers for a longer time in response to cartilage injury. We are characterising the origin and role of these progenitors in normal growth and in several models of injury, using single-cell RNA-seq and sophisticated genomics and genetic models
<b>Main techniques</b>	Mouse timed mating and embryo collection, PCR genotyping, flow cytometry, single-cell preparation, bioinformatics analysis
<b>Group leader</b>	Dr Alberto Roselló-Díez
<b>Supervisors</b>	Dr Alberto Rosello-Diez Ehsan Razmara Shani Amarasinghe





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