MONASH University

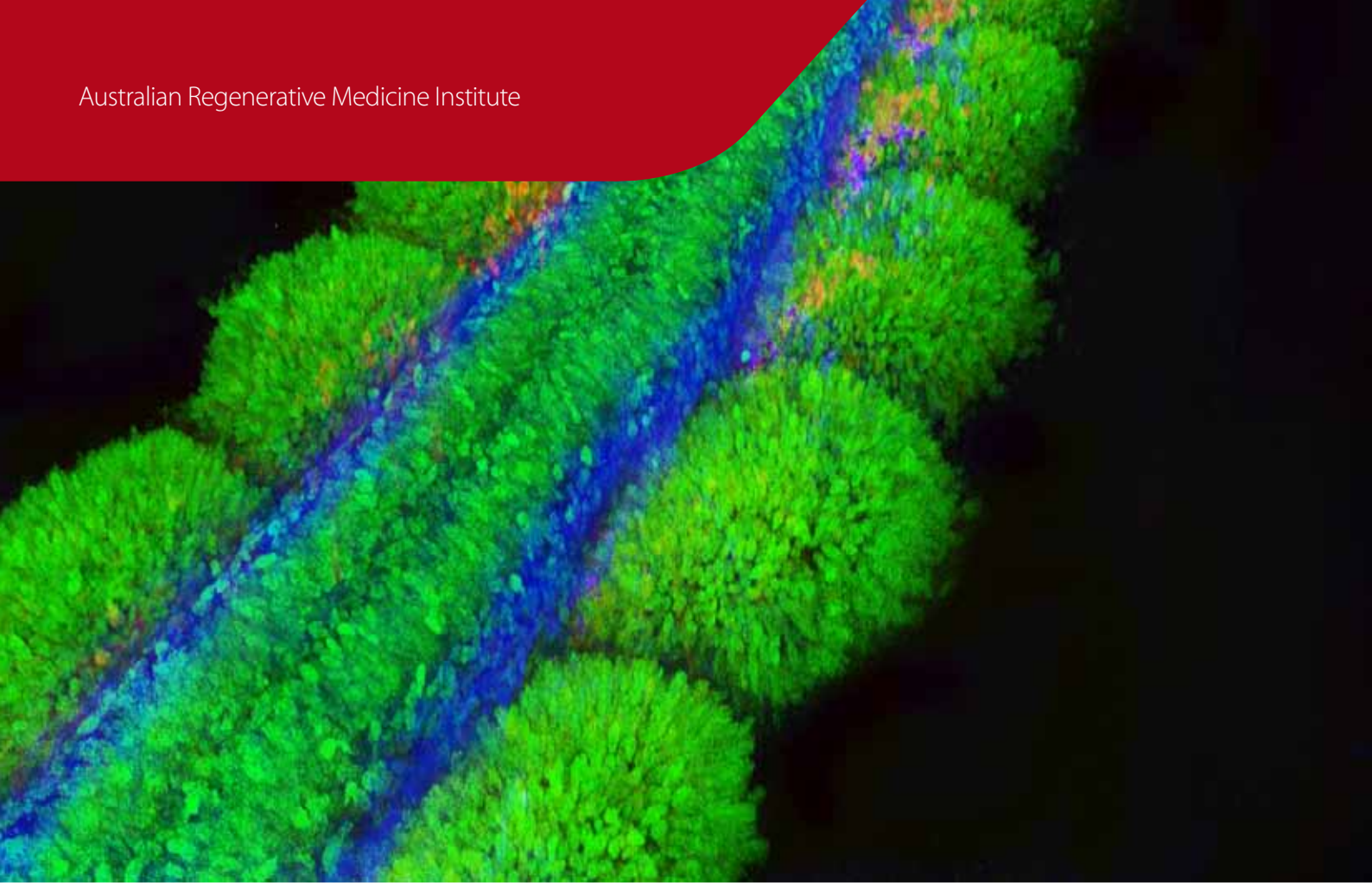
ARMI AUSTRALIAN REGENERATIVE MEDICINE INSTITUTE

Marcelle Group

The Group is interested in understanding how skeletal muscle, a fully functional, highly specialised tissue, arises from a group of unspecialised mesodermal cells. This phenomenon occurs in just a few days of embryonic development. Very little is known of the cellular and molecular processes that underly this process.

The group plans to follow two main lines of research. The first is a logical continuation of their in vivo analysis of muscle morphogenesis in vertebrate development, addressing questions as to the molecular mechanisms underlying muscle fusion. The second aims to identify gene networks implicated in the maintenance or differentiation of muscle stem cells.

Prof Christophe Marcelle
Professor Marcelle is a world leader in the application of developmental biology to the study of muscle growth and regeneration. His work has illuminated key aspects of how muscle precursor cells form in the early embryo and how they contribute to muscle growth throughout life. Professor Marcelle's work at ARMI continues his focus on muscle development and stem cell biology, with the ultimate aim being to understand how the muscle organ system forms. Before joining ARMI, Professor Marcelle led a research group at the Developmental Biology Institute of Marseille Luminy (IBDML) at the University of Marseille in France.



Research Themes

Muscle stem cells

We utilise an integrated systemic approach to define a core gene network governing "stem-cellness" in muscle. A first part of the project involves the generation of new mouse lines. Isolated stem cells from these lines will be used to perform micro-array, and ChIP-seq analyses. Functional analyses will be done in the chick embryo and in the zebrafish.

Myoblast fusion

Skeletal muscle fibers are plurinucleated. This occurs through multiple rounds of myoblast fusion, taking place during development and during muscle regeneration in the adult. A whole genome screen has been made to identify putative candidate genes important in fusion. Those will be tested in the chick embryo and in the zebrafish.

Morphogenesis of skeletal muscles

Muscle tissue is extremely well organised, fibres are aligned in a precise direction, and their attachment points are well defined. How this process is regulated at a cellular and molecular level is unknown. High-end imaging technologies will be used to address this question in live chick embryos.

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The chick embryo displays features of muscle formation that most resemble those found in human. Due to its accessibility to in vivo manipulation, the chick embryo has been historically one of the most prolific in terms of seminal findings, for example, in fields such as immunology, neurobiology or developmental biology. The recent development of novel ways to modulate the expression of candidate genes in the chick embryo, combined with the classical approaches that have made its success (e.g. lineage studies, micro-surgeries), together with high-end emerging technologies of live imaging, opens new fields of investigations, until now restricted to simpler animal models.

Version 2/August 2011