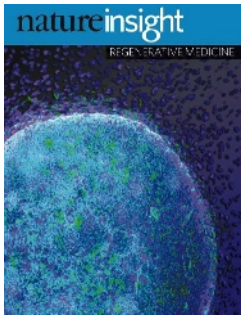

Cover illustration
A colony of human embryonic stem cells (light blue) growing on fibroblasts (dark blue). (Courtesy of A.Michalska and A. Trounson, Monash University (MISCL))

Editor, *Nature*
Philip Campbell
Insights Publisher
Steven Inchcoombe
Insights Editor
Ritu Dhand
Production Editor
Davina Dadley-Moore
Senior Art Editor
Martin Harrison
Art Editor
Nik Spencer
Sponsorship
Amélie Pequignot
Production
Jocelyn Hilton
Marketing
Katy Dunningham
Elena Woodstock
Editorial Assistant
Alison McGill

REGENERATIVE MEDICINE

Life is regenerative, by definition. But by and large, humans lack the regenerative capacity of creatures such as newts and hydra. Although some of our cells have the innate ability to replenish themselves — and, by doing so, to repair ageing and injured tissues and organs — most of the body's cells form the specialized cell type they are destined for and then go into lock down.

Having said that, humans do have organs and tissues, such as liver and skin, that regenerate well. Unfortunately, the insults of injury, disease and age wreak havoc on those that don't. This explains why diseases of the heart, an organ famously recalcitrant to regeneration, are killers. And even organs than can regenerate eventually succumb to the ravages of ageing.

The field of reprogramming began with John Gurdon's seminal work on the reprogramming of frog cells by cloning. His experiments showed that somatic cells that normally cannot regenerate (the majority of cells) can be stimulated to do so in certain circumstances. By bathing the nuclei of somatic cells in protein factors obtained from eggs, or even by inserting a few genes, the cells take on the quality of embryonic cells — the most regenerative cells of all.

Human musings on regeneration are ancient, as illustrated by the tale of the luckless Greek titan Prometheus. By day, an eagle torments him by tearing out his liver, only for the organ to regenerate overnight ready to be torn out again the next day. Now, scientists are discovering our bodies' innate stem cells and how to create new sources of such cells in a Petri dish. This knowledge is transforming biology.

The articles in this Insight explore the promises and challenges of the next era of regenerative medicine — and how to use the information gained from the study of model organisms and cell culture to eventually heal ourselves. For an additional perspective, see *Nature Reports Stem Cells* (www.nature.com/stemcells/index.html) for a series of Q&As with the Insight authors.

Natalie DeWitt, Senior Editor

INTRODUCTION

REVIEWS

nature insight