Preface

Discovered centuries ago, regeneration is a fascinating biological phenomenon. Organ regeneration occurs throughout life in complex organisms and has puzzled investigators for centuries. In some phylogenetically lower organisms, such as hydra and the scrutinised planaria, organ regeneration is a relatively common process.

In humans, the liver has a powerful regenerative ability after partial surgical resection; the remaining liver cells respond by growing and dividing to expand the liver to its original size. Lung diseases are common and costly. They present a serious burden to society: hospitalisation is frequent and expensive therapies are mostly palliative. Quality of life is poor and loss of productive working day expensive.

The ground breaking discovery of the presence of stem cells in mammals, including man, led to the realisation of their immense potential as therapeutic agents for a large number of diseases including those of the respiratory tract. The Nobel Prize for Medicine of 2008 was awarded to Professor Sir Martin Evans, one of the discoverers.

Stem cells are the engines of the body, generating an identical daughter cell and another one of a specific lineage (precursor cells). This means the body can maintain, in normal circumstances, a balanced homeostasis.

Respiratory diseases account for more than 845,000 hospital admissions each year, behind only injury and poisoning as a cause of emergency admissions. Of the 580,000 deaths each year in the UK, one in five is due to respiratory diseases with 35,000 deaths being attributed to lung cancer followed by pneumonia and chronic obstructive pulmonary disease (COPD). Many chronic lung diseases, such as COPD, remain without cure and are only treatable with lung transplantation. However, the demand for organ transplants is high, and the shortage of donor organs severely limits this clinical approach.

An increasing number of studies suggest that cell therapy approaches may be powerful tools both for repair of injured or diseased lungs as well as for understanding mechanisms involved in both lung development and lung repair. This rapidly progressing field encompasses a number of disciplines and conceptual approaches including study of endogenous stem and progenitor cells resident in the lung and investigations utilising exogenously administered cells for repair of injured lung.

In this volume a stellar group of researchers converge, from different angles, to help towards clarifying the basic mechanisms of lung repair. These range from basic concepts of regeneration and lung development, the analyses of a variety of cell types that may be involved in lung repair, to ways of creating complex lung structures, including artificial and bioartificial lungs. The book offers an insight into repair mechanisms of the diseased lung, the role of specific lung niches and provides information on initial clinical trials as well as the use of stem cells as vehicles for gene therapy. Ingenious technological aspects of assessing stem cell engraftment of stem cell bioprocessing are also included in this volume.

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