Introduction

Tissue engineering is a relatively young science, especially in terms of the soft tissues of the body. The present intense and growing interest can be seen not only in a scientific but also a sociological context, as the focus in a population with increased longevity now turns to the paradigm of "healthy old age". Evident successes in the field of skin, bone and dental replacements also fuel enthusiasm as treatments are seen to become clinical reality. The burgeoning science of stem cells is following a similar trajectory, and the two strands have such clear complementarity that they are frequently brought together both at scientific meetings and in the regrouping of university departments. In the present volume we have reflected this with a detailed consideration of cell types for tissue engineering, which *de facto* concentrate on the many varieties of stem cells that are being discovered and characterised.

A striking feature of tissue engineering and stem cell research is that the problems being addressed have an unexpected degree of commonality between different organ systems. Stem cell researchers in different fields are asking the same questions about directed differentiation of stem cells, genetic modification, the extent to which exogenous cells will remain after implantation and the role of the niche in controlling cell fate. They are also revising views on the plasticity of organs including brain and heart, as a result of the advances in stem cell biology. Engineers are tailoring the design of materials to the particular organ in terms of physical properties, but issues of biocompatibility and biodegradability have shared goals. Here we have presented together the latest information from the pulmonary, cardiac, skin, osteoarticular, liver, urogenital and dental areas, to draw out the differences and similarities of the approaches.

This volume also attempts to define the path from basic science to practical application. The issue of scale-up of stem cell numbers is fundamental to all the organs systems, with the role of bioreactors central to the success of translation. Importantly, the regulatory environment is considered as an integral part of the selection of stem cell types, and the variations in the international landscape are drawn out. A contribution from the UK Stem Cell Bank shows how the control and standardisation of lines will be crucial to underpin both research and translational efforts. The full discussion of the regulatory hurdles includes not only the stem cells but the fabrication of final approved products. We have brought in the opinion of venture capitalists to provide a perspective on the economics of the process by which these products will be carried through to the clinic.

Looking to the future, we highlight exciting new areas of stem cell biology, and the cross-fertilisation between the investigation of signalling in authentic stem cells with the understanding of intrinsic tissue regeneration in health and disease. We showcase new developments in the customisation and functionalisation of biomaterials for both bioreactor design and *in vivo* implantation. The vital contribution of novel sophisticated imaging technologies to assess the success of tissue engineering strategies *in vitro* and *in vivo* is emphasised. Above all, this volume shows the tremendous inventiveness and synergy that comes when biologists and physical scientists join together in a focused effort to address human disease.