

Foreword

Four decades ago, James Rheinwald and Howard Green described the first long-term culture method for normal human cells. They combined freshly isolated human skin cells with irradiated mouse fibroblasts. Gradual improvements allowed them to generate large confluent sheets of epidermis, starting from relatively small numbers of primary proliferative skin progenitor/stem cells. In 1980, Green and his colleagues performed the first successful therapy of two third-degree burn patients with cultured autologous keratinocyte sheets. In a dramatic demonstration during the summer of 1983, they exhibited that large-scale use of the method was life-saving for two brothers: five-year-old Jamie Selby and six-year-old Glen; both had sustained burns over >95% of their body surface. Later studies accomplished similar spectacular results in the lab and in the clinic with a related tissue, the cornea.

Despite these early successes, it has long been held that healthy mammalian cells cannot be maintained (let alone expanded) outside the body, in a dish. This is now rapidly changing. The stem cell field has gone through a period of prolonged expansion. Many new stem cell types have been identified and characterized. However, the ways by which stem cells are nurtured by their niches still remains uncovered. Based on the new insights in understanding stem cell niches, it is now possible to culture stem cells representing virtually any tissue type in a dish. Under the right conditions, these stem cells not only simply increase in their numbers but also self-organize into organoids: miniature versions of real organs, like mini-brains, kidneys, or guts. Organoids are great experimental tools to ask basic science questions. Yet, the ease of organoid production from stem cells and their resemblance to human organs in health and disease holds great appeal for translational research and invites their almost immediate application into the clinic.

This book is written by scientists who have contributed to many of the recent stem cell discoveries. It touches on all aspects of stem cell niche research, basic and applied. It contains a wealth of information for anyone with a scientific interest in learning about newest approaches to engineer stem cells and their niches. Enjoy a good read!

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