PREFACE

Is cancer a *stem cell disease*? At present, we are in the midst of an exciting turn of events in which the principles of stem cell biology have been applied to cancer biology. This leads to the realization that disruption of the processes of quiescence and differentiation (viewed as two sides of the coin of stem cell self-renewal) can lead to cancer. Disease progression in neoplasia is often accompanied by increasing resistance to apoptosis and therapy, development of a capacity for tissue invasion and migration, and an apparently limitless replicative potential—all features that can be described as being characteristics of a stem cell. The marriage of convenience between stem and cancer cells is thus strongly supported by the similarities between the two cell groups, and the considerable research effort that has been initiated in the field has resulted in incremental knowledge of cancer stem cells that continues to evolve rapidly.

Cancer stem cells (CSCs), first identified in acute leukemias, have now been isolated from several human malignancies, such as breast, brain, prostate, and ovarian, and also in retinoblastomas and melanomas. The initial isolation of CSCs relied on a basic knowledge of normal stem cells in the organ, assays for their functionality, and expression of specific markers on their cell membranes that provided robust mechanisms for identification of these elusive cells within the large mass of a tumor. In the absence of such specific channels for their identification, CSCs came to be identified based on the expression of characteristic genes associated with self-renewal in stem cells, including *OCT4*, *NANOG*, and *NESTIN*. Yet another novel approach to the isolation of CSCs within tumors was the identification of side population cells within tumors that were subsequently shown to be enriched in tumor-initiating cells.

Although the origin of CSCs is still datatable, it has been demonstrated variably that they may be generated from tissue-specific stem cells, progenitor cells, or mature cells or through fusion of tissue-residing cells with bone marrow–derived stem cells or cytotoxic T lymphocytes. Major differences between the two cell groups include the genetic and epigenetic changes in CSCs that secure and establish transforming events and make disease progression a certainty. The identification of cancer stem cells has thus opened up a new avenue in cancer biology. It is being realized increasingly that some of the limitations of current chemotherapeutics may be overcome by initiating detailed molecular investigations of the cellular hierarchies transformed in cancer. Several research groups are already exploring the design of new therapeutic strategies that could possibly target CSCs.

In this book we have sought to be as comprehensive as possible. We have detailed some of the important cancers in which CSCs have been identified. As the first book in this field, cancer biologists, stem cell researchers, and clinicians will find it a valuable repository of information. Further, we present the various approaches in the field in a highly intelligible manner, so that readers from diverse scientific fields and working environments will find it a convenient reference source in a field that is growing by leaps and bounds. It is my sincere hope that this book will stimulate readers to explore diverse ways of understanding the mechanisms by which these seemingly elusive cells evade being targeted, and thereby, help to open new pathways in the molecular aspects of biomedical research.

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