

Preface

Neural differentiation is an early embryonic event that occurs soon after germ layer specification from the blastula. The early formed ectoderm undergoes further patterning to separate into two identifiable components, the presumptive neural ectoderm and the presumptive epidermis. Neural tissue segregates as a clearly demarcated epithelium termed the neuroepithelium (or neuroectoderm). This neuroepithelium generates the central nervous system (CNS), whereas cells at the margins of the neuroepithelium will generate the peripheral nervous system (PNS). A variety of evidence has been accumulated to show that the process of neural differentiation involves a sequential restriction in differentiation potential.

A fundamental breakthrough in our understanding of nervous system development was the identification of multipotent neural stem cells (neurospheres) about 10 years ago. Dr. Samuel Weiss and colleagues showed that EGF (epidermal growth factor)-dependent stem cells could be harvested from different brain regions at different developmental stages and that these could be maintained over multiple passages in vitro. The original finding that EGF-dependent neural stem cells exist has been replicated and extended by many investigators, and there has been a veritable explosion of research on stem cells, their role in normal development, and their potential therapeutic uses. Different classes of neural stem cells have been identified, new markers described, cell lines generated, and factors that regulate the differentiation process characterized. Other investigators have shown that these pluripotent stem cells likely generate CNS and PNS derivatives via the generation of intermediate lineage restricted precursors that differ from each other and from multipotent stem cells. The therapeutic implications of accessing a virtually unlimited population of homogenous progenitor cells to treat CNS disorders or for gene and drug discovery has not escaped investigators, and several companies have been formed to exploit stem cell technology and several research institutions have initiated transplant studies. This rapid transition from a basic discovery to clinical trials is both surprising and unprecedented.

In *Stem Cells and CNS Development*, I have invited some of the leading authorities in the field of neural stem cell biology to summarize their findings and describe how these results may lead to novel therapies. The first part of the book surveys the various kinds of stem cells, progenitor cells, and precursors that have been described, while the second half describes how these cells are beginning to be used for therapeutic purposes. It is my hope that this book will serve as a valuable compendium of practical information on the current state of the field for all those engaged in this research.

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