
Preface

All sexually reproducing organisms produce primordial germ cells, a small population of cells that differentiate into gametes of either sex and carry totipotency, an ability to develop into an entire new organism. The study of germ cells has undergone enormous advances in recent years and has entered into an explosive phase of new discoveries with the introduction of transgenic technologies and nuclear cloning. Basic knowledge and techniques developed for lower vertebrate and invertebrate systems have facilitated the study of higher vertebrates, including humans. Many experiments that have first been performed on lower vertebrates provided the tools and strategies that could later be applied to other less readily available mammalian systems. The discovery of centrosomes in ascidians and sea urchin eggs now benefits studies of fertility and infertility in mammals. External *in vitro* fertilization, now a common technique in assisted fertilization, has only been possible as a result of numerous studies in lower systems in which external fertilization is natural. Egg activation, first explored in sea urchin and ascidian eggs, now benefits techniques designed to increase cloning efficiency in farm and domestic animals. Gene manipulations and molecular methods have added to the possibilities of producing live offspring with enormous biomedical, ecological, and economic implications.

The two volumes on germ cells combine techniques in a variety of different systems; we have selected those systems that have provided landmarks in advancing our knowledge on germ cells. Topics include sperm and egg activation, motility, fertilization, nuclear development, nuclear cloning, molecular characterization of specific events, imaging of cell structures, cryopreservation of germ cells, and other specific techniques that have advanced our knowledge of germ cells. Each chapter provides a short overview of the topic, followed by detailed techniques that are not normally described in regular research papers. Volume 1 is focused on sperm cells, oocyte analysis, oocyte maturation, fertilization, and preparation techniques, whereas volume 2 is mainly focused on molecular egg analysis, live egg imaging, nuclear cloning, oocyte techniques, and other specific methods for egg manipulation. Molecular preparations and characterizations and molecular imaging are methods treated in both volumes that will be of interest to cell and molecular biologists, reproductive biologists, physiologists, clinicians in human and veterinary medicine, and other researchers who want to become familiar with, and apply, techniques that are commonly not described in

sufficient detail in research papers. This book will also be of interest to students for the study of a variety of aspects regarding research on germ cells.

A number of chapters in *Germ Cell Protocols: Volume 1: Sperm and Oocyte Analysis* are devoted to the newly emerging field of nuclear transfer that will be of interest to researchers in agriculture. The possibility of producing offspring from cultured adult cell lines enables the generation of offspring from donors of high genetic value with proven performance. In addition, it might provide a powerful tool in saving endangered species or populations and in protecting biodiversity. The diversity of chapters in this volume will allow cross-species transfer of knowledge which will be useful to study animals whose germ cells are low in number or hard to obtain. Because no recent comprehensive literature using our format is available on germ cells, this book will be of value to a wide variety of researchers.

It is a great and timely pleasure to edit two volumes on germ cells depicting specific methods that have impacted germ cells research. The methods presented here are currently in the highest demand and are expected to continue to be of value to investigators in the future. I am indebted to Dr. John Walker for inviting these two volumes on germ cells, to the publisher who recognized the value of publishing detailed methods on specific topics, with special thanks to Tom Lanigan and Craig Adams. I would like to thank the contributors who shared their intellectual and practical laboratory expertise and experiences with the present germ cell community and with those who will enter the field in the future. My sincere thanks to everybody who contributed so well.

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