Preface

The oocyte is one of the largest and most mysterious of cells in mammalian organisms. After many years of inactivity in a primordial state, the oocyte progresses through growth and maturation achieving on the one hand a remarkable level of specialization, while maintaining throughout development a state of totipotency. Most telling of all is the unique capability of the oocyte, in collaboration with the spermatozoon, to give rise to a fully developed organism formed from hundreds of different tissues and myriads of individual cells – a feat that has inspired intellectuals of all ages. Aristotle theorized that "the embryo originates from a gradual development of undifferentiated material (the oocyte)," forerunning epigenesis views of development that emerged early in the seventeenth century. Around this period, preformistic (ovistic) viewpoints appeared that considered embryonic development as an unfolding and growth of parts already assembled in the oocyte. These perceptions and predispositions have withstood the test of time (through centuries) and are buttressed in a biological and clinical context by the work of contemporary scientists who share a passion toward understanding oogenesis. In the human, for example, meiotic errors initiated by events taking place in the fetal ovary can be propagated into the fully grown oocyte and impart a dark shadow on the genetic integrity of a resultant embryo decades after the original aberration took place. On a different time scale, the continuum of the growth and maturative phase of oogenesis, entailing the progressive accumulation and positioning of organelles, RNAs, and proteins, establishes the molecular foundations of the preimplantation embryo that will guide it in both time and space. With the advent of and continued application of assisted reproduction technology (ART) in human medicine, the biology of the oocyte has gained stature and prominence that few would have anticipated 60 years ago. We hope this book brings the reader a sense for why and how this extraordinary cell has become such a mainline focus in the biomedical research enterprise.

This book finds impetus and purpose in casting scientific perspective toward this unique cell for the benefit of scientists and ART specialists. The authors of the chapters are distinguished authorities in their respective areas of competence, some of whom have collaborated with the editors over the last several years. From the opening of the book, the reader is led on a fantastic voyage from the formation of the primordial oocyte to the development of the early embryo, passing through crucial processes of oogenesis, such as

co-ordination of oocyte and follicle growth, gene expression and organelle reorganization during growth and maturation, epigenetic mechanisms, regulation of meiosis, totipotency, cell polarity, oogenesis in vitro, and maternal regulation of early development.

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