

Oogenesis

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I started flipping through the pages of this book when the expression *Ab Ovo* came to my mind.

Ab Ovo, the beginning, the origin, the egg. This reminded me that the idea of correlating the origin of each human being with an egg characterized the human beliefs of the seventeenth century until Francesco Redi, inspired by the study of Iliad, wonders why Achilles asks his mother Thetis how to conserve the lifeless body of his beloved Patroclus. How the goddess can satisfy her son's request if the spontaneous generation of flies and butterflies from the dead body corresponds to reality? Only by covering Patroclus' body preventing flies and butterflies from laying their eggs on a dead flesh, is the correct answer!

This episode let Redi to perform his famous experiment showing, several years before Pasteur's theories, the impossibility of spontaneous regeneration, thus *Omne vivum ex ovo*: all animals generate from eggs.

As the editors wrote in the preface, the egg has always (and still does) inspired scientists, artists and all kinds of intellectuals because of its plasticity of being the *protagonist* in many different fields. Any scientist interested in studying the oocyte and, more in general, the process leading to the formation of a mature oocyte must have this book, wisely divided into five different parts devoted to different aspects of oocyte formation, maturation and development.

The first part is dedicated to the imaging strategies useful for the study of mammalian oogenesis and protocols for histological, fluorescence and confocal analyses are discussed in details. Each single paragraph includes tips

and suggestions making the preparation, visualization, image archiving and analysis of the sample of interest less complicated.

The second part covers different aspects of folliculogenesis and oogenesis. In particular, chapter two describes PGCs formation, migration and proliferation both *in vivo* and *in vitro*, stressing the importance of *in vivo* derivation of human PGCs for the study of cell stemness and of mechanisms related to their transformation into tumorigenic cells. Chapters 3-6 are more focused on the study of the factors/mechanisms involved in quality control during different phases of oocyte maturation or aging with a particular emphasis on the mechanisms regulating quiescence and communication between oocyte and surrounding somatic cells. These hot topics are important for the understanding of oocyte developmental competence related to fertility preservation during aging, after anticancer treatments or as a consequence of female reproductive disorders.

The oocyte achievement of meiotic and developmental competence is also widely discussed in chapters 7 and 8 referring to up-to-date progresses in the field of assisted reproductive technologies with the possibility of cryo-preserve ovarian tissue portions for both adolescent and adult female cancer patients.

The third part is more focused on the factors regulating oogenesis by oocyte-specific gene networks (chapter 9) and by the epigenetic regulation of oocyte function (chapter 11), beautifully explained thanks to detailed analyses of the epigenetic regulation and epigenetic alterations in oocytes (in the mouse 15% of methylated targets are maintained up to the blastocyst stage) that can be inherited and transmitted to future generations. Meiosis and the factors influencing its beginning and end are discussed in section four. Internal and external triggers leading to the formation of a mature oocyte are elucidated in details. Readers will have an overall view of kinase CDK1 activity in different time points during

oocyte maturation; about the mechanisms controlling first chromosome alignment and segregation and about organelle rearrangement and factors influencing and regulating aneuploidy.

To conclude, section five, is more focused on the oocyte developmental potentials linked to different molecular and cellular biomarkers. For example, cumulus cell quality is associated with successful embryo development and implantation and several genes involved in cell to cell communication, cumulus cell metabolism and signal transduction can be used as good candidates to predict oocyte-embryo quality. Chapter 18 elegantly shows how the establishment of the animal-vegetal axis ensures further embryo development: oocyte polarity ensures asymmetric meiotic divisions, prevents misplaced fertilization and provides clues for further embryonic development. The roles of sperm, cellular membranes and cytoplasmic organizations, maternal diet and metabolism (together with many other factors) contribute to the arrangement of the fertilization choreography (chapter 20) aimed to the formation of a viable embryo.

In conclusion, this book offers an up-to-date journey of oocyte life, from the beginning (folliculogenesis) to the end (fertilization and embryo formation) describing all the little changes in both nuclear and cytoplasmic compartments that can affect subsequent embryo development or can be influenced by different kinds of problems fertility-related.

In summary, I'm deeply convinced that the oocyte is like a wonderful miniaturized laboratory of molecular biology with several dark sides that still have to be discovered.

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