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Ri-Cheng Chian and Patrick Quinn  
Frontmatter  
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## Preface

### An introduction to fertility cryopreservation

Infertility or impaired fertility may be caused by a wide range of reasons, including reproductive disorders, gonadal toxic therapy (chemotherapy, radiation therapy), surgery, genetic predisposition, or exposure to environmental toxins. Among these, a large group of potential infertility patients will include survivors of childhood and adult cancer. Since the late 1970s, the incidence of cancer in children has increased by up to 20% while mortality rates have declined remarkably as a result of progress in cancer treatment [1].

Each year, more than half a million young adult men and women living in the USA have been diagnosed with some form of invasive cancer [2,3]. With earlier diagnosis and aggressive chemotherapy and/or radiotherapy coupled with bone marrow transplantation, more than 90% of teenage boys and girls as well as young adults affected by some malignancies will survive [4]. It has been estimated that approximately 1 in 250 young adults will be long-term survivors of cancer [5]. However, there is often a loss of both endocrine and reproductive function because of the sensitivity of the ovaries to cytotoxic treatment and ionizing radiation, and one of the major concerns is whether these patients will be able to have healthy children after cancer cure treatment [6,7]. Therefore, it has been suggested that providing options for preservation of fertility for men and women is not only an important issue for reproductive health but also a quality-of-life consideration [8].

Currently, there are a number of options available to try to preserve fertility. Adult males have the option of cryopreserving their sperm for later use, but this is not the case for prepubertal boys and for some post-adolescent boys [7,9,10]. Adult females have an option for embryo cryopreservation, but this is feasible only if a male partner is available and is not suitable for prepubertal girls [11]. Furthermore, this option requires time for the preparation and stimulation of the ovaries, which delays the treatment of cancer, and the ovarian

stimulation may be deleterious in the context of certain types of cancer. Therefore, attempts have been made to preserve fertility with gametes (sperm and oocytes) and gonadal tissues (testicular and ovarian tissues) as well as with whole gonadal organs (ovary). Apart from sperm and embryo cryopreservation, other technologies are still considered to be largely experimental by the American Society for Reproductive Medicine (ASRM) [3] even though tremendous developments have been achieved recently, especially with cryopreservation of oocytes and ovarian tissues. In fact, it is important to be aware that developing new technologies for preserving or restoring fertility should be considered in relation to the long-term effects of such technologies, healthy babies.

It has become apparent as fertility cryopreservation is increasingly practiced throughout the world that there is a real need for a comprehensive book for fertility cryopreservation. We have endeavored to collect contributors with international expertise in all aspects of fertility cryopreservation, from gametes (sperm and oocytes) and embryos to gonadal tissues as well as whole gonadal organs and who cover all areas from basic science to clinical application. The book is divided into five sections.

Section 1 covers the scientific rationale for cryobiology by outlining aqueous solutions, mechanism of cell cryopreservation, and cryoprotectants as well as the pathway for the movement of water and cryoprotectants during cryopreservation. Here we have to mention that cryobiology is a complicated area and not all the details can be covered in these chapters.

Section 2 covers cryopreservation of human sperm and testicular tissue. It gives brief information about historical aspects of sperm cryopreservation and the protocols developed. It also covers donor program and freezing of surgically retrieved sperm.

Section 3 covers human embryo cryopreservation from pronuclear stage to cleavage stage to blastocyst stage, using slow-freezing or rapid cooling (vitrification) methods. It also covers the recent development

## Preface

of blastocyst cryopreservation with the vitrification method.

Section 4 covers human oocyte cryopreservation either with slow freezing or vitrification. It briefly introduces the use of different tools to vitrify the oocytes, and the efficiency of donor programs with frozen-thawed oocytes. It also covers the initial information available about prenatal development and live births using vitrified oocytes.

Finally, Section 5 covers different technologies for the cryopreservation of ovarian tissue. It describes briefly the technologies for in vitro culture of primordial follicles isolated from ovarian tissue. It also covers transplantation of cryopreserved ovarian tissue and whole ovaries. Section 6 considers ethical issues involved in fertility cryopreservation with gametes, embryos, and gonadal tissues.

Although it is still considered a relatively new procedure for oocyte cryopreservation, ovarian tissue freezing can be followed by ovarian tissue transplantation. We hope that this book will be a helpful overview in the field of fertility cryopreservation and its development and will contribute towards its increased availability. We believe that fertility cryopreservation offers an option for people who need it urgently in order to have a possibility of having their own biological children in the near future.

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