# CONTENTS

## SECTION 1
## Fertility Preservation Approaches in the Female


**1. Fertility Preservation in Female Patients: An Overview** **3**
*Mohamed A Bedaiwy, Candice P Holliday, Botros RMB Rizk*

Evolution of Human Oogenesis 4
Anticancer Therapy-induced Premature Ovarian Failure (POF) 4
Chemotherapy/Radiotherapy-induced POF: Diagnosis and Prediction 5
When is Fertility Preservation Indicated in Women? 5
Strategies for Fertility Preservation 5
Introduction of Vascular Grafts in Animal Models 10
The Use of Vascularized Grafts in Human Trials 10
Heterologous Ovarian Transplantation 11
In Vitro Maturation of Oocytes 12

**2. Fertility Preservation in Cancer and Noncancer Patients** **17**
*Demeestere Isabelle, Englert Yvon*

Who is a Candidate for Fertility Preservation? 18
Option to Preserve Fertility 22

**3. Reproductive Implications of Chemotherapy and Radiotherapy** **27**
*Mohamed A Bedaiwy, Drisana Henry, Candice P Holliday, Botros RMB Rizk*

Chemotherapy 28
Radiotherapy 30
Protective and Preventive Measures 31

**4. Ovarian Reserve Testing for Cancer Patients** **34**
*Luciano G Nardo, Lamiya Mohiyiddeen*

Effect of Chemotherapy on the Ovary 35
Effect of Radiotherapy on the Ovary 35
Role of Ovarian Reserve Tests (ORT) in Cancer Patients 35
Ovarian Reserve Tests 35
Fertility Preservation 37

## 5. Medical Approaches for Fertility Preservation in Female Cancer Patients 41

*Eman Elgindy, Mohamed A Bedaiwy*

The Need for Fertility Preservation 41
Development of Gonadal Dysfunction Following Cytotoxic Treatment 42
The Hypothesis Behind Medical Approaches 44
Preservation of Ovarian Function with the Use of GnRH Analogs 44
GnRH Agonist: Human Randomized Controlled Trials 47
GnRH Agonist for Gonadal Protection: Current Evidence 48
Studies Using GnRH Antagonists for Ovarian Protection 48
The Use of Oral Contraceptives for Ovarian Protection 49
Ethical Issues Concerning Fertility Preservation in Cancer Patients 50

## 6. Ovarian Transposition as a Fertility Preservation Strategy 54

*Ayman Al-Talib, Togas Tulandi*

Ovarian and Reproductive Physiology 54
Radiation-induced Ovarian Failure 54
Terminology and Historic Overview 54
Indications and Surgical Techniques 55
Laparotomy Versus Laparoscopy 55
Surgical Procedure 55
Complications 55
Ovarian Function after Transposition 55
Fertility Outcome 56
Effect of Radiation on Endometrium and Fertility Outcome 56

## 7. Surgical Strategies for Fertility Preservation in Women with Cancer 59

*Mohamed A Bedaiwy, William W Hurd, Kristine Zanotti*

Gynecologic Cancers: Surgical Treatments that Preserve Fertility 60
Protecting Ovaries and Oocytes During Cancer Treatment 63
Ovarian Tissue Transplantation 64

## 8. Basics of Cryobiology 71

*Amjad Hossain, Shaikat Hossain, John Phelps III*

Relevant Cryobiological Facts Important to Reproductive Biologists 72
Cryopreservation Methodologies 76
Physics of Freezing Biological Materials 77
Physicochemical and Biological Events Occurring During Freezing 77
Physicochemical and Biological Events Occurring During Thawing 78
Safety Issues in Cryopreservation 78
Preservation of Cells and Tissues 78

**9. Oocyte Cryopreservation** **80**
*Faten F Abdelhafez, Mohamed A Bedaiwy, Nina Desai*
Determinants of Oocyte Cryopreservation Outcome 80
Clinical Application of Frozen Oocytes 82
Clinical Outcome of Oocyte Cryopreservation 83

**10. Embryo Cryopreservation** **90**
*Bonnie Patel, Candice P Holliday, Mohamed A Bedaiwy*
History 90
Indications 90
Embryo Cryopreservation 91
Cryopreservation 93
Success Rates 93
Ethical and Legal Issues 93

**11. The Challenges and Promises of Whole Human Ovary Cryopreservation** **96**
*Amanda N Kallen, Pasquale Patrizio*
Successes 97
Challenges 98

**12. Ovary Transplantation for Fertility Preservation in Cancer Patients: Fresh and Frozen** **102**
*Sherman J Silber*
Subject Recruitment and Consent 102
Clinical Profile 103
Genetic Studies 103
Fresh Cortical Ovarian Tissue Transplantation 103
Frozen Cortical Ovarian Transplantation 106

**13. In Vitro Maturation of Oocytes as a Fertility Preservation Strategy** **110**
*Baris ATA, Hai Ying Chen, Ayse Seyhan, Alper Mumcu, Seang Lin Tan*
In Vitro Maturation of Human Oocytes 111
Embryology Laboratory Procedures 112
IVM Treatment Outcome 112
IVM for Fertility Preservation for Women with Medical Conditions 113
IVM for Social Fertility Preservation 116

**14. Fertility Preservation in Women with Breast Cancer** **119**
*Wayne Lin, Elizabeth Ginsburg*
The Epidemiology of Breast Cancer 119
Breast Cancer Treatment 120

Chemotherapy and Ovarian Reserve 121
Fertility after Chemotherapy 122
Fertility Preservation Options 123
Ovarian Suppression During Chemotherapy 125
Alternatives—Donor Egg, Gestational Carrier and Adoption 126
Special Considerations 127

## SECTION 2
## Fertility Preservation Strategies in the Male

**15. Pathology Affecting Male Fertility** **133**
*Edmund Y Ko, Edmund S Sabanegh Jr*

Evaluation 133
Pathology 136

**16. Cryopreservation of Spermatozoa, Individual Sperm and Testicular Tissue** **143**
*Faten F Abdelhafez, Rachel Pope, Mohamed A Bedaiwy, Nina Desai*

Effect of Cryopreservation on Human Spermatozoa 143
Clinical Applications of Sperm Cryopreservation 144
Sperm Cryopreservation for Cancer Patients 144
Laboratory Techniques for Sperm Cryopreservation 145
Storage and Transportation of Cryopreserved Sperm 147

**17. Strategies for Fertility Preservation in the Male Cancer Patient** **150**
*Wayland Hsiao, Peter N Schlegel*

Cryopreservation of Ejaculated Sperm 150
Azoospermia at Presentation 151
Percutaneous Testicular and Epididymal Aspiration 151
Surgical Retrieval of Vasal or Epididymal Sperm 152
Surgical Retrieval of Testicular Sperm 152
Special Considerations in Testicular Cancer Patients 152
Persistent Azoospermia after Systemic Treatment 153
Retrieval of Sperm in Anejaculate Patient 154
Sperm Retrieval in the Azoospermic Patient after Chemotherapy 154
Sperm Retrieval in the Azoospermic Patient after Radiation Therapy 155
Use of Spermatozoa from Men who have Received Chemotherapy or Radiation 155

***Index*** ***159***