

# RCS - Reproductive Clinical Science

## **RCS 700 Biochem.& Molec. Cell Biology (2 Credit Hours)**

This course presents the basic principles of cellular structure and function, which are the infrastructure for understanding clinical endocrinology and embryo metabolism. This 4-module course examines the structure of biological components and their roles in biochemical processes - metabolism, molecular feedback through hormones, signal transduction, cellular physiology and molecular biology. Case study discussion boards and current journal article discussions connect the basic science content to IVF.

## **RCS 701 Intro IVF, Lab, & Skills Dev. (3 Credit Hours)**

Laboratory science and technology are at the foundation of the Clinical Embryology Laboratory, and ART success rates are largely dependent on the quality of the laboratory environment and the knowledge and skill of laboratory personnel. This course covers the basic laboratory skills and techniques used in the IVF and andrology laboratories. A required, on-campus component includes hands-on training and skills evaluation.

## **RCS 702 Molecular Biology & Genetics (3 Credit Hours)**

This course includes an introduction to molecular biology with an emphasis on the structure and function of both DNA and RNA and their roles in protein synthesis. Aspects of gene structure-function and regulation will also be discussed in this course, including a section on mitochondrial DNA. Research in this area includes the use of molecular techniques, which will be illustrated. This course also provides instruction in the fundamentals of human cytogenetics with discussions of chromosomal structure and cell division, as well as both genetic and epigenetic mechanisms of inheritance and different types of mutations and aneuploidies. This course will also introduce basic molecular biological techniques that are used in current molecular biological research including DNA, RNA isolation and analysis, protein isolation and analysis, genetic engineering, cloning and sequencing, gene expression analysis, PCR and quantitative real-time RCR.

## **RCS 703 Female Rep. Endo.& Infert. (3 Credit Hours)**

This course provides an introduction to endocrinology, female reproductive anatomy and the latest information in basic reproductive physiology of the female at all life stages, including puberty, mid-reproductive life and menopause. Chronic reproductive abnormalities will be discussed in detail using the current literature, including hypothalamic amenorrhea, polycystic ovarian syndrome and premature menopause. The role of gonadotropin hormone therapy in ovulation induction and controlled ovarian stimulation along with complications, such as ovarian hyperstimulation and multiple births, will also be discussed. The use of agonists and antagonists in ART and stimulation protocols for difficult cases, such as the poor responder and hyper-responder, will be covered, along with donor egg and surrogacy and ethics.

## **RCS 704 Current in IVF - Journal Club (1 Credit Hour)**

This course is a journal club format designed to give basic instruction for reading the literature as students prepare to take courses in the following semesters that depend on journal articles as a supplement to or the sole source of reading. Another purpose for this course is to introduce current topics in IVF prior to thesis topic selection in the second semester. The students will work in groups to present papers selected by the program faculty. The online meeting format will be used to present and record the sessions; these sessions can be attended synchronously or asynchronously. Discussion boards will also be used to review and critique the presentations.

## **RCS 705 IVF Technology (3 Credit Hours)**

In vitro fertilization has given its name to the field of reproductive medicine. This course presents a historic overview of the field of IVF and all current techniques and regulatory issues including: how to collect, recover, assess, prepare, fertilize and maintain gametes and embryos; the basic protocols for IVF, ICSI, GIFT, ZIFT, TET and ET; the types of culture media and culture systems used in IVF; how to design and maintain a quality IVF laboratory; the principles and application of Quality Assurance (QC, proficiency testing) and laboratory safety (security, fire, electrical, patient issues, staff issues); the operation and maintenance of common lab equipment, recordkeeping, personnel issues and standards of good practice; how to troubleshoot problems that may arise in the IVF lab; and topical subjects, such as derivation of embryo stem cells from blastocysts and cloning. Assigned asynchronous discussions with faculty and students connect students with current topics allowing them to present their own experiences and to review the current literature for changes in the field.

## **RCS 706 Gametes and Embryos (3 Credit Hours)**

The objective of this course is to present the recent understanding of the development of gametes and embryos to connect the participants with the molecular principles behind IVF laboratory practice. Using the historic and current literature, this course covers the molecular aspects of the origin of germ cells, oogenesis, spermatogenesis, meiosis, fertilization and preimplantation, development, implantation of embryos, gamete pathology and aging. The students are taught how to evaluate a current journal article and write a research paper to discuss their findings.

## **RCS 707 RMCT: Project & Statistics (2 Credit Hours)**

Statistics and research study design are essential tools in any scientific endeavor. Developing a thesis research study design and understanding the background literature needed to create a capstone review or practice improvement project requires a rudimentary knowledge of basic statistics. In this course, students will receive training in biostatistics, which is the study of statistics used in medical and basic biological research. Students will: learn the fundamental principles of biostatistics, study applications of biostatistics in clinical medicine, participate in statistical problem-solving and learn the fundamental components of a research study design.

## **RCS 708 Advanced IVF, Lab & Skills Dev. (2 Credit Hours)**

Laboratory science and technology are at the foundation of the Clinical Embryology Laboratory, and ART success rates are largely dependent on the quality of the laboratory environment and the knowledge and skill of laboratory personnel. This course covers advanced laboratory skills and techniques used in the IVF and andrology laboratories. A required, on-campus component includes hands-on training and skills evaluation.

## **RCS 709 RMCT: Project Proposal (1 Credit Hour)**

The master's project must be an original project of scholarship or research on a relevant topic in reproductive biology or medicine resulting in a paper. Students select either the review, QC/QI or research track. In all cases, an EVMS and possibly local advisers are selected to help determine the proper approach to the project. Depending on the track selected, a detailed capstone research or QC/QI study design is developed. To aid in capstone writing, a section of the courses have been developed to give the students an outline of the steps for writing their project. Basic elements of the capstone project for the three different tracks are covered: development of a thesis statement, data commentary, introduction, background, discussion and conclusion; specific to the research thesis, materials/methods and results. A major concern in publication today is plagiarism; this topic is also covered in detail. All students in this program are required to take IRB, bloodborne pathogens and HIPAA for research training during this course.

## **RCS 710 Genetics of Rep. & Infertility (3 Credit Hours)**

Many aspects of medicine, including reproductive medicine, are beginning to revolve around underlying genetic causes or predispositions. This course covers many important areas of genetics including: the basis of sex determination with functional anomalies of the reproductive system, the origin of aneuploidy and other chromosomal abnormalities in oocytes, sperm and embryos, the epidemiology and genetic basis of pregnancy wastage, the current status of preimplantation/prenatal genetic diagnosis and its applications and the molecular techniques that are available for PGD and prenatal diagnosis. Current journal article critiques and PGD design projects are used to connect with recent developments in the field.

**RCS 711 RMCT: Masters Project (1 Credit Hour)**

The master's project must be an original project of scholarship or research on a relevant topic in reproductive biology or medicine resulting in a paper. Students select either the review, QC/QI or research track. In all cases, an EVMS and possibly local advisers are selected to help determine the proper approach to the project. Depending on the track selected, a detailed capstone research or QC/QI study design is developed. To aid in capstone writing, a section of the courses have been developed to give the students an outline of the steps for writing their project. Basic elements of the capstone project for the three different tracks are covered: development of a thesis statement, data commentary, introduction, background, discussion and conclusion; specific to the research thesis, materials/methods and results. A major concern in publication today is plagiarism; this topic is also covered in detail. All students in this program are required to take IRB, bloodborne pathogens and HIPAA for research training during this course.

**RCS 712 Male Rep. Function & Dysfunc. (3 Credit Hours)**

The emphasis of this course will be on the physiology and pathology of the male reproductive system in the context of evaluations for male infertility. Knowledge of reproductive function by reviewing recent discoveries about the physiology and dysfunction of the male reproductive system will be presented using current articles and techniques. Relevant areas include: normal and abnormal spermatogenesis, reviewing slides prepared from testicular biopsies, basic semen analysis, standard tests of sperm function using microscopy and specialized functional and "non-functional" sperm evaluating assays. Also covered are disorders like testicular cancer, benign and malignant prostate and genetic causes of male infertility, male contraception and gender pre-selection using sperm. Additionally, students will be challenged with the evaluation of case studies in andrology.

**RCS 713 RMCT: Scientific Writing (3 Credit Hours)**

The master's project must be an original project of scholarship or research on a relevant topic in reproductive biology or medicine resulting in a paper. Students select either the review, QC/QI or research track. In all cases, an EVMS and possibly local advisers are selected to help determine the proper approach to the project. Depending on the track selected, a detailed capstone research or QC/QI study design is developed. To aid in capstone writing, a section of the courses have been developed to give the students an outline of the steps for writing their project. Basic elements of the capstone project for the three different tracks are covered: development of a thesis statement, data commentary, introduction, background, discussion and conclusion; specific to the research thesis, materials/methods and results. A major concern in publication today is plagiarism; this topic is also covered in detail. All students in this program are required to take IRB, bloodborne pathogens and HIPAA for research training during this course.

**RCS 714 Cryopreservation (2 Credit Hours)**

The goals of cryopreservation are to preserve viable gametes, embryos, tissues and even whole organs for future fertility options and to enable augmented pregnancy rates for IVF. In this course, the biological effects of cooling and freezing will be covered in detail. Additionally, the discussion will include the following: principles of cryopreservation using conventional, equilibrium cooling methods, vitrification as an alternative to conventional freeze-thawing, applications and adaptations of low temperature banking for different cell and tissue type as well as safeguards for quality assurance. Assigned asynchronous discussion groups between faculty and students are used to have students present their own experience in the lab or to review current literature to discuss recent changes in techniques.

**RCS 715 Ethics, Society, & ART (1 Credit Hour)**

The objective of this course is to provide the student with a historical background of various traditional beliefs about reproduction, as well as the comments of moral theologians, ethicists, philosophers, sociologists and others about these same beliefs. The student will gain considerable understanding to be prepared to discuss these sensitive subjects with patients. Specifically, the course will provide a limited amount of background material but will refer the student to original sources, as well as to selected commentaries. At the practical level, the student will be presented with clinical case histories and will be expected to discuss the pros and cons of each case and offer a realistic resolution to the ethical or moral dilemma. Grades in this course will be determined by the students' evaluation of these case studies and a take-home exam.

**RCS 716 RMCT:Scientific Writing (1 Credit Hour)**

Students who do not successfully complete the thesis requirement will be required to enroll in this extended writing course until it is completed. This course can only be repeated a select number of times.

**RCS 717 IVF Clinical Internship (3 Credit Hours)**

During the second year of the program, those entering with no or limited experience will be placed in internships at various clinics and at the EVMS training facility. These experiences will give students additional hands-on skills in andrology and embryology that will broaden their knowledge in best practices in the field of IVF.

**RCS 801 Advanced Statistics (3 Credit Hours)**

Advanced Statistics explores the use of statistics in basic and clinical science research. Learn what types, when and how to use different analysis tools for qualitative and quantitative statistics and quality assurance calculations. Particular attention will be focused on clinical and laboratory applications as well as basic science research.

**RCS 802 Assist Repro Prac Journal Club (1 Credit Hour)**

Using the best evidence from literature, learn how to interpret and formulate best practices in IVF. This course will utilize the principles of evidence-based medical practice and adapt them to the clinical IVF environment.

**RCS 803 Comp. Anatomy & Physio of Rep (3 Credit Hours)**

Knowing which type of animal models and how they may be used in research is an essential component of interpreting and applying study outcomes to humans. This course will illustrate the uses and limitations of these animal models in the study of human reproduction.

**RCS 804 Experimental Design (3 Credit Hours)**

Essential skills for a researcher are how to design a study and how to apply advanced experimental modeling techniques. These are both combined here, leading to best practices development in experimental design.

**RCS 805 Advanced Topics IVF (1 Credit Hour)**

Using the literature, students will present current topic areas in IVF, laboratory and clinical research. How to conduct research in this area will also be covered in this course.

**RCS 806 Developmental Biology (3 Credit Hours)**

Study the origin and development of form and patterns in organisms. Recent investigations and recent research methodology on the processes of growth and differentiation are stressed.

**RCS 809 Toxicology and Infertility (3 Credit Hours)**

Environmental factors influence fertility during development, gametogenesis, fertilization and embryogenesis. This course explores the current technology, theories and research surrounding toxins and fertility.

**RCS 810 Research Literature Review (3 Credit Hours)**

During this course, students learn the best techniques for reviewing the literature, summarizing previous data and writing a review of a topic area. Students will produce their own topic literature review by the end of this course.

**RCS 811 Male Infert.Research Lit. (1 Credit Hour)**

Using the literature, students will present current topic areas in male infertility, treatment and research. How to conduct research in this area will also be covered in this course.

**RCS 812 Clinical Laboratory Management (3 Credit Hours)**

All aspects of the management of a clinical lab will be presented in this course. Students will develop new protocols, write risk management reports, develop QC guidelines and design and justify the design of an IVF facility as a portfolio project.

**RCS 814 Genetics and Art (1 Credit Hour)**

Using literature, students will present current topics in ART and genetics. How to conduct research in this area will also be covered in this course.

**RCS 815 Dis. Research Proposal Develop (4 Credit Hours)**

This course gives students an opportunity to structure their research projects and write a proposal for their dissertation.

**RCS 816 Dissertation Research (1-7 Credit Hours)**

The objective of this course is to follow the dissertation research plan and track progress of dissertation research.

**RCS 819 The Business of IVF (1 Credit Hour)**

Management of the IVF facility from the business perspective is the main goal of this course. Students will construct an analysis of a laboratory business plan and propose phased changes to make improvements.