

General Information	BACELOR DEGREE IN BIOTECHONOLOGIES
Title of the subject	Reproductive Biotechnologies in Farm Animals
Degree Course (class)	Industrial and Agri-food Biotechnologies (L-2)
ECTS credits	6
Compulsory attendance	Yes
Language	Italian with slides in English
Academic year	2020/21

Subject Teacher		
Name and Surname	Maria Elena Dell'Aquila	
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Place and time of reception	Online reception via TEAMS platform after email request	
ECTS credits details	Discipline sector (SSD)	Area
	VET/10	Affine

Study plan schedule	Year of study plan	Semester
	3°	1°

Time management	Lessons	Laboratory	Exercises	Total
CFU	4	2		6
Total hours	100	50		150
In-class study hours	32	24		56
Out-of-class study hours	68	26		94

Syllabus

Prerequisites / Requirements

Although it is not mandatory, it is desirable to possess basic knowledge on following topics:

- anatomy and histology of the reproductive system;
- ovarian cycle and its hormonal regulation;
- mitosis and meiosis in human;
- regulation of gene expression in eukaryotic cells;
- main intracellular signaling mechanisms elicited by protein and steroid hormones.

Expected learning outcomes (according to Dublin descriptors)

Knowledge and understanding	<p>The course has the following purposes:</p> <ol style="list-style-type: none"> 1) to allow the student to understand the dynamics of the management of reproductive activity in livestock; 2) to give the student the ability to set up in vitro cultures and to conduct quality analyzes of animal gametes and embryos, set in relation to the physiological context in which the events of development and functional maturation of germ cells occur and within the framework of a complex and unitary vision of the in vitro production process of a viable embryo to be destined for animal production industry; 3) to promote in the student the aptitude for reading and interpreting
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	<p>texts and articles of international scientific literature in the sector in order to bring him/her closer to the most important international realities of research and clinical practice in the field of reproductive biotechnologies in farm animals in a comparative and methodologically profitable intercultural dimension;</p> <p>4) to solicit in the student the propensity to analyze his own experimental data, bringing him/her closer to the use of appropriate statistical analyses;</p> <p>5) to consolidate the student's expressive skills within the discipline in both Italian and English; to this end, a few hours of activity will be dedicated to the analysis of scientific articles in English on the topics of the course.</p>
Applying knowledge	<ul style="list-style-type: none"> - Knowledge of the physiological mechanisms of gametogenesis, the acquisition of the functional maturation of gametes, fertilization and development of the embryo in mammals; - Knowledge of the methods suitable for reproducing these physiological mechanisms in vitro applied to livestock; and the relative differences and similarities among different animal species;
Making informed judgments and choices	<ul style="list-style-type: none"> - Ability to evaluate, following the guidelines of the international scientific societies indicated by the professor, the normal or pathological condition of reproductive cells (oocyte, sperm or embryo) following morphological and/or functional parameters; - Ability to evaluate samples with different and integrated methods, even non-invasive and able to preserve sample viability;
Communicating knowledge	<ul style="list-style-type: none"> - Ability to present the contents of the course using appropriate terminology also in English and linking the concepts in a complete path that, starting from the aims, comes to describe the methods and related parameters and evaluation indices
Capacities to continue learning	<ul style="list-style-type: none"> - Ability to learn the contents of the course based on the attention shown to the lessons and exercises and the ability to study from texts in Italian and English indicated by the professor.
Study Program	
Content	<p>Part I (Frontal lessons)</p> <ul style="list-style-type: none"> - Introduction to reproductive biotechnologies in livestock. Importance of livestock models in reproductive toxicology. - Folliculogenesis and oogenesis. Hormonal regulation of oocyte maturation. Superovulation and estrous cycle synchronization. Applicative aspects in livestock. - Spermatogenesis and hormonal regulation. Macroscopic, microscopic and computerized analyzes of semen quality (concentration, vitality, motility, morphology, capacitation and acrosome reaction, integrity of sperm chromatin, apoptosis, energetic and oxidative state). - Physiological aspects of capacitation and acrosomal reaction, sperm-zone binding and fertilization. Anomalies of meiosis and fertilization. - In vitro embryo production (IVP). Recovery and selection of the oocyte. In vivo egg retrieval methods: Trans-vaginal oocyte aspiration (TVA) and Ovum pick-up (OPU). In vitro oocyte maturation (IVM); Selection of the motile fraction of the semen (swim-up and density

	<p>gradient centrifugation) and in vitro fertilization (IVF); In vitro embryo culture; co-cultures with enhancer cell monolayers. Transfer of embryos. Efficiency and current results of in vitro embryo production procedures in livestock.</p> <ul style="list-style-type: none"> - Cryopreservation of oocytes and embryos (hypothermic storage, slow freezing and vitrification). - Assisted microfertilization technologies. Applications of the ICSI technique (Intracytoplasmic sperm injection) in farm animals. Piezo- and Laser-assisted ICSI. - Computerized methods for the evaluation of the quality of oocytes (Polscope), spermatozoa (Sperm CASA System and Cytofluorimetry) and embryos (morphometric analysis; Long-Term Time-Lapse monitoring). - Applications of OMICS technologies to the study of the meiotic competence of the oocyte and pre-implantation embryonic development. - Embryonic manipulations: <ul style="list-style-type: none"> 1) Genetic tests on preimplantation embryo (PGT), embryo biopsy, sexing, diagnosis of chromosomal imbalances, identification of a pathological gene; 3) Manipulations aimed at producing multiple copies. Animal cloning: from embryo bisection to somatic cell nuclear transfer (SCNT and HMC). Production of transgenic animals and transgenic cloned animals. Aims in the biomedical and zootechnical fields. - Embryonic stem cells (ESC) and fetal adnexa-derived mesenchymal stem cells (FAD-MS). Methods and goals in farm animal models. <p>Part II (Laboratory activities):</p> <ul style="list-style-type: none"> - Practical introduction to the reproductive biotechnology laboratory; in vitro retrieval and maturation (IVM) of oocytes. - Thawing and evaluation of the quality (viability, motility and concentration) of spermatozoa. - In vitro seed capacitation and in vitro fertilization with conventional (IVF) and micromanipulative (ICSI) techniques. - In vitro embryo culture (IVEP) and conventional evaluation of embryonic morphology (CMA). - Immunofluorescence methods applied to the cumulus-oocyte complex, spermatozoa and embryos (Epifluorescence and confocal laser scanning microscopy). - sperm CASA analysis; embryo CMA and TLM analysis.
Bibliography and textbooks	<ul style="list-style-type: none"> - Gordon I. (2003) <u>In vitro production of cattle embryos</u>. CAB International, Dublin, UK <p>Articles from scientific journals of the sector recommended and delivered by the professor.</p>
Notes to textbooks	<p>All information concerning the texts and scientific articles included in the program is available from the teacher or online.</p>
Teaching methods	<ul style="list-style-type: none"> - Frontal lessons with PPT support - Frontal lessons with video projection and comments - Single seat laboratory exercises - Virtual laboratory activities with PPT and commented videos
Assessment methods (oral, written, ongoing assessment)	<p>Oral examination Ongoing tests after agreement with the interested students</p>
Evaluation criteria (describe criteria for each of the above)	<p>At the end of the course the student is expected to have acquired:</p> <ul style="list-style-type: none"> 1) ability to describe the methods of setting up in vitro cultures and analyzing the quality of gametes and embryos of farm animal species,

expected outcomes)	in relation to the physiological context in which the events of development and functional maturation of these cell systems occur and in the context the overall in vitro production process of a viable embryo for the use of animal production industry; 2) ability to read and interpret texts and articles of international scientific literature in the sector to approach the most important international realities in the animal reproduction field; 3) ability to analyze their own experimental data through the use of appropriate statistical analyzes; 4) expressive skills within the discipline in both Italian and English. 5) knowledge of the chronology and evolution of the methodologies presented up to the current methods with relative limits and prospects for evolution and improvement.
Further information	Students can always contact Prof. ME Dell'Aquila at the following mail address: mariaelena.dellaquila@uniba.it