

# 2017 - ANS 6702

## Physiology of the Mammary Gland and Lactation



### Instructor:

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Office Hours: by appointment

**Time and Location:** MW; 10:40 - 11:30 am; 2250 Shealy Drive, Room 102 (Animal Sciences Bldg.)

### Course description

Prerequisites: ANS 6704 (Mammalian Endocrinology) or permission from advisor.

This course will offer insights into the endocrinology and physiology of the defining characteristics of mammals: the mammary gland and lactation, focusing on the anatomy and development of the mammary gland with an overview of the biochemical, cellular and molecular processes controlling lactation emphasizing on livestock species. (**2 credits**)

### Course learning objectives and expected outcomes

Upon completion of the course, the student will be able to:

1. Describe the anatomy and physiology of the mammary gland.
2. Outline the prenatal development of the mammary gland and its changes throughout the lactation cycle controlled by systemic (hormonal) and local (autocrine/paracrine) mechanisms.
3. Discuss the physiological, biochemical, cellular and molecular processes controlling the process of milk formation, milk ejection and factors affecting milk yield.
4. Distinguish the major components of mammalian milk and their functions for the neonate.
5. Apply learned concepts to critically evaluate management issues related to lactation in farm animals.
6. Read, interpret and discuss scientific articles relating to mammary gland biology.

### Recommended reading material and text books

There is no assigned textbook for this class. The following reading materials are recommended for the students' consultation:

- Lactation and the Mammary Gland. R. Michael Akers. 2002. Iowa State Press.
- Lactation Biology Website: University of Illinois: <http://classes.ansci.illinois.edu/ansc438/index.html>
- Lactation on the NIH website: <http://mammary.nih.gov/>
- Capuco AV, Akers RM. The origin and evolution of lactation. *J Biol.* 2009; (4):37.
- Weaver SR, Hernandez LL. Autocrine-paracrine regulation of the mammary gland. PMID:26299162
- Neville MC et. al. 2002. Hormonal Regulation of Mammary Differentiation and Milk Secretion. *J Mammary Gland Biol Neoplasia.* (7):49.
- Capuco AV et. al. 2001. Mammary Cell Number, Proliferation, and Apoptosis During a Bovine Lactation: Relation to Milk Production and Effect of bST1. *J. Dairy Sci.* (84):2177
- Stein T, et al. 2007. Mammary Gland Involution as a Multi-step Process. *J Mammary Gland Biol Neoplasia* (12):25.

## Course Schedule

**Week 1.** August M 21: Course overview & introduction to lactation  
August W 23: Evolution of the mammary gland and lactation – assign each student a “mammal”

**Week 2.** August M 28: Mammary anatomy I: *macrostructure*  
August W 30: Mammary anatomy II: *microstructure (secretory cell and organelles)*

**Week 3.** Sept M 4: Holiday, no class  
Sept W 6: Mammary anatomy III: *circulatory, lymphatic and neural systems*

**Week 4.** Sept M 11: Mammary growth and development I: *fetal through puberty*  
Sept W 13: Mammary growth and development II: *Post-puberty through involution*

**Week 5.** Sept M 18: Neuro-endocrine control of lactation  
Sept W 20: Colostrum and Milk composition

**Week 6.** Sept M 25: Presentations (2): “My favorite mammal”  
Sept W 27: Presentations (2): “My favorite mammal”

**Week 7.** Oct M 2: Exam review section  
**Oct W 4: Mid-term 1**

**Week 8.** Oct M 9: Lactogenesis  
Oct W 11: Galactopoiesis

**Week 9.** Oct M 16: Involution  
Oct W 18: Milk carbohydrate synthesis and secretion

**Week 10.** Oct M 23: Milk protein synthesis and secretion  
Oct W 25: Milk lipids synthesis and secretion

**Week 11.** Oct M 30: Exam review section  
**Nov W 1: Mid-term 2**

**Week 12.** Nov M 6: Seven Habits of successful milking routines  
Nov W 8: Farm visit – parlor routine and dairy cow management

**Week 13.** Nov M 13: Graduate students’ presentation & debate (1)  
Nov W 15: Graduate students’ presentation & debate (2)

**Week 14.** Nov M 21: No class  
Nov W 23: Holiday, no class

**Week 15.** Nov M 27: Mammary gland immunology & Mastitis  
Nov W 29: Factors affecting milk yield: Manipulation of Milk Production

**Week 16.** Dec M 4: Exam review section  
**Dec W 6: Mid-term 3**

(\*) *Debate topics:* bST administration to dairy cows, organic *vs.* conventional dairy farming, skim *vs.* whole milk, robotic *vs.* conventional milking, among others.

**Course website:** lectures, supplementary materials, syllabus, assignments and grades will be available in Canvas: <http://elearning.ufl.edu/>

## Grades

Students can earn a maximum of **475 points**. The final grade will be based on: two midterms (100 points each), a non-cumulative final (100 points), an individual presentation (25) and short essay (50), a group presentation (50), and 5 homework assignments through the course (10 points each).

Individual presentation format: 5-8 minutes, topic: "Your favorite mammal".

Short essay: (3 pages) on your chosen mammal's characteristics and lactation strategy.

Group presentation: 15 minutes on a topic selected by the instructor.

Homework format: questions from lecture materials that will allow students to better prepare for the midterm and final exam.

## Grading scale

<b>A</b> ≥93%	<b>B-</b> ≥ 80 to < 83%	<b>D+</b> ≥67 to < 70%
<b>A-</b> ≥ 90 to < 93%	<b>C+</b> ≥77 to < 80%	<b>D</b> ≥63 to < 67%
<b>B+</b> ≥ 87 to < 90%	<b>C</b> ≥ 73 to < 77%	<b>D-</b> ≥60 to < 63%
<b>B</b> ≥ 83 to < 87%	<b>C-</b> ≥ 70 to < 73%	<b>E</b> <60

## Important dates!

August 21 - First day of class

September 25 and 27 – Students presentations

October 4 - First mid-term

November 1 – Second mid-term

November 13 and 15 – Group presentations

December 6 - Third mid-term

Information regarding University Policy on grade point equivalencies and calculation of grade points is located at the following web address:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>.

**Please note:** This course is taught concomitant with the graduate version **ANS 6702**. The graduate students will be required to perform all of the graded tasks as listed above and they will also be required to write an essay on a chosen mammal's characteristics and lactation strategy, and present (group presentation of 15 minutes) on a research paper or topic selected by the instructor.

## Attendance and make-up work

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

It is highly recommended that you do not miss class as your final grade will be positively correlated with attendance. A student missing an exam will be allowed to make up the exam if a documented, valid reason as outlined in UF's policy for excused absences exists. This problems should be discussed with the instructor in advance (when possible), preferably by email. A missed exam for an unexcused absence will be considered as a "0".

## University of Florida Complaints Policy

Please visit: [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

### Services for students with disabilities

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

0001 Reid Hall, 352-392-8565, [www.dso.ufl.edu/drc/](http://www.dso.ufl.edu/drc/)

### Academic honesty

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *"We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment."*

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

### Software use

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

### Campus helping resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- *University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, [www.counseling.ufl.edu/cwc/](http://www.counseling.ufl.edu/cwc/)*  
Counseling Services  
Groups and Workshops  
Outreach and Consultation  
Self-Help Library  
Wellness Coaching
- U Matter We Care, [www.umatter.ufl.edu/](http://www.umatter.ufl.edu/)
- *Career Resource Center, First Floor JWRU, 392-1601, [www.crc.ufl.edu/](http://www.crc.ufl.edu/)*