Animal Science 4384/7384
Reproductive Management
Fall Semester 2014

1. Instructors:  
Dr. M.F. Smith  
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Dr. R.S. Prather  
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Dr. T.J. Safranski  
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2. Office hours:  
After class or by appointment

3. Prerequisite:  
Senior standing, AnSc 3254 (Physiology of Domestic Animals) or equivalent, and instructor’s consent.

4. Instructors Background:

Dr. M.F. Smith  
I have been a member of the Animal Science faculty at MU since 1980 and I have both teaching (undergraduate and graduate) and research responsibilities. I also teach AnSc 4314/7314 (Physiology of Reproduction), a graduate course (AnSc 9434: Neuroendocrine and Gonadal Function), and I help coordinate the F.B. Miller Reproductive Management Internship Program.

The long range goal of my research program is to develop methods of improving reproductive efficiency in cattle. More specifically, my graduate students and I are trying to better understand the mechanisms regulating ovarian follicular maturation, ovulation, corpus luteum function, and the establishment/maintenance of pregnancy in cattle. We are also working with Dr. Dave Patterson (State Beef Cattle Reproduction Specialist) on the development of economical and effective methods for fixed-timed insemination of beef heifers and cows.
Dr. R.S. Prather
I have been a member of the Animal Science faculty at UMC since 1989. My primary academic responsibilities are in research and my lab is focused on two areas: 1) to describe normal embryonic development on a cellular and molecular level during the first week of development, and 2) to apply this knowledge to techniques that will decrease reproductive losses and enhance reproductive efficiency.

Dr. T.J. Safranski
I have been on the faculty at MU since 1994 with extension and research responsibilities for genetics and reproductive management of swine. A lot of my effort is spent educating producers and animal caretakers for commercial swine farms with an emphasis on the breeding herd. I have extension and research projects in both genetics and reproduction in both the boar and gilt/sow looking at development of replacements, seasonality of reproduction and heat stress. I also am collaborating to develop objective semen evaluation tools. The ultimate goal is to take my research findings to application on commercial farms in Missouri and beyond. Additionally I teach Animal Science 4978, the Capstone course in swine production.

5. Teaching Philosophy:

Science is not just something you do but a way of thinking about the world. Each of us has numerous opportunities to utilize our scientific training as we go about our daily lives. For example, when presented with a problem (e.g. car won’t start) we formulate a hypothesis about why it won’t start and subsequently modify the hypothesis as we obtain more information about why it won’t start. As scientists we also realize that not all information is created equal and we learn to carefully analyze the accuracy of information before we make a decision or draw a conclusion. The preceding points are relevant to problem solving in a production/management setting.

There is a profound difference between being an animal scientist verses a student enrolled in an animal science course! It is one thing to memorize information but another thing to utilize information to gain insight into a problem or make an intelligent decision. Students commonly compartmentalize information from individual courses and don’t learn to integrate their knowledge. Becoming an animal scientist involves assimilating and integrating information to make a decision or draw a conclusion. To be an animal scientist you need to think like an animal scientist and do the things that animal scientists do such as: 1) Integrate information from various disciplines (physiology, nutrition, forage management, genetics, growth biology, meat science & muscle biology, fisheries and wildlife biology, and economics) to make sound animal management decisions, 2) Apply biological concepts to the management and genetic improvement of livestock and companion animal species, 3) Consider the impact of management decisions on
animal welfare and the environment, 4) Calculate the economic impact of management decisions on a livestock or poultry operation, 5) Realize that animal scientists produce food instead of a commodity (e.g. produce beef vs. raising calves), 6) Become competent in a variety of animal husbandry skills, 7) Teach others about animal science, 8) Discuss animal science concepts with other animal scientists and with the public, and 9) Read, write, and think about animal science. **My approach to teaching is to help you become an animal scientist and I have designed this course to help accomplish this goal!** Additional information on my teaching philosophy is included in sections 6 and 7 (see below).

6. Instructors Responsibilities:

I view teaching as a partnership in which the instructor and students each have responsibilities. My responsibility is to do the best job possible of teaching this course. I hope to challenge you to learn more than you think you are capable of learning and to provide opportunities for you to think and act as an animal scientist. With each academic success comes additional confidence to successfully face a greater challenge in the future. I also believe that students will remember information they discover for themselves longer than information they simply hear during a lecture. Therefore, the laboratory sessions have been designed to be interactive and to provide students with as much hands-on experience as possible.

Becoming a self-directed learner and gaining the ability to critically analyze information are essential for your intellectual development. You will remember information that is relevant to you and that is presented in a meaningful context (i.e., connected to other information you have learned). Therefore, the course content is based on real world situations. In addition to long term retention of information, I expect you to critically analyze information, solve problems, present a logical argument, communicate effectively, and work as a productive member of a team. Consequently, I have developed a series of reproductive management problems, a heifer development exercise, case study, and a five-year reproductive management plan to aid your development in these areas.

I plan to come to each class well prepared and to clearly communicate the course material. I have developed a series of reproductive management questions that you will be expected to answer during the laboratory sessions (see laboratory performance). The purpose of these questions is to connect the course content with the animal industry. I am also eager to answer any questions you may have during the lecture or laboratory sessions. I enjoy and encourage class discussions.

7. Student’s responsibilities:

I expect you to come to each lecture and laboratory session with a desire to become an animal scientist. You are expected to read the assigned articles and
complete each class and laboratory assignment. You are also expected to study the material thoroughly outside of class, discuss the course material with your instructors and classmates, ask questions about subjects that are unclear to you, and initiate class discussions. I expect you to make efficient use of each laboratory session – dress appropriately, arrive on time, be prepared to answer the assigned laboratory questions, and work hard to learn the following techniques – semen handling, passing catheters through the cervix, pregnancy diagnosis, real-time ultrasonography of ovarian structures, reproductive tract scoring, and pelvic measuring. Remember, learning is an active process and requires time and effort!

8. Americans with Disabilities Act:

If you have special needs as addressed by the Americans with Disabilities Act (ADA) and need assistance, please notify the Office of Disability Services, A048 Brady Commons, 882-4696, or the course instructor immediately. Reasonable efforts will be made to accommodate your special needs.

9. General Course Objectives:

1. Enable students to learn the fundamental principles of reproductive management in cattle and pigs.

2. Familiarize students with procedures and techniques used for improving reproductive efficiency in cattle and pigs. Physiological mechanisms regulating important reproductive events will be presented.

3. Enable students to economically integrate principles of reproductive management in solving problems.

4. Provide hands on experience with semen handling, artificial insemination, and pregnancy diagnosis.

10. Additional Course Objectives

A student enrolls in a course with specific expectations which may or may not be aligned with the instructor’s expectations. The question is: “What are you expecting to learn from this course?” There are a number of things that can be accomplished in a course that go beyond the general course objectives, the most important of which is learning how to learn! Although this is a course on reproductive management, it is also a course on the application of scientific principles toward solving real-world problems. The lecture and laboratory sections of Reproductive Management are designed to provide you with a variety of learning opportunities (see below). In fact, you can think of this course in the following ways:

A) A course in which you learn to be an animal scientist.
B) A course in understanding the application of biological principles to controlling reproductive events in livestock species.

C) A course in learning the techniques of estrous detection, semen handling, artificial insemination, and pregnancy diagnosis (similar to an AI school).

D) A course in learning to apply principles of reproductive management to improve reproductive efficiency of beef cattle.

E) A course in learning how to integrate knowledge from other courses (i.e. nutrition, genetics, reproductive physiology, and economics) in developing a plan to increase reproductive efficiency in a beef herd.

F) A course in learning to appreciate the complexity of managing animals to economically maximize reproductive efficiency.

G) A course in learning patience and perseverance as you deal with the frustration of learning the artificial insemination technique and the development of a five year reproductive management plan.

11. Learning Outcomes for Reproductive Management.

After completing this course you should be able to clearly explain the following concepts to a producer or perform the following techniques:

A) Problems associated with long calving seasons and how to correct them.

B) How to assess the reproductive performance of a herd and to predict the pregnancy rate at the end of a breeding season and subsequent pounds of calf weaned after implementing a management change.

C) Changes in a dominant follicle (follicular waves) and corpus luteum throughout the estrous cycle.

D) Advise a producer regarding the most appropriate estrous synchronization protocol for a particular set of heifers or cows – provide advantages and disadvantages of each protocol.

E) Be able to explain the biological process by with a specific estrous synchronization protocol synchronizes follicular waves and corpus luteum lifespan in cows at different stages of the estrous cycle.

F) How to use expected progeny differences to select the most appropriate sire for a particular management situation.
G) The biological changes that a heifer experiences when she attains puberty or when a postpartum cow resumes normal estrous cycles.

H) Management practices that will maximize reproductive performance in beef heifers and postpartum cows.

I) The factors that affect dystocia in cattle and management practices that minimize calf loss at birth.

J) Describe the fundamental principles of cryopreservation of sperm and embryos, cloning, transgenics, gender selection of offspring, and in vitro embryo production. Explain how these relate to beef production.

K) Be able to properly thaw and handle frozen semen, efficiently pass an insemination gun through the cervix of a cow, determine the reproductive tract score of a heifer, visualize ovarian structures with real-time ultrasonography, measure pelvic area of a heifer, and determine if a cow is pregnant.

L) Understand how to collect, evaluate and process boar semen for artificial insemination.

M) Appreciate gilt development (health, rearing conditions, puberty management…. ) and its importance for lifetime productivity.

N) Be able to discuss multiple methods of synchronizing estrus in sows and gilts and select which method may be applicable to a given scenario with special attention to reducing non-productive sow days.

O) Be able to weigh pros and cons of farrowing induction protocols and understand when to use them.

P) Understand seasonal patterns of reproduction in swine and how to minimize their impact on a commercial swine farm.

12. Study Tips:

1. Attend class, review your notes several times a week, and complete each class and laboratory assignment.

2. Know and be able to apply the information in the handout entitled “Fundamental Concepts of Reproductive Management in Beef Cattle.”

3. Prepare a list of vocabulary words and review them weekly.
4. Discuss the fundamental concepts (see item 2 of this section) and vocabulary words with your classmates. Discussing class information in and outside of class is an excellent learning strategy.

5. Conscientiously seek out answers to the lab questions each week.

6. If you don’t understand a concept ask one of the instructors or TA’s.

7. Utilize the learning materials available on the course website and Blackboard.

8. Prepare a course portfolio (see below).

13. Textbook:

There is no required textbook for this class; however, there will be periodic reading assignments from articles that will be posted on Blackboard (see below).

14. Teaching Assistants:

Dylan Hamlin - dlhqm9@mail.missouri.edu
Rhianna Wallace - rmw44b@mail.missouri.edu

15. Information Technology

In this course I will utilize Blackboard and the course website. Below I have described how to use both forms of communication.

A. Blackboard

I will utilize Blackboard to provide you with course announcements, reading assignments, and weekly laboratory questions. In addition, you will be able to follow your grade throughout the semester. The course description, syllabus, reading assignments, case studies, and laboratory questions can be found under Course Documents.

B. Course Website

The website for the course can be accessed at http://animalsciences.missouri.edu (see AnSc 4384 – Reproductive Management under courses). The website contains information regarding the heifer development exercise, five year reproductive management plan and a link to videos that demonstrate estrous detection, semen collection, semen processing, and artificial insemination for a variety of species. There is also a link to animations that will allow you to visualize various aspects of the reproductive process. The videos and animations were provided by Dr. Rod Geisert (Division of Animal Sciences).
16. Examinations and Grading System:

A. Final grade will depend upon performance on the following methods of evaluation:

1. Two examinations (100 pts per exam)
2. Laboratory performance (50 pts)
3. Reproductive Mgmt Plan (100 pts)
4. Management problems (50 pts)
5. Heifer development exercise (50 pts)
6. Case study (50 pts)

B. Grading System:

Final grade determined by percentage of total possible points earned (total possible points = 500).

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Due to the opportunity to earn extra credit no grade curve will be developed for this course.

C. Extra Credit

The opportunities for extra credit are as follows: 1) demonstration of exceptional effort, creativity, and(or) leadership in developing a five year reproductive management plan, 2) initiating and sustaining a serious classroom discussion (during lecture) that involves at least three other students, 3) preparation of materials that assist your classmates in developing their reproductive management plan, or understanding the course material, and 4) preparation of a course portfolio (see below).

Course Portfolio:

A course portfolio should include the following: 1) cover page, 2) table of contents, 3) copy of your notes and all handouts, 4) all homework problems, with mistakes corrected, 5) complete answers to each of the laboratory questions, 6) heifer development write up, 7) case study write up, 8) exam 1, with mistakes corrected, 9) a copy of your reproductive management plan with an explanation of
any revisions you would like to make, and 10) A summary of the major concepts you learned from the course. Extra credit points (20 pts maximum) will be added to your point total if your portfolio meets all the requirements.

D. Missed Examinations

If you are going to be absent from class due to an official university function (athletic team, judging team, etc.) you need to contact me before the exam.

E. Laboratory Performance (50 points)

Students are expected to pass ten insemination catheters through the cervix of ten different cows (3 pts per catheter; total = 30 pts.) by the final laboratory at the farm (November 4th). This goal can normally be attained by attending each laboratory session.

Each week you will receive a reproductive management scenario and (or) questions to answer during the laboratory session (Blackboard – see assignments). You are expected to be able to answer the questions at the next laboratory session! You are encouraged to discuss the answers to the questions with your classmates before coming to lab. After discussing each question in lab the instructor will provide a full explanation of the answer to each question. You should bring the questions to each laboratory and be sure to write down the correct answers to each question. You will be evaluated on attendance and your ability to answer the questions during lab (total pts. per student will be 20).

F. Reproduction Plan (100 points)

Students will be required to develop a detailed plan for improving reproductive efficiency in a beef herd over a 5 yr. period. The objectives of this exercise are to: 1) understand the constraints of different geographical locations on approaches to reproductive management, 2) improve reproductive efficiency in a beef cowherd through implementation of reproductive management principles, and 3) determine the economic impact of reproductive management decisions in a beef herd.

Groups consisting of three students will be provided with the reproductive and economic records of a farm/ranch located in different parts of North America. You will be asked to create a reproductive management plan consisting of 1) detailed discussion of farm/ranch environment (climate, terrain, forage and grain availability, and stocking rate; season for breeding and calving; and justification for choice of breed), 2) assessment of current level of reproductive performance, 3) identification and economic justification of specific (measurable) objectives, 4) discussion of alternatives for accomplishing specific objectives, 5) the specific objectives for the genetic improvement of your herd including the economically relevant traits that you will be giving emphasis to (i.e. calving ease, weaning weight, yearling weight, carcass traits, etc), 6) a description of your marketing
plan and justification of why your group chose a specific marketing system, and
7) an annual and five year reproductive and economic summary. You will obtain
livestock marketing information for your assigned location via the Internet. Excel
spreadsheets have been developed to calculate the reproductive efficiency of
postpartum cows and replacement heifers based on the groups’ management
decisions and to calculate a yearly economic summary for each of the five years.
Management decisions need to be justified in a written report, and oral
presentations will be given to the class upon completion of the project. Finally,
you have the opportunity to add another profit center to your operation (e.g.
agrotourism, hunting expeditions, fishing expeditions, guest ranch, etc).

G. Management Problems (50 points)

Nine reproductive management problems have been developed that will teach you
how to mathematically predict the effect of specific management practices on
pregnancy rate and pounds of calf weaned in a beef herd. Successful completion
of the management problems will help you with the development of your
reproductive management plan.

H. Heifer Development Exercise (50 points)

One of the best ways to improve reproductive management of a beef herd is by
replacing nonpregnant and late calving females with early calving heifers.
Therefore, understanding the basic principles of heifer development will be a
critical component of the course. You can access the heifer development exercise
on the course web site (see Heifer Development tab). This is a problem-based
learning exercise that will require you to make a series of management decisions
on a group of replacement heifers. You will also be able to determine the impact
of your decisions on the reproductive performance of the heifers, growth
performance of the calves born to the heifers, and the profitability of the
marketing decisions you make regarding the weaned calves.

I. Case Study: A Global Perspective of Reproductive Management (50
pts)

An important objective of this course is to train you become a manager who can
assimilate and integrate information to make a decision or draw a conclusion.
Case studies are a good learning tool for helping accomplish this objective.
Furthermore, the ability to solve problems on an international scale will become
increasingly important. A large proportion of the agricultural labor force within
the USA consists of international workers (e.g. Hispanic workers); therefore, the
ability to educate and communicate cross culturally is essential. Consequently,
this exercise has been designed to help you solve a reproductive management
problem in Brazil. The specific learning objectives are as follows: 1) Become
more familiar with Brazilian beef production, 2) Enhance your critical thinking
and decision making skills, 3) Learn to solve management problems in another
country, and 4) Understand how theory relates to application in an international work place.

J. Students with Disabilities:

If you anticipate barriers related to the format or requirements of this course, if you have emergency medical information to share with me, or if you need to make arrangements in case the building must be evacuated, please let me know as soon as possible.

If disability related accommodations are necessary (for example, a note taker, extended time on exams, captioning), please register with the Office of Disability Services (http://disabilityservices.missouri.edu), S5 Memorial Union, 882-4696, and then notify me of your eligibility for reasonable accommodations. For other MU resources for students with disabilities, click on "Disability Resources" on the MU homepage.

K. Academic Dishonesty:

Academic honesty is fundamental to the activities and principles of a university. All members of the academic community must be confident that each person’s work has been responsibly and honorably acquired, developed, and presented. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. The academic community regards academic dishonesty as an extremely serious matter, with serious consequences that range from probation to expulsion. When in doubt about plagiarism, paraphrasing, quoting, or collaboration, consult the course instructor.

Cheating on exams or assignments will not be tolerated. Any person caught cheating will automatically receive a failing grade (F) on the exam/assignment. According to university policy any instructor who is aware of an incident of academic dishonesty is required to report the incident to the Divisional Director and to the Assistant Provost.

17. Lecture Topics:

A. Opportunities for increasing productivity of livestock species

B. Predicting reproductive performance in heifers and cows

C. Reproductive loss
   a. Incidence of reproductive loss
   b. Factors contributing to reproductive loss
D. Reproductive management
   a. Puberty
   b. Estrous synchronization
   c. Parturition
   d. Dystocia
   e. Postpartum reproduction
   f. Male fertility

E. Swine reproductive management

F. Gamete and embryo technology
   a. Embryo development
   b. Cloning
   c. Cryopreservation
   d. Transgenics
   e. Genetic markers

18. Laboratory Topics:

A. Artificial insemination (cattle and swine)
   a. Care and maintenance of a semen tank
   b. Semen handling
   c. Estrous detection
   d. AI equipment and technique
   e. Replacement heifer selection
   f. Sire selection

B. Pregnancy diagnosis (cattle and swine)

C. Real-time ultrasound of ovarian structures and pregnancy

D. Embryo Transfer

E. Reproductive management of swine

F. Presentation of reproduction plans