Title: Genetic Strategies in Plant Breeding (Agronomy625) Instructor: Michael Lee
Schedule for Agronomy 625 for Spring 2003
Meetings: Tuesday and Thursday, 11:00-12:30, room 2026, Agronomy Hall

Date	**Topics**
	SECTION I - Aspects of Plant Nuclear Genomes & Genetic Mechanisms
Jan.14	Course overview & rationale (why plant genetics?)
16	Nuclear genome - size, structure, composition, conservation &organization
21	Continuation of nuclear genome.
23	RNA transposons I - organization and function
28	RNA transposons II - implications for genome structure and genetic variation
30	DNA transposons I - organization and function
Feb. 4	DNA transposons II and Insertional Mutagenesis - implications for genome structure, genetic variation, exploitation for basic and applied research
6	Recombination I - analysis of patterns, consequences and mechanisms, native elements & physical and genetic mapping
11	Recombination II - continuation of previous session
13	Recombination III - technology and techniques for manipulating and directing recombination;
	SECTION II - Understanding and Manipulating Gene Expression
18	Chromatin. Gene expression I - overview, detection, inducible systems, methods of down regulation with examples
20	Gene expression II - continuation of part I & technical advances for surveying transcription (differential display, arrays, chips) and translation.
25	Epigenetics - methylation, imprinting & paramutation
27	Epigenetics - associations with phenotypes and phenomena
March 4	Epigenetics - What could investigations of gene expression reveal about heterosis and inbreeding?
	SECTION III - Producing and Utilizing Transgenic Plants
6	Transgenic Crops - recent technical advances for delivery
11	Transgene stability - MARs/SARs (Chromatin continued).
13	Transgene stability & inheritance - mechanisms of gene silencing & interactions
17-21 off	
25	Transgene stability & inheritance - mechanisms of gene silencing & interactions
27	Transgenics - Breeding Issues and Strategies
April 1	Why Transgenic Crops? - Societal & Environmental Concerns (e.g. escapes, recombinants, resistance, control, centralization), Risks & Benefits
	SECTION IV - Trait Modification
3	Plant Reproductive Biology and Seed Production I - genetically engineered male sterility systems, models for deployment and effects on breeding strategies.
8	Plant Reproductive Biology and Seed Production II
10	Plant Composition I - oils, proteins and other components
15	Plant Composition II & Metabolic Engineering
17	Insect Resistance
22	Disease Resistance I - viral diseases
24	Disease Resistance II - bacterial and fungal pathogens
29	Resistance to Abiotic Stress I- soil fertility, water deficits, temperature and free radicals.
May 1	Resistance to Abiotic Stress II .

Goals of course:

1. become more familiar with genetic, molecular, and cellular approaches to & aspects of crop improvement & plant breeding.
2. identify areas of basic biology and technology of current and potential significance to crop improvement & plant breeding.
3. discuss and critically evaluate concepts, research, methods, information and interpretation pertaining to genetic characterization and modification of crop species in the context of plant breeding programs.
4. review established plant breeding methods, schemes, and principles and their possible enhancement through recent advances in plant biology and technology.

The purpose of this course is to provide examples and a survey of current methods and knowledge and their actual or potential implications for crop improvement. Detailed knowledge of methods and principles discussed in this class may be obtained in more specialized courses in biochemistry, statistics, plant breeding, quantitative genetics, genetics, plant biology and plant pathology. **This course is not intended to be a technical "methods" course; rather, the emphasis is synthesis and evaluation.**

Prerequisites and other preparation: Agron 521, Gen 410, Bot 545, or permission of instructor (who understands that the format and content of some prerequisite courses have changed)

Student evaluation:

1. Class participation (10% of final grade). Most of the class time will be spent reviewing and discussing literature. Copies of the assigned literature and questions/topics for discussion will be distributed to the class (The instructor will arrange to make the copies and the students will pay for the copies near the end of the semester). Each student is responsible for reading each manuscript and for being prepared to address the questions/topics listed for discussion in class. Courage.
2. 2-3 homework assignments (30%).
3. 5-7 written in-class quizzes (60%). The quizzes will be based on the major points and concepts of the assigned literature and the discussion questions/topics. The subject matter of the quizzes will be the questions/topics covered in the most recent meetings of the class. The quizzes are NOT cumulative. The quizzes provide an objective means for me to assess your understanding of the subject matter. The lowest quiz grade for each student will be omitted in the calculation of the final grade for the course.

Critical reading and evaluating of research manuscripts for Agronomy625. This is one of the most important activities, and one of the most important skills practiced in this class. Your ability to think, critically, objectively and creatively, will be important throughout your career. It will be far more important than most technical tidbits reviewed in this class or any other class. Also, it will be very useful for you to develop communication skills (in one or more languages) that allow you to critically evaluate and describe an idea with colleagues in a variety of disciplines and cultures. Where and how may we develop such skills? Graduate school is the perfect place for such learning and development.

I understand that many of the manuscripts are highly technical in nature and a full understanding requires insights into the technology and methods and some familiarity with the background and history of the subject. What to do?

Plan to read each paper twice. **First, read the discussion questions/topics**. Then, in your first reading search for key results, discussion, important conclusions, and your assessment of their implications for plant breeding programs as they relate to the discussion questions/topics. **Write these down and be prepared to discuss them in class**. In the first reading, briefly review the materials and methods to become familiar with the experimental design. After the first reading, you will have a pretty good idea of how important it is to know about the methods. **In the real world, the materials and methods section is usually understood (completely) by the few, true experts in that particular field. Talk to your colleagues, the instructor and others.**

Still interested in the paper? Read the paper again and spend more time with the materials and methods section. After the first reading, this section will often be much more interesting to you and your initial impressions of the results and conclusions may change, for better, or worse. At this stage, you should have a better idea of the strengths and weaknesses of the results and conclusions, key evidence and logic used to support the main conclusions, their potential significance for plant breeding and genetics, and flaws in experimental design.**Write these down and be prepared to discuss them in class**. Review papers may be more difficult to read and appreciate due to their comprehensive nature and our inexperience with the topic. The value of the review paper often depends with our familiarity with the field. When reading reviews for this class, I would like you to keep a written list of the main points of the review and new (to you) ideas, concepts, criticisms, and challenges (unknowns) described in the manuscript. Be prepared to relate them to the class.

Attending, Participating, and Enrolling in A625. All members of the class will be required to participate in the lectures and discussions as requested by the instructor. If you are planning to attend most of the lectures, I will strongly encourage you to arrange to pay for and receive credit. The university needs to account for my time to the citizens of Iowa, I need to account for my time to my supervisors, and you need to account for your time to your sponsors. To arrange to receive credit, follow these steps:
1) contact the Graduate Admission Office, registrar's office, room 100 Alumni Hall, 294-0818.
2) Indicate you want to enroll with "undeclared graduate status."
3) Make sure you have some proof that you have an undergraduate degree from a U.S. university or your home country. Acceptable proof may consist of transcripts, diploma, memo from sponsor, letter from employer or representative verifying that you have earned the equivalent of a B.S. degree.

If you are only able to attend a portion of the course, register for 1 or 2 credits for course Agronomy699 (section LE). You may register for grade (A-F) or nongrade (pass or fail).