Biology 3322/5332, Section 001. 3 credit hours.

**Plant Genetics**, Fall 2016 Semester.
10:00 to 10:50 AM, MWF, Biology Life Sciences, Room 342
Prerequisites: Biology 2296 (Genetics) or equivalent.

Plant Genetics examines the current molecular and genetic analyses of the genetics of higher plants, with an emphasis on *Arabidopsis* and maize. Topics include plant reproduction, self-incompatibility, polyploidy in plants, chloroplast genetics, plant viruses, DNA and histone methylation and epigenetics, insertion elements, transposon tagging, RNA silencing in plants, plant genomics, embryonic pattern formation in plants, genetic engineering of monocot and dicot plants, chemical signaling in plants, leaf morphogenesis, flower development, and stem cell populations in plants.

**Instructor:** Gregory Smutzer, Ph.D.  Phone: 215 204-1236
352 Biology Life Sciences Bldg. (office), Temple Main Campus.
E-mail: smutzerg@temple.edu; smutzerg@gmail.com
Office Hours: 11 AM – 1 PM MWF, or by arrangement. Please e-mail me if you wish to meet at times outside of office hours.

**Textbook:** No textbook is required.
1. Thirteen scientific articles are posted on Blackboard in pdf format. The five readings in bold are **required** reading.
4. **Problem Sets:** At least one problem set will be posted on the Blackboard site each week. Please make sure that you complete each problem set before each lecture exam. Schaum’s Outlines of Genetics (McGraw Hill) is an excellent reference for the problem sets. Either the 3rd, 4th or 5th edition would be useful for this course. **Parts of the fourth edition are online.**

**Grading:** Two exams and a final exam will be given during the fall semester. Several homework assignments will be required, and will represent 3% of your final grade. Announced quizzes will equal 3% of your final grade. In addition, a three to five-page term paper is required on some aspect of higher plant genetics and development. Each exam is worth 30% of your final grade. Exams will be multiple-choice, short answer, discussion questions, and problems. The final exam will **not** be cumulative. The written term paper will be due on Friday December 12th.

| Exam 1 | 30% - Exam will start at 9:55 AM |
| Exam 2 | 30% - Exam will start at 9:55 AM |
| Final Exam | 30% - Please note that exam starts at 8 AM. |
| Homework, in-class Assts. | 2% |
| Quizzes | 3% |
| Term Paper | 5%-7% (Four pg. maximum including 300 word summary, references, 1.5 line spacing. **Required. Failure to turn in a term paper [both written and electronic] will result in a failing grade for the course.** |

**Makeup exams:** If an hourly exam is missed due to medical or legal reasons, documentation is required. If a medical or legal excuse is not presented, then a missed exam will result in a grade of zero percent. If an exam is missed for a medical or legal reason, then a makeup exam will be administered within one week of the scheduled exam.
**Final Exam:** Classes end on Monday, December 12th. Our last lecture is Monday, Dec. 12th. Tuesday, Dec. 13th and Wednesday Dec. 14th are study days. Final exam week starts on Thursday December 11. The final exam for lecture will be held in Room 342 BLS on Friday, Dec. 12 starting at 8:00 AM. Please do not ask to take the exam earlier than the scheduled date.

| 10:00 – 10:50 AM M W F | Friday 12/16 | 8:00 - 10:15 AM |

**Withdrawals.** Monday, September 12th, is the last day to withdraw from a course (without a W grade). Tuesday, October 25th is the last day to withdraw from an undergraduate course (with a W grade).

**Cell Phones.** Please turn off all cell phones and pagers before the start of each class.

**Temple e-mail account.** You can obtain an e-mail account online. Go to: [http://www.temple.edu/cs/](http://www.temple.edu/cs/), and press "activate account." You can instantly obtain a Temple e-mail account.

**Accommodation.** Any student who has a need for accommodation based on the impact of a disability should contact Disability Resources and Services at 100 Ritter Annex (003-00), 1301 Cecil B. Moore Ave., Philadelphia, PA 19122. The phone number is 215-204-1280. Please fill out the form for accommodation. Accommodations will be made for students with documented disabilities.

**Attendance.** Attendance is expected at lecture, and attendance will be taken during each class.

**Academic Integrity**
All relevant Temple University policies regarding Academic Integrity must be followed. These policies include no cheating, no plagiarism and reporting any knowledge thereof. Handbook, or the appropriate web-page ([http://oll.temple.edu/ih/writing/plagiarism2.htm](http://oll.temple.edu/ih/writing/plagiarism2.htm)) for further information.

**Student learning outcomes.** Plant genetics examines the current molecular and genetic analyses of the genetics of higher plants, with an emphasis on *Arabidopsis* and maize. Topics include DNA methylation and epigenetics, insertional elements, transposon tagging, embryonic pattern formation in plants, chemical signaling in plants, leaf morphogenesis, flower development, chloroplast genetics and chloroplast transport, RNA silencing in plants, stem cell populations in plants, self-incompatibility, phytochromes, genetic engineering of monocot and dicot plants, flowering, and plant development.

**Assessment:** Basic knowledge of these facts, processes, and concepts will be quantitatively assessed through the use of lecture exams, homework assignments, quizzes, and a four-page term paper with abstract and scientific references.

**Lecture topic**

**Module One: Plant Reproduction and Development**
Principles of Plant Development  
Double Fertilization in Flowering Plants  
Plant life Cycles, developmental genes  
Plant Embryogeneis  
Plant Hormones in Development – Auxins  
Self-Incompatibility in Plants  
Sex Chromosomes in Plants – Papaya, White Campion

**Module Two: Plant Chromosomes and Polyploidy**
Polyplody in plants, Autopolyploidy, Allopolyploidy  
Amphidiploids – *Raphanobrassica Triticale*, wheat polyplolds  
Genome plasticity and polyplody  
Nucleolar Dominance  
Monoploid Plants, Plant Hybrids

**Suggested and Required Readings** on Blackboard

(A). *Gilbert Devel. Biol.*, Ch. 20, pp. 627-630 (8th ed.)


(C). *Vyskot and Hobza, Trends in Genetics 2004*  

(D). *Hulse & Spurgeon, Scientific American,* 1974  
(E). *Dubcovsky and Dvorak, Science,* 2007
Breakage-Bridge-Fusion Cycle in Plants
Recombination in Corn
Telomeric DNA and cell reproduction
End Replication Problem
Telomerase and DNA replication

Exam I. Monday, October 10, 2016. Exam is maximum of 7 pages. ~15 MC, short answer, and problems. Make sure you complete the problem sets, do required readings, and study the PP slides.

Module Three: Chloroplast Genome and Plant Viruses
Chloroplast Genome
Chloroplast Genetics
Transit peptides in chloroplasts
Chloroplast Evolution Plant and Algal Viruses
TMV, CaMV, Giant Algal viruses – phycodnaviruses
Virophages

Module Four: Epigenetics in Higher Plant Systems
Intro to Epigenetics
DNA and Histone Methylation in Plants
RNA-directed DNA methylation
RNA-dependent RNA polymerases
Habituation in plants
Biotic stress and DNA methylation

Module V. Gene Silencing in Plants [a rapidly developing field]
Posttranscriptional Gene Silencing in Plants
siRNA Pathway and Gene Regulation
Virusoids and induction of DNA methylation
Virus-induced gene silencing
Superman and Kryptonite Genes
Chromomethyltransferases, DRM, ROS-1 genes
Genomic Imprinting – Medea, Polycomb Group Genes
Parental Conflict in Flowering Plants
Demeter and DNA repair
Histone code

Module VI. Transposons and Related Genetic Elements
Controlling Elements in Maize (Transposons)
Dotted locus
Ac-Ds, SpM, MdDR transposable elements
Mu Killer, Transposon Tagging
Pack Mules

Exam II. Monday, November 7, 2016.

Module VII: Modern Plant Genetics
Genetic Systems – Corn, Snapdragon, Arabidopsis
Plant Genomics
Forward and Reverse Genetics
Techniques in Plant Genetics, ISH, GUS reporter
Gene Guns, Ti plasmids

(G). Blackburn, Scientific American, February 1996
(H). Leister, Trends in Genetics, 2003
(K). Rhoades.pdf file from Genetics Textbook (impt!)
Module VIII. Plant Biotechnology
Plant Biotechnology – Monocots and Dicots
*Ti* plasmids and Gene Transfer
*Vir* genes, opine synthesis
Insect Resistance in Plants, Herbicide Resistant Plants
Golden Rice, GM Foods
Production of Biomass

Module IX: Plant Development
Florigen, Cell Signaling in Plants
Flower Morphogenesis, Flower Organ Identity
MADS Box genes and Flowering in Higher Plants
Cell Division in Plants (A). Gilbert, Chap. 20, pp. 634-639
Pollination and Fertilization in Higher Plants
Seed Development
Shoot Development – Plant Meristems and SAM
Stem cell niches - CLAVATA and WUS genes
*Datura* chimeras and plant stem cells
Leaf Development – Initiation and Growth
Root Development, RAM

Final Exam (Not Cumulative) Friday, December 16, 2016 at 8 AM.


Also, use The *Arabidopsis* Information Resource, [www.arabidopsis.org](http://www.arabidopsis.org) website for *Arabidopsis* genes.

REMEMBER: DO ALL ONLINE PROBLEM SETS FOR EACH EXAM!!

Potential topics for the short term paper are posted on Blackboard.