CONCENTRATION REQUIREMENTS FOR THE PLANT SCIENCES MAJOR

EFFECTIVE FALL 2015

All students who matriculate into the Plant Sciences major in Fall 2015 or later must declare a concentration. This will provide a more focused approach to coursework with an eye toward providing Plant Sciences students with marketable skills for immediate post-graduation employment or transition to graduate or professional study.

All PS students who matriculate as freshmen or sophomores must declare a concentration by the beginning of their junior year. Students matriculating as junior transfer students must declare an intended concentration by the end of their first semester at Cornell. Plant Sciences majors must satisfy all course requirements for at least one of the concentrations listed below.

Effective Fall 2015, the Plant Sciences concentrations are:

I. Ecology of Managed Landscapes (EML)
II. Plant Breeding & Genetics (PBG)
III. Plant Computational Biology (PCB)
IV. Plant Evolution and Systematics (PES)
V. Plant Molecular, Cellular & Developmental Biology (PMCDB)
VI. Plant Pathology & Plant-Microbe Biology (PPPMB)
VII. Plants and Human Health (PHH)
VIII. Sustainable Plant Production (SPP)
IX. Design Your Own Concentration (DYOC)

Although incoming freshmen have two years to settle on a concentration, it is prudent to begin to develop at least one back-up plan early on. Academic advisors will provide some guidance, but final decisions are at the discretion of each student.

I. Ecology of Managed Landscapes (EML): minimum of 15 credits
   We focus on creating healthy urban landscapes that provide many valuable ecosystem services. Students will learn skills that will lead to careers in public garden management, municipal forestry, arboriculture, professional landscape management, landscape design and build, environmental landscape assessment and soils remediation, turfgrass management, and outreach education.

   **Required Courses:**
   - PLHRT 4400: Restoration Ecology (5 credits, fall)
   - PLHRT/LA 4910-4920: Creating the Urban Eden (4 + 4 credits, fall, spring)

   **Choose one additional course from the following list:**
   - LA 1410-1420: Grounding in Landscape Architecture (4 + 4 credits, fall, spring)
   - PLHRT 2240: Urban Ecosystems: (3 credits, spring)
   - PLHRT 3000: Annual and Perennial Plant Identification and Use (3 credits, fall—even years)
   - PLHRT 3050: Arboriculture (3 credits, fall—even years)
   - PLHRT 4850: Public Garden Management (3 credits, spring)
II. **Plant Breeding & Genetics (PBG):** minimum of 12.5 credits  
Students graduating with extra coursework in this concentration will be prepared to compete successfully for graduate study opportunities or to enter the job market directly.

1. **Plant Biology**—at least one of the following:  
   - PLBIO 3430: Molecular Biology and Genetic Engineering of Plants (2 credits, spring)  
   - PLBIO 4440: Plant Cell Biology (4 credits, fall—odd years)  
   - PLBIO 4620: Plant Biochemistry (3 credits, spring)

2. **Plant Breeding**—at least two courses from the following list:  
   - PLBRG 4060: Methods of Plant Breeding Laboratory (2 credits, fall)  
   - PLBRG 4070: Nutritional Quality Improvement of Food Crops (2 credits, fall)  
   - PLBRG 4093: QTL Analysis: Mapping Genotype to Phenotype in Practice (1.5 credits, fall)  
   - PLBRG 4110: High-Throughput Plant Phenotyping (2 credits, spring—odd years)

3. PLBRG 4030: Genetic Improvement of Crop Plants (3 credits, fall)

III. **Plant Computational Biology (PCB):** minimum of 15 credits

Plant computational biologists analyze large datasets and devise computer modeling simulations for practical and research applications in academia, in biotechnology and pharmaceutical companies, in health science-related fields, and in governmental research institutions.

Students in this concentration are encouraged to perform an Internship in a **Bioinformatic Applications Workshop.** The Cornell Core Laboratories Center runs a series of bioinformatics workshops to teach users how to do data analysis. The workshops cover a broad range of topics, from introduction to the Linux computing environment to next generation sequencing data analysis. Each workshop includes both lectures and hands-on sessions.  

1. BIOMG 4000: Genomics (3 credits, fall)
2. CS 1110: Introduction to Computing Using Python (4 credits, fall, spring, summer) OR CS 1112: Introduction to Computing Using MATLAB (4 credits, fall, spring)
3. MATH 1110: Calculus I (4 credits, fall, spring, summer)
4. MATH 2310: Linear Algebra with Applications (3 credits, fall, spring)
5. PLBRG 3250: Plant Genomics Approaches (1 credit, spring)

IV. **Plant Evolution and Systematics (PES):** minimum of 12 credits

An important component of this concentration is learning methods for measuring and studying biodiversity across large scales, both in geologic time and globally. This concentration prepares students to enter graduate school and for careers in academia, governmental, private and international organizations focused on biodiversity and conservation issues, major natural history museums, and private and governmental research institutions.

**Required Courses:**
1. PLBIO 4400: Phylogenetics of Green Plants (3 credits, spring)
2. PLBIO 0000*: Plant Evolutionary Adaptations (3 credits, spring)
3. PLBRG 3250: Plant Genomics Approaches (1 credit, spring)
Choose any two of the following courses:
1. PLBIO 2300: Global Plant Biodiversity and Vegetation (3 credits, fall—odd years)
2. BIOPH 4470: Molecular Systematics (3 credits, fall)
3. PLBIO 4480: Plant Evolution and the Fossil Record (3 credits, spring)
4. PLBIO 4520: Systematics of Tropical Plants (3 credits, fall—offered only every three years)
5. PLBIO 0000*: Evolution of Plant Development (3 credits, fall)
6. PLBIO 0000*: Diversity of Plant Form and Structure in Relation to the Environment (3 credits, fall)

V. Plant Molecular, Cellular & Developmental Biology (PMCD): minimum of 14 credits
Coursework in Plant Molecular, Cellular, and Developmental Biology focuses on the study of how plants function at the subcellular, cellular, and organismal levels. The concentration prepares students to enter graduate school and for careers in academia, in biotechnology and pharmaceutical companies, in health science-related fields, and in governmental research institutions.

Required Courses:
1. PLBIO 3430: Molecular Biology and Genetic Engineering of Plants (2 credits, spring)
2. PLBIO 3431: Laboratory in Molecular Biology and Genetic Engineering of Plants (2 credits, spring)
3. PLBIO 4841: Plant Form and Function (3 credits, spring)
4. PLBG 3250: Plant Genomics Approaches (1 credit, spring)
5. CHEM 2070: General Chemistry (4 credits, fall)

PMCDB concentrators must complete CHEM 2070, not CHEM 1560. It is highly recommended for students planning to go on to graduate school to take CHEM 2080, postponing organic chemistry (CHEM 3570 (fall) or CHEM 1570 (spring)) until sophomore year.

Complete at least 6 additional credits from the list below:
PLBIO 4220: Plant Development (1 credit, fall)
PLBIO 4440: Plant Cell Biology (4 credits, fall)
PLBIO 4470: Molecular Systematics (3 credits, spring)
PLBIO 4620: Plant Biochemistry (3 credits, spring)
PLBIO 4831: Concepts and Techniques (3 credits, fall)
PLBG 4030: Genetic Improvement of Crop Plants (3 credits, fall)
PLBG 4070: Nutritional Quality Improvement of Food Crops (2 credits, fall)
PLHRT 4250: Postharvest Biology of Horticultural Plants (2 credits, spring)
PLSCS 4100: Plant Responses to Environmental Stress and Climate Change (3 credits, fall—odd years)
PLSCS 4420: Mineral Nutrition: From Plants to Humans (3 credits, spring—odd years)

VI. Plant Pathology & Plant-Microbe Biology (PPPMB): minimum of 13 credits
Students interested in plant diseases and their control, host-pathogen coevolution, microbial symbiosis, fungal biology and/or sustainable agriculture/biocontrol are good fits for this concentration. This concentration prepares students for careers related to disease and pest management, and for graduate study in plant pathology, mycology, and the biology of plant-microbe interactions.

Required Courses:
1. BIOMI 2900: General Microbiology Lectures (3 credits, fall, spring)
2. PLPPM 3010: Biology and Management of Plant Diseases (4 credits, fall)
3. PLPPM 4490: Advanced Mycology (3 credits, fall)
Complete at least 3 credits from the list below:

BIOMI 2911: General Microbiology Laboratory (2 credits, fall, spring)
PLPPM 2950: Biology of Infectious Disease: From Molecules to Ecosystems (3 credits, fall)
PLPPM 3190: Mushrooms of Field and Forest (2 credits, fall)
PLPPM 4010: Microbial Pathogens vs. Plants: Molecular weapons, Defenses, and Rules of Engagement (3 credits, spring)
PLPPM 4020: Biology of Plant Pathogens (3 credits, spring)
PLPPM 4090: Principles of Virology (3 credits, fall)
PLPPM 4330: Infectious Disease Ecology and Evolution (3 credits, fall)
PLPPM 4380: Filamentous Fungal Genomics & Development (3 credits, spring—even years)
PLPPM 4480: Symbioses: Evolution and Ecology (3 credits, spring)
PLPPM 6810: Plant Pathology and Plant-Microbe Biology Seminar (1 credit, fall, spring)

VII. Plants and Human Health (PHH): minimum 14 credits
This concentration addresses the growing interest in the role of plants in various health-related sub-disciplines that study disease prevention and therapy. Furthermore, it fulfills the academic responsibility to educate future professionals in the health-care field on the importance of this relationship.

Required Courses:
1. ANTHR 2468: Medicine, Culture, and Society (3 credits, spring)
2. PLBIO 2210: Natural Remedies and Ethnohealth (2 credits, fall)
3. PLBIO 3800: Strategies and Methods in Drug Discovery (2 credits, spring)
4. PLHRT 2350: Food, Fiber and Fulfillment (2 credits, spring—odd years)
5. PLSCS 4420: Mineral Nutrition: From Plants to Humans (3 credits, spring—odd years)
6. PLBRG 4070: Nutritional Quality Improvement of Food Crops (2 credits, fall)

VIII. Sustainable Plant Production (SPP): minimum 11 credits
Intended to provide intensive working knowledge and hands-on experience in the commercial production of plants, including field, fruit, vegetable, nursery and greenhouse crops. Students completing this concentration will be prepared for a career in regulatory or governmental agencies like the EPA and USDA, NYS Ag and Markets, or the DEC.

Required Courses:
1. One course of at least 3 credits at the 3000 level or greater that has a major focus on pest management:
   PLPPM 3010: Biology and Management of Plant Diseases (4 credits, fall)
   PLSCS 3150: Weed Biology and Management (4 credits, fall)
   PLSCS 4440: Integrated Pest Management (4 credits, spring)
   VIEN 3200: Grape Pest Management (3 credits, fall)
2. One course of at least 3 credits at the 3000 level or greater that has a major focus on soil and/or nutrient management:
   PLHRT 4551: Principles of Nutrient Management in Crops and Landscape Plants (3 credits, spring)
   PLSCS 3630: Soil Genesis, Classification and Survey (4 credits, fall)
   PLSCS 4600: Soil Ecology (4 credits, spring)
   PLSCS 4720: Nutrient Management in Agroecosystems (4 credits, spring)
3. Two courses that have a primary focus on plant production:
   PLHRT 3100: Production and Marketing of Greenhouse Crops (4 credits, spring—even years)
   PLHRT 3440: Viticulture and Vineyard Management (2 credits, spring)
   PLHRT 3500: Principles of Vegetable Production (3 credits, fall—odd years)
   PLHRT 4000: Principles of Plant Propagation (3 credits, fall—even years)
   PLHRT 4420: Berry Crops Culture and Management (3 credits, fall—even years)
PLHRT 4450: Ecological Orchard Management (3 credits, spring—odd years)
PLSCS 4050: Field Crop Systems (4 credits, fall)
PLSCS 4130: Physiology and Ecology of Yield (3 credits, spring)
PLSCS 4140: Tropical Cropping Systems (3 credits, fall)

IX. Design Your Own Concentration (DYOC)

If none of the above concentrations piques a student’s interest for more in-depth study, the student may petition the Plant Sciences Curriculum Committee to design his/her own concentration in Plant Sciences. The course and credit requirements for this concentration will be determined on a case-by-case basis.

* Courses marked with an asterisk are pending approval of the CALS Curriculum Committee.