

# Biology 342/542, Vascular Plant Taxonomy

Fall 2012

## Grading and Attendance

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Office hours: 10-11 AM on Monday and Wednesday or by appointment

Vascular plant taxonomy covers a large field. There are over 250,000 species of vascular plants in the world. Only two other groups traditionally covered in advanced university course deal with larger groups - insects and invertebrates. No other group of organisms approaches vascular plants in economic and ecological importance. In part because of the importance of vascular plants to the development of medicine, pharmacology, and agricultural, the volume of literature in plant taxonomy exceeds that of all other organisms combined.

Most students can recognize at least some common trees and wildflowers and can find names for some others in popular field guides before beginning a plant taxonomy course. However, identification of all of the plants of an area requires the ability to use the standard identification manuals which include all of the vascular plants, such as the Gleason and Cronquist *Manual of Vascular Plants of the Northeastern United States and Adjacent Canada* (the popular field guides include 10% or less of the species of this same area). Identification requires knowledge of structures and terms and practice in using the keys.

The ability to name plants in the field also requires a good memory. The key to developing a good memory for plants is learning to group similar plants together. Plant families have proven to be a useful unit. Unlike a person who has learned only some common plants of a local flora, the person who knows the larger plant families can quickly begin learning the local flora of a new area.

The objectives of this course are to develop the knowledge and skills to learn the plants of any area. We will concentrate on learning the flora of Wisconsin, but students are expected to know the most common families of plants worldwide, first by memorizing some key characteristics, then learning them through reinforcement. Students are also expected to develop skill and confidence in keying out unknowns through practice.

Letter grades will be based entirely on the total points accumulated by the student on the following scale based on 580 points in the course:

93% and above,	537 points or more	= A
90-92%,	520-536 points	= A-
88-89%	508-519 points	= B+
83-87%	479-507 points	= B
80-82%	462-478 points	= B-
78-79%	450-461 points	= C+
73-77%	421-449 points	= C

70-72%	404-420 points	= C-
68-69%	392-403 points	= D+
60-67%	346-391 points	= D
below 59.5%	345 points or less	= F

Bonus points earned on the collection count in the above totals, even though it could bring the number of points earned in the course to 600.

There is no "curve" or quota for any letter grade. The grading scale will not be adjusted based on class performance. Cheating will not be tolerated; it is your responsibility to know your academic rights and responsibilities; please read the following link (it is the same for all your other classes here):

<http://www.uwsp.edu/admin/stuaffairs/rights/rightsChap14.pdf>.

**The only excuses for missing a lecture exam are 1) illness (doctor's excuse required), 2) serious illness in your immediate family, 3) participation in a scheduled UWSP athletic event, or 4) attendance at a scheduled academic conference or field trip.** In the case of 3) and 4), please let me know as far in advance as possible so I can plan on re-scheduling your exam.

Attendance does not figure directly in the grades, but for each lecture exam, I may include up to 10% of the questions based solely on material presented in my lectures and not included in the lab manual or text. Also, the amount of material requires regular attendance and students usually need to spend extra time in lab to review for tests and to prepare their collection due at the end of the semester.

The tests include the following:

Exam 1. Introductory material and pteridophytes. 70 points. **Thursday, September 20, 2012.**

Exam 2. Gymnosperms. Structures and terms. 70 points. **Thursday, October 4, 2012.**

Exam 3. Families, genera, and species of the Magnoliidae, Hamamelidae, Caryophyllidae, and Dilleniidae. 100 points. **Thursday, November 1, 2012.**

Exam 4. Families, genera, and species of the Rosidae and Asteridae, excluding the Asteraceae. 100 points. **Thursday, November 29, 2012.**

Exam 5 (Final). Families, genera, and species of the Asteraceae, and the Liliopsida. 100 points. **Thursday, December 20, 2012, 10:15 a.m.-12:15 p.m.**

**Twelve unannounced keying out quizzes will be given during the second hour of most of the labs, beginning on Tuesday, 9 October 2012.** Each quiz will be worth 10 points, with 4 points for the flower formula, 2 points for the family, 2 points for the genus, and 2 points for the species. Although you may use any books and notes you wish, all unknowns will be in the Gleason and Cronquist *Manual*, but not necessarily in any other book. There will be no makeup quizzes and you do not have to turn in your quiz. All quizzes turned in will count and the highest total is 100 points (that is, you can only turn in 10 quizzes). If you are unable to attend several labs because of circumstances beyond your control, you could take some additional quizzes during the other lab section to make up for the some of those you missed.

**A collection of 10 specimens must be turned in by 6 p.m. on Friday, December 7th in TNR 300.** These specimens will not be returned to the student. They must be pressed, dried, and have complete labels. They are to be un-mounted, loose (not taped, stapled, or glued) in folded newspapers measuring about 12" X 16," with a collection evaluation sheet on top of the collection. The collection is worth 40 points. Remember that this is primarily an exercise in technique and few, if any, points will be given for poor technique or poor labels. Read carefully the "Plant Collection Techniques and Herbaria" chapter (pages 249-258) in Freckmann *Taxonomy of Vascular Plants*. Note that if the name of the collector, the date, or the place of collection is inaccurate, the collection will not be accepted and the grade will be a zero. Students taking the course for graduate credit (as Biology 542) will be required to turn in 20 specimens.

**Up to 10 additional specimens may be turned in for 2 bonus points each.**

## **Biology 342/542 Vascular Plant Taxonomy**

### **Schedule for Fall 2012**

The following schedule is based on an estimate of the time required for each topic, but could be off by a couple of days during the semester. Nevertheless, the exams will probably be given on these dates and should cover the material indicated on this schedule.

References after each entry in the schedule preceded by "S" and page numbers indicate the pages in **Simpson, *Plant Systematics***, which cover this topic. These should be read to provide a background for the topic, but tests will not be based on material in Simpson unless it is also covered in Freckmann, *Taxonomy of Vascular Plants*. The references after each schedule entry consisting of "F" plus page numbers indicate the pages in Freckmann, *Taxonomy of Vascular Plants* that cover the lecture and lab material for that date. This sequence of topics for the angiosperms also follows exactly the sequence in Gleason and Cronquist, *Manual of Vascular Plants, Second Edition*.

#### **Week 1**

Sept. 4 (Tuesday lecture/lab in TNR 300). "The Myth of the Fully Catalogued Flora". Handouts on course materials, schedules, plants-to-learn lists, grading, etc F249-258, S517-535.

Sept. 5 (Wednesday): Introduction to taxonomy, classification, and binomial nomenclature; the genus and species; the species problem. F1-17, 29-31; S3-15, 501-515.

Sept. 6 (Thursday) – Lab: Meet in 300. Plant walk around campus. Plant collection techniques and an explanation of the collection requirement.

#### **Week 2**

Sept. 10 (Monday) Fern allies (Rhyniophyta through Equisetophyta). F31-38; S77-82.

Sept. 11 (Tuesday): Fern allies.

Sept. 12 (Wednesday) Polypodiophyta (true ferns). F39-52; S82-95.

Sept. 13 (Thursday). Ferns.

### Week 3

Sept. 17 Begin Pinophyta. F53-58; S97-119.

Sept. 18 Finish Pinophyta. Introduction to Magnoliophyta. F59-63. S121-136 in part.

Sept. 19 Pinophyta.

**Sept. 20 (Thursday) Lecture and lab exam on introductory material and pteridophytes.**

### Week 4

Sept. 24 Vegetative structures and terms. F63-71.

Sept. 25 Vegetative structures and terms.

Sept. 26. Inflorescences; flowers, fruits. F72-86; S121-136 in part.

Sept. 27. Structures and terms of flowers.

### Week 5

Oct. 1. Magnoliopsida and phylogenetic arrangement of angiosperm families; begin Magnoliopsida. F87-97; S137-153.

Oct. 2. Fruit types. Writing floral formulas.

Oct. 3 Finish Magnoliidae. F98-102; S228-234.

**Oct. 4 (Thursday) Lecture and lab exam on gymnosperms, structures and terms.**

### Week 6

Oct. 8 Begin Hamamelidae. F103-111; S235, 250, 275-276.

Oct. 9 Magnoliidae. Practice keying unknowns. **Begin keying-out quizzes.** (Note: There will be a keying-out quiz the last 40 minutes of most labs from this day through the end of the semester).

Oct. 10 Finish Hamamelidae. F112-114; S265-269.

Oct. 11 Hamamelidae.

### Week 7

Oct. 15 Begin Caryophyllidae. F115-121; S238-249.

Oct. 16 Begin Caryophyllidae.

Oct. 17 Finish Caryophyllidae. Begin Dilleniidae. F122-133; S272-273, 280-286, 292-293.

Oct. 18 Finish Caryophyllidae, begin Dilleniidae.

### **Week 8**

Oct. 22 Continue Dilleniidae. F134-140; S259-262, 269, 278-282.

Oct. 23 Continue Dilleniidae.

Oct. 24 Finish Dilleniidae. F141-145; S293-298.

Oct. 25 Finish Dilleniidae.

### **Week 9**

Oct. 29 Begin Rosidae. F146-154; S250-252, 275-279.

Oct. 30 Begin Rosidae.

Oct. 31 Continue Rosidae. F155-161; S262-264.

**Nov. 1 (Thursday) Lecture and lab exam on Magnoliidae, Hamamelidae, Caryophyllidae, and Dilleniidae.**

### **Week 10**

Nov. 5 Continue Rosidae. F162-171; S252-259, 269-270, 275-277.

Nov. 6 Continue Rosidae.

Nov. 7 Finish Rosidae. F172-184; S272, 286-289, 322-325.

Nov. 8 Finish Rosidae.

### **Week 11**

Nov. 12 Begin Asteridae. F185-190; S301-306, 319-321.

Nov. 13 Begin Asteridae.

Nov. 14. Continue Asteridae. F191-195; S298-301, 305, 308-310 in part.

Nov. 15. Continue Asteridae.

**Week 12**

Nov. 19. Continue Asteridae. F196-206; S305-318 in part, 331-335

Nov. 20. Finish Asteridae (Asteraceae).

Nov. 21. Finish Asteridae (Asteraceae).

**Thanksgiving Break, Thursday, November 22nd to Sunday, November 25th**

**Week 13**

Nov. 26. Begin Liliopsida (Monocots): Alismatidae. F207-217. S326-331, S153-164 (in part).

Nov. 27. Alismatidae.

Nov. 28 Liliopsida (Monocots): Arecidae, Commelinidae. F218-228; S160-163 (in part), 185-188, 206-211.

**Nov. 29 (Thursday). Lecture and lab exam on Rosidae and Asteridae except the Asteraceae.**

**Week 14**

Dec. 3 Commelinidae (Poaceae). F229-233. S213-219.

Dec. 4 Zingiberidae; begin Liliidae.

Dec. 5. Commelinidae. F229-236. S203-207 (in part).

Dec. 6. Liliidae.

**Dec. 7 (Friday) – Deadline for turning in plant collections.**

**Week 15**

Dec. 10. Zingiberidae. Begin Liliidae. F236-243. S192-203, 163-172

Dec. 11 Liliidae.

Dec. 12. Finish Liliidae. F244-248. S171-177. Student evaluations – you get to rate me.

Dec. 13. Last lab; greenhouse tours.

**Week 16 (final exam)**

**Dec. 20 (Thursday), 10:15 a.m.-12:15 pm. Lecture and lab exam on Asteraceae and Liliopsida.** A-L Meet in TNR 120 at 10:15 a.m.; M-Z meet in TNR 300 at 10:15 a.m.; switch rooms after an hour.

## **BIOLOGY 342/542 BOOKS, MATERIALS, WEBSITES**

### **Books from Text Rental**

Text and reference: Michael G. Simpson, *Plant Systematics*, 2006.

Lab Manual and Identification Reference: Gleason and Cronquist, *Manual of Vascular Plants of Northeastern United States and Adjacent Canada, Second Edition*. 1992.

### **Required Purchase**

Freckmann, Robert F., *The Taxonomy of Vascular Plants, A Text to Accompany the Second Edition of Gleason and Cronquist Manual of Vascular Plants, 2000 edition*.

### **Useful Books (not required)**

#### **Woody Plants – Trees, Shrubs and Woody Vines**

*Trees and Shrubs of Minnesota*. Welby Smith. University of Minnesota Press, 2009. 640 pp. Outstanding book that will be the standard in for years. This guide will cover 99% of all woody species in western and northern Wisconsin, perhaps 90-95% in southeastern Wisconsin. The author does an excellent job of even difficult groups that no other guide will touch – willows, hawthorns, brambles, and juneberries. Get this guide for woody plants. \$40.46.

**Best website:** Trees of Wisconsin by Gary Fewless, UW-Green Bay:

[http://www.uwgb.edu/biodiversity/herbarium/trees/tree\\_intro01.htm](http://www.uwgb.edu/biodiversity/herbarium/trees/tree_intro01.htm)

..and Shrubs of Wisconsin by Gary:

[http://www.uwgb.edu/biodiversity/herbarium/shrubs/Shrub\\_intro01.htm](http://www.uwgb.edu/biodiversity/herbarium/shrubs/Shrub_intro01.htm)

#### **Ferns and Fern Allies (Pteridophytes)**

Again, there is no good regional guide and really no satisfactory national guide. Best (though way out date) is *Ferns and Fern Allies of Minnesota* by Rolla Tryon, 1954 Univ. Minnesota Press.

**Best website:** Pteridophytes of Wisconsin by Gary Fewless, UW-Green Bay:

[http://www.uwgb.edu/biodiversity/herbarium/pteridophytes/pteridophytes\\_of\\_wisconsin01.htm](http://www.uwgb.edu/biodiversity/herbarium/pteridophytes/pteridophytes_of_wisconsin01.htm)

#### **Wildflowers**

*Wildflowers of Wisconsin and the Great Lakes Region*. 2<sup>nd</sup> edition. Merel R. Black & E.J. Judziewicz. University of Wisconsin Press, 2009. \$28.00.

**Best website:** Ours! Plants of Wisconsin (<http://wisplants.uwsp.edu/VascularPlants.html>). 2,952 distribution maps; 7,872 pictures of 2,638 species; checklist of Wisconsin plants; plant communities of Wisconsin; news events; botany links.

USDA Plants Database (<http://plants.usda.gov/>): Searchable information on 20,000 U.S. plant species, many with images; links to state websites.

Angiosperm Phylogeny Website (<http://www.mobot.org/mobot/research/APweb>). A consensus-based evolutionary tree of the flowering plant families. Frequently updated.

*Prairie Plants of the University of Wisconsin-Madison Arboretum.* Theodore S. Cochrane, Kandis Elliot & Claudia Lipke. 2006. University of Wisconsin Press. Superb content and graphics covering 360 species. Applicable to prairie, old field, wetland, savanna, and barrens communities throughout the state. \$25.55.

*Field Manual of the Michigan Flora.* 2012. Edward G. Voss & Anton A. Reznicek. Cranbrook Institute of Science. This outstanding inexpensive (\$25.00 for each volume) set has excellent keys (including to aquatic macrophytes and graminoids) and will cover about 95% of the species that in northern Wisconsin (dropping to about 90% or less in southern Wisconsin). Downsides: Pteridophytes not included; no illustrations; habitat data a bit weak.

### Useful Regional Floras

Holmgren, *Illustrated Companion to Gleason & Cronquist's Manual.* \$125.00. If you are going to be doing any serious plant identification in your career, this book is highly recommended.

### Graminoids (Grasses, Sedges and Rushes)

**Best website:** Grasses of Iowa (<http://www.eeob.iastate.edu/research/iowagrasses/>).

*Field Guide to Wisconsin Sedges.* Andrew Hipp et al. 2008. Univ. of Wisconsin Press. Keys and distribution maps to all of Wisconsin's 157 species of *Carex*; illustrations of 50-70 species. \$20.40.

*Manual of the Grasses for North America.* 2007. Mary Barkworth et al. Intermountain Herbarium and Utah State University Press. Beware of this book. The keys to genera are almost unusable, even by professionals; tiny maps, many inaccurate. Good points (many): All species are illustrated; modern nomenclature.

### Aquatic Macrophytes

*Aquatic Plants of the Upper Midwest: A Photographic Field Guide to Submerged and Floating-Leaf Aquatic Plants.* 2010. Paul M. Skawinski. Excellent color photos of nearly all Wisconsin aquatic macrophytes; highly recommended. \$30.00. Available from the author: [Lakeplants@yahoo.com](mailto:Lakeplants@yahoo.com) or from <http://www.wisconsinlakes.org/books.htm> or <http://www.uwsp.edu/cnr/uwexlakes/publications/>.

### Invasive Plants



*Invasive Plants of the Upper Midwest: An Illustrated Guide to Their Identification and Control.* 2005. Elizabeth Czarapata. Univ. of Wisconsin Press. \$26.95.

### Equipment

A dissecting kit of at least two sharp needles, one forceps, and a mm ruler. Dissecting kits can be checked out from the Biology stockroom, TNR 193C, for the semester. A hand lens, 10-15X, is quite useful, but not required. Good hand lenses are available from the Museum of Natural History sales counter in the Library. A plant press can be checked out for two weeks from the Biology stockroom (TNR193C).

## Biology 342/542, Fall 2012

### PLANTS TO LEARN LIST

Learn to recognize the following families, genera, and species for sight recognition (without books or notes) on the lab portions of the major tests. You should learn the scientific names, although you may substitute the common names given on this list for up to one-third of your answers. The material on the lab exam will be live material (either recently collected or grown in the greenhouse) whenever possible. Otherwise the material will consist of pressed specimens, sometimes with drawings, photographs, pickled material, or thawed frozen material. Because these materials will not be the same specimens or photographs used in the study sets (and in the case of families or genera for recognition, they may not be the same species), you should learn to recognize these taxa by their main taxonomic features (such as flower formulas, fruit type, etc.). There will usually be material available for dissection or observation under the microscope during the exam for specimens that need this type of observation.

Specimens of each family, genus, or genus and species on this list will be on demonstration during the regular scheduled lab covering the unit and will remain on demonstration until the next lab is set up. A study set of specimens will be posted in the hall display cases until the exam over the unit. Slides of most of the plants on the list are available on the internet on the Plants of Wisconsin website at <http://wisplants.uwsp.edu/VascularPlants.html>. No materials may be removed from the lab. The lab is usually open weekdays from about 8:00 a.m. until about 10:00 p.m. The lab will be open on weekends if you can get into the building (there's no predicting when the building will be locked or unlocked on weekends). Copies of old lecture exams are posted in the Biol. 342 course public folders on D2L.

### First Exam

The first exam will be given in lab on **Thursday, September 20th** and will count for 70 points out of the 600 total points for the course. A small portion of the test will cover the introductory lecture material on Linnaeus, classification, the nature of genera and species, etc. Most of the test will cover the pteridophytes (Rhyniophyta, Lycopodiophyta, Equisetophyta. and Polypodiophyta); **up to 10% of the lecture exam may come from material covered only in lecture and not necessarily in the textbook, lab manual, or course intranet folder.** The lab portion may cover some terms and

structures (e.g. the parts of a fern), but will emphasize sight recognition of the genera and species of pteridophytes on the following list.

## PTERIDOPHYTES

*Lycopodium annotinum* bristly clubmoss  
*Lycopodium clavatum* running clubmoss  
*Lycopodium dendroideum* tree clubmoss or ground pine  
*Diphasiastrum* ground cedar  
*Huperzia* shining clubmoss  
*Selaginella* spikemoss  
*Isoetes* quillwort  
*Equisetum* horsetail  
*Equisetum arvense* field horsetail  
*Equisetum hyemale* scouring-rush  
*Osmunda claytoniana* interrupted fern  
*Osmunda cinnamomea* cinnamon fern  
*Osmunda regalis* royal fern  
*Botrychium* grape fern, moonwort  
*Gymnocarpium* oak fern  
*Dryopteris* shield fern, wood fern  
*Athyrium* lady fern  
*Polypodium* polypody fern  
*Pteridium* bracken fern  
*Adiantum* maidenhair fern  
*Onoclea* sensitive fern  
*Matteuccia* ostrich fern

## Second Exam

The second exam, worth 70 points, will be given in lab on **Thursday, October 4th**. It will cover structures and terms, but will not require writing flower formulas. Much of the lab part of the test (50 points) will be given from slides and you will be asked for the term or terms to describe the root system, stem modification, leaf arrangement, other leaf features, inflorescence type, flower characters, fruit type, etc. There will be sight identification of the gymnosperms on the list below. The lecture portion of this exam will be short (20 points) and cover only the Gymnosperms (Pinophyta, Cordaitopsida, Ginkgopsida, Pinopsida, Pinales, Pinaceae, Taxodiaceae, Cupressaceae, Lyginopteridopsida, Bennettitopsida, Cycadopsida, and Gnetopsida); up to 10% of the lecture exam may come from material covered only in lecture and not necessarily in the textbook, lab manual, or course intranet folder.

## GYMNOSPERMS

*Taxus* yew  
*Pinus* pine  
*Pinus strobus* eastern white pine  
*Pinus resinosa* red pine  
*Pinus banksiana* jack pine  
*Pinus sylvestris* Scotch pine

*Abies* fir  
*Picea* spruce  
*Picea glauca* white spruce  
*Picea abies* Norway spruce  
*Picea pungens* Colorado pungens  
*Tsuga* hemlock  
*Pseudotsuga* Douglas fir  
*Larix* tamarack, larch  
*Juniperus* juniper  
*Juniperus communis* common juniper  
*Juniperus virginiana* red cedar  
*Thuja* white cedar, arbor vitae  
*Ephedra* Mormon-tea or joint-fir  
*Ginkgo* ginkgo or maidenhair tree

### Third Exam

This exam will be given in lab on **Thursday, November 1st** and will count for 100 points, with about 45 points from the lab portion and 55 from the lecture portion. The lab part of the test will be given during the first hour. It will consist primarily of sight recognition of the families, genera, and species listed below. The lecture portion will cover only the families of the Magnoliidae, Hamamelidae, Caryophyllidae, and Dilleniidae on the list below; up to 10% of the lecture exam may come from material covered only in lecture and not necessarily in the textbook, lab manual, or course intranet folder. You should know the main taxonomic characteristics of each family on this list, the relative size, distribution, ecological and economic importance of each, and some of the major components.

Families (lecture and lab):

Magnoliaceae	Magnolia Family
Ranunculaceae	Buttercup Family
Papaveraceae	Poppy Family
Moraceae	Mulberry Family
Urticaceae	Nettle Family
Cactaceae	Cactus Family
Chenopodiaceae	Goosefoot Family
Amaranthaceae	Amaranth Family
Caryophyllaceae	Pink Family
Polygonaceae	Smartweed Family
Malvaceae	Mallow Family
Cucurbitaceae	Gourd Family
Brassicaceae (Cruciferae)	Mustard Family
Ericaceae	Heath Family
Primulaceae	Primrose Family

Genera and species (lab portion of exam only):

*Magnolia* Magnolia  
*Nuphar* yellow pond-lily, bull-lily

*Nymphaea* water-lily  
*Ulmus* elm  
*Celtis* hackberry  
*Comptonia* sweet fern  
*Juglans* walnut, butternut  
*Carya* hickory  
*Fagus* beech  
*Quercus* oak  
*Quercus alba* white oak  
*Quercus macrocarpa* bur oak  
*Quercus rubra* northern red oak  
*Quercus ellipsoidalis* northern pin oak, Hill's oak  
*Corylus* hazelnut  
*Ostrya* ironwood, hop-hornbeam  
*Carpinus* blue-beech, hornbeam, musclewood [not ironwood]  
*Betula alleghaniensis* (*B. lutea*) yellow birch  
*Betula nigra* river birch, red birch  
*Betula papyrifera* paper birch  
*Alnus* alder  
*Saponaria* bouncing-bet (invasive exotic)  
*Polygonum* smartweeds, knotweeds  
*Hypericum* St John's-wort (some species invasive exotics)  
*Tilia* basswood, linden  
*Sarracenia* pitcher-plant  
*Drosera* sundew  
*Viola* violet, pansy  
*Salix* willow  
*Populus grandidentata* big-toothed aspen  
*Populus tremuloides* trembling aspen, quaking aspen, popple  
*Populus deltoides* cottonwood  
*Populus balsamifera* balsam-poplar  
*Alliaria* garlic mustard (invasive exotic)  
*Vaccinium* blueberry, cranberry

#### Fourth Exam

This exam will be given in lab on **Thursday, November 29th** and will also count for 100 points. The format, coverage, and point distribution will be similar to the third exam, except that the unit covered is the Rosidae and Asteridae, excluding the Asteraceae. The lecture portion of the test will cover only the families listed below; up to 10% of the lecture exam may come from material covered only in lecture and not necessarily in the textbook, lab manual, or course intranet folder. The lab portion will cover these families as well as the genera and species listed below.

Families (lecture and lab):

Crassulaceae	Stonecrop Family
Rosaceae	Rose Family
Mimosaceae	Mimosa Family
Caesalpinaceae	Caesalpinia Family

Fabaceae	Bean Family
Onagraceae	Evening-primrose Family
Euphorbiaceae	Spurge Family
Araliaceae	Ginseng Family
Apiaceae	Carrot Family
Asclepiadaceae	Milkweed Family
Solanaceae	Nightshade Family
Convolvulaceae	Morning Glory Family
Boraginaceae	Borage Family
Lamiaceae	Mint Family
Scrophulariaceae	Figwort Family
Campanulaceae	Bellflower Family
Rubiaceae	Madder Family

Genera and species (lab portion of exam only):

*Ribes* currant, gooseberry  
*Spiraea* spiraea, meadowsweet, steeplebush  
*Rubus* bramble, blackberry, raspberry, dewberry  
*Rosa* rose  
*Fragaria* strawberry  
*Potentilla* cinquefoil  
*Prunus* cherry, plum, peach, apricot  
*Crataegus* hawthorn  
*Robinia* black locust (invasive exotic)  
*Trifolium* clover  
*Melilotus* sweet-clover (invasive exotic)  
*Medicago sativa* alfalfa  
*Lythrum* purple loosestrife (some species invasive exotics)  
*Cornus* dogwood, bunchberry  
*Euphorbia* spurge (some species invasive exotics)  
*Rhamnus cathartica* common buckthorn  
*Rhamnus frangula* glossy buckthorn  
*Acer* maple  
*Acer negundo* box-elder  
*Acer platanoides* Norway maple  
*Acer rubrum* red maple  
*Acer saccharinum* silver maple  
*Acer saccharum* sugar maple  
*Rhus* sumac  
*Toxicodendron* poison-ivy, poison-sumac  
*Pastinaca* (invasive exotic)  
*Plantago* plantain  
*Gentiana* gentian  
*Asclepias* milkweed  
*Fraxinus americana* white ash  
*Fraxinus nigra* black ash  
*Fraxinus pennsylvanica* green ash  
*Galium* bedstraw  
*Lonicera* honeysuckle  
*Sambucus* elderberry

*Viburnum* viburnum, nannyberry, high-bush cranberry

### **Fifth (Final) Exam**

This exam is worth 100 points and will be given on **Thursday, December 20th from 10:15 a.m.-12:15 p.m.**, with half of you (A-L) meeting in the lecture hall, TNR 120 and the other half (M-Z) in the lab, TNR 300. The lecture portion will cover the families of the Liliopsida (Monocots) listed below and the Asteraceae; up to 10% of the lecture exam may come from material covered only in lecture and not necessarily in the textbook, lab manual, or course intranet folder. The lab portion will include some structures and sight recognition of the families, genera, and genera and species on the list.

Families (lecture and lab):

Asteraceae	Aster Family
Alismataceae	Water-plantain Family
Arecaceae	Palm Family
Araceae	Arum (Calla-lily) Family
Lemnaceae	Duckweed Family
Commelinaceae	Spiderwort Family
Juncaceae	Rush Family
Cyperaceae	Sedge Family
Poaceae	Grass Family
Bromeliaceae	Bromeliad (Pineapple) Family
Liliaceae	Lily Family
Iridaceae	Iris Family
Orchidaceae	Orchid Family

Genera and species (Lab portion of exam only):

*Helianthus* sunflower  
*Ambrosia* ragweed  
*Solidago* goldenrod  
*Aster* aster  
*Liatis* blazing-star  
*Eupatorium* Joe-pye-weed, boneset, white snakeroot  
*Centaurea maculosa* (*C. biebersteinii*, *C. stoebe*) spotted knapweed  
*Cirsium* thistle  
*Hieracium* hawkweed  
*Taraxacum* dandelion  
*Arisaema* jack-in-the-pulpit  
*Symplocarpus* skunk-cabbage  
*Carex* sedge  
*Avena* oats  
*Triticum* wheat  
*Secale* rye  
*Phragmites* giant reed  
*Andropogon* bluestem  
*Typha* cattail  
*Trillium* trillium  
*Cypripedium* lady-slipper, moccasin-flower

## TERMS TO KNOW

Annual	Entire	Zygomorphic or irregular or bilaterally symmetrical
Biennial	Serrate	
Perennial	Dentate	
Tap root	Crenate	Androecium
Fibrous root	Lobed	Stamen
Adventitious roots	Incised	Filament
		Anther
Blade	Glabrous	Gynoecium
Leaflet	Glaucous	Carpel
Petiole	Viscid	Superior Ovary
Stipule	Glandular	Inferior Ovary
Thorn	Punctate	Hypanthium
Spine	Stellate	Stigma
Prickle	Uncinate	Style
	Scabrous	Ovary
Scape	Strigose	Ovule
Bulb	Hirsute or hispid	Locule or chamber
Corm	Pubescent	Region of placentation or suture
Rhizome	Puberulent	Basal placentation
Tuber	Pilose	Axile placentation
Stolon	Tomentose	Parietal placentation
Whorled		Free central placentation
Opposite	Peduncle	
Alternate	Pedicel	Berry
Basal rosette leaves	Solitary	Pepo
Cauline leaves	Dichasial cyme or dichasium	Pome
Pinnately compound	Scorpioid cyme	Drupe
Palmately compound	Axillary	Follicle
Parallel venation	Raceme	Legume
Net venation	Spike	Capsule
	Spathe	Silique
Linear	Spadix	Schizocarp
Lanceolate	Catkin or ament	Nut
Ovate	Corymb	Achene
Elliptical	Umbel	Caryopsis
Obovate	Compound umbel	Samara
Oblanceolate	Head	Aggregate fruit
Oblong	Panicle	Accessory fruit
Orbicular	Cyathium	Multiple fruit
Deltoid	Receptacle	
Sagittate		
Hastate	Calyx	
Acuminate	Sepal	
Acute	Corolla	
Obtuse or rounded	Petal	
Truncate	Tepal	
Mucronate		
Cuspidate	Monoecious	
Cuneate	Dioecious	
Cordate	Perfect (flower)	
Oblique	Actinomorphic or regular or radially symmetrical	
Clasping		
Perfoliate		