

UWSP Biology 342/542: Vascular Plant Taxonomy

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Course Description:

A survey of major groups of vascular plants with emphasis on identification, classification, and evolution. Lab emphasizes representative families and genera of flowering plants in Wisconsin, the use of keys and manuals, and the production of a plant collection. **Schedule:** M/W 2:00-2:50 (TNR 120), T/TH (TNR 300): Sec1: 10:00-11:50, Sec2: 1:00-2:50, Sec 3: 3:00-4:50. **Prerequisites:** Either Biology 101 *or* Biology 130. **Lecture slides, handouts, grades, and other materials will be posted on D2L.**

Learning Outcomes:

- Recognize c. 100 families and 120 genera of Wisconsin vascular plants on sight (see list below).
- Correctly interpret and utilize descriptive botanical terminology.
- Demonstrate utility with taxonomic keys.
- Demonstrate techniques for collecting, documenting, processing, and identifying vascular plant specimens.
- Understand and apply basic principles and rules of botanical nomenclature and classification.
- Understand how to construct and interpret phylogenetic trees, and explain the role of phylogenetic systematics in modern botanical classification.
- Describe the taxonomically and evolutionary important *characteristics* of major groups of land plants, as well as the evolutionary *relationships* among these groups.
- Demonstrate scientific literacy skills through discussion of recent papers in systematic botany.

Required Texts:

- Lab manual (available at Campus Bookstore)
- Voss, E.G. and A.A. Reznicek. 2012. *Field Manual of Michigan Flora*. University of Michigan Press
- Simpson, M.G. 2010. *Plant Systematics*. 2nd edition. Elsevier-Academic Press.

You will need to bring the first two texts with you to lab, especially after the first couple of weeks!

Recommended Texts (copies also available in lab):

- Black, M. and E. J. Judziewicz. 2009. *Wildflowers of Wisconsin and the Great Lakes Region: A Comprehensive Field Guide*. 2nd edition. Univ. of Wisc. Press.
- Harris, J. G. and M. W. Harris. 1994. *Plant Identification Terminology. An Illustrated Glossary*. Spring Lake Publ., Utah.
- Castner, J.L. 2005. *Photographic Atlas of Botany and Guide to Plant Identification*. Feline Press.

Other supplies:

- **Lab notebook** for drawings and observations (will check towards end of semester, ~ 5% of grade)
- **Dissecting kit** and **plant press**, to be checked out from the Biology stockroom, TNR 193C
- A hand lens, 10-15X, is useful but not required. Available for sale at the Museum of Natural History (LRC)

Other useful references:

- UW-Green Bay websites, by Gary Fewless:
 - Trees of Wisconsin: http://www.uwgb.edu/biodiversity/herbarium/trees/tree_intro01.htm
 - Shrubs of Wisconsin: http://www.uwgb.edu/biodiversity/herbarium/shrubs/Shrub_intro01.htm
 - Ferns and Lycophytes of Wisconsin: http://www.uwgb.edu/biodiversity/herbarium/pteridophytes/pteridophytes_of_wisconsin01.htm
- Gleason, H.A. and A. Cronquist. 1992. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada, Second Edition*. Also the *Illustrated Companion to Gleason & Cronquist's Manual*, N. Holmgren, P.K. Holmgren, H.A. Gleason. 1998. Both published by New York Botanical Garden.
- Smith, W. 2009. *Trees and Shrubs of Minnesota*. University of Minnesota Press.
- Judziewicz, E.J., R.W. Freckmann, L.G. Clark & M.R. Black. 2014. *Field Guide to Wisconsin Grasses*. Univ. of Wisconsin Press.
- Hipp, A. 2008. *Field Guide to Wisconsin Sedges*. Univ. of Wisconsin Press.
- Skawinski, P.M. 2010. *Aquatic Plants of the Upper Midwest: A Photographic Field Guide to Submerged and Floating-Leaf Aquatic Plants*. Available from the author: Lakeplants@yahoo.com
- Online Virtual Flora of Wisconsin: <http://wisflora.herbarium.wisc.edu/>
- Angiosperm Phylogeny Website: <http://www.mobot.org/mobot/research/APweb>

Grading scale:

93% and above = A
90-92% = A-
88-89% = B+
83-87% = B
80-82% = B-
78-79% = C+
73-77% = C
70-72% = C-
68-69% = D+
60-67% = D
below 59.5% = F

Grade components (800 points total):

4 lecture exams, each 50 points	25%
4 lab practicals, each 50 points	25%
Plant collection, 150 points	18.75%
Weekly keying quizzes, each 10 points	12.5%
Lab notebook	6.25%
5 lab group exercises, each 10 points	6.25%
Weekly D2L quizzes, each 5 points	6.25%

Exams:

Lecture exams and lab exams will be held on the same day, in our lab room. The exam period will begin with a 50 minute lecture exam (mostly multiple choice/true-false/matching, with one page of longer answer questions focusing on the scientific paper(s) assigned in that section), followed by a 1-hour lab practical consisting of multiple stations set up throughout the room. Over half of the lab practical points will come from correct identification of specimens *to genus*—however, the lab practical may also include related questions about higher-level classification (family, order, or larger clade), key structural features (*e.g.* stipules, flower parts, inflorescence type, fruit type, leaf arrangement, etc.), and/or important details of ecology (*e.g.* habitat, nutritional mode, pollinators).

Plant collection:

A collection of pressed plant specimens is required for this course—10 plants, native or naturalized (if collecting in-state, check WisFlora site for the most up-to-date scientific names), worth 15 points a piece. You may also hand in up to 5 additional specimens for extra credit, worth 5 points a piece. Specimens must be appropriately collected, pressed, and dried, with proper collection labels. They must be submitted

in newspaper sheets inside a folder with your name on it, together with an evaluation sheet, by the final day of classes. There will be a designated box in our lab room.

Keying quizzes:

Beginning in the third week of class, there will be weekly keying quizzes—the particular days will not be revealed beforehand. These quizzes will take place in the last 40 or so minutes of our scheduled lab time, and will consist of both an individual component and a group component. You may use any of the resources available to you in the classroom *except for phones and computers*, but I ask that you restrict your discussions to your assigned lab group.

Group exercises:

During the first half of the course there will also be several small-group lab activities focusing on key concepts and skills in plant systematics. You will have at least an hour of lab time to work on these activities in your small groups, though you may need to finish them on your own time. Final write-ups on these groups activities will be due within a week of the lab during which they were initiated.

Lab notebook:

Whenever you are not engaged in a keying quiz, a group activities, or a mini-lecture (I will try to keep lectures during our lab periods to minimum, but sometimes it cannot be helped), I expect people to be working on their lab notebooks. Every lab, the back benches will be full of specimens and supplementary information about the groups we are studying, and I will provide fresh or preserved material for dissection whenever possible. The best way for you to really understand what I'm talking about in lecture is to get your hands on specimens, describe them, draw and label them, pull them apart (when possible), and compare them with all the surrounding specimens. To this end, I am asking you to keep a lab notebook, ideally one that is separate from your lecture notes and that gives you space to *draw*. You do not have to be an artist to succeed in this class, but I do expect to see *labeled diagrams* in your notebooks, along with descriptions, floral formulas, independent observations, and any helpful information I may have shared with you during lab. Early on in the course, I will try to provide you with lists of particular specimens or structures I would like to see—later on, I will likely leave it up to you. I will collect and grade these notebooks towards the end of the semester.

D2L quizzes:

This semester I am implementing weekly D2L review quizzes. These quizzes should be taken on your own time, and will be open Thursday night (following each week's lab activities) through the following Monday. Each quiz will consist of 5 questions, drawn from a larger bank of questions, on key terms, concepts, characters, and taxa relevant to the previous week's material.

Extra credit:

In addition to extra specimens with your collection, I will also offer several opportunities for extra credit throughout the course. Two of these will be additional D2L quizzes—one on (phylogenetic) tree-thinking, and one on common Greek and Latin roots—each worth 10 bonus points. Later in the semester, I will likely solicit sample review questions—I am building up a question bank to use for D2L quizzes and review guides. Other extra credit opportunities may be available if they present themselves.

General expectations and study hints:

Vascular plant taxonomy is a challenging course—there is no getting around that! Much of the vocabulary may be new to you, and all of the scientific names and technical terms can sometimes feel overwhelming—even to professional botanists. You will need to put in significant effort both inside and outside of class to keep up with the material.

I highly recommend doing the relevant readings in your lab manual *and your textbook* before coming to class/lab. While both provide nice explanations of botanical terminology, and nice graphics illustrating diversity and key features in many different groups, your textbook has the advantage of being IN COLOR. The optional texts may also be very helpful to you. I strongly encourage people to study in groups, to share whatever study tools you have developed (flashcards, *etc.*), and to drill yourself using the study specimens in the hall (*early and often!*). If you still find you are seriously struggling, I encourage you to see me—or one of the TAs—well in advance of any upcoming exams.

Finally, if you have any questions/concerns/recommendations about the class or any particular assignments, please let me know! I welcome student feedback, though I generally prefer to have those discussions in person rather than via email. I respect my students as adults and as thinkers, and I will do what I can to work *with* you to make this class a positive learning experience for you.

Accommodations and Absences:

If you are eligible for accommodations (*i.e.* through Disability Services), please contact me outside of class ASAP. While your attendance in lecture is strongly recommended, **attendance in LAB is mandatory**. If you know ahead of time that you will miss lab because of a religious observance, a schedule UWSP athletic event, or another academic obligation (conference, field trip, *etc.*) please let me know ASAP. I will drop the lowest keying quiz score for everyone, but will only excuse other absences for serious illness or family emergencies, and may require documentation.

Electronic device policy:

Mobile phones are not to be used in my lectures—turn them on silent, and put them away. Studies have shown that taking notes by hand (*i.e.* pen and paper) improves information processing and retention—but if you feel you require a laptop in lecture, please see me for approval. Mobile phones and tablets MAY be used in lab for photographing specimens, looking up supplementary information, *etc.*—**except during keying quizzes and exams**.

Week	Lecture	Lab	Readings
1: 1/23-1/26	Intro	Intro to field and herbarium methods	Ch.1
	Nomenclature	Ex1: Fruit phylogeny	Ch.16
2: 1/30-2/2	Phylogenetic systematics	Vegetative morphology	Ch.2:17-22,24-9
	Evolution of vascular plants	Lycophytes & Ferns I	Ch.3:55-62;4:73-81
3: 2/6-2/9	Diversity of ferns & lycophytes	Ferns II	Ch.4:82-122
	Evolution of seed plants	Conifers 1; Ex2: Key construction	Ch.15
4: 2/13-2/16	Conifers I: Taxaceae, Pinaceae	Conifers 2	Ch.5
	Conifers II: Cupressaceae;		
	Lit1: <i>Historical Biogeography</i>	Exam 1	Papers: 1a, 1b
5: 2/20-2/23	Evolution of Angiosperms	Floral morphology & inflorescences	Ch.6
	Flowers & pollination	Fruit & seed morphology; Ex3: Descriptions	Ch.9
6: 2/27-3/2	ANA grade & Magnoliids	ANA & Magnoliids	Ch.7:182-200
	Monocots I: Alismatids	Monocots 1	Ch.7:200-232
7: 3/6-3/9	Monocots II: "Lillioids";		
	Lit2: <i>Pollinators & Speciation</i>	Monocots II	Papers 2a, 2b
	Monocots III: Commelinids 1	Monocots III; Ex4: Pollination	Ch.7:232-249
8: 3/13-3/16	Monocots IV: Poales	Monocots IV: Poales	Ch.7:249-264
	Plant species concepts	Exam 2	Ch. 19
	3/20-3/24	SPRING BREAK	
9: 3/27-3/30	Ranunculids; Proteales	Ranunculids	Ch.8:275-286
	Saxifragales; Rosids I: Vitales,	Rosids I	Ch.8:286-93;
	Rosales		331-9
10: 4/3-4/6	Rosids II: Fagales, Fabales,		Ch.8:312-31;
	Curcubitales	Rosids II	339-47
	Rosids III; Malpighiales, etc.;		
	Lit3: <i>Evolutionary Rates</i>	Rosids III	Papers 3a, 3b
11: 4/10-4/13	Rosids IV: Myrtales, Malvales,		
	Brassicales, Sapindales	Rosids IV, Ex5: Molecular phylogenetics	Ch.8:347-71
12: 4/17-4/20	Molecular phylogenetics	Exam 3	Ch.14
	Caryophyllales	Caryophyllales	Ch.8:295-312
13: 4/24-4/27	Asterids I: Ericales, Cornales	Asterids I	Ch.8:372-389
	Asterids II: Gentianales,		Ch.8:389-416
	Solanales, Boraginales,	Asterids II	Ch.8:412-416
14: 5/1-5/4	Asterids III: Lamiales	Asterids III	Ch.8:400-412
	Asterids IV: Asterales		Ch.8:426-435
	Lit4: <i>Hybrid Speciation</i>	Asterids IV: Asteraceae	Paper 4
15: 5/8-5/11	Asterids V: Aquifoliales		
	Dipsacales, Apiales	Asterids V	Ch.8:417-426
	Plant Oddities;		
	Lit5: <i>Mycoheterotrophy</i>	Work on plant collections	Papers 5a, 5b

FINAL EXAM (Exam 4) MONDAY, May 19, 8:00-10:00, TNR 120

PLANTS TO LEARN

Learn to recognize the following genera and families for sight recognition (without books or notes) on the lab practical exams. Because these materials will not be the same specimens or photographs used in the study sets, you should learn to recognize these taxa by their main taxonomic features (floral formulas, fruit type, leaf shape and arrangement, *etc.*). Families in bold need to be recognized at the family level *ONLY*. For all other families, be able to identify the family in general *AS WELL AS* the specific genera listed. Specimens of each family and genus on this list will be on demonstration during labs, and a study set of specimens will be available for review in the hall outside of our lab room. The lab is usually open weekdays from about 7:00 a.m. until about 10:00 p.m. The lab will also be open on weekends—**IF** you can get into the building!

EXAM 1:

Lycopodiaceae: *Diphasiastrum*, *Huperzia*,
Dendrolycopodium

Selaginellaceae: *Selaginella*

Isoetaceae: *Isoetes*

Ophioglossaceae: *Botrychium s.l.*

Equisetaceae: *Equisetum*

Osmundaceae: *Osmunda s.l.*

Dryopteridaceae *s.s.*: *Dryopteris*

Athyriaceae: *Athyrium*

Onocleaceae: *Onoclea*

Pteridaceae: *Adiantum*

Polypodiaceae: *Polypodium*

Pinaceae: *Picea*, *Pinus*, *Tsuga*, *Abies*, *Larix*

Taxaceae: *Taxus*

Cupressaceae: *Juniperus*, *Thuja*

Ginkgoaceae: *Ginkgo*

EXAM 2:

Nymphaeaceae: *Nuphar*, *Nymphaea*

Magnoliaceae

Annonaceae

Lauraceae

Piperaceae

Aristolochiaceae: *Asarum*

Alismataceae: *Sagittaria*

Araceae: *Arisaema*, *Lemna*, *Symplocarpus*

Hydrocharitaceae

Potamogetonaceae

Liliaceae: *Erythronium*

Melianthaceae: *Trillium*

Smilacaceae: *Smilax*

Asparagaceae: *Maianthemum*, *Polygonatum*

Iridaceae: *Iris*, *Sisyrinchium*

Orchidaceae: *Cypripedium*

Areaceae

Commelinaceae: *Tradescantia*

Cyperaceae: *Carex*

Poaceae: *Andropogon*, *Phalaris*

Juncaceae: *Juncus*

Typhaceae: *Typha*

Bromeliaceae

Berberidaceae: *Berberis*, *Podophyllum*

Papaveraceae: *Dicentra*, *Sanguinaria*

Ranunculaceae: *Aquilegia*, *Anemone* [*incl.*
Hepatica], *Caltha*, *Ranunculus*,
Thalictrum

Nelumbonaceae: *Nelumbo*

Platanaceae: *Platanus*

EXAM 3:Grossulariaceae: *Ribes*Hamamelidaceae: *Hamamelis*Saxifragaceae: *Mitella***Crassulaceae**Vitaceae: *Vitis, Parthenocissus*Rosaceae: *Potentilla, Prunus, Rosa, Spiraea*Rhamnaceae: *Rhamnus, Frangula*Ulmaceae: *Ulmus*Cannabaceae: *Celtis*Urticaceae: *Urtica***Moraceae**Fabaceae: *Lupinus, Robinia, Trifolium*Polygalaceae: *Polygala*Cucurbitaceae: *Echinocystis*Betulaceae: *Betula, Carpinus, Corylus, Ostrya*Juglandaceae: *Juglans*Myricaceae: *Comptonia*Fagaceae: *Fagus, Quercus*Euphorbiaceae: *Euphorbia*Salicaceae: *Populus, Salix*Violaceae: *Viola*Oxalidaceae: *Oxalis*Onagraceae: *Oenothera*Lythraceae: *Lythrum*Geraniaceae: *Geranium*Brassicaceae: *Berteroa, Cardamine*Malvaceae: *Tilia*Anacardiaceae: *Rhus, Toxicodendron***Rutaceae**Sapindaceae: *Acer***EXAM 4:**Droseraceae: *Drosera*Polygonaceae: *Persicaria*Amaranthaceae: *Amaranthus, Chenopodium*Caryophyllaceae: *Silene*Montiaceae: *Claytonia*Cactaceae: *Opuntia*Cornaceae: *Cornus*Ericaceae: *Chamaedaphne, Vaccinium*Primulaceae: *Lysimachia*Polemoniaceae: *Phlox*Gentianaceae: *Gentiana*Rubiaceae: *Galium, Mitchella*Apocynaceae: *Asclepias*Solanaceae: *Physalis, Solanum***Convolvulaceae**Oleaceae: *Fraxinus*Lamiaceae: *Lycopus, Monarda, Physostegia*Plantaginaceae: *Chelone, Linaria, Plantago*Verbenaceae: *Verbena***Orobanchaceae**Lentibulariaceae: *Utricularia***Boraginaceae**Aquifoliaceae: *Ilex*Campanulaceae: *Campanula, Lobelia*Asteraceae: *Ageratina, Ambrosia, Centaurea, Cirsium, Solidago*Apiaceae: *Daucus, Osmorrhiza*Araliaceae: *Aralia, Panax*Caprifoliaceae: *Lonicera, Viburnum*Adoxaceae: *Sambucus*