

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 evolutionary trends. Lab emphasizes representative families and genera of vascular plants in Wisconsin, the use of keys and manuals, and the production of a plant collection. **Schedule:** M/W 1:00-1:50 (SCI D102), T/TH (TNR 300): Sec1: 10:00-11:50, Sec2: 1:00-2:50, Sec 3: 3:00-4:50. **Prerequisites:** Biology 101 or Biology 130. Lecture slides, handouts, grades, supplemental readings 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.

REQUIRED Texts:

- **Lab manual** (available at Campus Bookstore)—please put in a 3-ring binder.
- 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.
- Additional required readings will be posted on D2L throughout the semester.

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

Other supplies:

- **Lab notebook (REQUIRED)** for drawings and observations (~ 5% of grade)
- **Dissecting kit (REQUIRED)** and **plant press**, to be checked out from the **Biology stockroom, TNR 193C**. *You will need to bring the dissecting kit with you to lab.*
- A hand lens, 10-15X, is useful but not required. Available for sale at the Museum of Natural History.

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.
- Castner, J.L. 2005. *Photographic Atlas of Botany and Guide to Plant Identification*. Feline Press.
- Harris, J. G. and M. W. Harris. 1994. *Plant Identification Terminology. An Illustrated Glossary*. Spring Lake Publ., Utah.

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, often with a page of long-answer questions focused on the supplemental readings 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). The night before each exam, TAs will staff an open lab/review session in the lab room.

Plant collection:

A collection of ten pressed plant specimens (each worth 15 points) is required for this course. All specimens must be wild-collected (not cultivated), and correctly identified to species. For specimens collected in Wisconsin, please consult the WisFlora site (<http://wisflora.herbarium.wisc.edu/>) for the most up-to-date name and classification. **NEW in Fall 2017:** Your collection **MUST** include specimens from **at least FIVE of the “Big Ten” Families** (the ten most diverse families in Wisconsin). We will discuss these families during the first couple weeks of class, and revisit them in detail as we progress through the phylogenetic classification of vascular plants. The “Big Ten” families are listed here for your convenience: **Apiaceae** - Carrot Family; **Asteraceae** - Daisy Family; **Brassicaceae** - Mustard Family; **Caryophyllaceae** - Pink Family; **Cyperaceae** - Sedge Family; **Fabaceae** - Pea Family; **Lamiaceae** - Mint Family; **Orchidaceae** - Orchid Family (uncommon—*do not collect if locally rare!*); **Poaceae** - Grass Family; **Rosaceae** - Rose Family. During the fall semester, you may add 2 additional families to that list: **Plantaginaceae** - Plantain/Foxglove family and **Polygonaceae** - Smartweed family. The remaining five specimens may be from any families of your choosing.

To receive full credit, specimens must be appropriately collected (*e.g.*, they **must include reproductive structures**), properly pressed and dried, and include correctly formatted, accurate, and complete **collection labels** printed on special archival paper (see your instructor). You may also hand in **up to 5 extra credit specimens** (from any family), worth 5 points each. Collections are to be submitted in newspaper sheets (you will NOT mount your own specimens) 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.

NOTE: I strongly recommend collecting MORE than 10-15 specimens. Most likely, at least some of your collections will be inappropriate for some reason or another (especially while you are just learning to press plants), or frustratingly difficult to identify. If you collect a few extra specimens, you will have the flexibility to choose which specimens you turn in for credit.

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. For non-seed plants, you will use the keys in your **lab manual**; for seed plants, you will use the *Flora of Michigan* book. You also may use any of the other 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:

Throughout the course there will be a series of 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 or two of the lab during which they were initiated.

Lab notebook:

Every lab period, the back benches will be full of specimens and supplementary information about the groups we are studying, and I will provide fresh and/or preserved material for dissection whenever possible. The best way for you to really understand the course material is to actually handle specimens,

dissect them *under the microscope*, describe them, draw and label them, and compare them with surrounding specimens.

You are required to keep a lab notebook. You do not have to be an artist to succeed in this class, but I do expect you to see *labeled drawings* in your notebooks, along with descriptions, floral formulas, independent observations. I will provide you with lists of particular specimens or structures I would like to see, but I encourage you to take the initiative to explore other material. I will collect and grade these notebooks towards the end of the semester. **NEW in Fall 2017:** You may choose to *simply compile the lab handouts* into a binder instead of keep a separate notebook for drawings. However, if you want to use a separate sketchbook, that is fine too!

D2L quizzes:

We will cover *a lot* of material in this class. To encourage regular review, you will be assigned *weekly D2L review quizzes*. These quizzes should be taken on your own time in the 2 week period during which each will be open. Each quiz will consist of 5 questions, drawn from a larger bank of questions, on key terms, concepts, characters, and taxa relevant to the current/previous week's material.

General expectations and study hints:

Vascular plant taxonomy is a challenging course. Much of the vocabulary may be new to you, and all of the scientific names and technical terms can 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*. 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, please come talk to me—or one of the TAs—well in advance of any upcoming exams. *Individual tutoring* for this course is also available through the on-campus tutoring center.

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 in advance that you will miss LAB because of a religious observance, a scheduled UWSP athletic event, or another academic obligation (conference, field trip, etc.) please let me know ASAP—I keep a running list of these, and it helps me in grading lab notebooks.

I will automatically drop the lowest keying quiz score for everyone, but I have a policy of only excusing other lab absences for serious illness or family emergencies, and I may require documentation. However, if you are experiencing *chronic* health issues (panic attacks, depression, recurring migraines,

chronic pain, etc.) or personal circumstances (working more than 20 hours/week, caring for young children, etc.) that routinely affect your attendance and/or performance in this class, I encourage you to come speak me to privately. We may be able to develop a plan to help you complete your work and succeed in the class—for instance, I have occasionally allowed people to attend a different lab section, or to complete some activities outside of standard lab hours.

Electronic device policy:

Mobile phones are generally not to be used in my lectures. In lab, mobile phones, tablets, and laptops MAY be used in lab for photographing specimens, looking up supplementary information, etc.—*except during keying quizzes and exams*—but please use the majority of this time to take advantage of the other resources available to you (specimens, books, your classmates and instructor).

Extra credit:

Watch for opportunities throughout the semester!

Week	Lecture	Lab	Simpson Readings
1: 9/5-9/7		Intro to field and herbarium methods	Ch.1,Ch.17
	Nomenclature	Ex1: Fruit phylogeny	Ch.16
2: 9/11-9/14	Classification	Vegetative morphology	Ch.2:17-22,24-9
	Vascular plant evolution	Schmeeckle trip: The Big Ten	Ch.3:55-62
3: 9/18-9/21	Ferns & lycophyte diversity	Lycophytes & Ferns I; Ex2: Key construction	Ch.4:73-81,Ch.15
	Seed plant evolution	Ferns II	Ch.4:82-122
4: 9/25-9/28	Gymnosperms	Gymnosperms	Ch.5
	Angiosperm evolution	EXAM 1	Ch.6
5: 10/2-10/5	Flowers & inflorescences	Flowers & floral formulas, Ex3: Descriptions	Appendix 1
	Pollination	Fruits & seeds	Ch.9
6: 10/9-10/12	ANA grade & Magnoliids	ANA & Magnoliids	Ch.7:182-200
	Monocots I: Alismatids	Monocots 1	Ch.7:200-210
7: 10/16-10/19	Monocots II: "Lillioids"	Monocots II	Ch.7:211-229
	Monocots III: Commelinids 1	Monocots III; Ex4: Pollination	Ch.7:230-249
8: 10/23-10/26	Monocots IV: Poales	Monocots IV	Ch.7:249-264
	Molecular phylogenetics	Ex 5: Molecular taxonomy (ON YOUR OWN)	Ch.14
9: 10/30–11/02	Intro to Eudicots	Ranunculales, Proteales & Saxifragales	Ch.8:275-293
	Rosids I: Vitales, Rosales	EXAM 2	Ch.8:331-9
10: 11/06-11/09	Rosids II: Fagales, Fabales, Curcubits	Rosids I	Ch.8:312-31;339-47
	Rosids III; Malpighiales & Myrtales	Rosids II	Ch.8:347-71
11: 11/13-11/16	Rosids IV: Malvales & Brassicales	Rosids III	Ch.8:372-389
	Rosids V: Sapindales	Rosids IV-V	
12: 11/20-11/22	Santalales & Caryophyllales	Caryophyllales	Ch.8:295-312
	Plant species & conservation	EXAM 3	Ch.19
13: 11/27-11/30	Asterids I: Ericales, Cornales	Asterids I	Ch.8:389-400
	Asterids II: Gentianales, Solanales, Borages	Asterids II	Ch.8:412-416
14: 12/04-12/07	Asterids III: Lamiales	Asterids III	Ch.8:400-412
	Asterids IV: Asterales	Asterids IV	Ch.8:426-435
15: 12/11-12/14	Asterids V: Aquifoliales, Dipsacales, Apiales	Asterids V	Ch.8:417-426
	Plant Oddities	OPEN LAB	

PLANT COLLECTIONS due on or before FRIDAY, Dec 15, 5 PM, in TNR300

FINAL EXAM (Exam 4) TUESDAY, Dec 19, 12:30-2:30 PM, SCI D102/TNR 300

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*

Arecaceae

Commelinaceae: *Tradescantia*

Cyperaceae: *Carex*

Poaceae: *Andropogon*, *Phragmites*

Juncaceae: *Juncus*

Typhaceae: *Typha*

Bromeliaceae

EXAM 3:

Berberidaceae: *Berberis, Podophyllum*
 Papaveraceae: *Dicentra, Sanguinaria*
 Ranunculaceae: *Aquilegia, Caltha, Ranunculus*
 Nelumbonaceae: *Nelumbo*
 Platanaceae: *Platanus*
 Grossulariaceae: *Ribes*
 Hamamelidaceae: *Hamamelis*
 Saxifragaceae: *Mitella*
 Vitaceae: *Vitis*
 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, Alnus*
 Juglandaceae: *Juglans*
 Myricaceae: *Comptonia*
 Fagaceae: *Fagus, Quercus*
 Euphorbiaceae: *Euphorbia*
 Salicaceae: *Populus, Salix*
 Violaceae: *Viola*
 Oxalidaceae: *Oxalis*
 Onagraceae: *Oenothera*
 Lythraceae: *Lythrum*
 Geraniaceae: *Geranium*
 Brassicaceae: *Berteroa*
 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
Boraginaceae

Oleaceae: *Fraxinus*
 Lamiaceae: *Lycopus, Monarda, Physostegia*
 Plantaginaceae: *Chelone, Linaria, Plantago*
 Verbenaceae: *Verbena*
Orobanchaceae
 Lentibulariaceae: *Utricularia*
 Aquifoliaceae: *Ilex*
 Campanulaceae: *Campanula, Lobelia*
 Asteraceae: *Ageratina, Ambrosia, Centaurea, Cirsium, Solidago*
 Apiaceae: *Daucus, Osmorrhiza*
 Araliaceae: *Aralia, Panax*
 Caprifoliaceae: *Lonicera*
 Adoxaceae: *Sambucus, Viburnum*