Biodiversity of Fungi

EEB351 (4 credits)
Meetings: M, W 1:25 pm – 4:25 pm; Hesler 202

Instructor: P. Brandon Matheny, Asst. Prof., Lab/Office: Hesler 332/334; tel. 974-8896;
Office hours MON 10:10-11:00 am, THUR 9:40-10:30 am, or by appointment
pmatheny@utk.edu

Teaching Assistant: Joshua Birkebak, PhD candidate: Hesler 332; tel. 974-8896;
Office hours MON 11:15-12:05 pm, or by appointment

Blackboard site: https://blackboard.utk.edu/

Required texts and materials:

- Arora D (1986) *Mushrooms demystified*. Second edition. Ten Speed Press, Berkeley. ISBN 0-89815-912-3 (deluxe)
- Roody WC (2003) *Mushrooms of West Virginia and the Central Appalachians*. University of Kentucky Press, Lexington. ISBN 0-8131-9039-8 (paper alk. paper)
- three-ring binder
- pencils
- Easy guide to mushrooms descriptions (1982) by Kit Scates (provided)
- Easy key to common gilled mushrooms (1981) by Kit Scates (provided)

Online taxonomic resource:
http://www.mushroomexpert.com/

Additional readings may be posted on Blackboard or provided in class.

Scope: This course will introduce undergraduate students to collection, identification, and diversity of mushroom-forming fungi. Biodiversity of fungi is designed to be "hands-on" and develop familiarity with mushroom diversity in an analytical fashion. The bulk of the course will emphasize field collection or isolation of fungi from the environment and their identification in a field and laboratory setting. Taxonomic methods will rely mostly on morphological and anatomical analysis. However, students will be trained to analyze DNA sequence data for identification purposes. Fungus taxonomy is increasingly becoming a molecular effort, but development of skills for identification of fungi in the field and/or using a microscope is indispensible to get a complete grasp of fungal biodiversity. This course will provide training and development of taxonomic and analytical skills, as well as skills in field ecology, microscopy, herbarium curation, and aspects of molecular biology.

Format and Grading: Most sections of the course will begin with a lecture providing necessary background on analytical or laboratory methods and an introduction to organisms under discussion. All three hours of each session will be spent either in the field on seven field trips or in the teaching lab in Hesler 202. Open or extended lab sessions are possible. Grades are based on (1) a lab notebook, (2) lecture or lab exercises, (3) a specimen collection, (4) two lab exams, and (5) two written exams, details of which are enumerated below.

(1) *Lab Notebook* (150 pts)
A lab notebook is your permanent record of observations made in the laboratory. In a course such as this, drawings and notes of your observations are the material that should be entered in your lab notebook. One does not need to be an artist or a photographer to make astute observations.

Students are required to maintain a lab notebook. A three-ring binder is probably best since this will allow insertion and organization of materials, including any handouts. A three-hole punch and blank paper will be available in the lab. Students may be required to turn in the lab notebook for assessment and/or grading. The notebook should contain observations of materials presented in lab.

1. Record each subject observed. Write the name of the organism, date of observation, origin of material (live, preserved, culture), if known. Drawings are an excellent means to keep records of details of structure and reproduction.
2. Share observations with classmates. If you find a particularly good example of some organism or structure, encourage others to examine it too.
3. Suggestions for drawings:
    a. avoid crowded drawings
    b. use fine pencil and good drawing paper
    c. label drawings
    d. indicate the scale of magnification
    e. stippling (a series of fine dots) is the cleanest way to indicate shading

Examples from major clades of mushroom-forming fungi will be presented throughout the course to get you acquainted with the diversity of these kinds of fungi. Generally, students are expected to observe the overall gross morphological appearance and/or anatomical feature(s) of each specimen. This will often require sectioning and slide preparation of a given specimen and observation under a compound microscope. *These observations should be made in the lab notebook*.

Note there are no lab make-ups. **Each lab is worth 10 points**. The lowest lab grade will be discarded. Grading criteria include completeness of observations, neatness, and organization.

(2) *Lecture or lab exercises* (est. 50 points)
Throughout the term various exercises may be provided during lecture or lab. These generally will be graded between five and ten points. No make-ups are allowed.

(3) *Specimen collection* (100 points)
Each student is required to amass *20 herbarium collections* of fungi during the course. Up to five cultures will be accepted in lieu of fruit body collections, but this figure is tentative depending on the collecting season. Periodically, collections must be turned in for grading. Five points are available for each collection. Thus, 100 points are possible for the entire collection. Duplicate species are discouraged, unless more information is gleaned from the second collection. Any taxonomic mixture is acceptable. The specimen collection will be accessioned into the University of Tennessee Fungus Herbarium and be made available for scientific study by other researchers.

(4) *Lab exams* (100 points)
Two lab exams (50 points each) will be given that will evaluate objectives presented in laboratory sessions and/or identification of fungal taxa. Use of the microscope or taxonomic keys in Arora may be required.

(5) *Written exams* (200 points)
Two written exams, one mid-term and the final, are scheduled that will evaluate concepts introduced in the course. The exams will include essay and short answer questions. Each will be 100 points. The final will be comprehensive.

Approximately 600 total points will be possible.

Grading scale EEB351, fall semester 2013

Percentage of total points (600)	Letter grade	Scale
94-100	A	4.0
91-93	A-	3.7
88-90	B+	3.3
84-87	B	3.0
81-83	B-	2.7
78-80	C+	2.3
74-77	C	2.0
71-73	C-	1.7
68-70	D+	1.3
64-67	D	1.0
61-63	D-	0.7
<61	F	0.0

By the end of this course, you should be able to explain and provide examples of five 'big ideas' in biology:

1. Evolution: Populations of organisms and their cellular components have changed over time through both selective and non-selective evolutionary processes.
2. Structure and Function: All living systems (organisms, ecosystems, etc.) are made of structural components whose arrangement determines the function of the systems.
3. Information Flow and Storage: Information (e.g., DNA) and signals are used and exchanged within and among organisms to direct their functioning.
4. Transformation of Energy and Matter: All living things acquire, use, and release and cycle matter and energy for cellular functioning.
5. Systems: Living systems are interconnected, and they interact and influence each other on multiple levels.

You should also be able to perform the following scientific practices:

- formulate testable hypotheses
- interpret figures and diagrams
- evaluate data and come to a conclusion based on evidence

EEB351: tentative schedule Fall 2013

No.	Date	Topic
01	W 21 Aug	Course organization; fungal basics; mushroom life cycle; laboratory techniques; Arora p. 4-13 Lab 1—Chemical reagents, microscope use; sterile techniques; Agaricus bisporus; Ascomycota and Basidiomycota (asci versus basidia); plate out spores
02	M 26 Aug	Field trip_1 Norris Dam, Grist Mill Trail; Arora p. 13-23
03	W 29 Aug	How to use taxonomic keys (assignment—key exercise); mushroom gross morphology; how to process specimens; how to write a label Lab 2—Process specimens; observe spores and cultures on agar
	M 2 Sep	Labor Day: no class
04	W 4 Sep	Mushroom anatomy: Arora p. 19-20 Lab 3—Microscopic features: clamps, pileipellis, cystidia; process specimens Key exercise due
05	M 9 Sep	Field trip_2 Norris Dam, Andrew's Ridge Trail; Arora p. 23-33
06	W 11 Sep	Mushroom habitats Lab 4—Process specimens
07	M 16 Sep	Gross morphology of non-mushroom forms; big ideas in biology, evolution of truffle forms Key out specimens from Wildacres Foray
08	W 18 Sep	Jelly fungi (heterobasidiomycetes) Lab 5—Heterobasidia of jelly fungi
09	M 23 Sep	Field trip_3 Big Ridge State Park 5 collections due (5 of 20)
10	W 25 Sep	Mating systems, mushroom life cycle, Chanterelles Lab 6—Cantharellales, Phallomycetidae; process specimens
11	M 30 Sep	Tree-thinking, Stinkhorns, coral fungi, and earth stars Lab 7—Tree-thinking exercises; Cantharelleales & Phallomycetidae; online herbarium exercise
12	W 2 Oct	Polypores, Thelephorales, Hymenochaetales Lab 8—brown rot vs. white rot, polypores
13	M 7 Oct	Field trip 4
14	W 9 Oct	Russulales and Boletales; gasteromycetization Lab 8—Russulales, Boletales, false truffles; process specimens
15	M 14 Oct	Agaricales (intro, Hygrophoraceae, Tricholomataceae) Mid-term review guide Lab 9--Hygrophoraceae, Tricholomataceae Agaricales (white spored clades)
16	W 16 Oct	No lecture Open lab 5 collections due (10 of 20)
	17-18 Oct	Fall Break: no class
17	M 21 Oct	Mid-term review Agaricales (Amanitaceae, pink-spored groups Entolomataceae, Pluteaceae) Lab 10—Entolomataceae, Amanitaceae, Pluteaceae
18	W 23 Oct	Mid-term exam (100 pts) Lab exam (50 pts)
	26-27 Oct	Smokies Field Trip (SAT overnight)
19	M 28 Oct	No lecture Lab 11—Process specimens from Smokies trip
20	W 30 Oct	DNA extraction, PCR, sequencing

		Lab 12—DNA extractions; process specimens
21	M 4 Nov	Arbuscular mycorrhizal plants, ectomycorrhizal plants Lab 13—Process specimens from Smokies trip; AM and ECM fungi *Allium vineale, Pinus virginiana* or *P. strobus*
22	W 6 Nov	Agaricales (dark spored clades) Lab 14—Strophariaceae, Bolbitiaceae, Coprinaceae, Agaricaceae, Cortinariaceae
23	M 11 Nov	Field trip 5 5 collections due (15 of 20)
24	W 13 Nov	Rusts and smuts Lab 15—rusts and smuts; process specimens
25	M 18 Nov	Lichens and other Ascomycota Lab 16—ascomycete diversity
26	W 20 Nov	Mushroom toxins, magic mushrooms, and mushroom foods Arora: 23-32; 888-898 Lab 17—survey of poisonous mushrooms, Meixner test for amatoxin, use of the herbarium
27	M 25 Nov	Molecular annotation analysis, GenBank, BLAST
28	W 27 Nov	Open lab
	28-29 Nov	Thanksgiving
29	M 2 Dec	Lab exam (50 pts) Turn in phyloinformatic results (24 pts) Review and open lab
	W 4 Dec	Last 5 collections due (20 of 20) Lab notebook due (120 pts)
	W 11 Dec	Final exam 2:45 am-4:45 pm; Hesler 202 (100 pts)

Other important dates:
Last day to drop without a "W" 30-Aug-2013
Last day to drop with a "W" 12-Nov-2013

If you need course adaptations or accommodations because of a documented disability, contact Disability Services: 2227 Dunford Hall, 974-6087; email: ods@utk.edu; website: http://ods.utk.edu/

If you feel you need counseling services, you can contact the Counseling Center a 900 Volunteer Boulevard, 974-2196; email: counselingcenter@utk.edu; website: http://counselingcenter.utk.edu/