THE BIOLOGY OF BACTERIA, ALGAE, SLIME MOLDS, FUNGI, LICHENS
AND THE NONVASCULAR PLANTS
BIOLOGY 233

COURSE SYLLABUS, LAB SCHEDULE & OUTLINE
FALL 1999

INSTRUCTOR: Gary A. Laursen
            305A Bunnell
            Phone: 474-6295/7616

TEACHING ASSISTANT: Chad Heverley
                     312 IAB
                     Phone: 474-6295

UNASSIGNED TEXT:
Morphology of Plants and Fungi, 5th Ed. Harper Collins
Publ.
ISBN 0-06-040839-1. Costs: $86.20 new, $64.65 used

SUPPLEMENTS
& LAB. TEXTS:
Class Handouts (HO)
Prescott, G.W. 1954. How to know the fresh water algae Pictured-Key Nature Series, Wm. C. Brown

HANDOUTS: Xeroxing fee, $10

LECTURE: M 5-7 p.m. Bunnell Bldg. Rm. 308

LABORATORY: W 5-8 p.m. Bunnell Bldg. Rm. 308 and 316

COURSE DESCRIPTION

Biology 233 was designed to provide an in-depth introduction, rather than a
taxonomic review, to the bacteria, algae, slime molds, fungi, lichens, liverworts,
hornworts, and mosses, found in Alaska and around the world in Arctic and
Antarctic, and subarctic and subantarctic environs. Our course is intended to whet your appetite for organisms representative of four Kingdoms, the bacteria (Monera), the microscopic, single and multicellular celled algae (Protista), the slime molds (Protista), the fungi & lichens (Myceteeae), the macroscopic algae and primitive plants in the liverworts, hornworts, and mosses (Plantae). Substantial emphasis will be placed on ecological relationships demonstrated by all groups to natural habitats, with an emphasis on those of high latitudes of the subarctic and subantarctic.

Biology 233 is a 3 credit lecture/laboratory course with a fall semester offering and will coincide with a course on the Fungi, Biology 193, to be offered alternate years. Content of this course will include the structure, function, comparative development, taxonomy, ecology, phylogeny, ancestral origins, adaptive mechanisms, and life histories, but not necessarily in that order, of non-vascular, spore producing/seedless (cryptogamic) plants and plant-like forms.

The groups of organisms to be studied are diverse, versatile, intriguing, and opportunistic assemblages. We are exposed to myriad forms daily and in many places (the kitchen sink, your refrigerator, on foods, shower walls, lawns, the water we drink, and the air we breath). There presence and utility, beneficial or destructive, affect all of us, some to a greater extent than we might want or know. Our course in nonvascular plant and plant-like organisms is designed to help you:

1. develop an increased awareness for their many forms, diversity, life histories, ecological relationships, symbiotic associations, taxonomic and evolutionary position, industrial importance, physiological mechanisms important to their survival, as biological control mechanisms, their toxins (poisons), medical and religious implications and how they impact the boreal forest, animals and man;

2. become familiar with literature sources available for information to be used in preparing your colloquium paper on any topic related to the groups of organisms covered. The preferred way of learning about them is to actually work with fresh specimens in the field. Since that can not be effected throughout our course, we will attempt to supplant the field with a rich assortment of audiovisuals in 35 mm slides, films, videos and video-discs, and through laboratory experiences; and

3. experience exciting and rewarding learning introductions to little known organisms, not all of them green. Kermit once quipped, “It’s tough being green”. It is hoped that you will gain greater understanding of our botanical world this semester through the study of nonvascular organisms, such that we develop a working knowledge about botanical science in general with emphasis on some biological specifics.

Our purpose then, is to provide a broad and encompassing exposure/survey to the world of these often lesser known “lower” botanical forms all of which were once members of the plant kingdom. We will not inundate you with binomial
memorization; albeit, several local taxa will become well known to you through lecture and early laboratory and/or field trip exposures.

Our attempt is to educate and produce informed and discerning citizens. Be tactfully critical. At the same time, your charge is to become compassionate and understanding of new and perhaps revolutionizing ideas. Go for it! We’re glad you’ve decided to embark upon this journey with us. Help us guide your learning about life as we trek down this provocative “garden path” together.

**EXAMS:**

If you must **miss an EXAM**, please **contact us BEFORE** the exam. We will ONLY provide make-up exams when the excuse is valid (documented, a debilitating illness; University-related travel, etc.) **and** when you have notified us **in advance** of the exam. Otherwise, you will forfeit any make-up for the exam missed and may lose valuable points. **No exams** may be made-up once graded exams have been returned; generally within one week. Our three exams and Symposium are scheduled for:

<table>
<thead>
<tr>
<th>Date</th>
<th>Exam</th>
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<tbody>
<tr>
<td>5 October</td>
<td>Exam 1</td>
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<tr>
<td>2 November</td>
<td>Exam 2</td>
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<tr>
<td>7 December</td>
<td>Exam 3</td>
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<tr>
<td>13 December</td>
<td>Symposium presentations</td>
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</table>

**SYMPOSIUM CRYPTOGAMAE II:**

Your presentation will be totally based on the research paper (a one page scientific ABSTRACT) you write for our course; i.e., you will be transferring, technologically or otherwise, what it is you have learned about the organism or group of organisms you pursue from reading literature sources in a 15 min. presentation/response period, 10 min. for presenting and 5 for questions and answers.

Much more **SPECIFIC** information on how your paper should be organized, how to write your abstract for printing in our **SYMPOSIUM CRYPTOGAMAE II** Program and Abstract Booklet, and **DEADLINES** will be forthcoming during lecture periods. **PRESENTATIONS** will be delivered on **14 Dec**, the day your written research paper is also due.

**BOTANICAL COLLECTIONS:**

A collection of organisms belonging to any of the four Kingdoms (Monera, Protista [algae, aquatic fungi, or slime molds], Myceteeae, or Plantae) **MAY** be made and submitted for one of three credit options. Botanical collections are **NOT** required, but if made, must be collected early in the course due to ensuing climatic limitations.

**OPTION 1:**

A maximum of **50** collections may be submitted for grading. Each will earn **ONE** point of EXTRA CREDIT to be used to ameliorate points lost in quizzes, exams, your research paper, and/or your paper presentation at our Symposium Cryptogamae II to be held **December 13.**
**OPTION 2:**
A maximum of 100 collections may be submitted for ONE graded point each to be used to WAIVE the grade on your lowest exam, 1 of 3. These are not considered as extra credit points as they are intended to supplant the lack of desired performance in the area of exams ONLY.

**OPTION 3:**
A maximum of 150 collections (ONE graded point each) may be submitted to replace any ONE 100 point exam of your choice and for up to 50 EXTRA CREDIT points. The first 100 collections will be graded as if dedicated to exam replacement. All collections turned in for credit(s) MUST be identified to GENUS, have attached macro- and/or microscopic notes/spore prints or photos if made, preserved, mounted/boxed, and labeled. All collections will be DUE 30 NOVEMBER.

**FIELD TRIPS:**
Three or four 2-4 hr. optional field trips to local habitats, and to coincide with Saturday afternoons of Sept. 11 & 25 and Oct. 2 & 9, are being planned. The purpose of making collections will be for future use in teaching, to enhance your lecture and laboratory experiences, to visit local sites of botanical interest, to give participants the advantage of my expertise in field settings, or just to be out of doors this fall and to enjoy this place we call home. Field trips are VOLUNTARY and somewhat dependent upon weather conditions. Access to post trip laboratory and microscope equipment use will be provided for working up and labeling collections.

**TEXT:**
We have also placed a copy of our unassigned text, *Morphology of Plants and Fungi*, in the laboratory (Rm. 316) for those of you who want to access a copy while studying on campus. PLEASE, do not remove from the lab any of the materials provided, at the risk of being severely ridiculed by your fellow students who also want the advantage of using these learning aids.

**OFFICE HOURS:**
We will determine the best times to meet with you. We shall also establish times to meet with you for EXAM REVIEWS. You are encouraged to set up individual appointments with me whenever you determine that individual attention is needed. Please utilize us. We know more about this course than anyone else because we have been actively involved in its development, set-up, and teaching, and are here to help you succeed!

**MISSED CLASSES:**

**DON'T miss lectures or laboratories!** There is a strong correlation with lectures missed and final grades in any course, but particularly this one! Regular attendance is expected. Obviously, we cannot chain you to a desk. Indeed, we do not want to! Any student desiring a passing grade in the class MUST make a reasonable effort. If a "reasonable effort" is not realized, a student runs the risk of
receiving a lower grade than might be expected. We will adhere to UAF guidelines for the issuance of “Incomplete” grades and the UAF Honor Code applies.

**Grading Policy:**

Grades will be performance-based on three in-class 90 minute exams, your written scientific research paper, and your symposium presentation. A non-comprehensive final exam will constitute Exam 3. Exams will consist of matching, true-false, multiple choice, short answer/fill-in-the-blank, short essay, and contemplative/synthesizing essay questions. They will examine your ability to recognize responses, recall ideas and terminology, discuss knowledge of concepts, synthesize new relationships between existing concepts, and using your new-found knowledge to solve small problems. HOMEWORK will consist of reading scientific articles and reports to construct a RESEARCH paper (abstract only) on any aspect/subject relevant to any of the organisms belonging to the four Kingdoms AND to prepare your symposium paper for presentation. Symposium IDEAS with a brief outline are DUE 12 Oct.; the Symposium ABSTRACT is DUE 6 Dec.; you deliver your symposium presentation 13 Dec. These items may be submitted earlier at your discretion.

**Grade Determination Synopsis:**

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Hour exams (3)</td>
<td>300</td>
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<tr>
<td>Research Paper Abstract</td>
<td>50</td>
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<tr>
<td>Research Paper Presentation</td>
<td>50</td>
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<tr>
<td>Extra Credit Collections</td>
<td>Variable Credit</td>
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</tbody>
</table>

Final grades shall be based on ca. 400+ total points and determined by percentage values as follows:

- A+ ≥ 98%
- A  = 92-97%
- A - ≥ 90%
- B+ ≥ 88%
- B  = 82-87%
- B - ≥ 80%
- C+ ≥ 78%
- C  = 72-77%
- C - ≥ 70%
- D+ ≥ 68%
- D  = 62-67%
- D - ≥ 60%
- F ≤ = 59%
# Lecture, Laboratory, & Field Trip Schedule

<table>
<thead>
<tr>
<th>DATE SUGGESTED</th>
<th>DISCUSSION TOPICS</th>
<th>WHO NOTES</th>
<th>READINGS</th>
</tr>
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<tbody>
<tr>
<td>2 SEP</td>
<td><em>First Day of Instruction &amp; Late Registration</em></td>
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<tr>
<td>6</td>
<td><em>Labor Day: No class</em></td>
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<tr>
<td>7</td>
<td><strong>Lab./Lect.:</strong> Introduction to Course, Laboratory, Research paper, Symposium, Collections, Grading, et al.</td>
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<tr>
<td>10</td>
<td><em>Late registration and fee payment ends, 100% refunds</em></td>
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<tr>
<td>11</td>
<td><strong>FIELD TRIP:</strong> Harding Lake St. Pk., Mile 321 Richardson Hwy. Mixed decid./conif. forest ecosystem for fungi, lichens, &amp; mosses.</td>
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<tr>
<td>13</td>
<td><strong>Lecture:</strong> Divisions of Plant Science &amp; Plant-like Organisms <strong>Prokaryota: Monera</strong> The Bacteria and Blue Green algae (= Cyanobacteria)</td>
<td></td>
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<tr>
<td>14</td>
<td><strong>Lab.:</strong> Lab Orientation and Safety The Bacteria and Blue Green algae (= Cyanobacteria) Field collections workup</td>
<td></td>
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<tr>
<td>17</td>
<td><em>Last day for Student and Faculty-initiated DROPs, 50% refunds</em></td>
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<tr>
<td>20</td>
<td><strong>Lecture:</strong> <strong>Eukaryota: Protista</strong> (= Protoctista) Water Molds, Slime Molds, &amp; Unicelled Algae</td>
<td></td>
<td>Chs. 31, 29</td>
</tr>
<tr>
<td>21</td>
<td><strong>Lab.:</strong> <strong>Eukaryota: Protista</strong> (= Protoctista) Water Molds, Slime Molds, &amp; Unicelled Algae Field collections workup</td>
<td></td>
<td></td>
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<tr>
<td>25</td>
<td><strong>FIELD TRIP:</strong> Ballaine Pond ecosystem for fresh H₂O algae</td>
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<tr>
<td>27</td>
<td><strong>Lecture:</strong> <strong>Eukaryota: Protista</strong> (= Protoctista) Unicelled Algae completion</td>
<td></td>
<td>Chs. 4, 6 &amp; 8</td>
</tr>
</tbody>
</table>
Multicelled Algae: green, brown & red

28 Lab.: **Eukaryota: Plantae** (= Phyta)
Multicelled Algae: green, brown & red
Field collections workup

2 OCT **FIELD TRIP:** The Riparian (river) Ecosystem for fungi & mosses

4 Lecture: **Eukaryota: Plantae** (= Phyta) Chs. 4, 5, 7,
Multicelled Algae: green, brown & red 9 & 10 completion

5 Lab.: **EXAM 1** Chpts. 1, 2, 4, 5, 6, 7, 8, 9, 10, 29 & 31
Bacteria, bluegreen algae, uni- & multi-celled algae (green, yellow-brown, brown, red, fire, & euglenoids)
Field collections workup

8 *Freshman low grade reports*

9 **FIELD TRIP:** Chena Hot Springs, warm & hot H₂O algae

11 Lecture: **Eukaryota: Mycetecae** (= Fungi) Ch. 28
Introduction to the Amastigomycota
**VIDEO:** The Rotten World

12 **Symposium presentation ideas/generalized outline is DUE!**
Lab: **Eukaryota: Mycetecae** (= Fungi)
Fungal life cycles, roles played, how to collect, key, micro- macro-describe, preserve, and section for “scoping”
Field collections workup

15 *Last day to apply for Fall Semester graduation*

18 Lecture: **Eukaryota: Mycetecae** (= Fungi) Ch. 32 & 35
Lower Fungi - the bread molds fly fungi and arthropod associates

19 Lab.: **Eukaryota: Mycetecae** (= Fungi)
Lower Fungi - the bread molds & asexual deuteromycetes
Field collections workup
Lecture: **Eukaryota: Myceteae (= Fungi)**
Higher Fungi: Fire, Flies & Fungi

Lab.: **Eukaryota: Myceteae (= Fungi)**
Collections of higher fungi: a survey of taxa
Field collections workup

Last day for Student and Faculty-initiated WITHDRAWLs w/ a “W”

1 NOV.
Lecture: **Eukaryota: Myceteae (= Fungi)**
Mammals, Mycophagy, Mycetes and Mycorrhizae

Lab.: **EXAM 2**
Chpts. 28, 30, 32, 35
Kingdom characters, lower fungi, sexless fungi, bread molds, arthropod associates, and ecology
Field collections workup

8
Lecture: **Eukaryota: Myceteae (= Fungi)**
Ascomycetes: the sac fungi

8
*Spring semester fee payment begins*

9
Lab.: **Eukaryota: Myceteae (= Fungi)**
Sac fungi: The yeast (products & processes), cleistotheciate, hysterotheciate, peritheciate & apotheciate fungi
Field collections workup

15
Lecture: **Eukaryota: Myceteae (= Fungi)**
Club fungi: The rust, smuts, jelly mushrooms and toadstools

16
Lab.: **Eukaryota: Myceteae (= Fungi)**
Club fungi: The rust, smuts, jelly mushrooms and toadstools
Field collections workup

22
Lecture: **Eukaryota: Myceteae (= Fungi)**
Mushroom toxins, Medical and Infectious Mycoses

23
Lab.: **Eukaryota: Myceteae (= Fungi)**
Asco- & Basidio-Lichens
Field collections workup

25-28 Nov  Thanksgiving Holidays

29  Lecture:  Eukaryota: Plantae (= Phyta)  Chs. 3, 11, & 12
     Liverworts, hornworts, and mosses

30  All Collections are DUE!!
    Lab.:  Eukaryota: Plantae (= Phyta)
           Liverworts, hornworts, and mosses

6 Dec  Research Paper Abstracts Due!
    Lecture:  Eukaryota: Plantae (= Phyta)
               Liverworts, hornworts, and mosses completion

7  Lab.:  Exam 3  Chpts. 3, 11, 12, 33, 34, 36
           Ascomycetes, basidiomycetes, liverworts, hornworts, & mosses

11 Dec  Last Day of Instruction

13  Symposium Cryptogamae II
    Research papers of speakers DUE
    Presentations Delivered

14-17 Dec  Finals
GENERALIZED COURSE OUTLINE OF
Alaskan Mushrooms, Toadstools and Other Fungi

KINGDOM OF FUNGI:

Key Characteristics of the Kingdom
- heterotrophy by absorption & assimilation
- achlorophyllous
- cellular structure, organization and reproduction
- nuclear condition(s)

FUNGAL LIFE CYCLES:

Mature Spore --> germination --> monokaryotic hypha --> monokaryotic mycelium (Spawn) --> monokaryotic fusion (somatogamy, plasmogamy) --> dikaryotic mycelium --> nuclear fusion (karyogamy) --> somatic specialization --> meiosis --> sexual meiospores

FUNGAL PHYSIOLOGY:

- Spore germination
- Hyphal growth and differentiation
- Reproduction signals
- Nutritional modalities
- Culturing

COLLECTING, DESCRIBING, PRESERVING AND PUBLISHING ON FUNGI:

ENVIRONMENTAL ROLES (SYMBIOSES AND BIOLOGICAL CONTROL) OF FUNGI:

Parasites: (epi- & endo- of animal & plant tissue)
- antagonists (capturing, parasitic and endosymbioses)
- interfungal (necro- & bio-trophics)

Saprobic Decomposers:
- bryophyllous (epibryophytic = on mosses and liverworts)
- carbonicolous (“fire” loving)
- coprophyllous (dung loving)
- geophyllous (ground loving)
- insectivorous (on/in insects)
- keratinophyllous (keratin = skin, feather, nail loving)
- lignicolous (wood inhabiting)
- siliceous (on soil)

Mycorrhizae: (endo-, ectendo-, and ecto-mutualisms)
Lichen associations: (fungus-algae)

FORESTS, FIRE, INSECTS AND FUNGAL USES:

- Aesthetics (art, photography, spore printing)
- Culturing and Farming
Formal study (mycology)
Infectious Mycoses (diseases)
Mind expansion and “Religion”
Mycophagy
Products (breads, tofu, cheese, spirits)

**Fungal Taxa:**

The basis for understanding is predicated upon structure, function, habit, habitats, ecology (to forest and man), symbioses, evolutionary relationships, biological controls, roles played, cycles, mycophagy, mycoplasms & -toxins

<table>
<thead>
<tr>
<th>DIVISION</th>
<th>FUNGAL GROUPS/COMMON NAMES</th>
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<tbody>
<tr>
<td><strong>Protosteliomycetes</strong></td>
<td>(Protostelid slime molds)</td>
</tr>
<tr>
<td><strong>Acraziomycetes</strong></td>
<td>(Dictyostelid false/cellular slime molds)</td>
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<tr>
<td><strong>Myxomycetes</strong></td>
<td>(Plasmodial true/coenocytic slime molds)</td>
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<tr>
<td><strong>Phycomycetes</strong></td>
<td>(Water molds)</td>
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<tr>
<td>Chytridiomycetes</td>
<td>(Uniflagellated)</td>
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<tr>
<td>Oomycetes</td>
<td>(Biflagellated water molds, white rusts &amp; downy mildews)</td>
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<tr>
<td><strong>Zygomycetes</strong></td>
<td>(Zygosporic bread, fly &amp; animal trap fungi)</td>
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<tr>
<td><strong>Trichomycetes</strong></td>
<td>(Arthropod “anal inhabitants”)</td>
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<tr>
<td><strong>Ascomycetes</strong></td>
<td>(Sac or cup fungi)</td>
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<tr>
<td>Hemiascomycetes</td>
<td>(Yeasts and leaf curl fungi)</td>
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<tr>
<td>Plectomycetes</td>
<td>(Black and blue molds)</td>
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<tr>
<td>Pyrenomycetes</td>
<td>(Perithelial ascomata)</td>
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<tr>
<td>Loculoascomycetes</td>
<td>(Ascostromatic fungi)</td>
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<tr>
<td>Discomycetes</td>
<td>(Cup fungi, morels &amp; truffles)</td>
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<tr>
<td>Laboulbeniomyces</td>
<td>(Insect fungi)</td>
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<tr>
<td><strong>Basidiomycetes</strong></td>
<td>(Club fungi)</td>
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<tr>
<td>Teliomycetes</td>
<td>(Rust &amp; smut fungi)</td>
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<tr>
<td>Phragmomyces</td>
<td>(Jelly fungi)</td>
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<tr>
<td>Gasteromycetes</td>
<td>(Non-organized hymenium, the Stomach fungi = puffballs, etc.)</td>
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<tr>
<td>Hymenomycetes</td>
<td>(Organized hymenium)</td>
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<tr>
<td><strong>Deuteromycetes</strong></td>
<td>(Imperfect or asexual fungi)</td>
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<tr>
<td>Hyphomycetes</td>
<td>(Stream &amp; river fungi)</td>
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<tr>
<td>Coelomycetes</td>
<td>(Acervulate or Pycnidial Plant parasites)</td>
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**Fungal Toxins & Mushroom Poisoning:**

- Aflatoxins (Hyphomycete carcinogens)
- Allergenic reaction (Histamines, immune hypersensitivity)
- Amatoxins (Cyclic octopeptides)
- CNS (PNS: ergot, ibotenic acid, LSD, muscazol, muscinol, pantherine, piltzatropine & tricholomic acid)
- Coprine (Antabuse-like)
Gastrointestinal irritants (Upsetters)
Hallucinogens (Psychoactive)
Ibotenic acid (Metabolites)
Mono-methyl-hydrazines (Protoplasmic)
Muscarine
Protoplasmic poisons
Secondary metabolites