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

COURSE SYLLABUS, SCHEDULE & OUTLINE
FALL 1997

INSTRUCTOR: Gary A. Laursen
Phone: 474-6295/7583
305A Bunnell
OFFICE HRS: By Appointment

TEACHING ASSISTANT: Chris Swingley
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212 IAB
OFFICE HRS: By Appointment

Costs: $86.20 new, $64.65 used

SUPPLEMENTS: Class Handouts (HOs)
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 algae, fungi, lichens, liverworts, horn worts, mosses, and to a much lesser extent, the bacteria, found in Alaska and around the world in Arctic and
subarctic/antarctic environs. It is intended to whet your appetite for members of four
Kingdoms, the bacteria (Monera), the microscopic, single celled algae (Protista), the
fungi & lichens (Myceteeae), and the macroscopic algae and primitive plants, the
liverworts, horn worts, and mosses (Plantae). Substantial emphasis will be placed
on ecological relationships demonstrated.

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 on 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.

The groups of organisms to be studied are a diverse, versatile, intriguing and
opportunistic assemblages. We are exposed to myriad forms daily and in many
places (the kitchen sink, your refrigerator, on foods, showers, lawns, the water we
drink, and the air we breath). There presence and utility, beneficial or destructive,
effect 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 course paper on any topic related to these organisms. 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.

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 biological world this semester
   through the study of nonvascular organisms, such that we develop a working
   knowledge about 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" 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 are scheduled for:
1. October
2. 29 October
3. December

**SYMPOSIUM CRYPTOGRAMAE I:**

Your presentation will be totally based on the research paper you write for our course; i.e., you will be transferring, technologically or otherwise, what it is you learned about the organism or group of organisms you pursued from reading literature sources in a 15 min. presentation, 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 CRYPTOGRAMAE I** Program and Abstract Booklet, and **DEADLINES** will be forthcoming during lecture periods. **PRESENTATIONS** will be delivered on 3 & 10 Dec., the day your written research papers are also due.

**BOTANICAL COLLECTIONS:**

A collection of organisms belonging to any of the four Kingdoms (Monera, Protista, Mycetaceae, 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 our 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 paper presentation at our Symposium Cryptogamae 1 to be held December 8 & 10.

**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 19 NOVEMBER.

**FIELD TRIPS:**

Three or four 2-4 hr. optional field trips to local habitats, and to coincide with Saturday afternoons of Sept. 13, 20, 27, and 4 Oct., 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 use will be provided for working up collections.

**TEXT:**

We have also placed a copy of our text, *Morphology of Plants and Fungi*, on Library Reserve in Rasmussen for those of you who cannot afford the text or need a copy while studying on campus. PLEASE, do not remove from the library 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 your TA or 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 **syposium 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 on any aspect/subject relevant to any of the organisms belonging to the four Kingdoms AND to prepare your symposium presentation. Ideas with a brief outline are DUE **8 Oct.**; the paper on the day you deliver your symposium presentation, **8 or 10 December**. These items may be submitted earlier at your discretion.

**Grade Determination Synopsis:**

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<tr>
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<tbody>
<tr>
<td>Hour exams (3)</td>
<td>300</td>
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<tr>
<td>Research Paper</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>
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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%
<table>
<thead>
<tr>
<th>DATE</th>
<th>DISCUSSION TOPICS</th>
<th>SUGGESTED READINGS</th>
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<tbody>
<tr>
<td>4 SEP</td>
<td><em>First Day of Instruction &amp; Late Registration</em></td>
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<tr>
<td>8</td>
<td><strong>Lecture:</strong> Introduction to Course, Laboratory, Research paper, Symposium, Collections, Grading, et al. Divisions of Plant Science &amp; Plant-like Organisms <strong>Prokaryota: Monera</strong> The Bacteria and Blue Green algae (= Cyanobacteria)</td>
<td>Chs. 1, 2</td>
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<tr>
<td>10</td>
<td><strong>Lab.:</strong> Lab Orientation and Safety The Bacteria and Blue Green algae (= Cyanobacteria) Field collections workup</td>
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<tr>
<td>12</td>
<td><em>Late registration and fee payment ends, 100% refunds</em></td>
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<tr>
<td>13</td>
<td><strong>Field Trip:</strong> Mixed forest of cross country ski trails</td>
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<td>15</td>
<td><strong>Lecture:</strong> <strong>Eukaryota: Protista</strong> (= Prototista) Water Molds, Slime Molds, &amp; Unicelled Algae</td>
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<tr>
<td>17</td>
<td><strong>Lab.:</strong> <strong>Eukaryota: Protista</strong> (= Prototista) Water Molds, Slime Molds, &amp; Unicelled Algae Field collections workup</td>
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<tr>
<td>19</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>Field Trip:</strong> The Pond Ecosystem</td>
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<tr>
<td>22</td>
<td><strong>Lecture:</strong> <strong>Eukaryota: Protista</strong> (= Prototista) Unicelled Algae completion Multicelled Algae: green, brown &amp; red</td>
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<tr>
<td>24</td>
<td><strong>Lab.:</strong> <strong>Eukaryota: Plantae</strong> (= Phyta) Multicelled Algae: green, brown &amp; red Field collections workup</td>
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<tr>
<td>27</td>
<td><strong>Field Trip:</strong> The Riparian (river) Ecosystem</td>
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</tbody>
</table>
Lecture: **Eukaryota: Plantae** (= Phyta) Chs. 4, 5, 7, 9 &10
  Multicelled Algae: green, brown & red completion

1 OCT

*Freshman low grade reports*

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

4

**Field Trip:** The Hot Springs Ecosystem

6

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

8

**Symposium presentation ideas/generalized outline is DUE!**

Lab: **Eukaryota: Mycetaceae** (= Fungi)
  Fungal life cycles, roles played, how to collect, key, micro- macro-describe, preserve, and section for “scoping”
  Field collections workup

13

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

15

*Last day to apply for Fall Semester graduation*

Lab.: **Eukaryota: Mycetaceae** (= Fungi)
  Lower Fungi - the bread molds & asexual deuteromycetes
  Field collections workup

20

Lecture: **Eukaryota: Mycetaceae** (= Fungi) Ch. 30
  Higher Fungi: Fire, Fliers & Fungi

22

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

27

Lecture: **Eukaryota: Mycetaceae** (= Fungi)
  Mammals, Mycophagy, Mycetes and Mycorrhizae

29

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

31 OCT  Last day for Student and Faculty-initiated WITHDRAWLs

3 NOV  Spring semester fee payment begins
Lecture:  Eukaryota: Mycetaceae (= Fungi)  Ch. 33
          Ascomycetes: the sac fungi

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

10    Lecture:  Eukaryota: Mycetaceae (= Fungi)  Ch. 34
          Club fungi: The rust, smuts, jelly
          mushrooms and toadstools

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

17    Lecture:  Eukaryota: Mycetaceae (= Fungi)  Ch. 36
          Mushroom toxins, Medical
          and Infectious Mycoses

19    Lab.:  Eukaryota: Mycetaceae (= Fungi)
          Asco- & Basidio-Lichens
          Field collections workup

24    Lecture:  Eukaryota: Plantae (= Phyleta)  Chs. 3, 11, & 12
          Liverworts, horn worts, and mosses

26    Lab.:  Eukaryota: Plantae (= Phyleta)
          Liverworts, horn worts, and mosses

27-30 NOV  THANKSGIVING HOLIDAYS

1 DEC  Lecture:  Eukaryota: Plantae (= Phyleta)
          Liverworts, horn worts, and mosses
          completion

3     Lab.:  EXAM 3  Chpts. 3, 11, 12, 33, 34, 36
          Ascomycetes, basidiomycetes, liverworts,
          horn worts, & mosses
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

M-SPORE --> germ. monokaryotic hypha --> monokaryotic mycelium (Spawn)
  --> monokaryotic fusion (somatogamy, plasmogamy) --> dikaryotic mycelium
  --> karyogamy --> somatic specialization --> meiosis --> asexual 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)
- Sabrobic Decomposers
  - bryophyllous (epibryophytic = on mosses and liverworts)
  - carbonicous (“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>Acraziomycetes</td>
<td>(Dictyostelid false/cellular slime molds)</td>
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<tr>
<td>Myxomycetes</td>
<td>(Plasmodial true/coenocytic slime molds)</td>
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<tr>
<td>Phycomycetes</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>Zygomycetes</td>
<td>(Zygosporic bread, fly &amp; animal trap fungi)</td>
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<tr>
<td>Trichomycetes</td>
<td>(Arthropod “anal inhabitants”)</td>
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</tbody>
</table>
Ascomycetes  (Sac or cup fungi)
    Hemiascomycetes  (Yeast and leaf curl fungi)
    Plectomycetes  (Black and blue molds)
    Pyrenomycetes  (Perithecial ascomata)
    Loculoascomycetes  (Ascostromatic fungi)
    Discomycetes  (Cup fungi, morels & truffles)
    Laboulbeniomyces  (Insect fungi)

Basidiomycetes  (Club fungi)
    Teliomycetes  (Rust & smut fungi)
    Phragmomyces  (Jelly fungi)
    Gasteromycetes  (Non-organized hymenium, the Stomach
           fungi = puffballs, etc.)
    Hymenomycetes  (Organized hymenium)

Deuteromycetes  (Imperfect or asexual fungi)
    Hyphomycetes  (Stream & river fungi)
    Coelomycetes  (Acervulate or Pycnidal Plant parasites)

Fungal Toxins & Mushroom Poisoning:

    Aflatoxins  (Hyphomycete carcinogens)
    Allergenic reaction  (Histamines, immune hypersensitivity)
    Amatoxins  (Cyclic octopeptides)
    CNS  (PNS: ergot, ibotenic acid, LSD, muscazon, muscimol, pantherine, piltzatropine &
            tricholomic acid)

    Coprine  (Antabuse-like)
    Gastrointestinal irritants  (Upsetters)
    Hallucinogens  (Psychoactive)
    Ibotenic acid  (Metabolites)
    Mono-methyl-hydrazines  (Protoplasmic)
    Muscarine
    Protoplasmic poisons
    Secondary metabolites