Chemical Ecology
BSPM 570
Spring 2012

Instructor: Louis B. Bjostad
Office: Plant Sciences E211
Phone: 970-491-5987
Email: louis.bjostad@colostate.edu

Lecture: 11 MWF
Room E8, Plant Sciences Building

Calendar:

Lectures
18 Jan (Wednesday) First class
10-18 March No classes, Spring break
4 May (Friday) Last class

Assignments
22 Feb (Wednesday) Exam One (30% of grade)
7 March (Wednesday) Abstract of review article due (5% of grade)
4 April (Wednesday) Review article due (30% of grade)
7 May (Monday) Exam Two (30% of grade), 7:30 AM -9:30 PM
Every Friday Class discussions (5% of grade)

PLEASE NOTE THAT THIS CLASS USES PLUS AND MINUS LETTER GRADES.

Optional Textbook: Introduction to Ecological Biochemistry, J. B. Harborne

Optional Laboratory (BSPM571):

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Time</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb 24</td>
<td>Friday</td>
<td>1 pm – 5 pm</td>
<td>Gas-liquid chromatography</td>
</tr>
<tr>
<td>Mar 23</td>
<td>Friday</td>
<td>1 pm – 5 pm</td>
<td>Thin layer chromatography</td>
</tr>
<tr>
<td>Apr 13</td>
<td>Friday</td>
<td>1 pm – 5 pm</td>
<td>Solid phase extraction</td>
</tr>
<tr>
<td>May 4</td>
<td>Friday</td>
<td>1 pm – 5 pm</td>
<td>Derivatization</td>
</tr>
</tbody>
</table>

Topic 1. Overview of chemical ecology: design and significance of bioassays, chemical techniques in studying ecological interactions.

Lectures:
Introduction Jan 18 Wed
Seven Postulates Jan 20 Fri
Chromatography Jan 23 Mon

Lecture (Jan 25 Wednesday):
Class discussion (Jan 27 Friday):
Zhang Dong; Terschak John A.; Harley Maggy A.; et al. Simultaneously Hermaphroditic Shrimp Use Lipophilic Cuticular Hydrocarbons as Contact Sex Pheromones. PLOS ONE Volume: 6 Issue: 4 Article Number: e17720 DOI: 10.1371/journal.pone.0017720 Published: APR 2011.

Topic 2. Major chemical groups of natural products and their structural features, plant, biosynthetic origins of secondary compounds

Lecture (Jan 30 Monday):
Chemical classes

Lecture (Feb 1 Wednesday):

Class discussion (Feb 3 Friday):
Chen Feng; Tholl Dorothea; Bohlmann Joerg; et al. The family of terpene synthases in plants: a mid-size family of genes for specialized metabolism that is highly diversified throughout the kingdom. PLANT JOURNAL Volume: 66 Issue: 1 Pages: 212-229 DOI: 10.1111/j.1365-313X.2011.04520.x Published: APR 2011.

Topic 3. Theories of the roles of plant allelochemicals

Lecture (Feb 6 Monday):
Theories of chemical defense

Lecture (Feb 8 Wednesday):

Class discussion (Feb 10 Friday):

Also of interest (NOT required reading):

Hadacek Franz; Bachmann Gert; Engelmeier Doris; et al. HORMESIS AND A CHEMICAL RAISON D’ETRE FOR SECONDARY PLANT METABOLITES. DOSE-RESPONSE Volume: 9 Issue: 1 Pages: 79-116 DOI: 10.2203/dose-response.09-028.Hadacek Published: 2011.

Topic 4. Herbivory and the chemical defenses of plants

Lecture (Feb 13 Monday):
Web of Science

Lecture (Feb 15 Wednesday):
Lampert Evan C.; Zangerl Arthur R.; Berenbaum May R.; et al. Generalist and specialist host-parasitoid associations respond differently to wild parsnip (Pastinaca sativa) defensive chemistry.
Class discussion (Feb 17 Friday):
*Today is the last course material that will be covered on Exam One on Feb 22 Wednesday.*


**Topic 4. Herbivory and the chemical defenses of plants (continued)**

Lecture (Feb 20 Monday):
*Today is the first course material that will be covered on Exam Two on May 7 Monday.*

Detailed examples for tannins, terpenes, cyanogens, cardenolides, toxic amino acids and proteins (no readings).

**EXAM ONE (Feb 22 Wednesday): THIS EXAM IS 30% OF YOUR FINAL GRADE.**

Lecture (Feb 24 Friday):

More detailed examples for tannins, terpenes, cyanogens, cardenolides, toxic amino acids and proteins (no readings).

**Topic 5. Coevolution of herbivores and plant allelochemicals**

Lecture (Feb 27 Monday):


Lecture (Feb 29 Wednesday):


Class discussion (Mar 2 Friday):


**Topic 6. Chemical recognition: chemosensory and neurophysiological basis, behavioral mechanisms**

Lecture (Mar 5 Monday):

Chemical recognition

Lecture (Mar 7 Wednesday):

**ABSTRACT (300 words) OF YOUR REVIEW ARTICLE DUE TODAY (5% OF FINAL GRADE)**


Class discussion (Mar 9 Friday):

SPRING BREAK IS MARCH 10 – MARCH 18

**Topic 7. Circumvention of defenses: detoxification, mixed function oxidases, group transfer**

**Lecture (Mar 19 Monday):**
Circumvention of defenses

**Lecture (Mar 21 Wednesday):**

**Class discussion (Mar 23 Friday):**
Ahn Seung-Joon; Badenes-Perez Francisco R.; Reichelt Michael; et al. METABOLIC DETOXIFICATION OF CAPSAICIN BY UDP-GLYCOSYLTRANSFERASE IN THREE Helicoverpa SPECIES. ARCHIVES OF INSECT BIOCHEMISTRY AND PHYSIOLOGY Volume: 78 Issue: 2 Pages: 104-118 DOI: 10.1002/arch.20444 Published: OCT 2011.

**Topic 8. Chemical interactions among plants: allelopathy, higher plant parasites, chemical communication**

**Lecture (Mar 26 Monday):**
Allelopathy

**Lecture (Mar 28 Wednesday):**
Inderjit; Evans Heather; Crocoll Christoph; et al. Volatile chemicals from leaf litter are associated with invasiveness of a Neotropical weed in Asia. ECOLOGY Volume: 92 Issue: 2 Pages: 316-324 DOI: 10.1890/10-0400.1 Published: FEB 2011.

**Class discussion (Mar 30 Friday):**
Kato-Noguchi Hisashi; Salam Md Abdus; Suenaga Kiyotake. Isolation and Identification of Potent Allelopathic Substances in a Traditional Bangladeshi Rice Cultivar Kartikshail. PLANT PRODUCTION SCIENCE Volume: 14 Issue: 2 Pages: 128-134 Published: APR 2011.

**Topic 9. Pollination biology: floral pigments, floral scent and floral rewards, toxic nectar**

**Lecture (April 2 Monday):**
Pollination

**Lecture (April 4 Wednesday):**
YOUR REVIEW ARTICLE IS DUE TODAY (30% OF FINAL GRADE)

**Class discussion (April 6 Friday):**
Topic 10. Microbial interactions: phytotoxins, phytoalexins and lectins

Lecture (April 9 Monday):
Microbial Interactions

Lecture (April 11 Wednesday):

Class discussion (April 13 Friday):

Also of interest (NOT required reading):

Topic 11. Chemical attack and defense in animals: toxins, venoms, phytotoxemia

Lecture (April 16 Monday):
Toxins

Lecture (April 18 Wednesday):
Bohlen Christopher J.; Chesler Alexander T.; Sharif-Naeini Reza; et al. A heteromeric Texas coral snake toxin targets acid-sensing ion channels to produce pain. NATURE Volume: 479 Issue: 7373 Pages: 410-U167 DOI: 10.1038/nature10607 Published: NOV 17 2011.

Class discussion (April 20 Friday):
Van Dyck Severine; Caulier Guillaume; Todesco Maite; et al. The triterpene glycosides of Holothuria forskali: usefulness and efficiency as a chemical defense mechanism against predatory fish. JOURNAL OF EXPERIMENTAL BIOLOGY Volume: 214 Issue: 8 Pages: 1347-1356 DOI: 10.1242/jeb.050930 Published: APR 2011.

Topic 12. Infochemicals: semiochemicals, pheromones, allomones, kairomones

Lecture (April 23 Monday):
Infochemicals

Lecture (April 25 Wednesday):

Class discussion (April 27 Friday):
Topic 13. Case studies: ongoing research in chemical ecology

Lecture (April 30 Monday):
David James Lecture
Sitosterol as a feeding stimulant for termites: chemistry and ecological rationale

Lecture (May 2 Wednesday):
Elisa Bernklau Lecture
Host selection in corn rootworms: chemistry and ecological rationale

Lecture (May 4 Friday):

GRADING CRITERIA

A. Written examination (30% of grade).
First exam will include all material from the first class until the day of the exam.

B. Abstract of review article (5% of grade).
Abstract should have 300 words, along with a preliminary reference list of 5 principal references in an appropriate format of your choice. Your abstract should summarize the topic that will be covered in your full-length review article.

C. Review article (30% of grade).
Review article must be on a research topic of current interest in chemical ecology in scientific format, including title, abstract (same one you turned in before), introduction, discussion (preferably in subsections), and references. You may insert photocopies of tables or figures from other publications, if you like. The paper should have 3000 words (this is usually about 10 double-spaced pages), and 10-20 references.

You must turn in:
- one printed copy, and also
- one electronic file in any of the following ways you prefer:
  - email me your review article as a PDF file, or a Microsoft Word file, or a text file (to louis.bjostad@colostate.edu)
  - give me a CD with your review article as a PDF file, or a Microsoft Word file, or a text file

Other comments about the printed copy you turn in:
- Double-space all pages, so that I have room to write comments between the lines
- Number the pages
- Staple the pages together
- Do not put your article in a binder (manuscripts submitted to journals never are)
- Include your email address at the top of your review article

D. Final examination (30% of grade).
Second exam will include only the material not covered on the first exam.

E. Class discussions (5% of grade).
Your performance in the discussions will NOT be graded, but 5% of your final grade will depend on your active participation in the discussions.