

**Biology 445/545 – Biology of Toxins**  
**Spring, 2009**  
**Dr. Eric C. Toolson**

Week	Date	Topic	Due
1	1/21	Course Introduction; Principles of Toxicology	
2	1/28	Principles of Toxicology	Toxins In The News assignment #1
3	2/4	Principles of Toxicology	Project team formed.
4	2/11	Principles of Toxicology	Project topic and preliminary presentation outline approved by me.
5	2/18	Principles of Toxicology	Toxins In The News assignment #2
6	2/25	Cytotoxins	1 <sup>st</sup> Paper Interpretation (team effort)
7	3/4	Cytotoxins	Presentation progress report, including a description of your team's efforts to date.
8	3/11	<b>MIDTERM EXAM</b>	
9	3/18	<b>SPRING BREAK</b>	
10	3/25	Gastrointestinal System Physiology; GI System Toxins	Toxins In The News assignment #3
11	4/1	Basic Neurophysiology; Neurotoxins	Presentation progress report, including a fairly detailed outline.
12	4/8	Neurotoxins	Toxins In The News assignment #4
13	4/15	Neurotoxins	2 <sup>nd</sup> Paper Interpretation (team effort)
14	4/22	Neurobiology of Addiction	
15	4/29	Cardiovascular System Physiology; CV System Toxins	Project completed and ready for evaluation
16	5/6	CV System Toxins ; Miscellaneous Toxins	
	TBA	<b>FINAL EXAM</b> – TBA	Student evaluations of projects due

### Goals For The Course

In addition to the obvious goals of presenting basic principles of toxicology and some of the important mechanisms by which toxins exert their effect(s), I've designed this course to:

- develop an understanding of the crucial roles played by toxins in the evolutionary ecology of many organisms.
- convey an appreciation of the medical applications of toxins – it is essential to treat this topic in some detail, because so many therapeutic drugs are derived from toxins, and the number is constantly increasing.
- hone your library research and presentation skills.
- improve your ability to critically analyze the types of papers that are published in the toxicological and medical research literature.
- instill in you a modicum of consumer awareness – toxins in one form or another are a fact of our daily lives, and you need to recognize this, if for no other reason than for the good of your little baboos and babettes, present and/or future.

We'll accomplish these goals through coverage of topics drawn from microbiology, physiology, biochemistry, evolutionary ecology, anthropology, pharmacology, medicine, history, sociology and politics.

The diverse nature of the topics we'll be covering during the semester is the reason I don't use a text for the course. Available toxicology texts either focus on toxicological principles and environmental toxins/pollutants, essentially ignoring completely toxins produced by organisms, or on the physiology and ecology of a relatively limited set of toxins. A single text that complements the breadth of topics and depth of coverage in this course is simply not available.

### Grading

Your grade will be determined as follows:

Homework, in-class quizzes, etc.	25%
Midterm exam	30%
Final exam	35%
Research Project Presentation	10%

The in-class quizzes – *which may be unannounced* – are intended to keep everybody up to speed with the material, and will focus on factual knowledge, individual toxins and their mechanism of action, etc. leaving the big-picture and conceptual questions for the midterm and final. Figure on a quiz at least every other week.

## Contact Information

The easiest way to contact me is via e-mail: [toolson@unm.edu](mailto:toolson@unm.edu) (there's a link on the course's web site). My phone number is 277-3329. Your TA for the course is Casey Gilman: [cgilman@unm.edu](mailto:cgilman@unm.edu).

## Office Hours

My official office hours are Wednesdays, 1300-1500. However, *please* do not feel constrained to seeking me out only during those times. You are welcome to drop by my office any time I'm there, which will be almost any day of the week except Friday. If you're having difficulty finding me, call or e-mail me and we'll set up an appointment.

## Course Website

The URL for the course website is <http://biology.unm.edu/toolson/biotox/biotox.htm>. I will make extensive use of the website for posting study questions, sample exams, homework assignments, announcements, etc. You should get in the habit of checking the website frequently, at least once per week. If you encounter any problems accessing the website or associated materials, please let me know ASAP.

## Class Project Teams

For a number of assignments, you will be working as a team with two or three of your classmates. In particular, the team approach will be used to complete the research project and the two critical analyses of scientific papers. Therefore, you should form your team as soon as possible after receiving this. Since your team will be responsible for the final presentation of your research project results, it is important to choose teammates who share your interest in a particular toxicological topic. As soon as you've formed your team, please e-mail me the names of the members of your team, and we'll get started on the approval process for your topic. If you have a topic in mind, but need to come up with some team members, e-mail me your topic and I'll post it on the website, along with your contact information.

## Homeworks

### 1. Toxins in the news

For this homework, you will select a toxin-related publication that appeared after 9/1/2008 and critically analyze the underlying science. The topic can be anything even remotely toxins-related: microbiology, bioterrorism, pollution, diseases, development of an antibiotic or other therapy (including therapies for non-infectious diseases such as cancer, diabetes, multiple sclerosis, etc.), bacterial resistance to antibiotics, Lip Venom<sup>®</sup>, articles such as <http://www.msnbc.msn.com/id/22611275/>, models of epidemic spread or intervention protocols, evolutionary ecology of toxins or venoms, 'natural' remedies, ethnobotany (use of plant products by indigenous peoples), etc. I interpret "toxins-related" very broadly, in other words.

Regardless of the source of the publication you choose to analyze, you will prepare a one-paragraph summary and a one-page critical analysis of the paper. Your critical analysis might include:

- i. Strengths & weaknesses of the study.
- ii. What research would you do next?
- iii. What hypothesis was the research designed to test, and did the results of the research actually test the hypothesis?
- iv. What unanswered question(s) did you have as a result of reading the publication?
- v. What is the potential impact of the article on our understanding of Nature, history, medicine, or everyday life?

In addition to your summary and critical analysis, you will submit ancillary information, depending on the source of the publication you are analyzing. The sources you may use to complete these four assignments will be categorized as follows:

#### a. Primary research literature

This category includes refereed journals such as *Toxicon*, *Science*, *Nature*, *American Naturalist*, *Molecular Evolution*, *Naturwissenschaften*, *PNAS*, *Journal of Chemical Ecology*, certain electronic journals (published on-line) such as [biology.plosjournals.org](http://biology.plosjournals.org), and other journals that I've listed in [tox\\_journals.pdf](#). These journals publish results of original scientific research, and the journals are routinely read by those with significant expertise in a particular field. Review articles would also be considered primary research literature.

#### b. Secondary scientific literature

Examples of this category would be publications such as *Science Today*, *New Scientist*, *Scientific American*, *American Scientist*, *Natural History*, editorials appearing in a primary literature journal such as *The New England Journal of Medicine* or the *Journal of the American Medical Association*, book chapters (some), etc. These journals are accessible to individuals with some background in science, but comprehending the articles doesn't require specialized knowledge or expertise in a particular scientific discipline. Newspaper articles and television programs are explicitly *excluded* from this category.

If you choose to analyze a paper from the secondary scientific literature, in addition to a copy of the paper, you must submit a copy of a relevant paper from the primary research literature.

#### c. Popular media

This category includes articles appearing in newspapers or magazines (including online, <http://www.latimes.com/> or <http://www.nytimes.com/>), online news sites such as [MSNBC](#) or [BBC](#), a press release from the [Centers for Disease Control](#), book chapters (most), POSSIBLY a radio or television program, websites such as [www.msnbc.msn.com/id/3033055/](http://www.msnbc.msn.com/id/3033055/), [www.invisiblekillers.com/resources/in\\_the\\_news.php](http://www.invisiblekillers.com/resources/in_the_news.php), <http://news.bbc.co.uk/2/hi/science/nature/7791989.stm>, <http://news.bbc.co.uk/2/hi/africa/7817355.stm>, or any of a number of others that señor Google might turn up.

If you choose to analyze something from the popular media, in addition to a copy of the item (or a link to it, if it's an online source), you must submit a copy of a relevant paper from the primary research literature.

## Grading

No matter what the source of the article you choose to review, your write-up should be submitted as a hard copy, typed (size 12 font, single-spaced). The key criteria used in grading your Toxins-in-the-news submission will be:

- i. How much thought went into your choice of an article?
- ii. How much thought and effort did you put into your summary and critical analysis, and how thorough was each?
- iii. Did your summary include a brief justification of why you chose the article you did?
- iv. The quality of your sources – if in doubt, *ask* Casey or me.
- v. **Extra credit** *may* be given for:
  1. Submitting a copy of a paper that cites the one you're analyzing.
  2. Choosing a paper that 'attacks' current dogma.
  3. Pursuing a new direction that your choice of paper suggested to you.
  4. Exceeding the minimum requirements. Note, however, that extra credit *will not* be given simply because you exceed the length limits listed above; in fact, writing too much will actually hurt your grade. Economy of expression is difficult to achieve, but it's a key component of good scientific writing. It's much more difficult to write a lucid, tightly-focused one-page analysis of an article than a sloppy two- or three-page tome.

## 2. Critical Analysis of a Scientific Paper

This assignment will involve reading and critically analyzing an article that I will assign from the primary research literature. At least for the first paper, I will provide a hyperlinked Glossary to help you understand key facts and concepts to which you may not have been previously exposed, and a series of questions designed to lead you through a thorough analysis of the article. You and the other members of your presentation team will submit your consensus answers to these questions. Analysis of the second article – which I will also select – will probably be less structured.

## 3. Research Project and Presentation

You and the other members of your self-selected team of 3-4 students will research a topic of toxicological relevance and present the results of your research to the class. The topic will be one of your choosing. I would prefer that it be a topic of particular interest to you and the other members of your team, a topic you're interested in learning more about.

### The Presentation

Because of the size of the class, it won't be feasible to have oral presentation of your project results ...doing so would require at least four, more likely five, entire class periods. Therefore, once you have completed your research you will use your results to prepare a presentation equivalent to a PowerPoint™ presentation that you would prepare for a scientific meeting. Your presentation will then be posted on online in the form of:

1. a PowerPoint™ presentation that your classmates can view on their own computers, or
2. a web site.

If you don't know how to write the code to produce your own website, I can offer some helpful – i.e., sleazy, devious and underhanded – suggestions and point you to a number of good on-line tutorials. On the other hand, I've had at least one student team put together a Facebook site for 'their' organism and its toxins; very creative, terminally cute, and perfectly acceptable...as long as the scientific rigor is evident.

In due time, I will provide you with a rubric for the presentation, which will include grading criteria. Each of you will evaluate all of the presentations prepared by your classmates, and your evaluations will be important in my assignment of the final grade for each project. FYI, presentations that have not fared well have included those in which:

- a. students chose a topic that I had presented in some detail during lecture.
- b. there was little or no evidence of original thinking about the chosen topic.
- c. students chose a single toxin or two and simply presented basic information about its name, source, and effects, omitting information about mechanisms of action, present medical uses and/or possible future uses, ethnobotanical, historical, religious and sociopolitical aspects, etc.
- d. research efforts were limited to sources targeted at the general public, rather than including information obtained from the primary research literature.
- e. there was little evidence that much time or effort was put into preparing the presentation.

Again, if you have *any* doubts about the adequacy of your research and/or sources, *ask* Casey or me. Of course, if you have doubts, that's probably a hint that your research and sources are *not* adequate...