

Biology 489/589, Ecotoxicology

Spring 2020

Monday, Wednesday & Friday, 1300-1350

Instructor: Dr. Benjamin D. Duval, benjamin.duval@nmt.edu

319 Jones Annex, 835-5820 (office)

Office Hours: Monday 11-noon; Wednesday 11:00-noon

**preferentially by appointment*

Textbook: Newman, M.C. (2015) “Fundamentals of Ecotoxicology”

.pdf version on Canvas

Statistical Software: required for class, this is a free download

<https://jasp-stats.org/download/>

Please read!

<http://alldowney.blogspot.com/2016/06/bayesian-statistics-for-undergrads.html>

Course Description:

Biological evolution has always been constrained by the chemical environment. Learning about how organisms deal with, and are physiologically impacted by heavy metals and novel organic compounds can aid in our understanding of remediating environmental pollution. This course will serve as a survey of how naturally occurring and anthropogenic contaminant and toxic compounds influence a range of organismal and ecosystem functions. We will use historical examples and modern case studies across the breadth of biological diversity (microbes to mammals) to better understand human influence on the “chemosphere” and how organisms are challenged by, and have adapted to, changing chemical environments. We will also devote class time to understanding the history of environmental pollution and learning modern statistical techniques to evaluate environmental chemical data. A university-level understanding of microbiology, ecology, organic and inorganic chemistry, and basic statistical inference are requisite for success in this course.

Courtesy Policies:

Attendance is mandatory, absences will be noted and deducted from your participation grade. I have high expectations that the utmost courtesy and respect will be given to your fellow students and to me. Part of those expectations are that you *will arrive on time* and ready to learn at 13:00. *Cell phones and electronic devices will be silenced and hidden* (that means you can't see them either) during class. Do not come to class sick, but let me know via email or phone message that you were out for that reason. I reserve the right to request documentation from a medical professional for absences due to illness.

Course Policies*:

Grades are based on participation “checks”, literature assignments and in-class data presentations. Late homework **will not** be accepted. All homework will be submitted as a **hard copy unless otherwise stated**. I will accept documentation from appropriate sources to excuse and re-assign an appropriate level of work for missed assignments.

Disability Accommodations: The Biology Department is committed to protecting the rights of individuals with disabilities. Individuals requiring reasonable accommodations are invited to make their needs known to the Office of Counseling and Disability Services (OCDS) as soon as possible, and inform Dr. Duval of any accommodations. PLEASE inform Dr. Duval if accommodations are needed before the first exam so that he can make necessary arrangements. Also, if you need assistance in contacting OCDS, I have a great relationship with that office and will gladly help you do so.

Your Plan for Success: Checking in with your professors in **all** of your classes from time to time will help you track your progress and demonstrate that you are serious about doing well.

Your *mental and physical health* is important for your success at New Mexico Tech. The University offers mental health and substance abuse counseling through the Office of Counseling and Disability Services, but you are also welcome to find a person you trust in the Biology Department if you just need to voice some concerns about this class, a different class, or life in general. Official services through NM Tech are confidential. You have every right as a student to take *complaints* to the University administration. But, please come talk to me first!

*I anticipate that at least some minor details will necessarily change. I reserve the right to do so, but guarantee I will give as much notice as possible.

Academic Honesty

You are responsible for adhering to New Mexico Tech’s Academic Honesty Policy, found starting on page 59 of the NMT catalog:

http://www.nmt.edu/images/stories/registrar/pdfs/2013-2014_UNDERGRADUATE_Catalog_FINAL.pdf (Links to an external site.)

Any behavior/actions suggestive of cheating or academic dishonesty may lead to failure of the course.

The fun stuff!

This is a new course and I am planning a novel approach to integrative and participation learning. We will have “formal” lectures on Monday’s and Wednesday’s, and Friday class periods will be devoted to more interactive and participation exercises. We will work with real-world toxicology data-sets to learn about statistical inference. We will engage with the primary ecotoxicology literature. You will give in-class presentations related to your data analysis and literature synthesis. We will also have tours of laboratories that deal with environmental chemistry and ecotoxicology samples (NMT Chemistry and NM Geology Bureau) so you can see first-hand how practitioners in the field obtain high-quality toxicology data.

Learning outcomes:

At the end of the course you should be able to:

1. Understand differences between naturally occurring and anthropogenic contaminants and toxins
2. Understand physiological adaptations to both of the above
3. Perform simple statistical (preferably Bayesian) analyses on toxicological data, including QA/QC checks
4. Present literature review syntheses
5. Graphically present your own interpretation of original data

I expect a LOT from students enrolled in this course, and you will get out of it what you put in!

Tentative Class Schedule (I reserve the right to change)

Week 1: Intro to Ecotoxicology; History & Current State of Field (Chpt. 1)

-Intro to data set (Jan. 17)

Week 2-3: Classes of Contaminants (inorganic, organic, radiations) (Chpt. 2)

-Data Homework 1 (data organization & summary stats, due Jan. 24)

-Lab Trip (Bonnie Frey, NMBGMR; Uranium expert, Jan. 31)

Week 4-5: Biotransformation, Detoxification (Chpt. 3)

-Literature Assignment 1 (paper discussion, Feb. 7)

-Data Lab/Bayesian Stats lecture (Feb. 14)

Week 6: Elimination, Accumulation (Chpt. 3)

-No class (Feb. 21)

Week 7-9: Bioaccumulation & Trophic Transfer (Chpt. 4-5)

-Literature Assignment 2 (paper presentation, Feb. 28)

-Open Data Lab (March 6)

-Data Homework 2 (preliminary analysis, due March 13)

Week 10: Spring Break

Week 11: Molecular Effects of Toxins (Chpt. 6)

-Lab Trip (Gayan Rubasinghe, NMT Chemistry; Pollutant Expert, March 27)

Week 12: Molecular continued...Toxin Effects at the Cell-level (Chpt. 7)

-Literature Assignment 3 (paper synthesis, April 3)

Week 13: Acute and Lethal Effects (Chpt. 9)

Week 14: Large-scale Effects of Toxins: Ecosystems, Global Change and Risk Assessment (Selections from Chpt. 11-13)

Week 15: Large-scale Effects of Toxins: Ecosystems, Global Change and Risk Assessment
(Selections from Chpt. 11-13)

Week 16: Final Data presentations
-Final Solo Presentations, April 27 & 29