

**The Ohio State University  
Freshman Seminar Program – Arts & Sciences 1137. ??**

**Fall Semester 2019**

**Title:** *Big Data for Bioinformatics and Biodiversity Studies*. 1 cr., graded

**Description:** The freshman seminar will introduce students to evolutionary theory, statistics, and data analysis by exploring, collecting, and analyzing biodiversity data. The professor believes that students learn by doing: during the course of the semester, students will access spatial data for a species of interest, learn how to map these data using the statistical software package R, learn how to model the climatic niche of this species, and then learn how to project this niche onto models of the future climate under various global change scenarios. In the second half of the course, student will explore existing genetic data for the species of interest and learn how to conduct population genetic analyses using these data. The seminar will conclude with a poster session that will encourage students to meet and discuss their work with scientists in the Department of Evolution, Ecology, and Organismal Biology.

**Professor:** Bryan C. Carstens, Ph.D., Professor, EEOB, College of Arts & Sciences, [carstens.12@osu.edu](mailto:carstens.12@osu.edu), 292-6587, (office 1130 Museum of Biological Diversity)

**Course goals:** Help students recognize that working at the intersection of data, bioinformatics, and theory leads to scientific discovery.

**Meeting times:** 2:20 – 3:10, Jennings 104

**Grading:** Grades will be assigned on an A-E scale. Students who earn an ‘A’ will attend and participate in class, prepare and present a poster, and be able to discuss their findings in a coherent manner.

**Weekly topics outline:**

**Aug 22:** Introduction to species, ecosystems, and biodiversity. (*no readings*)

**Aug 29:** R for data analysis (<https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf>)

**Sep 5:** The [Global Biodiversity Information Facility](http://www.gbif.org) (GBIF). Introduction to georeferencing, species distributions, and natural history collections. (<https://www.gbif.org/what-is-gbif> and <http://sdg.iisd.org/news/un-biodiversity-lab-offers-spatial-data-for-conservation-development/>)

**Sep 12:** Species occurrence mapping. R will be used to generate maps of collection localities for a species interest. ([Gaston 2000](#))

**Sep 19:** Species distribution modeling, part 1. Introduction to the [WorldClim](#) database. ([Fick Hijmans 2017](#))

**Sep 26:** Species distribution modeling, part 2. Creating a climate model using WorldClim data for your focal species. ([Pearson 2007](#))

**Oct 3:** Species distribution modeling, part 3. Forecasting the effect of climate change on species distribution. ([Kearney et al 2010](#))

**Oct 10:** Fall Break (no class)

**Oct 27:** Phylogeography & genetic data analysis. ([Hewitt 2000](#), [Pelletier & Carstens 2018](#))

**Nov 7:** Accessing genetic data from GenBank. (<https://www.ncbi.nlm.nih.gov/books/NBK44863/>) and genetic isolation by geographic distance using *poppr* ([http://grunwaldlab.github.io/Population\\_Genetics\\_in\\_R/index.html](http://grunwaldlab.github.io/Population_Genetics_in_R/index.html)).

**Nov 14:** Analysis of Molecular Variance in R ([https://grunwaldlab.github.io/Population\\_Genetics\\_in\\_R/AMOVA.html](https://grunwaldlab.github.io/Population_Genetics_in_R/AMOVA.html))

**Nov 21:** Preparing a scientific poster. (<https://www.craftofscientificposters.com/>)

**Nov 28:** Thanksgiving (no class)

**Dec 5:** Poster session.

**Required Materials:**

- (1) **Personal Computer** – students will be required to bring a personal computer running some version of Windows 10, MacOS, or Ubuntu Linux to class.
- (2) **Readings** – a mix of papers from the peer review literature, instruction guides to software packages, or blog posts. All readings will be posted on Carmen.
- (3) **Curiosity** – students are required to be curious about biodiversity; they will be asked to identify some plant, animal, or fungal species of interest, and they will likely need to do a little bit of research outside of class on this species.

**Assignments:**

**Poster session** - students will work on a project throughout the course of the semester, and present the results of their data analysis in a poster session to occur on the last day of class. Researchers from the Department of Evolution, Ecology, and Organismal Biology will be invited to this poster session, so this will be a great opportunity to meet people who do research in the field and may result in opportunities to join a lab as an undergraduate researcher.

***About the Professor***

[Bryan Carstens](#) is an evolutionary biologist who studies the history and formation of species. To date, he has published [~80 papers](#) in the peer reviewed literature that have been cited nearly 7000 times. Research in the Carstens lab is focused on the methodology used in phylogeographic and species level phylogenetic investigations, and is conducted on organisms ranging from salamanders to bats to carnivorous plants. See the [Carstens lab website](#) for more information.

**Academic Misconduct:** It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc/>

**Accessibility** Any student who has special needs because of a disability should make an appointment with Dr. Carstens as soon as possible in order to make arrangements for assistance. Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; <http://www.ods.ohio-state.edu/>

**Statement on Diversity** The instructors of this course are committed to promoting a welcoming climate for all students. We expect that all exchanges of ideas will be conducted with respect and collegiality. For more information, see [www.biosci.ohio-state.edu/~eeob/diversity](http://www.biosci.ohio-state.edu/~eeob/diversity)