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**Shoals Marine Laboratory**  
**Research in Biology (BIOSM 4990/MEFB 751)**  
**31 July - 14 August 2017**

Course Syllabus and Schedule

**Faculty:** Andrew Swafford and Jennifer Seavey\*

\*Additional SML faculty may participate in mentoring student project depending upon subject matter.

**Prerequisites:** Completion of MEFB 403 *Investigative Marine Biology Laboratory* or permission of Instructor(s).

**Class Enrollment Limit:** 16

**Credit Hours:** 4 (UNH), 3 (Cornell), or non-credit option

**Course Description**

A two-week course designed to prepare students for all aspects of research – design, proposal, execution, analysis, and presentation. Designed either of independent student research (with a faculty mentor) or as a companion course to *Investigative Marine Biology Laboratory* students will execute an independent research project and create a presentation discussing their findings. This course will cover the topics of methods development, best practices for data collection, handling, and analysis, intermediate bioinformatics, and scientific communication strategies. The course will have dedicated classroom and field time to work with SML faculty mentors, who will also be available for one-on-one mentorship. Field time will be primarily dedicated to independent research. Classroom sessions will include student-led discussions of primary literature, workshop sessions for data analysis, and lectures on statistics, programming, and presentation skills. At the end of the course, students will create and present a product (presentation or poster) that can be showcased at scientific conferences.

**General Topics Covered**

- *Quantitative sampling methods*
- *Robust & repeatable experimental design.*
- *Data handling, storage, and organization.*
- *Common statistical tests for data analysis.*
- *Statistical analysis in R (no experience necessary).*
- *Intermediate coding in R and Python (no experience necessary).*
- *Best practices for scientific communication with various audiences.*

**Skills Gained through Coursework**

- Design, propose, and execute a robust research project.
- Efficiently collect/create, store, and organize data in digital (local + cloud) and print media.
- Understand common statistical tests, when it is appropriate to apply each test, how each test can be



Cornell University



University of  
New Hampshire

interpreted, and how to quantifiably justify their use on a dataset.

- Create computer scripts to reliably handle and analyze datasets.
- Use cloud-based repositories to share/save code, scripts, analyses and pipelines.
- Effective communication for scientific presentations to general, specialized, and specific audiences in both oral and visual presentations.

### Course Expectations

Students are responsible for fully understanding all concepts and material that are presented in this course. It is the responsibility of the student to bring questions and concerns regarding comprehension of the course material to the instructor's attention. Additionally, students are responsible for attending all activities associated with this course and completing all assignments. Instructors will be available for consultation during scheduled class activities, and reachable through the *Slack* application outside scheduled class times.

Because of the unique nature of this course, students will be expected to manage their own time responsibly in order to complete the required assignments for the course. Instructors will provide advice, guidance, and mentorship, but it is ultimately the student's responsibility to organize and execute a research plan that fits within the confines of the course.

### Schedule (Research in Biology - 2017)

Day	Topic
<b>July 31 – Monday</b>	<b>Developing Robust Research</b> Morning: LECTURE – Introduction to the Course & Expectations Mid-Morning: LECTURE – Making Your Research Have an Impact Mid-morning: LECTURE – Designing Effective Experiments Afternoon: CLASS – Developing Project Ideas ( <i>Project Sketch</i> ) Evening: CLASS – Peer development of <i>Project Sketch</i> .
<b>August 1 - Tuesday</b>	<b>Developing Robust Research</b> Morning: CLASS – Finalize Project Ideas ( <i>Project Sketch</i> ). Mid-morning: CLASS – Present <i>Project Sketch</i> Afternoon: FIELD – Project setup & data collection Evening: FIELD – Project setup & data collection
<b>August 2 - Wednesday</b>	<b>Data Management Strategies</b> Morning: LECTURE – Future-proofing your data Mid-morning: FIELD – Project setup & data collection Afternoon: LECTURE – Statistical Analyses and When to Use Them Evening: FIELD – Project setup & data collection
<b>August 3 - Thursday</b>	<b>Data Management Strategies</b> Morning: FIELD – Data collection Mid-morning: CLASS – Progress presentations Afternoon: IND-STUDY – Project adjustment & data collection Evening: FIELD – Data collection
<b>August 4 - Friday</b>	<b>Analyzing Diverse Datasets</b> Morning: CLASS – Primary literature discussion Mid-morning: IND-STUDY – Project adjustment & data collection Afternoon: LECTURE – Justifying your Statistical Tests Evening: FIELD – Data collection
<b>August 5 - Saturday</b>	<b>Analyzing Diverse Datasets</b> Morning: FIELD – Data Collection Mid-morning: IND-STUDY – Data collection & preliminary analysis Afternoon: CLASS – Peer discussion of data & emerging trends Late-afternoon: CLASS – Primary literature discussion Evening: IND-STUDY – Data collection & preliminary analysis
<b>August 6 - Sunday</b>	<b>Analysis in the Era of Bioinformatics</b>

	<p>Morning: LECTURE – Statistical analysis in R  Mid-morning: LECTURE – Flow Control and Robust Scripting in R  Afternoon: IND-STUDY – Data Collection &amp; analysis  Late afternoon: CLASS – Progress presentation  Evening: CLASS – Group data analysis</p>
<b>August 7 - Monday</b>	<p><b>Analysis in the Era of Bioinformatics</b>  Morning: IND-STUDY – Data collection &amp; analysis  Afternoon: IND-STUDY – Data collection &amp; analysis  Late afternoon: LECTURE – Introduction to Python Pipelines  Evening: IND-STUDY - Analysis</p>
<b>August 8 - Tuesday</b>	<p><b>Analysis in the Era of Bioinformatics</b>  Morning: LECTURE – An introduction to Git  Mid-morning: LECTURE – Creating code anyone can use  Afternoon: IND-STUDY – Analysis  Evening: IND-STUDY – Analysis</p>
<b>August 9 - Wednesday</b>	<p><b>Science Communication</b>  Morning: LECTURE – Communicating Results Effectively  Mid-morning: IND-STUDY – Analysis &amp; poster prep  Afternoon: LECTURE – Graphical output in R  Evening: CLASS – Peer review of results &amp; poster prep</p>
<b>August 10 - Thursday</b>	<p><b>Science Communication</b>  Morning: FREE – Analysis &amp; poster prep  Mid-morning: CLASS – Progress presentation  Afternoon: CLASS – Primary Literature Discussion  Late Afternoon: IND-STUDY – Poster &amp; lightning talk prep  Evening: IND-STUDY – Poster &amp; lightning talk prep</p>
<b>August 11 - Friday</b>	<p><b>Science Communication</b>  Morning: IND-STUDY – Poster &amp; lightning talk prep  Afternoon: IND-STUDY – Poster &amp; lightning talk prep  Evening: IND-STUDY – Poster &amp; lightning talk prep</p>
<b>August 12 - Saturday</b>	<p><b>RMB Symposium</b>  Morning: IND-STUDY – Lightning talk prep  Afternoon: CLASS – Symposium presentations  Evening: CLASS – Symposium presentations</p>
<b>August 13 - Sunday</b>	<p><b>Wrap Up</b>  Morning: IND-STUDY – Poster prep &amp; clean up  Mid-morning: IND-STUDY – Poster prep &amp; clean up  Afternoon: CLASS – Primary literature discussion  Late-afternoon: CLASS – Data consolidation &amp; publishing  Evening: IND-STUDY – Poster prep &amp; clean up</p>
<b>August 14 - Monday</b>	<p><b>Departure</b>  Morning: CLASS – Poster presentations  Mid-morning: CLASS – Final clean up &amp; departure</p>

**LECTURE** – Class material & Exercises will be presented by the instructor.

**CLASS** – Collaborative exercises that will be done in a classroom setting.

**FIELD** – Time reserved for independent project work: Collecting data in the field is highly encouraged, but the time may be spent however the student feels best advances their project.

**IND-STUDY** – Focused time for students to engage in research, analysis, and discussion. Students may spend this time however they feel best advances their project (Data collection, collaborative work, mentor meetings, etc.)

### Required Equipment Additional to SML Recommended Packing List

1. Laptop computer with administrator privileges.

*Note:* Minimum requirements include a Linux, Windows, or Mac operating system. **Google**

**OS/Chromebooks/Web-books are not acceptable.** Please contact faculty if you are unsure if

your equipment is acceptable.

2. College Ruled Notebook.

## Texts & Required Reading

No text is required for this course. All readings will be compiled into a packet and provided to enrolled students by the instructor in print and digital format.

## Personal Conduct:

Every student is responsible for their own behavior- specifically in being respectful and collegial to other students and with instructors. Students are responsible for fully understanding and adhering all of the information presented in the SML Appledore Handbook (<http://www.shoalsmarinelaboratory.org/about-appledore>)

1. *Personal Technology.* Do not use cell phones, smart phones, iPads, mp3 players, headphones, or similar devices in the classroom or during course activities. If you take notes with your computer, disable wireless access during lecture.
2. The lab has a modest computer facility in Loughton Library; please treat this shared facility with respect. Printers are available, but please limit printing to your FINAL document (if required).
3. *Transmission of Course Materials.* Students are not authorized to replicate, reproduce, copy or transmit lectures and course materials presented, or derivative materials including class notes, for sale or free distribution to others without written consent of the instructors who are the original source of the materials.
4. *Academic Integrity.* Any work submitted must be your own. Uncredited use of another person's words, data or images is considered plagiarism, a serious violation of the Code, whether the material comes from another student, a web site, or a published paper. Students must adhere to Cornell's and UNH's Policy for Academic Honesty/Plagiarism and Discrimination
  - A. Cornell: <http://cuinfo.cornell.edu/aic.cfm>
  - B. UNH: <http://www.unh.edu/vpsas/handbook/welcome-university-new-hampshire>
5. *Disabilities & ADA Accommodation:* Students with a disability must contact Cornell's (420 CCC building; 607-254-4545) or UNH's Student Disability Services (<http://www.unh.edu/disabilityservices>) four weeks prior to start of class for confidential discussion of needs and for registration to verify eligibility for academic accommodations. No retroactive accommodations can be made.
6. *Mental Health:* Shoals Marine Laboratory cares about you and your well-being. If you experience unusual personal or academic stress during the course or need to talk with someone about a personal problem, seek support from your instructors as soon as possible. In addition, any SML staff is available for consultation 24/7. Find staff in the office in the Hamilton House between 8am – 7pm or knock on the door of Bartels Hall after hours

## Academic Honesty

Academic honesty and good faith is a central tenant of the scientific community and Shoals Marine Laboratory. The members of the academic community both require and expect one another to conduct themselves with integrity. This means that each member will adhere to the principles and rules of the University and pursue academic work in a straightforward and truthful manner, free from deception or fraud. Any attempts to deviate from these principles will be construed as acts of academic dishonesty and will be dealt with according to the rules of due process detailed in the academic conduct guidelines.

## Plagiarism

The unattributed use of the ideas, evidence, or words of another person, or the conveying of the false impression that the arguments and writing in a paper are the student's own. The penalty for cheating, plagiarism or misrepresentation in this class will be an automatic F for the course, and could result in dismissal from the University.

## Grade Breakdown

93-100	A
90-92.99	A-
87-89.99	B+
83-86.99	B
80-82.99	B-
77-79.99	C+
73-76.99	C
70-72.99	C-
67-69.99	D+
63-66.99	D
60-62.99	D-
Below 60	F

## Grade Items

Project sketch	10
Notebook	15
Progress Presentations	10
Primary Literature Discussion	10
Participation	5
Final Presentation	50
Final Poster	50
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<b>Total</b>	<b>150</b>