Syllabus: Intro to Aquatic Genomic Methods
Freshwater 650-002

Instructors:  Dr. Matthew Smith, School of Freshwater Sciences
Dr. Ryan Newton, School of Freshwater Sciences

Prerequisites: None. It is recommended that students have a basic background in biology; prior experience in molecular biology or microbiology is encouraged but not required. It is also recommended but not required that students take the course Accelerated Lab Techniques in Molecular Biology or have equivalent knowledge.

Course Schedule: This is a blended course. Background material will be presented online over a 2-week period, followed by a 1-week long intensive “hands on” practical component, and a 1-week online analysis and reporting period.

Course Meeting Dates:
June 27, 2016 – July 10, 2016 – Online content for background knowledge of procedures
July 11, 2016 – July 15, 2016 (9 AM-4:40 PM) – Hands on laboratory section,
July 16, 2016 – July 22, 2016 – Online content and final reporting
Final report due: 22/7/2016 by 5 pm

Class Location: GLRF, Room 1080 School of Freshwater Science, 600 E Greenfield Ave, Milwaukee, WI.

Contact Information:
Office: Dr. Matthew Smith: Room 3007, GLRF, School of Freshwater Science
Email: smith926@uwm.edu
Office: Ryan Newton: Room 3041 GLRF, School of Freshwater Science
Email: newtonr@uwm.edu

Office Hours: By appointment

TA(s): N/A

Course Description
This course is designed for students who have an interest in applying genomic/molecular techniques to aquatic sciences. The class will be conducted in a “boot camp” or intensive format and is aimed at students and professionals that do not have extensive molecular backgrounds, but are interested in how these approaches can be used to investigate environmental issues. Students will be introduced to the theory and application of approaches to collect and process a water sample for molecular/genomic-based techniques, including: DNA/RNA extraction, quantitative PCR, Next Generation Sequencing and microbial data analysis. Students will be required to perform experiments both individually and in groups. Final reporting will tie together experiments performed in the class. Students will use their class results to develop a consultant style technical report similar to one that would be presented to management or an external customer.
This course requires laboratory work. Any specific safety information will be posted on D2L prior to the commencement of the hands-on laboratory component. An initial safety induction will be performed on the first day of the laboratory class. All students shall be responsible for familiarizing themselves with pertinent MSDS for the chemicals that are being used and adhere to specific safety and operational procedures of the laboratories being used.

What is a hybrid (blended) course? Hybrid courses replace some portion of face-to-face meeting time with online learning activities and assignments. This design puts an emphasis on time and location flexibility for students but demands more personal responsibility to engage with course materials. Although more learning time is self-directed, all deadlines must be met for online assignments, exams, etc., and students must attend in-class meetings to get credit for materials and assignments presented. It is highly encouraged that students form working groups for studying.

**Required for Course Interactions:** To participate in the blended nature of this course, students must have at minimum daily access to a computer with an Internet connection. Most lectures, exams, and group discussions will be posted and conducted in the Desire to Learn (D2L) platform hosted by UW-Milwaukee (At the UWM homepage [http://uwm.edu](http://uwm.edu), click on the D2L link). To interact with the online material, students will need a computer with audio capabilities and software that can open voice-over PowerPoint (VOP) lectures posted on D2L. The online portion of this class will rely heavily on the D2L interface. Voiceover PowerPoint lectures will be posted on D2L and will require *Windows Media Player* (for *.wmv* files on PC), *QuickTime* (for *.M4V* files playable on iOS devices) or VLC (for PC & Mac – available at [http://www.videolan.org/vlc/index.html](http://www.videolan.org/vlc/index.html)). Content and course instructions will be posted on D2L as .pdf files. Software such as *Adobe Reader* (free at [http://get.adobe.com/reader/](http://get.adobe.com/reader/)) capable of reading these files is necessary. It is recommended that students check e-mail and the D2L course homepage a few times a day for notifications. Most of the course material will be posted in the Content area and discussions will be facilitated through the Discussions area of the D2L course site. For technical help and technical contact information, see the UWM Help Desk ([help@uwm.edu](mailto:help@uwm.edu); 414-229-4040), [http://www4.uwm.edu/technology/help/campus/gettechhelp.cfm](http://www4.uwm.edu/technology/help/campus/gettechhelp.cfm), or go to Bolton Hall room 225 for an in-person consultation.

**Learning Outcomes**

The course is designed such that students will:

- Become familiar with theoretical and practical aspects of basic genomic/molecular methods for microbial analysis
- Become familiar with how genomic/molecular methods can be applied to answer environmental questions
- Understand the type and quantity of data produced from microbial genomic/molecular analysis and the insights and limitations of these data types
- Understand and interpret data from molecular/genomic biological methods.
- Develop collaborative skills in a laboratory and data analysis setting
On completion of the course, students should be able to:

- Research relevant literature and develop robust experimental procedures.
- Be familiar with and operate analytical equipment / instruments commonly used in molecular microbial studies.
- Communicate the data from genomic/molecular biological experiments to a technical audience.

**Workload**

This is a 2 credit-hour course, as such the total time commitment that students are expected to devote to class activities are approximately 96 hours. This time commitment includes:

- Online learning of the theoretical background for the methods used in the class; reading of literature; online group discussions with the instructors; and final reporting.
- In-class time: Class will meet formally for one week, for an intensive “hands on” laboratory session.
- Preparation of technical report outlining the results and interpretation of the data obtained during the laboratory session.

**Resources**

Class notifications. The course will be coordinated through e-mail and D2L. Reading material, class feedback and assignment delivery must be submitted by the due date by uploading materials to D2L. Please ensure that you check your e-mail and D2L frequently because you are responsible for all announcements and course changes posted there.

The Library. Additional self-directed research into the techniques discussed and used maybe necessary for all students. Being familiar with the library system and how to access primary literature is an important component of the class. For graduate students, using library resources, including online journal access will be a necessary resource for completion of assignments.

Class Notes: You are responsible for your own note taking; taking notes is an essential part of the learning process.

Students with Special Needs: Students with special needs should arrange to speak with the instructor(s) during the first week of classes so we can best accommodate your learning style.

Note University Policies: Students with disabilities. Verification of disability, class standards, the policy on the use of alternate materials and test accommodations can be found at the following: [http://www.uwm.edu/Dept/DSAD/SAC/SACltr.pdf](http://www.uwm.edu/Dept/DSAD/SAC/SACltr.pdf)

The Writing Center welcomes writers at all skill levels, inexperienced through advanced, freshmen through graduate students. FYI--over 1/3 of the students who visited in the past 4 yrs were juniors, seniors or grad students. Whether still exploring a reading, brainstorming, drafting or revising, writers can benefit from talking one-on-one with the well-qualified and well-trained tutors. Make appointments online 24/7: [http://www.writingcenter.uwm.edu](http://www.writingcenter.uwm.edu).

**Suggested Readings**
Learning in this course will rely heavily on reading of scientific literature. There is no assigned textbook. However, students may find any of the following textbooks useful:


Course Requirements and Grading

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<thead>
<tr>
<th>Assessment</th>
<th>Undergraduate</th>
<th>Graduate</th>
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<tbody>
<tr>
<td>Exam 1</td>
<td>20</td>
<td>10</td>
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<tr>
<td>Exam 2</td>
<td>20</td>
<td>10</td>
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<tr>
<td>Essay</td>
<td>N/A</td>
<td>20</td>
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<tr>
<td>Laboratory book</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Technical Report</td>
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<td>30</td>
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<tr>
<td>Poster</td>
<td>20</td>
<td>N/A</td>
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<tr>
<td>Participation</td>
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Percentage/Grade

90-100% A
80-89% B
70-79% C
60-69% D
<60% F
**Written Materials**

**Exams:** Students will undertake 2 online exams. Graduate student exams will have 10% more questions than the undergraduate exams. Additional self-assessment material (quiz & discussion boards) will be required and completed online by the students as part of their participation grade.

**Essay (Individual - Graduate Students only):** Graduate Students will be expected to write an essay (in a review format) that highlights studies from the primary literature that either use or have developed techniques related to genomic/molecular microbial analysis. A number of papers will be provided on D2L as a guide. However students will be expected to cite additional literature support their essays.

Lab Books: Maintenance of a good record of experimental procedures and results is essential to a scientist; therefore, maintenance of a Lab book is an essential skill that is required for any scientist. Students are required to keep a Lab book detailing their experimental work. Lab books are required to be handed in and will be graded. See Lab manual maintenance [https://www.training.nih.gov/assets/Lab_Notebook_508_(new).pdf](https://www.training.nih.gov/assets/Lab_Notebook_508_(new).pdf) for an example of good Lab book maintenance.

Technical Report (Individual – Graduate Students Only): Graduate students will be required to prepare an individual technical paper highlighting the results from the laboratory session. A template for the format of the report is provided for download on D2L. All supporting raw data (e.g., DNA sequencing data, etc..) must be supplied to the instructors electronically.

**Poster (Individual – Undergraduate Students Only):** Undergraduate students will be required to prepare an individual poster highlighting the results from the group’s research. The format for the poster should be suitable for presentation at the UW-System Symposium for Undergraduate Research & Creative Activity. Instructions for authors can be found on the UWM office for undergraduate research website and through D2L. A physical copy of the poster is not required to be submitted, however an electronic copy in powerpoint or PDF format must be supplied electronically to the instructors by 5 pm on the due date. In addition, all supporting raw data (e.g., DNA sequencing data analysis files), must be supplied electronically to the instructors.

**Topics Covered and Important dates**

**Online material (27/6/2016 – 10/7/2016)**
Lab Safety (general and specific MSDS for reagents being used); Good laboratory practice (Lab books, record keeping, etc.); Sterilization methods and sampling approaches; filtration; DNA and RNA extraction methods and approaches; nucleic acid quality assessment methods; PCR methodologies; agarose electrophoresis; next generation sequencing methodologies; Online Q+A opportunities for participants, and a number of online tests (graded and for self-assessment).

**Laboratory material (11/7/2016 – 15/7/2016)**
Practical application of the subjects covered in the online material, including the topics: Specific laboratory induction; pipetting refresher course; preparation for sampling and field collection;
DNA/RNA extraction; Nucleic acid quality assessment; PCR (various forms PCR, qPCR, RT-PCR, RT-qPCR); next generation sequencing; data processing. This work will include student interactions (Q&A sessions) and presentations on results of experiments. Student Laboratory books will be required to be submitted for evaluation on Thursday (14/7/2016). To enable students to write their final report remotely, lab books will be returned Friday (15/7/2016)

**Online material** (16/7/2016 – 22/7/2016)
Opportunities for student Q&A. Final report (posters or technical reports) due.

**Assignments Due**
- Essay (Graduate Students) Due on Wednesday (midnight) of the Laboratory week
- Technical Report – Submitted week following the lab class
- Poster (Undergrads) to be Submitted week following the lab class
- Laboratory book Thursday during laboratory period (returned by instructors on Friday)

**Course Policies**
Attendance: With the exception of extreme emergencies, which require official documentation, class attendance is compulsory. Each missed class will result in a 5% decrease to the student’s grade. If an absence is anticipated or in the case of an extreme event, then contact either instructor as soon as possible to discuss the problem. Some of the material for this course will be made accessible through the internet. This material is meant to help the student prepare for class, but it does not replace the material presented in class.

Late assignments will be downgraded by 5% for each day past the due date.

Missed Exam Policy: Class presentations are considered examinations. There are no make-up exams except for extreme emergencies, which require official documentation. In such an event, contact us as soon as possible to discuss the problem. An un-excused absence will result in lost points for that exam. Policies regarding final examinations can be found at the following: [http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S22.htm](http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S22.htm).

**Other Campus Policies**
List individual topics with websites, as below, or provide the following link, which lists the information below: [http://www.uwm.edu/Dept/SecU/SyllabusLinks.pdf](http://www.uwm.edu/Dept/SecU/SyllabusLinks.pdf).

Students with disabilities. Verification of disability, class standards, the policy on the use of alternate materials and test accommodations can be found at the following: [http://www.uwm.edu/Dept/DSAD/SAC/SACltr.pdf](http://www.uwm.edu/Dept/DSAD/SAC/SACltr.pdf).

Religious observances. Policies regarding accommodations for absences due to religious observance are found at the following: [http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S1.5.htm](http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S1.5.htm).

Students called to active military duty. Accommodations for absences due to call-up of reserves to active military duty should be noted. [http://www3.uwm.edu/des/web/registration/militarycallup.cfm](http://www3.uwm.edu/des/web/registration/militarycallup.cfm)
Incompletes. The conditions for awarding an incomplete to graduate and undergraduate students can be found at the following:
http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S31.pdf

Discriminatory conduct (such as sexual harassment). Definitions of discrimination. Harassment, abuse of power, and the reporting requirements of discriminatory conduct are found at the following:
http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S47.pdf

Academic misconduct. In this course, you are expected to perform to the best of your ability in an honest manner. Cheating, plagiarism, or other acts of misconduct will result in a severe penalty to you, as per University of Wisconsin System Chapter 1. http://www.uwm.edu/Dept/OSL/DOS/conduct.html Plagiarism is a particular concern: many students seem unclear about what it involves. I recommend that you read: http://www.plagiarism.org/learning_center/what_is_plagiarism.html because ignorance is not acceptable as an excuse.

Complaint procedures. Students may direct complaints to the head of the academic unit or department in which the complaint occurs. If the complaint allegedly violates a specific university policy, it may be directed to the head of the department or academic unit in which the complaint occurred or to the appropriate university office responsible for enforcing the policy.

Grade appeal procedures. Procedures for student grade appeal appear at the following:
http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S28.htm

Final examination policy. Policies regarding final examinations can be found at the following:
http://www.uwm.edu/Dept/SecU/acad%2Badmin_policies/S22.htm