

# MCDB 1161 - Phage Genomics Laboratory I

## Course Information

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| Lecture: W 3:00-3:50pm, GOLD A2B70                      |  |
| Lab Section 011: T/R 10-11:50 MUEN E0040                | Lab Section 014: T/R 10-11:50 PORT B0026 |
| Lab Section 012: T/R 12-1:50 MUEN E0040                 | Lab Section 015: T/R 12-1:50 PORT B0026  |
| Lab Section 013: T/R 2-3:50 MUEN E0040                  | Lab Section 016: T/R 2-3:50 PORT B0026   |
| Lab Section 017: W/F 10-11:50 PORT B0026                |  |
| Open Lab: Wednesday 4-5, Thursday 4-5, Friday 1-3       |  |
| Optional Review and Problem Solving: W 4:00, GOLD A2B70 |  |

## Course Description

This course integrates molecular biology topics and basic laboratory techniques while allowing students the opportunity to participate in a real scientific research project. This course provides students with laboratory experience working on a bacteriophage genomic research project. Students will study novel bacteriophage they isolate from the environment. Topics covered include phage biology, bacteria and phage culturing and amplification, DNA isolation, restriction digestion analysis, agarose gel electrophoresis, and electron microscopy.

## Instructors

|                     | Office       | Phone        | Email  |
|---------------------|--------------|--------------|--|
| Dr. Christy Fillman | Porter B142A | 303-492-8559 | <a href="mailto:Christy.Fillman@Colorado.edu">Christy.Fillman@Colorado.edu</a> |
| Dr. Nancy Guild     | Porter B113A | 303-492-5054 | <a href="mailto:Nancy.Guild@Colorado.edu">Nancy.Guild@Colorado.edu</a>         |

## Lab Coordinator

|                |            |              |  |
|----------------|------------|--------------|--|
| Megan Greening | GOLD A1B52 | 303-492-1618 | <a href="mailto:Megan.Greening@Colorado.edu">Megan.Greening@Colorado.edu</a> |
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## Instructor Office Hours

Dr. Fillman: Tuesdays 11:00am and Fridays 11:00am

Dr. Guild: Tuesdays 4:00pm, Wednesdays 11:00am

## Teaching Assistants

Hannah Chatwin [hach0936@colorado.edu](mailto:hach0936@colorado.edu)

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## Lab Assistants

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Required Text: Phage Genomics I Lab Manual, laboratory notebook with carbonless copies (at least 50 pages).

**Course Schedule:**

**Lab A** is the first time your lab meets during the week (either Tuesday or Wednesday). **Lab B** is the second time your lab meets during the week (either Thursday or Friday). All students should attend the Wednesday lectures in GOLD A2B70.

Writing assignments noted with a star (\*) are due at 11:59pm uploaded to Canvas. Problem Sets are due by 11:59pm Wednesdays on Canvas. All other assignments are due at the end of class except where noted. Visit the **Assignments Tab** on Canvas for links to external articles, websites and videos listed in the reading section of the syllabus.

|                          | Topic  | Reading             | Due  |
|--------------------------|--|---------------------|--|
| <b>Week 1: 8/27-8/31</b> |  |                     |  |
| Lab A                    | No Class   |                     |  |
| W-8/29<br>Lecture        | Course Information<br>Enrichment and Direct Isolation                  | 5-8, 22, 69-71      |  |
| Lab B                    | Lab Safety and Pipetting<br>Sterile Technique                          | 8-13<br>Video       | Introduction Activity<br>Sterile Technique Activity    |
| <b>Week 2: 9/3-9/7</b>   |  |                     |  |
| Lab A                    | Enrichment and Direct Isolation<br>Lab Calculations                    | 35                  | Lab Calculations Activity                              |
| W-9/5<br>Lecture         | Bacteriophage Biology and Phage Lifecycles                             | 15-21<br>Video      | Problem Set 1  |
| Lab B                    | Phage Therapy Article Discussion<br>Plaque Assay Technique             | 37-38<br>Article    | Notebook 1   |
| <b>Week 3: 9/10-9/14</b> |  |                     |  |
| Lab A                    | Plaque Streak for Purification Technique                               | 39-40               | Phage Therapy Discussion<br>Phage Therapy Activity Lab |
| W-9/12<br>Lecture        | Phage Titer Assay<br>Reading Scientific Literature                     | 23                  | Problem Set 2  |
| Lab B                    | Phage Titer Technique  | 41-42               | Lab Notebook 2   |
| <b>Week 4: 9/17-9/21</b> |  |                     |  |
| Lab A                    |  |                     | Phage Lifestyles Activity                              |
| W-9/19<br>Lecture        | Diverse Uses for Phages<br>Archiving, Scientific Writing Part I        | 45, 73-74,<br>76-78 | Problem Set 3  |
| Lab B                    | High Titer Lysate Technique  | 43                  | Notebook 3   |
| <b>Week 5: 9/24-9/28</b> |  |                     |  |
| Lab A                    |  |                     | Phage Titer Activity                                   |
| W-9/26<br>Lecture        | Agarose Gel Electrophoresis<br>Quality Control<br>Restriction Analysis | 27-29, 51           | Problem Set 4  |
| Lab B                    | DNA Isolation Technique  | 25, 47-48           | Lab Notebook 4   |
| <b>Week 6: 10/1-10/5</b> |  |                     |  |
| Lab A                    | Agarose Gel Electrophoresis Technique<br>DNA check gel, practice gels  | 49-51               | Restriction Analysis Activity                          |
| W-10/3<br>Lecture        | Scientific Writing Part II<br>Phage Therapy Research                   | 75-76, 79-81        | Problem Set 5<br>M and M Draft*                        |
| Lab B                    | Journal Article Discussion   | Article             | Lab Notebook 5   |

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| <b>Week 7: 10/8-10/12</b>              |   |                         |   |
| Lab A                                  | Restriction Digest Technique                                  | 53-54                   | Journal Article Activity                                      |
| W-10/10<br>Lecture                     | Phage Clustering, PCR<br>FDA Approval and Phage Therapy       | 31-33<br>Article        | Problem Set 6<br>Results Draft*                               |
| Lab B                                  |   |                         | Lab Notebook 6  |
| <b>Week 8: 10/15-10/19</b>             |   |                         |   |
| Lab A                                  | PCR Technique   | 55-56<br>Website        | Phage Clustering Activity                                     |
| W-10/17<br>Lecture                     | Lysogens and Immunity<br>Scientific Presentations             | 83-86, Article<br>Video | Problem Set 7<br>Discussion Draft*                            |
| Lab B                                  |   |                         | Lab Notebook 7  |
| <b>Week 9: 10/22-10/26</b>             |   |                         |   |
| Lab A                                  |   |                         | Immunity Activity   |
| W-10/24<br>Lecture                     | Lab Midterm Exam  |                         | Problem Set 8<br>Abstract and Intro Draft*                    |
| Lab B                                  |   |                         | Lab Notebook 8  |
| <b>Week 10: 10/29-11/2</b>             |   |                         |   |
| Lab A                                  | Presentations   |                         |   |
| W-10/31<br>Lecture                     | Central Dogma   | Article                 | No Problem Set Due  |
| Lab B                                  | Presentations   |                         | No Notebook Due (include<br>weeks 10 and 11 in NKBK 9)        |
| <b>Week 11: 11/5-11/9</b>              |   |                         |   |
| Lab A                                  |   |                         | Central Dogma Activity  |
| W-11/7<br>Lecture                      | Scientific Posters, CURE Symposium<br>Sequencing and DOGEMs   | 88-89<br>Article        | Problem Set 9   |
| Lab B                                  |   |                         | Lab Notebook 9  |
| <b>Week 12: 11/12-11/16</b>            |   |                         |   |
| Lab A                                  |   |                         |   |
| W-11/14<br>Lecture                     | Power of Genomics<br>Sequencing Presentations                 |                         | Phage Biology Paper<br>No problem Set                         |
| Lab B                                  | Last Day for Experiments                                      |                         | Lab Notebook 10<br>Poster Evaluation Activity                 |
| <b>Week 13: 11/19-11/23 Fall Break</b> |   |                         |   |
| <b>Week 14: 11/26-11/29</b>            |   |                         |   |
| Lab A                                  | Poster Work Day   |                         |   |
| W-11/28<br>Lecture                     | Comparative Genomics – Phamerator<br>Phage Symposium Research | Website                 | Problem Set 10<br>Digital Poster Draft*<br>(sec 17 due 11/29) |
| Lab B                                  | Peer Review<br>Poster Work Day                                |                         | Final Poster*   |
| <b>Week 15: 12/3-12/7</b>              |   |                         |   |
| Lab A                                  | Genomics Activity I: Comparative Genomics<br>Archiving Report |                         |   |
| W-12/5<br>Lecture                      | Symposium Practice Talk<br>Functional Annotation              | Website                 | Problem Set 11<br>Poster Audio Recording*                     |

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| Lab B   | Poster Presentations<br>Genomics Activity II: Functional Annotation |  | Archiving Report  |
| <b>Week 16: 12/10-12/14</b>                         |   |  |   |
| <b>Monday 12/10 CURE Symposium 5:00-8:30pm</b>      |   |  |   |
| Lab A   | Lab clean up<br>Implications of Phage Therapy                       |  | Genomics Activities I and II<br>(beginning of class)<br>Surveys |
| W-12/12<br>Lecture                                  | Microbiome<br>Final Exam Review                                     |  | Problem Set 12  |
| Lab B   | No Class  |  |   |
| <b>T-12/18 7:30pm-10:00pm Final Exam GOLD A2B70</b> |   |  |   |

### Course Grading

Your grade will be calculated out of 497 points as shown in the chart below

|  |     |
|--|-----|
| Clicker Points and Lecture Participation   | 25  |
| Problem Sets   | 70  |
| Lab Notebook   | 50  |
| Lab Activities   | 110 |
| Writing Drafts   | 12  |
| Phage Biology Lab Paper  | 50  |
| Presentation   | 10  |
| <u>CURE Symposium</u><br>5 Poster Draft<br>5 Peer Review<br>10 Audio recording + in class presentation<br>20 Poster<br>20 Symposium Attendance (10 photo, 10 eval) | 60  |
| Archiving Report   | 20  |
| Mid-term assessment  | 25  |
| Final Exam   | 40  |
| Participation  | 25  |
| Total  | 497 |

### Clicker Points and Lecture Participation

Clicker points will be recorded using iClicker response pads. Points will be awarded for participating regardless of whether the answer is correct. To earn the maximum of 15 points for clicker participation you must answer 80% of the available clicker questions over the semester. Clicker points are only

recorded electronically; you cannot get clicker points for writing down answers during a class if you forget your clicker or if your clicker is not working.

### Problem Sets

Problems based on the reading and lecture material will be due weekly on Wednesdays at 11:59 (see syllabus). Each problem set is worth 7 points, and your 10 best problem set scores count towards your grade (2 problem sets are dropped).

### Lab Activities

Most lab activities are to be completed in class and turned in at the end of that lab period (see the syllabus). Lab activities can be completed as a group, but each group member must participate and must write their own answer in their own words. Copying activity answers from another student is a violation of the Honor Code. Lab activities are in the activities section of your lab manual.

### Phage Biology Paper

Each student will write a lab report about the discovery and characterization of their phage. Drafts of each section of the paper will be assigned, so you can get feedback on your writing before you turn in your final report. You must turn in two copies of your final paper: a digital copy must be uploaded to Canvas. For more information about writing scientific papers, see appendix 2 of your lab manual.

### Participation and improvement

Participation is an important part of the learning experience in this course. How far your project will go depends on how much work you are willing to put into it. You will not be graded based on how many “successful” experiments you complete but rather by your effort and your ability to critically troubleshoot your experiments and make the appropriate changes when you repeat the experiment. You will work with a lab partner for the experiments in this class. Both partners are expected to participate in all aspects of the experiment. If you find it necessary to repeat a procedure, you should discuss your revised procedure with an instructor first.

Participation points may be earned by: following lab etiquette, being helpful in the lab, sharing equipment, etc. Participation points may be lost by: being late to class, not helping your lab partner, not cleaning up after yourself, not following directions or safety protocols, leaving class early when there is still work to be done, or not following other lab etiquette procedures.

### Late Work Policy

All lab assignments that are due at the beginning of class must be turned in before class starts. Late work that is turned in the same day it was due will be marked down 10%. You will lose an additional 10% for each additional day the assignment is late. Work that is more than one week late will not be accepted. If you have an excused and documented absence, your work is due at the next lab period or at an earlier date as determined by your instructor. Please note that turning in your work late is much better than not turning it in at all (a 10% deduction is minor in comparison to a 0 grade).

### Attendance Policy

A large portion of this course requires your attendance. Every student is allowed four absences for any reason – these absences do not need to be documented and having documentation does not grant you additional absences. Absences must be made up by attending an open lab time. Be sure the LA records your attendance during open lab if you are making up a lab. All work due during a class when you are absent must be turned in at the next class you attend. Absences that are not made up within two weeks

of the absence will result in a 10 point deduction from your final grade. Please contact an instructor if you have a special circumstance or if you have questions about your absences. If you miss more than 6 class, please speak with an instructor about your options for withdrawing from the course.

#### Open Lab Policy

Open lab times are optional times that you can work in the lab on your experiments or lab activities. Open labs will be held Wednesday 4-5, Thursday 4-5, Friday 2-4. LAs will be available during open lab time to assist you and answer questions. Instructors have office hours at the times noted on the front page of the syllabus. Office hours and open lab time are also a great time to ask questions about activities and problem sets and to get help with your writing.

#### Academic Dishonesty

All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council ([honor@colorado.edu](mailto:honor@colorado.edu); 303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at <http://www.colorado.edu/policies/honor.html> and at <http://www.colorado.edu/academics/honorcode/>

#### Religious Observances

Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. You must report such conflicts at least one week in advance. See full details at [http://www.colorado.edu/policies/fac\\_relig.html](http://www.colorado.edu/policies/fac_relig.html)

#### Disability Accommodations

If you qualify for accommodations because of a disability, please submit to your TA a letter from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and <http://www.Colorado.EDU/disabilityservices/>

#### Classroom Behavior Policy

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. See policies at <http://www.colorado.edu/policies/classbehavior.html> and at [http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student\\_code](http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code)

#### Discrimination and Harassment

The University of Colorado at Boulder policy on Discrimination and Harassment, the University of Colorado policy on Sexual Harassment and the University of Colorado policy on Amorous Relationships apply to all students, staff and faculty. Any student, staff or faculty member who believes s/he has been the subject of discrimination or harassment based upon race, color, national origin, sex, age, disability, religion, sexual orientation, or veteran status should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Judicial Affairs at 303-492-5550. Information about the ODH, the above referenced policies and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at <http://www.colorado.edu/odh>