

APPLIED BIOINFORMATICS IN PLANT PATHOLOGY
PLP6235C – Spring 2025
2 credit hours

Course Description

Bioinformatics training for practical research applications in plant pathology. Analysis of omics data on viral, fungal, and oomycete plant pathogens, developing customized pipelines for large dataset analysis, supported by real case studies.

Prerequisites

The course assumes a foundational understanding of biology and genetics, particularly in the context of plant pathogen and host molecular interactions. While some knowledge of introductory bioinformatics concepts and Unix/Linux command line is helpful, it is not a strict requirement.

Pre-requirement training

Students are highly encouraged to take the HiPerGator training small workshops for connectivity to the cluster, file transfer, basic Unix commands, and Slurm submission scripts. (<https://help.rc.ufl.edu/doc/Training>).

Course Objectives

After completing this course students will be able to:

1. Proficiently Apply Bioinformatics Tools in Plant Pathology Research.
2. Solve Genomic Data Analysis Challenges.
3. Develop Customized Bioinformatics Pipelines to study genome data of major plant pathogens.

Course and Laboratory Instructor

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IT Support

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Class Time

Lecture: Wednesday Period 8 (3:00 pm - 3:50 pm) Lectures will be taught using PowerPoint slides. During each talk, the instructor will introduce the topic of the

day, explain the biological concepts of the topics, and briefly explain the algorithms for the analysis of the data.

Laboratory: Wednesday Period 9 (4:05 pm - 4:55 pm) The laboratory will be taught after each lecture. Each student will connect to the HiPerGator server using his or her computer. Exercises will be conducted in the share group located in the HiPerGator cluster

Location: Fifield Hall 2564

The course is hybrid, and it will be offered in both in-person and online formats to accommodate students' preferences and needs. Before the start of the semester, students are encouraged to contact the instructor to indicate their preferred method of participation, whether in-person or online. All lectures will be recorded in zoom, providing students the flexibility to utilize them for makeup classes or review.

Office Hours

Monday 1:55- 3:50 pm

Recommended Reading

There is no required text for the lab or the lecture. The following reading is recommended.

- Adams, M.J. & Antoniw, J.F. (2005). DPVweb: An open access internet resource on plant viruses and virus diseases. *Outlooks on Pest Management* 16: 268-270.
- Min, B., Grigoriev, I.V. & Choi, I. (2017). FunGAP: Fungal Genome Annotation Pipeline using evidence-based gene model evaluation. *Bioinformatics* 33(18): 2936-2937, <https://doi.org/10.1093/bioinformatics/btx353>
- Sperschneider, J. & Dodds, P.N. (2022). EffectorP 3.0: Prediction of Apoplastic and Cytoplasmic Effectors in Fungi and Oomycetes. *MPMI* 35(2): 146-156. <https://doi.org/10.1094/MPMI-08-21-0201-R>
- Madeira F. *et al.*, Search and sequence analysis tools services from EMBL-EBI (2022). *Nucleic Acids Res.* 50(W1): W276-W279. <https://doi.org/10.1093/nar/gkac240>
- Wang, Y., Zhao, Y. *et al.* (2021). Nanopore sequencing technology, bioinformatics and applications. *Nat Biotechnol* 39: 1348–1365. <https://doi.org/10.1038/s41587-021-01108-x>
- Buffalo, V. *Bioinformatics Skills: Reproducible and Robust Research with Open-Source Tools*. O'Reilly Media. ISBN-13:978-1449367374

- Giani, A.M., Gallo, G.R., Gianfranceschi, L., & Formenti, G. (2020). Long walk to genomics: History and current approaches to genome sequencing and assembly. *Comput. Struct. Biotechnol. J.* 18: 9-19.

Grading

Grading will be based on attendance, two assignments, and an oral presentation.

Assignment 1 will involve analyzing a set of genomic data, which students will submit as a report.

Assignment 2 will consist of tasks related to each student's research project. If a student does not have an ongoing project, the instructor will provide a mini project. For Assignment 2, students are required to design a pipeline to clean, organize, and present genomic findings as requested by the instructor. Assignment 2 should be submitted as a written report.

The oral presentation will be based on the content of Assignment 2.

Component	Points
Assignment 1	15
Assignment 2	40
Presentation	40
Attendance	5
Total	100

Make-up and Attendance Policy

Attending course lectures and labs, and completing the required project are expected. In this course, lectures build on each other. Slides for the talks will be made available but notes from missed lectures must be obtained from other students in the course. Please contact the instructor directly regarding any severe illness or prolonged absence.

Course Schedule

- **Week 1:**
 - Organizational meeting
- **Week 2:**
 - Research computing - HiPerGator (HP) resources and interaction by command line.
- **Week 3:**
 - Review of sequencing technologies

- Week 4:**
- Introduction to Bioinformatics resources for plant pathologists – Genome Databases.

- Week 5: Plant Virus Genomes and Analysis**
- Case Study 1.1: Genome mining for plant viruses

- Week 6: Plant Virus Genomes and Analysis**
- Case Study 1.2: Genome mining for plant viruses .

- Week 7: Fungal Pathogen Genomes and Analysis**
- Case Study 2.1: Assembly and annotation of fungal plant pathogens.

- Week 8: Fungal Pathogen Genomes and Analysis**
- Case Study 2.2: Gene content analysis of fungal plant pathogens.

- Week 9: Fungal Pathogen Genomes and Analysis**
- Case Study 2.3: Detection of apoplastic and cytoplasmic effectors.

- Week 10: Oomycetes genome analysis**
- Case Study 3.1: Genome complexity “The box of chocolates problem” – Bioinformatics approaches to study heterokaryosis and genome heterozygosity.

- Week 11: Oomycetes genome analysis**
- Case Study 3.2: Analysis of Phytophthora genomes – virulence factors and gene family expansions

Week12: Presentation of assignments and review of results

Week13: Presentation of assignments and review of results

Critical dates

Week 7: Assignment 1 report submission.

Week 12: Presentation of assignment 2 and submission of assignment 2 report

Grades and Grade Points

In accordance with the current University of Florida policy, grade points will be assigned as follows:

Letter Grade	Grade Points	%
A	4.0	90 or above
A-	3.67	87-89.9
B+	3.33	84-86.9
B	3.0	80-83.9
B-	2.67	77-79.9
C+	2.33	74-76.9
C	2.0	70-73.9
C-	1.67	67-69.9
D+	1.33	64-66.9
D	1.0	60-63.9
D-	0.67	57-59.9
E	0.0	56.9 or below
WF	0.0	NA
I	0.0	NA
NG	0.0	NA
S-U	0.0	NA

For information on current UF policies for assigning grade points, see <https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>.

Attendance and Make-Up Work

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:

<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>.

Our class sessions will be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Online Course Evaluation Process

Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to

provide feedback on the quality of instruction in this course using a standard set of university and college criteria. Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at:

<https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at: <https://gatorevals.aa.ufl.edu/public-results/>.

Academic Honesty

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity." You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

Software Use

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Services for Students with Disabilities

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office

will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation

0001 Reid Hall, 352-392-8565, <https://disability.ufl.edu/>

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general wellbeing are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu
Counseling Services
Groups and Workshops
Outreach and Consultation
Self-Help Library
Wellness Coaching
- U Matter We Care, www.umatter.ufl.edu/
- Career Connections Center, First Floor JWRU, 392-1601, <https://career.ufl.edu/>.
- Student Success Initiative, <http://studentsuccess.ufl.edu>.

Student Complaints

- Residential Course: <https://sccr.dso.ufl.edu/policies/student-honor-code-studentconduct-code/>
- Online Course: <https://pfs.tnt.aa.ufl.edu/state-authorization-status/#student-complaint>