

Intro to Metagenomics

Summer C 2018 (1 credit)
ENY4905/6905
1207 Steinmetz Hall
Monday 12:30-3:15 pm

Instructor: Peter DiGennaro and Weiming Hu
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Course description

This course is an introduction to high-throughput sequencing analysis, as well as community based data analyses. Content includes the processing of raw sequencing data, specifically metabarcoding marker-gene based community data, and statistical analyses and visualization. You will get hands on experience on sequencing data processing.

Overall, the instructors are committed to creating next-gen sequencing (NGS) data processing experiences that 1) facilitate raw data processing for all participants during and far beyond this course; 2) initiate the practice of community data analyses for participants now, so it is easy to manage their own high-throughput sequencing data in the future; and 3) recognize the programs and functions needed for NGS sequencing amplicon community data analyses.

Course objectives

As a result of taking this course, participants will be able to:

- Design a metabarcoding marker-gene based study
- Articulate the structure of NGS data
- Analyze NGS data from raw sequences to OTU tables
- Demonstrate knowledge of statistical and visualization of community data
- Develop their own scripts for community data analyses in R

Recommend readings

Those following papers can be obtained online:

Fungal community analysis by high-throughput sequencing of amplified markers-a user's guide.
Introducing mothur: open-source, platform-independent, community-supported software for describing and comparing microbial communities.

Parsing ecological signal from noise in next generation amplicon sequencing

Effort verses reward: preparing samples for fungal community characterization in high-throughput sequencing surveys of soils

Illumina-based analysis of microbial community diversity.
 Evaluating bias of Illumina-based bacterial 16S rRNA gene profiles.
 The control of the false discovery rate in multiple testing under dependency.
 Defining operational taxonomic units using DNA barcode data.
 Quality-filtering vastly improves diversity estimates from Illumina amplicon sequencing.
 De novo assembly methods for next generation sequencing data.
 Counting the uncountable: statistical approaches to estimating microbial diversity.

Course calendar

Date	Topics	Readings	Assignments
May 14, Class 1	Course introduction and overview of NGS amplicon sequencing	https://www.mothur.org/wiki/Download_mothur http://qiime.org Fungal community analysis by high-throughput sequencing of amplified markers-a user's guide	
May 21, Class 2	<i>Introducing NGS data and Mothur</i>	https://www.mothur.org/wiki/MiSeq_SOP Introducing mothur: open-source, platform-independent, community-supported software for describing and comparing microbial communities	Due: Installed Mothur on own computer
May 28, No Class	Memorial Holiday		
June 4, Class 3	Sequencing processing in Mothur	Parsing ecological signal from noise in next generation amplicon sequencing Effort versus reward: preparing samples for fungal community characterization in high-throughput sequencing surveys of soils	Due: Output files from Mothur
June 11, Class 4	Overview of community analysis, Alpha community analyses in R	Vegan: community ecology package	Due: OTU table; Install R and required packages
June 18, Class 5	Guest speaker		Due: Alpha diversity results
June 25, No Class	Summer break		
July 2, Class 6	Beta and other community related analyses in R	Ggplot2: Elegant graphics for data analysis	Due: Chose data set for final project
July 9, Class 7	Other community related analyses in R	The control of the false discovery rate in multiple testing under dependency	Due: Beta diversity results
July 16, Last class	Wrap -up		Due: community taxa results The report of the project will be due on July 23

Evaluation of Grades

Assignments	Points	Percent of Grade
Installed Mothur on own computer	50	5%
Summary files from Mothur	50	5%
OTU table, Install R and required packages	200	20%
Alpha diversity results	100	10%
Chose data set for final project	50	5%
Beta diversity results	100	10%
community taxa results	100	10%
Report of final project	350	35%
Total	1000	100%

Grading Policy

Score	Percent	Grade	Grade Points
934-1000	93.4-100	A	4.00
900-933	90.0-93.3	A-	3.67
867-899	86.7-89.9	B+	3.33
834-866	83.4-86.6	B	3.00
800-833	80.0-83.3	B-	2.67
767-799	76.7-79.9	C+	2.33
734-766	73.4-76.6	C	2.00
700-733	70.0-73.3	C-	1.67
667-699	66.7-69.9	D+	1.33
634-666	63.4-66.6	D	1.00
600-633	60.0-63.3	D-	0.67
0-599	0-59.9	E	0.00

More information on grades and grading policies is here:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Class Attendance and Make-Up Policy

Class attendance is expected. Each unexcused absence will result in a 10 point reduction in the final grade. Excused absences are consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation. Students are expected to arrive on time and attend the full class period. Students are expected to make up and submit any missed work before the next class session, and need to contact a peer in class to obtain notes, handouts, assignments, etc.

Late essay response papers will not be accepted. A makeup midterm and makeup final exam will be provided for students who miss either exam due to extreme, documented circumstances. A cumulative make-up quiz will be provided at the end of the semester for any and all quizzes missed. This score will replace all missing quiz grades. Students should arrange with the instructor for makeup material, and the student will receive one week to prepare for any makeup assignment, if circumstances allow it.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

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.

Class Demeanor

Students are expected to arrive to class on time and behave in a manner that is respectful to the instructor and to fellow students. Please avoid the use of cell phones and restrict eating to outside of the classroom. Opinions held by other students should be respected in discussion, and conversations that do not contribute to the discussion should be held at minimum, if at all.

Materials and Supplies Fees

There are no additional fees for this course.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students 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.” The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being 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/cwc/*

Counseling Services Groups and Workshops Outreach and Consultation Self-Help Library
Wellness Coaching

- U Matter We Care, www.umatter.ufl.edu/
- *Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/*