GNET/PHCO 749

Course title: Practical RNA-Seq

Course units/hours: 2 credit hours MWF 1:20 to 2:50pm

March 17 through April 28

Location:

Mon/Wed/Friday: Marsico Hall 2004

Some Fridays: Mary Ellen Jones 3116

Grading basis: (GRAD – H,P,L, F)

Course Component: (lecture or lab): lecture

Course Description: This module is designed to familiarize students with everything needed to run an RNA-Seq experiment, including the concepts behind experimental design, how to prepare samples, running them on a NextSeq 500, and analyzing data. There will be minimal emphasis on theory and heavy focus on practical aspects. There are no formal prerequisites required for this course and no prior experience with UNIX or the command line interface is expected.

Course objectives (learning outcomes): The objectives of this course are to provide scientists at all levels with enough practical knowledge that they would be able to carry out an RNA-Seq experiment in their own lab environment. Most individuals that take the class for credit are graduate students, but every year, we have a number of auditors, who in the past have included undergraduates, technicians, post-doctoral fellows, staff scientists, and faculty members. The course is broken up into three parts of unequal length. In the first part of the course, students learn the fundamentals of high-throughput DNA sequencing on the Illumina platform, its application to RNA-Seq, and the in-depth experimental details of preparing RNA-Seq libraries, starting from RNA extraction from tissues or cells, and extending through final RNA-Seq library preparation. In the second part of the course, students learn how to perform basic commands in the UNIX environment and the fundamentals of short-read quality control, alignment, and gene-level quantification on UNC's compute cluster, Longleaf. In the third part of the course, students learn the fundamentals of manipulating data frames in the R environment, and how to carry out differential gene expression analyses using the R package, DESeq2. In between the first and second parts of the course is a hands-on demonstration of the NextSeq1000 instrument. The data generated during the hands-on demonstration are provided to students to be analyzed as part of the final exam.

Course Assignments: Students are encouraged to practice the UNIX and R commands covered in the second and third parts of the course each day. Like a spoken language, computational analyses can only be learned through extensive practice and the taking of good notes.

Assessments: Student grades will be determined through attendance and performance on the final exam. Absences are allowed but must be explained by an email to the lead instructor, Mauro Calabrese. For the final exam, students will be asked to detect the differentially expressed genes in a panel of datasets that were generated earlier in the class, during the hands-on demonstration of the NextSeq1000. Students that report the correct list of differentially expressed genes along with the gene's adjusted p-values and a detailed computational notebook outlining each step of their analyses, including shell scripts, will receive a high pass (H). Those that report a list of differentially expressed genes that is incorrect, along with a detailed computational notebook outlining each step of their analyses, including shell scripts, will receive a pass (P). Those that fail to turn in a final assignment or that have more than three unexcused absences will receive a low pass (LP).

Assigned Space

03/17/2025 (Mon) : 01:20 PM - 02:50 PM

2004 Marsico

03/19/2025 (Wed) : 01:20 PM - 02:50 PM

2004 Marsico

03/21/2025 (Fri) : 01:20 PM - 02:50 PM

3116 MEJ

03/24/2025 (Mon) : 01:20 PM - 02:50 PM

2004 Marsico

03/26/2025 (Wed) : 01:20 PM - 02:50 PM

2004 Marsico

03/28/2025 (Fri) : 01:20 PM - 02:50 PM

3116 MEJ

03/31/2025 (Mon) : 01:20 PM - 02:50 PM

2004 Marsico

04/2/2025 (Wed) : 01:20 PM - 02:50 PM

2004 Marsico

04/4/2025 (Fri) : 01:20 PM - 02:50 PM

3116 MEJ

04/7/2025 (Mon) : 01:20 PM - 02:50 PM

2004 Marsico

04/9/2025 (Wed) : 01:20 PM - 02:50 PM

2004 Marsico

04/11/2025 (Fri) : 01:20 PM - 02:50 PM

3116 MEJ

04/14/2025 (Mon) : 01:20 PM - 02:50 PM

2004 Marsico

04/16/2025 (Wed) : 01:20 PM - 02:50 PM

2004 Marsico

04/21/2025 (Mon) : 01:20 PM - 02:50 PM

2004 Marsico

04/23/2025 (Wed) : 01:20 PM - 02:50 PM

2004 Marsico

04/25/2025 (Fri) : 01:20 PM - 02:50 PM

2004 Marsico

04/28/2025 (Mon) : 01:20 PM - 02:50 PM

2004 Marsico