Tentative fyllabus for: Microbial Metagenomics/Genomics Data Analysis
Short title: Microbiome Data Analysis
Instructor: Zaid Abdo-Spring 2017

Course Description:
Microbiomes, microbes and their genetic material present in a host/environment, are linked to risk to disease in humans, animals and plants. Metagenomics, including 16S rRNA community survey methods and shotgun metagenomics, use high throughput sequencing technology to provide insight towards composition and potential function of microbiomes. This course provides hands on experience in using bioinformatics and statistical tools necessary to process and analyze the resulting large datasets.

Topics:
Week 1:
    An introduction to microbial ecology
    Highlight of data generation and high throughput methods
    The Galaxy interactive environment: An Orientation and basics of use
Week2:
    Sequence Data + Quality view: the fastq and fasta files + FastQC and its output
    A Linux primer
    Preprocessing high throughput data: trimmomatic
    Metagenomic databases (JGI IMG, DACC, SILVA, GreenGene, RDP, …)
Week3:
    Data processing and classification (or not): Mothur (16S)
    Data processing and classification (or not): Metagenomics
Week4:
    An overview of R: R as a statistical and programming environment
Week5:
    The normalization problem: Rarefying, quantile normalization, CCS
    Exploratory, multivariate data analysis (vegan): PCA, PcoA, NMDS, Clustering
Week6:
    Comparative analysis: perMANOVA, RDA, metagenomeseq, DESeq2 and edgR
Week7:
    Predictive approaches: Random forests, glmnet, …
    Network analysis (R): Bayesian, Association and Co-occurrence Networks
    Microbial Genome Alignment: Downloading and Installing Tychus
Week8:
    Microbial SNP Calling and Consensus recovery and phylogenetic trees
    Microbial Genome de novo assembly and annotation: Tychus
    Highlights of Phylogenetics and phylogenomics

Exams and Homework:
    We will have 4 homework assignments during weeks 1, 3, 5, and 7 each worth 25% of the total grade. These will be due Monday of week 3, 5 and 7 and last lecture on week 8, respectively. No late assignments will be accepted.