Topics to possibly cover in Applied Genomics

1. Introduction to computational biology
   1. How to work on the command line
   2. Open source software
   3. Github
2. Databases
   1. Databases types
   2. Searching databases
   3. Retrieving Sequences from databases
3. QA/QC of Next generation sequences
   1. Quality assessment and Quality control
   2. Quality trimming
4. Reference-based assembly
   1. Genome Assembly – Mapping reads to reference
   2. Genome: Variant identification
5. De novo sequencing
   1. Genome Assembly – Greedy algorithms
   2. Genome Assembly – Debrujn graph generators
   3. Genome Assembly – prokaryotes versus eukaryotes
   4. Genome Assembly – Assessing Quality (Check-m, genome stats)
6. Annotation
   1. Genome Annotation (Gene calling - prokaryotes)
   2. Genome Annotation (Gene calling - eukaryotes)
   3. Genome Annotation (Assigning function – BLAST)
   4. Genome Annotation (Assigning function – HMMs - Pfam)
   5. Genome Annotation (Assigning function – KEGG mapping and metabolic pathways)
   6. Genome Annotation (Non-coding regions)
7. Comparative Genomics
   1. Comparative Genomics (Core and pan genomes)
   2. Comparative Genomics (ANI/Pan genome trees)
8. Gene expression
   1. Differential gene expression (mapping reads to a reference genome)
   2. Determining differential gene expression
   3. Differential gene expression (Assembling RNA seq data)
   4. Differential gene expression (Mapping reads to a de novo assembled genome)
9. Metagenomics
   1. Metagenomics – 16S rRNA sequencing
   2. Metagenomics – shotgun sequencing
   3. Metagenomics – binning

Mid-Year project

1. Resource announcement

Assessments

Weekly Assignments – 70%

Pre-reading quizzes (2 questions) – 10%

Final Project – 20%

1. Pick a topic of interest
   1. Variant Identification/GWAS
   2. De novo genome assembly
   3. Differential Gene Expression
   4. Metagenomics
2. Find a dataset – must be raw data can be your own and not previously published
3. Generate a hypothesis based on previous information
4. Design a pipeline for this analysis
5. Perform the analysis
6. Generate at least three figures related to your analysis
7. Present – 15-minute presentation
   1. Those enrolled in BL5300 must also write a 15-page term paper

Establish Group Charter/Work Plan

Roles

1. Facilitator/Task Lead 1
   1. Sets agenda for group meetings
2. Scheduler
   1. Coordinates scheduling of out-of-class meetings
3. Recorder/Reporter/Task Lead 2
   1. Takes notes for meetings
   2. Corresponds with Dr. Techtmann regarding progress