Course KB8019 Comparative Genomics, 7.5 hp

Stockholm University, DBB. 100% speed during period D, spring term 2017

Course goals: to learn current techniques for analysing genomes and how comparative genomics can be used to understand the organisation, evolution, and function of genomic sequences.

Course literature:
- Web resources.
- Zvelebil and Baum, Understanding bioinformatics. Not strictly required as it is partly outdated, but recommended for its in-depth explanations of many algorithms.

Course begin/end: 2/5-2/6 2017
Lectures: 8 lectures
Lecturer: Erik Sonnhammer
The listed literature must be read before the lectures.
Practicals: 8 practicals in the DBB computer room. Assistants will be present 10-15 on days with no lectures.
Practicals should be finished and reports submitted during the week they are listed, or at the latest the Monday after.
Practicals assistants: Daniel Morgan and Mateusz Kaduk
Information at http://www.nada.kth.se/~erison/
Materials for practicals in AFS volume ~erison/Public/Comparative_Genomics/

Week 1. The structure of prokaryotic and eukaryotic genomes; Gene prediction
Lectures May 2, 10.15-13.00 (Arrhenius KÖL K205):
> Introduction
> 1. Genome organisation
> 2. Gene prediction

Literature:
> http://en.wikipedia.org/wiki/Biological_databases
> http://en.wikipedia.org/wiki/List_of_biological_databases
> http://www.yourgenome.org/facts/what-is-a-genome
> http://en.wikipedia.org/wiki/Bioinformatics
> http://en.wikipedia.org/wiki/Genome
> https://en.wikipedia.org/wiki/Gene_prediction
> http://en.wikipedia.org/wiki/Introduction_to_genetics
> http://en.wikipedia.org/wiki/Human_genome
> http://en.wikipedia.org/wiki/Genome_evolution
> Zvelebil:
>> Chapter 3 Dealing with Databases
>> Chapter 9 Revealing Genome Features
>> Chapter 10 Gene Detection and Genome Annotation

Practical 1: Basic genome analysis
Practical 2: Gene prediction

Week 2. Evolution of genes and genomes
Lectures May 9, 13.15-15.30 (Arrhenius KÖL K205):
> 3. Phylogenetics
> 4. Phylogenomics

Literature:

       http://evolution.berkeley.edu/evolibrary/article/phylogenetics_01
       https://en.wikipedia.org/wiki/Phylogenetic_tree
       https://en.wikipedia.org/wiki/Phylogenomics
       https://en.wikipedia.org/wiki/Phylogenetic_network
       https://en.wikipedia.org/wiki/List_of_phylogenetics_software
       https://en.wikipedia.org/wiki/Phylogenetic_tree_viewers
       https://en.wikipedia.org/wiki/Phylogenetics

Zvelebil:

       Chapter 7: Recovering Evolutionary History
       Chapter 8: Building Phylogenetic Trees

Practical 3: Phylogenetic reconstruction
Practical 4: Phylogenomics

Week 3. Synteny and orthology analysis

Lectures May 15, 13.15-15.30 (Arrhenius KÖL K205):

    5. Gene order
    6. Orthology

Literature:

       https://en.wikipedia.org/wiki/Synteny
       https://en.wikipedia.org/wiki/Sequence_homology
       http://questfororthologs.org/
       http://orthology.benchmarkservice.org/

Zvelebil:

    Chapter 7.2 Molecular Evolution and its Consequences

Practical 5: Gene order analysis
Practical 6: Orthology

Week 4. Function and interaction prediction

Lectures May 22, 13.15-15.30 (Arrhenius KÖL K205):

    7. Function prediction
    8. Networks

Literature:

       https://en.wikipedia.org/wiki/Biological_network
       https://en.wikipedia.org/wiki/Interactome
       https://en.wikipedia.org/wiki/Systems_biology
       http://funcoup.sbc.su.se

Zvelebil:

    Chapter 17: Systems Biology

Practical 7: Function prediction
Practical 8: Interaction networks

Week 5. Project assignments: reports and preparation of group presentations

Fri 2/6 – 10.15-15.30 (TBA): group presentations.