Course KB8019 Comparative Genomics, 7.5 hp
Preliminary schedule for 2021, version 3/8/21, subject to change.

Hosted by Stockholm University, DBB.

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 as up to date as the web resources but has more in-depth explanations of many concepts and algorithms.

Course begin/end: May 3 – June 4 2021 (13/5 is a holiday)
- Classes via zoom https://stockholmuniversity.zoom.us/j/61994784456 by Prof. Erik Sonnhammer
- The listed literature must be read before each class. Time is reserved for this in the morning of the class day.
- Practicals are done via remote login on computers in the DBB computer room (A244 at Arrhenius) or locally at home. Accounts on the DBB computers will be provided at the course start. Teacher assistants will be available via videoconference on non-class days 13-17 at https://discord.gg/sV9Yg7Hets
- Reports for practicals should be submitted during the week they are listed, but at the latest the Monday after.
- Slides will be provided after the class.
- Teacher assistants: Emma Persson and Thomas Hillerton
- Course information on Google drive
- Course information and reporting via Athena; log in with your SU account on https://athena.itslearning.com
- Quizzes will either be on Canvas or Athena. If we use Canvas, then students need to add themselves at https://canvas.instructure.com/enroll/FFAEKF in order to take the quizzes.

Week 1. The structure of prokaryotic and eukaryotic genomes; Gene prediction
May 3, 10.00-12.00: Roll call, Introduction to course, and start of practicals
Practical 1: Basic genome analysis. Briefing May 3, ~11.00
Practical 2: Gene prediction. Briefing May 3, ~11.00

May 4, 14.00-16.30:
- Quiz 1 14.05-14.15 on your own device.
- Class 1. Genome organisation
- Class 2. Gene prediction

Literature:
http://en.wikipedia.org/wiki/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
https://en.wikipedia.org/wiki/Repeated_sequence_(DNA)
https://en.wikipedia.org/wiki/Non-coding_DNA
http://en.wikipedia.org/wiki/Genome_evolution
https://en.wikipedia.org/wiki/C-value

Zvelebil:
Chapter 3 Dealing with Databases
Chapter 9 Revealing Genome Features
Chapter 10 Gene Detection and Genome Annotation

Week 2. Evolution of genes and genomes
May 10, 14.00-16.30:
Quiz 2 14.05-14.15 on your own device.
Class 3. Phylogenetics
Class 4. Phylogenomics

Practical 3: Phylogenetic reconstruction. Briefing May 11, 10.30
Practical 4: Phylogenomics. Briefing May 11, 10.30

Literature:
https://en.wikipedia.org/wiki/Phylogenetic_tree
http://evolution.berkeley.edu/evolibrary/article/phylogenetics_01
https://en.wikipedia.org/wiki/Bootstrapping
https://en.wikipedia.org/wiki/UPGMA
https://en.wikipedia.org/wiki/Neighbor_joining
https://en.wikipedia.org/wiki/Phylogenomics
http://tiny.cc/3uzk6y (Lambkin et al., 2009)
http://genome.cshlp.org/content/8/3/163.long (Eisen, 1998)
https://en.wikipedia.org/wiki/Phylogenetic_profiling
https://en.wikipedia.org/wiki/Phylogenetic_network
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

Week 3. Synteny and orthology analysis
May 17, 14.00-16.30:
Quiz 3 14.05-14.15 on your own device.
Class 5. Gene order
Class 6. Orthology

Practical 5: Gene order analysis. Briefing May 18, 10.30
Practical 6: Orthology. Briefing May 18, 10.30
Final project assignment: Briefing May 19, 10.30
Literature:
https://en.wikipedia.org/wiki/Synteny
https://genomevolution.org/wiki/index.php/Synteny:_Getting_the_Big_Picture
https://en.wikipedia.org/wiki/Sequence_homology
http://questfororthologs.org/
http://orthology.benchmarkservice.org/
http://inparanoid.sbc.su.se/

Zvelebil:
Chapter 7.2 Molecular Evolution and its Consequences

Week 4. Interaction networks
May 24, 14.00-16.30:
  Quiz 4 14.05-14.15 on your own device.
  Class 7. Interaction networks
  Class 8. Pathway analysis

Practical 7: Interaction networks. Briefing May 25, 10.30

Literature:
https://en.wikipedia.org/wiki/Biological_network
https://en.wikipedia.org/wiki/Network_science
https://en.wikipedia.org/wiki/Scale-free_network
https://en.wikipedia.org/wiki/Interactome
https://en.wikipedia.org/wiki/Pathway_analysis
The Architecture of Biological Networks (Wuchty et al., 2006)
https://string-db.org/
https://david.ncifcrf.gov/

Zvelebil:
Chapter 17: Systems Biology

Week 5. Project assignments: report writing and preparation of group presentations
(Briefing in week 3)

June 4, 10.15: group presentations of final project assignments.