Bioinformatics and Systems biology for human biologists

September 2015
Introduction by Isa Kristina Kirk

isa.kirk@cpr.ku.dk
Course Topics

- DNA, RNA & protein sequences
  *Formats, tools and methods*

- Protein structure and function
  *From experiment to models & hypotheses*

- Microarray analysis
  *Looking in depth at the gene expression*

- Networks
  *How everything interact*

- Systems Biology: What then?
  *Using Systems Biology in science*
<table>
<thead>
<tr>
<th>Day</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Introduction to bioinformatics</td>
<td>3 Protein structures</td>
<td>5 Microarray analysis</td>
<td>7 Biologic networks</td>
<td>9 Systems Biology: what then?</td>
</tr>
<tr>
<td></td>
<td>Mette Beck</td>
<td>Alberto Santos</td>
<td>David Westergaard</td>
<td>Lars Juhl Jensen</td>
<td>Søren Brunak</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&amp; Helen Cook</td>
<td>&amp; Annelaura Bach</td>
<td>&amp; Helen Cook</td>
<td>Evaluation</td>
</tr>
<tr>
<td></td>
<td>2 Sequence alignments</td>
<td>4 Homology and databases</td>
<td>6 Microarray analysis part II</td>
<td>8 Biologic networks part II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jessica Xin Hu</td>
<td>Alberto Santos</td>
<td>David Westergaard</td>
<td>Lars Juhl Jensen</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&amp; Cecilia Engel Thomas</td>
<td>&amp; Annelaura Bach</td>
<td>&amp; Helen Cook</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monday</td>
<td>Tuesday</td>
<td>Wednesday</td>
<td>Thursday</td>
<td>Friday</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------------------</td>
<td>---------------------------------------</td>
<td>--------------------------------------</td>
<td>--------------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Introduction to bioinformatics</td>
<td>3 Protein structures</td>
<td>5 Microarray analysis</td>
<td>7 Biologic networks</td>
<td>9 Bioinformatics and application</td>
</tr>
<tr>
<td></td>
<td>![Image](222x30 to 433x546)</td>
<td>![Image](434x404 to 504x492)</td>
<td>![Image](139x404 to 210x492)</td>
<td>![Image](607x401 to 743x492)</td>
<td>![Image](810x402 to 873x492)</td>
</tr>
<tr>
<td>2</td>
<td>Sequence alignments</td>
<td>4 Homology and databases</td>
<td>6 Microarray analysis part II</td>
<td>8 Biologic networks part II</td>
<td></td>
</tr>
<tr>
<td></td>
<td><img src="143x630" alt="Image" /></td>
<td><img src="309x630" alt="Image" /></td>
<td><img src="456x630" alt="Image" /></td>
<td><img src="632x630" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Venues

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victor Haderup</td>
<td>Build. 29.01.32, Mini aud. 2</td>
<td>Panum Canteen Room 42.0.01</td>
<td>Victor Haderup Building 20</td>
<td>Adolf Hannover Building 20</td>
</tr>
<tr>
<td>Building 20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Bioinformatics For Human Biologists

One week intensive course for students at the "Human Biology" study-line at Panum.

Contact
- Course responsible: Søren Brunak, CPR/CBS
- Course organizer: Isa Kristina Kirk, CPR

Course programme

Next course:
- 2015: September 2015 (Mon 14th - Thu 17th)

Past courses:
- 2014: September 2014 (Mon 15th - Thu 18th)
- 2013: September 2013 (Mon 16th - Fri 20th)
- 2012: October 2012 (Mon 1st - Fri 5th)
- 2011: January 2011 (Mon 3rd - Fri 7th)
- 2010: January 2010
- 2009: January 2009

Curriculum
Reading Material

• All reading material is linked from the programme on the course homepage.

• Can be read on a day-to-day basis.
Hardware / Software used
First and foremost: YOU MUST BRING YOUR OWN LAPTOP TO THE COURSE. For the PyMOL-based exercises Tuesday, please bring a 3-button / scrollwheel mouse as well.

The computer exercises can be executed from any internet connected computer (Mac, Linux, Windows) with a modern browser (e.g. FireFox, Safari or a recent version of Internet Explorer - a browser which supports tabs is recommended).

Flash and Java should be installed since these are used in some exercises to run visualization software.
- Link to Adobe Flash player: http://get.adobe.com/flashplayer
- Link to Java: http://www.java.com

We recommend the JEdit text editor for use on sequence files, since it is well suited for this purpose and is platform independent. Link: http://www.jedit.org

For Tuesdays exercises:
For the protein structure exercise the PyMOL software (also cross-platform) will be used. Main link: http://www.pymol.org

Free Student's version:
- PyMOL for Mac
- PyMOL for Linux
- PyMOL for Windows

Unpack (unzip) the downloaded file and follow the instructions to install (for Windows, simply double-click the ".msi" file). The installation will take a few minutes. Just use the default settings. When asked if you want to make PyMOL your default molecular viewer, just press "Yes". You should now be ready to go.

For Wednesdays exercises:
For the expression analysis exercise the statistical software, R and R Studio, will be used. Main links: https://www.r-project.org and https://www.rstudio.com.

To download the free R software you can go directly to the downloading page and choose the version for your platform: R and R Studio.

For Thursdays exercises:
For the network analysis exercise the network visualization tool, Cytoscape, will be used. Main link: http://www.cytoscape.org/index.html

To download the free software you can go directly to the downloading page and choose the version for your platform: http://www.cytoscape.org/download-platforms.html

Reporting
All exercise is part of the curriculum and made during the class, and are therefor not supposed to be handed in.
Answer for each days exercises are put up on this page by the end of the day, but there will be time friday morning to ask questions and catch up on missing exercises.
Exercises Tuesday

• Bring a three-button mouse (with a scroll wheel) for the PyMOL-based exercises Tuesday.
Passing the course

- Passing the course is based on
  1. Participation in lectures and exercises.
  2. Correct answers at the oral exam

- Exercises are done during the lectures, and can be made in groups.

- Catch up on missing exercises and question time Friday morning.
Questions

- Over all course contents and practical matters: Isa: isa.kirk@cpr.ku.dk
- Specific lectures: See webpage

http://wiki.bio.dtu.dk/teaching/index.php/BioinformaticsForHumanBiologists