BY 436 BY 734 – Functional Genomics and Systems Biology

Fall 2013 MWF 1:25-2:15 PM, Education Bldg. 134, 51521, 1F

INSTRUCTOR: Dr. Shahid Mukhtar
Office: Campbell Hall 369
Phone: 934-8335
Email: smukhtar@uab.edu
Office Hours: by appointment

COURSE DESCRIPTION:
Goals of this course include:

• To give a foundation in understanding complex biological interactions at the molecular, network and genomic levels.
• To cover state-of-the-art high-throughput put established and novel approaches used in genome sequencing, transcriptomics, proteomics and metabolomics to obtain, integrate and analyze complex data.
• To familiarize students with knowledge on experimental perturbation of genomes, gene regulatory networks, comparative genomics and evolution.
• To introduce common databases and teach how to implicate them in various biological problems.
• To help develop a general understanding of basic bioinformatics in deciphering key questions related to systems biology.
• All lecture materials, including the PowerPoint slides, articles, and additional resources, will be made available to the students.

Introduction to the Biological Systems and Genomics
• Introduction to “Omics”
• Next generation genome sequencing
• Introduction of Bioinformatics’ tools in genome sequencing
• Applications of next generation sequencing in medicine and agriculture
• Personalized genomics and medicine

Transcriptomics and Construction of Regulatory Networks
• Next generation transcriptomics technologies
• Generation of transcriptional regulatory networks
• Data mining and bioinformatics software to build transcriptional regulatory modules
• Introduction of databases and software for transcriptomics
• High-throughput genetic screens to understand signaling pathways in model and non-model organisms
• High-throughput genetic manipulations
Proteomics and Generation of Interactomics
• High-throughput proteomics
• Construction of interactomics
• Bioinformatics and data visualization software for proteomics
• Diseasomes
• Bioinformatics methods to predict protein-protein interactions

Other Biological Networks and Database Mining
• Metabolic Networks
• Phylogenetic Networks
• Ecological Networks
• Correlation Networks

Analysis of Biological Networks
• Networks in Biology
• Global network properties
• Network centralities and motifs
• Network clustering

Metabolomics and Chemical Genomics
• Metabolomics toolbox
• Statistical analyses and software in metabolomics
• Human metabolome project
• Chemical genomics and drug discovery

Comparative Genomics & Molecular Evolution
• Evolution of Genomes
• Measurement of evolution rate
• Cross species comparisons

Points:
The breakdown of four in-class exams, one take-home exam and two home assignments is as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>In-class exam 1</td>
<td>100</td>
</tr>
<tr>
<td>In-class exam 2</td>
<td>100</td>
</tr>
<tr>
<td>Home assignment 1</td>
<td>25</td>
</tr>
<tr>
<td>Home assignment 2</td>
<td>25</td>
</tr>
<tr>
<td>Home assignment 3</td>
<td>25</td>
</tr>
<tr>
<td>Take-Home exam</td>
<td>25</td>
</tr>
<tr>
<td>In-class exam 3</td>
<td>100</td>
</tr>
<tr>
<td>In-class exam 4 (Final)</td>
<td>100</td>
</tr>
<tr>
<td>Paper</td>
<td>100</td>
</tr>
</tbody>
</table>

Total possible points 600

Grades will be determined on the following scale:
A: 90-100%
B: 80-89%
C: 70-79%
Exam Policy: Make-up exams for the two in-class exams will be administered in the last week of class (no exceptions). Only individuals with written medical (Doctor) or legal excuses will be allowed to take the exam. The excuse must be submitted to me no later than seven (7) days after the missed exam; otherwise, the grade will be assigned as a 0. Individuals must contact my office within 24 hours of an exam (either before or after) to be considered for a make-up exam; otherwise, the grade will be assigned as a 0. No more than 1 make-up exam for each Student is permitted unless extreme, extenuating circumstances prevail. All exams except for the FINAL IN-CLASS EXAM take place on Regular Lecture Days and in the same Lecture Room. Students will have only the lecture time to complete the exam unless the Student has official UAB documentation through the office of Disability Support Services.

Students who require special assistance can contact the office of Disability Support Services to obtain appropriate documentation. All Students with such documentation are responsible to inform the instructor of arrangements prior to EACH exam. In order to register with the office of Disability Support Services you may go to 9th Ave. Office Building (1701 9th Ave. South) or call 934-4205. For more information check DSS main page (http://main.uab.edu/Sites/students/services/disability-support/).

Conduct: The use of cellular phones and other mobile devices during class is also disruptive and disrespectful to your fellow classmates and instructor. Therefore, all electronic devices must be either turned off or on vibrate during class. You will be asked to leave if your ringtone sounds in class or you are observed talking on the phone or texting during class. If you have an emergency and must take a call - be polite and go outside.

Severe/Inclement Weather: There will be no class if the campus is closed during normal class time. The topic for that day will be discussed during the following class session. During inclement weather please check the UAB main page (www.uab.edu) or WBHM (90.3 FM) or call WBHM (934-2606) or the UAB Bad Weather Hotline (934-2165) to determine if campus is closed.

Important deadlines and dates:
9/16 Guest lecture-1
9/18 In-class exam 1
9/25 Home assignment 1
10/11 In-class exam 2
10/18 Home assignment 2
10/30 Paper due
11/01 Guest lecture-2
11/06 In-class exam 3
11/13 Take Home exam
12/06 Last day of Class
12/06 Home assignment 3
12/13 Official date for In-class exam 4 (final exam) 10:45 AM – 12:00 PM

You may withdraw and receive a grade of “W” up to and including October 25th.

Paper format
A- Review Article:
1- Title page (1 page)
2- Background and significance (2 pages)
4- Discussion (8 pages)
5- References (use of EndNote is desired, if possible)
*Use Single-spaced, Arial font size 11, Calibri font size 12 or Times New Romans font size 12.

B- Research Article
1- Title page (1 page)
2- Background and significance (2 pages)
3- Layout of the objectives (1 page)
3- Outcome (5 pages)
4- Discussion (3 pages)
5- References (use of EndNote is desired, if possible)
*Use Single-spaced, Arial font size 11, Calibri font size 12 or Times New Romans font size 12.

**Paper points breakdown:**
Paper write-up: 85
Paper presentation: 15 *(7 minutes presentation)*