Course Syllabus: Genomics - B 204

<table>
<thead>
<tr>
<th>Division</th>
<th>Biological and Environmental Sciences &amp; Engineering Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Number</td>
<td>B 204</td>
</tr>
<tr>
<td>Course Title</td>
<td>Genomics</td>
</tr>
<tr>
<td>Academic Semester</td>
<td>Fall</td>
</tr>
<tr>
<td>Academic Year</td>
<td>2016/2017</td>
</tr>
<tr>
<td>Semester Start Date</td>
<td>08/21/2016</td>
</tr>
<tr>
<td>Semester End Date</td>
<td>12/13/2016</td>
</tr>
<tr>
<td>Class Schedule</td>
<td>04:00 PM - 05:30 PM</td>
</tr>
</tbody>
</table>

### Instructor(s)

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Phone</th>
<th>Office Location</th>
<th>Office Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timothy Ravasi</td>
<td><a href="mailto:timothy.ravasi@kaust.edu.sa">timothy.ravasi@kaust.edu.sa</a></td>
<td>+966128082387</td>
<td></td>
<td>9:00 am to 5:00 pm.</td>
</tr>
<tr>
<td>Manuel Ignacio Aranda Lastra</td>
<td><a href="mailto:manuel.aranda@kaust.edu.sa">manuel.aranda@kaust.edu.sa</a></td>
<td>+966128082979</td>
<td></td>
<td>9:00 am to 5:00 pm.</td>
</tr>
<tr>
<td>Takashi Gojobori</td>
<td><a href="mailto:takashi.gojobori@kaust.edu.sa">takashi.gojobori@kaust.edu.sa</a></td>
<td>+966128082893</td>
<td>4220, 3, Ibn Sina (bldg. 3)</td>
<td>9:00 am to 5:00 pm.</td>
</tr>
</tbody>
</table>

### Teaching Assistant(s)

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
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<tbody>
<tr>
<td>None</td>
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### Course Information

#### Comprehensive Course Description

Principles and technologies for generating genomic information for ecological, biomedical and biotechnological applications. Technologies will be introduced progressively, from DNA to RNA to protein to whole cell systems. The integration of biology, chemistry, engineering, and computational sciences will be stressed. Topics include: Technology for the High-throughput Sequencing, Methods for annotating genomes, characterizing functional genes, Gene Expression, Comparative Genomics, Population Genomics, Proteomic Technologies and Systems Biology.

#### Course Description from Program Guide

Principles and technologies for generating genomic information for ecological, biomedical and biotechnological applications. Technologies will be introduced progressively, from DNA to RNA to protein to whole cell systems. The integration of biology, chemistry, engineering, and computational sciences will be stressed. Topics include: Technology for the High-throughput Sequencing, Methods for annotating genomes, characterizing functional genes, Gene Expression, Comparative Genomics, Population Genomics, Proteomic Technologies and Systems Biology.

#### Goals and Objectives

The goals and objectives is that the students understand principles and technologies for generating genomic information for ecological, biomedical and biotechnological applications at the end of the present course. Moreover, the students are expected to obtain the knowledge of how organismic diversity and evolution can be understood through comparative approaches of genomic information. In particular, the students learn how to make ecological and evolutionary interpretation of phenotypic features from analyses of genomic information.

#### Required Knowledge

Basic knowledge of molecular biology is required. Very basic mathematics and statistics are preferably helpful if the students have.
### Reference Texts

**Recommended Books (for reference only):**


### Method of evaluation

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>70.00%</td>
<td>Exam 2</td>
</tr>
<tr>
<td>30.00%</td>
<td>Exam 1</td>
</tr>
</tbody>
</table>

### Nature of the assignments

**Exams:** A total of two exams will be given:

1) The mid-term exam **(Date to be determine).**
2) The final exam **during the final exam period.**

*There are no make-up exams for this Class.*

- **Exams:** Will include all topics covered in the course.

- **Grading Scheme:**
  - Mid-term Exam: 30%
  - Final Exam: 70%

**Final course grades will be assigned according to the chart below:**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>86 % - 90 %</td>
</tr>
<tr>
<td>A-</td>
<td>82 % - 86 %</td>
</tr>
<tr>
<td>B+</td>
<td>78 % - 82 %</td>
</tr>
<tr>
<td>B</td>
<td>74 % - 78 %</td>
</tr>
<tr>
<td>B-</td>
<td>70 % - 74 %</td>
</tr>
<tr>
<td>C+</td>
<td>66 % - 70 %</td>
</tr>
<tr>
<td>C</td>
<td>62 % - 66 %</td>
</tr>
<tr>
<td>C-</td>
<td>58 % - 62 %</td>
</tr>
<tr>
<td>D</td>
<td>45 % - 58 %</td>
</tr>
<tr>
<td>F</td>
<td>below 45%</td>
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### Course Policies

**Attendance Policy:** Attendance to class is expected. If any class session is missed, it is the responsibility of the student to find out if any assignments or schedule changes were made during the missed class.

### Additional Information
<table>
<thead>
<tr>
<th>Week</th>
<th>Lectures</th>
<th>Topic</th>
</tr>
</thead>
</table>
| 1    | Sun 08/21/2016 Wed 08/24/2016 | **Introduction to Genome and Gene structure 1-3:**  
History of genome projects  
Gene families  
Functional domains  
Transcriptomics  
Proteomics  
Biodatabases |
| 2    | Sun 08/28/2016 Wed 08/31/2016 | **Lectures 4-5:**  
*Genome sequencing techniques and applications 4-5:*  
Next-Generation sequencers  
Sequencing strategies and the shotgun method  
Massive parallel sequencing and its applications  
-  
- |
| 3    | Sun 09/04/2016 Wed 09/07/2016 | **Lectures 6-7:**  
*Genome assembly and annotation 6-7:*  
Gene finding  
Promoter identification  
TFBS analysis |
| 4    | Sun 09/11/2016 Wed 09/14/2016 | **Lectures 8-11:**  
*Basis of population genomics 8-11:*  
Allelic frequency  
Heterozygosity  
Haplotypes  
Linkage disequilibrium  
Genetic drift  
Natural selection |
| 5    | Sun 09/18/2016 Wed 09/21/2016 | **Lectures 12-14:**  
*Comparative genomic 12-14:*  
Comparative and evolutionary genomics  
Gene duplication  
Genome duplication  
Paralogous and orthologous genes  
Neofunctionalization |
| 6    | Sun 09/25/2016 Wed 09/28/2016 | **Lectures 15-18:**  
*Basis of molecular evolution 15-18:*  
Nucleotide substitution  
Evolutionary rate  
Molecular clock  
Phylogenetic tree  
Synonymous and non-synonymous substitution |
| 7    | Sun 10/02/2016 Wed 10/05/2016 | **Lectures 19-21:**  
*Functional Genomics:*  
Transcriptome assembly, annotation and analysis  
Forward Genetics  
Reverse Genetics  
Fine-Structure Genetics  
- |
| 8    | Sun 10/09/2016 Wed 10/12/2016 | **Lectures 22-24:**  
*Ecological genomics:*  
Ecology  
Animal and Plant Physiology  
Phenotypic plasticity  
Molecular Marker  
Model Organisms |
| 9    | Sun 10/16/2016 Wed 10/19/2016 | **Lectures 25-28:**  
*Systems Biology:*  
Networks analysis,  
Protein-protein interactions,  
Protein-DNA interactions, |
|   | Sun 10/23/2016  
|   | Wed 10/26/2016  
|---|----------------|
| 10 | **Exam Week:**  
|    | **Final Exam:**  
|    | Will include all topics covered in course.  
|   | Sun 10/30/2016  
|   | Wed 11/02/2016  
| 11 |               
|   | Sun 11/06/2016  
|   | Wed 11/09/2016  
| 12 |               
|   | Sun 11/13/2016  
|   | Wed 11/16/2016  
| 13 |               
|   | Sun 11/20/2016  
|   | Wed 11/23/2016  
| 14 |               
|   | Sun 11/27/2016  
|   | Wed 11/30/2016  
| 15 |               
|   | Sun 12/04/2016  
|   | Wed 12/07/2016  
| 16 |               
|   | Sun 12/11/2016  
| 17 |               
| 18 |               

**Note**  
The instructor reserves the right to make changes to this syllabus as necessary.