Syllabus for Functional Genomics BIOCH 6733
3 credits
Spring 2011

Instructor: Ramamurthy Mahalingam (Mali)
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Location and Time: 348B NRC; Tue and Thr- 2 PM to 3:15 PM

Slides and reference articles for each class will be made available before the scheduled lecture via the Desire2Learn, OSU’s learning management system.

Course objectives: The principal objective of this course is for students to acquire knowledge about high throughput tools of genome science. This knowledge should enable students to explain the fundamental principles underlying various functional genomics techniques and their applications in various biological systems. Students will be made aware of the issues involved in data interpretation from high throughput techniques. The knowledge and understanding of the various tools of functional genomics should help the students comprehend, analyze, evaluate and intelligently critique research papers in this field. Students will develop a research proposal that incorporates functional genomics/genetics techniques discussed in the class.

Prerequisites: Molecular Biology at the graduate level

1. Jan 11   INTRODUCTION
   Syllabus
2. Jan 13   Genomics
   Overview
   Structural genomics
3. Jan 18   Physical maps
4. Jan 20   PCR based approaches
5. Jan 25   Cytological maps
6. Jan 27   Structural genomics continued
7. Feb 1    SNPs and variation, genotyping
8. Feb 3    SNP genotyping techniques continued
9. Feb 8    Gene expression analysis- Microarrays
10. Feb 10  Microarray applications
11. Feb 15  Microarray applications
12. Feb 17  Analyses of microarray data
13. Feb 22  EXAM 1
14. Feb 24  Gene expression analysis-open end techniques
15. Mar 1   Gene expression analysis-open end techniques
17. Mar 3  Introduction to Proteomics
18. Mar 8  Structural proteomics
19. Mar 10 Structural proteomics
20. Mar 14-18 SPRING BREAK
21. Mar 22 Interaction proteomics
22. Mar 24 Protein modifications in proteomics
23. Mar 29 Metabolomics
24. Mar 31 Functional Genetics - Forward genetics
25 Apr 5  Functional Genetics - Reverse genetics
26. Apr 7  **EXAM 2**
27. Apr 12 Functional genetics continued
28. Apr 14 Integrative genomics /Systems Biology
29. Apr 19 Meta-genomics
30. Apr 21 **PROPOSAL PRESENTATIONS**
31. Apr 26 **PROPOSAL PRESENTATIONS**
32. Apr 28 **PANEL MEETING**

**TEXTS:**

_A single text that satisfactorily covers all the course material could not be identified. Some of the books I am referring are listed below._

2. Plant Genomics and Proteomics. Author: C.A. Cullis. 572.862 C967p
3. Bioinformatics and Functional Genomics. Author: J. Pevsner. 572.86 P514b
4. Microarray analysis. Author: M. Schena. 572.8636 S324m.
7. Practical in situ hybridization. Author: Schwarzacher and Heslop-Harrison. 572.84.S411p

PDFs of relevant journal articles will be posted on D2L. Students are encouraged to read these papers.

**Attendance Policy:**

For this course, 10% of the final grade is determined based on in-class participation. Students are expected to attend all the lectures and actively participate in the paper discussions to obtain all the 10 points. Points will be deducted for irregular attendance, non-participation in class and late submission of assignments. Valid reasons for students to miss class include illness, inclement weather, required participation in university sponsored events, military training. For any other reasons please contact the instructor.

**ASSIGNMENTS**
Assignment 1: Due on Jan 30, 2011 (5 points)

Pick a gene of your interest in your favorite model system.

1. Briefly (one paragraph) explain the biological importance of this gene.
2. Schematically show the location of this gene on its genetic map and also on a physical map
3. Diagram the important parts of this gene (promoter, introns, exons, UTRs)
4. Gene Ontology classification for this gene (use directed acyclic graphs)
   - Biological process
   - Molecular function
   - Cellular component
5. Identify $cis$-acting elements on the promoter of this gene. Based on this information speculate about the regulation of this gene.

Assignment 2: Proposal

This solicitation is to encourage young investigators to utilize the existing genome sequence information of organisms and the functional genomics tool kits to investigate important biological problems. This includes proposals dealing with characterization of genes or gene families important for growth, development or an organism’s interaction with environment. Gene characterization can be addressed at biochemical, genetic and/or molecular biology levels. Proposals seeking to sequence new organisms are not acceptable.

Proposals should be no more than 10 pages. Proposals should be typed using Times or Times new roman, 12 font and should be single-spaced. The 10 pages do not include the literature-cited section. Proposals that do not meet these formatting requirements will be sent back without review.

Proposals are due on April 15. Late proposals will not be considered for review. The proposals will be sent out for peer review immediately. Proposals should have the following sections in the stipulated 10 pages.

Abstract of 250 words or less describing the importance of the proposed study, methods to be used and the long-term benefits of the research to science and society.

Introduction: Summarize the current state of knowledge relevant to the proposed study. This section should highlight what is known and more importantly what is missing in our knowledge about the scientific problem and how your plan will help to fill this void.

Experimental: Describe the scientific plan with emphasis on materials, methods, and experimental design for each of the objectives. You must also include anticipated problems and alternatives for each of the objectives. Your experiments should be logical and must eventually help in filling the gap in the knowledge that you outlined in the introduction.

Timetable: Duration for each of the experiment. A table format as shown in the below is preferred. Table. Projected time frame for the experiments described in the proposal.

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<thead>
<tr>
<th>Objective</th>
<th>Proposed experiments</th>
<th>Duration in months</th>
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<td>2.</td>
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Future directions: Where do you expect to be in the event of a resubmission?
Budget: This proposal is for 2-3 year duration. Investigators should develop a budget sheet for each year based on the format given in the attachment. The total budget should not exceed $300,000. A budget justification for each year and for each item is required.

Budget request: Year

Fill out a form as shown below for each of the years of the proposed project. For supplies indicate the major kits you will be using for your experiments. Allocate approximately $15,000 for each person you would like to have in the proposed project for regular lab supplies –gloves, tips, etc.

<table>
<thead>
<tr>
<th>Personnel Name</th>
<th>Title/Position</th>
<th>Hrs/ wk</th>
<th>Amount Requested (dollars only)</th>
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<tbody>
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<td>PI</td>
<td>-0-</td>
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<td>Subtotals:</td>
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Professional travel: (maximum is $1,000)

Supplies: (itemize by category)

Equipment: (list items over $500)

Subcontracted services: (itemize)

Facilities and Resources: Describe the facilities and available resources in your institution that will assist in carrying out the experiments proposed in your proposal. This should include core facility, computing facility and other colleagues with expertise in the proposed area of research in your institution.

Proposals that do not follow this format will be sent back without review.

Reviews: Critically review the proposal taking into consideration

i. Importance or significance of the project

ii. Feasibility of the techniques for the proposed experiments

iii. Time allocated

iv. Budget requested.

Written reviews of the proposal are due on Apr 20 by 5 PM. Reviews should be submitted electronically to ramamurthy.mahalingam@okstate.edu.

Oral presentations and Panel meeting: Panel members/reviewers will make a 10-minute oral presentation to the panel articulating why the proposal they reviewed should be selected or not selected for funding. In the panel meeting reviewers will rank the proposals based on the written and oral reviews. Two proposals will be selected for funding this year depending on the availability of funds. Final decision on the proposals will be made on April 28 during the panel meeting.
Grading Policies:

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<thead>
<tr>
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<th>% Of total grade</th>
<th>Due date</th>
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<tbody>
<tr>
<td>Participation</td>
<td>10</td>
<td>In class and during paper discussions</td>
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<tr>
<td>Assignment 1</td>
<td>5</td>
<td>Jan 30, in class</td>
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<tr>
<td>Exam 1</td>
<td>15</td>
<td>Feb 20</td>
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<td>Exam 2</td>
<td>15</td>
<td>Mar 27</td>
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<td>Proposal due</td>
<td>40</td>
<td>Apr 15</td>
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<tr>
<td>Written review</td>
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<td>Apr 20, in class</td>
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<td>Oral presentation</td>
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<td>Apr 21-26</td>
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<td>Panel meeting</td>
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<td>April 28</td>
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<td>Final exam</td>
<td>15</td>
<td>May 3 (optional)</td>
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Letter grades for the course will be assigned according to the following scale.

- > 75  A
- 65-74  B
- 55-64  C
- 45-54  D
- <44   F

Academic Integrity
Oklahoma State University is committed to the maintenance of the highest standards of integrity and ethical conduct of its members. This level of ethical behavior and integrity will be maintained in this course. Participating in a behavior that violates academic integrity (e.g., unauthorized collaboration, plagiarism, multiple submissions, cheating on examinations, fabricating information, helping another person cheat, unauthorized advance access to examinations, altering or destroying the work of others, and fraudulently altering academic records) will result in your being sanctioned. Violations may subject you to disciplinary action including the following: receiving a failing grade on an assignment, examination or course, receiving a notation of a violation of academic integrity on your transcript (F!), and being suspended from the University. You have the right to appeal the charge. Contact the Office of Academic Affairs, 101 Whitehurst, 405-744-5627, academicintegrity.okstate.edu. (Source = http://academic integrity.okstate.edu).

Students with disabilities
According to the ADA, each student with a disability is responsible for notifying the University of his/her disability and requesting accommodations. If you think you have a qualified disability and need classroom accommodations, contact the office of Student Disability Services (SU 315). Please advise the instructor of your disability as soon as possible, to ensure timely implementation of appropriate accommodations. Faculty has an obligation to respond when they receive official notice of a disability from SDS but are under no obligation to provide retroactive accommodations. To receive services, you must submit appropriate documentation and complete an intake process during which the existence of a qualified disability is verified and reasonable accommodations are identified. Call 744-7116 v/t for more information.