AGRO, GENE and MEPS-655: Complex Genomes (lab)

(Spring 2006)

1. Course Description:

"Changes that will have effects comparable to those of the Industrial Revolution and the Computer-based Revolution are now beginning. The next great era, a genomics revolution, is in an early phase" (*Science*, Vol. 279 p2019, 1998). This course is to teach students in technologies and methods in genomics research, from the basic to the state-of-the-art ones, and introduce their applications. Emphasis will be given to those widely used for genetic mapping, genome physical mapping, genome analysis, map-based cloning, genome sequencing and gene expression analysis. The technologies and methods to be taught include conventional and megabase-sized DNA preparation, DNA markers (RFLPs, STSs, RAPDs, AFLP, SSR and SNP), Southern blot hybridization, PCR, pulsed-field gel electrophoresis, physical mapping, DNA library construction, large DNA fragment cloning in bacteria, plasmid, phage and large-insert BAC library manipulation, plasmid and BAC DNA isolation and analysis, inverse PCR and BAC end isolation, genome sequencing, and gene chips/microarrays. Prerequisite: GENE 603, equivalent or instructor approval.

2. Course Level:

Graduate students having majors in life sciences, including plants, animals, human, insects, and microbes.

3. Instructor:

Dr. Hongbin Zhang (phone: 862-2244; e-mail: **hbz7049@tamu.edu**)

4. Teaching Materials:

There is no textbook recommended for this course, however, relevant reading materials for the lectures and detailed procedures for the labs will be provided before each lecture and lab.

5. Credits:

This is a 3-credit hour course. To complement and enhance the course, an additional one-credit hour of directed studies (**AGRO-685-Section 606**) has been combined into the course. Therefore, students who register for this course are encouraged to register AGRO-685. The combined course will use 2 hours for lecture and 4 hours for lab, from 1:00 to 7:00 PM on Fridays. Sometimes, other hours are required to complete a lab experiment. This course is limited to 6 graduate students due to limited facilities for the labs.

6. Grading:

Midterm	30%
Lab report 1	10%
Lab report 2	10%
Lab report 3	10%
Final	40%
	100%

7. Schedule:

Although it is encouraged to use your own organism materials in the below labs, which can be collected from plants, animals, insects or microbes, we will use plant materials as the standards.

Lecture (Lec.)/lab		Schedule Date	Hours
Lec.:	Course introduction	01/20	3
Lec.:	DNA marker technology: RFLP, STS, RAPD, AFLP, SSR, and SNP	01/27	1.5
Lab 1:	Conventional genomic DNA isolation		4.5
Lec.:	Genetic mapping I: Map development	02/03	1
Lab 2:	DNA digestion, electrophoresis and Southern blotting		3 + 2
Lec.:	Genetic mapping II: Trait, QTL, and gene expression QTL (eQTL) mapping	02/10	1.5
Lab 3:	Southern hybridization and library screening		2.5 + 2
Lec.:	Gene tagging (BSA)	02/17	1
Lab 4:	PCR: genomic DNA and plasmid DNA		3 + 2
LAB REPORT 1 DUE		02/24	
Lec.:	Megabase recombinant DNA I: Megabase DNA	02/24	1
Lab 5:	Megabase DNA preparation (1)		5
Lec.:	Megabase recombinant DNA II: BACs, TACs, BIBACs, PACs, YACs, and PBCs	03/03	1.5
Lab 6:	Megabase DNA preparation (2)		4.5
	No class to complement the weekend time for Lab 8 (see below)	03/10	
	Spring Break, 03/13 – 03/17/2006		
Lec.:	BAC applications: Plant BIBAC transformation, targeted marker development, and genome analysis	03/24	1
Lab 6:	Pulsed-field gel electrophoresis		3 + 2
Lec.:	Map-based cloning/chromosome walking, gene fishing, and gene golfing	03/31	1
Lab 7:	Library construction and BAC cloning - partial digestion		4 + 1

Schedule (continued)

Lecture (Lec.)/lab	Schedule Date	Hours
MIDTERM EXAM	03/31	
MIDTERM EXAM DUE	04/07	
LAB REPORT 2 DUE	04/07	
Lab 8: Library construction and BAC cloning - Partial, size-selection, ligation and transformation	04/07	6 + 12 (whole weekend)
Lec.: Physical mapping: PFGE, FISH, RH, and clones	04/14	1
Lab 9: Plasmid and BAC DNA isolation and analysis		4 + 1
Lec.: Genome sequencing	04/21	1.5
Lab 10: Library manipulation and high-density clone membrane preparation		1.5 + 3
Lec.: Microarray technology and applications	04/28	2
Lab 12: DEMO: Microarray preparation, hybridization and image analysis		5
Lec.: Others tools for functional Genomics: RNAi, Quantitative real-time RT-PCR, Gene tagging, and TILLING	05/05	2
FINAL EXAM	04/28	
LAB REPORT 3 DUE	05/08	
FINAL EXAM DUE	05/08	

Supplementary Protocols:

Lab 11: IPCR and BAC End Isolation
Lab 13: Preparation of DNA Cloning Vectors