COURSE SYLLABUS

BIOLOGY 4480 MOLECULAR BIOLOGY 4 CREDIT HOURS SPRING 2018 10:00-10:50 MWF, LDB 136 2:00-4:50 W, LDB 136

INSTRUCTOR

DR. ANNE GAILLARD DEPARTMENT OF BIOLOGICAL SCIENCES OFFICES: LDB 105H and LDB 200 OFFICE PHONE: (936) 294-1549 E-MAIL: <u>ARGAILLARD@SHSU.EDU</u> OFFICE HOURS: DROP-IN, OR BY APPOINTMENT

COURSE DESCRIPTION

A HANDS-ON STUDY OF THE STRUCTURE AND FUNCTION OF MOLECULES IMPORTANT FOR THE CENTRAL DOGMA OF MOLECULAR BIOLOGY, INCLUDING DNA AND PROTEIN, WITH EMPHASIS ON ELECTROPHORETIC ANALYSIS AND GENE CLONING.

PREREQUISITES

A GRADE OF "C" OR BETTER IN BIOL 1411, BIOL 1413, BIOL 2440, BIOL 3450, BIOL 3470, AND CHEM 2325/2125; JUNIOR STANDING OR HIGHER.

METHODS OF INSTRUCTION

Lectures consist of selected topics in molecular biology, coordinated with the laboratory portion of the course. The laboratory includes a studentdesigned project on RNA interference in *C. elegans*. The course also emphasizes the development of scientific writing skills through laboratory-based writing assignments. <u>Lecture and laboratory meeting times are used</u> interchangeably throughout the course.

COURSE OBJECTIVES

- LEARN FUNDAMENTAL PRINCIPLES AND THEORIES OF MOLECULAR BIOLOGY
- DEVELOP TECHNICAL SKILLS AND COMPETENCIES NEEDED BY MOLECULAR BIOLOGISTS
- LEARN TO ANALYZE AND CRITICALLY EVALUATE EXPERIMENTAL DATA
- DEVELOP WRITTEN EXPRESSION SKILLS

REQUIRED MATERIALS

TEXTBOOKS:

- ALISON, L. FUNDAMENTAL MOLECULAR BIOLOGY. SECOND EDITION. WILEY. ISBN 1-118-05981-4
- KNISELY, K. A STUDENT HANDBOOK FOR WRITING IN BIOLOGY. FIFTH EDITION. MCGRAW HILL. ISBN 1-319-12181-0

REQUIRED SUPPLIES

- SCIENTIFIC NOTEBOOK (A BOUND LABORATORY NOTEBOOK)
- Permanent marking pens (i.e. $Sharpie^{(B)}$) in black and red

ATTENDANCE POLICY

REGULAR AND PUNCTUAL CLASS ATTENDANCE IS REQUIRED.

IN ACCORDANCE WITH THE UNIVERSITY'S ATTENDANCE POLICY, STUDENTS ARE ALLOWED NO MORE THAN THREE HOURS OF ABSENCE FROM CLASS FOR THE ACADEMIC TERM.

ATTENDANCE AT THE LABORATORY SESSIONS IS <u>MANDATORY</u>. STUDENTS ARE EXCUSED FROM LAB ONLY IN THE CASES OF EXTREME ILLNESS, DANGEROUS WEATHER CONDITIONS, FAMILY EMERGENCY, OR PARTICIPATION IN A UNIVERSITY-SPONSORED EVENT. STUDENTS MAY BE ASKED TO PROVIDE DOCUMENTATION SUPPORTING THE REASON FOR THE ABSENCE. <u>UNEXCUSED ABSENCES FROM LAB WILL RESULT IN A GRADE OF "F" FOR THE COURSE</u>.

METHODS OF EVALUATION

EXAMS (SHORT ANSWER AND ESSAY)	2 AT 100 PTS. EACH	200 pts.
WRITING ASSIGNMENTS	2 AT 50 PTS. EACH	100 pts.
LAB NOTEBOOK PRELIMINARY EVALUA	ATION (UNANNOUNCED)	25 pts.
LAB NOTEBOOK FINAL EVALUATION (UNANNOUNCED)	50 pts.
FINAL PROJECT LAB REPORT		75 pts.
FINAL PROJECT ORAL PRESENTATION		50 pts.
FINAL EXAM		100 pts.
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TOTAL

600 pts.

THERE WILL BE NO EXTRA CREDIT AVAILABLE IN THIS COURSE.

COURSE GRADES WILL BE DETERMINED BY THE PERCENTAGE OF TOTAL POINTS THE STUDENT HAS EARNED, ACCORDING TO THE FOLLOWING GRADING SCALE:

90-100%	А	60-70%	D
80-90%	В	< 60%	F
70-80%	С		

STUDENTS ARE REQUIRED TO TAKE EXAMINATIONS AT THE SCHEDULED TIMES. MAKE-UP EXAMS WILL BE ALLOWED ONLY IN THE CASES OF EXTREME ILLNESS, DANGEROUS WEATHER CONDITIONS, FAMILY EMERGENCY, OR PARTICIPATION IN A UNIVERSITY-SPONSORED EVENT. <u>STUDENTS MUST NOTIFY THE INSTRUCTOR NO LATER THAN 24 HOURS AFTER A MISSED EXAM IN ORDER TO SCHEDULE A MAKE-UP EXAM</u>. STUDENTS MAY BE ASKED TO PROVIDE DOCUMENTATION SUPPORTING THE REASON FOR THE ABSENCE.

WRITING ASSIGNMENTS ARE DUE BY THE TIME REQUIRED (SEE COURSE SCHEDULE) ON THE DUE DATE. <u>NO LATE ASSIGNMENTS WILL BE ACCEPTED</u>. ASSIGNMENTS MUST BE SUBMITTED VIA BLACKBOARD.

ALL SCORES WILL BE POSTED ON BLACKBOARD AS SOON AS THE SCORES ARE AVAILABLE. STUDENTS MAY CHECK THEIR PROGRESS IN THE COURSE AT ANY TIME THROUGH THE BLACKBOARD COURSE WEBSITE.

IF A STUDENT BELIEVES THAT AN EXAM OR ASSIGNMENT HAS BEEN GRADED IN ERROR, OR THAT AN EXAM OR ASSIGNMENT SCORE HAS BEEN POSTED INCORRECTLY, THE STUDENT SHOULD CONTACT THE INSTRUCTOR IMMEDIATELY TO DETERMINE IF AN ERROR HAS BEEN MADE. ALL DECISIONS REGARDING THE CHANGE OF A SCORE WILL BE MADE BY THE INSTRUCTOR AND ARE FINAL; HOWEVER, THE INSTRUCTOR WILL PROVIDE THE STUDENT WITH A RATIONALE FOR THE DECISION.

GENERAL EXPECTATIONS

STUDENTS WILL REFRAIN FROM BEHAVIOR IN THE CLASSROOM THAT INTENTIONALLY OR UNINTENTIONALLY DISRUPTS THE LEARNING PROCESS, AND THUS, IMPEDES THE MISSION OF THE UNIVERSITY. CELL PHONES MUST BE SILENCED BEFORE THE START OF CLASS. <u>TEXT-MESSAGING IS NOT ALLOWED DURING CLASS</u>. TALKING IS NOT ALLOWED WHILE THE INSTRUCTOR IS LECTURING. STUDENTS WHO ARE DISRUPTIVE WILL BE ASKED TO LEAVE CLASS AND MAY BE REPORTED TO THE DEAN OF STUDENTS FOR DISCIPLINARY ACTION IN ACCORDANCE WITH UNIVERSITY POLICY.

DUE TO THE NATURE OF SCIENTIFIC RESEARCH, STUDENTS WILL OCCASIONALLY BE EXPECTED TO COLLECT DATA AND/OR SET UP CULTURES FOR EXPERIMENTS AT TIMES OTHER THAN SCHEDULED LAB MEETING TIMES.

UNIVERSITY POLICIES

FOR UNIVERSITY POLICIES REGARDING ACADEMIC DISHONESTY, STUDENT ABSENCES ON RELIGIOUS HOLY DAYS, STUDENTS WITH DISABILITIES, AND VISITORS IN THE CLASSROOM, PLEASE SEE THE FOLLOWING WEBSITE: <u>HTTP://WWW.SHSU.EDU/SYLLABUS/</u>

COURSE SCHEDULE (TENTATIVE)

WEEK OF	MONDAY AM	WEDNESDAY AM	WEDNESDAY PM	FRIDAY AM
1/15				Lecture: Course
				Introduction;
				Regulation of Gene
				Expression
1/22	Lecture:	Lecture:	Lab: Lab Notebooks	Lecture: RNA
	Introduction to	Introduction to	AND	Editing,
	RNA Interference	RNA Interference	Lab #1: Observing	pp 428-434
	and C. elegans,	and C. elegans,	Wild-Type and	
	pp 434-442	pp 434-442	Mutant C. elegans	
1/29	Lab #2: Culturing	<u>Tuesday</u>	Lab #2: Culturing C.	No Lecture
	C. elegans—Part	Afternoon:	elegans—Part II:	AND
	I: Chunk Wild-	Lab #3: Culturing	Pick L4 Stage C.	Out of Class
	type <i>C. elegans</i>	<mark>E.coli—Part II</mark> :	elegans AND Lab	Assignment:
	AND Lab #3:	<mark>Grow <i>E.coli</i></mark>	#3 : Culturing	CRISPR and Gene
	Culturing E.coli—	<mark>Overnight Cultures</mark>	E.coli—Part III:	Editing
	Part I: Streak	Lecture: Culturing	Seed NGM-lite and	
	<i>E.coli</i> to Obtain	Bacteria and	NGM-	
	Single Colonies	Culturing C.	lite/amp+IPTG	
		elegans	Plates with <i>E. coli</i>	

WEEK OF	MONDAY AM	WEDNESDAY AM	WEDNESDAY PM	FRIDAY AM
2/5	Lab #4: Inducing	Lecture: Plasmid	Lab: CRISPR Gene	Lab #4: Inducing
	RNAi by	DNA Vectors, pp	Editing in <i>E.coli</i>	RNAi by Feeding—
	Feeding—Part I:	195-199; pL4440	AND	Bioinformatics
	Transfer C.	RNAi Feeding	Lab #4: Inducing	
	elegans to OP50-	Vector;	RNAi by Feeding—	<mark>Meet in Computer</mark>
	seeded NGM-lite	RNAi Spreading	Part II: Induce RNAi	<mark>Lab</mark>
	Plates		by Feeding	
	Lecture: Gene			
	Editing in Bacteria			
	using CRISPR			
2/12	Lab #4: Inducing		Lab: Observation of	
	RNAi by	Lecture: RNAi and	Results from	Lecture: Designing
	Feeding—	Cancer, pp 557-	CRISPR Gene	an RNAi
	Observe and	558 and journal	Editing in <i>E.coli</i>	Knockdown
	Score Phenotypes	article	AND	Experiment
	AND		Lab #5: Examining	
	Lab #5: Examining		the RNAi	
	the RNAi		Mechanism—Part	
	Mechanism—Part		II: Induce RNAi by	
	I: Transfer C.		Feeding	
	elegans to OP50-			
	seeded			
	NGM-lite Plates			
2/19	Lab #5: Examining	Lab #5: Examining	Lab #5: Examining	Lecture: DNA
	the RNAi	the RNAi	the RNAi	Microarrays and
	Mechanism—	Mechanism—Part	Mechanism—Part	Protein Arrays, pp
	Observe and	IV : Amplify DNA by	V: Analyze PCR	529-531
	Score Phenotypes	PCR	Products by Gel	
	AND Part III:	AND	Electrophoresis	
	Isolate DNA from	Lecture:	AND	
	C. elegans	Polymerase Chain	Bioinformatics, pp	
		Reaction (PCR), pp	215-216	
		205-206		
			PCR Exercise	
2/26	Lab: Finalizing	Lab: Design RNAi		Lecture: pPR244
	Student-Designed	Primers	<mark>Exam I</mark>	RNAi Feeding
	RNAI Knockdown			Vector
	Experiment	Nieet in Computer		
		Lab		
2/5	PCR Exercise			1
3/5	Lecture: IIn-4 and	Lab: Amplify Wild-	Lab: Amplity DNA	Lecture:
	1111-14 IN C.	(Similar to Lab #5	Dy Gel	Restriction
	elegans,	(Similar to Lab #5:	Electrophoresis	Endonucleases and
	pp 438-439 and	Part IV)		1 A Cioning, pp
	journal article		Part V)	190-192

WEEK OF	MONDAY AM	WEDNESDAY AM	WEDNESDAY PM	FRIDAY AM
3/12	Spring Break	Spring Break	Spring Break	Spring Break
3/19	Lecture: Bacterial Transformation, p 197; pPR244 RNAi Feeding Vector	Lecture: Plasmid DNA Cloning Vectors, pp 196- 199; DNA Ligation, pp 194-195	Lab: Transform pPR244 Plasmid DNA Vector into ccdB Survival <i>E.coli</i>	Lecture: Lac Operon, pp 274- 279
3/26	Lecture: Amplification and Purification of Plasmid DNA, pp 199-201; Plasmid DNA Electrophoresis	Tuesday Afternoon: Lab: Inoculate Overnight Bacterial Culture Lab: Plasmid DNA Miniprep of pPR244 Vector	Lab: BP Clonase Recombination Reaction; Transform BL21(DE3) <i>E.coli</i> with RNAi Feeding Vector	Good Friday Holiday
4/2	Lab: Streak RNAi Feeding Strain Colonies AND Lecture: SNP's, CNV's and Genome- Wide Association Studies, pp 534- 540	Tuesday Afternoon: Lab: Inoculate Overnight RNAi Feeding Strain Culture Lab: Plasmid DNA Miniprep of RNAi Feeding Vector	Exam II	Lab: Plasmid DNA Quantification and Preparation for DNA Sequencing
4/9	Lecture : DNA Sequencing, pp 220-223	Lab: PCR of RNAi Feeding Strains (Colony PCR)	Lab: DNA Electrophoresis of Colony PCR AND Analysis of DNA Sequencing Results AND Experimental Design	Lecture : DNA Typing, pp 511-520
4/16	Lecture : Gene Therapy, pp 566- 578	Tuesday Afternoon: Lab: Inoculate Overnight Cultures of RNAi Feeding Strains Lecture: Final Review of Experimental Design	Lab: Seed NGM-lite and NGM-lite +Kan +IPTG plates; Chunk Worms	Lab : Pick L4 Worms

WEEK OF	MONDAY AM	WEDNESDAY AM	WEDNESDAY PM	FRIDAY AM
4/23	Lab: Observe	Lab: Observe	Lab: Observe	Lab: Observe
	Knockdown	Knockdown	Knockdown	Knockdown
	Phenotypes*	Phenotypes*	Phenotypes*	Phenotypes*
4/30	Lab: Observe	Lecture: Final	Lecture: Final	No Lecture: Final
	Knockdown	Project Oral	Project Oral	Lab Report Out of
	Phenotypes*	Presentations	Presentations	Class Work Day
5/7	Final Exam, 10:30			
	<mark>AM-12:30 PM</mark>			

* THESE LAB SESSIONS ARE OPTIONAL—TO BE USED AS NEEDED BY EACH LAB GROUP

IMPORTANT DUE DATES

- WRITING ASSIGNMENT #1 (CRISPR GENE EDITING) DUE <u>SUNDAY</u>, <u>FEBRUARY 18TH</u>
 <u>@ 11:00 pm</u>
- WRITING ASSIGNMENT #2 (LAB REPORT) DUE <u>SUNDAY, MARCH 11[™]@11:00 pm</u>
- FINAL PROJECT REPORT DUE FRIDAY, MAY 4TH@ 11:00 PM

TIPS FOR SUCCESS

- BE PREPARED FOR LAB
- KEEP <u>DETAILED</u> NOTES IN YOUR LAB NOTEBOOK
- KEEP YOUR LAB NOTEBOOK UP TO DATE
- LABEL EVERYTHING!
- TAKE THOROUGH LECTURE NOTES AND LINK TO DIAGRAMS/FIGURES PRESENTED
- SEEK HELP FROM YOUR INSTRUCTOR EARLY AND OFTEN (IF NEEDED)
- PREPARE FOR EXAMS EARLY
- START YOUR WRITING ASSIGNMENTS EARLY