Course Change Request

New Course Proposal

Date Submitted: 11/23/20 2:01 pm

Viewing: FRSC 325 : Molecular Biology

Last edit: 11/23/20 2:01 pm

Changes proposed by: kcarisi

In Workflow

1. **FRSC Representative**
2. **SC Curriculum Committee**
3. SC Associate Dean
4. Assoc Provost-Undergraduate
5. Registrar-Courses
6. Banner

Approval Path

1. 11/24/20 12:06 am Kimberly Rule (kcarisi): Approved for FRSC Representative

Are you completing this form on someone else's behalf?

Yes

Requestor:

Name	Extension	Email
Mark Wilson	703-993-5071	mwilso47@gmu.edu

Effective Term: Fall 2021

Subject Code: FRSC - Forensic Science

Course Number: 325

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: Molecular Biology

Banner Title: Molecular Biology

Will section titles vary by semester? No

Credits:

3

Schedule Type: Lecture

Hours of Lecture or Seminar per week: 3

Repeatable: May be only taken once for credit, limited to 3 attempts (N3)

Max Allowable Credits: 9

Default Grade Mode: Undergraduate Regular

Recommended Prerequisite(s):

Recommended Corequisite(s):
FRSC 326

Required Prerequisite(s) / Corequisite(s) (Updates only):
BIOL 213, BIOL 214 or STAT 250, and BIOL 311.

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(	Course/Test Code	Min Grade/Score	Academic Level	)	Concurrency?

Registration Restrictions (Updates only):

Registrar's Office Use Only - Registration Restrictions:

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog Description:

This course will cover the structure and function of genes. Students will study nucleic acid structure and the mechanics of replication, repair, transcription, and translation in bacteria, archaea, and eukaryotes. A central goal is understanding gene expression and regulation at all levels, and the structure-function relationships of nucleic acids and proteins. Critical experiments will be examined to learn how our current understandings have developed from experimental results. Techniques in molecular biology will be examined in lecture as necessary to understand experiments and concepts. The course will also cover protein structure and function- especially protein interactions with nucleic acids- and post-translational events that effect the functional output of genes. The course will also pursue a selection of topics which varies from year to year but all impact on interpretation of forensic DNA evidence.

Justification:

Justification (What has been proposed?): The Forensic Science Program is proposing a newly created course FRSC 325 Molecular Biology course which is a 3 credit lecture course to complement a newly created laboratory course FRSC 326 Molecular Biology Laboratory.

Justification (Why is this proposal necessary?): The proposed FRSC 325 Molecular Biology course is critical for students who intend to pursue employment within the field of Forensic Biology. Forensic DNA Analyst positions within the United States must meet the minimum education requirements as outlined by the Federal Bureau of Investigations (FBI) Quality Assurance Standards (QAS) Standard 5.4.1 which indicates that "employees shall have successfully completed coursework covering the following subject areas: biochemistry, genetics, and molecular biology, statistics and/or population genetics". Therefore, this course will satisfy the national educational standard for employment purposes as a fully dedicated Molecular Biology course. Additionally, this course in conjunction with it's recommended co-requisite proposed laboratory (FRSC 326 Molecular Biology Laboratory) will satisfy the educational requirement for the Forensic Science Education Programs Accreditation Commission (FEAPC) standard in the proposed BS Forensic Biology Concentration as a "specialized science course in more advanced coursework in chemistry or biology that provide greater depth or breadth and are consistent with the biology concentration specialization to include laboratory training".

Does this course cover material which crosses into another department?	No

Learning Outcomes:

Students will be able to explain how the structure and chemistry of nucleic acids relate to their functions, their relative stability, and their interactions with proteins.
Students will be able to understand the regulation of protein and nucleic function by structure-function relationships and macromolecular interactions.
Students will know the complete structures of DNA/RNA components, the different forms of nucleic acids and the types of amino acids that mediate backbone and sequence-specific binding.
Students will be able to relate DNA structure to forms of DNA damage.
Student will be able to compare and contrast mechanisms of DNA replication, repair, recombination, transcription, gene regulation, RNA processing and translation in bacteria and eukaryotes.
Students will understand recombinant DNA techniques, PCR, and DNA sequencing.
Students will be able to interpret the results of experiments using standard molecular techniques to explain how classic experiments have led to our current understandings about DNA replication, recombination, transcription, gene regulation, etc.
Students will be able to explain how recent genomics and functional genomics advances are altering our views of molecular biology in, for example, eukaryotic transcription and chromatin function.
Students will be able to apply molecular knowledge to understand and hypothesize about specific complex systems including human disease states with underlying molecular dysfunction.

Attach Syllabus

FRSC 325-525 Molecular Biology Syllabus.pdf

Additional Attachments

Staffing:

Mark Wilson
Kelly Knight
Georgia Williams

Relationship to Existing Programs:

FRSC 325 Molecular Biology will be a required course for the proposed Forensic Biology Concentration within the Bachelor of Science in Forensic Science degree.

Relationship to Existing Courses:

FRSC 325 Molecular Biology will be a fully dedicated Molecular course which will be the lecture component to complement the proposed FRSC 326 Molecular Biology laboratory course. This course will be cross level listed with the proposed graduate level FRSC 525 Molecular Biology course.

Additional Comments:

Reviewer Comments

Key: 17039

FRSC 325/525 Molecular Biology (3 credits)

Instructor: Mark R. Wilson, Ph.D.
Forensic Science Program
George Mason University
Mwilso47@gmu.edu
Exploratory Hall, Rm. 3409

Time	Day	Location	Instructor
TBD			Wilson, M.

Required text:

Molecular Biology, 5th Edition, by Robert Weaver. ©2012 WCB/McGraw-Hill.

Supplemental text:

The Eighth Day of Creation: Makers of the Revolution in Biology by Horace Freeland Judson. Expanded edition, ©1996 Cold Spring Harbor Laboratory Press.

Undergraduate Pre-requisites and Co-requisites (FRSC 325): Students are required to have completed the following with a minimum grade of C in: BIOL 213 (Cell Biology), BIOL 214 (Biostatistics) or STAT 250 (Intro to Statistics), and BIOL 311 (Genetics) or equivalent courses. It is strongly recommended that all students concurrently enroll in the laboratory component of the course: FRSC 326.

Graduate Pre-requisites and Co-requisites (FRSC 525): Students are required to have successfully completed coursework in topics covering Cell Biology, Statistics, and Genetics. It is strongly recommended that all students concurrently enroll in the laboratory component of the course: FRSC 526.

Catalog/Course Description: This course will cover the structure and function of genes. Students will study nucleic acid structure and the mechanics of replication, repair, transcription, and translation in bacteria, archaea and eukaryotes. A central goal is understanding gene expression and regulation at all levels, and the structure-function relationships of nucleic acids and proteins. Critical experiments will be examined to learn how our current understandings have developed from experimental results. Techniques in molecular biology will be examined in lecture as necessary to understand experiments and concepts.

The course will also cover protein structure and function – especially protein interactions with nucleic acids – and post-translational events that effect the functional output of genes. The course will also pursue a selection of topics which varies from year to year but all impact on interpretation of forensic DNA evidence.

Course Note: All topics required to satisfy the FBI Quality Assurance Standards for forensic DNA analysts in molecular biology will be covered.

Goals and Objectives: Upon completion of the course, a student should be able to:

- Explain how the structure and chemistry of nucleic acids relate to their functions, their relative stability, and their interactions with proteins.
- Understand the regulation of protein and nucleic function by structure-function relationships and macromolecular interactions.
- Know the complete structures of DNA/RNA components, the different forms of nucleic acids and the types of amino acids that mediate backbone and sequence-specific binding.
- Relate DNA structure to forms of DNA damage.
- Compare and contrast mechanisms of DNA replication, repair, recombination, transcription, gene regulation, RNA processing and translation in bacteria and eukaryotes.
- Understand recombinant DNA techniques, PCR, and DNA sequencing.
- Interpret the results of experiments using standard molecular techniques to explain how classic experiments have led to our current understandings about DNA replication, recombination, transcription, gene regulation, etc.
- Explain how recent genomics and functional genomics advances are altering our views of molecular biology in, for example, eukaryotic transcription and chromatin function.
- Apply molecular knowledge to understand and hypothesize about specific complex systems including human disease states with underlying molecular dysfunction.

Student Responsibilities:
Attendance at all lectures is strongly recommended. Attendance at participatory activities such as presentations/discussions, and at any guest lectures is always required.

The beginning of class may also include handing in assignments, quizzes, and discussion among the class that will be scored. For any missed lecture, a student should consult a fellow student for notes.

Office hours are for further explanation and discussion, not a repeat of material presented in lecture. Lecture materials – outlines and presentations – will all be available on the class home page. These materials are meant to assist you in preparation for lecture and studying but are not a substitute for lecture attendance.

Missed quizzes or tests may be made up only for excused absences (e.g., sickness). Students should inform the instructor of the reason for their absence as soon as possible – ideally, before the class is missed. Grades on papers, problem sets, or other assignments turned in late may be reduced except for excused absences.

Students will be responsible for reading the required material prior to each class and to be prepared for questions and discussions. Class attendance and participation is essential in order to cover the course material

with a breadth of understanding. Students are further encouraged to formulate questions for the instructor which address the scientific, technological, legal, and practical aspects of the methods discussed.

Homework assignments will be provided by the instructor via Blackboard. Homework questions will cover material from lectures with supplementary information from the text. Students should cite outside sources if used in answering homework questions.

Assigned readings contain more material than will be covered in lecture. Tests will emphasize lecture material as found in the lecture outlines. The quality of your writing on exams is important. Your answer to a question must be clear (and legible) to be correct. Note that modifications to grading percentages may be necessary, depending on alterations in assignments, or unforeseen changes in the class schedule. As much as possible, grading will follow the outline indicated above.

Exams will be a combination of multiple choice, short answer, and essay. Most examination questions will be based on lecture and discussion materials. Students are expected to read the text and come to class with discussion questions from the text and assigned readings. In addition to completing all required course assignments, graduate students will complete a term paper describing a technique discussed in the course in greater detail.

Undergraduate Grading (FRSC 325):

- Attendance and Class Participation (10%)
- Homework (45%)
- Mid-term Exam (20%)
- Final Exam (25%)

100	A+	87-89	B+	77-79	C+	60-69	D
95-99	A	83-86	B	73-76	C	0-59	F
90-94	A-	80-82	B-	70-72	C-		

Graduate Grading (FRSC 525):

- Attendance and Class Participation (5%)
- Homework (45%)
- Mid-term Exam (15%)
- Term Paper (20%)
- Final Exam (15%)

100	A+	87-89	B+	70-79	C
95-99	A	83-86	B	0-59	F
90-94	A-	80-82	B-		

Graduate Grading Expectations (FRSC 525): The expectation for graduate students is that they will do not only more work, but more advanced work. Therefore, graduate student assignments will be evaluated at a more advanced level and graduate students will additionally complete a term paper. The term paper topic should be approved by the instructor prior to the start of the fourth week of class and is due on the last day of the final week of the semester prior to finals week. The paper should be at least twenty (20) pages in length with at least twenty (20) references.

GMU Add/Drop Deadlines – Check the GMU Website
Last day to add classes
Final class drop deadline (no tuition penalty)
Withdrawal Period (100% tuition liability)
Selective Withdrawal Period (100% tuition liability)

GMU Honor Code
The Honor Code states that all students "pledge not to cheat, plagiarize, steal, or lie in matters related to academic work."

All students are expected to maintain the GMU honor code by practicing ethical behavior and submitting original work. To assist with another student's unethical behavior is also a violation of the honor code. Remember, the honor code protects your hard work and the value of your degree from GMU.

Academic Integrity
GMU is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form. Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind) please ask for guidance and clarification.

GMU Code of Student Conduct
The University Code of Student Conduct is George Mason University's statement of community values. The Code fosters a safe, secure, and fair learning environment by establishing expectations for behavior, identifying a process for resolving incidents outside the stated expectations and the results of such processes. No student or student organization shall commit an Act of Misconduct in any location. Students and student organizations found responsible under this CSC of committing Acts of Misconduct are subject to sanctions by the University. The Office of Student Conduct has authority over all non-academic disciplinary matters. Please refer to https://studentconduct.gmu.edu/.

COVID Considerations
All students taking courses with a face-to-face component are required to take Safe Return to Campus Training prior to visiting campus. Training is available in Blackboard (https://mymason.gmu.edu). Students are required to follow the university's public health and safety precautions and procedures outlined on the university Safe Return to Campus webpage (www2.gmu.edu/safe-return-plan). Similarly, all students in face to face and hybrid courses must also complete the Mason COVID Health Check daily, seven days a week. The COVID Health Check system uses a color code system, and students will receive either a Green, Yellow, or Red email response. Only students who receive a "green" notification are permitted to attend courses with a face-to-face component. If you suspect that you are sick or have been directed to self-isolate, please quarantine or get testing. Faculty are allowed to ask you to show them that you have received a Green email and are thereby permitted to be in class.

Diversity and Inclusion
Students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. The intent to present materials and activities that are respectful of diversity:

gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Suggestions are encouraged and appreciated.

Sexual Harassment, Sexual Misconduct, and Interpersonal Violence
Notice of mandatory reporting of sexual or interpersonal misconduct: As a faculty member, I am designated as a "Non-Confidential Employee," and must report all disclosures of sexual assault, sexual harassment, interpersonal violence, stalking, sexual exploitation, complicity, and retaliation to Mason's Title IX Coordinator per University Policy 1202. If you wish to speak with someone confidentially, please contact one of Mason's confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-380-1434 or Counseling and Psychological Services (CAPS) at 703-993-2380. You may also seek assistance or support measures from Mason's Title IX Coordinator by calling 703-993-8730, or emailing titleix@gmu.edu.

GMU E-mail Accounts
Students must activate their GMU email accounts to receive important University information, including messages related to this class.

Office of Disability Services
If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Services (ODS) at 993-2474. All academic accommodations must be arranged through the ODS. http://ods.gmu.edu

Other Useful Campus Resources
WRITING CENTER: A114 Robinson Hall; (703) 993-1200; http://writingcenter.gmu.edu

University policy states that all sound emitting devices shall be turned off during class unless otherwise authorized by the Professor.

Note: The schedule is subject to change, please listen for announcements during class.

Note: Additional reading assignments may be added throughout the semester.

Course Schedule: Topics and Assigned Readings

Week 1 Introduction, course syllabus and mechanics. History of 20th and 21st century molecular biology, genomics. DNA as the genetic material, nucleotides, solving DNA/nucleic acids structure, supercoiling, hybridization. Protein structure review.
Chapters 1 – 5, Supplemental reading.

Week 2 DNA Replication: Basic mechanism and enzymology. Semi-discontinuous replication, replication strategies, bacterial and eukaryotic DNA polymerases, priming, elongation, DNA Pol III subunit functions, termination. DNA damage and repair.
Chapters 20, 21

Week 3 Intro to Retroviral & HIV molecular biology. Retroviral (esp. HIV) replication, reverse transcriptases.

Week 4 Homologous recombination, Holliday junctions, RecA, RecBCD, RuvAB functions. Site-specific and illegitmate recombination. DNA transposons, retrotransposons, retroviral integration.
Chapters 22, 23

Week 5 Gene structure and transcription in bacteria, *E. coli* RNA polymerase, initiation, functions of σ, elongation, termination.
Chapter 6

Week 6 λ phage life cycle in E. coli: lysis vs. lysogeny. DNA-protein interactions in bacteria, helix-turn-helix DNA binding motifs.
Chapters 7, 8

Week 7 Operons, Major shifts in bacterial transcription, *E. coli* σ subunits. Eukaryotic transcription: RNA polymerases, promoters and enhancers. RNA polymerase II structure and subunit functions.
Chapters 8 - 10

Week 8 Mid-term Examination – will cover topics covered in weeks 1-7

Week 9 Eukaryotic transcription: General transcription factors, basal transcription complex formation. Eukaryotic transcriptional activators: specific TF structural classes. Chromatin structure and regulation, histone modifiers, coactivators and corepressors.
Chapters 11 - 13

Week 10 RNA processing: exons and introns, splicing, spliceosomes, snRNPs, self-splicing introns, capping, polyadenylation. RNA editing, trans-splicing, RNA interference, siRNAs, miRNAs, other ncRNAs.
Chapters 14 - 16

Week 11 Translation: initiation, elongation and termination, ribosome structure and function, genetic code
Chapters 17, 18

Week 12 Viral molecular biology, including HIV, RNA viruses, protein functions
Supplemental Readings

Week 13 Special topic(s) I – introduction to forensic applications of molecular biology, emphasizing enzymatic processes employed in forensic DNA laboratories, Next Generation DNA Sequencing and SNP microarrays.

Week 14 Special topic(s) II – forensic applications of molecular biology, including Next Generation DNA Sequencing, interpretation, statistics, validation of new techniques and methods, emerging technologies, and SNP microarrays.

Week 15 Review. Term Paper due for Graduate Students only

Week 16 Final Exam – will cover all topics presented in class with an emphasis on material covered in weeks 9-14