

Advanced Methodology in Exercise Biology

PET5936 | Class # 17724 | 3 Credits | Fall 2024

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Course Info

INSTRUCTOR

Terence E. Ryan, Ph.D.
Office: FLG114
Office Phone: 352-294-1700
Email: ryant@ufl.edu
Preferred Method of Contact: **Email**

OFFICE HOURS

Office hours will be held on Monday's from 10:00a – 12:00p

MEETING TIME/LOCATION

FLG 225 - M periods 6-8

COURSE DESCRIPTION

This is a special topics course that provides lab-based experiential learning using state-of-the-art methodologies in molecular and exercise biology.

PREREQUISITE KNOWLEDGE AND SKILLS

Previous course work in biology, chemistry, and biochemistry is helpful but not necessary.

REQUIRED AND RECOMMENDED MATERIALS

No textbook is required for this course. Specific course materials including published literature of relevance will be shared via CANVAS.

COURSE FORMAT

This course is designed primarily as a hands-on lab based course designed to help students develop basic research skills in molecular biology and the theoretical underpinning of critical methodologies used in exercise biology research. During scheduled meeting times, most class sessions will include performing actual experiments and data collection in a laboratory setting. There will be occasion sessions where discussion of methodologies and data analysis approaches will be covered in a classroom setting.

COURSE LEARNING OBJECTIVES:

Learning objectives for this course are listed below:

Molecular Cloning

- 1) Demonstrate technical proficiency in plasmid design including design of primers, proper control procedures, and validation of end product
- 2) Perform molecular cloning to introduce RNA interference to cultured cells
- 3) Purify and verify plasmids from bacterial cultures
- 4) Demonstrate understanding of the basic principles of molecular cloning in biomedical research
- 5) Identify technologies available for plasmid delivery of cultured cells and organisms, including the benefits and limitations of approaches

RNA Analysis

- 1) Demonstrate technical proficiency in design including design of primers for real-time PCR analyses
- 2) Identify the requisite controls required to ensure your RT-PCR analyses are accurate and appropriate
- 3) Perform RNA isolations from cells and measure quality and quantity of the product
- 4) Demonstrate proficiency in gene expression analyses from cells and tissues

Protein Analysis

- 1) Perform western blotting analysis for protein abundance in biological samples
- 2) Derive proper controls necessary to validate antibodies for use in experiments
- 3) Analyze protein abundance data from western blotting experiments in biological samples

Cell Culture

- 1) Operate laboratory procedures using sterile aseptic technique which are necessary for basic cell culture applications
- 2) Maintenance and quality control testing of cell lines
- 3) Utilization of cell lines for testing basic biological mechanisms

Assessing Muscle Contractile Function

- 1) Attain an understanding of muscle function testing in preclinical models
- 2) Perform analysis of muscle strength, power, fatigue, and work across a variety of muscle contraction types
- 3) Critically evaluate muscle function data and identify experimental errors and their root cause

Immunofluorescence and Histological Analysis of Muscle

- 1) Perform tissue histological analyses
- 2) Cryosection tissues and mount to microscope slides to produce high quality images
- 3) Achieve proficiency on the proper freezing and preparation of tissues for histological analysis, including the use of fixatives

Mitochondrial Function

- 1) Understand the basic principles of bioenergetics
- 2) Perform mitochondrial function analyses including polarographic oxygen consumption and reactive oxygen species production
- 3) Analyze mitochondrial function data from muscle cells and isolated organelles

Basics of Single Cell/Nuclei Sequencing Analysis

- 1) Prepare single nuclei for RNA sequencing analysis
- 2) Organize and produce analyses of NGS results obtained using Python
- 3) Discuss basic concepts of single cell/nuclei RNA analysis and sample preparation that impact experimental outcomes

Course & University Policies

ATTENDANCE

It is expected in graduate level courses that students will always be in attendance. However, because of outside activities expected of graduate students, illness, etc. there are often unexpected absences. It is expected that if you cannot attend class for any reason you will contact the lead instructor regarding your reasons for absence.

PERSONAL CONDUCT & ACADEMIC INTEGRITY

Students are expected to exhibit behaviors that reflect highly upon themselves and our University. Arriving to class on time and prepared for the days topic will be critical to achieving success in the learning objectives. University of Florida students are bound by the Honor Pledge. On all work submitted for credit by a student, the following pledge is required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The [Student Honor Code and Conduct Code \(Regulation 4.040\)](#) specifies a number of behaviors that are in violation of this code, as well as the process for reported allegations and sanctions that may be implemented. All potential violations of the code will be reported to Student Conduct and Conflict Resolution. If a student is found responsible for an Honor Code violation in this course, the instructor will enter a Grade Adjustment sanction which may be up to or including failure of the course.

APPROPRIATE USE OF AI TECHNOLOGY

The UF Honor Code strictly prohibits *cheating*. The use of any materials or resources prepared by another person or Entity (inclusive of generative AI tools) without the other person or Entity's express consent or without proper attribution to the other person or Entity is considered *cheating*. Additionally, the use of any materials or resources, through any medium, which the Faculty / Instructor has not given express permission to use and that may confer an academic benefit to a student, constitutes *cheating*. In some instances within this course, the use of AI tools will facilitate student development of skills and knowledge acquisition within the stated learning objectives. However, in other components, the use of any AI enabled tool in this course substantially compromises the student's ability to achieve the stated learning objectives.

IN-CLASS RECORDING

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or guest lecturer during a class session. Publication without permission of the instructor is prohibited.

To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

EXAM MAKE-UP POLICY

There will be one take home exam for this course at the end of the semester. Students who cannot complete the exam in the assigned timeframe should let the instructor know in advance and an agreed upon make-up will be negotiated between the student and instructor. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found in the online catalog at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.”

ACCOMMODATING STUDENTS WITH DISABILITIES

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center by visiting their Get Started page at <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

COURSE EVALUATIONS

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

Getting Help

HEALTH & WELLNESS

- **U Matter, We Care:** If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit [U Matter, We Care website](#) to refer or report a concern and a team member will reach out to the student in distress.
- **Counseling and Wellness Center:** Visit the [Counseling and Wellness Center website](#) or call 352-392-1575 for information on crisis services as well as non-crisis services.
- **Student Health Care Center:** Call 352-392-1161 for 24/7 information to help you find the care you need, or visit the [Student Health Care Center website](#).
- **University Police Department:** Visit [UF Police Department website](#) or call 352-392-1111 (or 9-1-1 for emergencies).
- **UF Health Shands Emergency Room / Trauma Center:** For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; or visit the [UF Health Emergency Room and Trauma Center website](#).
- **GatorWell Health Promotion Services:** For prevention services focused on optimal wellbeing, including Wellness Coaching for Academic Success, visit the [GatorWell website](#) or call 352-273-4450.

ACADEMIC RESOURCES

- **E-learning technical support:** Contact the [UF Computing Help Desk](#) at 352-392-4357 or via e-mail at helpdesk@ufl.edu.
- **Career Connections Center:** Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services.
- **Library Support:** Various ways to receive assistance with respect to using the libraries or finding resources.
- **Teaching Center:** Broward Hall, 352-392-2010 or to make an appointment 352- 392-6420. General study skills and tutoring.
- **Writing Studio:** 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers.
- **Student Complaints & Grievances:** Students are encouraged to communicate first with the involved person(s), but [here](#) is more information on the appropriate reporting process.

APK ADMINISTRATORS

For suggestions or concerns related to APK courses or programming, please reach out to any of the following:

- Dr. David Vaillancourt (he/him), APK Department Chair, vcourt@ufl.edu
- Dr. Demetra Christou (she/her), APK Department Vice Chair, ddchristou@hhp.ufl.edu
- Dr. Steve Coombes (he/him), APK Graduate Coordinator, rachaelseidler@ufl.edu
- Dr. Joslyn Ahlgren (she/her), APK Undergraduate Coordinator, jahlgren@ufl.edu

Grading

Evaluation Components (number of each)	Points Per Component	Approximate % of Total Grade
Weekly Participation (14)	10 pts each = 140 pts	140/340 = 41.2%
Weekly Data Analysis and Presentation	100 pts	100/340 = 29.4%
Final Lab Exam (1)	100 pts	100/340 = 29.4%

Class Participation – We will be actively performing data collection to learn modern methods in molecular and exercise biology. Weekly participation in data collection are a considerable portion of the course grade. It is expected that students will be able to demonstrate proficiency in the techniques learned and used throughout the course. This proficiency will be directly assessed by the instructor by reviewing data collection, lab notebooks, and analytic technique throughout the course.

Weekly Data Analysis and Presentation – This course is designed for the majority of in-class scheduled time to be used for hands-on laboratory learning. Throughout the semester, students will be asked to perform data analysis, statistical calculations, and graphing of data on a weekly basis. Additional homework will be needed for preparing future experimental calculations outside of the class meeting times.

Final Lab Exam – Final examination in this course will involve two assignments. First, we will have a practical examination that involves written descriptions of experimental procedures and demonstrating proper use of laboratory calculations. The second assignment is related to providing publication quality methods, results, analysis, and graphing of data collected throughout the course as well as copies of each individuals detailed laboratory notebook. It is planned that these written details and data will be compiled into a manuscript for publication in which all students will be co-authors.

GRADING SCALE

This course will utilize the grading scale shown in the table below. More detailed information regarding current UF grading policies can be found here: <https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>.

Letter Grade	Percent of Total Points Associated with Each Letter Grade	GPA Impact of Each Letter Grade
A	90.00-100%	4.0
A-		3.67
B+	87.00-89.99%	3.33
B	80.00-86.99%	3.0
B-		2.67
C+	77.00-79.99%	2.33
C	70.00-76.99%	2.0
C-		1.67
D+	67.00-69.99%	1.33
D	60.00-66.99%	1.0
D-		0.67
E	0-59.99%	0

Weekly Course Schedule

Week	Dates	Topic
1	Aug 26	Introduction to the Class and discussion of exercise biology project
2	Sept 2	NO CLASS – Labor Day Holiday
3	Sept 9	Molecular Cloning
4	Sept 16	Molecular Cloning
5	Sept 23	Muscle Mechanics, Hemodynamics, and Physiology
6	Sept 30	Muscle Mechanics, Hemodynamics, and Physiology
7	Oct 7	No Class - Dr. Ryan out of town
8	Oct 14	Single Cell/Nuclei RNAseq sample prep

9	Oct 21	Single Cell/Nuclei RNAseq sample prep
10	Oct 28	No Class – Spring Break!
11	Nov 4	Mitochondrial Energetics
12	Nov 11	NO CLASS – Veterans Day holiday
13	Nov 18	Single Cell/Nuclei RNAseq Analysis
14	Nov 25	NO CLASS – Thanksgiving holiday
15	Dec 2	Single Cell/Nuclei RNAseq Analysis and Interpretation
16	Dec 9	Take Home Exam Due

SUCCESS AND STUDY TIPS

The instructors encourage you to learn to UNDERSTAND the underlying principles by listening, reviewing the course materials and readings, and asking questions. Take time to break down experimental procedures into small steps that lead towards the end result. Memorizing methodology is not necessary for success, but a thorough and broad understanding of biological experimental design is crucial for success in science.

We hope to make the class exciting and accessible and will appreciate getting feedback as we go.