

Fall 2021

## Research Methods in Medical Physics

GMS 5905; Section 13828; 2 credits

### CLASS MEETING INFO

Tuesdays and Thursdays 12:25PM – 1:15PM  
Rom C2-33  
Course materials on Canvas

### INSTRUCTORS

Stephanie Leon, PhD; leons@radiology.ufl.edu  
BC Schwarz, PhD; schwbc@radiology.ufl.edu  
Office Hours: Arrange via email

### TEACHING ASSISTANTS

Colin Schaeffer, MS; csch0005@radiology.ufl.edu

### DESCRIPTION

(2 credits) This course is intended to prepare students for their MS and PhD research in medical physics by introducing relevant concepts in statistics and experimental design. The course also introduces essential concepts of Monte Carlo simulation and artificial intelligence, which are widely-used techniques in medical physics research.

### PRE-REQUISITES/CO-REQUISITES

None

### OBJECTIVES

1. Students will learn essential concepts of statistics and experimental design, which special relevance to medical physics.
2. Students will learn good practices for presenting data in posters, abstracts, manuscripts, and oral presentation.
3. Students will develop a basic understanding of common techniques used in medical physics research, including Monte Carlo simulation and artificial intelligence.

### MATERIALS AND SUPPLY FEES

None

### REQUIRED TEXTBOOKS & SOFTWARE

“Intuitive Biostatistics” by Harvey Motulsky, 4th ed. Oxford University Press. 2018.  
Microsoft Excel  
SAS JMP (<https://software.ufl.edu/software-listings/sas-jmp.html>)

### RECOMMENDED MATERIALS

None

### COURSE SCHEDULE

Date	Lecture	Topic	Instructor
24-Aug	1	Why do we need statistics? Intuition and probability	Leon
26-Aug	2	Kinds of data, types of variables, descriptive statistics	Leon

31-Aug	3	Asking a good research question; the scientific method	Leon
2-Sep	4	How to read a scientific paper	Leon
7-Sep	5	Probability distributions	Leon
9-Sep	6	Confidence intervals and extrapolating error	Leon
14-Sep	7	P values and their interpretation	Leon
16-Sep	8	Type I/Type II errors and their applications	Leon
21-Sep	9	Statistical tests	Leon
23-Sep	10	Statistical tests continued	Leon
28-Sep	11	Test 1	Leon
30-Sep	12	Correlation and linear regression	Schaeffer
5-Oct	13	Nonlinear and multiple Regression	Schaeffer
7-Oct	14	Multiple comparisons and ANOVA	Leon
12-Oct	15	Statistical traps and how things go wrong	Leon
14-Oct	16	Graphical displays	Leon
19-Oct	17	Literature reviews: general principles	Pomputius
21-Oct	18	Literature reviews: databases ( <b>room C1-121</b> )	Pomputius
26-Oct	19	Communicating results	Leon
28-Oct	20	Ethics in Research, HIPAA	Leon
2-Nov	21	Test 2	Leon
4-Nov	22	Mathematical basis of Monte Carlo Methods	Schwarz
9-Nov	23	Defining the problem (source, geometry, tallies)	Schwarz
11-Nov	--	<i>UF Homecoming – no class</i>	--
16-Nov	24	Understanding results, variance reduction	Schwarz
18-Nov	25	Applications of Monte Carlo methods in medical physics	Schwarz
23-Nov	26	Fundamentals of machine learning	Schaeffer
25-Nov	--	<i>Thanksgiving Holiday – no class</i>	--
30-Nov	27	Types of AI	Schaeffer
2-Dec	28	Neural networks	Schaeffer
7-Dec	29	Applications of AI; bias and ethics	Schaeffer
Finals week		Test 3	

#### ATTENDANCE POLICY; CLASS EXPECTATIONS; MAKE-UP POLICY

Attendance is required during this course. Any class periods that may be missed should be brought to the attention of the instructors as far in advance as possible.

Excused absences must be consistent with university policies in the Graduate Catalog and require appropriate documentation:

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>

#### EVALUATION OF GRADES

A list of assignments in each category is found below the table. Each assignment is weighted equally within its category.

Assignment Category	Percentage of Final Grade
Exams	40%
Homework	40%
Critical analysis project	20%
	<b>Total: 100%</b>

## GRADING POLICY

Percent	Grade
93-100	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-
67-69	D+
63-66	D
60-62	D-
59 & below	E

More information on UF grading policy may be found at: <http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

## STUDENTS REQUIRING ACCOMMODATIONS

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565; <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

## EVALUATIONS

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

## UNIVERSITY HONESTY POLICY

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

## SOFTWARE USE

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

## STUDENT PRIVACY

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

## CAMPUS RESOURCES

Health and Wellness

### **U Matter, We Care**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

### **Counseling and Wellness Center**

352-392-1575; <http://www.counseling.ufl.edu/cwc>

### **Sexual Assault Recovery Services (SARS)**

352-392-1161; Student Health Care Center

### **University Police Department**

352-392-1111 (or 911 for emergencies); <http://www.police.ufl.edu/>

## **Academic Resources**

### **E-learning Technical Support**

352-392-4357 (select option 2); [learning-support@ufl.edu](mailto:learning-support@ufl.edu); <https://lss.at.ufl.edu/help.shtml>

### **Career Resource Center**

Career assistance and counseling.

352-392-1601; Reitz Union; <https://www.crc.ufl.edu/>

### **Library Support**

Various ways to receive assistance with respect to using the libraries or finding resources.

<http://cms.uflib.ufl.edu/ask>

### **Teaching Center**

General study skills and tutoring.

352-392-2010 or 352-392-6420; Broward Hall; <https://teachingcenter.ufl.edu/>

### **Writing Studio**

Help brainstorming, formatting, and writing papers.

352-846-1138; 302 Tigert Hall; <https://writing.ufl.edu/writing-studio/>

### **Student Complaints Campus**

[https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf)

### **On-Line Students Complaints**

<http://www.distance.ufl.edu/student-complaint-process>