

Fall 2022

Research Methods in Medical Physics

GMS 5905; Section MPY3; 2 credits

CLASS MEETING INFO

Tuesdays and Thursdays 10:45 AM – 11:35 AM
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
25-Aug	1	Asking a good research question; the scientific method	Leon
30-Aug	2	Why do we need statistics? Intuition and probability	Leon

1-Sep	3	Kinds of data, types of variables, descriptive statistics	Leon
6-Sep	4	Gaussian,Poisson, lognormal distributions	Leon
8-Sep	5	Confidence intervals and extrapolating error	Leon
13-Sep	6	P values and their interpretation	Leon
15-Sep	7	Type I/Type II errors and their uses: Statistical power, sample size, ROC curves	Leon
20-Sep	8	Statistical tests	Leon
22-Sep	9	Statistical tests	Leon
27-Sep	10	Correlation and linear regression	Leon
29-Sep	11	Nonlinear and multiple Regression	Leon
4-Oct	12	Multiple comparisons; ANOVA	Leon
6-Oct	13	How things go wrong	Leon
11-Oct	14	Mathematical basis of Monte Carlo Methods	Schwarz
13-Oct	15	Defining the problem (source, geometry, tallies)	Schwarz
18-Oct	16	Defining the problem 2 (source, geometry, tallies)	Schwarz
20-Oct	17	Understanding results, variance reduction	Schwarz
25-Oct	18	Applications of Monte Carlo methods in medical physics	Schwarz
27-Oct	19	Fundamentals of machine learning	Schaeffer
1-Nov	20	Types of AI	Schaeffer
3-Nov	21	Neural networks	Schaeffer
8-Nov	22	CNNs, GANs, other specialized networks	Schaeffer
10-Nov	23	Applications and bias/ethics	Schaeffer
15-Nov	24	Publication and research ethics	Schwarz
17-Nov	25	Principles of literature reviews	Leon/Pomputius
22-Nov	26	How to read a paper	Leon
29-Nov	27	Literature review demo	Leon/Pomputius
1-Dec	28	Communicating results: scientific writing	Leon
6-Dec	29	Graphical displays	Leon

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	30%
Homework	50%
Final Project	20%
	Total: 100%

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 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; <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

On-Line Students Complaints

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