

PHA 6935 Foundations in Precision Medicine: Principles of Pharmacogenomics and Genomic Technologies (3 Cr Hr)

Spring 2021

Delivery Format: Online Course

E-Learning Site

Course Coordinators:

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Preferred course communications: discussion board, email or by appointment

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Preferred course communications: discussion board, email or by appointment

Pre-Requisites / Co-Requisites: Students must have basic knowledge of genetics and molecular biology.

PURPOSE and OUTCOME

Course Overview

Genomic technologies are emerging technologies used to manipulate and analyze genomic information. The course content will focus on current developments and emerging trends in genomic testing, clinical and research applications of emerging genomic tests, role of computing and data science, and applications of bioinformatics in genomics. The objective of this course is to help you understand how data from current and emerging genomic tests are generated, analyzed, stored, and potentially used to inform research or clinical decision making strategies.

Relation to Program Outcomes:

This 3-credit course is a required, foundational course for the Precision Medicine Graduate Certificate Program, and covers information pertaining to the following overarching program competency:

- Apply current and emerging developments in genetics, genomics, pharmacogenomics, clinical informatics, value-based medicine, pathology, and ethics to integrate genomic medicine into practice.

Course Objectives

Upon completion of this course, the student will be able to:

1. Discuss the application of methods used to identify genomic variation in the clinical setting.
2. Describe and critically evaluate a range of up-to-date genomic technologies and platforms used to sequence targeted parts of the genome or whole genome.
3. Assess precision medicine laboratory tests and patient-specific data to determine the clinical utility of a pharmacogenomic or genomic test.
4. Practice interrogating major data sources, e.g., of genomic sequence, protein sequences, variation, pathways, (e.g. EVS, dbSNP, ClinVar, etc.) and be able to integrate with clinical data to assess the clinical significance of the genome result.
5. Discuss and critically appraise approaches to the bioinformatics analysis and interpretation of genomic data.
6. Discuss statistical methods for handling and analysing genomic data for application in both diagnostic and research settings.

Instructional Methods

This is an online course that includes viewing of recorded lectures, quizzes, completion of written assignments, and participation in an asynchronous discussion board. Students will independently view recorded lectures and complete assigned readings. Then, the student will complete an online quiz to assess understanding of the material and also complete an assignment. In addition, students are expected to participate in discussion

board. Every week, each student is required to initiate at least one discussion thread, and participate in the discussion of at least two other student's discussion threads. The contents of the discussion must be closely related to the course materials. The grade will be determined by both the quantity and the quality of discussion board postings. Throughout all of these learning activities, the instructors are available to clarify information via discussion board postings.

DESCRIPTION OF COURSE CONTENT

Course Schedule (based on a 16-week schedule)

Week		Topics	Contact Hrs.
Week 1 (01/11-01/17)	Lecture	Course Introduction	
	Lecture	Human Genome and Genomic Variation	.5
	Lecture	Overview of methods for detecting genomic variation	1.0
	Assignment	Asynchronous Discussion Board Participation	1.0
	Quiz	Quiz #1	.5
	Readings	Chapters:* The Human Genome and Genetic Variation (.5 Contact hr.) Laboratory Methods to Detect Genome Variation (1.0 Contact hr.) Journal Articles: Biparental inheritance of mitochondrial DNA in humans. PNAS 115:13039-13044. www.pnas.org/cgi/doi/10.1073/pnas.1810946115 (1.0 Contact hr.) Human Genetics: Insights into human genetic variation and population history from 929 diverse genomes (Links to an external site.) ; Bergström et al., Science 367, 1339 (2020) 20 March 2020. (1.0 Contact hr.)	
Week 2 (01/18-01/24)	Lecture	Genotyping Technology	.5
	Lecture	Next generation sequencing technology	.75
	Assignment	Assignment #1 Due	1.0
	Assignment	Asynchronous Discussion Board Participation	1.0
	Quiz	Quiz 2	.5
	Readings	Journal Articles: Sequencing technologies---the next generation Doi: 10.1038/nrg2626 (.75 contact hr.)	
Week 3 (01/25-01/31)	Lecture	Application of next generation sequencing	1.0
	Lecture	Currently available genetic and genomic tests	.75
	Assignment	Assignment #2 Due	1.0
	Assignment	Asynchronous Discussion Board Participation	1.0
	Quiz	Quiz 3	.5
	Readings	Journal Articles:	

		New approaches to molecular diagnosis JAMA 2013;309(14):1511-1521 (.75 contact hr.)	
Week 4 (02/01-02/07)	Lecture	Understanding and interpreting genetic and genomic test results	.75
	Lecture	Web tools for genetic variation analysis	.75
	Assignment	Assignment #3 Due	1.0
	Assignment	Asynchronous Discussion Board Participation	.5
	Quiz	Quiz 4	.5
	Readings	Journal Articles: Standards and Guidelines for the Interpretation of Sequence Variants: A Joint Consensus Recommendation of the American College of Medical Genetics and Genomics and the Association for Molecular Pathology; doi: 10.1038/gim.2015.30 (.5 contact hr.) Clinical Interpretation of Genomic Variations; doi: 10.4274/tjh.2016.0149 (1 contact hr.)	
Week 5 (02/08-02/14)	Lecture	Overview: Bioinformatics approaches to the analysis of genomic data	.75
	Lecture	Challenges with handling and storing genetic and genomic data	.5
	Assignment	Assignment #4 Due	1.0
	Assignment	Asynchronous Discussion Board Participation	1.0
	Quiz	Quiz 5	.5
	Readings	Journal Articles: Computational solutions to large-scale data management and data analysis. doi: 10.1038/nrg2857 (.75 contact hr.)	
Week 6 (02/15-02/21)	Lecture	Lecture Introduction to Pharmacogenomics Emily Cicali, PharmD, BCPS Lecture	0.5
	Lecture	Principles of Genetic Medicine – part 1 Emily Cicali, PharmD, BCPS	1.0
	Reading	Journal Articles: Goodman & Gilman's: The Pharmacological Basis of Therapeutics – Chapter 7: Pharmacogenetics	1.0
Week 7 (02/22-02/28)	Lecture	Principles of Genetic Medicine – part 2 Emily Cicali, PharmD, BCPS	0.75
	Lecture	Database Tools for Pharmacogenomics Emily Cicali, PharmD, BCPS	1.0
	Assignment	Assignment #5 Due	1.0
	Quiz	Quiz 6 <i>Note: Quizzes are open book/open notes, but must be completed individually.</i>	
Week 8 (03/01-03/07)	Lecture	Pharmacogenetics of Drug Metabolism – Part 1 Emily Cicali, PharmD, BCPS	0.75
	Lecture	Pharmacogenetics of Drug Metabolism – Part 2 Emily Cicali, PharmD, BCPS	1.0
	Assignment	Asynchronous Discussion Board Participation	1.0

	Reading	Journal Articles: Ahmed S, Zhou Z, Zhou J, Chen SQ. Pharmacogenomics of Drug Metabolizing Enzymes and Transporters: Relevance to Precision Medicine. Genomics Proteomics Bioinformatics. 2016 Oct;14(5):298-313. doi: 10.1016/j.gpb.2016.03.008. Epub 2016 Oct 8. Erratum in: Genomics Proteomics Bioinformatics. 2018 Apr 21;: PMID: 27729266; PMCID: PMC5093856	
Week 9 (03/08-03/14)	Lecture	Pharmacogenetics of Drug Metabolism – Part 3 Emily Cicali, PharmD, BCPS	0.5
	Lecture	Pharmacogenetics of CES-mediated Metabolism John S. Markowitz, Pharm.D., BCPP	1.0
	Assignment	Assignment #6 Due	1.0
	Quiz	Quiz 7 Note: Quizzes are open book/open notes, but must be completed individually	
Week 10 (03/15-03/21)	Lecture	Pharmacogenomics of Drug Transport – Part 1 Emily Cicali, PharmD, BCPS	0.75
	Lecture	Pharmacogenomics of Drug Transport – Part 2 Emily Cicali, PharmD, BCPS	0.75

	Assignment	Asynchronous Discussion Board Participation	1.0
	Reading	Marin, J.J.G.; Serrano, M.A.; Monte, M.J.; Sanchez-Martin, A.; Temprano, A.G.; Briz, O.; Romero, M.R. Role of Genetic Variations in the Hepatic Handling of Drugs. Int. J. Mol. Sci. 2020, 21, 2884. Download Link	
Week 11 (03/22-03/28)	Lecture	CPIC Guidelines Emily Cicali, PharmD, BCPS	0.5
	Lecture	Pharmacogenomics of Adverse Drug Reactions Reginald F. Frye, Pharm.D., Ph.D.	0.5
	Assignment	Assignment #7 Due	1.0
	Quiz	Quiz 8 Note: Quizzes are open book/open notes, but must be completed individually	
Week 12 (03/29-04/04)	Lecture	“OMICs” and Personalized Medicine Emily Cicali, PharmD, BCPS	0.75
	Lecture	Pharmacogenomics in Drug Discovery and Development Reginald F. Frye, Pharm.D., Ph.D.	0.5
	Assignment	Asynchronous Discussion Board Participation	1.0
	Reading	Duarte JD. Epigenetics primer: why the clinician should care about epigenetics. Pharmacotherapy. 2013 Dec;33(12):1362-8 http://onlinelibrary.wiley.com/doi/10.1002/phar.1325/epdf (Links to an external site.) Links to an external site. (UF network or VPN required). Oates JT, Lopez D. Pharmacogenetics: An Important Part of Drug Development with A Focus on Its Application. Int J Biomed Investig. 2018;1(2):111. doi: 10.31531/2581-4745.1000111. PMID: 32467882; PMCID: PMC7255432. https://ijbi.edwiserinternational.com/admin/uploads/vq8aPO.pdf	
	Quiz	Quiz 9 Note: Quizzes are open book/open notes, but must be completed individually	
Week 13 (04/05-04/11)	Lecture	Pharmacokinetics 1- introduction	0.5
	Lecture	Pharmacokinetics 2- Absorption	
	Lecture	Pharmacokinetics 3- Distribution	
	Lecture	Pharmacokinetics 4- Metabolism	
	Lecture	Pharmacokinetics 5- Excretion	
Week 14	Lecture	Principles of Clinical Pharmacology Reginald F. Frye, Pharm.D., Ph.D.	0.75

(04/12-04/18)	Lecture	Principles of Clinical Pharmacology Reginald F. Frye, Pharm.D., Ph.D.	0.75
	Assignment	Asynchronous Discussion Board Participation	1.0
	Quiz	Quiz 10 Note: Quizzes are open book/open notes, but must be completed individually.	
Week 15 (04/19-04/25)	Lecture	Food and Herbal Supplement-Based Drug Interactions Reginald F. Frye, Pharm.D., Ph.D	
	Lecture	Enzyme and Transporter Mediated Drug-Drug Interactions Reginald F. Frye, Pharm.D., Ph.D	
	Lecture	Disease-Drug Interactions Reginald F. Frye, Pharm.D., Ph.D	
	Assignment	Asynchronous Discussion Board Participation	1.0

*from: *Precision Medicine: A Guide to Genomics in Clinical Practice* (see below).

Materials and Supply Fees – N/A

Course Materials and Technology Required Textbooks and Software

- McCarthy JJ, Mendelsohn BA. eds. *Precision Medicine: A Guide to Genomics in Clinical Practice* New York, NY: McGraw-Hill; . <http://accessmedicine.mhmedical.com/content.aspx?bookid=1930§ionid=140196838>. Available through the UF Health Science Center Library (VPN access required off campus).
- Journal articles, class notes developed by the instructor, or other required reading/resources will be provided to students through the course website.

For technical support for this class, please contact the UF Help Desk at:

- Learning-support@ufl.edu
- (352) 392-HELP - select option 2
- <https://lss.at.ufl.edu/help.shtml>

ACADEMIC REQUIREMENTS AND GRADING

Grading:

Requirement	Percent Weighting
Quizzes	30%
Discussion Board Participation (Rubric is in Appendix A)	40%
Assignments (Rubric is in Appendix A)	30%
	100%

Grading Policy

Percent	Grade	Grade Points
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 – 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33

63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

Letter grade to grade point conversions are fixed by UF and cannot be changed.

Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	WF	I	NG	S-U
Grade Points	4.0	3.67	3.33	3.0	2.67	2.33	2.0	1.67	1.33	1.0	0.67	0.0	0.0	0.0	0.0	0.0

For greater detail on the meaning of letter grades and university policies related to them, see the Registrar's Grade Policy regulations at:

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>
<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Policies

Policy Related to Quizzes, Assignment submissions, and Discussion Board Participation

Make-Up Policy: Students will be allowed to make-up quizzes, assignments, and discussion board activities for acceptable reasons as described in the Graduate Catalog. See:

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

Any requests for make-ups due to technical issues MUST be accompanied by the ticket number received from LSS when the problem was reported to them. The ticket number will document the time and date of the problem. You MUST e-mail me within 24 hours of the technical difficulty if you wish to request a make-up.

Policy Related to Required Course Participation

This is an online course and therefore, attendance means you are expected to complete the course learning activities so that you meet the established deadlines. Please note all faculty are bound by the UF policy for excused absences. For information regarding the UF Attendance Policy see the Registrar website for additional details: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Students who wish to drop from the course must do so by the drop/add deadline established by the Office of the University Registrar. Students must not assume they will be automatically dropped if they fail to participate in the course learning activities.

Policy Related to Late Assignments (Optional)

Students are expected to submit assignments on time. If a student has an emergency, they must communicate with the instructor in a timely manner (more than one day prior to the deadline, if possible). It is at the instructor's discretion to provide assignment extensions. Assignments are subject to reduced credit based on the submission of late assignments.

STUDENT EXPECTATIONS, ROLES, AND OPPORTUNITIES FOR INPUT

Expectations Regarding Course Behavior: Students are expected to participate in online collaborations such as the asynchronous discussion board. Students should make sure that discussion board comments are posted on the correct discussion thread. Discussion board comments should be clearly written, relevant to the topic of discussion, use appropriate grammar and spelling, and concise.

Communication Guidelines: In all course communications including emails and treaded discussions, students are expected to follow Netiquette Guidelines. These guidelines promote an environment that encourages everyone to ask questions and learn from each other. Discussion board posts that are not

respectful of other opinions discourage a positive learning environment. The following link provides these guidelines:

<http://teach.ufl.edu/wp-content/uploads/2012/08/NetiquetteGuideforOnlineCourses.pdf>

Academic Integrity

Students are expected to act in accordance with the University of Florida policy on academic integrity. As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge:

“We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.”

You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit 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.”

It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For additional information regarding Academic Integrity, please see Student Conduct and Honor Code or the Graduate Student Website for additional details:

<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>

<http://gradschool.ufl.edu/students/introduction.html>

Please remember cheating, lying, misrepresentation, or plagiarism in any form is unacceptable and inexcusable behavior.

Online Faculty Course Evaluation Process

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/>.

SUPPORT SERVICES

Accommodations for Students with Disabilities

If you require classroom accommodation because of a disability, you must register with the Dean of Students Office <http://www.dso.ufl.edu> within the first week of class. The Dean of Students Office will provide documentation of accommodations to you, which you must then give to me as the instructor of the course to receive accommodations. Please make sure you provide this letter to me by the end of the second week of the course. The College is committed to providing reasonable accommodations to assist students in their coursework.

Counseling and Student Health

Students sometimes experience stress from academic expectations and/or personal and interpersonal issues that may interfere with their academic performance. If you find yourself facing issues that have the potential to or are already negatively affecting your coursework, you are encouraged to talk with an instructor and/or seek help through University resources available to you.

- The Counseling and Wellness Center 352-392-1575 offers a variety of support services such as psychological assessment and intervention and assistance for math and test anxiety. Visit their web site for more information: <http://www.counseling.ufl.edu>. On line and in person assistance is available.
- You Matter We Care website: <http://www.umatter.ufl.edu/>. If you are feeling overwhelmed or stressed, you can reach out for help through the You Matter We Care website, which is staffed by Dean of Students and Counseling Center personnel.
- The Student Health Care Center at Shands is a satellite clinic of the main Student Health Care Center located on Fletcher Drive on campus. Student Health at Shands offers a variety of clinical services. The clinic is located on the second floor of the Dental Tower in the Health Science Center. For more information, contact the clinic at 392-0627 or check out the web site at: <https://shcc.ufl.edu/>
- Crisis intervention is always available 24/7 from the Alachua County Crisis Center: (352) 264-6789, <http://www.alachuacounty.us/DEPTS/CSS/CRISISCENTER/Pages/CrisisCenter.aspx>

Do not wait until you reach a crisis to come in and talk with us. We have helped many students through stressful situations impacting their academic performance. You are not alone so do not be afraid to ask for assistance.

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:

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. <https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <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>.

Appendix A. Rubric for Assessing Student Participation in Assignments and Discussion Board Activities.

Grade Determination:

Total Points - 6 points = 100% 5 points = 83% 4 points = 66% 3 points = 50% 2 points = 33% 1 point = 17% 0 points = 0%

Proficiency Level	Deficits Exist (0 Points)	Meets Expectations (1 Point)	Accomplished (2 Points)
Quality of Information	Reflections are descriptive: a reiteration of what was presented by instructor or read. Serious misinterpretations or not interpretation of the information is evident. Reflection is shallow and egocentric.	Information is summarized and not a reiteration of information provided by the instructor or in readings. References are sometimes made to other readings or experiences. Interpretations of information are precise and clear.	Interprets information in accurate and highly insightful ways. Cites readings and prior experiences and explains how these references extend and refine insights.
Organization	Information is disorganized.	Information is logically organized and most paragraphs are well organized. One or two paragraphs could be better organized.	Information is very well organized with well-organized paragraphs and sub-headings where appropriate.
Mechanics	Three or more grammatical, spelling or punctual errors.	1-2 grammatical, spelling or punctual errors.	No grammatical, spelling or punctual errors.