



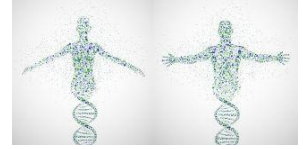
## BIOLOGY 278 01 PRECISION MEDICINE (SPRING 2019)

Lafayette College

117 Kunkel Hall (Lecture)/301 Kunkel Hall (Lab)

Lecture: Tuesdays and Thursdays, 9:30–10:45 am EST

Lab: Wednesdays, 1:10–4:00 pm EST



### INSTRUCTOR INFORMATION

**Instructor:**

Dr. Khadijah A. Mitchell

**Office Location:**

203 Kunkel Hall

**Email:**

[mitcheka@lafayette.edu](mailto:mitcheka@lafayette.edu)

(24 hour e-mail response time, preferred method of contact)

**Phone:**

610-330-5946

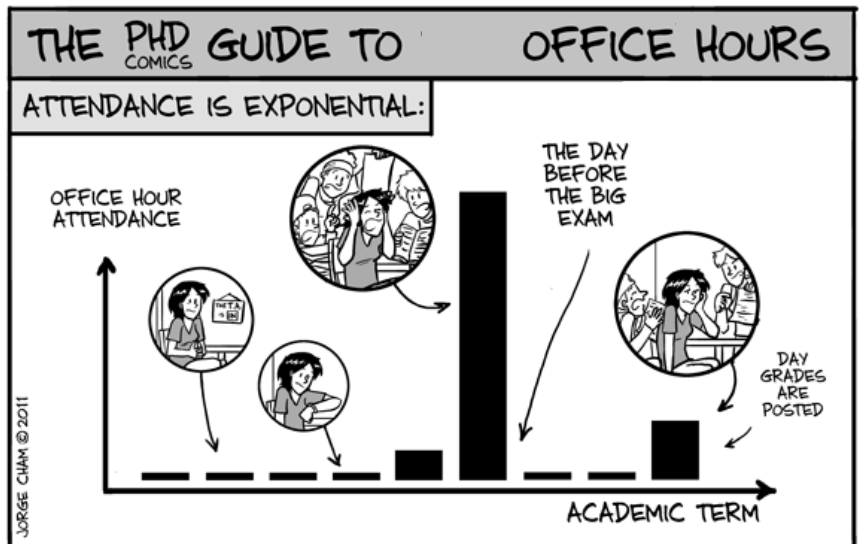
**Office Hours:**

Tuesdays (11 am–12 pm EST), Thursdays (11 am–12 pm EST),

Wednesdays (11 am–12 pm EST), or by appointment

If you ever see my door open, feel free to stop by and say “Hi!”

Office hours are a great resource. Don’t let your office hour attendance be exponential!



Source: Modified from phdcomics.com

**Lab Teaching Assistant:**

Wednesday:

Andrew J. Hudak ([hudaka@lafayette.edu](mailto:hudaka@lafayette.edu))

**Lab Office Hour:**

Mondays (1–2 pm EST)

### COURSE DESCRIPTION

The Human Genome Project (HGP) revolutionized biomedical research through the discovery and integration of Big Data. Post-HGP endeavors, such as ClinVar and the All of Us Research Program, have been designed to rapidly accelerate our research progress into clinical practice. Prevention and treatment strategies that take individual variability into account are not new concepts. However, precision medicine advances the field by leveraging technological progresses and ‘omics’ data to improve prediction, diagnosis, prognosis, and treatment for individual patients.

*“What is needed now is a broad research program to encourage creative approaches to precision medicine, test them rigorously, and ultimately use them to build the evidence base needed to guide clinical practice.”*

Dr. Francis S. Collins, Director of the National Institutes of Health



Source: Drew Sheneman

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## PREREQUISITES

BIOL 101, 102, or permission of the instructor.

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## COURSE AIMS

This combined lecture and lab course will:

- Explore the possibilities, promises, and pitfalls of precision medicine, using real-world examples. It is intended to bridge the gap between basic and translational research and its practical clinical applications, which will help prepare any student interested in research or health professions careers.
- Provide students with knowledge about prolonging health and treating disease that will empower them to make shared informed decisions with their physicians.

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## COURSE LEARNING OBJECTIVES

Upon successful completion of this course, students will be able to:

- Explain how the HGP has advanced technology in biomedical research.
- Understand how the diversity of life evolves over time by processes (leading to) of genetic change, particularly the role of genetic and genomic variation throughout the genome in health and disease.
- Describe recent advances in disease risk prediction, molecular diagnosis and progression of diseases, and targeted therapies for individuals.
- Understand how to translate research findings and technology into healthcare delivery that benefits the general public.
- Discuss the ethical, legal, and social implications of health privacy and policy laws for precision medicine.
- Critically evaluate primary and secondary precision medicine research
- Utilize modern human genomic and transcriptomic methods to analyze health and disease data in dry and wet lab settings.

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## REQUIRED TEXTBOOKS

### Lecture

Genomic and Precision Medicine, 3<sup>rd</sup> Edition, Geoffrey Ginsburg and Huntington Willard, 2016

The Language of Life: DNA and the Revolution in Personalized Medicine, Francis S. Collins, 2010

## Lab

The lab course component will use various published protocols, articles, and reviews, as well as internet-based resources. All required lab documents will be made available on the course Moodle site.

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## INSTRUCTOR EXPECTATIONS

**Attendance:** Please make every effort to attend all classes (both lecture and lab) and on time. Three unexcused absences from lecture and lab without a Dean's Excuse will result in a full letter grade drop.

**Sickness/illness:** If you are not feeling well, please notify me and stay home to take care of yourself. You will be responsible for the lecture and/or lab material missed. Unfortunately, labs cannot be made-up.

**Assigned readings:** All assigned readings should be read before coming to class (both lecture and lab).

**Class participation:** Active listening skills, discussion participation, and respect for our classroom is expected and encouraged at all times. Each student is expected to participate at least once during every class session.

**Weekly quizzes and formative assessments:** Weekly quizzes and formative assessments are due by 5:00 pm EST every Friday on the course Moodle site.

**Lecture and lab documents:** All documents will be available on the course Moodle site for the following week every Friday by 5 pm EST. Everyone is expected to check the site weekly before coming to class.

*Class Success Tip: You should check Moodle (at least) every Friday at 5:00 pm EST.*

**Cell phone policy:** Cell phones must be turned to silent or vibrate during class time.

**Laptop and tablet policy:** Laptops and tablets are permitted during lecture, however, their use should be restricted to class-related materials. Laptops and tablets are permitted in the lab as directed by the course instructor.

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## STUDENT EXPECTATIONS

Expectations work both ways. What are your expectations of me as your instructor?

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## FEDERAL CREDIT HOUR POLICY:

The student work in this course is in full compliance with the federal definition of a four credit hour course. Please see the Registrar's Office web site (<https://registrar.lafayette.edu/wp-content/uploads/sites/193/2013/04/Federal-Credit-Hour-Policy-Web-Statement.doc>) for the full policy and practice statement.

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## ASSIGNMENTS AND GRADING

	Points	Percentage
<b>Lecture</b>		
Weekly quizzes (5-10 pts/week)	75	25
Group presentation proposal	25	8.3
Weekly formative assessments (5-10 pts/week)	75	25
Final group presentation	25	8.3
<b>Lab</b>		
Weekly assignments	75	25
Precision Medicine Lung Cancer CURE Final Project Report	<u>25</u>	<u>8.3</u>
TOTAL	300 points	100%

Extra credit will not be provided and this course will not be curved. Late assignments are not accepted and partial credit will not be given for late assignments.

You will be graded according to the following Lafayette College five-letter plus/minus grading scale.

<http://catalog.lafayette.edu/current/Catalog/Academic-Programs/Attendance-and-Standing/Grades>

A	4.0	95-100%	A-	3.7	90-94.9%			
B+	3.3	86-89.9%	B	3.0	83-85.9%	B-	2.7	80-82.9%
C+	2.3	76-79.9%	C	2.0	73-75.9%	C-	1.7	70-72.9%
D+	1.3	66-69.9%	D	1.0	63-65.9%	D-	0.7	60-62.9%
F	0.0	0-59.9%						

## ACADEMIC INTEGRITY

According to the Statement on the Rights and Responsibilities of Students, Section II. In the classroom: *“Students who cheat on examinations, plagiarize, or are otherwise dishonest, or who help others to do so, are subject to disciplinary action.”*

In addition, the Student Code of Conduct Academic Integrity section states: *“Moreover, certain violations of the community’s standards clearly rise to the level of academic dishonesty and can have serious consequences.”*

Please consult the most recent Lafayette College Student Handbook with any questions regarding the Statement on the Rights and Responsibilities of Students and Student Code of Conduct: <https://conduct.lafayette.edu/student-handbook/>

## ADDITIONAL SUPPORT FOR YOUR LEARNING

**Office Hours:** This is the best way to help me help you. Your questions and ideas are always welcomed.

**Differentially Aabled:** In compliance with Lafayette College policy and federal laws, I am available to discuss appropriate academic accommodations that may be required for students that are differentially abled. Requests for academic accommodations are to be made during the first two weeks of the semester, except for unusual circumstances, so arrangements can be made. Students are encouraged to register with the Academic Resource Hub to verify their eligibility for appropriate accommodations.

**Campus resources:** The Academic Resource Hub are resources made available throughout the semester and are provided free of charge.

## INCLEMENT WEATHER POLICY

I expect to hold lectures and labs despite inclement weather. However, there is sometimes a possibility of classes being canceled. I will alert all students of a canceled class through an announcement on the course Moodle site and via email. If class is ever canceled due to inclement weather, it will be made up at another time.

## DIVERSITY, INCLUSION, AND EQUITY STATEMENT

Our classroom and lab is a community of scholars and a radically inclusive space for all students. One of my goals as your instructor is to make sure that the background and perspective of every student is appreciated and respected, regardless of their ability level, country of origin, ethnicity, gender, genetic information, learning style, nationality, political affiliation, race, religion, sexual orientation, or social class. I am committed to providing an atmosphere for learning that respects diversity and inclusion, as well as promotes equity by removing any educational barriers in our classroom and/or lab.

A large proportion of this course is discussion-based. While we are working together to build our classroom and lab community, I ask each one of you to:

- share your own unique experiences, values, and beliefs.
- be open to the views of others.
- honor the uniqueness of your colleagues.
- appreciate the opportunity that we have to learn from each other.

- value each other’s opinions and communicate in a respectful manner.
- keep class discussions that your colleagues may have of a personal nature confidential.



Source: AMWA

**LECTURE FORMAT AND SCHEDULE (Subject to change)**

Every semester week will include an “Interactive Lecture”, a “Seminal Studies” journal club-style discussion highlighting landmark papers in precision medicine or an information literacy (IL) workshop, and a “Science and Society” discussion surrounding trending topics in the field. Lecture handouts, readings, journal articles, and clinical case studies will be posted on the course Moodle site for the following week every Friday by 5:00 pm EST. Weekly quizzes are to be taken on the course Moodle site and due every Friday by 5:00 pm EST. Weekly formative assessments are to be submitted on the course Moodle site and due every Friday by 5:00 pm EST. Rubrics will be provided for the group presentation proposal, final group presentations, and the Precision Medicine Lung Cancer CURE Final Project Report.

*Class Success Tip: Read the chapters in the order listed for each week.*

Student choice matters. If there is a topic not covered that you’d like to learn more about, let me know and I will incorporate it into our schedule. **\*Co-Instructor Ben Jahre (Skillman Library)**

		<b>Tuesday 9:30-10:45 am</b>	<b>Thursday 9:30-10:00 am</b>	<b>Thursday 10:00-10:45 am</b>	
<b>Week</b>	<b>Dates</b>	<b>Interactive Lecture Topic</b>	<b>Seminal Studies</b>	<b>Science and Society</b>	<b>Due Fri by 5 pm EST (pts)</b>
1	1/28-2/1	Introduction to Precision Medicine, the Human Genome, and Human Genomic Variation Ginsburg & Willard (Ch. 1)	Journal article	ELSI Case Study	Quiz 1 (5) FA 1 (5)
2	2/4-2/8	Genome: Whole Genome Sequencing (WGS) Ginsburg & Willard (Ch. 3)	Journal article	Collins (Intro/Ch. 1)	Quiz 2 (5) FA 2 (5)
3	2/11-2/15	Genome: Whole Exome Sequencing (WES) Ginsburg & Willard (Ch. 3 pg. 52, Ch. 17)	Journal article	Collins (Ch. 2)	Quiz 3 (5) FA 3 (5)
4	2/18-2/22	Pharmacogenome Ginsburg & Willard (Ch. 16)	Journal article	Collins (Ch. 3)	Quiz 4 (5) FA 4 (5)
5	2/25-3/1	Epigenome: DNA Methylation Ginsburg & Willard (Ch. 2)	<b>Information Literacy Workshop*</b> <b>-Reading and writing a research abstract</b> <b>-Citation management</b>		Quiz 5 (5) FA 5 (5)
6	3/4-3/8	Epigenome: Histone Modifications Ginsburg & Willard (Ch. 2)	Journal article	Collins (Ch. 4)	Quiz 6 (5) FA 6 (5)

7	3/11-3/15	Epigenome: Chromatin Remodeling Factors (Assigned Readings)	Journal article	Collins (Ch. 5)	Quiz 7 (5) FA 7 (5) Prop (25)
8	3/18-3/22	<b>Spring Break</b>			
9	3/25-3/29	Transcriptome Ginsburg & Willard (Ch. 17 pg. 254-255, Assigned Readings)	Journal article	Collins (Ch. 6)	Quiz 9 (5) FA 9 (5)
10	4/1-4/5	Proteome Ginsburg & Willard (Ch. 5)	Journal article	Collins (Ch. 7)	Quiz 10 (5) FA 10 (5)
11	4/8-4/12	Metabolome (Assigned Readings)	Journal article	Collins (Ch. 8)	Quiz 11 (5) FA 11 (5)
12	4/15-4/19	Microbiome Ginsburg & Willard (Ch. 4)	Journal article	Collins (Ch. 9)	Quiz 12 (5) FA 12 (5)
13	4/22-4/26	Developing Evidence for PM & Designing PM Clinical Trials Ginsburg & Willard (Ch. 12, Ch. 11)	<b>NMRI 2019 Research Conference No Class</b>		Quiz 13 (5) FA 13 (5)
14	4/29-5/3	Implementation Science & Costs of PM Ginsburg & Willard (Ch. 15, Ch. 22)	Journal article	Collins (Ch. 10)	Quiz 14 (5) FA 14 (5)
15	5/6-5/10	Educating the Public and Providers (Ch. 20)	Journal article	ELSI Case Study	Quiz 15 (10) FA 15 (10)
16/17	5/13-5/17	Final Exam/Grand Rounds-style group presentations (25)			

### LAB FORMAT AND SCHEDULE (Subject to change)

Each lab session will begin with a ~15 minute short lecture, followed by the lab activity. Please adhere to all wet lab safety guidelines. Working in an unsafe manner will result in dismissal from wet labs. Protective equipment (PPE) and appropriate clothing must be worn at all times during wet labs. No sandals or open-toed shoes are allowed. Contact lenses are prohibited. Open food and drinks should not be brought into wet labs. Weekly assignments are to be submitted on the course Moodle site by 12:00 pm EST of your next scheduled lab (Wednesdays).

<b>Wednesday 1:10-4:00 pm</b>		
<b>Week</b>	<b>Dates</b>	<b>Topic (weekly assignment pts)</b>
1	1/28-2/1	DRY LAB: World Tour of the Human Genome I: Exploring the Human Genome and ENCODE with the UCSC Genome Browser Goal: Identify genomic regulatory features of tobacco and menthol metabolizing genes (5)
2	2/4-2/8	DRY LAB: World Tour of the Human Genome II: Exploring Human Genomic Variation and 1000 Genomes Project (1KG) WGS Data with the Ensembl Genome Browser Goal: Identify population-specific SNPs in tobacco and menthol metabolizing genes (5)
3	2/11-2/15	DRY LAB: World Tour of the Human Genome III: Exploring WES Data with the Exome Aggregation Consortium (ExAC) Browser and NHLBI Exome Sequencing Project Exome Variant Server (EVS) Goal: Validate population-specific SNPs in tobacco and menthol metabolizing genes (5)
4	2/18-2/22	DRY LAB: Mining the The Cancer Genome Atlas (TCGA) with cBioPortal, Broad GDAC Firehose, and Firebrowse Goals: Assess tobacco and menthol metabolizing gene mutations, copy number variations, and gene expression in lung cancer patients (5)
5	2/25-3/1	DRY LAB: CURE Clinic I - Data Summary and Hypothesis Refinement (5)
6	3/4-3/8	DRY LAB: qRT-PCR primer design (5) WET LAB (control reaction): RNA isolation, DNase-treatment, and RNA quantification (5)

7	3/11-3/15	WET LAB (control reaction): cDNA synthesis (5)
8	3/18-3/22	<b>Spring Break</b>
9	3/25-3/29	WET LAB (control reaction): quantitative Reverse Transcription PCR (qRT-PCR) (5)
10	4/1-4/5	WET LAB (control reaction): qRT-PCR analysis (5)
11	4/8-4/12	WET LAB (experimental + control reaction): RNA isolation, DNase-treatment, and RNA quantification (5)
12	4/15-4/19	WET LAB (experimental + control reaction): cDNA synthesis (5)
13	4/22-4/26	WET LAB (experimental + control reaction): quantitative Reverse Transcription PCR (qRT-PCR) (5)
14	4/29-5/3	WET LAB (experimental + control reaction): qRT-PCR analysis (5)
15	5/6-5/10	DRY LAB: CURE Clinic II - Data Summary (5)
16/17	5/13-5/17	Precision Medicine Lung Cancer CURE Final Project Report Due (25)