

Term Information

Effective Term Spring 2022

General Information

Course Bulletin Listing/Subject Area Pharmacy
Fiscal Unit/Academic Org Pharmacy - D1800
College/Academic Group Pharmacy
Level/Career Undergraduate
Course Number/Catalog 2420
Course Title Drug Culture and Genetics: Revelations from Otzi to Ozzy
Transcript Abbreviation Drg Cltr & Genetics
Course Description Humans have been experimenting with chemicals for therapeutic use and taking mind-altering substances for thousands of years. In this course we investigate the genetic evidence of past human drug use, the genetic revelations and techniques involved in therapeutic drug use and addiction behavior today, and the role of genetics in the future of therapeutics.
Semester Credit Hours/Units Fixed: 3

Offering Information

Length Of Course 14 Week
Flexibly Scheduled Course Never
Does any section of this course have a distance education component? No
Grading Basis Letter Grade
Repeatable No
Course Components Lecture
Grade Roster Component Lecture
Credit Available by Exam No
Admission Condition Course No
Off Campus Never
Campus of Offering Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites
Exclusions
Electronically Enforced No

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code 51.2001
Subsidy Level Baccalaureate Course
Intended Rank Freshman, Sophomore, Junior, Senior

Requirement/Elective Designation

General Education course:
Culture and Ideas

Course Details

Course goals or learning objectives/outcomes

- Students evaluate significant cultural phenomena and ideas in order to develop capacities for aesthetic and historical response and judgement; and interpretation and evaluation.
- Students analyze and interpret major forms of human thought, culture, and expression.
- Students evaluate how ideas influence the character of human beliefs, the perception of reality, and the norms which guide human behavior.
- Demonstrate a historical knowledge of drugs and a general understanding of how drugs work to understand the impact of drugs on humans and society
- Describe the hallmarks of drug addiction and how it manifests to understand the effect of addiction on human health and behavior
- Explain basic genetic concepts and nomenclature to relate how DNA determines our traits, how we function, and how we act
- Describe the role that genetic factors play in guiding behavior, maintaining health, and preventing disease
- Understand the contribution of genetic variability to inter-individual variations in therapeutic and addictive drug responses
- Examine gene-environment interactions and analyze how this impacts drug culture and human behavior especially relative to addiction
- Understand how genetic variations that contribute to drug metabolism and drug targets can be studied to implement personalized therapeutics, which could radically change drug culture

Content Topic List

- Drug use in ancient times - tzi the Iceman
- Types of drugs (therapeutic, legal, illegal)
- How drugs work, are developed, and regulated
- Drug culture in America
- Historical use of addicting drugs
- Drugs, the Brain, and Behavior: The Science of Addiction
- Introduction to Genetics
- Genetics, Drugs and Behavior
- Genes and Health
- Pharmacogenomics

Sought Concurrence

No

Attachments

- PHR 2420 Drugs and Genetics GE Syllabus_C&I.pdf: Syllabus
(Syllabus. Owner: Bowman, Michael Robert)
- PHR 2420 Course RoadMap.pdf: Course Roadmap
(Other Supporting Documentation. Owner: Bowman, Michael Robert)
- PHR 2420 GE Proposal SPRING 2022.pdf: GE Proposal
(Other Supporting Documentation. Owner: Bowman, Michael Robert)

Comments

- approved by UGRD Studies Committee 3/19/21 *(by Bowman, Michael Robert on 03/23/2021 10:24 AM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Bowman, Michael Robert	03/23/2021 10:25 AM	Submitted for Approval
Approved	Mercerhill, Jessica Leigh	03/23/2021 04:29 PM	Unit Approval
Approved	Kelley, Katherine Ann	03/23/2021 05:08 PM	College Approval
Pending Approval	Jenkins, Mary Ellen Bigler Hanlin, Deborah Kay Oldroyd, Shelby Quinn Hilty, Michael Vankeerbergen, Bernadette Chantal	03/23/2021 05:08 PM	ASCCAO Approval



PHR 2420

Drug Culture and Genetics: Revelations from Ötzi to Øzzy

SP 2022



COURSE DESCRIPTION

Humans have been experimenting with chemicals for therapeutic use and taking mind-altering substances for thousands of years. In this course we investigate the genetic evidence of past human drug use, the genetic revelations and techniques involved in therapeutic drug use and addiction behavior today, and the role of genetics in the future of therapeutics. Examining the genetic and forensic data from the nearly 5000-year-old Ötzi the Iceman as well as the sequenced genome of Ozzy the Madman, we will gain insight into what our genome can tell us about our need and propensity for drugs. Furthermore, we will explore the interplay between drugs and genetics to gain insight into the leveraging of genetics to enhance drug development as well as to realize the potential of personalized medicine in providing customized health care. Overall, students will identify and evaluate the ideas, beliefs, and attitudes that influence healthcare and addiction treatment given our significant progress in understanding and manipulating the human genome.

INSTRUCTOR

Leslie C Newman, PhD

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COURSE INFORMATION

General Education

- Culture and Ideas, 3 credit hours

Goal - Students evaluate significant cultural phenomena and ideas in order to develop capacities for aesthetic and historical response and judgement; and interpretation and evaluation.

○ **Learning Outcomes**

- Students analyze and interpret major forms of human thought, culture, and expression.
- Students evaluate how ideas influence the character of human beliefs, the perception of reality, and the norms which guide human behavior.

Course-Specific Expected Learning Outcomes

- Demonstrate a historical knowledge of drugs and a general understanding of how drugs work to understand the impact of drugs on humans and society
- Describe the hallmarks of drug addiction and how it manifests to understand the effect of addiction on human health and behavior
- Explain basic genetic concepts and nomenclature to relate how DNA determines our traits, how we function, and how we act
- Describe the role that genetic factors play in guiding behavior, maintaining health, and preventing disease
- Understand the contribution of genetic variability to inter-individual variations in therapeutic and addictive drug responses
- Examine gene-environment interactions and analyze how this impacts drug culture and human behavior especially relative to addiction
- Understand how genetic variations that contribute to drug metabolism and drug targets can be studied to implement personalized therapeutics, which could radically change drug culture

COURSE DELIVERY

Teaching Methods

Class time will involve short lectures as well as active learning strategies focused on encouraging students to apply what they have learned through selected reading or individual study outside of class to discussions and real-world applications in the classroom. Depending on the individual topic being covered and on the learning outcomes, Team-Based Learning, Problem-Based Learning and Breakout Groups will form the framework of in class activities.

Team-based learning is a structured process which emphasizes student preparation out of class and application of knowledge in class. This format enhances student engagement as well as the quality of student learning.

Problem-based learning involves working in groups to solve an open-ended problem such as in a case scenario. This problem drives motivation and learning.

Breakout Groups involve a less structured method of group work and discussions and may involve addressing current event topics and/or providing peer reviews for final papers.

Course technology

This course requires use of Carmen and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with Dr. Newman. For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at ocio.osu.edu/help/hours, and support for urgent issues is available 24/7.

- Self-Service and Chat support: ocio.osu.edu/help
- Phone: **614-688-4357(HELP)**
- Email: servicedesk@osu.edu
- TDD: **614-688-8743**

Course materials

There is no textbook for this course. All course materials will be posted on Carmen at least one week prior to their relevant class period.

ASSESSMENTS

Exams

There will be 2 exams and a final exam. The final exam will be semi-comprehensive.

Quizzes

On-line and in-person quizzes will be given on Carmen. The top 5 quizzes will be counted in the final grade. All other quiz grades will be dropped.

Activities

Group activities will consist of methods to enhance learning of the material as well as to create effective, thoughtful discussions.

Final Paper

Consists of a 4 page (double-spaced) paper on a research topic of your choice related to drug culture and genetics. In class activities related to the final paper will involve brainstorming ideas and outlines as well as providing peer reviews of rough drafts.

Module Reflections

Consists of a “blog-like” entry at the end of each module to provide an opportunity to assess, reflect, and build upon learning experiences.

Point Distribution

In-class examinations (3 @ 100 pts each)	48%
Final paper (100 pts)	16%
Quizzes (top 5 @ 15 pts each)	12%
Discussions/Activities (top 5 @ 15 pts each)	12%
Module reflections (5 @ 15 pts each)	12%
Total Points - 625	

Grading Scale

A	A-	B+	B	B-	C+	C	C-	D+	D	E
100 - 93%	92.9 - 90%	89.9- 87%	86.9- 83%	82.9- 80%	79.9- 77%	76.9- 73%	72.9- 70%	69.9- 67%	66.9- 60%	59.9- 0%

ASSESSMENT POLICIES

All students must take exams/quizzes at the time and date specified. Failure to take the exam/quiz at the time and date specified will result in a zero for that exam/quiz. Any makeup exam MUST include a *bona fide* reason and written documentation. There will be no make-up quizzes since the lowest quiz scores will be dropped.

Exams will be completed using ExamSoft software on your laptop or iPad. Please be sure that your device is FULLY charged for all testing periods. The exam will be made available for download the evening before the test date. You MUST download the exam with ExamSoft software BEFORE test time (i.e. the evening before) and assure the download went through (exam will show available on software). The exam will be encrypted on your device so that it cannot be accessed. At the beginning of the exam, you will be given the password which will unlock the exam and lock down all browsers and access to any files on your device except for the exam. Any attempt to access any function on the device other than the ExamSoft software during testing will abort the test progress. The software will shut down after the assigned testing time period is reached. The ExamSoft program has a built in timer that will alert you when 5 minutes are remaining. No other electronic devices are permitted during the examination period, including access to cell phones. We will practice with a mock test (~10 questions), for which you will receive a quiz grade, before the first exam to assure that all procedures are well understood. In the event of an uncontrollable situation during the exam we will have paper copies of the exam. These contingencies are designed for uncontrollable events and not as backups for a failure for appropriate preparation and planning. At the end of the exam, your exam should be automatically uploaded and I will need to see the green confirmation screen in order for you to exit the room. Once uploaded, the exam will be deleted from your device by the program.

ATTENDANCE AND PARTICIPATION

It is the responsibility of a student to participate in all directives designed to promote learning. Poor attendance can adversely affect understanding of and ability to complete assignments. Students are expected to come prepared and fully participate during class activities. Activities, discussions and quizzes support the information presented and facilitate an understanding of the topics such that the student learns to apply and integrate the material. In every instance, the student remains responsible for all materials covered in the course.

ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Disability statement

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: **slds@osu.edu**; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

ACADEMIC INTEGRITY AND COLLABORATION

While activities will consist of group work, **ALL** writing assignments (including discussion posts), exams and quizzes **MUST** be your own work. It is the responsibility of the Committee on Academic Misconduct (COAM) to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct (<http://studentlife.osu.edu/csc/>)

Specific assignment considerations

Quizzes and exams (both online and in class): Students must complete exams and quizzes on their own, without any external help or communication from others.

Written assignments: Written assignments, including discussion posts, should consist of a student's own original work. Specific [MLA/APA/Chicago etc.] styles should be followed to cite the ideas and words (paraphrase or quote) of any research sources. Students are encouraged to ask a trusted person/peer to proofread assignments before turning them in but no one else should revise or rewrite the work.

Reusing past work: In general, students are prohibited in university courses from turning in work from a previous class, even if it is modified. If you want to build on past research or revisit a topic you have explored in previous courses, please discuss the situation with Dr. Newman.

Collaboration: This course includes many opportunities for formal collaboration with peers. While study groups and peer-review of major written projects is encouraged, remember that comparing answers on a quiz or assignment is not permitted. If you are unsure about a particular situation, please ask ahead of time.

WRITING HELP

Since this course will feature writing assignments worth a large portion of your semester grade, you may find it helpful to utilize Ohio State's [Writing Center](#). The Writing Center offers free help with writing at any stage of the writing process for any member of the university community. During sessions, consultants can work with you on anything from research papers to lab reports, from dissertations to résumés, from proposals to application materials.

Appointments are available in-person at 4120 Smith Lab, as well as for online sessions. You may schedule an in-person or online appointment by visiting WOnline or by calling 614-688-4291. You do not have to bring in a piece of writing in order to schedule a writing center appointment – consultants are perfectly happy to just talk through your ideas with you. Check the [Individual Writing Support](#) and [Group Writing Support](#) pages for the types of consultations offered. The Writing Center also maintains a [Writing Resources](#) page with writing handouts and links to online resources.


MENTAL HEALTH

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. No matter where you are engaged in distance learning, The Ohio State University's Student Life Counseling and Consultation Service (CCS) is here to support you. If you find yourself feeling isolated, anxious or overwhelmed, on-demand resources are available at <https://go.osu.edu/ccsondemand>. You can reach an on-call counselor when CCS is closed at 614-292-5766, and 24-hour emergency help is also available through the 24/7 National Prevention Hotline at 1-800-273-TALK or at <https://suicidepreventionlifeline.org>. The Ohio State Wellness app is also a great resource available at <https://go.osu.edu/wellnessapp>.

For non-crisis support, please reach out to the College of Pharmacy Office of Student Services at 614-292-5001 OR connect with Dr. Shawn Levstek, College of Pharmacy Embedded Counselor. Any College of Pharmacy student may contact Dr. Levstek directly via email (levstek.4@osu.edu), and he will offer you an initial counseling session via Zoom to initiate services. During this meeting, he will address your current concerns and mental health needs in addition to collecting background information and assessing your history of concerns. He will also discuss future treatment options with you and can connect you with other resources as well where appropriate. If any students have questions or concerns, please email Dr. Levstek directly.

Tentative Schedule

Module	Topics	Reading/Activity
Module 1 (Weeks 1-3): Pharmacology	<ul style="list-style-type: none"> • Course expectations • Introduction and Overview • What is a drug? • History of drugs <ul style="list-style-type: none"> • Drug use in ancient times - Ötzi the Iceman 	<ul style="list-style-type: none"> • Read: <i>Introduction to Pharmacology</i> • Read: <i>Lessons in the Iceman's Prehistoric Medicine Kit</i> • Discussion Post #1
	<ul style="list-style-type: none"> • Types of drugs (therapeutic, legal, illegal) • How do drugs work? 	<ul style="list-style-type: none"> • Read: <i>Introduction to Pharmacology</i> (cont.) • Quiz #1
	<ul style="list-style-type: none"> • How are drugs developed? • How are drugs regulated? • Legalization of drugs • Drug culture in America 	<ul style="list-style-type: none"> • Read: <i>The legal regulation of drugs and role of government: Perspectives from people who use drugs</i> • Discussion Post #2
Module 2 (Weeks 4-6): Drug Addiction	<ul style="list-style-type: none"> • What is an addicting drug? • Categories of addicting drugs • Historical use of addicting drugs • Ozzy Osbourne's drug use 	<ul style="list-style-type: none"> • Reference: NIDA Drug Chart • Read: <i>Understanding Substance Use and Addiction Through the Lyrics of Black Sabbath: A Content Analysis</i> • Quiz #2
	<ul style="list-style-type: none"> • Drugs, the Brain, and Behavior: The Science of Addiction 	<ul style="list-style-type: none"> • Read: <i>Drug addiction: the neurobiology of behavior gone awry</i> • Discussion Post #3
	<ul style="list-style-type: none"> • Drugs, the Brain, and Behavior: The Science of Addiction (cont) • Review for Exam 1 	<ul style="list-style-type: none"> • Read: <i>Neurobiologic Advances from the Brain Disease Model of Addiction</i> • Discussion Post #4
Module 3 (Weeks 7-9): Genetics	Exam 1	<ul style="list-style-type: none"> • Read: <i>Genes and chromosomes 1: basic principles of genetics</i>

	<ul style="list-style-type: none"> • Introduction to Genetics: The Basics <ul style="list-style-type: none"> • Chromosomes, genes, and alleles, oh my! 	<ul style="list-style-type: none"> • Read: <i>Colonizing Mars is hard - and genetics is one reason why</i> • Read: <i>Scientists have found a time machine - it's your DNA</i> • Quiz #3
	<ul style="list-style-type: none"> • Intro to Genetics (cont) <ul style="list-style-type: none"> • Genetic variation • The genome 	<ul style="list-style-type: none"> • Read: <i>Pokemon - Who was the human Mew?</i> • Quiz #4
Module 4 (Weeks 10-12): Applications of Pharmacology and Genetics: The Past and Present	 Spring Break	
	<ul style="list-style-type: none"> • Genetics and History • Ancient DNA and early medicine <ul style="list-style-type: none"> • Ötzi the Iceman • Genetics and Disease • Genetic estimation of drug mechanisms and effects 	<ul style="list-style-type: none"> • Read: <i>Testimony from the Iceman</i> • Read: <i>Identification of the remains of King Richard III: 500 year old missing person's case solved</i> • Read: <i>Queen Victoria's curse: New DNA evidence solves medical and murder mysteries / Hemophilia: The Royal Disease</i> • Discussion Post #5 • Quiz #5
	<ul style="list-style-type: none"> • Genetics, Drugs and Behavior • Ozzy Osbourne's genome • Review for Exam 2 	<ul style="list-style-type: none"> • Read: <i>Gene's Addiction, or Why Ozzy Osbourne Is Still Alive</i> • Read: <i>Shot in the dark: uncovering the secrets in the genome of 'The Prince of Darkness'</i> • Quiz #6
Module 5 (Weeks 13-15): Pharmacogenomics: The Present and Future	Exam 2	
	<ul style="list-style-type: none"> • Genes and Health • Pharmacogenomics <ul style="list-style-type: none"> ○ Introduction and concepts 	<ul style="list-style-type: none"> • Read: <i>Ozzy Osbourne is a genetic mutant: Uncovering the Ozzy genome</i> • Read: <i>Introduction to Pharmacogenomics</i>
	<ul style="list-style-type: none"> • Pharmacogenomics <ul style="list-style-type: none"> • Predicting Susceptibility to Disease/Addiction 	<ul style="list-style-type: none"> • Read: <i>Introduction to Pharmacogenomics (cont.)</i> • Discussion Post #6
<ul style="list-style-type: none"> • Pharmacogenomics <ul style="list-style-type: none"> • Personalized Medicine in Practice • Personalized Vaccines for Addiction • Review for Final Exam 	<ul style="list-style-type: none"> • Read: <i>Personalized medicine: motivation, challenges, and progress</i> • Discussion Post #7 	

GE Proposal – Culture & Ideas
PHR 2420 – Drug Culture and Genetics: Revelations from Ötzi to Ozzy
The Ohio State University - College of Pharmacy

General Education: Culture and Ideas

- **Goal:** Students evaluate significant cultural phenomena and ideas in order to develop capacities for aesthetic and historical response and judgement; and interpretation and evaluation.

- **Learning Outcomes:**
 1. Students analyze and interpret major forms of human thought, culture, and expression.
 2. Students evaluate how ideas influence the character of human beliefs, the perception of reality, and the norms which guide human behavior.

Course-specific Learning Outcomes:

By the end of this course, students should successfully be able to:

1. Demonstrate a historical knowledge of drugs and a general understanding of how drugs work to understand the impact of drugs on humans and society
2. Describe the hallmarks of drug addiction and how it manifests to understand the effect of addiction on human health and behavior
3. Explain basic genetic concepts and nomenclature to relate how DNA determines our traits, how we function, and how we act
4. Describe the role that genetic factors play in guiding behavior, maintaining health, and preventing disease
5. Understand the contribution of genetic variability to inter-individual variations in therapeutic and addictive drug responses
6. Examine gene-environment interactions and analyze how this impacts drug culture and human behavior especially relative to addiction
7. Understand how genetic variations that contribute to drug metabolism and drug targets can be studied to implement personalized therapeutics, which could radically change drug culture

Overview

Humans have been experimenting with chemicals for therapeutic use and taking mind-altering substances for thousands of years. Today we use many of the same substances, but science and technology have advanced to increase drug potency in addition to creating new drugs and synthetics. While drug discovery and development have contributed to longer and healthier lives, more drugs have been prescribed in recent years and dependence on and withdrawal from these drugs, whether prescribed or not, can be intense. Moreover, in some cultures, drug and alcohol consumption have become a part of daily life and combined with the pressures of modern society, some individuals turn to drugs as an escape and a means of self-medicating.

Besides being intellectually fascinating, genetics has many practical applications relating to our health and everyday life. Deoxyribonucleic acid (DNA) decides virtually everything about us including our physical features, how we function, and how we act. Understanding human genetic makeup and its role in determining drug action is essential to developing effective, safe medications as well as to decipher the mechanisms of addiction in order to design effective treatments. In this course we investigate the genetic evidence of past human drug use, the genetic revelations and techniques involved in therapeutic drug use and addiction behavior today, and the role of genetics in the future of therapeutics. Examining the genetic and forensic data from the nearly 5000-year-old Ötzi the Iceman as well as the sequenced genome of Ozzy the Madman, we will gain insight into what our genome can tell us about our need and propensity for drugs. Furthermore, we will explore the interplay between drugs and genetics to understand the leveraging of genetics to enhance the development of effective, safe medications at doses tailored to an individual's genetic makeup to provide customized health care.

GE Rationale

A. How do the course objectives address each individual GE expected learning outcome?

The first GE learning outcome will primarily be met through course objectives (course-specific learning outcomes) 1-3, 5-7.

The second GE learning outcome will primarily be met through course objectives (course-specific learning outcomes) 1-4, 6-7

- a. Course-LO1: Through an examination of human drug use from ancient times all the way through drugs used today, students will evaluate the progression as we have moved from mainly fighting invading organisms to combatting complex, “man-made” diseases resulting from changing lifestyles. Students will examine how our society requires and depends on drugs, which greatly influences human thought toward drug therapy and addiction. Additionally, gaining insight into how drugs work will challenge students to evaluate beliefs surrounding drug use and the social norms around what is an appropriate drug as well as what is considered appropriate use of a drug.

GE Proposal – Culture & Ideas
PHR 2420 – Drug Culture and Genetics: Revelations from Ötzi to Ozzy
College of Pharmacy

- b. Course-LO2: Through an analysis of the mechanisms of drug addiction and its effect on human health and behavior, students will evaluate the thought process behind decisions to take an addictive drug as well as the ramifications of falling into an addiction cycle. Additionally, students will examine the stigma of addiction prevalent in our culture and how this impacts social behavior as well as personal and medical treatment of addicts. Students will also analyze the social norms and beliefs associated with the perception that addiction is the result of a moral deficiency, which has important implications for health promotion and addiction treatment and prevention.
- c. Course LO3: By studying basic genetic concepts that contribute to our very existence and place in society, students will develop an appreciation for what determines our uniqueness, how we express this uniqueness, how our actions affect our interactions with others, and how we function in and perceive the world around us.
- d. Course-LO4: Students will build upon their basic genetic knowledge gained in Course-LO3 to become adept at relating the role of genetic factors in behavior, health, and disease prevention by understanding how the information stored in our DNA affects our mental and physical health and our overall ability to thrive. Students will also weigh the ethics associated with the revealing nature of genetic knowledge and what this means with regard to the perception of privacy and individual rights.
- e. Course-LO5: By understanding the contribution of genetic variability to inter-individual variations in drug response, students will gain an appreciation for the challenges associated with treating the human population with information and data from a limited, defined population. Students will think about the ramifications on various cultures that are impacted from health care decisions that are based on this limited data and will challenge the perception that medical research and care is representative of all humans and cultures. Students will also further develop an understanding of the vast genetic differences that contribute to disease propensity including the inclination for some individuals to use drugs for recreation and subsequently succumb to addiction.
- f. Course-LO6: Through an examination of gene-environment interactions, students will recognize that genes alone do not determine drug actions and addiction outcomes. Environmental factors including upbringing, peer interactions, and socioeconomic status also play an important role. Students will begin to relate how gene-environment interactions shape behavior and thoughts about drug use.
- g. Course-LO7: Through an understanding of how genetic variations affect pharmacology, students will generate ideas about how this genetic information can be used to provide the ideal scenario of getting the right drug at the right dose to the right person at the right time. Students will also think about the ramifications regarding the ethics of gaining this information and how this knowledge affects our beliefs and cultural norms surrounding privacy and individual rights. Additionally, students will consider how information justifying an individual's genetic propensity for developing addiction might normalize addictive drug use in society. That is, an individual may be empowered to self-medicate based on the perception of validating genetic information.

B. How do the assigned readings address each individual GE expected learning outcome?

A variety of readings from scholarly journal articles and secondary sources will be assigned. Note: All of the assigned readings contribute to both GE-LOs. The associated course learning objectives and any distinctions with regard to GE-LOs are noted for each.

1. *Pharmacology, Part 1: Introduction to Pharmacology and Pharmacodynamics*, G.M. Currie, J Nucl Med Technol 2018; 46:81–86
 - a. This source provides a basic review of the basics of pharmacology and serves as a resource to complement lectures and activities. By learning the basics of drug characteristics and mechanisms, students will be able to understand the proper roles of drugs in society as well as how accidental and intentional misuse of drugs occurs.
 - b. This source aligns with Course Learning Outcomes #1, #5 and #7.

2. *Lessons in Iceman's Prehistoric Medicine Kit*, J.N. Wilford, NY Times, 1998
 - a. This source provides a rare glimpse into prehistoric medicine, giving a picture of what individuals experienced with regard to health issues and how they treated conditions with plants and minerals from their surroundings. This provides insight into the thoughts of prehistoric man as he sought to make life better as well as into the customs and social structure that contributed to these decisions.
 - b. This source aligns with Course Learning Outcomes #1 and #6.

3. *The Legal Regulation of Drugs and Role of Government: Perspectives from People Who Use Drugs*, A.Greera and A. Ritterb, Drug and Alcohol Dependence 206, 2020
 - a. This source provides an overview of the status of drug regulation and legalization and also looks at these issues from the standpoint of individuals who use drugs, giving a unique perspective on considerations and thoughts surrounding drug use.
 - b. This source aligns with Course Learning Outcomes #1, #2 and #6.

4. *Understanding Substance Use and Addiction Through the Lyrics of Black Sabbath: A Content Analysis*, K.P. Conway and P. McGrain, Subst Use Misuse, 2016
 - a. This source explores addiction through an analysis of the music of Black Sabbath where substance misuse was recurrent in their songs and in the personal lives of its members which included Ozzy Osbourne. Contrary to the notion that heavy metal music glorifies or encourages substance use, the findings showed that Black Sabbath's lyrics as a whole recount a cautionary tale of how persistent substance use can hijack free will, become the dominant focus of the addict, and produce myriad forms of human misery. The insidiousness of chronic substance use depicted by the lyrics mirrors findings from historical anecdotal studies of individuals with substance use disorders and aligns with neurobiological underpinnings of addiction.

5. *Drug Addiction: The Neurobiology of Behavior Gone Awry*, N.D. Volkow, K.R. Warren, *Nat Rev Neurosci*, 2014
 - a. This source provides an introduction to addiction and serves as a resource to support the material in lectures and activities. Understanding addiction and addiction behavior is vital to thinking about what might contribute to addiction, how addiction affects individuals and their interactions with others, and the conflicting views of society on addiction as a personal choice versus a chronic disease.
 - b. This source aligns with Course Learning Outcomes #1, #2 and #6

6. *Neurobiologic Advances from the Brain Disease Model of Addiction*, N.D. Volkow, G.F. Koob, A.T McLellan, *N Engl J Med*, 2016
 - a. This source provides foundational material on the mechanisms contributing to the development of addiction and serves as a resource to support the material in lectures and activities. Through an understanding of the mechanisms involved in the manifestation of addiction, students will be able to appreciate the changes that occur in the brain which result in distorted decision-making ability, which ultimately dictates the behavior of an addict.
 - b. This source aligns with Course Learning Outcomes #1, #2 and #6

7. *Genes and Chromosomes 1: Basic Principles of Genetics*, EMAP Publishing, 2018
 - a. This source provides a basic review of genetics to serve as a resource to complement lectures and activities. Besides being intellectually fascinating, genetics also has many practical applications including helping us understand our health and providing the information to discover new therapies for complex diseases. DNA is the blueprint for our development, is what makes us unique, and has the potential to reveal key information about our potential for development of disease and response to drugs. A thorough understanding of the human genome can have important medical, social and legal impacts.
 - b. This source aligns with Course Learning Outcomes #3, #4, #5, #6 and #7

8. *Scientists Have Found a Time Machine—It’s Your DNA*, Helix Research Blog, 2018
 - a. This source describes how DNA can reveal information about the past to uncover what life was like before written text or before the beginning of modern oral history. It also describes genetic changes over time to suggest interpretations of various behaviors and customs throughout history.
 - b. This source aligns with Course Learning Outcomes #1, #3 and #5

9. *Colonizing Mars is Hard - and Genetics Is One Reason Why*. Helix Research Blog, 2018
 - a. This source delivers a thought experiment involving the idea of unique traits and how the formation of populations can result in distinct variations. Students will learn how traits appear and disappear in various populations and cultures.
 - b. This source aligns with Course Learning Outcomes #3, and #5

10. *Pokemon - Who was the human Mew?* J. Bowes, Helix Research Blog, 2018
 - a. This source offers a whimsical look at the ability to discover mankind's most recent common ancestor, an enduring genetic mystery as told through the lens of the "ancestor of all Pokémon". This source also helps to explain the concept of heritability which is important in understanding the similarities in individuals and how certain traits and behaviors persist in society.
 - b. This source aligns with Course Learning Outcomes #3 and #5

11. *Testimony from the Iceman*, B. Cullen, Smithsonian Magazine, 2003
 - a. This source discusses the story of Ötzi the Iceman which provides a foundation for relating the use of drugs in ancient times and gives us a sense of how our ancestors discovered and used drugs.
 - b. This source aligns with Course Learning Outcomes #1 and #4

12. *Identification of the remains of King Richard III: 500 year old missing person's case solved*, T.E. King et al., Nature Communications, 2014
 - a. This source examines the details around Richard III, who is the first historical figure in the world to have his full genome sequenced. From this article, students will learn about the wealth of information that can be determined from a sequenced ancient genome including physical traits, overall health, potential infidelity in a family line etc.
 - b. This source aligns with Course Learning Outcomes #3 and #4

13. *Queen Victoria's curse: New DNA evidence solves medical and murder mysteries*, K. Harmon, Scientific American, 2009
 - a. This source details the discovery of hemophilia (the "Royal disease") and how researchers have traced this disease through a family line with DNA evidence. Students will learn how a disease passes along a lineage and how this genetic information can provide clues to a person's way of life as well as to help generate ideas regarding treatment.
 - b. This source aligns with Course Learning Outcomes #3 and #4

14. *Gene's Addiction, or Why Ozzy Osbourne Is Still Alive: Our Genes Might Play a Role in Influencing Who Falls Prey to Addiction*, B. Sullivan, Discover Magazine, 2019
 - a. This source, as well as #15 below, discusses the sequencing of Ozzy Osbourne's genome focusing on the aspect of his health and how he has endured extensive damage due to excessive drug use without apparent significant detriment to his overall health. Students will learn about how variations in different genes may confer a detrimental effect, such as susceptibility to addiction, or protection against environmental or chemical assaults.
 - b. This source, as well as #15 below, aligns with Course Learning Outcomes #2, #4, #5 and #6

15. *Shot in the dark: uncovering the secrets in the genome of 'The Prince of Darkness'*, T. Free, BioTechniques, 2018
16. *Ozzy Osbourne is a Genetic Mutant: Uncovering the Ozzy Genome*, C. Hutchison, ABC News Medical Unit, 2010
 - a. This source examines the genetic occurrences that make Ozzy Osbourne unique; provoking thought about what these differences mean with regard to overall health, predicting health issues, and understanding the propensity to become addicted to drugs. Students will further learn how genetic variations are found and how scientists determine what these variations mean. Additionally, students will begin to understand the complexity of associating genetic variations with an effect especially given complex gene-gene and gene-environment interactions.
 - b. This source aligns with Course Learning Outcomes #2, #3, #4, #5 and #6
17. *An Introduction to Pharmacogenomics*, A. Malhotra, *Pharmacotherapeutics For Advanced Practice*, Chapter 8, 2015
 - a. This source provides the foundational material for pharmacogenomics and serves as a reference for the lectures and activities. Studying pharmacogenomics will help students to apply their knowledge of pharmacology and genetics to understand relevant genetic information and how it applies to health and drug use. Pharmacogenomics plays two major roles in precision medicine. It guides pharmaceutical companies in drug discovery and development and secondly, it guides health care professionals in selecting the right drug and dose for patients based on their genetic make-up in order to avoid adverse reactions and to maximize drug effectiveness. Moreover, pharmacogenomics can predict susceptibility to disease and addiction prompting individuals to make proper decisions surrounding their healthcare and lifestyles.
 - b. This source aligns with Course Learning Outcomes #3 and #7
18. *Personalized Medicine: Motivation, Challenges, and Progress*, L.G and N. Schork, 2018
 - a. This source provides a summary of the progress made in understanding and implementing personalized medicine as well as the hurdles that must be addressed in order to achieve the goal of individualized and precision medicine. In studying personalized medicine, students will contemplate the ethics associated with revelations about their genome and how this affects individual rights and privacy.
 - b. This source aligns with Course Learning Outcomes #3 and #7

C. How do the course topics address each individual GE expected learning outcome?

Course topics covered in each module are listed in the course schedule (see Syllabus).

Module 1 focuses on the concept of a drug, how drugs work, how drugs are regulated, how we think about drugs, our beliefs with regard to drug therapy and addiction, and how drugs fit into our culture. This Module addresses both GE expected LOs and Course Learning Objective #1.

Module 2 focuses on the characteristics of addiction, how addiction manifests, how we view addicts, how we think addicts should be treated in the medical community, and how addiction is a learned behavior. This Module addresses both GE expected LOs and Course Learning Objectives #1, #2, #4, #5 and #6.

Module 3 introduces genetics where students will learn about the basic nature of heredity and how our bodies interpret the instructions stored in our DNA. In this module, students will gain an appreciation for what makes us who we are, what makes us different from each other, what determines our behavior, and what we can predict about our past and future. Additionally students will think about the influences of traditions and cultural practices on our genetics such as how lactose tolerance developed due to cultures having a history of dairy farming and milk drinking. Or how a uniquely human behavior such as yam farming led to malaria resistance. This culture of farmers had higher rates of a sickle cell gene which protects against malaria and, in chopping down trees to accommodate yam farming, water accumulated and attracted mosquitoes which ultimately created the conditions for sickle-shaped cells to become adaptive. This Module addresses both GE expected LOs and Course Learning Objectives #3, #4 and #6.

Module 4 focuses on the applications and intersections of pharmacology and genetics including examining what we can learn about health and drug practices throughout history, how we can understand the development and eventually treatment of disease, and how genetics informs us about addictive behavior. This Module addresses both GE expected LOs and Course Learning Objectives #2, #3, #4, #5 and #6.

Module 5 looks at the exciting revelations of pharmacogenomics and the promising future of health care where treatments are customized to each individual. Pharmacogenomics also offers the promising potential to predict who will be prone to addiction as well as ways to treat addiction. This Module addresses both GE expected LOs and Course Learning Objectives #2, #3, #4, #5 and #6.

D. How do the writing assignments address each individual GE expected learning outcome?

The main writing assignments include short response writings in the form of in-class group activities, writings through Discussion Posts and peer interactions as well as a final research paper on a topic related to Drug Culture and Genetics. Each writing assignment aligns to both GE-LOs, yet measures different course learning outcomes (see Course Roadmap). Discussion #1 (in Module 1) and Discussion #2 (in Module 1) align with course learning objective 1. Discussion #3 (in Module 2) and Discussion #4 (in Module 2) align with course learning objectives 1-2 and 4-6. Discussion #5, #6 and #7 help students stay on track and prepare for their final project (consisting of a paper and a poster). These assignments require students to analyze and interpret thought and expression relating to drug culture and the information we gain from genetics (GE-LO #1), as well as discuss thought-provoking questions that evaluate how advanced genetic knowledge and ideas influence our healthcare beliefs, social norms, and existing realities in both therapeutics and drug addiction relating to our drug-taking culture (GE-LO #2). Please see the Course Roadmap for writing prompts, examples of discussion questions, alignment of course objectives, and supporting details.

E. How do the remaining course components address each individual GE expected learning outcome?

The remaining course components include class and article discussions, module reflections, class activities and the final research poster presentation. Students will submit a module reflection at the conclusion of each module, which will provide students with an opportunity to assess and reflect on their individual learning experiences throughout the semester. Each course component aligns to both GE-LOs in terms of asking students to interpret thought and expression relating to our drug culture and its role and relationship with genetics (GE-LO#1) as well as asking students to evaluate how our beliefs about therapeutics and drug addiction affect our perceptions of what is “normal” (GE-LO#2). Throughout the semester, these course components will encourage students to express their analysis of our drug culture and how our very essence, our genetic make-up, affects decisions about our health. Students will also examine their own beliefs, thoughts and feelings towards addiction and the ethics associated with genetic information. Additionally, students will frequently be asked to generate ideas that society, the government, and the scientific and medical community can implement to promote a culture of health given our knowledge and advancements of genetics as well address the issues and stigma associated with addiction. Students will also evaluate how these ideas can influence our healthcare beliefs, combat existing public health crises (e.g. the opioid epidemic), and help to reframe the perception of addiction as being the result of a moral deficiency. The overall goal is for students to identify and evaluate the ideas, beliefs, and attitudes that influence healthcare and addiction treatment given our significant progress in understanding and manipulating the human genome.

GE Proposal – Culture & Ideas
 PHR 2420 – Drug Culture and Genetics: Revelations from Ötzi to Ozzy
 College of Pharmacy

GE Assessment Plan for PHR 2420
Drug Culture and Genetics: Revelations from Ötzi to Ozzy

GE Expected Learning Outcomes	Methods of Assessment <i>*Direct methods are required. Additional Indirect methods are encouraged.</i>	Level of student achievement expected for the GE ELO. <i>(for example define percentage of students achieving a specified level on a scoring rubric)</i>	What is the process that will be used to review the data and potentially change the course to improve student learning of GE ELOs?
<u>ELO 1</u> Students analyze and interpret major forms of human thought, culture, and expression.	GE ELO Scoring Rubric-based evaluation of Final Project (Appendix A)	100% of students meeting milestone 2. 70% of students meeting milestone 3.	At the end of each course offering, the instructor(s) will convene with the College of Pharmacy’s Assessment Analyst, the Associate Dean for Assessment and Strategic Initiatives and the Assistant Dean for Undergraduate Studies to review the data compiled from the GE ELO scoring rubric, identify any deficiencies, and make changes to the lessons/ assignments as appropriate. If the benchmarks prove too low, they will discuss adjustments to ensure that students are being challenged at an appropriate level.
	GE ELO Scoring Rubric-based evaluation of Module 1 and 5 Module Reflections (Appendix B)	100% of students mark milestone 3 or higher.	
<u>ELO 2</u> Students evaluate how ideas influence the character of human beliefs, the perception of reality, and the norms which guide human behavior.	GE ELO Scoring Rubric-based evaluation of Final Project (Appendix A)	100% of students meeting milestone 2. 70% of students meeting milestone 3.	
	GE ELO Scoring Rubric-based evaluation of Module 1 and 5 Module Reflections (Appendix B)	100% of students mark milestone 3 or higher.	

Appendix A: PHR2420: GE Outcome Scoring Rubric

Instructors will put an “x” in the appropriate cell for each ELO and each student based upon their final project. The instructor will then compile the number of students who met each milestone (1-4) for each of the ELOs, and this is how the data will be reported.

	Capstone (4)	Milestone (3)	Milestone (2)	Benchmark (1)
(ELO 1) Students analyze and interpret major forms of human thought, culture, and expression.	Student demonstrates a superior ability to analyze major forms of human thought and aspects of drug culture and genetics. Student demonstrates a superior ability to interpret artistic expressions of said topic.	Student effectively analyzes major forms of human thought and aspects of drug culture and genetics. Student effectively interprets artistic expressions of said topic.	Student is able to analyze and interpret some forms of human thought and aspects of drug culture and genetics, and expression but shows room for improvement.	Student demonstrates limited ability to analyze major forms of human thought and aspects of drug culture and genetics. Student demonstrates limited ability to interpret artistic expression of said topic.
(ELO 2) Students evaluate how ideas influence the character of human beliefs, the perception of reality, and the norms which guide human behavior.	Student demonstrates a superior ability to evaluate how ideas and genetic knowledge influence the healthcare beliefs, attitudes, and social norms surrounding drug taking and addiction behaviors.	Student effectively evaluates how ideas and genetic knowledge influence the healthcare beliefs, attitudes, and social norms surrounding drug taking and addiction behaviors.	Student is able to evaluate how some ideas and genetic knowledge influence the healthcare beliefs, attitudes, and social norms surrounding drug taking and addiction behaviors but shows room for improvement.	Student demonstrates limited ability to evaluate how ideas and genetic knowledge influence the healthcare beliefs, attitudes, and social norms surrounding drug taking and addiction behaviors.

Appendix B: PHR 2420: GE Outcome Scoring Rubric

Instructors will put an “x” in the appropriate cell for each ELO and each student based upon analysis of their Module 1 and Module 5 module reflections (which will include each student completing this rubric). The instructor will then compile the number of students who agreed with each milestone (1-4) for each of the ELOs, and this is how the data will be reported.

	Capstone (4)	Milestone (3)	Milestone (2)	Benchmark (1)
(ELO 1) Students analyze and interpret major forms of human thought, culture, and expression.	Student believes course provided a significant opportunity to analyze major forms of human thought and aspects of drug culture and genetics.	Student believes course provided opportunities to analyze major forms of human thought and aspects of drug culture and genetics, but some course improvements could be made.	Student believes course provided limited opportunities to analyze major forms of human thought and aspects of drug culture and genetics.	Student believes course provided no opportunities to analyze major forms of human thought and/or aspects of drug culture and genetics
(ELO 2) Students evaluate how ideas influence the character of human beliefs, the perception of reality, and the norms which guide human behavior.	Student believes course provided a significant opportunity to evaluate how ideas influence the healthcare beliefs, attitudes, and social norms surrounding drug taking and addiction behaviors.	Student believes course provided opportunities to evaluate how ideas influence the healthcare beliefs, attitudes, and social norms surrounding drug taking and addiction behaviors; but some improvements could be made.	Student believes course provided limited opportunities to evaluate how ideas influence the healthcare beliefs, attitudes, and social norms surrounding drug taking and addiction behaviors.	Student believes course provided no opportunities to evaluate how ideas influence healthcare beliefs, attitudes, and social norms surrounding drug taking and addiction behaviors.

Course Roadmap

Drug Culture and Genetics: Revelations from Ötzi to Ozzy

PHR 2420



Module 1 - (Weeks 1-3): Pharmacology



Readings

1. *Pharmacology, Part 1: Introduction to Pharmacology and Pharmacodynamics*, G.M. Currie, J Nucl Med Technol 2018; 46:81–86
 - This source provides a basic review of the basics of pharmacology and serves as a resource to complement lectures and activities.
2. *Lessons in Iceman's Prehistoric Medicine Kit*, J.N. Wilford, NY Times, 1998
 - This source provides a rare glimpse into prehistoric medicine, giving a picture of what individuals experienced with regard to health issues and how they treated conditions with plants and minerals from their surroundings. This provides insight into the thoughts of prehistoric man as he sought to make life better as well as into the customs and social structure that contributed to these decisions.
3. *The Legal Regulation of Drugs and Role of Government: Perspectives from People Who Use Drugs*, A.Greera and A. Ritterb, Drug and Alcohol Dependence 206, 2020
 - This source provides an overview of the status of drug regulation and legalization and also looks at these issues from the standpoint of individuals who use drugs.



Discussion Posts

- **Discussion Post #1 – Drugs in History – Research Drug History**
 - Objectives
 - Gain knowledge on a medication from ancient or olden times
 - Gain an appreciation for the scope of historical medicines
 - Students will choose from several prompts of historical medicines for which they will briefly research and discuss. Students will gain further knowledge and appreciation by responding to one of their peers who chose a different prompt.

- **Discussion Post #2 – Drug Legalization and Regulation – Branch Chain Activity**
 - Objectives
 - Enhance student engagement in developing an opinion on a controversial subject
 - Encourage student consideration of opposing views of their stances
 - Encourage student discussion around complex issues
 - This activity resembles a “Choose Your Own Adventure” type activity where students are given a question regarding drug legalization and/or regulation and will then be given four choices to choose the BEST reason for their stance. Selecting this choice brings them to a page with a description and article in opposition to their stance. The students then provide a counterargument to support their view or discuss how the opposing information altered their view.



Quiz

- Quizzes are meant to encourage focus on foundational material and to give students practice in answering questions about the material.
- **Quiz #1**
 - This quiz will be based on the lectures and readings focused on the basic concepts of drugs and how they work.



Module 2 (Weeks 4-6): Drug Addiction



Readings

1. *Understanding Substance Use and Addiction Through the Lyrics of Black Sabbath: A Content Analysis*, K.P. Conway and P. McGrain, *Subst Use Misuse*, 2016
 - This source explores addiction through an analysis of the music of Black Sabbath where substance misuse was recurrent in their songs and in the personal lives of its members, which included Ozzy Osbourne. Contrary to the notion that heavy metal music glorifies or encourages substance use, the findings showed that Black Sabbath's lyrics as a whole recount a cautionary tale of how persistent substance use can hijack free will, become the dominant focus of the addict, and produce myriad forms of human misery. The insidiousness of chronic substance use depicted by the lyrics mirrors findings from historical anecdotal studies of individuals with substance use disorders and aligns with neurobiological underpinnings of addiction.
2. *Drug Addiction: The Neurobiology of Behavior Gone Awry*, N.D. Volkow, K.R. Warren, *Nat Rev Neurosci*, 2014
 - This source provides an introduction to addiction and serves as a resource to support the material in lectures and activities.

3. *Neurobiologic Advances from the Brain Disease Model of Addiction*, N.D. Volkow, G.F. Koob, A.T. McLellan, *N Engl J Med*, 2016
 - This source provides foundational material on the mechanisms contributing to the development of addiction and serves as a resource to support the material in lectures and activities.



Discussion Posts

- **Discussion Post #3 – Drugs, the Brain, and Behavior: The Science of Addiction – Addiction Video Analysis**
- Objectives
 - Develop an understanding of and critically think about how drugs affect brain structure and function
 - Practice applying knowledge of addiction
- Students will watch two short videos describing the mechanism of addiction and will describe how drugs cause changes in the brain that might make it more difficult for an individual to stop using drugs. Students are to craft their story as if they are explaining the concept of addiction to someone with no prior knowledge of addiction. The basis for this exercise is founded on the fact that learning is enhanced when you can effectively explain a topic to someone else.
 - [Dopamine and Glutamate in Addiction Video](#)
 - [The Addicted Brain: The Science of Addiction Video](#)
- **Discussion Post #4 – Drugs, the Brain, and Behavior: The Science of Addiction – The Rat Park Experiment**
 - Objectives
 - Develop an understanding of and critically think about how drugs affect behavior and decision making
 - Practice applying knowledge of addiction
 - Think about the contributions of genetics and environment to addiction potential and development
 - Students will watch a short video, which gives an overview of Rat Park, a series of studies into drug addiction conducted in the late 1970s by Canadian psychologist, Bruce Alexander. The gist of these experiments suggests that “addiction isn’t you — it’s the cage you live in”. These studies showed that rats living in a social environment are less likely to self-administer morphine than those housed in isolation, suggesting that environment and social construct determined addiction potential. Students will give a short synopsis (3-4 sentences) of the Rat Park experiments including thoughts and any criticism of the experiment and interpretations.
 - [The Rat Park Experiment Video](#)



Quiz

- **Quiz #2**
 - This quiz will be based on the lectures and readings focused on the characteristics of drug addiction as well as the different categories of addicting drugs.



Module 3 (Weeks 7-9): Genetics



Readings

1. *Genes and Chromosomes 1: Basic Principles of Genetics*, EMAP Publishing, 2018
 - This source provides a basic review of genetics to serve as a resource to complement lectures and activities.
2. *Scientists Have Found a Time Machine—It’s Your DNA*, Helix Research Blog, 2018
 - This source describes how DNA can reveal information about the past to know what life was like before written text or before the beginning of modern oral history. It also describes genetic changes over time to suggest interpretations of various behaviors through time.
3. *Colonizing Mars is Hard - and Genetics Is One Reason Why*. Helix Research Blog, 2018
 - This source delivers a thought experiment involving the idea of unique traits and how the formation of populations can result in distinct variations.
4. *Pokemon - Who was the human Mew?* J. Bowes, Helix Research Blog, 2018
 - This source offers a whimsical look at the ability to discover mankind’s most recent common ancestor, an enduring genetic mystery as told through the lens of the “ancestor of all Pokémon”. This source also helps to explain the concept of heritability, which is important in understanding the similarities in individuals and how certain traits and behaviors persist in society.



Quizzes

- **Quiz #3**
 - This quiz will be based on the lectures and readings focused on the Introduction to Genetics
- **Quiz #4**
 - This quiz will be based on the lectures and readings focused on genetic variation and the genome



Module 4 (Weeks 10-12): Applications of Pharmacology and Genetics: The Past and Present



Readings:

1. *Testimony from the Iceman*, B. Cullen, Smithsonian Magazine, 2003
 - This source discusses the story of Ötzi the Iceman which provides a foundation for relating the use of drugs in ancient times and gives us a sense of how our ancestors discovered and used drugs.
2. *Identification of the remains of King Richard III: 500 year old missing person's case solved*, T.E. King et al., Nature Communications, 2014
 - This source examines the details around Richard III, who is the first historical figure in the world to have his full genome sequenced. From this article, students will learn about the wealth of information that can be determined from a sequenced ancient genome including physical traits, overall health, potential infidelity in a family line etc.
3. *Queen Victoria's curse: New DNA evidence solves medical and murder mysteries*, K. Harmon, Scientific American, 2009
 - This source details the discovery of hemophilia (the "Royal disease") and how researchers have traced this disease through a family line with DNA evidence. Students will learn how a disease passes along a lineage and how this genetic information can provide clues to a person's way of life as well as to help generate ideas regarding treatment.
4. *Gene's Addiction, or Why Ozzy Osbourne Is Still Alive: Our Genes Might Play a Role in Influencing Who Falls Prey to Addiction*, B. Sullivan, Discover Magazine, 2019
5. *Shot in the dark: uncovering the secrets in the genome of 'The Prince of Darkness'*, T. Free, BioTechniques, 2018
 - Sources 4 and 5 discuss the sequencing of Ozzy Osbourne's genome focusing on the aspect of his health and how he has endured extensive damage due to excessive drug use without apparent significant detriment to his overall health.



Discussion Posts

- **Discussion Post #5 – Choose a Topic for Final Paper and Generate an Outline**
 - Objectives
 - Apply written communication skills toward presenting a balanced view on a final topic
 - Assess peers' planning, ideas, and written communication skills
 - Gain help and feedback for enhancing the final project

After developing a research question, students will briefly reflect on their current understanding of their chosen topic and research question. As part of their reflection, they will write responses to the following questions:

 - Why did you choose this topic?
 - What do you want to learn about your topic?
 - Where might you find more information about your topic?
 - Students will offer and get feedback on their ideas and progress towards their final paper.



Quizzes

- **Quiz #5**
 - This quiz will be based on the lectures and readings focused on how we learn about drug use and addictive behavior through genetics
- **Quiz #6**
 - This quiz will be based on the lectures and readings focused on Pharmacogenomics and its use in predicting disease and addiction treatment and susceptibility



Module 5 (Weeks 13-15): Pharmacogenomics: The Present and Future



Readings:

1. *Ozzy Osbourne is a Genetic Mutant: Uncovering the Ozzy Genome*, C. Hutchison, ABC News Medical Unit, 2010
 - a. This source examines the genetic occurrences that make Ozzy Osbourne unique; provoking thought about what these differences mean with regard to overall health, predicting health issues, and understanding the propensity to become addicted to drugs.
2. *An Introduction to Pharmacogenomics*, A. Malhotra, *Pharmacotherapeutics For Advanced Practice*, Chapter 8, 2015
 - a. This source provides the foundational material for pharmacogenomics and serves as a reference for lectures and activities.
3. *Personalized Medicine: Motivation, Challenges, and Progress*, L.G and N. Schork, 2018
 - a. This source provides a summary of the progress made in understanding and implementing personalized medicine as well as the hurdles that must be addressed in order to achieve the goal of individualized and precision medicine.



Discussion Posts

- **Discussion Post #6 – Peer Review of Final Paper Rough Draft**
 - Objectives
 - Apply written communication skills toward presenting a balanced view on a final topic
 - Assess peers' ideas and written communication skills
 - Gain help and feedback for enhancing the final project
- Students will submit a rough draft of their final paper for peer review. In addition to their rough draft, students will briefly state two challenges or concerns that they would like specific feedback on.

- **Discussion Post #7 – Presentation of Poster**
 - Objectives
 - Provide a visual presentation that showcases scholarly research to allow the class to view the various topics chosen by their peers
 - Practice condensing a topic into a visually appealing format that clearly explains a significant topic in Drug Culture and Genetics
 - Students will make a poster representing their topic chosen for their final paper in order to showcase their topic research to their peers. Research posters present an engaging platform to concisely present a topic and communicate it in a clear manner. Similar to an oral presentation, a poster's use of communication aids and organization of content is vital for an effective poster. The main idea is to make it visual and informative. Individuals should be drawn to the poster and be able to effectively get a general sense of the topic.

Note: In addition to the above course plan, students will complete low risk/high reward type activities in class. These activities are meant to support the material, encourage thoughtful discussion, and strengthen peer communication and interaction. Students will also submit a module reflection at the conclusion of each module, which will provide students with an opportunity to assess and reflect on their individual learning experiences throughout the semester.