This course will meet in-person for class lectures and discussion sections.

Instructors:

Prof. J.S. (Sandy) Parkinson *parkinson@biology.utah.edu*
Prof. Kent Golic *u0030856@utah.edu*

Teaching assistants:

Hyrum Diesen *hyrum.diesen@utah.edu*
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The instructors will present in-class lectures; the TAs will lead the discussion sections. The instructors and the TAs will gladly schedule individual and group help sessions upon request. Just contact us by email or in-person after any class or discussion section to arrange an appointment.

Prerequisites:

BIOL 2020 (Principles of Cell Biology) or equivalent. In particular, the following knowledge is vital to, but not explicitly covered in, the present course:

- Structures of amino acids, nucleotides, proteins, and nucleic acids
- Structures and workings of prokaryotic and eukaryotic cells
- Structures of chromosomes and the processes of DNA replication and mitosis
- Enzymes and biochemical pathways for energy production and synthesis of biomolecules
- Transcription and translation and the proteins and other factors involved

Course objectives:

- to provide a basic introduction to hereditary mechanisms in microbes and higher organisms
- to develop logic skills for analyzing genetic experiments and data
- to illustrate ways in which genetic logic and approaches can answer biological questions

Textbooks:

There is NO required text for this course. The knowledge and analytical skills needed to pass this course will be based entirely on the material presented in Canvas lesson notes, in-class lectures and optional office hours and one-on-one tutorial sessions with the instructors.

If you want supplementary coverage of course topics you may wish to consult an introductory genetics text. Two recommended ones are: *"An Introduction to Genetic Analysis"*, Griffiths *et al*., W.H. Freeman & Co.; and *"Genetics from Genes to Genomes"*, Hartwell *et al*., McGraw Hill.

Canvas: *https://utah.instructure.com/courses/883284*

These instructional materials will be available on the course Canvas site:

Comprehensive lesson notes and recorded lectures from on-line classes in prior years
Mini-lessons (pdfs and videos) on how to carry out various genetic analyses
Genetics help sheets and glossaries
Problem sets, solved problems, and practice exams
Answer keys (pdfs) and solution tutorials (videos) for problem sets and practice exams

You must pass a Syllabus Quiz and complete a Student Code of Conduct form on the Canvas site before you can access the lesson notes and some other course materials.

To effectively access the course Canvas site, you will need to have an adequate desktop or laptop computer and a broadband internet connection. Laptops are available for checkout from the Marriott Library, depending on availability: https://lib.utah.edu/coronavirus/checkout-equipment.php.You will also need to be able to smoothly navigate Canvas. If you have concerns about ether of these requirements, please contact an instructor as soon as possible.

Course organization:

The course material will be covered in four units. Each unit is introduced on Canvas with lists of new terms and concepts to be covered and the explicit learning goals for that unit. Each unit has voluntary problem sets, solved problems and a practice exam for honing analytical skills and assessing comprehension of the material. These are highly recommended activities for mastering the course material and analytical skills, but are not course requirements *per se*.

Grades:

The course will be graded on an **absolute** (*i.e.*, non-curved) 400 point scale. The instructors may modify this scale downward as the semester progresses, but **it will never be modified upward**.

A	100% - 94%	≥ 376 points
A-	93.9% - 90%	≥ 360 points
B+ / B / B-	89.9% - 80%	≥ 320 points
C+ / C / C-	79.9% - 70%	≥ 280 points
D	69.9% - 60%	≥ 240 points
E	<60%	< 240 points

You can accumulate course points in three ways:

(1) Unit exams: 4 exams each worth 100 points

(2) Discussions: attendance and quizzes worth 100 points

11 of the 14 weekly discussions will conclude with short quizzes. Each quiz taken will garner five points for attendance and up to five points for correct quiz answers.The total of your top 9 discussion session scores will be scaled by a factor of 10/9 to determine your total points earned for the Discussion option. This means that you can miss up to two discussion sessions – but no more than two – with no penalty.

(3) Comprehensive final exam: 100 points

Your top four point scores will be used to determine your overall course point total.

scenario #1: best four unit exam and final exam scores

scenario #2: best three unit exam and final exam scores plus discussion points

The scenario that maximizes your point total will be used to calculate your grade.

Important grading info:

– **There are no make-up exams in this course.** If you are unable to take a unit exam, the missed exam will score as zero. With the instructor's prior approval, you may arrange to take an exam in advance of the scheduled exam time to accommodate extenuating circumstances (*e.g.*, athletes traveling to away events).

– **You can miss or score poorly on TWO exams without jeopardizing your final grade if you attend and participate in a Discussion Section.** If you do not want to attend the discussions, you will only be able to drop one exam score for your point total. This means that you will need to take the unit 4 exam and/or the comprehensive final.

– **The comprehensive final exam and the fourth unit exam are optional.** If you're satisfied with your course point total, you do not need to take either of these exams during finals week.

Exams:

There will be three unit exams during the semester, each worth a total of 100 points. Each unit exam will focus on material covered in the unit topics, but will also include concepts, facts, and analytical skills from prior course units. Practice exams, similar in content and difficulty to the real ones, will be posted on the course Canvas site and covered in discussion and lecture review sessions. Solution tutorials for each practice exam will be posted at least four days in advance of the for-credit exams to allow for discussions, help sessions, *etc*.

A fourth unit exam (worth 100 points) and a comprehensive final exam (worth 100 points) will be given on the final exam date. Each of these exams will be constructed to allow completion in one hour, but you may use the entire two-hour exam period to work on just one or both of the exams.

Exam content and format:

The exams will test student command of genetic terminology and concepts and ability to analyze and solve genetics problems. **You may not use calculators/phones or other devices during the exam. You may prepare and use a one-page"cheat-sheet" containing (on both sides) any information that you feel will help you perform well on the exam.**

Discussion sections:

You may opt to earn course points by regularly attending the discussion section **for which you are officially registered.** If you want to attend for credit a different discussion section than the one for which you registered, you will need to change your section registration so that your grades can be recorded propertly in Canvas. Notify an instructor if you encounter difficulty making such a change.

All discussion sections meet in JTB 110.

Tuesdays	8:35 - 9:25 2030-002	9:40 - 10:30 2030-003	10:45 - 11:35 2030-004	4:10 - 5:00 2030-005
Wednesdays	8:35 - 9:25 2030-009	9:40 - 10:30 2030-006	11:50 - 12:40 2030-007	3:05 - 3:55 2030-008

Quizzes and attendance: Short written quizzes on the analytical skills covered in the class discussion will be given at the end of most discussion sessions and are worth up to five points each. Turnng in a quiz also earns five points for attendance.

Students who have chosen to participate in the in-person discussion sections cannot receive points for sessions they are unable to attend. Although there is no mechanism to "make up" for missed point-earning opportunities, you may have up to two unexcused absences during the course of the semester without jeopardizing your Discussion point total (see Grades above).

Academic Conduct

In order to ensure that the highest standards of academic conduct are promoted and supported at the University, students must adhere to generally accepted standards of academic honesty. Acts of academic misconduct include cheating, plagiarizing, research misconduct, misrepresenting one's work, and inappropriately collaborating. Suspected cases of academic misconduct will be dealt with according to the procedures found in the Student Code, University Policy 6-400(V) (*http://regulations.utah.edu/academics/6-400.php*). Instances of academic misconduct will be recorded in a database that may be made available to other Uni- versity of Utah Departments and Colleges.

ADA accommodations:

Students requesting an ADA accommodation should first contact the Center for Disability and Access (CDA) (*https://disability.utah.edu/*). CDA will then work with the instructor to determine what, if any, ADA accommodations are reasonable and appropriate.

Content accommodations policy:

The instructor does not grant content accommodation requests because the course content fulfills legitimate pedagogical goals.

Withdrawals and audits:

This course will adhere to the University policy on withdrawals and incompletes, *i.e.*, the instructor will not approve any course withdrawals. Students who have completed and passed at least 80% of the course material are eligible for an incomplete grade, if extenuating circumstances prevent them from completing the course.

Important dates:

Friday, September 1 - last day to add, drop, audit, and elect CR/NC

Friday, October 20 - last day to withdraw from classes

This syllabus is not a binding legal contract:

It may be modified by an instructor when students are given reasonable notice of the change.

Additional important documents (attached):

Lecture and Exam Schedule

Schedule for Discussion Sections

Expected Learning Outcomes (EOLs)

University Policies and Information

BIOL 2030 - Fall, 2023 **Genetics** **TH 2:00-3:20 PM ASB 220**

https://utah.instructure.com/courses/883284

Lecture & Exam Schedule

date	*day*	*lesson*	*Lesson & Lecture topics*: Parkinson / Golic
Aug 22	T	1	intro to course; Mendelian genetics
Aug 24	H	2	chromosomes & meiosis: sex determination; nondisjunction
Aug 29	T	3	genes in populations: Hardy-Weinberg; genes with multiple alleles
Aug 31	H	4	genotype to phenotype: biochemical genetics; pathways; gene interactions
Sep 5	T		review & exam prep
Sep 7	**H**		**Exam #1 (lessons 1-4)**
Sep 12	T	5	linkage: crossovers, chromosome maps; tetrad analysis
Sep 14	H	6	tetrad analysis: centromere mapping, interference
Sep 19	T	7	chromosome changes: recombination effects; gamete consequences
Sep 21	H	8	chromosomes and genomes
Sep 26	T	9	DNA replication and sequencing
Sep 28	H	10	mutation, repair, recombination
Oct 3	T		review & exam prep
Oct 5	**H**		**Exam #2 (lessons 5-10)**
Oct 8-15			***FALL BREAK***
Oct 17	T	11	bacteria & phage: life cycles; mutations, mutants, phenotypes
Oct 19	H	12	bacterial crosses: conjugation, transformation, transduction
Oct 24	T	13	extrachromosomal genetic elements: plasmids & episomes; lysogeny
Oct 26	H	14	defining genes: T4rII system; fine structure, complementation; colinearity
Oct 31	T	15	genetic code: triplet code; reading frames; degeneracy, wobble, nonsense
Nov 2	H	16	central dogma: mutation consequences; reversion & suppression
Nov 7	T		review & exam prep
Nov 9	**H**		**Exam #3 (lessons 11-16)**
Nov 14	T	17	gene and operon fusions
Nov 16	H	18	gene regulation in prokaryotes: *lac* operon, global control
Nov 21	T	19	gene regulation in eukaryotes
Nov 23-26			***THANKSGIVING***
Nov 28	T	20	transposons
Nov 30	H	21	DNA restriction and modification enzymes
Dec 5	T	22	genetic engineering
Dec 7	H	23	CRISPR
Dec 11	**M**	**1:00-3:00 PM**	**Exam #4 (lessons 17-23) & Final Exam (comprehensive)**

BIOL 2030 - Fall, 2023 **Genetics** **TH 2:00-3:20 PM ASB 220**

https://utah.instructure.com/courses/883284

Schedule for Discussion Sections

week	dates	*Discussion topics*
2	Aug 29 & 30	Problem Sets 1 & 2; **Quiz #1**
3	Sep 5 & 6	Problem Sets 3 & 4; Practice Exam #1
	Sep 7	**Exam #1 (lessons 1-4)**
4	Sep 12 & 13	Exam #1; **Quiz #2**
5	Sep 19 & 20	Problem Sets 5 & 6; **Quiz #3**
6	Sep 26 & 27	Problem Sets 7 & 8; **Quiz #4**
7	Oct 3 & 4	Problem Sets 9 & 10; Practice Exam #2
	Oct 5	**Exam #2 (lessons 5-10)**
	Oct 8-15	***FALL BREAK***
9	Oct 17 & 18	Exam #2; **Quiz #5**
10	Oct 24 & 25	Problem Sets 11 & 12; **Quiz #6**
11	Oct 31 & Nov 1	Problem Sets 13 & 14; **Quiz #7**
12	Nov 7 & 8	Problem Sets 15 & 16; Practice Exam #3
	Nov 9	**Exam #3 (lessons 11-16)**
13	Nov 14 & 15	Exam #3; **Quiz #8**
14	Nov 21 & 22	Problem Sets 17 & 18; **Quiz #9**
	Nov 23-26	***THANKSGIVING***
15	Nov 28 & 29	Problem Sets 19 & 20; **Quiz #10**
16	Dec 5 & 6	Problem Sets 21 & 22; **Quiz #11**
M, Dec 11	**1:00-3:00 PM**	**Exam #4 (lessons 17-23) & Final Exam (comprehensive)**

Expected Learning Outcomes

Conceptual Skills - By the end of this class you should understand

- the discrete nature of genetic characters and genotype inheritance patterns
- the relationship between genotype and phenotype
- the different genetic outcomes of mitosis and meiosis
- the key experiments that established that genes were carried on chromosomes
- the significance of sex chromosomes and nondisjunction to inheritance
- the factors that influence the frequencies of genes in populations
- the key experiments that established the relationship between genes and proteins
- the basis for phenotypic interactions between pairs of alleles
- the basis for phenotypic interactions among multiple genes
- the relationship between chromosomes and linked genes.
- when and where crossing-over takes place during meiosis
- the consequences of crossing-over to chromosome segregation and gamete genotypes
- the consequences of chromosome aberrations to meiosis and to offspring
- the lifestyles of bacteria and bacterial viruses
- the sources of the enormous resolving power of microbial genetic systems
- the various kinds of bacterial and phage mutants and how their phenotypes are assessed
- the experiments that established DNA as the genetic material
- the chemical and structural properties of DNA that are uniquely suited to a genetic material
- the manner in which genetic crosses are done and analyzed with bacteriophage
- the important mechanistic differences between genetic transfer in bacteria and higher organisms
- the ways in which genetic material is transferred and inherited in bacteria
- the nature of extrachromosomal genetic elements in bacteria and how they persist in their hosts
- the structural features of phage DNA molecules that determine the nature of their genetic maps
- the experiments that elucidated the fine structure of genes
- the experiments that established the relationship between a gene and its protein product
- the experiments that elucidated the triplet nature of the genetic code and how its read out
- the relationship between genetic information and the primary structure of a gene's protein product
- the kinds of mutational changes in the genetic code and their effects on protein and phenotype
- the origin, properties and reversion patterns of different kinds of mutations
- mechanisms by which gene expression can be regulated in eukaryotes and prokaryotes
- mechanisms and types of gene fusions and their experimental applications
- the selective forces that drive evolution of transposable genetic elements
- the ways in which transposable genetic elements are used in genetic analyses
- the chemical properties of DNA and common techniques for examining and manipulating DNA
- how recombinant DNA molecules are made *in vitro* and used *in vivo*

Expected Learning Outcomes

Analytical Skills - By the end of this course, you should be able to...

- deduce genotypes and modes of inheritance from cross results or pedigrees
- calculate progeny genotype and phenotype ratios and probabilities in crosses
- diagram movements of chromosomes through normal or nondisjunctional meiosis
- calculate gene, genotype, and phenotype frequencies in populations
- calculate inbreeding coefficients in consanguineous pedigrees
- analyze gene interactions in terms of protein properties and biochemical pathways
- determine the linkage relationships between marked loci in genetic crosses
- calculate recombination frequencies and construct genetic (linkage) maps from cross data
- diagram meiotic crossover patterns to account for recombinant gamete classes
- map genes relative to their centromeres; analyze unordered and ordered fungal tetrads
- interpret bacterial mutant growth phenotypes in terms of number and kinds of mutational defects
- construct genetic maps from bacterial conjugation, transduction, and transformation data
- construct genetic maps from phage genetic cross data
- diagram integration, excision, and aberrant excision of episomes (F and lambda)
- construct deletion maps from deletion by deletion or point by deletion crosses
- determine gene assignments from complementation data
- apply central dogma principles to infer mutational and functional change(s) in a mutant organism
- use knowledge of the genetic code to identify open reading frames and analyze reversion patterns
- deduce gene expression control mechanisms from properties of regulatory mutants
- predict gene expression phenotypes of mutants from regulatory circuits
- use transposons as genetic markers in crosses
- construct restriction maps of DNA molecules
- analyze DNA sequences with web-based software programs (ORF-finders, *etc.*)

Important Terminology - By the end of this course, you should be able to recognize, distinguish, and define approximately 300 words and concepts central to classical and modern genetics.

University Policies and Information

COVID information

Information about the university's response to COVID-19: https://coronavirus.utah.edu

On-campus vaccination information: https://alert.utah.edu/covid/vaccine/

Self reporting forms: To help monitor the spread of COVID-19 and respond appropriately, the university requires that all students, faculty and staff complete a reporting form if they have been exposed to, are being tested for, or have been diagnosed with COVID-19: Self-reporting Form

Exposure guidelines: If you have been exposed to COVID-19, you should read and follow the guidelines posted at: University COVID exposure guidelines

Wellness Statement

Personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences, *etc*., can interfere with a student's ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness at www.wellness.utah.edu or 801-581-7776.

Student Mental Health Resources

Rates of burnout, anxiety, depression, isolation, and loneliness noticeably increased during the pandemic. If you need help, reach out for campus mental health resources, including free counseling, trainings and other support.

Equal Access Provisions and the Americans with Disabilities Act

The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability & Access, 162 Olpin Union Building, (801) 581-5020. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the Center for Disability & Access.

Veterans Center

If you are a student veteran, the U of Utah has a Veterans Support Center located in Room 161 in the Olpin Union Building. Hours: M-F 8-5 pm. Visit our website (http://veteranscenter.utah.edu/) for more information about what support we offer, a list of ongoing events and links to outside resources:. Please also let us know if you need any additional support in this class for any reason.

English Language Learners

If you are an English language learner, please be aware of several resources on campus that will support you with your language and writing development. These resources include: the Writing Center (http://writingcenter.utah.edu/); the Writing Program (http://writing-program.utah.edu/); the English Language Institute (http://continue.utah.edu/eli/).

University Policies and Information

Campus Safety

The University of Utah values the safety of all campus community members. To report suspicious activity, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu.

Addressing Sexual Misconduct

Title IX makes it clear that violence and harassment based on sex and gender (which Includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801- 585-2677(COPS).

Lauren's Promise: Lauren's Promise is a vow that anyone – faculty, staff, students, parents, and community members – can take to indicate to others that they represent a safe haven for sharing incidents of sexual assault, domestic violence, or stalking. Anyone who makes Lauren's Promise vows to: 1.) listen to and believe those individuals who are being threatened or experiencing sexual assault, dating violence or stalking; 2.) represent a safe haven for sharing incidents of sexual assault, domestic violence, or stalking; and 3.) change campus culture that responds poorly to dating violence and stalking. By making Lauren's Promise, individuals are helping to change campus cultures that respond poorly to dating violence and stalking throughout the nation.

Drop/Withdrawal Policies:

Students may drop a course within the first two weeks of a given semester without any penalties. Students may officially withdraw (W) from a class or all classes after the drop deadline through the midpoint of a course. A "W" grade is recorded on the transcript and appropriate tuition/fees are assessed. The grade "W" is not used in calculating the student's GPA. For deadlines to withdraw from full-term, first, and second session classes, see the U's Academic Calendar.