The Biology of Cancer

Course Syllabus

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Julia Lieu  Email: jlieu@wustl.edu

**Class Schedule/Location:**  Tuesdays & Thursdays, 2:30 – 4.15 pm/Simon Hall, room 17

**Discussion Session/Location:**  Mondays, 7 – 8 pm/TBA

**Office Hours/Location:**  Wednesdays, 3:00 – 5 pm, and by appointment/Zoom

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**Course Summary**

**Rationale:**

Cancer is the second-leading cause of death worldwide, claiming nearly 10 million lives in 2019 alone. The prevalence and profound impact of cancer on society has resulted in intensive research efforts to better understand, diagnose, and treat this collection of diseases. As such, a clearer understanding of the underlying biology of human cancers and their treatment modalities will be important for those pursuing a future in the health sciences or those continuing education in the field of biological sciences.

**Description:**

Cancer is the second-leading cause of death worldwide. In spite of focused research efforts, cancer still poses a unique biomedical puzzle as it is now recognized that cancer is not a single disease, but rather a collection of many disorders with underlying mechanistic complexities that can affect most tissues in the human body. This interactive 1st-semester course provides an introductory overview of the biology, diagnosis, and treatment of human cancers. We touch upon background topics in DNA structure and replication, gene regulation and transcription, protein synthesis, mutations and DNA repair, but the primary focus is on the genetic and molecular changes that normal cells undergo during transformation into malignant cancer cells, emphasizing the dysfunction of essential biological processes like programmed cell death, cell proliferation, differentiation, and immune surveillance. Classical diagnosis and treatment methods are compared with newer strategies, such as targeted therapies. Finally, the growing role of "omics" technologies in tumor classification, patient prognosis, and therapy are discussed. The course is a mix of lectures, student-led discussions/presentations, guest seminars and activities. Lectures provide an overview of each topic, while activities and discussions of cutting-edge oncology topics in the news and primary literature familiarize students with current trends in cancer research/treatment as well as enhance reading and critical analysis skills. Students choose a specific type of cancer for further study and near the end of the semester prepare a presentation to the class on its molecular and cellular etiology, epidemiology, pathology, diagnosis, and current/future treatment options. Midterm Exams, which attendance is required, will be administered on Wednesday, September 23, 6:30 – 8 pm & Wednesday, October 28, 6:30 – 8 pm.

**Prerequisite:**  High school biology and chemistry, while completing AP or Honors biology is highly recommended. Enrollment is restricted to first-year students in the “Hallmarks of Cancer & Patient Care” program.

**Grade Options:**  Credit, Pass/Fail
**Course Outcomes**

In this course, students will gain a broad knowledge of the molecular features of mammalian cells and the underlying processes that go awry during tumorigenesis as well as an understanding of the current anti-cancer therapies available today. Students will also sharpen their critical thinking and communication skills through discussions and presentations. After completing this course, students will be able to:

1. demonstrate an understanding of the structure and function of DNA in the cell, gene expression, and how mutations alter gene products
2. describe the eight hallmarks of cancer and how each contributes to cancer development
3. describe the roles of oncogenes and tumor suppressor genes in tumorigenesis
4. give a critical account of conventional and emerging therapeutic oncological options
5. relate knowledge of molecular and genetic processes to the molecular basis, diagnosis and treatment of cancer
6. interpret and analyze data from scientific literature regarding cancers and human disease
7. assemble a detailed account of the etiology, epidemiology, molecular biology, pathology, and therapy of selected tumors

Course outcomes are met through a variety of planned learning activities: readings, lectures, small group activities, site visits, web-based materials, homework assignments, examinations, student presentations, and individual interactions.

**Course Grades**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework (top 20 assignments)</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm Exam 1</td>
<td>10%</td>
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<tr>
<td>Midterm Exam 2</td>
<td>10%</td>
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<tr>
<td>Final Exam</td>
<td>15%</td>
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<tr>
<td>Group Cancer Project</td>
<td>25%</td>
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<tr>
<td>Outline</td>
<td>(5%)</td>
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<tr>
<td>Oral Presentation</td>
<td>(15%)</td>
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<tr>
<td>Written Report</td>
<td>(5%)</td>
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<tr>
<td>Participation/Discussion</td>
<td>20%</td>
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<tr>
<td>Canvas Discussions</td>
<td>(12%)</td>
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<tr>
<td>Class Participation/Journal Club</td>
<td>(8%)</td>
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HW (20x): 5 questions/assignment; 1 question = 2 points → 10 pts/assignment | [200 pts]
Midterm Exam: 10 questions/exam; 1 question = 10 points → 100 pts/exam

Final Exam: 15 questions/exam; 1 question = 10 points → 150 pts/exam

Group Project:
- Outline (5%) [50 pts]
- Oral Presentation (15%) [150 pts]
- Written Report (5%) [50 pts]

Participation/Discussion (Class Participation, Canvas & Journal Club Discussions):
- Canvas Discussions (12%) [120 pts]
- Class Participation/Journal Club (8%) [80 pts]

___________ = 1000 pts

Grade Distribution:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
<th>Points Range</th>
<th>Letter Grade</th>
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<tbody>
<tr>
<td>A+</td>
<td>97% - 100%</td>
<td>[970 pts – 1000 pts]</td>
<td>Pass</td>
</tr>
<tr>
<td>A</td>
<td>93% - 96%</td>
<td>[930 pts – 960 pts]</td>
<td>Pass</td>
</tr>
<tr>
<td>A-</td>
<td>90% - 92%</td>
<td>[900 pts – 920 pts]</td>
<td>Pass</td>
</tr>
<tr>
<td>B+</td>
<td>87% - 89%</td>
<td>[870 pts – 890 pts]</td>
<td>Pass</td>
</tr>
<tr>
<td>B</td>
<td>83% - 86%</td>
<td>[830 pts – 860 pts]</td>
<td>Pass</td>
</tr>
<tr>
<td>B-</td>
<td>80% - 82%</td>
<td>[800 pts – 820 pts]</td>
<td>Pass</td>
</tr>
<tr>
<td>C+</td>
<td>77% - 79%</td>
<td>[770 pts – 790 pts]</td>
<td>Pass</td>
</tr>
<tr>
<td>C</td>
<td>73% - 76%</td>
<td>[730 pts – 760 pts]</td>
<td>Pass</td>
</tr>
<tr>
<td>C-</td>
<td>70% - 72%</td>
<td>[700 pts – 720 pts]</td>
<td>Pass</td>
</tr>
<tr>
<td>D+</td>
<td>67% - 69%</td>
<td>[670 pts – 690 pts]</td>
<td>Fail</td>
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<tr>
<td>D</td>
<td>63% - 66%</td>
<td>[630 pts – 660 pts]</td>
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<tr>
<td>D-</td>
<td>60% - 62%</td>
<td>[600 pts – 620 pts]</td>
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</tr>
<tr>
<td>F</td>
<td>0% - 59%</td>
<td>[0 pts – 590 pts]</td>
<td>Fail</td>
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**Course Expectations**

**Homework (HW):** There are two types of homework sets in this course – lecture-based homework sets, consisting of 5 multiple-choice questions pertaining to a particular lecture, and journal article-based homework sets, consisting of 10 short-answer questions pertaining to an article from a scientific or medical journal. Lecture-based HW sets are assigned AFTER a given lecture is delivered and must be finished/submitted by the beginning of the next class period. Journal article-based HW sets are assigned BEFORE a given journal article discussion and must be finished/submitted by the start of the discussion period.

Each individual HW set is worth 1% of your overall grade. The top 20 HW sets will be counted (meaning, you can drop 4 HW sets), yielding 20% of your overall grade.

**Exams:** There are three open-book exams in this course – two midterms and a final. The midterm exams consist of 10 short-essay questions pertaining to lecture and journal article content. Midterm exam 1, administered on October 14 (from 6:30 – 8:30 pm), covers content from Sept. 15 – Oct. 8 and is worth 10% of your overall grade. Midterm
exam 2, administered on November 18 (from 6:30 – 8:30 pm), covers content from Oct. 15 – Nov. 12 and is worth 10% of your overall grade.

The cumulative final exam, consisting of 15 short-essay questions, will be administered on Jan. 8, 2021 (from 3:30 – 5:30 pm) and is worth 15% of your overall grade.

**Group Cancer Project:** There is a group cancer project in this course consisting of three components – an outline, oral presentation, and written report, worth 5%, 15%, and 5%, respectively (additively, 25% of your overall grade).

**I.** Each group must first choose a specific type of cancer from the list below for further study (due by Oct. 27):

- colon/rectal
- breast
- liver
- pancreatic
- lung
- skin: melanoma or non-melanoma
- prostate
- kidney
- lymphoma: Hodgkins or non-Hodgkins
- bladder
- thyroid
- leukemia
- endometrial
- stomach
- brain
- cervical
- penile
- bone
- oral
- throat
- head/neck
- ovarian
- testicular

(if a specific type of cancer is not listed here, please consult with the course master for approval).

*NOTE* Only one type of cancer can be presented in class (i.e., multiple groups can NOT present the same type of cancer). Cancer selections are first-come, first-served.

**II.** A cancer presentation outline must be completed by each group (due Nov. 24), outlining the contents of your oral presentation. Topics that must be outlined include molecular and cellular etiology (ex: mutations and cells affected), epidemiology (ex: incidence, distribution, and any health-related factors related to the prevalence of the disease), pathology (ex: which cells are affected, negative impact on human physiology or cellular processes, the presentation phenotype), diagnosis (ex: medical methodologies for screening/detecting the disease), and current/future treatment options (ex: currently-used therapies and future modes of treatment intervention).

Outline contents and specific cancer information must be backed by both primary (at least one) and secondary sources. Primary sources are materials that were created by people who witnessed or were involved in events first-hand. Examples of primary sources include: original research articles, newspaper reports (from reporters who witnessed an event or quoted people who witnessed/experienced an event), speeches or interviews, data sets, survey data (such as a census). Secondary sources are works that analyze, assess or interpret an event that was not witnessed first-hand. Secondary sources often utilize primary sources in their interpretation. Examples of secondary sources include: textbooks, journal review articles, documentaries, Wikipedia.

*NOTE* Only one copy of a group’s outline needs to be turned in. Each member of the group receives the same grade for the outline.

**Guidelines for writing an effective outline:**


**Cancer websites containing primary and secondary sources:**
III. An oral Powerpoint presentation 20 min in duration is to be delivered to the class (Dec. 15 & Dec. 17) covering the abovementioned outline topics for a selected cancer, followed by a 5 min question/answer session. Minimally, each member in the group is required to speak on at least one cancer topic (ex: epidemiology, pathology, treatment, etc.); it is the group’s decision as to how to allocate the various cancer topics to group members for the presentation (but all members must have a speaking role covering at least one distinct topic).

The oral presentation should address the following topics/questions:

**Etiology** – What is the disease (i.e, specific cancer)? What specific mutations or genetic errors are associated with this cancer? What cells are affected? Is there an overarching biochemical/molecular cause?

**Epidemiology** – Who is most susceptible to this cancer? How many people are afflicted? Are there any specific factors which affect the prevalence of this cancer (ex: hereditary, dietary, geographical, environmental)? Is the cancer transmissible?

**Pathology** – What cellular/physiological/biological processes are negatively impacted by this cancer? How is the cancer pathologically classified (i.e., biopsies and specific stainings)?

**Diagnosis** – Are there any specific screening techniques employed as a preventative measure (ex: colonoscopies for colon/rectal cancer)? How is the cancer officially diagnosed? Are there any available biomarkers that can be measured and used in screening or diagnosis?

**Treatment** – How is the cancer initially treated? Is there a sequence or chronology of treatment steps? Does treatment regimen change if the cancer reoccurs? Are there any experimental treatment options in the scientific pipeline or active clinical trials investigating a future therapeutic option?

**Research** (*BONUS*) – What is one of the current, pressing scientific questions pertaining to this cancer? Are there any interesting clinical trials or research studies involving this cancer? Are there any interesting/fascinating/famous people or stories involving this cancer, its treatment, or research?

*NOTE* Each member of the group receives the same grade for the oral presentation.

Guidelines for preparing and delivering an effective oral presentation:

https://www.e-education.psu.edu/styleforstudents/c7_p4.html
IV. A written report consisting of a presentation summary and peer review must be completed by each group (due Jan. 10 at 11:59 pm, CST). Each group will be assigned to report on another group’s cancer presentation. The written report consists of two parts – the presentation summary and peer review. The first section of the report must summarize key aspects from the five essential cancer topics (etiology, epidemiology, pathology, diagnosis, and treatment), highlighting the important points raised in the presentation. The second section of the report must provide honest feedback and assessment of a group’s presentation, evaluating such attributes as confidence, organization, clarity, timeliness, knowledge. Finally, at the end of the report, two multiple-choice-questions must be created (questions must contain four to five answer choices), drawing from key aspects of the presentation.

*NOTE* Only one copy of a group’s report needs to be turned in. Each member of the group receives the same grade for the report.

Guidelines for writing an efficient report and effective multiple-choice-questions:
https://cft.vanderbilt.edu/guides-sub-pages/writing-good-multiple-choice-test-questions/

Participation & Discussion: Class points are awarded to encourage active student engagement & dialogue.

-Participation: Class participation is encouraged and expected throughout lectures, group activities, and journal club discussions. The instructor's role during activities and discussions is that of a moderator. Participation should not be dependent on “right” or “wrong” answers, rather, on thoughtful contributions which constructively advance the level and depth of discourse (and this includes questions – asking questions is helpful for all participants in the class). Students will be awarded a perfect score (80 points) as long as they frequently arrive to class on time and actively contribute to class lectures, discussions, and activities.

-Discussion: A Canvas discussion board will be opened every few weeks for active student participation (6 discussion boards in total). There will be a question prompt which students must address on their own; once answered, the discussion board opens for inter-student communication. Students must intellectually respond to at least one other student posting, with careful thought and reflection. As before, student contributions should not be dependent on “right” or “wrong” answers, rather, on contributions which constructively advance the level and depth of discourse.

Each discussion board is worth 20 points. Students will be awarded a perfect score (120 points) as long as they provide contemplative, thoughtful responses to each discussion prompt as well as engage constructively with at least one other member in the class for each discussion board.
Class Schedule

Sept. 15: Introduction – What is Cancer

Lecture Topics: History of Cancer; Major Causes/Risk Factors; Hallmarks
Supplemental Reading: Pecorino 2 – 13
Discussion: Why Cancer?
Assignment Due: None

Sept. 17: Molecular Features of a Normal Cell I

Lecture Topics: Hydrophilicity vs Hydrophobicity; Bonds within DNA; DNA Structure
Supplemental Reading: Sadava et al. 66 – 69; 270 – 274
Assignment Due: Homework #1

Sept. 22: Molecular Features of a Normal Cell II

Lecture Topics: DNA Replication & Enzymes Involved; Leading vs Lagging Strand Synthesis; Fidelity
Supplemental Reading: Sadava et al. 274 – 281
Assignment Due: Homework #2

Sept. 24: Molecular Features of a Normal Cell III

Lecture Topics: RNA Structure & Transcription; Gene Regulation; Post-transcriptional Processing
Supplemental Reading: Sadava et al. 293 – 294; 298 – 301 342 – 345
Assignment Due: Homework #3

Sept. 29: Molecular Features of a Normal Cell IV

Lecture Topics: Degeneracy of Genetic Code; Translation; Chaperones
Supplemental Reading: Sadava et al. 301 – 307
Assignment Due: Homework #4

Oct. 1: DNA in the Nucleus

Lecture Topics: DNA Packaging; Histone Modifications; Chromosomes & Karyotypes
Supplemental Reading: Pecorino 61 – 62
Assignment Due: Homework #5

Oct. 6: Cancer Genetics & Tumorigenesis

Lecture Topics: Temporal Pattern of Tumorigenesis; Oncogenes & Tumor-Suppressor Genes
Supplemental Reading: Pecorino 89; 128-129; Sadava et al. 248 – 250
Discussion: Mouse Models for Cancer Research
Assignment Due: Homework #6
Oct. 8: Genetic Damage & Repair

Lecture Topics: Mutations; Types of DNA damage; DNA Repair Pathways

Supplemental Reading: Pecorino 24 – 43

Assignment Due: Homework #7

Oct. 13: Mutagens/Carcinogens

Lecture Topics: Mutagens & their Effects on DNA; Mitigation Efforts

Supplemental Reading: Pecorino 27 – 38

Assignment Due: Homework #8

Discussion: Carcinogens in Society

Oct. 14: MIDTERM EXAM {scheduled from 6:30 – 8 pm}

Oct. 15: Journal Club – Xeroderma Pigmentosum


Assignment Due: Homework #9 (journal article write-up)

Oct. 20: Cell Cycle

Lecture Topics: Cell Cycle Stages; Cyclins, CDK’s & CDK Inhibitors; Checkpoints & R-Point; pRb & E2F

Supplemental Reading: Pecorino 109 – 120

Assignment Due: Homework #10

Oct. 22: Cancer Hallmark: Sustained Proliferation

Lecture Topics: Signal Transduction; Growth Factors & their Receptors; Ras Signaling

Supplemental Reading: Pecorino 80 – 97

Assignment Due: Homework #11

Oct. 27: Cancer Hallmark: Evasion of GrowthSuppressor Signals

Lecture Topics: Growth Factor Signal Termination; Guardian of the Genome (p53) & its Mutations

Supplemental Reading: Pecorino 128 – 145

Assignment Due: Homework #12; Group Cancer Project – Cancer Type

Oct. 29: Cancer Hallmark: Replicative Immortality

Lecture Topics: Telomeres; End-replication Problem; Senescence/Crisis; Telomerase Reactivation

Supplemental Reading: Pecorino 70 – 72

Discussion: Is too much Telomerase a Good Thing?

Assignment Due: Homework #13
Nov. 3: Cancer Hallmark: Resistance to Cell Death
   Lecture Topics: Intrinsic and Extrinsic Apoptotic Pathways; Mutations Affecting Apoptosis Susceptibility
   Supplemental Reading: Pecorino 155 – 169
   Assignment Due: Homework #14

Nov. 5: Cancer Hallmark: Altered Metabolism
   Lecture Topics: Energy in Metabolism; Stages of Aerobic vs. Anaerobic Cellular Respiration; Warburg Effect
   Supplemental Reading: Pecorino 258 – 259
   Assignment Due: Homework #15

Nov. 10: Cancer Hallmark: Induction of Angiogenesis
   Lecture Topics: Blood Supply; Angiogenic Factors; Cancer Subversion
   Supplemental Reading: Pecorino 228 – 236
   Assignment Due: Homework #16

Nov. 12: Introduction to the Immune System
   Lecture Topics: Intro to Immunology; Innate vs Adaptive Immunity; Overview of Immune Cells & Function
   Supplemental Reading: Sadava et al. 868 – 885
   Assignment Due: Homework #17

Nov. 17: Cancer Hallmark: Metastasis
   Lecture Topics: Tissue Architecture; EMT Transition; Cancer Morphology & Invasion Mechanisms
   Supplemental Reading: Pecorino 205 – 219
   Assignment Due: Homework #18
   Discussion: Mutations & Precision Medicine

Nov. 18: MIDTERM EXAM {scheduled from 6:30 – 8 pm}

Nov. 19: Cancer Hallmark: Avoiding Immune Destruction
   Lecture Topics: Downregulation of Tumor Antigens, Immune Suppression, Cytotoxic Resistance
   Supplemental Reading: Pecorino 279 – 286
   Assignment Due: Homework #19; Group Cancer Project – Cancer Presentation Outlines

Nov. 24: Journal Club – Immune System Checkpoint Drugs
   Assignment Due: Homework #20 (journal article write-up)

Nov. 26: Thanksgiving Break
Dec. 1: Personalized Medicine & “Omics” Technologies
Lecture Topics: Overview of Personalized Medicine & Genomics Technology; Biomarkers
Supplemental Reading: Pecorino 17 – 18; 327 – 329; 345 – 346
Assignment Due: Homework #21

Dec. 3: Cancer Imaging and Treatment I
Lecture Topics: History & Evolution of Cancer Treatment; Standard & New Therapies; Prognosis for Cure
Supplemental Reading: Pecorino 13 – 15; 43 – 48; 236 – 242; 286 – 298
Assignment Due: Homework #22
Discussion: Move Over Cancer, COVID-19 is Here!

Dec. 8: Cancer Imaging and Treatment II
Lecture Topics: History & Evolution of Cancer Treatment; Standard & New Therapies; Prognosis for Cure
Supplemental Reading: Pecorino 13 – 15; 43 – 48; 236 – 242; 286 – 298
Assignment Due: Homework #23

Dec. 10: Guest Lecture – Cancer and the Future of a Cure {Dr. Michael Kinch}
Guest Lecturer Profile:
Assignment Due: Homework #24

Dec. 15: Guest Lecture – The Challenges of Oncological Patient Care during the COVID19 Pandemic {Dr. Hiram Gay, Dr. Abby Green, Dr. Jessica Vanderlan}
Guest Lecturer Profiles:
https://radonc.wustl.edu/people/hiram-a-gay-md/
http://news.peds.wustl.edu/faculty-feature-abby-green/
https://siteman.wustl.edu/vanderlan-named-manager-of-siteman-psychology-service/

Dec. 17: Student Presentations
Assignment Due: Group Cancer Project – Oral Presentations
Assignment Due: Group Cancer Project – Cancer Reports (due by Jan. 10, 11:59 pm, CST)

Jan 2021: TAKE HOME FINAL EXAM
Course Policies

**Safe Educational Environment:** The best learning environment is one in which all members feel respected while being productively challenged. At Washington University in St. Louis, we are dedicated to fostering an inclusive atmosphere, in which all participants can contribute, explore, and challenge their own ideas as well as those of others. Every participant has an active responsibility to foster a climate of intellectual stimulation, openness, and respect for diverse perspectives, questions, personal backgrounds, abilities, and experiences, although instructors bear primary responsibility for its maintenance.

A range of resources is available to those who perceive a learning environment as lacking inclusivity, as defined in the preceding paragraph. If possible, we encourage students to speak directly with their instructor about any suggestions or concerns they have regarding a particular instructional space or situation. Alternatively, students may bring concerns to another trusted advisor or administrator (such as an academic advisor, mentor, department chair, or dean). All classroom participants—including faculty, staff, and students—who observe a bias incident affecting a student may also file a report (whether personally or anonymously) utilizing the online Bias Report and Support System (https://diversityinclusion.wustl.edu/brss/).

**Respect for Teaching Assistants, Guest Lecturers, and Fellow Students:** Students in this course are expected to treat teaching assistants, guest lecturers, and fellow students with the highest level of respect. Any violation of this standard jeopardizes the learning environment for the entire class and will not be tolerated. It is expected that each of us will intervene and speak up if we believe that anyone in the class is showing disrespect to another.

**Undergraduate Student Academic Integrity:** Students in this course are expected to comply with the Washington University Undergraduate Student Academic Integrity Policy. Violations of this policy include plagiarism, cheating on exams or quizzes, and other forms of deceit, dishonesty, or inappropriate conduct. Students are expected to read the details of the academic integrity policy: (https://www.wustl.edu/policies/undergraduate-academic-integrity.html). Students who violate this policy will be referred to the Academic Integrity Policy Committee. Penalties for violating the policy will be determined by the Academic Integrity Policy committee, and can include failure of the assignment, failure of the course, suspension or expulsion from the University.

**Technology:** The use of laptops or tablets in class is permitted in order to take notes or consult online readings. However, any other use of these devices is strictly prohibited. Cell phones are not to be used and should be muted or powered down upon entering class. Repeatedly violating this policy will negatively impact your ability to achieve a passing grade.

**Intellectual Property, Copying, & Recording:** Taking written notes is encouraged but recording in the classroom is prohibited unless advance written permission is obtained from the instructor. Recording means a video or audio replication or photographic image recorded on devices, including, but not limited to, audio recorders, video recorders, cell phones, smartphones, digital cameras, media players, computers, tablets, or other devices that record images or sound. Students who require recording or other adaptations of lectures as a reasonable accommodation for a disability should contact the Disability Resource Center (https://students.wustl.edu/disability-resources/; 314-935-5970) in advance of the lecture in order to obtain permission for the recording. Permission to allow a lecture recording is not a transfer of any copyrights in the recording or related course materials. Such recordings and materials may be used only for studying by students enrolled in the class, and may not be shared, reproduced, transferred, distributed, or displayed in any manner, public or commercial. Students must destroy all recordings at the end of the semester in which they are enrolled in the class. Violations of this policy may constitute copyright infringement in violation of federal or state law, and may be subject to University disciplinary action.

**Late Assignments:** Lecture-based homework (HW) sets are assigned AFTER a given lecture is delivered and must be finished/submitted by the beginning of the next class period. Late lecture-based HW sets result in a grade reduction – 3 points lost if 1 – 24 h late, 6 points lost if 24 – 48 h late, or 10 points lost if > 48 h late.
Journal article-based HW sets are assigned BEFORE a given journal article discussion and must be finished/submitted by the start of the discussion period. Since answers to journal article-based HW sets are revealed during the class discussion period, NO POINTS WILL BE AWARDED IF THESE HW SETS ARE TURNED IN LATE.

Late cancer outlines or written reports (group project) will result in a grade reduction – 15 points lost if 1 – 24 h late, 30 points lost if 24 – 48 h late, or 50 points lost if > 48 h late.

Oral cancer presentations must be delivered to the class on Dec. 17. DUE TO END-OF-THE-SEMESTER SCHEDULING, NO POINTS WILL BE AWARDED IF A GROUP IS UNABLE TO PRESENT AT THEIR DESIGNATED TIME.

Missed Exam: The syllabus includes the dates of the midterm exams (Oct. 14, 6:30 – 8:00 pm; Nov. 18, 6:30 – 8 pm), at which attendance is mandatory. No makeup exams will be allowed without a justifiably valid and documented absence (ex: illness documented by a physician, a family crisis such as a death or hospitalization). If an excuse for missing an exam is deemed valid by the course master, then a makeup exam will be allowed during finals week at the end of the semester.

Resources for Students

Disability Resources: If you have a disability that requires an accommodation, please speak with the instructor and consult the Disability Resource Center (https://students.wustl.edu/disability-resources/; 314-935-5970). Disability Resource Center staff will determine appropriate accommodations and will work with the instructor to ensure such accommodations are made available.

Writing Assistance: For additional help with writing, consult the expert staff of The Writing Center (writing@wustl.edu; 314-935-4981) in Mallinckrodt Center (first floor). It can be enormously helpful to ask someone outside a course to read and look over a student’s essay or paper to provide feedback on strength of argument, clarity, organization, etc.

Speaking Assistance: For additional help with public speaking and oral presentations, consult the expertise of Mr. Steve Pijut, Associate Director of The Writing Center (sapijut@wustl.edu; 314-935-4981) in Mallinckrodt Center (First floor). Mr. Pijut developed and serves as the primary contact of The Speaking Studio, a service of The Writing Center, providing free, one-on-one tutoring for any member of the Washington University community for any public speaking project. The Speaking Studio helps speakers at any stage of the process, from generating ideas to developing a speaking outline to planning visual aids. Speakers can also practice their presentations with a trained tutors serving as their audience. Speakers are welcome to bring in any work in progress, including class assignments, conference papers, and presentations for student groups.

Accommodations based upon Sexual Assault: The University is committed to offering reasonable academic accommodations to students who are victims of sexual assault. Students are eligible for accommodation regardless of whether they seek criminal or disciplinary action. Depending on the specific nature of the allegation, such measures may include but are not limited to: implementation of a no-contact order, course/classroom assignment changes, and other academic support services and accommodations. If a student needs to request such accommodations, please direct the request to Ms. Kim Webb (kim_webb@wustl.edu; 314-925-8761), Director of the Relationship and Sexual Violence Prevention Center. Ms. Webb is a confidential resource; however, requests for accommodations will be shared with the appropriate University administration and faculty. The University will maintain as confidential any accommodations or protective measures provided to an individual student so long as it does not impair the ability to provide such measures.

If a student comes to me to discuss or disclose an instance of sexual assault, sexual discrimination, sexual harassment, dating violence, domestic violence or stalking, or if I otherwise observe or become aware of such an allegation, I will keep the information as private as I can, but as an employed member of Washington University, I am required to immediately report it to Ms. Jessica Kennedy, the University’s Title IX Coordinator. If a student would like to speak with the Title IX Coordinator directly, Ms. Kennedy can be reached at jw kennedy@wustl.edu; 314-935-
3118 or by visiting her office in the Women's Building. Additionally, a student can report incidents to the Washington University Police Department (314-935-5555) or a local law enforcement agency.

A student can also speak confidentially and learn more about available resources at the Relationship and Sexual Violence Prevention Center by calling 314-935-8761 or visiting the 4th floor of Seigle Hall.

**Mental Health:** Mental Health Services’ professional staff members work with students to resolve personal and interpersonal difficulties, many of which can affect the academic experience. These include conflicts with or worry about friends or family, concerns about eating or drinking patterns, and feelings of anxiety and depression. Please consult/contact the Habif Health & Wellness Center for more information/support (shs.wustl.edu/MentalHealth; 314-935-8515).

**Disclaimer**

The instructor reserves the right to make modifications to this information throughout the semester.
Tips for Success

In order to be best prepared and successful in class, time is required outside of the classroom. College courses will require more than just attending class, taking notes, and regurgitating information on exams. Please consider the following tips for this class as well as others during your time here at Washington University:

- **Pre-reading/Previewing:** Looking over lecture slides and supplemental readings before coming to class can result in a more active approach to listening and note-taking during lectures. Even spending 15-30 min on the next upcoming lecture can enhance a student's attention and understanding during the delivery of that lecture in class.

- **Note-Taking:** Pay attention, think during class, and do NOT write down every word spoken by the instructor. Although this advice seems obvious, many students do not practice this, instead furiously writing every word spoken, unable to critically process and comprehend lecture content. Pre-reading/previewing can help you become a more engaged, active listener, helping you be a more selective, effective note-taker and listener.

- **Questions:** Ask questions! Please do not feel awkward or embarrassed to ask questions during class or discussion sessions (chances are there are other students wondering the same thing). Interacting with instructors or TA’s in this way is a great way to build rapport while learning in the process.

- **Study Periods:** Students retain information more effectively if studying for short periods of time several times per week rather than one long study session before the upcoming test/exam. For example, educational studies have revealed it is far more effective to study 30 min every night vs a single 4-hr study session once per week.

- **Study Products:** Studying that simply involves reading over your notes after a lecture is termed “passive studying” and not conducive for long-term comprehension and success. Educational studies have shown that students who “actively study” perform much better on tests and enhance their long-term understanding and recall of material. Active studying refers to active engagement with your notes, so that students do not simply re-read or re-write your notes after class, rather, students use their notes as a template to create study products. Study products are tools created by students (using their notes and learning objectives from a class) to help them effectively study and efficiently prepare for tests/exams long after a lecture has been delivered. Examples of study products include items like flash cards, diagrams, concept maps, drawings, flowcharts, organized outlines, pictures, stories.

- **Learning Objectives:** Learning objectives are important topics/concepts/ideas instructors wish to impart to students during classes. These should not be ignored, as test and exam questions will focus on these main objectives. Students can even use them as practice questions – can I provide answers to these learning objectives?

- **Group Studying:** A combination of solo studying and group study has proven to be most effective in many of the STEM (science, technology, engineering, mathematics) classes here at Wash U. Group studying allows students to process information in different ways, understand material in different terms, and provides opportunities to explain concepts/ideas to fellow peers, which often enhances comprehension and retention. ADDED BONUS – you get to make more friends and have fun with the material!

- **Practice Problems:** One of the strongest predictors for student success in professional education (ex: medical school) is practice questions. The more you can incorporate practice questions into your study routine, the better off you are likely to be in the class. Practicing application of concepts using practice problems is one of the best ways to ensure you fully understand and comprehend the material. If a class provides practice problems, DO THEM after studying the material. If a class does not supply practice problems, there are plenty of internet sources for these in most academic disciplines.
• **Discussion Sessions:** Discussion/help/resuscitation sessions are provided as an additional academic resource to better ensure student success. Please make great use of these sessions as they are tailored to student discussion and understanding of class material. These sessions are frequently taught by senior undergraduate or graduate students with valuable experience in the coursework. Also, these sessions often include problems in which students work out the answers together to best ensure comfort and understanding of the material. ADDED BONUS – you also get to interact with upper-class students who can help answer not only class-related questions but also questions related to their journey through Wash U.

• **Office Hours:** Please make use of office hours, as this is a more personalized environment to interact with instructors, to clarify concepts, build your understanding of the material, and (again) build rapport. ADDED BONUS – the more you engage instructors during office hours or before/after class, building a mutual understanding and growing the student-faculty relationship, the more likely the instructor can write you a strong, personalized letter of recommendation for your future applications (study abroad, professional school, internship, job, etc.).

• **Test Taking:** Taking tests can be a stressful endeavor for college students, especially when a course has only a few high-stakes exams that largely determine a student’s final performance grade. Also, in college, many courses employ tests/exams containing MCQ’s, multiple-choice questions. While getting restful sleep and eating a nutritious meal before a test can help minimize stress and enhance student endurance and memory recall, there are additional strategies students can employ when dealing with tests possessing MCQ’s – (1) Read questions carefully (rephrase in your own words); (2) Don’t assume facts given or not given in the question; (3) Skip hard questions and return to them if you have time; (4) Don’t dwell on what you don’t know (think about what you do); (5) Try to answer the question before reading answer choices; (6) Read answer choices carefully, ruling out as you go; (7) Don’t second-guess/change answers without good reason.