

**BI490 Codes, Mixed Messages and Cellular Chaos:  
Nucleic Acids in Cancer Progression, Diagnostics, and Treatment**

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**Professors' office hours:** Tuesdays and Thursdays, 5:30-6:30 pm, Dane 211

**Course meeting times:** Tuesdays and Thursdays, 4:00-5:30 pm, Dane 211

**Course format:** Lectures supplemented with interactive classroom activities. In addition to providing an introduction to cancer biology, this course will also introduce students to reading, synthesizing and analyzing scientific literature.

**Course objectives:**

The major objective of the course is to understand that many biological factors can contribute to diseases, and that many diseases begin with problems in human DNA/RNA. To illustrate this, we will spend the semester discussing cancer, often in the context of nucleic acids.

Biology Program Goals:

The curriculum of the Biology Department at PMC aims to accomplish the following educational goals:

**1) A mastery of the content of the core and elective courses.**

This goal will be addressed through various in-class and homework assignments and Sequenced Writing Assignments I-VIII, which require the knowledge of molecular, cellular, and cancer biology acquired in the course. Mastery of specific course content will be assessed in weekly cumulative quizzes.

**2) The ability to write in the language of science, through specific writing assignments.**

This goal will be addressed throughout the course in various homework assignments and will be specifically assessed in Sequenced Writing Assignments I-VIII.

**3) An understanding of the methodology of science research.**

This goal will be addressed in the reading and analysis of primary scientific literature throughout the course, but specifically during the two Primary Literature Reading Days. Students' understanding of correct research methodology will be assessed in Sequenced Writing Assignments V (evaluation and interpretation of scientific data) and VI (generation of new research questions).

**4) Ability to access research literature and analyze the validity of these materials.**

This goal will be addressed throughout Sequenced Writing Assignments I-VI. Students will be taught where and how to search for primary and secondary scientific sources and how to evaluate the validity of these sources during the Library Research Day. Students' ability to find and utilize valid sources will be specifically assessed in Sequenced Writing Assignments I-VI.

**5) Ability to think and reason quantitatively.**

This goal will be addressed in the reading and analysis of primary scientific data, which will occur during the two Primary Literature Reading Days and in-class activities and discussions. Homework, in-class assignments, and Sequenced Writing Assignments V and VI will be used for assessment.

**6) Ability to problem-solve and utilize critical reasoning skills.**

This goal will be addressed in the critical analysis of scientific data in the Primary Literature Reading Days, throughout the Sequenced Writing Assignments, and in various in-class activities, but it will be specifically assessed in Sequenced Writing Assignments II, IV, and V (critical/comparative analyses).

General Knowledge Objectives:

- 1) To understand that nature consists of careful balances and that misregulation of fundamental cellular processes leads to a disease phenotype.
- 2) To understand that cancer is a multi-faceted disease; thus cancer research and treatment must also be multi-faceted.
- 3) To understand nucleic acid biology and its potential roles in disease progression and in therapeutics.

Specific Objectives:

- 1) Define “tumor suppressor genes” and “oncogenes” and explain their roles in the context of cell cycle regulation.
- 2) Define the structure of DNA and the structure(s) of damaged DNA; describe the basic mechanisms of genotoxic stress, how they can lead to DNA damage, and how such damage is normally repaired by the cell.
- 3) Define “mutation” and describe the major classes of mutations; explain how accumulation of genetic mutations leads to a cancer phenotype.
- 4) Identify foreign agents (such as viruses) associated with cancer formation and describe the mechanisms by which they can promote the development of cancer.
- 5) Compare/contrast the molecular basis of genetic signatures and expression profiling in cancer diagnostics.
- 6) Identify and describe current cancer treatments, including gene therapy and RNA interference, and compare/contrast the molecular bases of these treatments.
- 7) Use your basic knowledge of nucleic acid biology and the molecular basis of cancer to read and critically analyze primary scientific literature on these topics.
- 8) Write a comprehensive and critical analysis of the molecular basis of a particular cancer and its treatment based on readings of primary and secondary scientific literature and present these findings to a general audience.

**Course Website:** <http://biology490.googlepages.com>

This site contains a copy of the course syllabus, .pdf files of relevant reading materials, and course announcements. Be sure to check it frequently!

**Textbook:** Kleinsmith, Lewis J. (2006). Principles of cancer biology. San Francisco: Pearson Benjamin Cummings. Please speak to one of the instructors if purchasing this textbook presents an overwhelming financial burden. Additional copies of this text are on reserve in the Annenberg Library.

Course overview

In order to address the objectives of the course outlined on Page 2 of the syllabus, the course will progress through the following five general topics:

**(I) Introduction to cancer as a multi-faceted disease**

**(II) Nucleic acids as CAUSES of cancer**

**(III) Nucleic acids as BIOMARKERS of cancer**

**(IV) Nucleic acids as TREATMENTS for cancer**

**(V) Special topics in cancer and nucleic acid biology**

Final grade calculation

Weekly quizzes	25%
Class participation	10%
Sequenced writing assignment	50%
Homework assignments	15%

Grading Scale

A	93-100	C	73-76
A-	90-92	C-	70-72
B+	87-89	D+	67-69
B	83-86	D-	63-66
B-	80-82	D-	60-62
C+	77-79	F	≥ 59

**Quizzes:** Weekly quizzes will be given at the beginning of each Tuesday's class. These quizzes will be cumulative. Quizzes will start exactly at 4:00 pm each Tuesday throughout the course. Students must show up on time; no time extensions will be permitted. There will be no make-up quizzes; each student's lowest quiz grade during the course of the semester will be dropped when calculating their final grade.

**Attendance and punctuality in lecture:** Due to the large amount of material being covered in this course, with a fair amount of the information being covered only during class sessions, attendance in lecture is essential for succeeding in BI490. In-class assignments will be given frequently, and no make-ups of these assignments will be allowed. For these same reasons, you are expected to show up for class on time.

**Sequenced writing assignment on cancer:** Throughout the semester, students will be developing information literacy by researching a specific cancer using primary and secondary literature, as well as web and encyclopedic resources. See separate handout for more details regarding this semester-long assignment.

<u>Breakdown of the writing assignment</u>	<u>% of Writing Grade</u>
I. Blog entry (5 paragraphs)	5%
II. Blog commentary (3 paragraphs)	5%
III. Short paper on epidemiology, genetic, and environmental causes of chosen cancer (3 pages)	15%
IV. Cancer website critique (5 paragraphs)	10%
V. Compare/contrast on two primary articles on related to chosen cancer (5 paragraphs)	15%
VI. Molecular biology research paper (5 pages)	20%
VII. Brochure/poster	20%
VIII. Final combined paper (10-12 pages)	10%

**Homework:** Homework assignments will be given frequently throughout the course. These assignments will fall into one of two categories – 10 pt assignments (e.g., reading comprehension questions) and 100 pt assignments (e.g., larger, more time-consuming activities). The top of each homework assignment will be labeled with one of these point values. All homework must be turned in on the specified due date, which will also appear at the top of each assignment.

**Late policy:** For the sequenced writing assignment, late papers will be accepted, but the grade of each assignment will be penalized 1-letter grade per 24 hours that the assignment is tardy. For homework assignments, no late work will be accepted.

**Special circumstances:** If there are special circumstances, such as illness or other form of emergency, that should be taken into account with regard to any of the stated class policies, please inform one of the course instructors as soon as possible so that alternative arrangements can be made.

**Students needing additional help:** Please do not hesitate to speak with either of the instructors if you have a documented learning issue, if English is not your native language, if you have a learning style of which you would like us to be aware, or if you are experiencing any difficulties in the course. Students with learning needs should also speak with Mary Walsh (617-731-7181), Director of the Learning Resource Center.

**Academic ethics and integrity policy**

From the Student Handbook, pgs 29-31:

“Cheating and plagiarizing the work of others are serious offenses that undermine the spirit of truth in all areas of college life.”

Please read this section of the handbook carefully. Any student who has cheated on an assignment or quiz will receive a “0” and there will be no opportunity to make-up this work or retake the quiz. Cheating will be reported to the academic ethics committee on campus.

For writing assignments, please note the following definition of “plagiarism,” also listed in the Student Handbook (pg 29):

“Plagiarism is intentionally or unintentionally using someone else’s words or thoughts, without giving proper credit.”

It is essential that you abide by the following code of conduct in all of your writing assignments for this course:

1. A direct quotation must be acknowledged and documented.
2. The source of all paraphrased or summarized materials must be cited.
3. Work of others, even in the form of ideas, must be acknowledged. (This includes data of any kind, graphs, illustrations, etc.)
4. False or misleading citations of sources is considered plagiarism.

Again, please read this section of the Student Handbook very carefully. This matter will also be addressed in the first day of class.

### **Learning outcomes**

The assignments and activities associated with this course contribute to the following learning outcomes of the Portfolio Learning Program:

- Outcome 1: Effective communication
- Outcome 2: Critical thinking
- Outcome 6: Depth of knowledge
- Outcome 7: Oral communication
- Outcome 9: Application of knowledge

**Course Schedule (subject to change)**

(Week) Days	Lecture	Lecture Topic	Activity	Kleinsmith Chapters	Homework (before class)	Sequenced Writing Due
(1) Jan 15	1	Introduction				
Jan 17	2	Introduction	Case study	Ch. 1		
(2) Jan 22	3	Cell Cycle/ Growth Factors/ Signaling	<b>Quiz</b>	Ch. 2		
Jan 24	4	Oncogenes	**Both days: Individual mtgs w/Profs in office hours	Ch. 9		
(3) Jan 29	5	Cell Cycle Regulation	<b>Quiz</b>	Ch. 2, 10		
Jan 31	6	Tumor Suppressors		Ch. 8, 10		
(4) Feb 5	7	Primary Literature Day 1	<b>Quiz</b>			
Feb 7	8	Library Day	Library day			
(5) Feb 12	9	DNA replication	<b>Quiz</b>	Ch. 2		
<b>*Feb 13</b>						<b>Wed, 2/13 4pm: A1 Blog post</b>
Feb 14	10	DNA repair	Course Evaluation I	Ch. 2, 10		
(6) <b>*Feb 18</b>						<b>Mon, 2/18 4pm: A2 Blog comments</b>
Feb 19	11	Mutagens	<b>Quiz</b>	Ch. 5		
Feb 21	12	Hallmarks of Cancer				
(7) Feb 26	13	Noncoding DNA	<b>Quiz</b> Sign-up office hours	TBA		
Feb 28	14	miRNA		TBA		
<b>*Feb 29</b>						<b>Fri, 2/29 4pm: A3 Short paper</b>
(8) Mar 4	15	Viruses & cancer	<b>Quiz</b> Sign-up office hours	Ch. 7		
Mar 6	16	Viruses & cancer		Ch. 7		
<b>*Mar 7</b>						<b>Fri, 3/7 4pm: A4 Short paper</b>

<b>(9)</b>		<b><u>SPRING BREAK</u></b>					
<b>(10)</b> Mar 18	17	Biomarkers	<b><u>Quiz</u></b>	Ch. 11			
Mar 20	18	Primary Literature Day 2					
<b>(11)</b> Mar 25	19	Biomarkers	<b><u>Quiz</u></b>	TBA		<b>Tue, 3/ 25 in class: A5 Short paper</b>	
Mar 27	20	Biomarkers	Course evaluation II	TBA			
<b>(12)</b> Apr 1	21	Peer review - A6	<b><u>Quiz</u></b>			<b>Tue, 4/1 in class: A6 draft (Short paper)</b>	
Apr 3	22	Cancer treatments		Ch. 11			
<b>(13)</b> Apr 7						<b>Mon, 4/7 4pm: A6 Short paper</b>	
Apr 8	23	Cancer treatments	<b><u>Quiz</u></b>	Ch. 11			
Apr 10	24	Novartis field trip	Field trip	TBA			
<b>(14)</b> Apr 14						<b>Mon, 4/14 4 pm: A7 draft (brochure)</b>	
Apr 15	25	Cancer treatments	<b><u>Quiz</u></b>	TBA			
Apr 17	26	Special topics		TBA			
<b>*Apr 18</b>						<b>Fri, 4/18 4pm: A7 Poster and Brochure</b>	
<b>(15)</b> Apr 22	27	<b><u>HEALTH FAIR</u></b>	<b><u>HEALTH FAIR</u></b>	<b><u>HEALTH FAIR</u></b>		<b><u>HEALTH FAIR</u></b>	
Apr 24	28	Special topics and reflection	<b><u>Quiz</u></b> Course Evaluation III				
<b>*Apr 25</b>						<b>Fri, 4/25 4pm: A8 Final Paper</b>	