

## Biotechnology in Food and Medicine

ISB204 Section 2 Spring Semester 2007

Lectures: Monday and Wednesday 3:00-4:20 room A149 Plant and Soil Sciences

Web Site: ANGLE – <http://angel.msu.edu>

Homework: LON-CAPA - <http://loncapa.msu.edu>

Instructor: Dr. Jon Stoltzfus

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**Course Rationale:** Modification of living cells to create products and treat disease has brought ideas from science fiction movies and cutting edge research laboratories into everyday life. This course will increase your understanding of how science works and prepare you to carry out intelligent debates and make informed decisions concerning the use of these technologies in society.

**Course Goals:** After successfully completing this course, you will be able to:

- 1) explain the scientific method
- 2) explain basic concepts in classical and molecular genetics
- 3) evaluate the scientific merit of claims made by the popular press
- 3) discuss issues related to the use of biotechnology in food and medicine
- 4) evaluate the pros and cons of utilizing biotechnology in agriculture and medicine based on reasoned assessment of the issues

The use of biotechnology in food and medicine covers a vast array of material. This class will focus on the following subjects.

- Genetically Modified Plants
- Food Labeling & Safety
- Stem Cells
- Cloning
- Genetic Disorders
- Genetic Testing
- Gene Therapy

Please note that the exact material covered may be modified based on your input as the class progresses.

**Course Format:** This course includes readings, LON-CAPA homework, lectures, classroom activities, two short papers, and exams. The readings and homework will provide background information and reinforce concepts from previous classes. The lectures will build on this information. Therefore, it is important to complete the reading and homework prior to lecture. Classroom activities are designed to help reinforce and broaden your understanding of the topics. The writing assignments will provide practice evaluating scientific claims made in the popular press. Quizzes and exams will cover material from readings, homework, lectures, and classroom activities.

**Classroom Policies:** The purpose of these policies is to provide an equitable and hospitable learning environment to all students.

### **Attendance**

Attendance is not required. However, 50 points of your final grade are based on classroom activities that cannot be made up. In addition, correctly answering questions during lecture using an i-clicker will allow you to earn up to 5 bonus points on each exam. In the event of a documented, extended illness, please see the instructor for accommodations.

### **Respect for Others**

Talking during lecture, coming to class late or leaving early, or other activities that disturb students and hinder learning will not be tolerated. If you disturb the classroom, you will not receive credit for classroom exercises done on that day. If the problem persists, you will not be allowed to attend lectures but will be allowed to complete all LON-CAPA homework, writing assignments, and exams.

### **Academic Honesty**

You are expected to follow Michigan State University's guidelines on Academic Honesty. Cheating, plagiarism, and any other form of academic dishonesty will result in a grade of zero (0) on that assignment and possibly for the class. For more information on your rights and responsibilities please visit the ombudsman web site at <http://www.msu.edu/unit/ombud/>.

Working together on LON-CAPA homework is encouraged. You may use the discussion board to ask question, help other students find answers, and discuss why you think an answer is correct or incorrect. Copying your answers and posting them is not allowed and will result in loss of discussion board privileges. You must complete and submit the problems while logged into LON-CAPA with your MSU username to receive credit.

The written papers are individual efforts. These papers do involve some group work and naturally some papers will have ideas and references in common. However, copying of large phrases and complete sentences is **NOT ACCEPTABLE** and will be treated as academic dishonesty. If you write the papers yourself and follow the guidelines for source citation and paraphrasing discussed in class, you will not encounter difficulties.

Classroom activities are clearly defined as group or individual. During group activities you are encouraged to work together and share information. During individual activities sharing of information is academic dishonesty and will result in a grade of zero (0) for that activity.

**Text Books and Readings**

Required texts for this class are *Biology: A Brief Guide to Biology with Physiology* 1<sup>st</sup> Edition by David Krogh and *The Prentice Hall Guide to Research Navigator* that should come packaged with the Krogh text. There will also be readings from other sources. These are listed in the course schedule and are found on the [LON-CAPA](#) web site. You are expected to carefully read and take notes on this material before you come to each class.

**i-clickers**

Electronic classroom response pads are part of the instruction in this course. While these pads are not required, they can help you to gain a better understanding of the material and help me assess how well you grasp material so I can modify the course to best meet your needs. You can earn up to 5 bonus points on each exam by using the pads. It is your responsibility to purchase and register the pad, bring it to class everyday, and keep them in working order. You should also read the directions that come with the pad and monitor it for proper function. If the pad stops functioning correctly it is your responsibility to see me immediately after class. Bonus points are awarded as shown below.

% of Questions Correctly Answered	# of Bonus Points
>90.00	5
80.00 - < 90.00	4
70.00 - < 80.00	3
60.00 - < 70.00	2
50.00 - < 60.00	1
<50.00	0

**Lecture Notes**

Copies of the slides used in class are posted on ANGEL prior to each lecture. It is highly advisable to print this material and bring it to class to aid in note taking.

**Exams**

There will be four regular exams plus a final. Three of the regular exams, worth 100 points each, will be given in class on Wednesday, January 31; Wednesday, February 28; Wednesday, April 4. On Wednesday, May 2, there will be a final exam consisting of two parts: the fourth regular exam (100 points) and the cumulative final (100 points). The lowest score of these 5 exams will be discarded and the 4 best exams will be used. **There will be NO makeup exams.** The final exam follows the MSU exam schedule. It will be Wednesday, May 2 from 3:00 to 5:00 in PSS A149, the same room as lecture.

**Written Papers**

There are two written paper for this class. These papers allow you to evaluate information concerning the science behind biotechnology in society. There are also a classmate evaluations associated with these papers. Each paper requires a reference submission, a first submission, evaluations of classmates' papers, and a final submission as noted on the course schedule. **Failure to turn in any part of a paper on time will result in a score of zero (0) on all remaining parts of that paper.** For a complete description of these papers, see the ANGEL web site.

**LON-CAPA Homework**

LON-CAPA homework will be due one hour before the beginning of each class period except on days of exams. This homework will be based mostly on the reading material assigned for the upcoming class period but may also cover topics from previous lectures. You can access the LON-CAPA server at <http://loncapa.msu.edu> using your MSU username and logon. Upon correct completion of a problem, a "receipt" number will be issued. You should save this number. In the extremely unlikely event of computer problems, this number will allow verification that the assignment was completed.

**Classroom Activities**

Points will be assigned for participation in and adequate completion of classroom activities. These activities will include mini quizzes, group activities, and in class writing assignments. The value for these activities will range from one to ten points. There are no make-ups for missed classroom activities. Note that approximately 10% of the lowest classroom activity scores will be dropped. The large number of grades dropped accommodates the fact that occasionally you miss class due to illness or other emergency. Please bring a number two pencil to each lecture as activities require a bubble sheet. Answers to the classroom activities will be posted on LON-CAPA following each lecture.

**Student evaluation:** Grades will be determined based on exams, two short papers and associated materials, LON-CAPA homework, and classroom activities. The points earned for each type of evaluation are given below.

Exams (5 @ 100 points drop the lowest score)	400 points
Your evaluation of classmates' papers	30 points
Written Papers	70 points
LON-CAPA Homework	100 points
Classroom activities (lowest ~10% dropped)	<u>50 points</u>
TOTAL POINTS	650 points

Grades are earned using the following scale

>585.00 points	= 4.0
>554.00 to 585.00 points	= 3.5
>520.00 to 554.00 points	= 3.0
>488.00 to 520.00 points	= 2.5
>455.00 to 488.00 points	= 2.0
>423.00 to 455.00 points	= 1.5
>390.00 to 423.00 points	= 1.0
390.00 points or less	= 0.0

## Course Schedule

Date	Day	Topic	Reading
Jan. 8	M	Course Introduction	
10	W	What is the GMO Controversy?	<a href="#">Harvest of Fear (1)</a>
15	M	MLK Day - no class	
17	W	What is Science?	Krogh pp 1-13 (2) and Resources and Plagiarism Web Sites (3-5)
22	M	You are what you eat? - <b>Submit Resource Reference</b>	Krogh pp 30-53 (2)
24	W	Populations & Microevolution	Krogh pp 271-287 (2)
29	M	Plant Breeding & the Green Revolution	<a href="#">IFPRI Green Rev. (6)</a>
31	W	<b>Exam I</b>	
Feb. 5	M	DNA	Krogh pp 202-213 (2)
7	W	Transcription, Translation, and Regulation	Krogh pp 214-231 (2)
12	M	Biotechnology	Krogh pp 232-251 (2)
14	W	Gene Transfer	<a href="#">IANR Animation (7) and Engineer a Crop (8)</a>
19	M	GMOs in Agriculture	<a href="#">Designer Seeds (9)</a>
21	W	Food Safety - <b>1st Submission Paper Due</b>	<a href="#">AgBiosafety (10)</a>
26	M	Labeling & the Right to Know	<a href="#">CSU Labeling (11)</a>
28	W	<b>Exam II - Classmate Evaluations Due</b>	
Mar. 5&7	M&W	Spring Break	
12	M	Mitosis and Cytokinesis- <b>Paper Due</b>	Krogh pp 136-153 (2)
14	W	Meiosis	Krogh pp 154-165 (2)
19	M	Cloning - <b>Submit Resource Reference</b>	Krogh pp 538-557 (2)
21	W	Stem Cells	<a href="#">NIH Stem Cells (12)</a>
26	M	Mendel's Laws	Krogh pp 166-183 (2)
28	W	Chromosomes and Inheritance	Krogh pp 168-199 (2)
Apr. 2	M	The Human Genome Project	<a href="#">DOE Genomics Primer (13)</a>
4	W	<b>Exam III</b>	
9	M	Genetics and Behavior - <b>1st Submission Paper Due</b>	<a href="#">DNA and Behavior (14)</a>
11	W	Genetic Testing	<a href="#">Genetic Testing (15)</a>
16	M	Gene Therapy - <b>Classmate Evaluations Due</b>	<a href="#">HGPI Therapy (16)</a>
18	W	RNAi	<a href="#">RNAi (17)</a>
23	M	Case Studies - <b>Paper Due</b>	To Be Announced
25	W	Wrap Up and Review	
May 2	W	<b>Exam IV and Final exam - 3:00 to 5:00</b>	

- (1) Tyson, Peter. "Should We Grow GM Crops?" *Harvest of Fear*. PBS. 2001. 20 Dec. 2006 <<http://www.pbs.org/wgbh/harvest/exist>>.
- (2) Krogh, David. *A Brief Guide to Biology with Physiology*. 1st Edition. Boston: Pearson Custom Publishing, 2007.
- (3) UC Berkeley Library. "Critical Evaluation of Resources." UC Berkeley. September 2004. 20 Dec. 2006 <<http://www.lib.berkeley.edu/TeachingLib/Guides/Evaluation.html>>.
- (4) Olin and Uris Libraries. "Distinguishing Scholarly Journals from Other Periodicals." Cornell University. October 2004. 20 Dec. 2006 <<http://www.library.cornell.edu/olinuris/ref/research/skill20.html>>.
- (5) Writing Tutorial Services. "Plagiarism: What It is and How to Recognize and Avoid It". Indiana University. April 2004. 20 Dec. 2006 <<http://www.indiana.edu/%7Ewts/pamphlets/plagiarism.shtml>>.
- (6) Hazell, Peter J.R. "Green Revolution: Curse or Blessing." International Food Policy Research Institute. 2002. 20 Dec. 2006 <<http://www.ifpri.org/pubs/ib/ib11.pdf>>.
- (7) Hain, Patty, and James Ehly. "How to Make Transgenic Plants: Animation Demo." University of Nebraska IANR. March 2004. 20 Dec. 2006 <<http://www.colostate.edu/programs/lifesciences/TransgenicCrops/animation.html>>.
- (8) Groleau, Rick. "Engineer A Crop" *Harvest of Fear*. PBS. 2001. 20 Dec. 2006 <<http://www.pbs.org/wgbh/harvest/engineer/>>.
- (9) Patlak, Margie. "Designer Seeds." *Beyond Discovery*. National Academy of Sciences. 1998. 20 Dec. 2006 <<http://www.beyonddiscovery.org/includes/DBFile.asp?ID=58>>.
- (10) Peterson, Robert K.D. "Why Scientists Can Never Prove that Biotech Crops Are Safe?" *AgBiosafety*. 2003. 20 Dec. 2006 <<http://agbiosafety.unl.edu/science.shtml>>.
- (11) Bryne, P. "Labeling of Genetically Engineered Foods." *CSU Cooperative Extension*. June 2006. 20 Dec. 2006 <<http://www.ext.colostate.edu/pubs/foodnut/09371.html>>.
- (12) NIH "Stem Cell Basics." *Stem Cell Information*. National Institutes of Health. October 2006. 20 Dec. 2006 <<http://stemcells.nih.gov/info/basics/basics1.asp>>.
- (13) HGMIS. "Genomics and Its Impact on Science and Society." Department of Energy. 2003. 20 Dec. 2006 <[http://www.ornl.gov/sci/techresources/Human\\_Genome/publicat/primer2001/primer11.pdf](http://www.ornl.gov/sci/techresources/Human_Genome/publicat/primer2001/primer11.pdf)>.
- (14) Koliopoulos, Sophia. "DNA & BEHAVIOR: Is Our Fate in Our Genes?" *The DNA Files*. 2001. 20 Dec. 2006 <<http://www.dnafilos.org/about/pgm2/topic.html>>.
- (15) Understanding Gene Testing. National Cancer Institute. September 2006. 20 Dec. 2006 <<http://www.cancer.gov/cancertopics/understandingcancer/genetesting>>.
- (16) HGPI "Gene Therapy" *Human Genome Project Information*. Human Genome Project. 2003-2005. 20 Dec. 2006 <[http://www.ornl.gov/sci/techresources/Human\\_Genome/medicine/genetherapy.shtml#whatis](http://www.ornl.gov/sci/techresources/Human_Genome/medicine/genetherapy.shtml#whatis)>.
- (17) NOVA "RNAi" *Science Now*. PBS. July 2005. 20 Dec. 2006 <<http://www.pbs.org/wgbh/nova/sciencenow/3210/02.html>>.