# ANFS 449/649 – Food Biotechnology

**Instructor**

Rolf D. Joerger (Tel. 831-6605; email: rjoerger@udel.edu)

Email is the preferred method of communication regarding any issues arising from this course. I generally answer email within 24 h. I can also be reached by phone, and I am available to meet with you whenever the need arises. You can stop by my office at your convenience or make an appointment. I will make every effort to meet with you as soon as possible.

**Course logistics**

The course consists of a lecture component (TuTh 9:30-10:45, 002 TNS) and a laboratory component (Th, 12:30 -3:15, 202 WOR). Field trips may be scheduled and will most likely take place during the time allocated for the laboratory component. Dates and times will be announced once confirmation from the host of the field trip has been obtained.

Safety glasses and proper lab attire are required for participating in the laboratory section.

Any student who has a need for accommodations based upon the impact of a disability should contact me as soon as possible. Contact the Office of Disabilities Support Services to coordinate appropriate accommodations.

**Course Description**

The course is a required course for Food Science majors, but is open to Food Science minors and others with an interest in Food Biotechnology. Currently the graduate-level section of the course is offered concurrently.

The course provides you with the opportunity to learn about the concepts and experimental techniques of Food Biotechnology.

Specifically, the following topics will be discussed in this class:

- Microorganisms for food production
- Enzymes in food production
- Domestication of animals and plants
- Genetic engineering tools
- Genetic modification of bacteria, plants and animals
- Social, economic, ecological issues of food biotechnology

**Course Materials**

The course does not rely on a specific textbook, but requires the use of hardcopy or electronic resources (books, journals, internet) to find information.

**Teaching Methods**

ANFS449 is a 400-level course that, in 2016, will not follow the conventional instructor-based lecture format. Instead, students will introduce the topics to the class. The reasons for this approach to the course include an anticipated higher engagement in the class, learning by teaching others, and gaining experience in group work and presentation methods.
Specifically, the class will be divided into 5 groups with 3 to 4 members each. Each group will be responsible for 4 class sessions during the semester. The list of anticipated topics can be found below. (Changes to the topic list can be made as warranted based on the instructor's judgement and student input.) As soon as a group has chosen or been assigned a topic, the group needs to meet with the instructor to discuss the scope of the session. The group will then decide how best to introduce the topic to the class and what needs to be done to prepare for the session. The preparation will include literature searches and likely also searches for appropriate images and videos.

- Cultures to make food – from baker's and brewery yeast to cheese starters, and probiotics
- Fermentation engineering – jars, barrels, vats, trays and computerized bioreactors
- Fermentations to make food ingredients – the story of acetic, citric acid and lactic acid
- Fermentations to make food ingredients – amino acids, vitamins, gums
- Genetic engineering of microorganisms –plasmids, promoters and gene transfers
- Fermentations to make enzymes for the food industry
- Characterizing and identifying organisms by genetic means – sequencing methods
- From the sink to the river, from biowaste to mushrooms and methane
- Bacteriophage – friend and foe
- Growing and harvesting algae for food
- After the ice age – domestication of plants – from teosinte to modern corn – what changed genetically?
- Of cavities, The impact of domestication on the human condition
- Plant breeding, hybrids and the green revolution
- Genetic engineering of plants – the basic techniques
- The array of genetically engineered plants currently grown and the outlook for the future
- RNAi and Crisper
- From the Reinheitsgebot to national and international GMO regulations
- From the auerochs to the Holstein – domestication of animals
- Genetic engineering and cloning of animals
- Growing animal cells, tissues and meat

The groups will post their respective session materials and students not presenting on a particular day will summarize the major items they have learned that day in the form of a blog. The goal of this approach is to require the student to reflect back on what was presented that day.

For the laboratory section, in 2016, the five groups will prepare a 30-min video on a topic of their choice. The video will need to include filmed documentation of a laboratory or other equivalent activity that was carried out by the group. In addition, the video will have to contain high-quality information that explains the background of the activity including biochemistry, microbiology, technology etc.
Examples of possible activities and video topics are:

- Cheese making
- Pickle fermentation
- Beer fermentation
- Plant tissue culture
- PCR application
- Sequencing application
- Animal tissue culture
- Immobilized enzyme
- Bacteriophage utilization

**Learning Outcomes**

The teaching and learning tools are intended to achieve learning outcomes that are in line with the goals of the **Department of Animal and Food Sciences**:

- Think critically; use quantitative reasoning, skeptical inquiry and the scientific approach to solve problems in animal and food sciences.
- Effectively communicate scientific ideas orally and through writing
- Demonstrate knowledge of major scientific concepts, social, economic and ethical implications in the animal and food sciences
- Work collaboratively and independently, learning from diverse perspectives to assimilate knowledge and synthesize new solutions and ways of thinking.

The learning goals of this course are also aligned with the GOALS OF UNDERGRADUATE EDUCATION at the University of Delaware which state that, upon graduation, students should be able to:

- (1) Read critically, analyze arguments and information, and engage in constructive ideation.
- (2) Communicate effectively in writing, orally, and through creative expression.
- (3) Work collaboratively and independently within and across a variety of cultural contexts and a spectrum of differences.

- (4) Critically evaluate the ethical implications of what they say and do.
- (5) Reason quantitatively, computationally, and scientifically.

Specifically, students will gain:

- Experience in the use of literature resources to research topics in food biotechnology
- An understanding of the methods humans have developed to use biotechnology to produce foods and food ingredients
- Sufficient knowledge to evaluate the pros and cons of the use of biotechnology to produce foods including ecological, social and economic impacts
- Experience in presenting the outcome of literature researches in the form of oral presentations and written reports
- Experience in working together with other students on projects in the classroom and in the laboratory

**Assignments**

1. Group assignment – topic presentation to the class

You are required to discuss the scope of the topic with the instructor, then, as a group, discuss what will be required to successfully present the material to the class. You can chose whatever teaching method/material you think will be appropriate. The instructional section should be about 1 h long and leave some time for questions and discussion. Suitable presentation methods are slides and videos and reading assignments, discussion of hand-outs and others. Any instructional materials used (PowerPoint slides, literature, videos) has to be posted to the presenters' blogs.

Your group' session will be evaluated by the instructor and the class.

2. Writing assignment

After each class, unless decided otherwise, you will need to write a blog entry that summarizes the major points learned during the class that day. At least one image illustrating the important point learned has to be included. The blog entries should be between ½ and 1 page in length. The entries will be edited by the instructor and you may have to revise entries to achieve a satisfactory posting.

3. Video project

You will need to decide on a topic (no two groups can pick the same topic) and then make plans as to the laboratory or equivalent activity you will include in your video. You have to familiarize yourself with video editing and find material that you will include in your video alongside footage of your own experiment/activity. The video has to be complete by May 9. The video will be evaluated by the instructor and the class with regard to content and technical quality (footage, images, sound etc).

**Grading**

You will receive points for your four sessions (the same number of points will be given to each group member). You will receive up to 10 points from the instructor and the average of points you receive from your classmates (also up to 10 points).
You will receive up to 10 points for each blog entry.
Points for the video will be maximally 20 points from the instructor and 20 points from the class (calculated as average of the ratings). The same grade will be given to each group member.
You will receive 2 points for each class you attend. You may miss two class periods without penalty.

Grades will be based on points accumulated during the course. Submissions received after the due date will receive a 20% reduction in points for every day the assignment is late. Some assignments are due at a particular time without an option of late submission; failure to submit the assignment at the specified time will result in a complete loss of points.

Determination of final grade:

| Percent of possible points | Grade |
|---|---|
| 93-100 | A |
| 90-92 | A- |
| 87-89 | B+ |
| 83-86 | B |
| 80-82 | B- |
| 77-79 | C+ |
| 73-76 | C |
| 70-72 | C- |
| 67-69 | D+ |
| 63-66 | D |
| 60-62 | D- |

**Course Policies**

Expectations:

- Appropriate **conduct** in the classroom (Consult the Official Student Handbook at http://www.udel.edu/stuhb/99-00/stuhb.html).

- Adherence to safety rules in the laboratory

- Adherence to academic **honesty** standards (http://www.udel.edu/stuguide/10-11/code.html#honesty and http://www.udel.edu/provost/fachb/III-1-d-dishonesty.html. Please note: "It is the official policy of the University of Delaware that all acts or attempted acts of alleged student academic dishonesty be reported to the Office of Judicial Affairs. At the faculty member's discretion and with the concurrence of the student or students involved, some cases, though reported to the Office of Judicial Affairs, may be resolved within the confines of the course. All others will be adjudicated within the Undergraduate Student Judicial System.

- Making use of **Support Services** (Academic Services Center, Writing Center, Math Center, Library, Computer Center) if you need help.

- **Attendance** at every class session. Three class periods can be missed for any reason (illness, interviews, family obligations, religious observances, athletic or other extracurricular activities) without penalty provided the instructor has been informed beforehand during class or by phone or email. Students have to discuss with the instructor how lab work or homework assignments can be made up. Absence from class for an extended period of time (e.g., hospitalization, surgery, or protracted medical illness or convalescence) requires notification of the Assistant Dean's Office for verification of documentation supplied from the student. The office will then notify the respective faculty member(s) if an excused absence is warranted.

- Participation in **discussions** and adequate preparation of information to be presented to the class

- Equal sharing of a group's workload

- Establishing and maintaining communication with group members and instructor

- Contacting instructor immediately with any issues that you feel need to be addressed.

**For Honors students**:

At the beginning of the semester, the instructor will meet with the student(s) who registered for the Honors section of the course. A detailed plan on the specifics (activities, grading, etc) of the Honors sections will be set up at that time. The activities connected with the Honors section will be in line with those outlined by the Honors Program, and may include weekly or bi-weekly meetings with the instructor to discuss topics in food biotechnology, reading and/or reviewing of books or papers concerned with food biotechnology, and a reflective assay. Laboratory experiences specific to the Honors section are also an option.

**Calendar of planned activities and events**

| Date | | Activity | Due |
|---|---|---|---|
| Feb. 9 | | | |
| Feb. 11 | Fermentations – from spontaneous to genetically engineered | Just in time for Valentine's Day – biotechnology and chocolate | |
| Feb. 16 | | | Blog 1 |
| Feb. 18 | | Cultures to make food – from baker's and brewery yeast to cheese starters, and probiotics | Blog 2 |
| Feb. 22 | | Last day to register or add course. | |
| Feb. 23 | | Fermentation engineering – jars, barrels, vats, trays and computerized bioreactors | Blog 3 |
| Feb. 25 | | Fermentations to make food ingredients – the story of acetic, citric acid and lactic acid | Blog 4 |
| Mar. 1 | | Fermentations to make food ingredients – amino acids, vitamins, | Blog 5 |
| Mar. 3 | | Genetic engineering of microorganisms –plasmids, promoters and gene transfers | Blog 6 |
| Mar. 8 | | Fermentations to make enzymes for the food industry | Blog 7 |
| Mar. 10 | | Characterizing and identifying organisms by genetic means – sequencing methods | Blog 8 |
| Mar. 15 | | From the sink to the river, from biowaste to mushrooms and methane | Blog 9 |
| Mar. 17 | | Bacteriophage – friend and foe | Blog 10 |
| Mar. 22 | | Growing and harvesting algae for food | Blog 11 |
| Mar. 24 | Plant domestication and engineering | After the ice age – domestication of plants – from teosinte to modern corn – what changed genetically? | Blog 12 |
| Mar. 29 | | Spring Break | |
| Mar. 31 | | Spring Break | |
| Apr. 1 | | Last day to change registration or withdraw from course | |
| Apr. 5 | | The impact of domestication on the human condition | Blog 13 |
| Apr. 7 | | Plant breeding, hybrids and the green revolution | Blog 14 |
| Apr. 12 | | Genetic engineering of plants – the basic techniques | Blog 15 |

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| Apr. 14 | | The array of genetically engineered plants currently grown and the outlook for the future | Blog 16 |
| Apr. 19 | | RNAi and Crisper | Blog 17 |
| Apr. 21 | | From the Reinheitsgebot to GMO regulation | Blog 18 |
| Apr. 26 | Animal Domestication and genetic engineering | From the auerochs to the Holstein – domestication of animals | Blog 19 |
| Apr. 28 | | Genetic engineering and cloning of animals | Blog 20 |
| May 3 | | Growing animal cells, tissues and meat | Blog 21 |
| May 5 | | Open | Blog 22 |
| May 10 | Video presentations | | Video |
| May 12 | | | |
| May 17 | | | |