1. **COURSE TITLE\*: Biotechnology in Business, Law, Government and Culture**
2. **CATALOG – PREFIX/COURSE NUMBER/COURSE SECTION\*: BTNL 2225**
3. **PREREQUISITE(S)\*: COREQUISITE(S)\*:**
4. **COURSE TIME/LOCATION: (*Course Syllabus – Individual Instructor Specific*)**
5. **CREDIT HOURS\*: 2-4 LECTURE HOURS\*: 2-4**

**LABORATORY HOURS\*: (contact hours) OBSERVATION HOURS\*:**

1. **FACULTY CONTACT INFORMATION: *(Course Syllabus – Individual Instructor Specific)***
2. **COURSE DESCRIPTION\*:** An examination into the ethical, legal, social, and economic issues raised by the modern world of DNA science. This course will study the history of: scientific investigation, the discovery of DNA, the discovery of the structure of DNA, biotechnology, and laboratory science. The course will analyze the ethical issues related to genetically modified organisms (GMOs), cloning, scientific research, eugenics, experimentation on humans, preimplantation genetic diagnosis, prenatal testing, general genetic testing, animal care, medical treatment and other issues. Legal issues will be studied and include patents, copyrights, and the application of genetic use restriction technology (GURT). Economic issues associated with the stock market and patents will be examined. Biotechnology and laboratory science plays an important role in popular culture. Books, movies, and television shows based on laboratory science and biotechnology will be reviewed.

Career skills and workplace ethics will be discussed. Students will prepare a resume and examine opportunities for employment.

A trip to Europe to visit sites associated with the discovery of the structure of DNA and other important related places will be an option. Visits to the University of London- Kings College where X-ray crystallographic images of DNA were made by Rosalind Franklin, the Cambridge area and The Eagle Pub where the announcement of the discovery of DNA structure was made, and many important sites associated with molecular biology and the history of science in general will be an option.

**8. LEARNING OBJECTIVES\*:**

1. Describe people and events in the historic development of science, including

the scientific method with emphasis on the discoveries pertinent to laboratory

science and biotechnology.

2. Evaluate some of the experiments performed to examine the theory of

abiogenesis (spontaneous generation).

3. Describe the role of Louis Pasteur in the experimental examination of

spontaneous generation and in foundational work in the biotechnology of wine

production.

4. Describe Friedrich Miescher and his unique character traits that led to the

discovery of DNA. Describe the care Meicher took to make sure his discovery

was valid.

5. Explain the historical development of the discovery that DNA was the genetic

material. Describe the role of Frederick Griffith in the discovery of the

Transforming Factor. Explain how Oswald Avery, Colin MacLeod, and Maclyn

McCarty purified the transforming factor and demonstrated that it was DNA.

Explain the experiments of Hershey and Chase.

6.Describe the events leading to the discovery of the structure of DNA by James

Watson and Francis Crick. Describe how James Watson came to England and how

he met Francis Crick. Describe the relationship of Watson and Crick to Maurice

Wilkins and Rosalind Franklin. Evaluate the way Watson and Crick gained

information for the DNA structure discovery. Describe how the discovery of DNA

structure was reported in the *Eagle Pub*.

7. Describe the role Linus Pauling played in the discovery of the structure of

DNA. Explain why Pauling did not travel to Europe during the important events

leading up to the DNA structure discovery.

8. Relate the story of the life of Rosalind Franklin. Describe where she was working before she worked with Maurice Wilkins in London. Examine whether Rosalind Franklin or Maurice Wilkins was in charge of their laboratory. What problems did this cause?

Explain the work of Rosalind Franklin in taking crystallographic photos of the

DNA molecule. Relate how Rosalind Franklin took care of her parents when they

were elderly.

9. Describe how the discoveries relating to the structure of DNA were reported in

Nature in 1953.

10. Explain why Watson, Crick, and Wilkins won the Nobel prize, but Rosalind

Franklin did not.

11. Explain the events and individuals involved with: the deciphering of the

genetic code, the use of restriction endonucleases, recombinant DNA technology,

the Polymerase Chain Reaction, and the Mouse and Human Genome Projects.

12. Describe the major branches of philosophy including epistemology,

metaphysics, and ethics. Explain how ethics relates to the other areas of

philosophy such as epistemology and the source of information.

13. Describe the primary branches of the philosophy of ethics, evaluate different

major ethical viewpoints, and discuss proponents of each viewpoint.

14. Evaluate the pertinent ethical issues relating to:

1. Genetically modified organisms (GMOs)

2. Genetic Testing

a. Medical genetics testing

b. Preimplantation genetic diagnosis

c. Prenatal testing

3. Cloning of plants, animals, and humans

4. Biopiracy

5. Religion and ethics

6. Forensic biotechnology and DNA fingerprinting

7. Scientific research

8. The humane treatment of animals

9. Eugenic

10. Human experimentation; The use of human tissue with an emphasis on the cancer cells of Henrietta Lacks

11. Medical and genetic information

12. Human multiple gene analysis for medical genetic prediction

13. Medical and bioinformatic information systems and databases

15. Describe eugenics movements throughout history.

16. Describe in detail and evaluate eugenics in the United States and the major Eugenics Movement of the late 19th Century and early 20th Century in the

United States. Explain how Harry Laughlin and the Eugenics Record Office influenced American legislative policy. Explain the relationship of the Eugenic

Movement to Cold Spring Harbor Laboratory. Explain how the American Eugenics Movement influenced eugenics in Nazi Germany.

17. Describe and evaluate laws related to and legal issues concerning:

1. Patents

2. Cloning

3. Medical records

4. Human experimentation

5. Animal experimentation

6. Recombinant DNA experimentation

7. Transgenic organisms (Genetically Modified Organisms)

18. Describe and evaluate the relationship of biotechnology and laboratory

science with insurance providers including:

1. Use of genetic information to allow or deny coverage

2. Genetic testing for prevention of disease

3. Privacy issues

4. Legal issues

19. Examine and evaluate methods used to commercially regulate the use of

plant strains.

20. Explain and evaluate genetic use restriction technology (GURT) which is also

called terminator technology or suicide seed technology.

21. Explore the influence of the science of biotechnology on culture.

1. Describe the fictional story, characters, and science found in the following

books:

a. Jurassic Park byMichael Crichton

b. The Lost World by Michael Crichton

2. Examine and use bioinformatics to explain the secret message in the

genetic code found in The Lost World.

3. Describe the fictional story, characters, and science found in the movies:

a. “Jurassic Park”

b. “The Lost World”

c. “GATTACA”

4. Describe the setting, characters and some of the science in the following

television shows:

a. “CSI”

b. “NCIS”

c. “Quincy”

22. Examine and evaluate economic factors associated with biotechnology and

laboratory science including:

1. Patents

2. Research funding

3. The Stock Market

23. If possible travel to the London, England area to see related sites, and better

understand the history of science and the discovery of the structure of DNA.

Some of the historic sites to view and evaluate may include:

1. The Cambridge Area

a. The Eagle Pub where Watson and Crick announced the discovery of the

structure of DNA.

b. Cavendish Laboratory site

2. Kings College- The University of London

3. Westminster Abbey and the burial place of Isaac Newton

4. Darwin Down House

24. Prepare a resume, prepare for job interviews, and investigate employment opportunities.

25. Examine work ethics and good work habits that contribute to steady employment.

1. **ADOPTED TEXT(S)\*:**

*Introduction to Biotechnology. Third Edition.* 2013. William J. Thieman and

Michael A. Palladino. Columbus: Pearson. ISBN: 0-321-76611-3.

*The Double Helix: A Personal Account of the Discovery of the Structure of DNA*.

Norton Critical Edition. by James D. Watson. Gunther S. Stent (Editor).

ISBN-13: 9780393950755. ISBN: 0393950751.

*Rosalind Franklin, The Dark Lady of DNA*. Brenda Maddox. 2003. Harper Collins

Publishers. ISBN-13: 9780060985080.

Classical Ethics East and West. 2011. Robert Zeuschner. New York: McGraw-Hill.

National Institutes for Health/Department of Energy Joint Working Group on the

Ethical, Legal and Social Implications (ELSI) of Human Genome Research,

current reports.

Cold Spring Harbor Online Documents on Eugenics.

**9a: SUPPLEMENTAL TEXTS APPROVED BY FULL TIME DEPARTMENTAL FACULTY (INSTRUCTOR MUST NOTIFY THE BOOKSTORE BEFORE THE TEXTBOOK ORDERING DEADLINE DATE PRIOR TO ADOPTION) \*\*\*.**

1. **OTHER REQUIRED MATERIALS: (SEE APPENDIX C FOR TECHNOLOGY REQUEST FORM.)\*\*** Supplementary Handouts
2. **GRADING SCALE\*\*\*:**

Grading will follow the policy in the catalog. The scale is as follows:

A: 90 – 100

B: 80 – 89

C: 70 – 79

D: 60 – 69

F: 0 – 59

1. **GRADING PROCEDURES OR ASSESSMENTS: (*Course Syllabus – Individual Instructor Specific)***

|  |  |  |
| --- | --- | --- |
| *Category* | ***EXAMPLE ONLY***  *Total Points* | *% of Grade* |
| Chapter Assignments (10x30) | 300 | 30% |
| Quizzes (10x20) | 200 | 20% |
| Unit Exams (3x100) | 300 | 30% |
| Assignments (5x10) | 50 | 5% |
| Annual Report Project (100) | 100 | 10% |
| Attendance | 50 | 5% |
| Total | 1000 | 100% |

1. **COURSE METHODOLOGY OR COURSE FORMAT: *(Course Syllabus – Individual Instructor Specific)***

May include but not limited to: Lectures, visual and audio presentations, independent and group projects, in-class and home assignments, tests, quizzes and lab exercises. Modification of experimental procedures to promote learning, safety, or efficiency may occur.

14. **COURSE OUTLINE: *(Course Syllabus – Individual Instructor Specific)***

A. Historic Perspective

1. The foundations of science

2. The development of the Scientific Method

3. Biological foundations

4. Development of laboratory science

5. The discovery of DNA

6. DNA as the genetic material

7. The discovery of the structure of DNA

8. The Genetic Code discovery

9. Discovery of the operon

10. Development of PCR

11. Review of genome sequencing

12. The Human Genome Project

13. The Mouse Genome Project

14. Molecular biology equipment, techniques and procedures

B. Ethics

1. Historic overview of ethical viewpoints

2. The philosophy of ethics

a. Normative ethics

1.) Utilitarianism

a.) General views

b.) The philosophies of Jeremy Bentham and John Stuart Mill

2.) Deontology

3.) Practical Reason

4.) Intuition

5.) Revelation

6.) Relativism

b. Practical Ethics

c. Metaethics

3. Genetically modified organisms and ethics

4. Biopiracy and ethics

5. Genetic testing and ethics

a. Medical genetics testing

b. Preimplantation genetic diagnosis

c. Prenatal testing

6. Cloning of plants, animals and humans

7. Genetic use restriction technology

8. Religion and ethics

9. Scientific research ethics

10. The humane treatment of animals

11. Eugenics

12. Human experimentation

13. Stem cell research

14. Medical testing

15. Medical and genetic information

16. Human multiple gene analysis for medical genetic prediction

17. Patents

18. Gene discovery and ownership

19. Forensics and DNA databases

C. Eugenics and the Eugenics Movement in the United States

D. Legal Issues

1. Patents

2. Cloning

3. Medical

4. Animal experimentation

5. Forensics

6. Insurance

a. Use of genetic information to allow or deny coverage

b. Genetic testing for disease prevention

c. Privacy issues

7. Control of plant strains

8. Genetic use restriction technology (GURT) (Terminator Gene Technology),

9. Genetically modified plants and animals and commercial rights.

E. The ELSI Working Group (Ethical, Legal, and Social Implications)

1. National Institutes for Health/Department of Energy Joint Working Group on the

Ethical, Legal and Social implications of Human Genome Research

2. History of the foundation of the group and start of work in 1989

3. Recommendations developed concerning health insurance and genetic testing

F. Social issues, the influence of biotechnology on culture

1. Books

a. Jurassic Park byMichael Crichton

b. The Lost World by Michael Crichton

2. Movies

a. “Jurassic Park”

b. “The Lost World”

c. “GATTACA”

3. Television Shows

a. CSI

b. NCIS

c. Quincy

G. Economic Issues

1. Patents

2. Research funding

3. The stock market

H. European Tour of DNA and Laboratory Science, England

1. Cambridge Area

a. The Eagle Pub where Watson and Crick announced the discovery of the

structure of DNA.

b. Cavendish Laboratory Site

c. St. Benet's Church

2. Kings College- The University of London

3. Westminster Abbey and Isaac Newton

4. Darwin Down House

I. Preparation of a resume, examination of employment opportunities, and workplace

ethics.

**Example Tentative Course Schedule Excluding A Field Trip**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Lecture and Study Topics |  | Readings |  |
| 1 | Course introduction and syllabus. Development of a resume, applying for a job, work ethics. |  |  |  |
| 2 | Development of a resume, applying for a job, work ethics |  | *Classical Ethics East and West* |  |
| 3 | Development of a resume, applying for a job, work ethics  History of scientific discovery and the scientific method.  History of Biotechnology and Laboratory Science. The discovery of DNA. Discoveries leading up to the discovery of the structure of DNA. |  | *Classical Ethics East and West* |  |
| 4 | The Discovery of the structure of DNA, the Genetic Code, Restriction Enzymes, the Operon, and PCR. The Human Genome Project |  | *The Double Helix* by James Watson |  |
| 5 | Overview of Philosophy, Principles and Viewpoints of Ethics  Principles of Ethical Analysis |  | Chapter 1, *Introduction to Biotechnology* by Thieman and Palladino |  |
| 6 | Ethics in scientific research  Ethics of Gene transfer and transgenic organisms |  | *Rosalind Franklin the Dark Lady of DNA* by Brenda Maddox |  |
| 7 | Ethics of gene discovery and ownership  Ethics of patents  Ethics of genetic use restriction technology |  | *Classical Ethics East and West* by Robert Zeuschner |  |
| 8 | Ethics of Biopiracy  Ethics of Genetic Testing- Preimplantation testing, Prenatal Testing |  | Chapter 13 Ethics and Biotechnology in Thieman and Palladino |  |
| 9 | Ethics of Cloning  Ethics of Stem Cell Research  Ethics of Tissue Research and the Henrietta Lacks story |  |  |  |
| 10 | Ethics of Eugenics  Ethics of Medical Experimentation  Ethics of forensics and DNA databases |  |  |  |
| 11 | Biotechnology issues and Religion |  |  |  |
| 12 | Legal Issues and biotechnology |  |  |  |
| 13 | Business Issues and biotechnology: funding and the stock market |  |  |  |
| 14 | Biotechnology and Culture: Fiction Books |  |  |  |
| 15 | Biotechnology and Culture: Fiction Movies  Medical and bioinformatic information systems and ethics |  |  |  |

1. **SPECIFIC MANAGEMENT REQUIREMENTS\*\*\*:**

Assignments will be evaluated according to instructor directives.

**16. OTHER INFORMATION\*\*\*:**

**FERPA:** Students need to understand that your work may be seen by others. Others may see your work when being distributed, during group project work, or if it is chosen for demonstration purposes. Students also need to know that there is a strong possibility that your work may be submitted to other entities for the purpose of plagiarism checks.

**DISABILITIES:** Students with disabilities may contact the Disabilities Service Office, Central Campus, at 800-628-7722 or 937-393-3431.

**SYLLABUS TEMPLATE KEY**

**\*** Item cannot be altered from that which is included in the master syllabus approved by the Curriculum Committee.

**\*\*** Any alteration or addition must be approved by the Curriculum Committee

**\*\*\*** Item should begin with language as approved in the master syllabus but may be added to at the discretion of the faculty member.