Course Number: BIE 661  
Course Title: Biology and Biotechnologies for Ethicists  
Term: Summer 2016

Instructors
Dr. Laura Frieboes, Dr. Hermann Frieboes

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1. Course Description
This course focuses on the basic biological principles related to ethical issues such as in vitro fertilization and other reproductive technologies, embryonic and adult stem cells, artificial contraception, and genetic engineering from the standpoint of the Catholic faith.

2. Envisioned Learning Outcomes
1. Students will demonstrate a basic grounding in biology, biological principles that will enable them to gain a deeper understanding of bioethics issues.
2. Students will demonstrate an ability to understand and utilize scientific vocabulary and concepts that will enable them to communicate effectively with people in scientific and clinical fields.
3. Students will demonstrate an ability to explore and analyze scientific advances from their original sources by learning to read scientific journal articles.
4. Students will demonstrate an ability to articulate the basic principles that guide the Catholic moral teaching as it applies to medicine and health care.

3. Course Schedule
As these technologies and issues are constantly changing, we will also cover a basic grounding in the study of biology. The results of scientific studies filtered through the lens of the popular media can be inaccurate and misleading. As such, we will also practice reading and analyzing scientific journal articles, so that we are prepared to study scientific advances from their original sources. Finally, we will read key documents that evaluate related ethical issues from the standpoint of the Catholic faith.

Week 1
Topics: Introduction to and Internal Organization of the Cell; Intrinsic Dignity of Human Beings;  
Sub-Topics: Structure and Function of Cells; Cell Chemistry and Biosynthesis; Proteins; Intro to Organelles; Membrane Structure/ Transport; Intracellular Compartments/ Protein Sorting; Intracellular Vesicular Traffic;  
Readings: RH 13-16; EV 1-4;  
Notes/ Items Due: Lecture 1
Week 2

Topics: Internal Organization of the Cell;
Sub-Topics: Cell Metabolism (Mitochondria); Cell Communication; Cytoskeleton; Cell Life Cycle, Aging, and Apoptosis; Mechanics of Cell Division; Cell Junctions, Adhesion and Extracellular Matrix;
Readings: M1-2;
Notes/ Items Due: Lecture 2; HW1 Due

Week 3

Topics: Basic Genetics; Human Freedom and the Natural Law
Sub-Topics: Heredity; DNA and Chromosomes; DNA Replication, Repair and Recombination; Protein Synthesis; Control of Gene Expression
Readings: M4-6; VS 42-47;
Notes/ Items Due: Lecture 3

Week 4

Topics: Basic Genetics
Sub-Topics: Genetic Technologies (Gene Therapy, Genetic Screening/ Human Enhancement, Genetic Engineering, Artificial Life, Chimeras)
Readings: A1-7, A21, M7-10
Notes/ Items Due: Lecture 4; HW2 Due

Week 5

Topics: Cells in Community; Human Beings as a Unity of Body and Soul;
Sub-Topics: Germ Cells and Fertilization (Stem Cells); Development of Multicellular Organisms (Cloning);
Readings: A7-8, M11-14, VS 48-53;
Notes/ Items Due: Lecture 5; Discussion 1 Due

Week 6

Topics: Cells in Community; Methods of Studying Cells and Tissues; Value of Human Life;
Sub-Topics: The Immune System (Vaccines, Viral Therapy); Manipulating Proteins, DNA, RNA; Visualizing Cells;
Readings: A9, M15, EV 29-51;
Notes/ Items Due: Lecture 6; HW3 Due

Week 7

Topics: Intro to Scientific Journal Articles; Anatomy and Physiology: Methods of Study;
Sub-Topics: Scientific Method; Research Methods (i.e. Models, Current Technologies, Histology of Tissues, Visualization)
Readings: M16-18;
Notes/ Items Due: Lecture 7; Discussion 2 Due
Week 8

Topics: Anatomy and Physiology: Nervous System;
Sub-Topics: Central vs. Peripheral Nervous System; Cells of the Nervous System; How Neurons Work; Regeneration and Repair; Spinal Cord/ Peripheral Nerves
Readings: M19-20;
Notes/ Items Due: Lecture 8; HW4 Due

Week 9

Topics: Anatomy and Physiology: Nervous System; Present-day Threats to Human Life;
Sub-Topics: Brain Anatomy & Physiology; Neuroethics (Psychopharmaceuticals, Brain Surgeries, Neurocognitive Enhancement, Mood and Personality Enhancement); Pain Management; Persistent Vegetative State
Readings: A10-14; A22-23; EV 7-28
Notes/ Items Due: Lecture 9

Week 10

Topics: Anatomy and Physiology: Endocrine System; Sanctity of Human Life;
Sub-Topics: Hormones (Hormone therapies); Endocrine Glands;
Readings: A15-16; EV 52-77
Notes/ Items Due: Lecture 10; Journal Article 1 Paper Due

Week 11

Topics: Anatomy and Physiology: Reproductive System
Sub-Topics: Male Reproductive System; Female Reproductive System
Readings: HV – all; DV – all; A17-18; A25-26; A24; M21
Notes/ Items Due: Lecture 11; HW5 due

Week 12

Topics: Human Procreation
Sub-Topics: Reproductive Technologies (In Vitro Fertilization and Other Infertility Treatments, Artificial Womb, Birth Control Methods, Abortion)
Readings: DP – all
Notes/ Items Due: Lecture 12; Journal Article 2 Paper Due

Week 13

Topics: Anatomy and Physiology: Development and Ageing
Sub-Topics: Prenatal Development; Prenatal Testing (Down Syndrome, Cystic Fibrosis, Trisomy 21, Spina Bifida)
Readings: A19-20
Notes/ Items Due: Lecture 13
Week 14

**Topics:** Anatomy and Physiology: Development and Ageing

**Sub-Topics:** Ageing/Death (Determination of Death, Cryonics, Life Support, Eugenics, Life Span Extension/Human Enhancement)

**Notes/Items Due:** Lecture 14; HW6 Due

Week 15

**Final Exam**

4. COURSE REQUIREMENTS

**Homework Assignments (40%):**

The bi-weekly homeworks will be based on the preceding 2 or 3 weeks of lectures and due Friday of the following week at 11:59PM EST (with the exception of the final HW6 which will be due to Wednesday before Thanksgiving at 12:00PM EST). The homeworks will assess the students’ understanding of the science lectures and Church documents, and they will focus on comprehension of key concepts. They will also evaluate the students’ understanding of important biology concepts related to the topic. The format of the questions will include several short answer questions and a bioethics essay.

**Journal Articles (20%):**

Journal Articles will be assigned to the students on Weeks 10 and 12. The students must read the articles and, if necessary, research any vocabulary, concepts, methods, etc. that are unknown to them in order to understand the article. The goal is to understand the purpose of the study, background, hypothesis, conclusions, and have some basic understanding of the methods used and results. However, understanding the details of the experimental methods, results and methods used for data analysis is not necessary.

The students will then submit a one to two page, single spaced report summarizing the paper (purpose of the study, background, hypothesis, methods, results, and conclusions) and either discussing its merits/weaknesses or comparing the findings with an associated article in the popular media. These reports will be worth 15% of the students’ total grade for the course. These reports and the blog comments are due the Friday of Weeks 10 and 12.

**Discussion (5%):**

Students will participate in an online discussion board discussing a selected bioethics topic with their fellow students (at least 3 comments per article) on Weeks 5 and 7. Comments may include discussion of the scientific background related to the issue, responses to requests for help in understanding the issue, exploring the ethical implications of the issue, and references to/discussion of related articles in the popular media.

**Final Exam (35%):**

The Final Examination will be closed book, closed notes. It will cover the materials learned in the lectures in Weeks 1-14. The format of the exam will include short answer questions that incorporate knowledge of both the biology and ethics. All materials tested will be taken directly from the lecture notes, Church documents, and required resources. No materials from the Journal Articles will be on the Exam. Similar to the homework, the exams will focus on comprehension of key concepts.

**Citations in Discussion Posts**

For the purposes of the Discussions in Populi, please do provide a full footnote for sources at the end of your post. You will have to type a special character (^) at the beginning and end of your numbers to make a superscript in Populi, e.g. ^1^, ^2^, etcetera. Use the special characters for superscript also in your footnote.
Example Footnote


Also, to bold, italicize, or underline words in Populi, please refer to the “Formatting Guide” located below all discussion/comment fields in Populi.

5. REQUIRED READINGS and RESOURCES:

Multi-Media Animations/Videos:

- **M1**: Mitosis. Virtual Cell Animation Collection, Molecular and Cellular Biology Learning Center, North Dakota State University.
- **M2**: Meiosis from The Meaning of Sex: Genes and Gender. Howard Hughes Medical Institute, 2001.
- **M4**: Regulated Transcription. Virtual Cell Animation Collection, Molecular and Cellular Biology Learning Center.
- **M5**: mRNA Splicing from DNA: Animations. Howard Hughes Medical Institute.
- **M6**: Translation. Virtual Cell Animation Collection, Molecular and Cellular Biology Learning Center, North Dakota State University.
- **M7**: Gene Therapy, Cortical Studios.
- **M8**: Genetic Engineering from DNA: Animations. Howard Hughes Medical Institute.
- **M9**: RNA Interference, Nature Reviews Genetics.
- **M10**: Cloning 101. Biology Animation Library, Dolan DNA Learning Center, Cold Springs Harbor Laboratory.
- **M12**: Differentiation and the Fate of Cells from Potent Biology: Stem Cells, Cloning, and Regeneration. Howard Hughes Medical Institute, 2006.
- **M15**: Viral Lifecycle from Holiday Lectures: 2000 and Beyond: Confronting the Microbe Menace. Howard Hughes Medical Institute, 2009.
- **M16**: Model Organisms. Biology Animation Library, Dolan DNA Learning Center, Cold Springs Harbor Laboratory.
- **M17**: Sanger method of DNA sequencing from DNA: Animations. Howard Hughes Medical Institute.
- **M18**: Polymerase Chain Reaction from DNA: Animations. Howard Hughes Medical Institute.
- **M19**: Molecular Mechanisms of Synaptic Function from Making Your Mind: Molecules, Motion, and Memory. Howard Hughes Medical Institute, 2008.
- **M20**: 3D Brain. Biology Animation Library, Dolan DNA Learning Center, Cold Springs Harbor Laboratory.
Church documents:

- RH: Redemptor Hominis
- VS: Veritatis Splendor
- EV: Evangelium Vitae
- HV: Humanae Vitae
- DV: Donum Vitae
- DP: Dignitas Personae

Articles:


• **A26**: Fertility problems linked to children's mental health issues, research claims by Ian Sample. The Guardian, 2014.


### 6. SUGGESTED RESOURCES:

- **Inside the Cell**, National Institute of General Medical Sciences, National Institute of Health.
- **Kimball's Biology Pages** (Online Biology Textbook).
- **Molecular Biology Web Book**.
- **Online Biology Book**, by Michael J. Farabee, Estrella Mountain Community College.
- **DNA From the Beginning**, Cold Springs Harbor Laboratory.
- **Assisted Reproductive Technologies**, American Society for Reproductive Medicine, 2011.
- **Howard Hughes Medical Institute Biointeractive**.
- **Virtual Cell Animation Collection**, Molecular and Cellular Biology Learning Center.
- **DNA Learning Center**.
- **Life Science**.

### 7. EVALUATION

(Basis of evaluation with explanation regarding the nature of the assignment and the percentage of the grade assigned to each item below). Students who have difficulty with research and composition are encouraged to pursue assistance with the Online Writing Lab (available at [http://www.holyapostles.edu/owl](http://www.holyapostles.edu/owl)).

Homework assignments and exams will be graded based on the accuracy of the answers.

**GRADING SCALE:**

A 96-100; A- 90-95; B+ 87-89; B 83-86; B- 80-82; C+ 77-79; C 73-76; C- 70-72 D 69-60; F 59 and below
Grading Rubric for the Discussion Board (DB) Postings and Journal Article (JA) Papers

<table>
<thead>
<tr>
<th>DB-0</th>
<th>DB-2</th>
<th>DB-4</th>
<th>DB-6</th>
<th>DB-8</th>
<th>DB-10</th>
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<tr>
<td>JA-0</td>
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<td>JA-8</td>
<td>JA-10</td>
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**CONTENT**

<table>
<thead>
<tr>
<th>Absence of Understanding</th>
<th>Lack of Understanding</th>
<th>Inadequate understanding</th>
<th>Adequate understanding</th>
<th>Solid Understanding</th>
<th>Insightful understanding</th>
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<tbody>
<tr>
<td>Analysis shows no awareness of the discipline or its methodologies as the relate to the topic</td>
<td>Analysis seems to misunderstand some basic concepts of the discipline or lacks ability to articulate them.</td>
<td>Analysis is sometimes unclear in understanding or articulating concepts of the discipline.</td>
<td>Analysis demonstrates an understanding of basic concepts of the discipline but could express them with greater clarity.</td>
<td>Analysis demonstrates a clear understanding and articulation of concepts of the discipline as they relate to the topic; highlights connections to other concepts; integrates concepts into wider contexts.</td>
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**WRITING & EXPRESSION**

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<tr>
<th>Incomplete writing</th>
<th>Writing difficult to understand, serious improvement needed</th>
<th>Episodic writing, a mix of strengths and weaknesses.</th>
<th>Acceptable writing, but could use some sharpening of skill</th>
<th>Solid writing, with something interesting to say.</th>
<th>Command-level writing, making a clear impression</th>
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<tr>
<td>Analysis is only partially written or completely misses the topic</td>
<td>Analysis fails to address the topic; confusing organization or development; little elaboration of position; insufficient control of sentence structure and vocabulary; unacceptable number of errors in grammar, mechanics, and usage</td>
<td>Analysis noticeably neglects or misinterprets the topic; simplistic or repetitive treatment, only partially internalized; weak organization and development, some meandering; simple sentences, below-level diction; distracting errors in grammar, mechanics, and usage</td>
<td>Analysis is an uneven response to parts of the topic; somewhat conventional treatment; satisfactory organization, but more development needed; adequate syntax and diction, but could use more vigor; overall control of grammar, mechanics, and usage, but some errors</td>
<td>Analysis is an adequate response to the topic; some depth and complexity in treatment; persuasive organization and development, with suitable reasons and examples; level-appropriate syntax and diction; mastery of grammar, mechanics, and usage, with hardly any error</td>
<td>Analysis is a thorough response to the topic; thoughtful and insightful examination of issues; compelling organization and development; superior syntax and diction; error-free grammar, mechanics, and usage</td>
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### 8. DISABILITIES ACCOMMODATIONS POLICY

Holy Apostles College & Seminary is committed to the goal of achieving equal educational opportunities and full participation in higher education for persons with disabilities who qualify for admission to the College. Students enrolled in online courses who have documented disabilities requiring special accommodations should contact Bob Mish, the Director of Online Student Affairs, at rmish@holypostles.edu or 860-632-3015. In all cases, reasonable accommodations will be made to ensure that all students with disabilities have access to course materials in a mode in which they can receive them. Students who have technological limitations (e.g., slow Internet connection speeds in convents) are asked to notify their instructors the first week of class for alternative means of delivery.
9. ACADEMIC HONESTY POLICY

Students at Holy Apostles College & Seminary are expected to practice academic honesty.

Avoiding Plagiarism

In its broadest sense, plagiarism is using someone else's work or ideas, presented or claimed as your own. At this stage in your academic career, you should be fully conscious of what it means to plagiarize. This is an inherently unethical activity because it entails the uncredited use of someone else's expression of ideas for another's personal advancement; that is, it entails the use of a person merely as a means to another person's ends.

Students, where applicable:

- Should identify the title, author, page number/webpage address, and publication date of works when directly quoting small portions of texts, articles, interviews, or websites.
- Students should not copy more than two paragraphs from any source as a major component of papers or projects.
- Should appropriately identify the source of information when paraphrasing (restating) ideas from texts, interviews, articles, or websites.
- Should follow the Holy Apostles College & Seminary Stylesheet (available on the Online Writing Lab's website at http://www.holyapostles.edu/owl/resources).

Consequences of Academic Dishonesty:

Because of the nature of this class, academic dishonesty is taken very seriously. Students participating in academic dishonesty may be removed from the course and from the program.

10. ATTENDANCE POLICY

Even though you are not required to be logged in at any precise time or day, you are expected to login several times during each week. Because this class is being taught entirely in a technology-mediated forum, it is important to actively participate each week in the course. In a traditional classroom setting for a 3-credit course, students would be required to be in class 3 hours a week and prepare for class discussions 4.5 hours a week. Expect to devote at least 7 quality hours a week to this course. A failure on the student's part to actively participate in the life of the course may result in a reduction of the final grade.

11. INCOMPLETE POLICY

An Incomplete is a temporary grade assigned at the discretion of the faculty member. It is typically allowed in situations in which the student has satisfactorily completed major components of the course and has the ability to finish the remaining work without re-enrolling, but has encountered extenuating circumstances, such as illness, that prevent his or her doing so prior to the last day of class.

To request an incomplete, distance-learning students must first download a copy of the Incomplete Request Form. This document is located within the Shared folder of the Files tab in Populi. Secondly, students must fill in any necessary information directly within the PDF document. Lastly, students must send their form to their professor via email for approval. “Approval” should be understood as the professor responding to the student’s email in favor of granting the “Incomplete” status of the student.

Students receiving an Incomplete must submit the missing course work by the end of the sixth week following the semester in which they were enrolled. An incomplete grade (I) automatically turns into the grade of “F” if the course work is not completed.

Students who have completed little or no work are ineligible for an incomplete. Students who feel they are in danger of failing the course due to an inability to complete course assignments should withdraw from the course.
A “W” (Withdrawal) will appear on the student’s permanent record for any course dropped after the end of the first week of a semester to the end of the third week. A “WF” (Withdrawal/Fail) will appear on the student’s permanent record for any course dropped after the end of the third week of a semester and on or before the Friday before the last week of the semester.

12. ABOUT YOUR PROFESSORS

Dr. Laura Frieboes has a Ph.D. in Biomedical Engineering from the University of California Irvine. Her dissertation focused on mechanotransduction and signaling in the peripheral nervous system related to chronic compressive neuropathies (i.e. carpal tunnel syndrome). She also holds a B.A. in Physics from Lewis and Clark College and a B.S. in Biomedical Engineering/ Biomechanics from Columbia University. Dr. Frieboes is a Lecturer in Bioengineering at the University of Louisville.

Dr. Hermann Frieboes, Ph.D., has a faculty appointment in Bioengineering at the University of Louisville, focusing on cancer research. Dr. Frieboes holds a Master’s degree in Moral Theology from Holy Apostles, as well as a Certificate in Health Care Ethics from the National Catholic Bioethics Center. His doctoral studies are in Biomedical Engineering, and he holds undergraduate degrees in engineering and the computer and physical sciences. In addition, he has extensive work experience in engineering design, development and management.

In the last several years, Dr. Frieboes and his wife Laura have been extensively involved in adult religious education at their home parish and at monastic retreats, offering presentations and courses on various topics such as faith and reason, development of science and the Church, relationship between science and religion, ethics in business and the workplace, current medical issues, and bioethics.

*This syllabus is subject to change over time at the discretion of the course professors.*