

Dear biotechnologist,

Welcome to BIOL 0170, or as students have come to endearingly call it — Biotech in Medicine. If you are currently shopping this course and considering enrolling, we thank you for giving us an opportunity and hope that this will serve to guide your decision to join us. And if you are just looking through the syllabus in preparation for a project or one week before classes end, may this letter serve as a reminder of why you chose to take this course.

Human health is the most fundamental aspect of our existence. At the core of all civilizations and societies is human health — without health, life cannot exist.

And with health comes biotechnology! From the development of prosthetic limbs in Ancient Greece and primitive smallpox vaccines in China thousands of years ago to organ transplants and the editing of the human genome, biotechnology has shaped how we address our most basic needs for the entirety of history. Biotechnology drives our evolution as a species, it allows us to be who we are — not only as individuals, but as *homo sapiens sapiens*.

The goal of this course is to expand upon that — the progress we've made from medicine past, the different types of biotechnologies that make our present possible, and then take a peek into the future of human health. Behind every medical treatment that exists today there is vast science, protocol, and history. You will be given an overview of the objectives, techniques, and problems related to the application of biomedical technology for the diagnosis and treatment of disease and the contemporary health care industry.

At the same time, science is never only science. There are strong ethical implications that come with every new medical treatment that arises, and it is important to consider these in our study of biotechnology. Is it worth the risk to rush a high-demand medical treatment? If there are two patients in need of an organ transplant, what determines who gets priority? If a patient's life is in critical condition — is their family's word worth more than theirs? What does permanently changing our genome mean for our children and their children and all those that follow? These are some of the questions that we will consider throughout the course, for biotechnology is a coin with two equally important sides — the human aspect and scientific innovation.

In one way or another, biotechnology has changed your life — and this class will help you understand how that is and why. Thank you for joining us in this adventure. We are happy you are here with us.

“All that is necessary for faith is the belief that by doing our best we shall succeed in our aims: the improvement of mankind” - Rosalind Franklin

syllabus for

BIOL 0170: Biotechnology in Medicine

Dr. Toni-Marie Achilli

Fall 2020

Table of contents

1 to 2	welcome letter
3	cover page
4	table of contents
5 to 7	course overview, prerequisites, materials, objectives, and expectations
7 to 9	assignments and grades
10	digital citizen code of conduct
10 to 11	piazza policy
11	student accessibility and accommodations, diversity and inclusion
12	contact information, technology, teaching assistants, books and supplies
13 to 14	frequently asked questions

Course Overview

BIOL 0170 is designed to introduce undergraduates to the main technological advances currently dominating the practice of medicine. The course will be taught entirely online.

The course will be broken into three main modules:

1. pharmaceuticals and biopharmaceuticals
2. substitutive and regenerative medicine
3. the new wave in biotechnology

Topics will include: pharmaceutical development and formulation, organ replacement by prosthesis and transplantation, medical imaging, tissue engineering, therapeutic cloning, regenerative medicine, stem cells, CRISPR, and genetic editing — all while considering societal, economic, and ethical issues.

Course Prerequisites

There are no prerequisites for BIOL 0170. Given that this course is an elective, all students take this course for a different reason — we recognize and value that. Some students take this course as an introduction to biotechnology, others see their future in medicine and the pharmaceutical industry, and others may be somewhere in between. The curriculum has been designed to allow all students of different backgrounds to thrive, and we hope that you may learn from others and their contributions just as they will learn from yours.

Class Recording and Distribution of Course Materials

Each lecture will be derived from primary literature and will be posted on Canvas prior to lecture. The reading due for each lecture period, along with section and assignment handouts will be organized by module chronologically. PDF lecture notes will be available on Canvas immediately following class. These lecture notes are meant to be a guide and will require additional annotation from information discussed in class.

Lectures will be streamed live on Zoom during regular class hours. All lectures will be recorded to account for students in different time zones, poor internet connections, or any health issues that may arise. This means that all classes will be recorded to be made available to all students that are enrolled but cannot be present. If you have

questions or concerns about this protocol, please contact Dr. Achilli to talk through those to ensure your full participation in this course.

Lectures and other course materials are copyrighted. Students are prohibited from reproducing, making copies, publicly displaying, selling, or otherwise distributing the recordings or transcripts of the materials. The only exception is that students with disabilities may have the right to record for their private use if that method is determined to be a reasonable accommodation by Student Accessibility Services. Disregard of the University's copyright policy and federal copyright law is a Student Code of Conduct violation.

All course material needed for this course will be posted on Canvas — the purchase of any books, supplies, or materials will not be necessary.

Course Objectives and Expectations

Upon successful completion of this course students should be able to:

- Appreciate the history of biotechnology and understand the progress we have made as a species that led to the foundations of modern biotechnology
- Identify and critically evaluate key questions, concerns, and approaches of biotechnology with regards to medicine
- Acknowledge that science is never only science and recognize the ethical implications of biotechnology
- Go beyond the scope of the course and understand the role biotechnology plays in human kind's daily lives
- Critically analyze and use scientific evidence to convey a convincing argument and form your own perspectives
- Develop presentation skills for the thorough understanding of scientific literature
- Recognize the importance of and continually practice teamwork and collaboration, both in the course and all science

The expectations for students enrolled in the course are as follows:

1. You are responsible for knowing what goes on in class and in section, and for any information that is emailed to the course list or posted to Canvas. In addition to reading this document in its entirety, it is required that you read *Biol*

0170 Ethics and Values, Rules for Section and Class Discussion, Piazza and TA Hours Policy, and Understanding our Technological Resources. You are responsible for knowing all information in these documents.

2. It is expected that students watch all lectures and are prepared when they arrive – whether this be during the lecture live stream or during their own time.
3. All students must complete the required readings prior to class – the readings facilitate class participation, which is a fundamental component of your and your classmates' learning experience.
4. In order to receive full credit at section, students must read the section handout and all required section readings posted on Canvas each Saturday prior to the week.
5. We expect that you will attend all sections in the semester. Virtual attendance (through Zoom) for 9 sections will be required to pass the course. Unless there is a Dean's note or extensive circumstances discussed with the course staff, attending less than 9 sections will result in an NC in the class.
6. Assignment due dates are non-negotiable, and requests will only be considered with documentation from the Dean or in extensive circumstances. In cases of unexcused tardies, there will be a 10% grade deduction on assignments for each day late. All deadlines posted are in Eastern Standard Time.

Completion of this course depends on you completing all required assignments yourself. Violations of academic integrity such as cheating and plagiarism will result in no credit for the assignment and possible course failure and referral for disciplinary action. Brown University's policy may be accessed with this [link](#). Violations of the academic code will be reported.

Assignments

The assignments for this course consists of three projects, one essay, and a final exam, along with bi-weekly quizzes and section participation. The specifics of each respective component of the course, along with their respective weights and due dates, are expanded upon below.

Assignment	Percentage	Deadline	Expected Time Spent
FDA proposal	16%	October 4	25 hours
Investing pitch	16%	October 23	25 hours
GATTACCA essay	16%	November 2	20 hours
Genetic Editing Counsel	16%	November 25	25 hours
Final exam	16%	Date pending	40 hours
Section	10%	Weekly	25 hours
Bi-weekly quizzes	10%	Approximately weekly	20 hours

FDA Proposal - 16%

You will be assigned a mystery medical treatment and will present such treatment as if you were presenting to the FDA review board, using scientific evidence to make your case as to why this treatment should be approved for commercial use. You will also develop a 1 to 2 minute video advertisement for your treatment in adherence to FDA pharmaceutical advertising regulations. We will provide you with sufficient information for a thorough investigation. The project's focus will be on ensuring a thorough understanding of the FDA review process and the science behind your medical treatment. This will be a group project and is expected to take around 25 hours.

Investing Pitch - 16%

You will be assigned to an existing biotechnology company listed on the stock market that specializes in either regenerative medicine, organ transplant, or prosthetics. You will be required to elaborate a 15 minute pitch asking for an investment in your company, delving into your company's financials and potential market. This will require a deep understanding of the technology your company specializes in, along with the financial components of the biotechnology industry. A presentation will be required, and section during the week prior to this project being assigned will consist of a rundown on how to interpret financial information. This will be a group presentation and is expected to take around 25 hours.

GATTACA Reflection - 16%

A reflective 1 to 2 page essay on the movie GATTACA that considers the accuracy of the film, its societal implications, and the impact of the movie on the fields of genetics and biotechnology. The film will serve as an important foundation for your

considerations in the genetic editing project. This will be an individual assignment and is expected to take around 20 hours.

Genetic Editing Regulatory Counsel - 16%

The premise is similar to that of the FDA pitch, but the roles are reversed: you will be given a proposal for a potential gene therapy and must decide whether it is to be approved or rejected for commercial use. A scientific based jurisdiction will be required, along with a deep understanding of the ethical consequences of the treatment. We will give you sufficient information regarding the treatment to facilitate your investigation, but all ethical considerations will be up to you. A 15 minute presentation and a one page write-up that states your decision and the reasons why will be required. This will be a group project and is expected to take around 25 hours.

Final Exam - 16%

As an end-of-semester assessment, you will be given a cumulative essay-based exam with open-ended free response questions that will test your understanding of course materials, requiring scientific evidence to back up your claims along with a deep reflection on the ethical and societal effects of medical biotechnology.

Bi-weekly section - 10%

There are 50-minute long weekly sections outside of class time in which we will delve into the implications beyond the science of the course in a discussion-based community gathering. There will be one ethical debate per module, and the remaining sections will be devoted to conversations regarding relevant case studies to course material. It is expected that you will attend at least 9 sections to receive a passing grade. There will be numerous section dates and times available to ensure that every student can attend at their convenience.

Quizzes - 10%

10 to 25 question quizzes will assess course material. These will not be cumulative, rather focusing only on the lectures and readings of the week prior to the assessment.

Grades

Grades will follow the standard 90 and above A, 80 and above B, 70 and above C, below 70 NC. These cutoffs are subject to change if the grade distribution differs from expectations.

Digital Citizen Code of Conduct

Recognizing the inherent challenges presented by an online education, we propose and uphold all students and course staff to the following code of conduct.

- I. Understand the liberties that come with an online education and act with responsibility, treating this course with the same priority and dedication it would have had as an in-person course.
- II. Treat all of your peers and course staff with respect and empathy, understanding that the world is in a tumultuous state and that you may not know what someone else is going through. Be a good listener and seek to be a good learner, and always engage in civil discourse.
- III. Communicate often the course staff, expressing any doubts, questions, comments, or remarks with full transparency. We will strive to ensure that physical distance does not act as a barrier towards your education, but we can only do so much. We ask that, with full trust, you share whatever thoughts you have regarding the nature of the course so that we can better help you. It is our goal for you to succeed.
- IV. Collaborate with your classmates in positive ways that help you learn. Form study groups. Prepare with each other for weekly sections. Discuss the readings over dinner. We strive to foster a community around this class and its topics, and encourage you to be creative in the ways that you work with your peers.
- V. Show respect and professionalism during zoom lectures and section meetings, allowing others their turn to speak and not interrupting the course. We ask that you “raise your hand” whenever you wish to speak and be mindful of what you send in the discussion chats. An online education is, in its nature, distracting. Help us make it the most engaging possible.

Piazza Policy

Piazza (<https://www.piazza.com/brown/fall2020/biol0170>) is the place to post comments, questions, or any BIOL 0170 related discussions on readings, projects, exams, and lectures. We will often post clarifications on projects there, so make sure to enroll and actively participate. *All questions* must be posted on Piazza unless in the case of an emergency — neither Dr. Achilli nor the TAs will be answering individual questions in the form of emails unless it pertains to office hours or regrade requests.

If your Piazza question pertains to the clarification of a concept, the logistics of a project, or any type of generic question, it *must* be posted public so it can be seen by all students.

If your Piazza question pertains to a very specific question pertaining only to you or your group, including questions about the content of the project handouts, it *must* be posted privately so that only Dr. Achilli and the TAs can see it.

Failure to abide by these rules will result in a delay in the course staff's answers. As noted above, it is required that you read the *Piazza and TA Hours Policy* found on the Canvas homepage.

Note that Piazza collects data of your activities and shares it with companies. You can opt out of sharing your data by following the steps in [this link](#).

Student Accessibility and Accommodations

Brown University is committed to full inclusion of all students. Please inform Dr. Achilli early in the term if you may require accommodations or modification of any of course procedures. You may speak with her after class, during office hours, or by appointment. If you need accommodations around online learning or in classroom accommodations, please be sure to reach out to [Student Accessibility Services \(SAS\)](#) for their assistance (seas@brown.edu, 401-863-9588). Students in need of short-term academic advice or support can [contact one of the academic deans in the College](#).

Commitment to Diversity & Inclusion

We strive to create a learning environment that is supportive of all perspectives, experiences, and identities (including race, gender, class, sexuality, religion, ability, etc). If there is some aspect of this course, whether it is content that is presented or content that is discussed during class that is upsetting to you or needs to be addressed, please feel free to privately bring it to Dr. Achilli's attention. In addition, if any other matters not specifically addressed in the syllabus come up, please feel free to discuss them with Dr. Achilli.

Contact Information

Dr. Achilli can be reached through her email at toni-marie_achilli@brown.edu. You can also reach her at +1 401 863 2946. Office hours are held through Zoom by appointment only.

Teaching Assistants' Information

There will be 8 undergraduate teaching assistants and 1 graduate student helping with the course throughout the semester — they are here to help you with whatever questions you may have. Regular TA hours and their contact information will be posted on Canvas early in the semester. Per the Piazza policy, we ask that all communications with the TAs be through private Piazza posts.

Use of Technology to Support Student Learning

This course will use the following technological platforms: Canvas, Piazza, Zoom, GoReact. More information on the technology for the course can be found on the *Understanding our Technological Resources* reading.

Dr. Achilli and the course staff are committed to ensuring access to online course resources by students. If you have any concerns or questions about access or the privacy of any of these platforms, please reach out to Dr. Achilli.

Books and Supplies

If your Brown undergraduate financial aid package includes the Book/Course Material Support Pilot Program (BCMS), concerns or questions about the cost of books and course materials for this or any other Brown course (including RISD courses via cross-registration) can be addressed to bcms@brown.edu. For all other concerns related to non-tuition course-related expenses, whether or not your Brown undergraduate financial aid package includes BCMS, please visit the Academic Emergency Fund in E-GAP (within the umbrella of "E-Gap Funds" in UFunds) to determine options for financing these costs, while ensuring your privacy.

Frequently Asked Questions

What is the best way to contact Dr. Achilli? — To speak in person, please make an appointment for office hours, or see me immediately following class. Otherwise, email is generally the best way to contact me. During the week, I aim to respond within 24 hours. Remember to include the name of the course in the message line.

Help! I am struggling with course material, what should I do? — The TAs are here to assist you with any questions you may have. If regular TA hours do not work for you or you have an urgent question, feel free to reach out to any TA and we will get back to you as soon as possible.

I missed class, what should I do? — You are responsible for all material covered in class. If you must miss a lecture, check the course Canvas site to access reading material and presentation slides. TA tip: try to make one or two friends in the course during the first few weeks so that if you miss class, they can give you a copy of their notes!

What if I need an accommodation because of a disability? — we are committed to making sure every student is included and has the tools necessary for them to succeed. Please refer to the Student Accessibility and Accommodations section above if you require accommodations.

Can I turn in an assignment late or take a make-up exam? — Late exams and assignments will only be accepted in extraordinary and well documented situations, accompanied by a letter from the Dean or a physician. Otherwise, there will be a 10% grade deduction for each day late. TA tip: be sure to check the deadline and your time zone! All deadlines are listed in Eastern Standard Time.

I think my grade is wrong, what should I do? — If you believe there is a mathematical error in the calculation of your grade, please email me. Requests for a regrade should be submitted in writing during TA office hours. Please provide your original assignment and a detailed explanation of how you believe your work was mis-graded. Please be advised, regrade requests are subject to the entire assignment being regraded, and can increase or decrease your grade.

I'm really struggling to take notes! — Lecture can at times be fast paced and overwhelming, which is why we encourage students to quickly review the slides before class to get a general sense of what will be discussed in class. TA tip: don't try to copy

everything that's on the slides! Rather, focus on writing down and processing what Dr. Achilli says and use the slides as a reference point. You will always have access to the presentations online.

I feel uncomfortable discussing one of the lecture or section subjects, what should I do? — While we aim to bring you outside of your comfort zone, we recognize that biotechnology is something that impacts all of us in different ways and want to ensure that you feel safe and that you prioritize your mental health. If there is any topic that may be distressing to you, feel free to reach out to Dr. Achilli or any of the TAs so we can figure out the best ways to help you.