



MASTER OF BIOTECHNOLOGY PROGRAM

Compulsory Course Component

BTC 1820H

BIOTECHNOLOGY IN
AGRICULTURE
&
NATURAL PRODUCTS

Duncan Jones

Fall Term, 2021

MASTER OF BIOTECHNOLOGY

UNIVERSITY OF TORONTO MISSISSAUGA

BTC 1820H – Biotechnology in Agriculture & Natural Products

Course Outline (Fall 2021)

Class Location:	Your living room, bedroom, study or basement, <i>i.e.</i> ZOOM
Class Times:	Mondays, 9:00-11:00AM and Wednesdays & Thursdays, 2:00-4:00PM, 18-Oct to 8-Dec (up to 22 classes)
Instructor:	Duncan Jones , MSc, MBA, PMP
Office Hours:	By appointment
Contact:	Text/cell 416-301-6700, duncan.jones@utoronto.ca

Course Description

This course is a survey of the various ways biotechnology is being employed commercially in agricultural and industrial contexts (so called “green” and “white” biotechnology). These applications of biotechnology will be compared and contrasted with those of the better known medical/healthcare/(bio)pharmaceutical biotechnology (so called “red” biotechnology).

The technical, financial and operational aspects of developing and commercializing a variety of products including genetically modified (GM) crops, biochemicals and biofuels as well as bioremediation processes will be examined. The potential impact and implications of these biotechnological advances on the economy, the environment, human health and sustainability will also be discussed.

Guest lectures, from industry experts, will supplement the regular lectures. Student presentations will provide additional context and deepen the students’ understanding of complex technologies and controversial issues.

Course Goals

- To develop a working knowledge of a wide range of biotechnology applications and opportunities, and their associated technologies *i.e.*, **creating** value;
- To analyze the various aspects of commercializing a biotechnology product or process *i.e.*, **delivering** value;
- To gain an understanding of the economic and societal benefits (and risks) of biotechnology as applied to agriculture (green) and natural products (industrial or white) *i.e.*, **capturing** value;
- To further develop soft skills including analyzing, critiquing, discussing and presenting scientific information from research papers, patents and news sources.

Reading Materials

No textbook is required for the class. Pre-read materials will be posted on Quercus to introduce the materials and to provide additional context for lectures and class discussion. Student reports will also be posted to support broader learning.

Marking Scheme/Assignments

Class participation, Quickwrite, pre-read quizzes, and Twitter (5 + 8 + 8 + 4 = 25%)

The pre-reads and lecture material will serve the basis for class discussion, debate and reinforcing challenge events. Most weeks there will be a short quiz covering the pre-read material posted on Quercus in advance of class. In addition, recent press releases and news articles of particular relevance to the course will be posted on Twitter, referencing #BTC1820. These same tweets will be referenced in a dedicated Quercus Discussion Group, and each student is required to post a brief summary and implications statement for one tweet on a first-come-first-serve basis and comment on three.

Two Individual reports and case work on GMOs (5 + 5 + 5 = 15%)

- 1) The pros and cons of the development and commercialization of genetically modified products, especially crops, and processes utilizing genetically modified organisms is to be reviewed. Recommendations as how we should proceed, including an explanation on how to mitigate potential risks, are to be made.
- 2) Following the screening of the film "Food Evolution", a brief critique of the film's content and opinions is to be prepared.

Group case report and presentation on a commercial application of biotech (20%)

A review of a specific and significant agriculture or natural products (industrial) biotechnology application and its commercialization or commercial potential is to be presented to the class, along with a summary document. The presentation should include details of the underlying science and technology, the product or process characterization, as well as an evaluation of the economic and environmental value. A summary of the issues/risks facing the commercialization efforts, and possible means to mitigate them are to be addressed. Groups should challenge the audience and respond to key questions on the topic asked by the class and the instructor as part of their assessment.

Individual report on an interesting statement/claim (10%)

A report is to be prepared by each student, providing additional background and analysis of a particular statement or claim that they come across in the readings that is interesting, unexpected, controversial, unsupported or unclear.

Final Exam (30%)

The final exam will consist of a series of 30 short questions (with some choice) on the underlying concepts contained in the assigned readings, the materials presented/discussed in the lectures including the guest lectures and to a lesser extent the group presentations and tweets.

Course Schedule v1.0*

Session	Date	Topic	Speaker	Readings	Assignments Due
1	18-Oct	Introduction Macroeconomics Sustainability Syllabus			
2	20-Oct	GMO Introduction <ul style="list-style-type: none"> o Movie: FOOD EVOLUTION 			
3	21-Oct	GMO debate <ul style="list-style-type: none"> o Panel discussion 	Guests: D. Ma G. Hannam J. Herbert		GMO report
4	25-Oct	Communicating science		Canola	GMO movie critique
5	27-Oct	Herbicidal Traits Heterosis/ Breeding		Monsanto	
6	28-Oct	Insecticidal Traits		Golden Rice	
7	01-Nov	Other GMO/Agricultural Traits Trait Technologies <ul style="list-style-type: none"> o <i>Agrobacterium tumefaciens</i> 		Snow White	
8	03-Nov	Regulatory/Commercial			
9	04-Nov				Group presentations (5/6)
10	08-Nov	Pharming <ul style="list-style-type: none"> o Glycosylation o Production/Economics o Examples 		Plantform?	
11	10-Nov				Group presentation (1,7)
12	11-Nov	Bioremediation Metagenomics COVID-19 surveillance	Guest: P. Dennis, SiREM		
13	15-Nov	Natural products <ul style="list-style-type: none"> o Examples o Secondary Metabolites o Structures 			

Session	Date	Topic	Speaker	Readings	Assignments Due
14	17-Nov	Enzymes/Biocatalyst <ul style="list-style-type: none"> ○ Function ○ Classes ○ Applications ○ Biocatalysts ○ Microorganisms 		Marine Screening?	Group presentation (2)
15	18-Nov	Chemical industry		Pregabalin	
16	22-Nov	Biofuels <ul style="list-style-type: none"> ○ Marcoeconomics ○ Bioethanol ○ Biodiesel ○ Algae 		Enogen Xylanase	
17	24-Nov				Group presentation (3,4)
18	25-Nov	Verbio biodiesel	Guest: Lee Whitley?	Verbio?	
19	29-Nov	Green Chemistry <ul style="list-style-type: none"> ○ Metrics ○ Tools ○ Platform chemicals 			
20	1-Dec	Commercializing Green Chemistry		7-ACA Sitagliptin	
21	2-Dec	Cargill Industrial enzymes	??		Interesting claim
22	8-Dec	Final Exam			Exam

* Subject to change based on speaker availability.