

BIO 1140 – INTRODUCTION TO CELL BIOLOGY

Class Details

Location: Marion Auditorium (MRN150)

Section A - Tuesday 11:30AM - 12:50PM and Friday 1:00 - 2:20PM

Section B - Monday 8:30 - 9:50AM and Thursday 10:00 - 11:20AM

Section C - Monday 2:30 - 3:50PM and Thursday 4:00 - 5:20PM

Website

Lecture Component - BIO 1140 on [Brightspace](#)

There you will find the course outline, lecture slides, any required readings/viewing, a discussion forum, and all communication from me outside of lectures.

You are responsible for reviewing the site regularly for the latest content.

Lab Component - <http://www.biolab1.uottawa.ca/BIO1140/>

The 1140 Team

Dr. Alexandra Pettit – Instructor

alexandra.pettit@uottawa.ca

Office: BSC 108

Office hours: Tuesdays 1:30-2:30PM and Friday 2:30-3:30PM

* If you wish to meet outside of office hours, please email me and propose 3 times to facilitate scheduling

Dr. Fabien Avaron – Lab Coordinator

fabien.avaron@uottawa.ca

Office: BSC 106

Office hours: Friday 10:30-11AM, open-door policy

Marc Charette – Large Class Coordinator

marc.charette@uottawa.ca

Office: GNN 281

Office hours: Email for an appointment, please propose 3 times to facilitate scheduling

Teaching Assistants

Teaching assistants will be available to answer your questions via the ECHO 360 chat window during class or through the discussion forum on Brightspace outside of class.

Course Description

This course includes both a theoretical and a laboratory component. Topics covered in the lecture component will include: the chemistry of life, structure and function of cells and organelles, organization, replication and expression of genetic material, cell cycle, intracellular traffic, extracellular matrix, intercellular communication, and signal transduction. In the laboratory portion of the course, students will put into practice the theoretical concepts learned in lecture and gain experience using relevant experimental techniques.

Prerequisites: 4U Biology or BIO1109

Teaching Method

Each in-class lesson will incorporate lecture, discussion, and active learning exercises. I highly encourage you to come to each class meeting prepared to actively engage with the course content and participate fully. This holds true outside of class too, active engagement with the material (not re-reading notes or re-watching lectures) has proven to be the most reliable path to success in this (and any other) course!

Where Can I Get Help?



Your success in this class is important to me and asking for help will not be considered a sign of weakness! If there are aspects of this course that prevent you from learning or exclude you, please let me know as soon as possible. Together we will develop strategies to meet both your needs and the requirements of the course. If you have a question about the course content, future classes, university life or careers, **drop by my office hours or make an appointment to see me**, I'd be happy to chat!

The university also offers many free and easily accessible resources to help you succeed in your studies. A few key programs and points of contact are listed below but please do not hesitate to reach out if you are in need of help, I'm happy to point you in the right direction!

Student Academic Success Service (SASS) – SASS offers many workshops, academic mentoring and writing assistance, as well as counseling services. To see their full range of services, visit their [website](#).

Faculty of Science Mentoring Centre – The mentoring center can help you to set realistic goals, develop effective learning strategies, time and stress management skills. They offer **study groups** for specific science courses (BIO1140 is one of them!) and **skill development workshops** to help you improve your academic performance and your student experience. To see their full range of services or sign up for one of their offerings, visit their [website](#).

Science Students' Association (SSA) – SSA offers a variety of science merchandise, social events, scholarships and grants for science students at the University of Ottawa. To see their full range of services, visit their [website](#).

University of Ottawa Student Union (USUO) – Beginning its mandate as the new student union, check in with the USUO for matters pertaining to health/dental benefits and many new initiatives in the coming months. Visit their website [here](#).

What Resources Are Available for This Course?



Lecture Slides – The lecture slides for the course will be posted to Brightspace in .pptx and .pdf format. Each slide deck will include *specific learning outcomes* for the associated content; these should be used to help focus your attention and guide your studying within the course.

Lecture Capture - Lectures will be recorded with OpenCast. Recordings can be accessed after the class period (not in real-time) by clicking on the ‘Class Video Recordings’ link within Brightspace. These recordings are not meant to replace attendance in class or allow you to transcribe the discussion verbatim; rather they should be viewed as a means to catch up or revisit individual topics as needed for clarification after class. Please note that technical difficulties have occurred in the past resulting in certain recordings being lost and unavailable.

Reading - There is no required textbook for this class. There may however be times when supplemental reading will enhance your understanding of a given topic. For this purpose, the most recent edition of the following textbooks are suggested and you will see figures taken from them in the lecture slides.

- **Campbell Biology** by Reece *et.al.* (Pearson) – This is the required text for BIO1130. It is also a suitable resource for this course.
- **BIOLOGY 2e** (OPENSTAX) – This is a **free** open source biology textbook. You can [download your own copy](#) by clicking on the hyperlink.



Smart Biology - [Smart Biology](#) is an online learning tool that you will need to buy for the portion of the course on the plasma membrane and cellular communication. This resource is specially designed

for introductory courses in cellular biology, offers dynamic and active learning, and an overall greater level of detail on these subjects than the other reference texts. The price of the tool is **\$37 + taxes and its purchase is mandatory** because its use is directly related to your attendance, participation and reflection grade.

Detailed instructions on how to purchase the Smart Biology can be found on Brightspace. Remember to create your user account with your @uottawa.ca email address – this is how we identify you in order to award you points for completion of the associated lessons.

ECHO360 – The [ECHO360 active learning platform](#) will be used throughout the semester to facilitate in-class participation. Specific instructions detailing how to access and use the platform are available on Brightspace. This resource is **free** and students are expected to bring a compatible device (e.g. – smartphone, tablet, laptop) to class for **mandatory** participation.





Biolingo – [Biolingo](#) is an online learning platform developed by Drs. Elaine Beaulieu and Caroline Petit-Turcotte to study the effect of repeat testing and distributed learning specific to the content of BIO1140. Specific instructions detailing how to access and use the platform are available on Brightspace and will be discussed in class. This resource is **free** but is part of a research project. When you register for the game, we will ask you if you agree to allow us to use your data for research purposes. Your acceptance or refusal will not affect your ability to use the game or your academic performance. In addition, the professor will not be able to know whether or not you have agreed to participate in the project until the official grades are submitted to the Faculty in May. Full details pertaining to the research project can be found at the end of this document

Supplementary Info – Any additional resources used throughout the semester will be posted to Brightspace.

What Are We Going to Learn in This Course?



Course Content

By the end of this course, you should be able to:

1. Identify, use and define the relevant scientific terms describing cellular structures and processes.
2. Illustrate and interpret general concepts discussed during the course, both from a theoretical perspective and through the laboratory experiments.
3. Organize and structure biological observations and analyzes them to confirm or refute general concepts.
4. Choose and recommend appropriate observation techniques according to the level of cellular organization of interest.
5. Analyze, criticize, and relate to scientific material stemming from relevant literature.
6. Apply concepts learned to answer problems pertaining to both familiar and novel cell biology problems.

Communication, Professionalism, and Metacognition

Throughout the semester students will:

1. Demonstrate the ability to effectively communicate and work collaboratively with peers to successfully create and address problems sets in cell biology.
2. Critically evaluate one's own performance in the course to identify strengths and personal limitations in your knowledge of cell biology and/or study methods; develop personal learning goals to address any weaknesses and actively seek out assistance from appropriate sources to successfully address these areas.

3. Demonstrate professional behavior by: completing all course requirements in a timely manner; attending and being punctual at all required course activities and requesting an excused absence from a required course activity well ahead of the scheduled date whenever possible; honestly completing course evaluations without attempting to seek an advantage by unfair means, and by reporting any unethical behavior of peers to the course administration.

Program Level

Students will continue to develop their competencies in [all program level learning outcome categories set forth by the department of biology](#). The following program level learning outcomes will be emphasized within this course:

1. Explain the chemical and physical underpinnings of life.
2. Explain and integrate the key concepts of living systems such as biological diversity and its evolution, **cellular organization, transmission of biological information, structure-function relationships**, and functioning of ecological systems.
3. Apply the scientific method including formulating a hypothesis, designing studies, and drawing conclusions.
4. Demonstrate a set of core field and laboratory-based observations, measurements, and sampling techniques.
5. Acquire, process and analyze data using appropriate bibliographic, mathematical and statistical techniques.
6. Develop and defend logical, coherent arguments.
7. Demonstrate professional work habits and ethical conduct when working individually or as part of a team.

Laboratory Schedule

There are 5 labs during the semester. They take place in the afternoon from 2:30 to 5:20PM on the 3rd floor of the BSC building. The 1st lab will start during the week of **January 13th** and will run for 2 weeks. Visit the lab website at www.biolab1.uottawa.ca/BIO1140/ and read the lab manual introduction for more information. The laboratory manual is mandatory and is for sale at the UCU bookstore or you can download it from the laboratory website (which you can access from Brightspace). There will be a final (written) lab exam on **March 28th 2020**.

Lecture Schedule

This is a tentative lecture schedule subject to change as required during the semester.

	Week	Date	Class #	Topic	
Block 1	1	Jan 6 - 10	L1	Welcome	
			L2	Introduction to Cell Biology	
	2	Jan 13-17	L3	The Cell and its Organelles	
			L4	The Chemistry of Life	
	3	Jan 20-24	L5	Cell Membranes and Transport - Part 1	
			L6	Cell Membranes and Transport - Part 2	
	4	Jan 27-31	L7	The Cytoskeleton and Extracellular Matrix	
			L8	Spillover and Review	
	5	Feb 3-7	L9	Midterm 1	
	Block 2			L10	Metabolism - Part 1
6		Feb 10-14	L11	Metabolism - Part 2	
			L12	Cell Communication - Part 1	
Feb 17-21		Reading Week - No Classes			
7		Feb 24-28	L13	Cell Communication - Part 2	
			L14	Cell Communication - Part 3	
8		Mar 2-6	L15	Cell Death	
			L16	Spillover and Review	
9	Mar 9 - 13	L17	Midterm 2		
Block 3			L18	Nucleic Acids and Replication	
	10	Mar 16-20*	L19	Cell Cycle	
			L20	Transcription and Translation - Part 1	
	11	Mar 23-27	L21	Transcription and Translation - Part 2	
			L22	Transcription and Translation - Part 3	
	12	Mar 30-Apr 3	L23	Regulation of Gene Expression	
L24			Spillover and Review		
Final Exam Period (April 7-24th)					

* March 20 is the final date to withdraw from the course

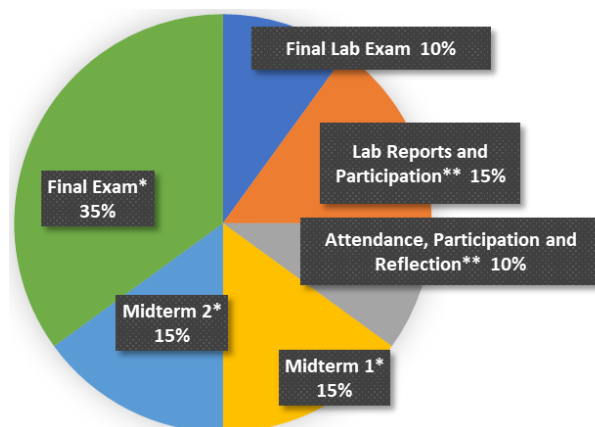
How Will My Learning Be Evaluated in This Course?

Your overall course mark will be determined based on your performance in both the laboratory and lecture.

Assessments OF Learning (75%)

There are two midterms and a final exam for the lecture portion of the course, along with one final lab exam.

You must achieve a passing average (37.5/75) across these four evaluations in order to pass the course. A final grade of “E” will be given for a cumulative grade between 40 and 50% (30-37.49/75) or “F” for a cumulative grade below 40% (<30/75).



i) Final Lab Exam (10%)

March 28th 2020 at 1PM, duration ~ 75 minutes

Refer to the [lab website](#) for additional details and policies related to a missed final lab exam.

ii) Midterm Exams (2 x 15%)

*If your final exam grade is higher than one or both of your midterm grades, it will be used to replace 2/3 of that midterm grade. This means that each midterm can be worth as little as 5%. This adjustment will be calculated and applied automatically at the end of the semester.

Exam Format (midterms and final)

- Multiple Choice (Scantron; please bring a pencil!), fill in the blank, figure drawing and/or labeling, definitions and short answer questions.

Midterm #1

Lecture #9 (week of Feb 3-7th), in class (MRN150), 1hr 15min (one class period)

- Content – lectures 1-8

Midterm #2

Lecture #17 (week of March 9-13th), in class (MRN150), 1hr 15min (one class period)

- Content – lectures 9-16
While this exam is **not cumulative**, please keep in mind that each topic builds on the fundamental concepts learned in the earlier material which may, therefore, be required to answer questions on this exam.

Procedure for Missing a Midterm

1. If you must miss a midterm due to serious illness, caregiver responsibilities or a death in the family contact me or Marc Charette as soon as possible.
2. To justify your missed midterm and **transfer its weight to the final exam**, you will be asked to complete a 'Student Declaration of Absence' form (available via brightspace) within 5 days of the missed examination.
3. If your absence is not documented, you will receive a grade of 0 for that evaluation.

iii) Final Exam (35%)

Date, time and location TBD – 3 hours, during the final exam period (April 7th - 24th)

* If your final exam grade is higher than one or both of your midterm grades, it will be used to replace 2/3 of that midterm grade. This means that your final exam can be worth up to a maximum of 55%. This adjustment will be calculated and applied automatically at the end of the semester.

- Content – The final exam is **cumulative** and will cover material from the entire course. Approximately 35% of questions will be drawn from lectures 1-16 and the remaining 65% of questions from lectures 18-24.

Procedure for Missing the Final Exam

- If you miss the final exam, you must contact the [Faculty of Science Undergraduate Office](#), not the instructor for the course, within 5 working days.
- Please consult [section 9.5 of the academic regulations](#) for acceptable grounds to request a deferral and the justification you will be required to submit.

Assessment FOR and AS Learning (25%)

** Points earned in the assessment FOR and AS learning categories will only count towards your final grade if you earn a passing grade on the assessments OF learning (i.e. – you must earn a cumulative average of 50% on midterms 1, 2, final exam, and the final lab exam).

You must participate in each of the following categories to earn the full 25% within this grade category. Points will be awarded as follows:

i) **Laboratory Participation and Reports (15%)** – See the [BIO1140 lab manual](#) for details pertaining to how this 15% is earned and all policies related to the lab. Please note that missing more than one in lab session, will result in a grade of 0 for this portion of the course.

ii) **Attendance, Participation, and Reflection (10%)** –

ECHO 360 and Brightspace - Throughout the semester, you will be asked to answer content related questions, engage in self-reflection and provide feedback on learning activities both in class and outside of class via these platforms. You are expected to attend the lectures for your assigned course section and will not be awarded participation points for attending any other section. Due dates for activities to be completed outside of class will be available on brightspace.

Smart Biology - You must view the assigned lessons and submit your Smart Biology quizzes by the due date indicated for each assignment (3 in total).

Due Dates Plasma Membrane – **Jan 20th 8:30am**
 Cell Communication 1 (modules 1-3) – **Feb 13th 8:30am**
 Cell Communication 2 (modules 4-7) – **Feb 24th 8:30am**

Each time you submit an answer to one of the questions in this grade category, you will earn a point. You are NOT required to submit the correct answer, so long as you make an honest effort to complete the activity to the best of your current ability you will be awarded the associated point. If you collect 80% of the total points available throughout the semester, you will earn the full 10% in this category. If you engage less than 80% of the time, your grade will be prorated accordingly (i.e. – [#of pts earned/(#of total points available*0.8)]*10).

Procedure for Missed Attendance, Participation, and Reflection Activities

The marking scheme for each category in the assessments FOR and AS learning takes into account the possibility of missed classes, forgotten activities, and technical issues. As such documentation for missed activities will not be accepted.

Grading

Grades for each evaluation will be posted to the gradebook on Brightspace for your information only. Please note that the tabulated final grade you see in Brightspace is not your official final grade, official final grades can be accessed via uoZone and will be posted according to [the official dates and deadlines of the university](#).

Letter grades assigned in this course will have the following percentage equivalents as per university regulations (see [Academic Regulation I-10 - Grading system](#) for further details):

A+ = 90-100	B = 70-74	D = 50-54
A = 85-89	C+ = 65-69	E = 40-49
A - = 80-84	C = 60-64	F = 0-39
B+ = 75-79	D+ = 55-59	



ABS (Absent) – Assigned to a student who has not attended the course, has not submitted any assignment and has not advised the University, within the time limits specified in the Important dates and deadlines schedule, that the course was dropped. This symbol is equivalent to a failing grade (F).

DFR (Deferred) – Assigned when the appropriate authority considers that the student has not completed the course requirements for a valid reason. The student will have to complete such requirements within a maximum of 12 months after the end of the term. If no mark has been filed with the Office of the Registrar twelve months after the end of the course, the DFR symbol will be changed to EIN.

DR (Drop) – Assigned to a student who has dropped the course within the time limits specified in the important dates and deadlines schedule. This symbol is not associated with a mark and, therefore it does not affect average calculations.

EIN (Failure/Incomplete) – Assigned to a student who has failed to complete a significant portion of the course assignments and/or examinations. This symbol is equivalent to a failing grade (F).

Exam Consultation

Midterms will be handed back by a TA at various sessions (the schedule will be posted to Brightspace once it is available) in the 1st floor lobby of BSC. Please note that picking up your midterms outside these specified sessions is not possible, so please ensure that you attend one of them if you want your midterm. Due to provincial privacy legislation, you will need to present your UOttawa student ID card or UPass to pick up your exam; no exceptions.

You will be allowed to consult your final exam during sessions that will be held during the month of May. The schedule will be posted on Brightspace once final exams have been marked. If you want to consult your final exam you will need to present yourself at one of these sessions and provide your UOttawa student ID card or UPass; no exceptions.

Remarking Requests

All exam remarking submissions are governed by and subject to [academic regulation 10](#). In this course, we have set up a remarking procedure that allows students to make a written appeal of their midterm or final exam mark, prior to embarking on a formal First Stage Grade Review. Students are required to specifically identify questions for which they have potentially detected an issue in the marking. A written rationale is required, on the back of the last page of the exam and must specifically compare the text in the exam that has potentially been incorrectly marked and the corresponding portion on the marking scheme. All midterm/final exam remarking appeals must be handed in to Marc Charette prior to the specified deadline, without exception, and will be remarked by Marc Charette. Remarking can increase, decrease or result in no change to the mark originally awarded. Remarking can also result in the entire exam being remarked, and this is at the discretion of the professor and/or Marc Charette. When the remarking process is complete, you will be notified via an announcement on the course website. Therefore, please do not contact us regarding the progress of the remarking process.

First Stage: Grade Review

This is a formal process by which the student appeals directly to the Chair of the Biology Department. Please note: this process has strict time limits, it is resource intensive for both the Chair, the professor and the student and should not be embarked on lightly. However, it is your right to trigger this process if you so choose. It is an inappropriate process for students to use if solely looking to increase their final grade letter in the course. More details can be found [here](#).

Policies

Attendance



Attendance and attention in lecture are expected for this class. Students are expected to attend all lectures **in their assigned course section** and will not be awarded participation points for attending any other section. While lecture slides are provided to registered students via Brightspace, participation in ongoing discussions and in-class activities is expected and necessary for your success in the course. Further, as outlined in the evaluation section, in-class activities will be awarded marks that will count towards your final grade and cannot be earned in an alternate manner.

I recognize that perfect attendance is not always possible for every student. I have designed this course to allow students the flexibility needed to succeed even when managing such circumstances. The specific policies pertaining to justification of absences are outlined for each evaluation type above. As a rule of thumb, contact me as soon as you become aware that you will miss an evaluation. Open, honest and early communication is key when individual accommodations may be required.

Accommodations

Your professor and the University of Ottawa are committed to providing access to the educational experience in order to promote [academic accessibility](#) for all individuals. For specific accommodation requests, the processes are as follows:

For Disability:

- The [Student Academic Success Service \(SASS\) Academic Accommodations](#), provides services to students with a variety of disabilities, including but not limited to learning disabilities, mental health challenges, chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact SASS at 613-562-5976 or adapt@uOttawa.ca, visit them at Desmarais Building (Rm 3172) or fill out their online form to arrange a formal evaluation. If you are already registered with SASS, please contact me at the start of the semester to ensure that the necessary accommodation arrangements are made to allow for your success in the course.

For Religious Obligation:

- Please write to me with any requests for academic accommodation as soon as possible after the need for accommodation is known to exist. For more details see the [Academic Regulation I-15 - Religious accommodations](#).

For Needs Related to Family Status or Exceptional Life Circumstance:

- Please write to me with any requests for academic accommodation as soon as possible after the need for accommodation is known to exist. For more details see [section 9.5 of the academic regulations on the evaluation of student learning](#).

Academic Integrity and Conduct

Academic integrity is defined as:

“A commitment even in the face of adversity to five fundamental values: honesty, trust, fairness, respect, and responsibility.” – Centre for Academic Integrity (1999)



Breaches of academic integrity are considered a serious offense at the University of Ottawa and cannot be resolved directly with the course instructor. In the event of a suspected offense, the Dean of the Faculty will conduct a rigorous investigation as outlined in [section I-14 of the Academic Regulations - Academic fraud](#). Penalties are not trivial and may range from a reprimand to a suspension from all studies or expulsion from the University. Some common violations are listed below but please see the [university website on academic integrity](#) and [download the student guide to academic integrity](#) for further details.

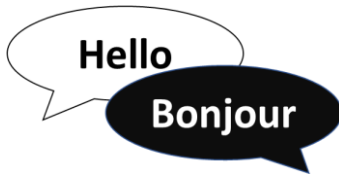
Plagiarism – Plagiarism is defined as presenting, whether intentional or not, the ideas, expression of ideas or work of others as one’s own. This may include:

- reproducing or paraphrasing portions of someone else’s published or unpublished material, regardless of the source, and presenting these as one’s own without proper citation or reference to the original source;
- submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, or paraphrased material, concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another’s data or research findings;
- handing in the same piece of work for academic credit more than once without prior written permission of the course instructor in which the submission occurs

Examinations - attempting to read another students exam paper; purposefully leaving an exam paper exposed for others to read; communicating with others during an examination; bringing unauthorized materials to an exam; posing as another student to write an exam; improper access to examination materials

Other - collaboration on work otherwise indicated to be done as an individual; disruption of instructional time

Conduct - The University of Ottawa is committed to providing a safe environment for learning. It is a violation of the standards of academic integrity for a student registered in class to disrupt the class or other period of instruction with any action or behaviour reasonably judged by the instructor, lab assistant or tutorial assistant to be detrimental to course instruction. *To ensure an optimum learning environment, [students are expected to behave in a professional manner at all times](#).* If a student exhibits obstreperous behavior in class and/or online and chooses not to refrain from such behavior at the request of the instructor, the student’s behavior will be reported to the faculty.



Bilingualism

I encourage students to submit work in the official language of their choice regardless of the language of instruction. This is your right as per [university regulations](#).

E-mail Etiquette

To facilitate efficient communication, I ask that you follow these guidelines:

- Always use your official @uottawa.ca e-mail address. I reserve the right to refuse to answer any e-mails not originating from university-issued addresses.
- Include the course code “BIO 1140” in the subject line
- Include your full name (first and last name) and student number
- Use appropriate and professional language while being mindful of your tone. Profanities, disrespect, aggression, and threats will not be tolerated.
- Be clear and brief when writing your messages. Please realize that I receive many e-mails per day from students. By avoiding unnecessarily long e-mails, you demonstrate respect for our time and are most likely to receive a timely reply.
- If your issues are complex or you wish to discuss a matter in great depth, I suggest stopping by office hours or making an appointment to speak in person.



Intellectual Property

Student or professor materials created for this course (including presentations and posted notes, labs, case studies, assignments, and exams) remain the intellectual property of the author(s). They are intended for personal use and may not be reproduced or redistributed without prior written consent of the author(s).

Sexual Violence

The University of Ottawa is committed to providing a safe and healthy campus for all members of the university community, this includes providing support to those members of the university community affected by sexual violence as outlined in [policy 67b](#). For more information, to make a report, or seek confidential support visit the university website on [sexual violence support and prevention](#).

Image Attributions

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BIOLINGO RESEARCH PROJECT

Title of the project: *Using gaming as an engaging distributed learning tool in post-secondary science education.*

Principal investigator:

Elaine Beaulieu

Assistant professor, Département de biologie, Université d'Ottawa

Tel: (613) 562-5800 ext x7884

Elaine.Beaulieu@uottawa.ca

Invitation and nature of the project: You are invited to participate in a research project aimed at assessing and improving bioscience education. This project is conducted under the direction of Dr. Elaine Beaulieu. The goal of this research is to study how the gamification of learning could be beneficial to science education. Participation is entirely **voluntary** and your participation decision will remain **anonymous** to both BIO1540 and BIO1140 professors until final grades have been released in May 2020. This way, your decision to participate in the research project will not act as prejudice towards you and your course mark.

The questions we are seeking to answer with this research project are as follows:

1. Do game users have increased learning gains in comparison to unexposed students?
2. Do high score gamers have increased learning gains in comparison to low score gamers?
3. Is the game well perceived by the students?

Although all students are required to use the online game as part of the regular course, consent is being sought for the access your course and game results for analysis purposes. In order to be able to answer these research questions, we need to be able to use your test results, your concept inventory results (a type of practice test we do in class every year to gauge how well students know the material before instruction and after instruction) and the data we will have acquired during your gaming experience (for example your score, time spent gaming during the semester, which questions were the hardest for you, etc...). The goal is to be able to measure whether playing the game actually helped the students to do better in the course.

The ethical aspects of this study have been reviewed and approved by the University of Ottawa Health Sciences and Science Research Ethics board.

Nature of the requested participation and conduct of the research project: Your participation in the research project consists in (i) carefully reading this consent form, (ii) consent to participate in the study by clicking the "I agree" box at the bottom of this consent form.

Advantages to the student: The student will have the gratification contributing to the advancement of knowledge on science education, with the ultimate goal of improving the quality of undergraduate science education at the university of Ottawa and elsewhere.

Anonymity and confidentiality: Your participation in this research project will remain anonymous to the professor until final grades are released to the Faculty in May 2020. All

collected data will be kept on password protected computer drives, to which only the investigators who need that data will have access. All the data will be kept for up to 10 years after the completion of the study, after which digital data will be securely and completely deleted and hard copies of exams will be destroyed appropriately. Any publication or reporting of the project findings will be done with pooled group data: no personal information will be divulged in any form. It is possible that partial student exam answers may be cited as examples in publications, but these will be anonymized and care will be taken so as not to reveal any information that could identify a student.

Right to withdraw without prejudice to the participation: Participation in this project is entirely voluntary. You have the right to withdraw consent at any point for any reason(s). You have the right to refuse to grant permission for the researchers to access your course and game results for any reason(s). The risks to you in granting permission to access course and game results are minimal and your participation will not affect your grades in any way. Your participation will help further scientific knowledge in this field, and may help improve bioscience education at the University of Ottawa and abroad, which may help you and other students.

If you have any questions about the research project or concerns with your participation to this project, please contact Elaine Beaulieu at the following number (613) 562-6800 ext 7884 or elaine.beaulieu@uottawa.ca.

If you have any concerns or questions about the ethical conduct of this research, please communicate with the uOttawa Office of Research Ethics and Integrity (613) 562-5387; ou ethics@uottawa.ca.