University of Toronto Scarborough – Department of Biological Sciences

BIOB32 – Animal Physiology Laboratory – Winter 2019

Course Instructor: **Dr. Jason Brown**
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Office Hours: Mondays 12:30-2:30pm, 3:30-5:30pm
Wednesdays 5:30-7:30pm

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Teaching Assistants: **Sen Sivalinghem**
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Course Description: This course examines physiological mechanisms that control and co-ordinate the function of various systems within the body. The laboratory exercises examine properties of digestive enzymes, characteristics of blood, kidney function, metabolic rate and energetics, nerve function and action potentials, synaptic transmission, skeletal muscle function, and mechanoreception.

Corequisites: (BIOB30H3) or BIOB34H3

Exclusions: BIO252Y, BIO270H, BIO271H, (ZOO252Y)

Lectures: Mondays 11:10am-12pm, HW216

My goal for the lectures in BIOB32 is two-fold:

i) to provide students with an overview of several important and/or interesting concepts in animal physiology (related to the topics addressed in the laboratory exercises) but to approach each concept from a different perspective than is typically taken in an introductory course on the subject (e.g., BIOB34) so that students can contemplate the material in a novel way and, thereby, achieve a more comprehensive understanding of the discipline;

ii) where possible, to place emphasis on non-mammalian species in order to highlight diversity in animal physiology.

Lecture notes will be posted (in PowerPoint format only) on Quercus ~24 hours before each lecture. NOTE: I reserve the right to make changes to the lecture notes after they are posted.

Laboratories: Students must be enrolled in one of the following laboratory sessions:

Pra1 – Mondays 1:10-4pm, SW321
Pra2 – Mondays 1:10-4pm, SW323
Pra3 – Tuesdays 11:10am-2pm, SW321
Pra4 – Tuesdays 2:10-5pm, SW321
Pra5 – Tuesdays 2:10-5pm, SW323
Pra6 – Wednesdays 11:10am-2pm, SW321
Pra7 – Wednesdays 11:10am-2pm, SW323
Pra8 – Wednesdays 2:10-5pm, SW321
Pra9 – Wednesdays 2:10-5pm, SW323

Students are expected to attend all laboratory sessions. Content from all of the laboratory sessions is subject to examination, and students are only permitted to receive credit for laboratory assignments when they have attended the corresponding laboratory session.

In the event that a student misses a laboratory session due to illness, they must submit a Self-Declaration of Student Illness Form, which is available at the following link:

https://www.utsc.utoronto.ca/biosci/sites/utsc.utoronto.ca.biosci/files/u26/Self%20Declaration%20of%20Student%20Illness%20Fall%202018.pdf

This form must be submitted within three days of the missed laboratory session or it will be declined. Students who submit this form will be receive credit for the laboratory assignment(s) corresponding to the missed laboratory session(s) so long as they make a meaningful contribution the laboratory assignment. Therefore, students who miss a laboratory session due to illness should communicate with their group members about their absence and make arrangements to contribute to their group's laboratory assignment as soon as possible. The course instructor reserves the right to inquire with a group about whether a student who missed a laboratory session contributed meaningfully to the laboratory assignment. Students who are deemed to have not contributed to their group's laboratory assignment will be denied credit, and students cannot submit individual laboratory assignments to make up for these lost marks.

Students must attend only the laboratory session for which they are registered as, for legal and safety reasons, there are limits to the number of students that each laboratory session can accommodate. Students attempting to attend a laboratory session for which they are not registered will be denied entry unless they have previously been granted permission by the course instructor. Students who arrive to their laboratory session late may be denied entry into the laboratory session at the discretion of the teaching assistant. Arriving late for a scheduled laboratory session will not be accepted as grounds for attending another laboratory session later in the week.

Students who are granted permission to attend a different laboratory session must still contribute to their assigned group's laboratory assignment, not the group with which they worked to complete the laboratory exercise. Students who are attending a different laboratory session in a given week should communicate with their group members about their planned absence and make arrangements to contribute to their group's laboratory assignment as soon as possible.

By provincial law, students are required to wear a lab coat and closed-toed shoes whenever they are in the laboratory. Moreover, no food or drink (not even water bottles) is permitted in the laboratory at any time. If students violate any of these legal requirements, the teaching assistant will rescind their entry into the laboratory immediately. When necessary, disposable gloves will be provided to students.

The procedure for each laboratory exercise, as well as some pertinent background information, will be posted on Quercus about one week prior the laboratory session in which it is to be completed. Students must have access to the laboratory procedure throughout each laboratory exercise, whether in print or via electronic device, and should familiarize themselves with the procedures before coming to the laboratory session. Students will often be required to record the results of their laboratory exercise and should have a notebook (paper or electronic) for this purpose.

Before leaving each laboratory session, students must "check-in" with their teaching assistant, at which time the teaching assistant will review the student's completion of the laboratory exercise and the student's attendance at the laboratory session will be noted.

Textbook:

Each lecture in this course has been inspired by one or more review papers from the primary literature, and I will post these papers on Quercus for those students who may be interested in reading them. You are not required to read these papers, and you are only responsible for material covered in class (both lecture and laboratory).

Because there is only a limited amount of lecture time, I will not be reviewing basic physiological concepts in class. If you need to refresh your knowledge of these basic concepts, I would recommend the following textbook, which is available in the campus bookstore:

Animal Physiology, 4th ed., by Hill, Wyse, and Anderson
**This is the same textbook used in BIOB34 in Fall 2018

I will not be posting any suggested readings from this textbook. It is the responsibility of the student to locate the relevant background information in the textbook, if desired.

Evaluation:

Term Tests	15% (15% best; 0% worst)
Laboratory Assignments	40% (5% each x 8 best)
Laboratory Work Ethic	10%
Final Exam	35%

**NOTE: Students must pass at least one exam in order to receive credit for this course. Students who do not pass at least one exam will receive a grade no higher than 49%.

Important Notes Regarding Evaluations:

Term Tests
There are two Term Tests in this course, which are held outside of class time. The dates and times of the Term Tests will be determined by the Registrar's Office during the first few weeks of the semester, and I will post this information on Quercus as soon as it is available.

Term Tests may cover any material taught in this course, but the lectures emphasized on each Term Test will be announced in class and on Quercus. Term Tests will be 2 hours and will comprise of short answer questions only. Students will be evaluated based on the reasonableness, clarity, and conciseness of their written answers to the questions. Students will have some choice with regards to which questions they answer (e.g., answer 1 of 2 short answer questions). **The Term Test questions will require students to think critically and creatively about the lecture and laboratory content as students will be expected to explain novel observations and solve problems. This reflects my belief that undergraduate students need to develop not only their**

scientific knowledge but, more importantly, their competency for thinking, reasoning, and scientific inquiry.

To help student prepare for Term Tests, optional quizzes (here optional means not worth any marks) will be posted on Quercus each week. Students are strongly encouraged to discuss these quizzes with the course instructor when they encounter any difficulties, either by email or during office hours (preferred).

If you know in advance that you cannot write a Term Test at the scheduled time because it conflicts with some other valid activity, please notify the course instructor as soon as possible so that arrangements can be made for you to write the Term Test at an alternative time. Any such alternative time must be before the scheduled date of the Term Test.

If you miss one Term Test due to medical illness, then the missed Term Test will be automatically considered as your Worst Term Test, which is not worth any marks. No medical documentation is required.

If you miss both Term Tests due to medical illness, then you must submit a detailed UTSC Medical Certificate filled out by the physician who saw you on the day of the Term Test, for both Term Tests. These notes must be submitted to the course instructor as soon as possible following the second Term Test, whether in person or via email. Other medical notes will not be accepted, and if the UTSC Medical Certificates are not completed to the satisfaction of the course instructor, it may be refused. The UTSC Medical Certificate can be found via the following link:

http://www.utsc.utoronto.ca/~registrar/resources/pdf_general/UTSCmedicalcertificate.pdf

If you miss both Term Tests for any other valid reason(s), please consult with the course instructor as soon as possible after the second Term Test. The course instructor will determine whether the reason(s) given for the missed Term Tests is valid in accordance with university policies. Also, the course instructor may ask for any documentation required to verify the reason given.

For students who miss both Term Tests for valid reasons (medical or otherwise), their final exam will be worth 50% of their final course grade.

Students who miss a Term Test for any invalid reason will receive a grade of zero for that Term Test.

Laboratory Assignments

During the first laboratory session (January 14-16), students will be organized into groups of approximately 4-5. Each group will be assigned a laboratory bench and will choose a group name, which will be used organize groups on Quercus. Reflecting that science is a collaborative discipline, students will perform all laboratory exercises and submit all laboratory assignments in these groups.

There are 11 laboratory sessions, but only the best 8 assignments will count towards the students' grade for laboratory assignments, each one being worth 5% of their final grade. All assignments

will be submitted via Quercus, with only one submission required per group. Assignments will be submitted as attached files, which must be either .doc or .pdf files. Assignments are due before the commencement of the following laboratory exercise. Late submissions may be rejected at the discretion of the teaching assistant.

Each laboratory assignment will consist of three of the following six sections. For each laboratory assignment, students can choose which three particular sections they wish to incorporate, but, over the course of the semester, students must incorporate each of the following sections into at least one laboratory assignment. Failure to meet this requirement will lead to laboratory assignments being rejected.

Detailed guidelines for each section follow:

1) Structured Abstract

A structured abstract is a concise and factual written description of the laboratory exercise. It is clearly subdivided into the following sections: Background & Objectives (i.e., the context and purpose of the laboratory exercise), Methods (i.e., the procedures and equipment used to carry out the laboratory exercise), Results (i.e., the actual data collected in the laboratory exercise), and Conclusions (i.e., your interpretation of the results and their significance to the field of animal physiology). A structured abstract must be able to be understood by a general science reader (e.g., teaching assistant) without any reference to other sources (including the laboratory procedure posted on Querucs). To this end, references are not necessary, and abbreviations should be avoided unless necessary or common, in which case they must be defined at their first mention (e.g., Oxidative phosphorylation (OXPHOS) is the major source of ATP in the cell.).

The word limit for this section is 300 words.

For examples of structured abstracts, please consult:
https://www.nlm.nih.gov/pubs/techbull/ja10/ja10_structured_abstracts.html
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6121046/

2) Graphical Abstract

A graphical abstract is a concise, single-panel pictorial representation of the laboratory exercise. It should grab the attention of a general science reader (e.g., teaching assistant) and clearly illustrate the principal results of the laboratory exercise as well as their meaning and/or significance (i.e., the "take-home message"). Only simple labels should be used; that is, the graphic itself should be easily interpretable without any caption or complex written descriptions. No additional text/abstract is required.

For examples of graphical abstracts from published biology papers, please consult:
https://www.elsevier.com/authors/journal-authors/graphical-abstract

3) Captioned Figure

A captioned figure is a graph that depicts in detail the results from one particular part of the laboratory exercise. It should have the appearance of a figure as it would be presented in a scientific publication (e.g., black-and-white, no gridlines, complete axes labels, etc.) and should have a complete and proper caption (whose first sentence is the figure title; thus, the figure title should not appear on the figure itself) that allows for it to be understood by a general science reader (e.g., teaching assistant) without any reference to other sources (including the laboratory procedure posted on Quercus). All symbols used on the figure should be explained (either in the caption or in a legend), and it is preferred that students use open or filled bars, circles, triangles, squares, or diamonds, where possible. Students are not required to conduct any statistical analysis of their data. [NOTE: Captioned figures may have multiple panels (A, B, C, etc.).]

For examples of captioned figures, please consult:
http://jeb.biologists.org/content/jexbio/219/16/2469.full.pdf
http://jeb.biologists.org/content/jexbio/219/18/2802.full.pdf

For assistance with plotting data in Excel, please consult:
https://www.youtube.com/watch?v=uH4RuuVQKLI

4) Literature Search and Comparison

For a literature search and comparison, students should find two primary (i.e., non-review) articles, published in peer-reviewed journals, that investigated a research problem similar to that of the laboratory exercise, whether in the same or a different species. For each article, students should briefly describe the results and whether they are consistent with the results of their laboratory exercise. Where the results are consistent, students should explain the general principle(s) that we, as animal physiologists, can extrapolate from these results. Where the results are inconsistent, students should provide a reasonable hypothesis to explain the discrepancy.

The primary articles used for this section must be cited using the reference format employed by the *Journal of Experimental Biology*: http://jeb.biologists.org/content/manuscript-prep#ref

The word limit for this section is 500 words (not including references).

5) Inquiry-Based Laboratory Exercise Proposal

This course employs "cookbook"-style laboratory exercises, so called because students follow step-by-step instructions in order to achieve an expected outcome, in the same way that one follows the directions of a recipe to get the desired product. While there are many advantages to such laboratory exercises (e.g., manageable for courses with large enrollment, laboratory exercises correspond with classroom lectures, etc.), there are also significant disadvantages of such laboratory exercises (e.g., critical thinking and problem-solving skills not developed, students do no learn how to plan experiments, etc.). In response to these disadvantages, many educators advocate for "inquiry-based" laboratory exercises, where students design and execute their own experiment.

An inquiry-based laboratory exercise proposal is a document in which students put forward a plan for their own experiment. [NOTE: Students will not actually be conducting these experiments, but

they should design these experiments as if they were going to conduct them.] The proposal must outline a research question, hypothesis, and experimental design. In designing their experiment, students must consider the cost of any resources needed, and are limited to spending $500. (A detailed budget must be included for any proposed expenditures. This will require students to consult online catalogues to find pricing information from such sites as sigmaaldrich.com/canada and ca.vwr.com) Students may propose the use any resources that were utilized in the corresponding "cookbook"-style exercise carried out in this course, free of charge.

The word limit for this section is 1000 words.

6) Press Release

It is important for scientists to be able to communicate the results of their experiments to the general public, especially since most experiments are funded publicly through taxation.

For the press release, students should write an article that could be displayed on the UTSC Homepage. Students should consult the UTSC Homepage to familiarize themselves with the format and style of the articles featured there. The article must have a catchy title and brief description, as well as photo image, that would appear on the rotating banner on the UTSC Homepage. The article must also have a body (word limit = 500 words) that describes the laboratory exercise in a manner i) suitable for consumption by prospective students and the general public and ii) that will excite people about the work being conducted by students at UTSC. Students must also provide a second, different photo image that could appear when someone clicks on the banner to read the article. All photo images used for this section must have been taken by the students during the laboratory exercise. Stock images from the Internet are not permitted due to copyright laws.

[NOTE: I am hoping to persuade the UTSC Webmaster to profile the best "Press Release" submitted by students in this course on the UTSC Homepage.]

Grading:

All laboratory assignments will be evaluated via Quercus. There are only three possible grading outcomes for each submitted laboratory assignment:

1) *Accepted***:** This means that the laboratory assignment has been done very well. Assignment receives 10/10. TA will not provide any feedback.

2) *Revisions Required***:** This means that the laboratory assignment has been done well but there remains significant room for improvement. Assignment receives 7/10. TA will provide feedback. Students can choose to accept the current grade or revise the assignment in accordance with the TA's feedback and resubmit. The TA will then review the resubmitted assignment and, if the changes made make the assignment acceptable, the TA will change the students' grade to 10/10. (All resubmitted assignments are due within one week from the date and time that the TA's feedback was posted to Quercus. It is the students' responsibility to check Querucs to see when the TA's feedback has been posted. Late submissions may be denied at the discretion of the teaching assistant.)

3) *Rejected***:** This means that the laboratory assignment has been done incorrectly or does not meet the expectations of a second-year undergraduate student at UTSC. Assignment receives 0/10. TA will provide feedback to help improve future assignments. No revision/resubmission is permitted for rejected assignments. Please note that, in rejecting a laboratory assignment, we are not discounting the amount of work that students may have put forth in the preparation of the assignment; rather, we are expressing that the assignment has considerable shortcomings that could not be easily corrected through minor revision.

When students receive a 7/10 or 0/10 for a laboratory assignment, they are encouraged to carefully read and reflect upon the feedback provided to improve future submissions rather than protesting their grade. The objective of these assignments is help students develop a broad array of scientific skills, and one of the best methods for learning a new skill is to learn from failure. If students wish to protest the grading outcome of their laboratory assignments, they should contact their teaching assistant first. They should only contact the course instructor after having failed to resolve their concerns with the teaching assistant.

Laboratory Work Ethic

This mark will be awarded by the teaching assistants at their discretion and will be based on preparedness for and contribution to laboratory sessions. During the first laboratory session, each teaching assistant will communicate to their students any specific expectations that they have with regards to the demonstration of work ethic. The course instructor will not entertain any disputes by students with regards to this grade. Students are encouraged to maintain an open dialogue with their teaching assistant throughout the semester so that any problems with a student's laboratory work ethic can be addressed early.

Final Exam

The Final Exam (3 hours) will be scheduled by the Registrar's office (April 10-27). The Final Exam will cover all material taught in the lectures and laboratory sessions throughout the course, though it will place emphasis on the material taught after Term Test 2. It will have the same format as the Term Tests.

Tentative Schedule:

WEEK	LECTURE	LABORATORY SESSION
Jan 7	Introduction to the Course	***No Laboratory Exercise***
Jan 14	Comparative Digestive Physiology	Properties of Digestive Enzymes
Jan 21	Discontinuous Gas Exchange in Insects	Blood: A Comparison Between Two Vertebrates
Jan 28	Comparative Physiology of Body Fluid Regulation in Vertebrates	Water Diuresis
Feb 4	Comparative Physiology of the Heart	Effects of Pharmacological Agents on *Daphnia* Heart
Feb 11	Recent Advances in Our Understanding of Metabolic Scaling	Metabolic Rate of a Crayfish and the Q_{10} Effect
Feb 18	FAMILY DAY & READING WEEK	
Feb 25	Understanding the Resting Membrane Potential	Extracellular Recordings of Action Potentials in the Earthworm
Mar 4	Understanding the Action Potential	Extracellular Recordings of Compound Action Potentials in a Crab Nerve
Mar 11	The Physiology of Superfast Skeletal Muscles	Action Potentials of Frog Sciatic Nerve/Force Recordings of Frogs Gastrocnemius Muscle (video)
Mar 18	Understanding the Mechanisms of Smooth Muscle Contraction	Excitation of Crustacean Muscle
Mar 25	The Origins of Specific Dynamic Action	Specific Dynamic Action in Cockroaches
Apr 1	Understanding Taste	Mechanoreceptors (Cricket Sensory Neurons and Mammalian Diving Response

Accessibility Needs:

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the Access*Ability* Services Office as soon as possible. I will work with you and Access*Ability* Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC Access*Ability* Services staff (located in S302) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or ability@utsc.utoronto.ca.

Academic Integrity:

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's *Code of Behaviour on Academic Matters* (http://www.governingcouncil.utoronto.ca/policies/behaveac.htm) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

In papers and assignments:	-using someone else's ideas or words without appropriate acknowledgement -submitting your own work in more than one course without the permission of the instructor -making up sources or facts -obtaining or providing unauthorized assistance on any assignment.
On tests and exams:	-using or possessing unauthorized aids; -looking at someone else's answers during an exam or test -misrepresenting your identity
In academic work:	-falsifying institutional documents or grades -falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. There are other offences covered under the Code, but these are the most common. ***Please respect these rules and the values that they protect.***