

# BIOB32H3

## Animal Physiology Laboratory

### Winter 2016

#### Course Syllabus

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*“This course examines physiological mechanisms that control and coordinate the function of various systems within the body. The laboratory exercises examine properties of digestive enzymes, characteristics of blood, metabolic rate, kidney function, nerve function and action potentials, synaptic transmission, skeletal muscle function and mechanoreception.”*

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#### Instructor

Kenneth Welch, Ph.D.

Room SW521C

[kwelch@utsc.utoronto.ca](mailto:kwelch@utsc.utoronto.ca)

#### Objectives

This course builds on the foundational knowledge of physiology you gained in the pre-requisite, lecture-based course, BIOB34. Here, we will put many of the concepts you learned to a practical test. You will conduct experiments and exercises designed to demonstrate these concepts in action, familiarize you with experimental and quantitative technique, and help you to appreciate the scientific work that originally elucidated these principles. Experiments don't always go as planned or produce flawless, perfectly understandable results. It takes time to develop the technical expertise and experience necessary to carry out the highest quality experimental work. And even then, results can sometimes be confusing...this is why we always repeat experiments many times before we are fully satisfied we understand the results.

In addition to the practical element, this course will highlight comparative differences among animals. You will be exposed to examples you have and have not already seen in order to understand how common physiological principles apply across taxa, and how some details relating to these principles can differ in relation to phylogeny (evolutionary lineage), ecology, and environment.

With this in mind, ***it is important that you be able to recall and reuse the information you gained in BIOB32. You will need to know this material in order to understand many concepts and examples presented in BIOB32 and to be able to correctly answer many/most exam questions. We are building from the lessons in BIOB34, not repeating them.*** If you do not remember material learned in BIOB34, you should review it. If you do not understand the context of comparative examples given in this course, you should review the basic information you learned or consult your textbook.

I am happy to answer questions about the material in this course. But I cannot be your study partner for a review of BIOB34.

# General Information

## *Lab Technician*

Chris Armstrong, SW322

## *Prerequisite*

BIOB34 – Animal Physiology

## *Textbook*

BIOB34 is the required prerequisite course and assigned Animal Physiology (by Hill, Wyse, and Anderson) as its required textbook. I will assume you still have this textbook. However, *if you do not, don't panic*. Any recent (last 2-3) edition of a human or animal physiology textbook such as Eckert's Animal Physiology (Randall, Burggren and French), Human Physiology (by Silverthorn), Comparative Animal Physiology (by Withers), and Principles of Animal Physiology (by Moyes and Schulte) will provide you all the pertinent information. I will place copies of some of these various animal physiology textbooks on reserve in the library.

It is **STRONGLY** recommended that you read/review the assigned text from one of these textbooks. This reading will dramatically help with your studying for this course.

## *Lectures*

Monday 11 AM - 12 PM, Room HW216

The first lecture will be available on January 4<sup>th</sup> via **WebOption ONLY** (this one day) and will introduce the course material (see schedule below).

## *Blackboard*

The course Blackboard site will be your primary resource for lecture notes, lab manuals, assignment instructions, course announcements, posted grades, and for asking content-based questions.

## *Lecture Notes*

The lecture notes (the slides) will be posted on the course Blackboard site the day before (when possible), or immediately after, the lecture. Please let me know if there are any problems accessing these notes. If the lecture is not present on the site, it is not yet ready. You are *strongly* encouraged to take some notes while I talk about each slide. You are welcome to record lectures on your own devices to review at home.

## *Asking Questions*

***NOTE: Due to privacy concerns we can only respond to e-mails from official UofT e-mail addresses. E-mails from private addresses will be ignored.***

### Administrative/Logistical Issues

If you have questions about personal issues (e.g. missed lecture/lab/exam, illness, etc.), e-mail me ([kwelch@utsc.utoronto.ca](mailto:kwelch@utsc.utoronto.ca)).

### Lecture content

If you have questions about lecture content (e.g. "How does concept XXX relate to the difference between example A and example B?"), ***post your question to the course Blackboard discussion board***. The discussion board will be set to "anonymous", so you don't have to be embarrassed to ask a question. I want all students to benefit from seeing my answer to your question. ***I will not respond to e-mail directly to me asking course content questions.***

## Laboratory-related questions

All lab-related questions (e.g. “Am I supposed to refer to the lab-average results to answer question Y (and not my own group’s, given the strange result we got during experiment B?”), should be directed to your lab TA. I cannot answer questions about experiments I did not see you perform.

## Laboratories

### *Weekly Schedule*

Section	Day	Time	Room	TA
<b>PRA0001</b>	Monday	1-4 PM	SW321	<b>Derrick Groom</b>
<b>PRA0002</b>	Monday	1-4 PM	SW323	<b>Thanara Rajakulendran</b>
<b>PRA0003</b>	Tuesday	11 AM-2 PM	SW321	<b>Annik Carson</b>
<b>PRA0004</b>	Tuesday	2-5 PM	SW321	<b>Annik Carson</b>
<b>PRA0005</b>	Tuesday	2-5 PM	SW323	<b>Thanara Rajakulendran</b>
<b>PRA0006</b>	Wednesday	11 AM-2 PM	SW321	<b>Sen Sivalinghem</b>
<b>PRA0007</b>	Wednesday	11 AM-2 PM	SW323	<b>Brandy Velten</b>
<b>PRA0008</b>	Wednesday	2-5 PM	SW321	<b>Sen Sivalinghem</b>
<b>PRA0009</b>	Wednesday	2-5 PM	SW323	<b>Peter Perri</b>

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*Remember: Your TA is the first person you should turn to for answers about questions having anything having to do with the lab. They know your lab section and the details of what happened in lab that week even when the instructor doesn't.*

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### *TA E-mails*

TA	E-mail Address
<b>Annik Carson</b>	<b>annik.yalnizyan.carson@mail.utoronto.ca</b>
<b>Derrick Groom</b>	<b>derrick.groom@mail.utoronto.ca</b>
<b>Peter Perri</b>	<b>p.perri@mail.utoronto.ca</b>
<b>Thanara Rajakulendran</b>	<b>thanara.rajakulendran@mail.utoronto.ca</b>
<b>Sen Sivalinghem</b>	<b>sen.sivalinghem@utoronto.ca</b>
<b>Brandy Velten</b>	<b>brandy.velten@mail.utoronto.ca</b>

### *Lab Manual*

Available on Blackboard. Each lab manual will be posted at least 1 week prior to lab. You can record all data in manual pages, or on separate sheets stapled to your lab manual. You will need to download and read the manual for each week’s lab PRIOR TO attending the lab so that you understand what is expected of you in each laboratory session.

### *Materials and Lab Rules*

***You are required to purchase a lab coat before the week of January 12th.*** You must submit lab manual materials for grading in a DUOTANG folder. Disposable gloves are provided in lab.

Provincial law states that the *wearing of lab coats while inside the labs is mandatory at all times*. No food or drink (including water bottles) is allowed inside the labs. There will be periodic inspections to ensure these rules are followed. Those not complying will be removed from the class. It's the law, and we all have to follow it!

### *Attendance*

Attendance at laboratories is mandatory.

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*Missing ONE lab (without prior legitimate excuse) may affect participation grade.*

*Missing TWO or MORE labs may result in a student **NOT PASSING** the course.  
This is a practical course and 'doing' the labs is the whole point.*

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If you anticipate you might miss a lab (or if you already did), contact me as soon as possible ([kwelch@utsc.utoronto.ca](mailto:kwelch@utsc.utoronto.ca)), to try to make the lab up. Due to lab space availability limits I cannot promise this can be done in all cases.

In case of absence due to illness, only fully completed official University of Toronto Illness Verification Forms will be accepted for consideration. I cannot accept other notes.

Download the official illness verification form at [www.illnessverification.utoronto.ca](http://www.illnessverification.utoronto.ca).

### *Lateness*

Students that are 10 minutes or more late for lab are considered absent.

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*Regardless of absence or lateness, you are still responsible for lab manual completion and all assignments (even if you miss a lab for legitimate reasons).*

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### *BioPac Lab Software*

Many of the labs make use of BioPac equipment. Using the student software, you will have the ability to analyze computer recordings of lab data outside of lab time. You can obtain the software (MAC or PC) off of the lab laptops or download the software at:

[http://www.utsc.utoronto.ca/~kwelch/BIOB32/bsl\\_analysis.zip](http://www.utsc.utoronto.ca/~kwelch/BIOB32/bsl_analysis.zip) (PC)

[http://www.utsc.utoronto.ca/~kwelch/BIOB32/bsl\\_analysis\\_mac.zip](http://www.utsc.utoronto.ca/~kwelch/BIOB32/bsl_analysis_mac.zip) (MAC)

## Evaluation

### *Grade Breakdown*

Lab Participation, **10%**

Lab manual assignments, **20%**

Quizzes (3 of them, dates announced >1 week in advance), **10%** (for all 3)

Midterm Exam, **15%**

Mini Lab Report, **5%**

Full Lab Report, **15%**

Final Exam, **25%**

### *Lab Participation (10%)*

You will be graded on your attendance, timeliness, and participation in group research projects (this will include equipment setup, carrying out experiments, recording results, and cleaning up). You will also be graded on your apparent preparation for lab tasks. For example, if you fail to bring your lab coat, consistently fail to have read the lab manual instructions, or fail to bring the lab manual or other necessary items, your participation grade may be adversely affected.

TAs will periodically check your lab notebook to ensure that you are taking adequate notes, recording data, and will grade assignments in the lab manual. You are responsible for completing all lab manual assignments (e.g. for lab #4) for a given lab by the start of the next lab section (e.g. by start of lab #5). Your TA can 'spot-check' your lab manual at any time. They will also require you to submit your lab manual for grading at a few select points during the term. Your TA will discuss the timing of this with you in lab.

### *Quizzes (x3) (10% total)*

Quizzes will be brief (5-10 questions), composed of multiple choice and/or short answer questions, and will be administered at the beginning of **your lab**. The date of quizzes will be announced during the lecture the preceding week ( $\geq 1$  week ahead of time). Quizzes will cover material from the last few labs AND material covered in the lab manual for the lab taking place that week (so, make sure you read the lab manual ahead of time). Quizzes are different for each lab section but are all of equal difficulty.

### *Lab Reports (5% and 15%)*

Specific instructions on what is expected in this report will be made available online prior to the lab itself. This is not a group project but will require sharing of results from other groups.

### Important Note

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*During the winter 2016 term, we will be using the program "Turnitin" for the submission of assignments (e.g. lab report). More information will be provided once all of the details have been worked out. For now, you should be aware of the following policy for the use of Turnitin at the University of Toronto.*

*"Normally, students will be required to submit their course essays to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site".*

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### *Late Policy*

Late penalties are:  $\leq 1$  day late (15%),  $\leq 3$  days late (30%),  $\leq 5$  days late (50%) and  $> 7$  days late (100%).

### *Exams (Midterm: 15%; Final: 25%)*

The midterm will take place **TBD**

**If your last (family) name begins with A-L: Room TBD.**

**If your last (family) name begins with M-Z: Room TBD.**

The final exam will take place **TBD**

**If your last (family) name begins with A-L: Room TBD.**

**If your last (family) name begins with M-Z: Room TBD.**

All exams/quizzes are closed-note. Software intended to detect plagiarism within lab reports will be used. The UTSC academic ethics/cheating policies will be enforced.

The midterm and final exams will consist of multiple choice, T/F, and matching questions as well as a select few short-form written answer questions. The midterm will cover It will cover material from **lectures 1-6 and labs 1-5**. The final exam will be cumulative. Approximately 1/3 of the material covered will be from the first half of the course (covered on the midterm) with about 2/3 of the material covered from after the midterm. The final format of the exams will be announced once the exams are scheduled.

Exam questions will come from the lectures, lab manual, select readings posted to the intranet, carryover materials from BIOB34, and from concepts and data presented in the labs. You are not responsible for material from a textbook that was not covered in the lectures (BIOB34 or BIOB32) or the labs.

Lecture and Laboratory Schedule

Week of	Lecture	Suggested Reading/Review	Laboratory Exercise
Jan. 4	#1 Introduction to Comparative Physiology	---	---
Jan. 11	#2 Acquiring Energy; Digestive Physiology	Chapter 2 “Molecules and Cells in Animal Physiology”: Sections “Enzyme Fundamentals” through “Evolution of Enzymes” Chapter 6 “Nutrition, Feeding, and Digestion”	#1: Properties of Digestive Enzymes
Jan. 18	#3 Respiratory Physiology and High Elevation Adaptation	Chapter 22 “Introduction to Oxygen and Carbon Dioxide Physiology”: Sections “The properties of gases...” through “Convective transport of gases...” Chapter 23 “External Respiration: The Physiology of Breathing”: Sections “Fundamental concepts...” through “Breathing by birds” Chapter 24 “Transport of Oxygen and Carbon Dioxide in Body Fluids”	#2: Blood: A Comparison Between Two Vertebrates
Jan. 25	#4 Maintaining Water Balance	Chapter 5 “Transport of Solutes and Water”: Section “Osmosis” Chapter 27 “Water and Salt Physiology I”: Section “Metabolic water” Chapter 28 “Water and Salt Physiology II”: Sections “Animals on land: Fundamental physiological principles” through “Control of water and salt balance in terrestrial animals” Chapter 29 “Kidneys and Excretion”: Section: “Nitrogen disposition and excretion” Chapter 30 “Water, Salts, and Excretion at Work”: Sections “The dramatic adaptations of particular species”	#3: Water Diuresis/Osmoregulation
Feb. 1	#5 Metabolism and Energetics I	Chapter 7 “Energy Metabolism”: Sections “Fundamentals of animal energetics” through “Basal metabolic rate and standard metabolic rate” Chapter 8 “Aerobic and Anaerobic Forms of Metabolism”: Sections “Mechanisms of ATP production and their implications” through “Comparative properties of mechanisms of ATP production”	#4: Introduction to Data Recording and Analysis in BioPac
Feb. 8	#6 Metabolism and Energetics II	Chapter 7 “Energy Metabolism”: Section “Metabolic scaling” Chapter 8 “Aerobic and Anaerobic Forms of Metabolism”: Sections “Comparative properties of mechanisms of ATP production” through “The interplay of aerobic and anaerobic catabolism during exercise”	#5: Metabolic Rate in Invertebrates I
Feb. 15	NO LECTURE OR LAB: READING WEEK		

Lecture and Laboratory Schedule, continued

<b>Week of</b>	<b>Lecture</b>	<b>Suggested Reading/Review</b>	<b>Laboratory Exercise</b>
Feb. 22	#7 Scaling With Body Mass; Thermal Physiology	Chapter 10 “Thermal Relations”: Sections “Temperature and heat” through “Endothermy and homeothermy in insects”	#6: Metabolic Rate in Invertebrates II
Feb. 29	#8 Thermal Physiology; Measuring Electrical Phenomena	Chapter 5 “Transport of Solutes and Water”: Section “Passive solute transport by simple diffusion” Chapter 12 “Neurons”: Section “The ionic basis of membrane potentials”	#7: Extracellular Recordings of Action Potentials
Mar. 7	#9 Action Potentials	Chapter 12 “Neurons”: Sections “The action potential” through “The propagation of action potentials” Chapter 13 “Synapses”: Sections “Synaptic transmission is usually chemical but can be electrical” through “Fast chemical synaptic actions are exemplified...”	#8: Compound Action Potentials in an Invertebrate
Mar. 14	#10 Synapses and the Neuromuscular Junction	Chapter 12 “Neurons”	#9: Compound Action Potentials in a Vertebrate
Mar. 21	#11 Skeletal Muscle	Chapter 20 “Muscle”	#10: Vertebrate Skeletal Muscle
Mar. 28	#12 Sensing the Environment		#11: Mechanoreceptors

\* Disclaimer: The above schedules, procedures and policies are subject to change in the event of extenuating circumstances.