

# BIOB34H3 – Animal Physiology



Course Syllabus

Fall 2015

## Instructor

Dr. Blake Aaron Richards – [blake.richards@utoronto.ca](mailto:blake.richards@utoronto.ca) – Room SW525

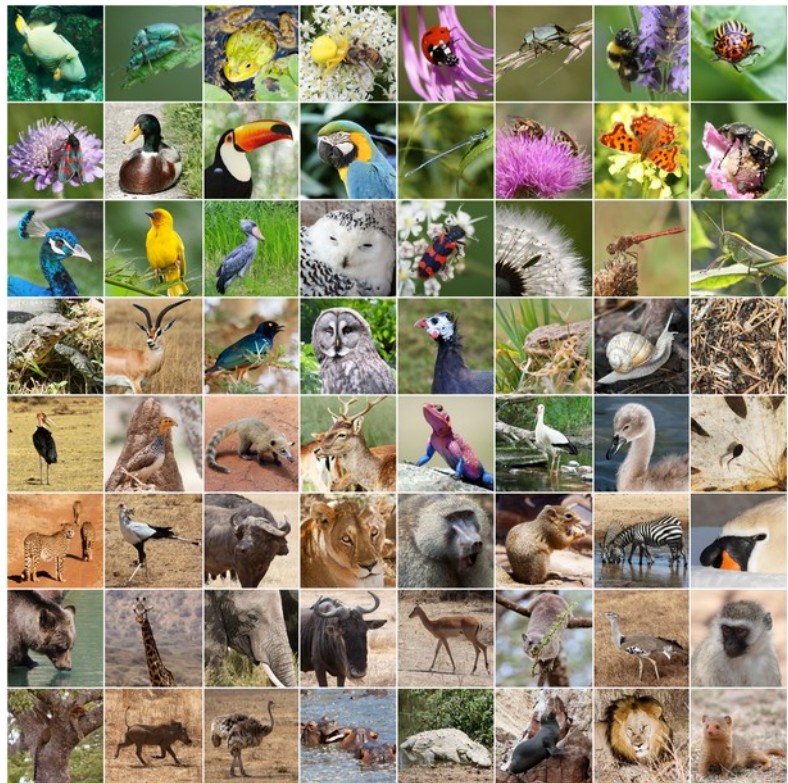
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## Overview

Animal life comes in many diverse forms, but there are core principles that lie beneath the function of every species on Earth. **All animals, including humans, are carbon-based machines who convert chemical energy into ordered molecules, work and heat.** With some very limited exceptions, animals obtain their chemical energy from other photosynthesizing life-forms, which obtain their energy from the electromagnetic radiation of the sun. Natural selection has modified a core set of fundamental cellular mechanisms that are used by all life to produce the many different physiological strategies for survival that we can observe in nature today. This course will provide you with an understanding of these fundamental mechanisms and it will give you an introductory glimpse at the many different ways that they have been shaped and combined by evolution.

## Objectives

You should leave this course with a solid grasp of the core mechanisms that underpin all animal life at the *microscopic* level. As well, you should come to appreciate the rich variety of *macroscopic* systems that these microscopic mechanisms can produce. By understanding both what unites all animals and what distinguishes them, you should develop a “big picture” understanding of animal physiology. The purpose of this course is not for you to memorize the specific physiology of different species. (In the age of Google and Wikipedia memorization is a waste of synapses.) Rather, this course should help you to form the concepts that will serve as scaffolding for your future studies. It should give you a basis for any future



career path you may pursue that requires an understanding of animal physiology, whether that be within academia, medicine, ecology, agriculture or bio-technology.

## GENERAL COURSE INFORMATION

### Teaching assistants

Matthew Tran – [matt.tran@mail.utoronto.ca](mailto:matt.tran@mail.utoronto.ca)

Kirthana Sathiyamar – [sankirthana.sathiyakumar@mail.utoronto.ca](mailto:sankirthana.sathiyakumar@mail.utoronto.ca)

Kanghoon (Danny) Seo – [kanghoon.seo@mail.utoronto.ca](mailto:kanghoon.seo@mail.utoronto.ca)

Please only write to the TAs for specific issues, such as help with finding a resource they mentioned in tutorial, etc. If you have questions regarding course content, you must post it to the Learning Portal discussion board for the class (see below).



### Course coordinator

Jennifer Campbell – [jacampbell@utsc.utoronto.ca](mailto:jacampbell@utsc.utoronto.ca) – Room SW421-D

**Office Hours:** Mon./Tue./Wed. 9-10AM (or by appointment)

You should contact Jennifer for the following reasons:

- Questions regarding course prerequisites or exclusion
- Questions regarding exam conflicts
- Questions regarding missing/missed exams (UTSC medical certificates)
- Questions regarding viewing graded exams

### Prerequisites

BIOA01H3 and BIOA02H3

### Exclusions

(BIOB30H3),(BGYB30H3), BIO270H, BIO204H

### Lectures

**Tuesdays and Thursdays from 9-10 AM in room AC223** (see course schedule below).

### Tutorials

**Every third Thursday from 5-7 PM in room AC223** (see course schedule below).

The tutorials are important for the assignment (see below), but also to help you study for exams.

### Office hours

**Tuesdays and Thursdays 10:30 AM-12 PM – Room AC254**

I encourage you to come to office hours if you are struggling to understand any course content. I have booked a library room so we can accommodate many people. I have also made it right after lecture, so it will be a good forum to ask any questions you may have from the lectures.

### Learning Portal ([portal.utoronto.ca](http://portal.utoronto.ca))

All course materials (lectures, optional readings, handouts and study guides) will be available on the Learning Portal site for the class. Course announcements will also be posted there. Additionally, you must post any questions regarding class content to the Learning Portal site on the discussion board. The TAs and I will answer all questions posted there as fast as possible. *We will ignore questions on course material emailed to us.* **You should visit the Learning Portal page frequently.**

### WebOption

Video recordings of all of the lectures will be made available online via WebOption Lecture Casting, and can be accessed through the Learning Portal site. These can be used as a supplement to the

lectures if you can't make it and provide a study aid. I still encourage you to attend lectures, though.

### Top Hat

I will be using **Top Hat** to create an interactive classroom. You can sign up for Top Hat at [tophat.com](http://tophat.com). If you do sign up, you will be able to ask questions via text, and participate in skill testing questions to test your knowledge. Top Hat is optional (as it costs money to register), but **if you can afford it I strongly encourage you to sign up and use it.**

### How to ask questions

I will have a strict policy of not answering any questions regarding course content via email, as I want the answers to any such questions to be available for everyone to read. I will spend some time every Tuesday and Thursday evening reading and answering any questions posted to the discussion board. *I will ignore questions about course content that are emailed to me.* Only email me if you have a personal issue that the TAs or the Course Coordinator do not have the authority to resolve.



## COURSE REQUIREMENTS AND EVALUATION

### Reading

The assigned textbook for this class is *Animal Physiology* (3<sup>rd</sup> edition) by Hill, Wyse and Anderson. It is available at the bookstore and the UTSC library. Readings from the text will be assigned for each week. **Please read the sections for each week before or soon after the lectures for that week!** I have also assigned study questions from the textbook (see below). You will not be marked on these and they are not mandatory. But, I encourage you to try to answer them and bring them to Office Hours or Tutorials if you have any trouble with them.

I will also post optional readings on the Learning Portal. These are not mandatory and you will not be tested on their content. But, I encourage you to read them as they will provide additional insights.

### Assignment

There will be one assignment during the term, **due November 9<sup>th</sup> (before midnight)**. It is worth 20% of your final grade. **Late assignments will not be accepted.**

The assignment is about making predictions using previous data, and focuses on metabolic rate (covered in Lecture 10, see below). You will find the assignment, along with instructions and the marking rubric on the Learning Portal sometime before Lecture 10.

### Exams

There will be one midterm exam and a final exam (their dates, times and locations have yet to be determined). Their worth will be worth 30% and 50% of your final mark, respectively. They will be composed of multiple choice and short answer questions. **It is critical that you take both exams.** If you have a valid reason for missing an exam (e.g. sickness) you must contact the course coordinator and make arrangements, see also UTSC's policy on deferred exams:

[http://www.utoronto.ca/~registrar/current\\_students/deferred\\_exams](http://www.utoronto.ca/~registrar/current_students/deferred_exams)

## IMPORTANT DATES

Date	Event
September 3 <sup>rd</sup>	Start of classes
September 17 <sup>th</sup>	1 <sup>st</sup> Tutorial
October 8 <sup>th</sup>	2 <sup>nd</sup> Tutorial
October 12 <sup>th</sup> -16 <sup>th</sup>	Reading week
October 29 <sup>th</sup>	3 <sup>rd</sup> Tutorial
November 9 <sup>th</sup>	Assignment due
November 19 <sup>th</sup>	4 <sup>th</sup> Tutorial and last day to drop without penalty
December 3 <sup>rd</sup>	Final lecture

**Note: the dates, times and places for both the midterm exam and the final exam have yet to be determined.** When they are fixed I will make an announcement both in class and on the Learning Portal



## CLASS OUTLINE

### Week 1 – Introduction to animal physiology

#### Lecture 1 (Sep 3<sup>rd</sup>)

Topic – You are a machine

#### Readings and study questions

- Chapter 1 (p3-5, up to Mechanism and Origin section)
- No study questions

*No tutorial*

### Week 2 – The fundamentals

#### Lecture 2 (Sep 8<sup>th</sup>)

Topic – Order and homeostasis

#### Readings and study questions

- Chapter 1 (p11-14, up to Time in the lives of animals section)
- Questions 1,11

*No tutorial*

#### Lecture 3 (Sep 10<sup>th</sup>)

Topic – Thermodynamics and life on Earth

#### Readings and study questions

- Chapter 7 (p 161-166, up to Metabolic Rate section)
- Questions 2,3,7

*No tutorial*

### Week 3 – Biosynthesis

#### Lecture 4 (Sep 15<sup>th</sup>)

Topic – It's all about protein

#### Readings and study questions

- Chapter 1 (p 14-16, from Time in the lives of animals, up to Size in the lives of animals)
- Box 2.1 & On-line Extension
- Chapter 4 (p 90-92)
- Questions (Ch. 1) 2, (Ch. 2) 1

*No tutorial*

#### Lecture 5 (Sep 17<sup>th</sup>)

Topic – Enzyme function

#### Readings and study questions

- Chapter 2 (p 40-52, up to Evolution of Enzymes)
- Questions 4,6

**Tutorial** (Sep 17<sup>th</sup> – 5-7 PM) – Review session: entropy and the Michaelis-Menten equation

### Week 4 – Membranes and gradients

#### Lecture 6 (Sep 22<sup>nd</sup>)

Topic – Cell membranes and epithelia

#### Readings and study questions

- Chapter 2 (p 30-42, from Cell Membranes up to Elements of Metabolism, p 58-64 from Reception to end of chapter)
- Questions 5,9

*No tutorial*

#### Lecture 7 (Sep 24<sup>th</sup>)

Topic – Electrochemical gradients

#### Readings and study questions

- Chapter 5 (p99-108, up to Passive Solute Transport by Facilitated Diffusion)
- Questions 1,9

*No tutorial*

## Week 5 – Transport and absorption

### Lecture 8 (Sep 29<sup>th</sup>)

Topic – Osmosis, transporters and channels

#### Readings and study questions

- Chapter 5 (p 108-123)
- Questions 2,4,5,10

*No tutorial*

### Lecture 9 (Oct 1<sup>st</sup>)

Topic – Digestion and absorption

#### Readings and study questions

- Chapters 6 (p 127-155, up to Responses to Eating)
- Questions 2,10

*No tutorial*

## Week 6 – Metabolism and heat

### Lecture 10 (Oct 6<sup>th</sup>)

Topic – Metabolism

#### Readings and study questions

- Chapter 7 (p166-181)
- Chapter 8 (p183-194, up to Fatigue and Muscle Fiber Types)
- Questions (Ch. 7) 5,11 (Ch. 8) 3,8

*No tutorial*

### Lecture 11 (Oct 8<sup>th</sup>)

Topic – Thermal relations

#### Readings and study questions

- Chapter 10 (p225-268, up to Warm Bodied Fish)
- Questions 1,5,9

**Tutorial** (Oct 8<sup>th</sup> – 5-7 PM) – Review session: allometric relationships and linear regression

## Week 7 – Reading week (no class)

## Week 8 – Gas exchange and breathing

### Lecture 12 (Oct 20<sup>th</sup>)

Topic – Gas exchange

#### Readings and study questions

- Chapter 22
- Questions 3,8,10

*No tutorial*

### Lecture 13 (Oct 22<sup>nd</sup>)

Topic – Breathing

#### Readings and study questions

- Chapter 23 (p583-594, up to Breathing by Amphibians & p597-608, from Breathing by Mammals up to Breathing by Aquatic Invertebrates)
- Questions 1,5,9

*No tutorial*

## Week 9 – Gas transport and circulation

### Lecture 14 (Oct 27<sup>th</sup>)

Topic – O<sub>2</sub> and CO<sub>2</sub> transport

#### Readings and study questions

- Chapter 24
- Questions 2,4,9

*No tutorial*

### Lecture 15 (Oct 29<sup>th</sup>)

Topic – Vascular systems

#### Readings and study questions

- Chapter 25 (p647-670, up to Invertebrates with Closed Circulatory Systems)
- Questions 2,4,8

**Tutorial** (Oct 29<sup>th</sup> – 5-7 PM) – Assignment help session

## Week 10 – Water, salt and nitrogen regulation

### Lecture 16 (Nov 3<sup>rd</sup>)

Topic – Principles of water and salt regulation

#### Readings and study questions

- Chapter 27
- Box 28.3
- Questions (Ch. 27) 1,2,8

*No tutorial*

### Lecture 17 (Nov 5<sup>th</sup>)

Topic – Kidney function and nitrogen excretion

#### Readings and study questions

- Chapter 29, (p753-777 up to Urine Formation in Decapod Crustaceans and p782-785, from Nitrogen Disposition and Excretion)
- Questions 4,5,7

*No tutorial*

## Week 11 – Introduction to the nervous system

### Lecture 18 (Nov 10<sup>th</sup>)

Topic – Neurons

#### Readings and study questions

- Chapter 12
- Questions 1,5,10

*No tutorial*

### Lecture 19 (Nov 12<sup>th</sup>)

Topic – Synapses

#### Readings and study questions

- Chapter 13
- Questions 2,9,10

*No tutorial*

## Week 12 – Control systems

### Lecture 20 (Nov 17<sup>th</sup>)

Topic – Sensation and perception

#### Readings and study questions

- Chapter 14
- Questions 6,8,10

*No tutorial*

### Lecture 21 (Nov 19<sup>th</sup>)

Topic – Endocrine systems

#### Readings and study questions

- Chapter 16 (p419-448 up to Insect Metamorphosis)
- Questions 4,7,9

**Tutorial** (Nov 19<sup>th</sup> – 5-7 PM) – Final exam help session

## Week 13 – Movement

### Lecture 22 (Nov 24<sup>th</sup>)

Topic – Motor control

#### Readings and study questions

- Chapter 19
- Questions 2,5

*No tutorial*

### Lecture 23 (Nov 26<sup>th</sup>)

Topic – Muscles

#### Readings and study questions

- Chapter 20
- Questions 2,3,4

*No tutorial*

## Week 14 – Sensation and course summary

### Lecture 24 (Dec 1<sup>st</sup>)

Topic – Course summary

#### Readings and study questions

- No new readings

*No tutorial*

### Lecture 25 (Dec 3<sup>rd</sup>)

Topic – Review and Q&A session

#### Readings and study questions

- No new readings

*No tutorial*

## Week 15-16 – Study and exam period (no classes, final exam date/time TBA)