Biology 4602F: Thermal Physiology

1. Course Information

Biology 4602F Thermal Physiology. Fall term 2022
Class: Monday, Wednesday, Friday 10.30 am – 11.30 am
Note that although this class will primarily be in-person, we will use the magic of Zoom to bring in a few guest lecturers and if the instructor or >25% of the class have to isolate due to Covid.

List of Prerequisites
A minimum mark of 65% in one of Biology 3601 (Animal Physiology I) or Biology 3602 (Animal Physiology II).

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

2. Instructor Information

Dr. Brent Sinclair
Email: bsincla7@uwo.ca

Office hours: I will be available in my office (BGS 2078) for drop-in discussion on Wednesdays 8-9 am. Note that there are no classes before 8.30, so most of you should be free for some of this time. You are welcome to make an appointment as well. In your email, please specify all the days and times during normal business hours (8am – 5pm) when you are available over the next two weeks, and whether you are available in-person or just on zoom. My schedule is very full, so if you propose only a select few slots, there is no guarantee that I will be available.

Feel free to use the office hours to discuss class material, other things related to the course that you are curious or concerned about, or to come in to chat about science, research or careers.

For your security, please use your Western (@uwo.ca) email address when contacting me (emails about the course from other addresses will be deleted without being read). Please include 'Biology 4602' in the subject line, and endeavour to maintain some professional level of communication: this includes beginning your email with a salutation ('Dear Dr. Sinclair'), and ending it with some indication of who you are ('Thanks in advance, Aloysius A. Student'). I will try to reply to your email within two business days of receipt.

3. Course Syllabus, Schedule, Delivery Mode

In this course, we will focus on how temperature affects physiological processes, with a strong emphasis on animals. We will explore the basic concepts of temperature and heat, what impacts temperature has on cells and biological molecules, and the strategies animals use to deal with both 'normal' and 'extreme' temperatures. While we will acknowledge (and even explore) the role of behaviour in modifying exposure to thermal extremes, our focus (and your focus in the evaluations) should be on physiological mechanisms, not animal behaviour.

We will read a range of papers and case studies, engage with some invited speakers, and practice our communication, reading, and critical thinking skills. To this end, there will be no exams in this course, but there will be take-home essay tests and guided paper analyses.

Learning outcomes

Successful students will:

- have a working knowledge of how temperature affects physiology and biochemistry
- be able to articulate how temperature has influenced the evolution of biochemical and physiological systems
- be able to describe the effects of temperature changes at all relevant levels organization within an organism
- be able to discuss thermal physiology in a precise and factual manner, drawing on key examples, and synthesizing across the course
- identify, evaluate, interpret and synthesize primary literature associated with thermal physiology

Delivery mode

Interactive lectures will be the primary method of delivery, and you will be expected to have completed the reading prior to coming to class. We will primarily meet in-person, but we will use the magic of Zoom to facilitate contributions by some guest lecturers (others will be in-person) – the dates of those lectures will be advertised well in advance, and you'll be able to log in to the zoom sessions from wherever is convenient for you.

Although some version of the powerpoint slide decks will usually be available afterwards as a handout, this will be incomplete, and I very strongly encourage you to take your own notes (and to review and reflect on them after class). Much research suggests that taking handwritten notes enhances your understanding and retention relative to taking notes using a keyboard, so please consider your note-taking strategy. Consider also, that the lectures and discussion are to enhance your understanding of the readings (and vice-versa), so you will want to synthesize your notes from the reading and the discussion after the class to help prepare you for the (time-limited) evaluations.

Topics covered

Topics we will cover in this course include:

- Mechanisms underlying temperature effects on organisms, cells, and their constituent molecules
- Heat gain, loss, and thermoregulation
- Organismal responses to extreme high and low temperatures

Timetable - You will find an approximate timetable at the end of the course outline. The timetable is subject to change, especially if we lose time to covid or other interruptions, the availability of guest speakers changes, or if we (as a group) identify a need to focus more on a specific topic.

Contingency plan for an in-person class pivoting to 100% online learning
In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered synchronously online (i.e., at the times indicated in the timetable). The grading scheme and nature of the assignments will **not** change.

4. Course Materials

Students should check OWL (http://owl.uwo.ca) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class, and I will assume that you have received information posted there. Much of the relevant readings for the course will be in the form of scientific papers available through the library, or via the Course Readings tool on OWL, and I will make them available there prior to the relevant classes. General readings that will underpin the course are:

Hill, R.W., Wyse, G.A. & Anderson, M. 2016. *Animal Physiology*. Fourth Edition. Sinauer, New York.
Chapters 10 (Temperature) and 11 (The lives of mammals in frigid places)
(this is the textbook used in your 2nd and 3rd year physiology classes. Earlier editions are pretty similar in content for these chapters, and the chapters in question should be available under Course Readings on OWL). You may also find this text useful for refreshing your knowledge on all aspects of cellular physiology, energetics, metabolism, and ion and water balance, all of which are essential in this course.

Clarke, A. 2017. *Principles of Thermal Ecology*. Oxford University Press, Oxford.
Although this book is in an ecological context, it provides a thorough introduction to temperature effects in biology, and is a fairly easy read. It is available electronically via the library, and I recommend reading the whole book if you can, but definitely focusing on the readings. Remember that one of the skills you will be applying at this level of your undergraduate degree is the ability to parse complex or diverse information to reveal the core concepts that are important to the question at hand – reading this book is an excellent way to practice this skill.

Somero, G.N., Lockwood, B.L. & Tomanek, L. 2017. *Biochemical Adaptation: Response to Environmental Challenges from Life's Origins to the Anthropocene*. Sinauer, New York.
Chapter 3 (Temperature)
This chapter should be available under Course Readings on OWL. It gets pretty dense, so I will largely assign focused section, but it is worth reading the whole thing at least once. If you bring up unassigned material from this chapter in discussions in class, I will be deeply impressed.

If you need assistance with OWL, please seek support on the OWL Help page. Alternatively, contact the Western Technology Services Helpdesk at 519-661-3800 or ext. 83800.

Technical Requirements
To participate in the guest lectures in this course, you will need a stable internet connection and a computer with a working webcam and microphone. If you are unable to meet these requirements, please discuss this with the instructor early on so we can develop an alternative plan.

5. Evaluation

This may be an unusual course for you, in that the focus will be on discussion and critical thinking, even in the lectures. Not everything in the lectures will be 'on the test', because as fourth year students you should be engaging with knowledge regardless of tests as you transition to life-long learning. However, if you haven't done the reading and come to class expecting me to passively impart information (perhaps with the goal of memorizing the slides later), you will have a very uncomfortable time. Indeed, if that has been your approach to your undergraduate education, you have truly missed out on the opportunity to enrich yourself.

Assessment in this course is therefore focused on consolidating the interpretation and written communication skills that the world will expect of you as a biology graduate. This takes consistent engagement (if you try to cram these assignments a few hours before the deadline, you will probably perform pretty poorly). To help you maintain some discipline, some of the marks in this course are an incentive to engage as we go along. I will provide detailed marking rubrics for all of the assessments on OWL, and I am happy to discuss the assessment expectations in class.

Assessment item	**Due Date(s)**	**Item Value**	**Total**
Engagement logs	October 1, November 12, December 8	5 % each	15 %
Paper analysis	October 6, November 24	1st: 15% 2nd: 25 %	40 %
Take-home assignment	October 25, December 8	1st: 15% 2nd: 30%	45 %
Total			**100 %**

Deadlines are 3pm Eastern time on the day of the deadline.

Engagement Logs
I expect you to engage fully in the class and the out-of-class reading and reflection that will be necessary to be successful. To gauge your investment in the class, I will ask you to each maintain a log of your investment in the class each week, on a form that I provide. A minimum level of investment (as described in the rubric) will be sufficient to get full marks. The engagement log will help you to make sure that you are investing in the course sufficiently to be successful, and provide a place for you to record your reflections on the content, discussion, and activities.
I'm not expecting extensive essays (although I am happy to read your deep reflections!), so this should take you ~ 10 min/week. You should also fill this in as you go along (for example after each lecture, trying to complete it in the hours before the deadline for the entire period is, frankly, abusing the entire notion of this exercise, and if you find yourself doing this, I suggest you reflect on what your

expectations are in tertiary education. Because this is such a small investment, it would be very surprising if you needed to use an SRA to avoid this particular deadline; if you need a small amount of flexibility for submission of the Engagement logs, please contact the instructor. Note that this flexibility does not apply to any other assignments.

Paper analysis
I will provide you with a published scientific paper on a Wednesday morning (the week before the deadline), alongside a structured series of questions that will help you to critically assess the paper. Your assessment will be due the following Wednesday. You will need both your knowledge of thermal physiology AND your critical thinking skills to perform well in this evaluation. You may have to do some additional reading around the topic to perform well, and please take every (relevant) opportunity to display the breadth of your thermal physiology knowledge.

Take-home assignments
These will take the format of the exams I had as an undergrad (but you have a *lot* more time to work on them!) You will be given a choice of six topics related to the course material, and you will choose four of them. For each, you will write a short essay (750-1500 words). You do not need to provide references. To do well, each essay will need to be factually correct, make a logical set of arguments, be well-written (i.e. not repetitive, irrelevant, or facile, and use language, including technical language, appropriately), free of spelling and grammar errors, and (importantly!) answer the question. If your essay does not address the question, you will not receive any marks for it! Do note that these will pass through Turnitin-com and cheating and plagiarism will be treated as serious academic misconduct, with potentially severe consequences. The tests are not cumulative, but you will need to understand the information from the first part of the course in the second test, and factual inaccuracies related to the material in the first part of the courses will also be penalized in the second test.

A note about time management
Please don't rely on me reminding you about deadlines. There are no surprises in this course: the dates above have been communicated to you on day 1, and part of being a grown-up is to manage multiple competing priorities. Indeed, most employers *expect* University graduates to have solid time management skills! Thus, you know now that the weeks of the take-home tests and paper analyses will require you to do some work for this course, but please keep it in perspective: I toyed with the idea of doing these as in-class or scheduled mid-terms. If you had good exam skills, the paper analysis would be at most ~1.5 hours work, and the take-home test is an identical format for the 2h final exams I had as a 3rd year undergraduate. If you haven't prepared prior to the assessment being made available, then it will take longer than that, and in any case it gives you the opportunity to do a much more polished job than we could under exam circumstances. If you remain engaged with the course, you should already have most of the information at your fingertips. The engagement log should take about 10 min per week, and you should fill it in every week (or even after every class), so you only need to find 10 min in the week of the deadline. As a result, I will take a pretty dim view of any requests for extensions on the engagement log deadlines, because they reveal a lack of engagement on your part!

Finally, none of the above negates a genuine need for accommodation. If you need accommodation, please contact me as soon as you can so we can work out appropriate and fair accommodation. However, do note that "I'm very busy" is not grounds for any kind of accommodation.

Click here for a detailed and comprehensive set of policies and regulations concerning examinations and grading. The table below outlines the University-wide grade descriptors.

A+	90-100	One could scarcely expect better from a student at this level
A	80-89	Superior work which is clearly above average
B	70-79	Good work, meeting all requirements, and eminently satisfactory
C	60-69	Competent work, meeting requirements
D	50-59	Fair work, minimally acceptable
F	below 50	Fail

6. Student Absences and Accommodation

Academic Consideration for Student Absences
Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration.

Assessments worth less than 10% of the overall course grade:
This applies only to the engagement logs. We can be flexible, contact the instructor, but also read the material above about the expectations for these engagement logs and why it's so little work that the need for accommodation should be negligible. The marks are for your engagement with eh course, not the material in the document.

Assessments worth 10% or more of the overall course grade:

For work totaling 10% or more of the final course grade (i.e. all the other assignments), you must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University's medical illness policy at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf.

The Student Medical Certificate is available at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

Please contact the instructor by email as soon as possible and we will work together to establish an appropriate alternative submission deadline.

Religious Accommodation
When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

https://multiculturalcalendar.com/ecal/index.php?s=c-univwo

Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf.

I'm very happy to work with you on documented accommodation needs, so please touch base with me by email or visit my office hours as soon as possible if you wish to discuss your requirements. I have ADHD, and appreciate the challenges of being neurodiverse, and will be happy to discuss more general strategies for success in an academic environment (although if you've made it this far, you're probably doing a pretty good job!!)

7. EDI statement

Science is at its best when it is equitable, diverse and inclusive. Like all of us, I am still learning, and EDI is a work in progress. Please feel free to discuss potential EDI issues with me (in my office hours or by appointment is probably best). I am an immigrant, the first in my family to finish high school, am neurodiverse, and I'm from a poor background. Thus, although I am a middle-aged white dude (I use he/him pronouns – feel free to share yours if you are comfortable doing so), I do have some experience of 'not belonging'. If you feel like you'd like to stay in science, but are not sure if you belong, please stop by for a chat.

8. Land acknowledgment

I acknowledge that Western University is located on the traditional lands of the Anishinaabek, Haudenosaunee, Lūnaapéewak and Attawandaron peoples, on lands connected with the London Township and Sombra Treaties of 1796 and the Dish with One Spoon Covenant Wampum.

With this, I respect the longstanding relationships that Indigenous Nations have to this land, as they are the original caretakers. I acknowledge historical and ongoing injustices that Indigenous Peoples (e.g. First Nations, Métis and Inuit) endure in Canada, and I aim to facilitate Western's responsibility as a public institution to contribute toward revealing and correcting miseducation as well as renewing respectful relationships with Indigenous communities through our teaching, research and community service.

If your home town is not London, please take the time to learn about the Indigenous peoples and their history at your location. This article is a good resource to begin this journey https://locallove.ca/issues/what-are-land-acknowledgements-and-why-do-they-matter/#.X0qesMhKiUk.

10. Academic Policies

The website for Registrarial Services is http://www.registrar.uwo.ca

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

You have almost certainly completed Biology 2290… please review Biology 2290 learning outcomes. You are expected to know what plagiarism is at this stage of your programme.

Turnitin ***aids*** in identifying plagiarism and ensuring fair assessment of all students. All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Professionalism & Privacy:

Western students are expected to follow the Student Code of Conduct. Additionally, the following expectations and professional conduct apply to this course:

- Students are expected to follow online etiquette expectations provided on OWL
- All course materials created by the instructor(s) are copyrighted and cannot be sold/shared
- Recordings are not permitted (audio or video) without explicit permission
- Permitted recordings are not to be distributed
- Students will be expected to take an academic integrity pledge before submitting some assessments

Online Etiquette:

Some components of this course will involve online interactions. To ensure the best experience for both you and your classmates, please honour the following rules of etiquette:

- "arrive" to class on time
- use your computer and/or laptop if possible (as opposed to a cell phone or tablet)
- ensure that you are in a private location to protect the confidentiality of discussions in the event that a class discussion deals with sensitive or personal material
- to minimize background noise, mute your microphone for the entire class until you are invited to speak, unless directed otherwise
- please be prepared to turn your video camera off at the instructor's request if the internet connection becomes unstable
- unless invited by your instructor, do not share your screen in the meeting

The course instructor will act as moderator for the class and will deal with any questions from participants. To participate please consider the following:

- If you wish to speak, use the "raise hand" function and wait for the instructor to acknowledge you before beginning your comment or question.
- Please remember to unmute your microphone and turn on your video camera before speaking.
- Self-identify when speaking.
- Please remember to mute your mic and turn off your video camera after speaking (unless directed otherwise).

General considerations of "netiquette":

- Keep in mind the different cultural and linguistic backgrounds of the students in the course.
- Be courteous toward the instructor, your colleagues, and authors whose work you are discussing.
- Be respectful of the diversity of viewpoints that you will encounter in the class and in your readings. The exchange of diverse ideas and opinions is part of the scholarly environment. "Flaming" is never appropriate.
- Be professional and scholarly in all online postings. Use proper grammar and spelling. Cite the ideas of others appropriately.

  Note that disruptive behaviour of any type during online classes, including inappropriate use of the chat function, is unacceptable. Students found guilty of Zoom-bombing a class or of other serious online offenses may be subject to disciplinary measures under the Code of Student Conduct.

11. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: https://www.uwo.ca/sci/counselling/

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at (519) 661-2147 if you have any questions regarding accommodations.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: https://www.uwo.ca/se/digital/

Learning-skills counsellors at the Student Development Centre (http://www.sdc.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (http://www.health.uwo.ca/mentalhealth) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC: https://westernusc.ca/your-services/

12. Timetable (subject to change)

Week of…	**Class topic**	**Other notes and Deadlines***
Sept 5	Introduction (Fri)	This is an important class!
Sept 12, 19	Basics of thermal biology	Guest lecture 23 Sept
Sept 26	'Other' Endotherms; extreme thermoregulation	Paper for analysis 1 distributed on Wednesday Engagement Log 1 due 30 Sept
Oct 3	Mammalian Thermoregulation	Paper analysis 1 due 5 Oct End of material - Assignment 1 Guest lecture 5 Oct No class Friday 7 Oct
Oct 10, 17	Temperature and biochemistry	No Class Monday 10 Oct (Thanksgiving) Guest lecture 17 Oct Assignment 1 distributed 17 Oct
Oct 24	Extreme temp fluctuations	Assignment 1 due 24 Oct No class Fri 28 Oct
Oct 31	Reading week – no classes	
Nov 7, 14	Freeze tolerance, plasticity, climate change	Engagement Log 2 due 11 Nov Paper for analysis 2 distributed 16 Nov Guest Lecture 18 Nov
Nov 21, 28	Climate change	Paper analysis 2 due 23 Nov. Take-home assignment 2 distributed 30 Nov Guest lecture 23 Nov
Dec 5	Wrap-up	Take-home assignment 2 **and** Engagement log 3 due 7 Dec.