

Trent University - Peterborough Campus  
Department of Physics & Astronomy

PHYS-BIOL 3510H - Astrobiology: Life in the Universe  
Course Outline: Fall 2017

1. **Course Description:** An examination of the prospects for extraterrestrial life, based primarily on material from astronomy, biology, and planetary science. Topics include the origin and evolution of life on Earth, extremophiles, the habitability of Mars and Jovian moons, the nature and habitability of exoplanets, SETI, the Drake equation, and the Fermi paradox.
2. **Lectures:** Mondays 09:00-10:50 (CCS 307) and Wednesdays 09:00-09:50 (FPHL 117). Regular attendance is expected.
3. **Instructor:** Prof. Dave Patton, SC 320, 748-1011 ext. 7462; dpatton@trentu.ca
4. **Office Hours:** Mondays 15:00-15:50, Thursdays 11:00-11:50 or by appointment.
5. **Physics & Astronomy Department Office:** SC 327, physics@trentu.ca, ext. 7715
6. **Teaching Assistant:** Dustin Short (dustinshort@trentu.ca)
7. **Prerequisites:** 5.0 university credits, including at least two of the following courses: BIOL 1020H, BIOL 1030H, PHYS 1510H, and PHYS 1520H.
8. **Required Text:** *Life in the Universe (4th Edition)* by Bennett & Shostak. This textbook is available in the bookstore in several formats (bound, looseleaf and electronic), all of which include an access code for *MasteringAstronomy* (see below).
9. **Weekly Readings:** Students will normally be expected to complete weekly readings from the textbook *before* the material is covered in class, so that they come prepared to ask questions and contribute to discussions in class. Students will be tested on their understanding of these readings in quizzes, assignments and exams.
10. **Blackboard:** We will use *Blackboard* (also called *LearningSystem*) to access online content in this course. *Blackboard* can be accessed by logging in to mytrent.
11. **MasteringAstronomy:** We will make extensive use of an online learning facility called *MasteringAstronomy* in this course. *MasteringAstronomy* includes the e-book, tutorials, animations, quizzes and other content, and is designed to improve your understanding of material covered in this course. We will be using *MasteringAstronomy* for all assigned coursework (excluding the midterm and final exam), so you are required to use *MasteringAstronomy* in this course. *MasteringAstronomy* is accessible through *Blackboard* (you will need to enter your access code when you first access *MasteringAstronomy*).
12. **Lecture Format:** The majority of the lecture time will centre on a review of topics from the textbook, highlighting and expanding on subjects that are of particular relevance. The remaining time will be devoted to a variety of supplementary activities which are designed to enhance your understanding of the material. Activities will include class-wide discussions, small group discussions, short movies, video clips and guest speakers.

13. **Lecture Notes:** Lecture notes will be made available on *Blackboard* shortly after each lecture, and will consist of powerpoint slides saved in pdf format. These lecture notes are intended to save you from copying down what is shown on the screen in class, but are to be supplemented by additional notes that you take in class.
14. **Lecture Webcasts:** Video recordings of the lectures will be available on *Blackboard* soon after each lecture is over. You may need to install the free Silverlight software to view the webcasts on your own computer. These webcasts are intended to be a useful resource for reviewing the lecture material and preparing for exams.
15. **Reading Quizzes:** These weekly online MasteringAstronomy multiple-choice quizzes will assess your understanding of the required readings from the textbook, and will provide some feedback to help improve your understanding of the material. These quizzes will be due *before* the material is covered in class, providing additional incentive for you to complete the readings in advance of the lectures. Reading Quizzes will normally be due on Sundays at 9 p.m. However, **the first Reading Quiz will be due on Wed. Sep. 13 at 9 p.m.**, and will cover Chapters 1 and 2 from the textbook. Your lowest Reading Quiz grade will not count towards your overall grade in this course.
16. **Weekly Surveys:** After completing the required reading, students are encouraged to complete the optional online Weekly Survey. This survey will ask you which topics from the readings you found to be particularly challenging. You will also be asked to identify topics which you would like to learn more about during the lectures. The instructor will attempt to cover the most commonly identified topics during the subsequent lecture(s). These surveys are **optional**, and will have no influence on your grade in the course. Each survey will have the same deadline as the corresponding Reading Quiz.
17. **Assignments:** These weekly online MasteringAstronomy assignments are designed to further your understanding of topics covering in the textbook and during the lectures. These assignments will include components such as tutorials, short calculations, and reading comprehension questions. Assignments will normally be due on Thursdays at 4 p.m. The first assignment will be due on Thursday Sep. 14, and will cover material from Chapters 1 and 2 from the textbook. Your lowest Assignment grade will not count towards your overall grade in this course.
18. **Summary Quizzes:** These weekly online MasteringAstronomy multiple-choice quizzes will test your understanding of the course material after it has been covered in class. Summary Quizzes will normally be due on Thursdays at 4 p.m. The first Summary Quiz will be due on Thursday Sep. 14, and will cover Chapters 1 and 2 from the textbook. Your lowest Summary Quiz grade will not count towards your overall grade in this course.
19. **Late Policy:** Online quizzes and assignments will become unavailable after the posted deadline, so late submissions will not normally be possible. As a result, a grade of zero will normally be assigned on any quiz or assignment not completed before the deadline. It is therefore recommended that all online work be completely comfortably in advance of the deadline. In exceptional circumstances (such as a medical issue), alternative arrangements can be made with the instructor. The instructor reserves the right to request a doctor's note (or equivalent) in such circumstances.

20. **Midterm Exam:** There will be a 2-hour midterm exam during class on Monday Oct. 16. Some of the exam questions will be marked by a TA.

21. **Final Exam:** There will be a mandatory 3-hour final exam during the December exam period. This exam will cover all of the material in the course, though with an emphasis on material covered after the midterm exam. Some of the exam questions will be marked by a TA.

22. **Grading Scheme:**

- 10% Reading Quizzes
- 15% Assignments
- 20% Summary Quizzes
- 20% Midterm Exam
- 35% Final Exam

**Note:** Regardless of the overall grade calculated above, an overall average of at least 40% on the midterm exam and final exam, weighted as above, must be obtained in order to pass this course. Otherwise, a grade of no more than 45% (i.e. an F) will be assigned.

23. **Academic Calendar:** Please see the Trent University academic calendar for University Diary dates, Academic Information and Regulations, and University and departmental degree requirements. The last date to withdraw from Fall term half courses without academic penalty in 2017-18 is November 7, 2017.

24. **Learning Outcomes:**

Upon successful completion of this course, the student will have

- a clear idea of the scope and goals of the science of astrobiology
- an understanding of the spatial and temporal extent of our universe, and our place in it
- an overview of Earth's geological history, and the factors which contribute to the Earth's suitability for life
- an understanding of the nature of life on Earth, as informed by the science of biology
- a modern day understanding of how life likely originated on Earth, and how it has evolved from then until the present day
- a clear concept of which locations in our solar system are likely to be the most suitable for microbial life, and the factors which are important in assessing this
- an up-to-date picture of the nature and diversity of exoplanets around other stars, including an understanding of the techniques used to detect these exoplanets
- an understanding of the factors which determine whether a given exoplanet is likely to be habitable
- a basic understanding of how scientists are searching for signs of extraterrestrial intelligence using radio telescopes
- an appreciation of the factors which are crucial in assessing whether or not civilizations (such as ours) may be able to travel large distances through interstellar space

## 25. Course Outline

Dates	Topic	Required Reading
Sep. 11, 13	Introduction to Astrobiology	Chapters 1,2
Sep. 18, 20	The Universal Context of Life	Chapter 3
Sep. 25, 27	The Habitability of Earth	Chapter 4
Oct. 2	The Nature of Life on Earth	Chapter 5
Oct. 4, 11	The Origin and Evolution of Life on Earth	Chapter 6
Oct. 16	Midterm Exam	
Oct. 18	Searching for Life in the Solar System	Chapter 7
Oct. 30, Nov. 1	Mars	Chapter 8
Nov. 6, 8	Jovian Moons	Chapter 9
Nov. 13, 15	The Nature and Evolution of Habitability	Chapter 10
Nov. 20, 22	Habitability Outside the Solar System	Chapter 11
Nov. 27, 29	The Search for Extraterrestrial Intelligence	Chapter 12
Dec. 4, 6	Interstellar Travel and the Fermi Paradox	Chapter 13

26. **Access to Instruction:** It is Trent University's intent to create an inclusive learning environment. If a student has a disability and documentation from a regulated health care practitioner and feels that he/she may need accommodations to succeed in a course, the student should contact the Student Accessibility Services Office (SAS) at the respective campus as soon as possible.
27. **Academic Integrity:** Academic dishonesty, which includes plagiarism and cheating, is an extremely serious academic offence and carries penalties varying from failure on an assignment to expulsion from the University. Definitions, penalties, and procedures for dealing with plagiarism and cheating are set out in Trent University's *Academic Integrity Policy*. Note that all graded online work that you complete in this course must be carried out by you alone; collaboration with others on graded material is a clear example of academic dishonesty and will be treated as such. You have a responsibility to educate yourself - unfamiliarity with the policy is not an excuse. Visit Trent's Academic Integrity website to learn more: [www.trentu.ca/academicintegrity](http://www.trentu.ca/academicintegrity).