

Course Syllabus

[Jump to Today.](#)



AST 251: Life on Other Worlds

Dr. Michael Reid

Classes: Mondays, 4:00-6:00 p.m., in ES 1050

Contact: Please post your questions on the course discussion forums, such as the [General Questions](#) forum.

Confidential Contact: Illness reports, regrade requests, and other confidential matters must be sent to ast251@astro.utoronto.ca. (<mailto:ast251@astro.utoronto.ca>)

Course Description

This course will introduce you to the search for life beyond Earth. We will cover the definition, origin, and development of life, the conditions for planetary habitability, the search for life within our solar system, the methods used to search for and characterize potentially habitable exoplanets, and the search for extraterrestrial intelligence. The course will cover aspects of biology, chemistry, physics, and earth sciences, all through the lens of astronomy. Our goal is to make the course accessible to students from all academic backgrounds, so the primary instructional approach is conceptual, not mathematical. Students from all subject majors excel in this course.

Important Dates

First day of classes: Monday, January 6, 2020

Midterm: Monday, March 2, 4:10-6:00 p.m.

Make-up midterm: Friday, March 6, 12:10-2:00 p.m.

Final exam: Final exam dates will be announced by the university in late February

Required Materials

1. Textbook: *Introduction to Astrobiology, 3rd edition*, edited by Rothery, Gilmour, and Sephton (We've changed the book from last year, based on student feedback.)
2. Device: We will be doing interactive activities in class every class using Poll Everywhere. Please bring a web-enabled device to every class. **You do NOT need to pay for this service--we have a license that will cover all students for free.** If you can't bring a suitable device to class, please contact us as soon as possible to discuss accommodations.

Course Learning Goals

By the end of this course, you will be able to:

1. identify the essential requirements for life-like-us to survive on and beyond Earth.
2. describe and critique different models for the origin and spread of life in the cosmos.

3. assess the astrobiological significance of key events in the history of the universe.
4. critique definitions of "life" and "habitable planet".
5. analyze data from the transit and radial velocity methods to extract properties of exoplanets.
6. assess the habitability of planets, moons, and exoplanets, both real and hypothetical.
7. identify promising locations for near-term searches for life in the cosmos.
8. assess near-term prospects for the discovery of extraterrestrial life.
9. critically evaluate news reports of discoveries of "Earth-like" exoplanets.

Office Hours

We offer office hours both in person and online. **No appointments are required.**

Dr. Reid's in-person office hours: Wednesdays, 12:00-1:00 p.m. in AB 129 at 50 St. George Street

Dr. Reid's online office hours: Thursdays, 1:00-2:00 p.m., online on Zoom by clicking

<https://dunlap.zoom.us/j/607100824> (<https://dunlap.zoom.us/j/607100824>)

TA office hours: Thursdays, 3:00-4:00 p.m. in AB 111 at 50 St. George Street

In-Class Activities Using Poll Everywhere

Research shows that students learn more when they are actively engaged, instead of passively listening. To help you engage, we will do in-class activities every class. These activities will offer you the chance to practice what you are learning as you learn it. They will help you identify areas where you may need to ask questions or do additional readings. We think that participating in these activities is an essential part of the learning process, so you will get some marks just for participating. Each time you answer a question on Poll Everywhere, you will receive 0.5 marks for giving any answer, and an additional 1 mark if that answer is correct.

This year, to help reduce your costs, we will be using the Poll Everywhere system for in-class activities. Poll Everywhere allows my department to pay once and all of you can use the system for free for the semester, saving you \$30-50. To use it, you will need to bring your own internet-connected device (phone, laptop, tablet) to each class. There are both web and app interfaces.

To allow for occasional absences, as well as technological mishaps (such as difficulty connecting to Poll Everywhere), we will use a grading scheme with some built-in forgiveness. At the end of the semester, your Poll Everywhere activities will be graded out of a total of 80% of the total possible marks. So, if we do 100 activities over the course of the semester, there will be 150 possible marks (1.5 for each question), but you will be graded out of $150 \times 80\% = 120$ marks. **This grading scheme will not be reflected on Poll Everywhere, but will be implemented on Quercus at the end of the semester.**

Here are some sample grading scenarios:

- You answer every single question during the semester, and get them all correct. You will receive 150 marks, which is more than the 120 required for a perfect grade. Your final grade is 100% (grades higher than 100% are not counted and do not transfer to other portions of your grade).
- You miss 20 questions due to absences and 5 questions due to technical problems. Of the remaining 75 questions, you answer 50 correctly. You therefore earn 50×1.5 marks + 25×0.5 marks = 87.5 marks. So, your final score is $87.5/120 = 72.9\%$. So, your final score is considerably higher than 50% even

though you only answered 50% of the questions correctly!

Because we already allow you to miss 20% (equivalent to 2 classes) of the questions without penalty, **we will only accept medical documentation for absences lasting longer than 2 classes. You MUST provide documentation covering *all* of your absences, not just the ones exceeding 2 classes.** So, for example, if you choose not to come to class for 2 classes, then are sick for an additional 1 class and provide medical documentation of your illness, you will not be excused for any additional grades on your Poll Everywhere activities--that one medically excused absence counts against your allowed 2 absences, with no additional allowance for the classes you skipped. However, if you miss 3 classes for medical reasons and provide documentation for all of them, you will be excused for a total of 3 absences.

You will receive instructions by e-mail in the first week of classes about how to sign up for Poll Everywhere.

Grading Scheme

The grading scheme for the course is:

Component	Percentage of Final Grade
In-class Poll Everywhere activities	9%
Weekly homework on Quercus	9%
Projects (2)	27% (13.5% each)
Midterm	20%
Final exam	35%

Projects

There are two projects to be completed in this course. Each one will require you to analyse some data (mostly qualitatively, but partially quantitatively), do some independent research, prepare some figures, and write a report. The typical length of these projects will be 4-6 pages, of which a significant fraction will be figures.

The first project will be released on February 3 and will be due on March 9. The second project will be released on March 9 and will be due on March 30.

Illnesses and Missed Work

The late penalty in this course is 10% per calendar day, excepting these cases:

1. Necessary personal travel for which complete documentation is submitted prior to traveling.
2. Exceptional circumstances, such as illness or family issues. Documentation must be submitted within 48 hours of returning to campus.

All documentation must be submitted electronically to ast251@astro.utoronto.ca (<mailto:ast251@astro.utoronto.ca>). You may take a picture of your document and email it to us. Keep the original in case we request to see it.

Late work will not be accepted after the relevant homework or assignment has been graded and returned to the rest of the class.

No accommodations will be made for in-class activities missed during absences lasting less than two weeks. Short absences of this type are accounted for in the default grading policy for the in-class activities (see above).

Academic Integrity

All students are expected to rigorously adhere to the university's Code of Behaviour on Academic Matters:

<http://www.artsci.utoronto.ca/osai/The-rules/code/the-code-of-behaviour-on-academic-matters/>
(<http://www.artsci.utoronto.ca/osai/The-rules/code/the-code-of-behaviour-on-academic-matters/>)

Make completely sure that you understand the Code and all of its contents before submitting any work for grading in this course. In brief, we expect all work that you submit to be uniquely and originally your own. Anything you use that is not your own creation--ideas, text, images, and so on--must be clearly cited. While we encourage you to collaborate with your classmates, especially across disciplines, whatever work you submit for grading must reflect your individual understanding of the material. We strongly encourage you to review this helpful webpage on what constitutes Academic Misconduct:

<http://www.artsci.utoronto.ca/osai/The-rules/what-is-academic-misconduct>
(<http://www.artsci.utoronto.ca/osai/The-rules/what-is-academic-misconduct>)

You should also read the university's excellent advice on proper use and citation of sources in research:

<http://advice.writing.utoronto.ca/using-sources/> (<http://advice.writing.utoronto.ca/using-sources/>)

Accessibility

The University of Toronto offers a wide variety of accommodations for students with disabilities and persistent health problems. Please see Accessibility Services to learn about accommodations that may be available to you (see: <https://www.studentlife.utoronto.ca/as> (<https://www.studentlife.utoronto.ca/as>)). They can make a confidential assessment of your needs and pass this information along to your professors. If you are registered with Accessibility Services, please forward your documentation to ast251@astro.utoronto.ca (<mailto:ast251@astro.utoronto.ca>) as early as possible and we will be happy to make accommodations.

Electronic Devices in Class

Please be considerate about your use of electronic devices during class. Distracting use of electronic devices is strictly forbidden (e.g. playing games, excessive use of social media). All devices must be silenced for the duration of class.

The Role of Math in the Course

This course is designed to be accessible to any student in the university. We understand that not all students find math equally approachable. The math you will see in this course will mainly occur on the projects, where you will have to use roughly grade 10 algebra. This will entail putting numbers into equations

and calculate the results. The level of math you'll see will be something like:

Let $y = b \cdot x^2$. If $b = 3.1$ and $x = 5.3$, what is y ?

We will not ask you to do any calculator math on tests or exams. If you need help with the math that appears on projects, we will gladly help you via office hours or on the discussion boards. If there isn't enough help available, let us know and we'll schedule additional office hours wherever possible.

Readings

To prepare adequately for the in-class activities, we strongly recommend that you do the assigned readings. The assigned readings for each week will appear on the main Quercus page for the course.




Note that the textbook goes into considerably more detail on some topics than we will have time to cover. In particular, the mathematical treatment of many topics is much more elaborate in the textbook than you will see in class or on exams. Use the class notes as a guide for what to study in detail. **Only material that has been covered in class will appear on tests or exams.**



What To Do If You're Overwhelmed

If you feel overwhelmed with schoolwork or your personal circumstances are interfering with your performance at university, there are many resources available to you:

1. This site is a great resource for anyone who is experiencing any type of distress:
<https://www.studentlife.utoronto.ca/feeling-distressed> (<https://www.studentlife.utoronto.ca/feeling-distressed>)
2. You can always speak to an academic counsellor at your college registrar's office to get advice on how to handle your academic responsibilities.
3. Student Life offers a variety of programs to enhance academic success and reduce stress. See:
<https://www.studentlife.utoronto.ca/asc> (<https://www.studentlife.utoronto.ca/asc>)
4. The Health and Wellness Centre offers confidential mental health and other support services to students. See: <https://www.studentlife.utoronto.ca/hwc> (<https://www.studentlife.utoronto.ca/hwc>)
5. For matters associated with this course, please visit me during office hours. I will be happy to review your progress on assignments or go over effective study techniques with you.

Course Summary:

Date	Details
Mon Jan 13, 2020	 Homework 1 (https://q.utoronto.ca/courses/133263/assignments/272209) due by 3pm
Mon Jan 20, 2020	 Homework 2 (https://q.utoronto.ca/courses/133263/assignments/281097) due by 3pm
	 Poll Everywhere as of Jan 6 (https://q.utoronto.ca/courses/133263/assignments)

Date	Details
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	 Project 1 (https://q.utoronto.ca/courses/133263/assignments/272210)
	 Project 2 (https://q.utoronto.ca/courses/133263/assignments/272212)

