

# Earth Sciences 3001B: Astrobiology

**WINTER 2019**

**Instructor:** Mr. Josh Hedgepeth, BGS 0175

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**Office hours:** By appointment

**TA:** Ana Gonzalez Flores ([agonzlez@uwo.ca](mailto:agonzlez@uwo.ca))

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**Office hours:** TBD, BGS 1025

**Lectures:** T-Th 1:30 pm - 2:30 pm

**Location:** Physics and Astronomy 117 (PAB-117)

## **Lab Section 002:**

**Lab time:** Th 2:30 pm - 4:30 pm

**Location:** Health Science Building 14 (HSB-14)

## **Lab Section 003:**

**Lab time:** Th 10:30 am - 12:30 pm

**Location:** Social Science Centre 1032 (SSC-1032)

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## **Course Description:**

Astrobiology is the study of life in the universe, including the origin of life on Earth, the possibility of life elsewhere in the solar system/universe, and the future of human life off-Earth. As such, it is interdisciplinary in nature, and will include topics that draw from biology, physics, astronomy, geology, chemistry, and other areas.

*Prerequisites:* Any 1.0 course equivalent at the 1000 level from Chemistry, Biology, or Physics.

## **Course Materials:**

Required: *Astrobiology: Understanding Life in the Universe* by Cockell

In addition to the required textbook, material will be presented during lectures in the form of PowerPoint presentations and handouts. Some additional material may be posted on OWL (<http://owl.uwo.ca>). Students should check OWL on a regular basis for news and updates.

### Anticipated Lecture Topics:

Earth Sciences 3001B is a course about life in the universe, and thus, is very interdisciplinary in nature. The topics listed below may be adjusted to reflect lecture progress or to introduce new developments in the field.

- Week 1: Astrobiology and Life
- Week 2: Life's Structure
- Week 3: Energy for Life
- Week 4: The Origin of Life
- Week 5: Early Life on Earth
- Week 6-8: The Tree of Life
- Week 9: The Limits of the Biosphere
- Week 10: The Habitability of Planets
- Week 11: The Astrobiology of Mars
- Week 12: The Moons of the Giant Planets
- Week 13: Exoplanets: The Search for Other Habitable Worlds

### Course Objectives:

Upon completion of this course successful students will be able to:

- Explain the possible origins of life and the evolutionary steps of life on Earth
- Explain how to search for life elsewhere in the universe
- Apply knowledge of the origin and evolution of life to design a basic life detection mission including instruments
- Develop writing skills and project development related to space exploration

### Course Evaluation:

The overall course grade, out of 100, will be calculated as listed below. Listed next to the respective components are their maximum contributions toward the course grade.

| <i>Component</i>                          | <i>Notes</i>  | <i>Value</i> |
|---|---|--------------|
| In-class quizzes OR<br>Writing assignment | Open book quizzes on course material<br>Written report on a topic in astrobiology | 10           |
| Lab assignments                           | Assignments based on activities conducted during<br>lab time                      | 20           |
| Group project                             | Oral and written report on astrobiology mission                                   | 20           |
| Midterm exam                              | To be held in class (likely on February 28, 2019)                                 | 20           |
| Final exam                                | Scheduled by the Registrar  | 30           |

On occasion I will give informal quizzes during lecture periods. These **In-class Quizzes** will be used to determine how well you understand the material and will serve as a random check on attendance. Each quiz will receive a score between 0 and 2. If I don't receive the quiz, the score will be a 0. If it is a weak response, the score will be a 1. A strong response will receive a 2. No make-ups are allowed, except for serious extenuating circumstances (see Course Policies below). However, you may drop one quiz to cover any unexpected absences. Those students who turn in all quizzes will be able to drop the quiz with the lowest score.

I strongly encourage you to come to class and engage with your classmates. Education research has demonstrated the value of interactivity in helping students to learn and retain knowledge. HOWEVER, if your learning style favors more independent study, you can replace your score for the in-class quizzes by a **Writing Assignment** due the last day of class. This is a six-page research proposal on a topic of your choice in astrobiology. It should be based on the NASA Earth and Space Science Fellowship (NESSF), described in detail here: <http://tinyurl.com/arjogrz>. As it states in the solicitation, "*The proposal should present a well-defined problem and justification of its scientific significance, as well as a detailed approach for its solution.*" For more information, see the URL above.

Assignments related to work conducted during lab time will also be assigned during the course. These **Lab assignments** will typically be assigned on Thursday and will be due at the beginning of class on the following Thursday. No late work will be accepted, so please plan ahead. However, you may drop one lab assignment to cover any unexpected absences. Those students who turn in all lab reports will be able to drop the assignment with the lowest score.

Students are also expected to work together in small groups (~4 people) to design an astrobiology mission. This **Group project** will consist of a written and oral component. The written component is expected to be 15 pages long (this includes tables and figures but excludes references). The oral component is expected to be 10 minutes long and can be presented in person in front of the class or through a previously taped video. Your grade will be based on (a) the assessment of your contribution by the others in your group (individual score), and (b) the instructor's assessment (group score). *Groups will be assigned by the instructor.* More details on the format of the project will be posted on OWL.

One **Midterm exam** and one **Final exam** will also be given. All exams will be closed book, and no electronic devices may be in your possession during the exams. It is Faculty of Science policy that a student who chooses to write an exam deems themselves fit enough to do so, and the student must accept the mark obtained. Claims of medical, physical, or emotional distress after the fact will not be considered.

## **Course Polices and Friendly Reminders:**

*Assignments:* Assignments must be submitted at the beginning of class on the assigned due date and will not be accepted late, except under medical or other compassionate circumstances (see below). Submitting a late assignment without appropriate documentation will result in a zero (0) grade. However, to allow for reasonable absences, the lowest score on each student's lab assignments and the lowest score on each student's in-class quizzes will be dropped.

Students must write their assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge this both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see below). APA style is the approved style of writing for all assignments produced for this course. Please refer to the University of Western Ontario Library webpage for information on citation style and format or consult the APA publication manual: Publication manual of the American Psychological Association (6<sup>th</sup> ed.). (2009). Washington, DC: American Psychological Association.

*Accessibility:* Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

*Missed course components:* If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or supporting documentation to the Academic Counseling Office of your home faculty as soon as possible. If you are a Science student, the Academic Counseling Office of the Faculty of Science is located in WSC 140, and can be contacted at 519-661-3040 or scibmsac@uwo.ca. Their website is:  
[http://www.uwo.ca/sci/undergrad/academic\\_counselling/index.html](http://www.uwo.ca/sci/undergrad/academic_counselling/index.html)

A student requiring academic accommodation due to illness must use the Student Medical Certificate ([https://studentservices.uwo.ca/secure/medical\\_document.pdf](https://studentservices.uwo.ca/secure/medical_document.pdf)) when visiting an off-campus medical facility. For further information, please consult the university's medical illness policy at:  
[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_medical.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf)

If you miss the Midterm Exam, please contact your faculty's Academic Counseling Office as soon as you are able to do so. The instructor will schedule a makeup exam once the documentation is received.

If you miss the Final Exam, please contact your faculty's Academic Counseling Office as soon as you are able to do so. They will assess your eligibility to write the Special Exam (the name given by the university to a makeup Final Exam). You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (see [http://www.registrar.uwo.ca/examinations/exam\\_schedule.html](http://www.registrar.uwo.ca/examinations/exam_schedule.html)).

*Academic misconduct:* Academic 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/handbook/appeals/scholoff.pdf>

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>). Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

*Classroom Behavior:* Disruptive behavior will not be tolerated in class or on the course website. Please respect the rights of your classmates to benefit from the lecture by limiting your conversations to those essential to the class. Students who persist in loud, rude or otherwise disruptive behavior will be asked to leave. Cellular phones, pagers, and text-messaging devices are not to be used in class and must be placed in silent mode. Laptops for the purpose of typing lecture notes are permitted in class, but please be respectful to your fellow students and turn the sound off. Audio and/or videotaping of lectures is not permitted unless approval has been sought from the instructor in advance.