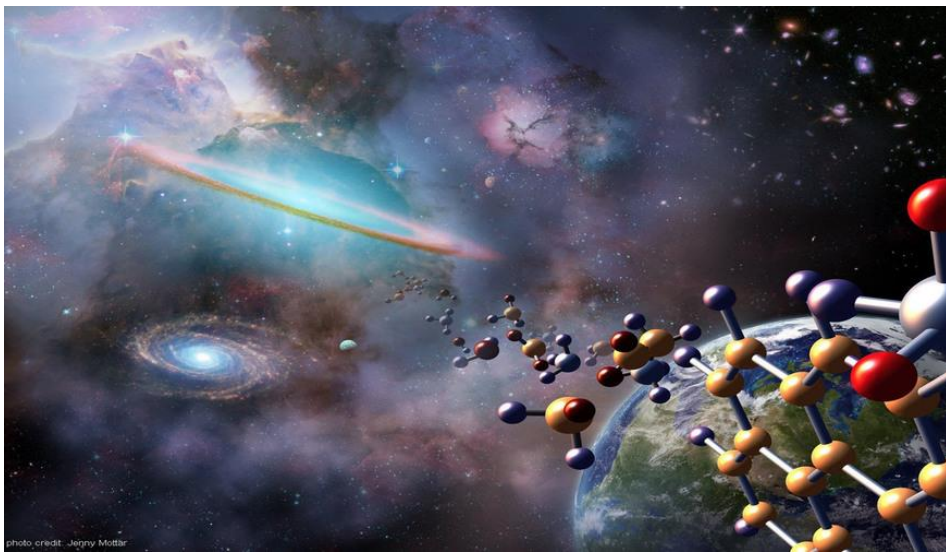




## Course Outline



**BEES2741**

**Introduction to Astrobiology:  
Life in the Universe**

School of Biological, Earth  
and Environmental Sciences

Faculty of Science

Term 2, 2022

## 1. Staff

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Position	Name	Email
Course Convener and instructor	Associate Professor Carol Oliver	carol.oliver@unsw.edu.au
Tutor	Dr Bonnie Teece	<a href="mailto:b.teece@unsw.edu.au">b.teece@unsw.edu.au</a> (after June 25)
Tutor	Clare Fletcher	<a href="mailto:Clare.fletcher@student.unsw.edu.au">Clare.fletcher@student.unsw.edu.au</a>

## 2. Course information

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Units of credit: 6

Teaching times and locations: **Fully online**

### 2.1 Course summary

Welcome to BEES2741 Introduction to Astrobiology

Astrobiology is the study of origins, evolution, distribution, and future of life in the universe. UNSW has the only astrobiology research centre in the southern hemisphere - the Australian Centre for Astrobiology in the School of Biological, Earth and Environmental Sciences.

Astrobiology is still a relatively young science, driven by one of the most profound questions we can ask of ourselves: "Are we alone in the universe?". To begin to answer this question we need to start with the only sample of life we know of - life on Earth - and pose another question: "What is life?" This question leads to other, more intriguing questions that relate to the idea that if we have trouble with a definition of life on Earth, how will we fare with defining life beyond the thin biosphere that envelopes the planet?

This course is an introduction to astrobiology. Throughout the course, life is the theme - from the origin of life on Earth to the ideas that we have about life

elsewhere within the solar system and to extrasolar systems in the universe beyond. The course also provides students with a good foundation on which to consider going onto our third level science elective course, *BEES6741 Astrobiology: Life in the Universe* in Term 3, in which students study early life on Earth and apply it to the search for life on Mars and have a Q & A session with a NASA scientist involved in the Perseverance rover mission.

### Course aims

1. To introduce students to the broadly interdisciplinary subject of astrobiology.
2. To develop skills in interdisciplinary thinking.
3. To inspire students through the study of the origin of life, the possibility of life elsewhere in the universe and space exploration in general.

### Course learning outcomes

CL01	Describe, analyse, and evaluate the role of an interdisciplinary approach to discoveries made to date in the search for life elsewhere in the solar system.
CL02	Construct a short primary literature review, demonstrating they are able to search for and select appropriate primary literature and critically review, and evaluate, and with the ability to recognise the significance of the publications they select.
CL03	Investigate and combine the elements of the evolution of life and our planet, and then to reorganise these concepts into the potential that other planets and moons in our solar system have for past or present life.
CL04	Reflect on their own performance through adaptive e-learning, and that he or she recognises the construct of the phylogenetic Tree of Life demonstrates the relatedness of all life on Earth.

## 2.2. How to be successful in this fully online course

**NOW:** Time management in an online course means regular WEEKLY interactions with the content to enjoy a teaching approach that encourages you to think about the big question “Are we alone in the universe?” rather than to rote learn facts. Review the course outline carefully and create a work and assessment schedule in relation to your other courses to stay on track. The new Moodle Enhance presentation of the course means you can see when assessments are due, and in the same place you can

download the assessments and upload your submissions to Turnitin. The course uses more than text, images, and video – there is a Virtual Field Trip to hot springs in New Zealand, and a Virtual Lab where you can see how all life on Earth must be related.

**DAILY:** Read any announcements posted in the course. You will get a summary each day

**DAILY:** Read and respond to any course email messages. Course messages will go to your student e-mail account.

**DAILY:** Check on the forum for hot news about life in the universe and post your own when you come across it. Use the assessments forum to ask questions – or write to me at [carol.oliver@unsw.edu.au](mailto:carol.oliver@unsw.edu.au).

**ON A WEEKLY BASIS:** plan to spend 3-4 hours a week completing the modules plus time for undertaking additional reading and reflection and the three assessments, Virtual Field Trip and optional Virtual Lab.

**Take notes** when reading course materials or watching videos (it will help you practise better note-taking skills). Research shows that writing notes by hand helps you to reflect more easily the materials and do better on assignments. **Reading online only and watching the videos without taking is not an effective learning strategy and will also likely cause you to spend more time on assessments than is necessary.** A much better strategy for this online course is to mind-map the concepts for each module to make sure you understand the relationships and undertake the three optional quiz questions each week to check your progress.

You are also strongly encouraged to begin assessments at least one week in advance. Print and keep referring to the assessment instructions and the rubric to understand exactly what you will be marked on – students commonly do not do this, so waste time and marks going off-topic. **It you stick to the rubric you will find yourself doing less for more marks!**

**ON A WEEKLY BASIS:** Connect with me, Carol Oliver at [carol.oliver@unsw.edu.au](mailto:carol.oliver@unsw.edu.au) if you have any questions in advance of due dates. I am here to help, and I really like to see students do well !! :)

## Graduate attributes developed in this course

Faculty of Science Graduate Attributes	Level of Focus 0 = No Focus 1 = Minimal 2 = Minor 3 = Major	Related Tasks & Assessment
1. Research, inquiry, and analytical thinking abilities.	3	All aspects of this course are focused on the ability to reflect on the content, to think analytically, and to integrate information to achieve learning. The course therefore contains no rote learning and no final exam.
2. Capability and motivation for intellectual development.	3	Learning in the course is designed to drive motivation for intellectual development to create capability and capacity for lifelong learning.
3. Ethical, social and professional understanding.	2	Searching for life in the universe is a societal as well as a science question. For example, is life bound to rise to intelligence, or is life on Earth the result of chance? Is it ethical to land on pristine planets with spacecraft that cannot be completely Earth microbe-free?
4. Communication.	3	Students are encouraged to share their reflections on the content of the course with other students through the forum.
5. Teamwork, collaborative and management skills.	3	Students partner with other students to produce a three-minute video on the search for life on other worlds in the solar system.
6. Information literacy.	3	Search for and make extensive use of primary literature.

For more information, visit: [https://teaching.unsw.edu.au/sites/default/files/upload-files/unsw-graduate-attributes\\_0.pdf](https://teaching.unsw.edu.au/sites/default/files/upload-files/unsw-graduate-attributes_0.pdf)

### 3. Strategies and approaches to learning

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#### 3.1 Learning and teaching strategies, rationale, and activities

BEES2741 benefits from two aspects: One is you chose the course, and the other is that who among us is not interested in life in the universe?! The overall strategy is to build on the intriguing question "Are we alone in the universe?". A technology-

enabled fully online delivery enables students to understand the unique interdisciplinary approach of astrobiology. Technology-enabled means a course designed specifically for online learning, including virtual technologies: The hot springs Virtual Field Trip to the origin of life and the virtual lab to demonstrate life on Earth evolved from a common ancestor. These virtual technologies establish the basis for looking for life elsewhere in the solar system and beyond.

The three assessments build one on the other. From the outset, it will be made clear to students why the concepts in astrobiology necessarily require an interdisciplinary approach, and how this might be applied. Interrelated assessments provide a coherent story for the student to work through. It is formative (learning) as well as a summative (marking) approach to encourage reflective and active student-centered learning aligned to course outcomes. In short, the assessments are designed to be meaningful and useful in the underlying soft skills such as critical thinking and collaboration.

**Supporting materials:** BEES2741 is both a science elective and a general education course. Therefore, there is no assumption of prior knowledge of astrobiology. Students at any point in their university career can take this course. All that is needed is an interest in science in the context of searching for life elsewhere in the universe.

**Lessons** – The core content is delivered via short electronic books containing text, images and videos aimed at student understanding of the interdisciplinary nature of key concepts in astrobiology. There are four non-mandatory video classes – an introductory one and the remaining three focused on help for each of the three assessments.

**Three assessments** – These assessments are aimed at helping students understand the study the origin of life on Earth, the search of life in the universe, and the implications for future life on Earth.

**THERE IS NO FINAL EXAM.** The course is **fully online**. Your total course marks out of 100% will be based on:

Three assignments (90% combined) **A1 = 20%; A2 = 25%; A3 =45%**

## 6. Course schedule and structure

Week	Topics	
<p><b>Week 1</b></p> <p><b>To do this week:</b></p> <ul style="list-style-type: none"> <li>• Read the e-book and take notes</li> <li>• Watch the videos and take notes</li> <li>• Reflect on the e-book content</li> <li>• Put up a paragraph about yourself on the “who else is in this class” forum to find video assignment partners</li> </ul>	<p><b>Is life common in the universe?</b></p> <p>An introduction to the course; an overview of astrobiology; the Big Bang to the formation of planetary systems; the chemistry of life resident in the PeriodicTable; is life common in the universe, or could life be limited to Earth or our solar system? The Drake Equation.</p>	<p><b>Finding partners for video in Assessment 2</b></p> <p>Introduce yourself to the classwith a paragraph on “who else is in this class?” This is a good way to find another you might like to team with online for the video assessment in Week 5. There is no compulsion to work with a partner, but it is recommended. Whatever you choose your mark will not be affected.</p> <p><b>FIRST NON-MANDATORY VIDEO CLASS 4PM FRIDAY JUNE 3: (30 MINS)</b></p>
<p><b>Week 2</b></p> <ul style="list-style-type: none"> <li>• Read the e-book and take notes</li> <li>• Watch the videos and take notes</li> <li>• Reflect on the e-book content</li> <li>• Read the assignment 1 and rubric and make notes on requirements</li> </ul>	<p><b>Origin of life and water on Earth</b></p> <p>Formation of the solar system; creation of the moon; early and late bombardment; history of zircon crystals; hot springsin the ocean; hot springs on the land; the origin of water on Earth, its special properties, and relevance to searching for life elsewhere in the universe.</p> <p><u><i>Hot springs Virtual Field Trip open in preparation for Assessment 1.</i></u></p> <p>Module contains help with Assessment 1.</p>	<p><b>Assignment 1 and VFT:</b></p> <p>Origin of life on Earth: Students engage with a Virtual Field Trip and a short-answer question for 10% of the course marks. In the second part of the assessment, students write a short essay or make a short video on the evidence for the possible origin of life in hot springs on the land and hot springs at the bottom of the ocean for 20% of the course marks. Assessment is due at the end of Week 3.</p> <p><b>SECOND NON-MANDATORYVIRTUAL CLASS FRIDAY JUNE 10 (30 MINS)</b></p>

<p><b>Week 3</b></p> <ul style="list-style-type: none"> <li>• Read the e-book and take notes</li> <li>• Watch the videos and take notes</li> <li>• Reflect on the e-book content</li> <li>• Submit Assignment 1</li> </ul>	<p><b>The Tree of Life, early life on Earth and extremophiles</b></p> <p>The phylogenetic Tree of Life, the Last Universal Common Ancestor (LUCA), role of energy in life systems, role of lateral gene transfer in evolution, extremophiles, microbiology of microbial mats, and Shark Bay stromatolites. Early life on Earth and detecting biosignatures on Earth and elsewhere in the solar system</p>	<p><b>Assessment 1 due on Friday this week at 23.59.</b></p> <p>Make sure you have read the assessment and the marking rubric and that you have rechecked your assessment when complete. The Assessment is loaded in two parts: Part A, a short answer after completing the hot springs VFT and Part B, a short essay comparing hot springs on the land and hot springs at the ocean floor as possible places for the origin of life on Earth.</p> <p>Submit your assignment to Turnitin</p>
<p><b>Week 4</b></p> <ul style="list-style-type: none"> <li>• Read the e-book and take notes</li> <li>• Watch the videos and take notes</li> <li>• Reflect on the e-book content</li> </ul>	<p><b>Life elsewhere in the solar system?</b></p> <p>Could there be life elsewhere in the solar system? Could life exist in the clouds of Venus or in the depths of slushy ice seas found on Europa, a moon of Jupiter, or Enceladus, a moon of Saturn? Or could life exist in an entirely different chemistry on Titan, the only other planet or moon in the solar system with a thick atmosphere life that found on Earth? Module contains help for Assessment 2.</p>	<p><b>Assessment 2</b></p> <p>Students investigate the potential hot springs of Europa, an icy moon of Jupiter, producing a three-minute video (plus or minus 15 seconds). Students partner to produce a video using PowerPoint, with a voiceover and then exported to video for upload to YouTube or write an essay with slides.</p> <p>Videos must be uploaded to YouTube as <b>UNLISTED</b> – do not use the public or private settings.</p> <p>The assessment is worth 25% of the course marks and is due on Friday in Week 7 at 23.59. A one paragraph <b>statement of contributions</b> is required with student names and numbers uploaded to Turnitin <u><a href="#">with the link to the video.</a></u></p>



<p><b>Week 5</b></p> <ul style="list-style-type: none"> <li>• Read the e-book and take notes</li> <li>• Watch the videos and take notes</li> <li>• Reflect on the e-book content</li> <li>• Submit Assignment 2 on Friday of this week at 7pm</li> </ul>	<p><b>What makes a planet habitable?</b></p> <p>An introduction and overview of the formation of the Earth and its co-evolution with the emergence of life on Earth.</p> <p>From island chains and no oxygen to oceanic crust, plate tectonics, the rise of oxygen, the rise of complexity and to intelligence. Earth's planetary systems.</p>	<p><b>THIRD NON-MANDATORY VIRTUAL CLASS FRIDAY JULY 1 AT 4PM (30 MINS)</b></p>
<p><b>Week 6</b></p>	<p><b>Flexible week no coursework</b></p>	
<p><b>Week 7</b></p> <ul style="list-style-type: none"> <li>• Read the e-book and take notes</li> <li>• Watch the videos and take notes</li> <li>• Reflect on the e-book content</li> <li>• Read and take notes on the requirements for Assignment 3 and associated marking rubric</li> </ul>	<p><b>Why did Mars die so early?</b></p> <p>Mars got going as a habitable planet before Earth, but it died early on. What have we learned about Mars and what are the implications for life on Earth? Did life arise on Mars? Is life still present today? Will humans go to Mars?</p>	<p><b>Assessment 2 is due on Friday this week at 23.59</b></p> <p><b>Assessment 3</b></p> <p>Students write a 1,500-2,000-word report on the search for life on Mars and elsewhere in the solar system, the implications for the origin of life on Earth, and the likelihood of life (and intelligent life) elsewhere in the universe.</p> <p>Additional evidence is drawn in from supplying at least five primary references referred to in their essay. APA style must be used for referencing. The UNSW APA should be used in-text and in a reference list at the end.</p>

		<p>Secondary references may be used but each secondary reference requires a one-line defense of why the source can be considered reliable (e.g. NASA). Course content may be referenced.</p> <p>The assessment is worth 45% of the course mark and is due Friday on Week 10 at 23.59.</p>
<p><b>Week 8</b></p> <ul style="list-style-type: none"> <li>• Read the e-book and take notes</li> <li>• Watch the videos and take notes</li> <li>• Reflect on the e-book content</li> </ul>	<p><b>Is there life elsewhere in the universe?</b></p> <p>The discovery of exoplanets; how they are discovered, how many have been discovered; how many are habitable; the Kepler mission; sniffing the atmospheres of distant world for evidence of life – James Webb Space Telescope.</p>	<p><b>FINAL NON-MANDATORY VIRTUAL CLASS ON FRIDAY JULY 20 AT 4PM JULY 22 (30 MINS).</b></p>
<p><b>Week 9</b></p> <ul style="list-style-type: none"> <li>• Read the e-book and take notes</li> <li>• Watch the videos and take notes</li> <li>• Reflect on the e-book content</li> </ul>	<p><b>Technosignatures: Will ET be biology or technology?</b></p> <p>The Search for Extra-Terrestrial Intelligence (SETI) – searching for intelligence elsewhere in the universe. Radio and optical search strategies; Breakthrough Listen; and Breakthrough Starshot</p>	<p><b>Dr Seth Shostak, the Senior Astronomer at the SETI Institute in California will be answering your questions on Assessment 3 in a special virtual session this week – day and time TBA.</b></p>

<p><b>Week 10</b></p> <ul style="list-style-type: none"> <li>• Read the e-book and take notes</li> <li>• Watch the videos and take notes</li> <li>• Reflect on the e-book content</li> </ul>	<p><b>Revision and hot news week</b></p> <p>Module is entirely devoted to help with Assessment 3.</p>	<p><b>Assignment 3 is due on Friday this week at 23.59</b></p> <p>You are advised to undertake this module with the week 9 module to revise and reflect on the content of the course to help you with Assessment 3.</p>
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Please help me by completing the [MyExperience survey](#).

Your feedback matters to me.

Thank you!

## Assessment criteria and standards

These will appear on the assessment instructions

UNSW grading system: <https://student.unsw.edu.au/grades>

UNSW assessment policy: <https://student.unsw.edu.au/assessment>

## Submission of assessment tasks and special consideration

Late submission of assignments will result **in 5% penalty per day** (including weekends) **for the first five days after the deadline. On the sixth day, the assessment cannot be marked.**

If for any reason you are unable to submit an assignment on time be sure to contact the course staff and make the necessary special consideration steps. Instructions can be found at: <https://student.unsw.edu.au/special-consideration>. We understand that extenuating circumstances occur and are here to support you - but it is up to you to let us know before the submission deadline. Submission of assignment assumes 'fit to submit'. **If you have anything impacting on your studies (such as your own illness or serious illness of an immediate relative, or COVID-19 related issues) please act as soon as these issues appear.**

## Feedback on assessment

Feedback on assessments will appear online with a breakdown of marks. If you are concerned for any reason that your mark is incorrect, or you are unsure as to why you have received a specific mark, don't hesitate to contact the course staff.

## 6. Academic integrity, referencing and plagiarism

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**Referencing** is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas, or research. Not referencing other people's work can constitute plagiarism. APA referencing is used for Assessment 3 and for the choice of essays in Assessment 1 and 2. How to reference in APA style is located at <https://student.unsw.edu.au/apa>

**Academic integrity** is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility, and courage. At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity and **plagiarism** can be located at:

The *Current Students* site <https://student.unsw.edu.au/plagiarism>, and

The *ELISE* training site

<http://subjectguides.library.unsw.edu.au/elise/presenting>

The *Conduct and Integrity Unit* provides further resources to assist you to understand your conduct obligations as a student:

<https://student.unsw.edu.au/conduct>.

## 7. Additional support for students

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The Current Students Gateway: <https://student.unsw.edu.au/>

Academic Skills and Support: <https://student.unsw.edu.au/academic-skills>

Student Wellbeing, Health and Safety: <https://student.unsw.edu.au/wellbeing>

Disability Support Services: <https://student.unsw.edu.au/disability-services>

UNSW IT Service Centre: <https://www.it.unsw.edu.au/students/index.html>

## Virtual contact hours

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You can also request a one-on-one virtual meeting at a time convenient for you by e-mailing Carol Oliver [carol.oliver@unsw.edu.au](mailto:carol.oliver@unsw.edu.au).

I am very happy to answer any questions or provide advice and arrange tutorials.

I generally aim to respond to your enquiries relatively immediately but usually within 12 hours, so please feel free to follow up if you do not get a response in that timeframe. **All correspondence will be via your UNSW student account.**