



# GEOS204

## Life, the Universe and Everything

S1 Day 2015

*Dept of Earth and Planetary Sciences*

### Contents

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<a href="#"><u>General Information</u></a>	2
<a href="#"><u>Learning Outcomes</u></a>	3
<a href="#"><u>Assessment Tasks</u></a>	3
<a href="#"><u>Delivery and Resources</u></a>	8
<a href="#"><u>Unit Schedule</u></a>	11
<a href="#"><u>Policies and Procedures</u></a>	11
<a href="#"><u>Graduate Capabilities</u></a>	12
<a href="#"><u>Changes from Previous Offering</u></a>	18

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#### **Disclaimer**

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

## General Information

Unit convenor and teaching staff

Other Staff

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E7A 514

Send email to book time

Unit Convenor

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Lecturer

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Lecturer

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Credit points

3

Prerequisites

12cp

Corequisites

Co-badged status

### Unit description

This is a broad-based interdisciplinary science unit which aims to present a non-technical overview of recent ideas in astrobiology, which is about the origin of life on Earth and the possibility of finding life elsewhere in the universe. The presentation is suitable for students without any science background. The unit presents an integrated view of science across a broad range of disciplines (geoscience, biology, astronomy, cosmology and organic chemistry); looks at some of the 'big questions' (such as the origin of the Universe; what is life?; are we alone?; early Earth; and the search for life on Mars and outer solar system moons); and presents science as it is actually done, not just as a set of facts.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding of scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Understanding that scientific knowledge is always advancing and changing
- Distinguishing between complex and sometimes mutually exclusive hypotheses
- Application of knowledge to solving problems and evaluating ideas and information
- Capacity to present ideas clearly with supporting evidence

## Assessment Tasks

Name	Weighting	Due
<a href="#">On-line quizzes, lectures</a>	8%	various
<a href="#">On-line quiz: solar system</a>	2%	8/3/2015
<a href="#">On-line quiz on meteorites</a>	2%	29/3/15
<a href="#">On-line quiz, macroscopic life</a>	2%	5/4/15
<a href="#">On-line quiz on rocks</a>	4%	3/5/15
<a href="#">On-line quiz, VFT</a>	2%	10/5/15
<a href="#">On-line quiz on biomarkers</a>	4%	24/5/15

Name	Weighting	Due
<a href="#">Assignment 1</a>	11%	20/3/15
<a href="#">Assignment 2</a>	15%	27/4/15
<a href="#">Assignment 3</a>	20%	15/5/15
<a href="#">Unit exam</a>	30%	Session 1 Exam period

## On-line quizzes, lectures

Due: **various**

Weighting: **8%**

On-line quizzes on each learning module

On successful completion you will be able to:

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding of scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Understanding that scientific knowledge is always advancing and changing
- Application of knowledge to solving problems and evaluating ideas and information

## On-line quiz: solar system

Due: **8/3/2015**

Weighting: **2%**

On-line quiz on solar system formation

On successful completion you will be able to:

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding of scientific methodology
- Understanding that scientific knowledge is always advancing and changing
- Application of knowledge to solving problems and evaluating ideas and information

## On-line quiz on meteorites

Due: **29/3/15**

Weighting: **2%**

On-line quiz on meteorites

On successful completion you will be able to:

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding that scientific knowledge is always advancing and changing
- Application of knowledge to solving problems and evaluating ideas and information

## On-line quiz, macroscopic life

Due: **5/4/15**

Weighting: **2%**

On-line quiz on macroscopic life

On successful completion you will be able to:

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding of scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Understanding that scientific knowledge is always advancing and changing
- Distinguishing between complex and sometimes mutually exclusive hypotheses
- Application of knowledge to solving problems and evaluating ideas and information

## On-line quiz on rocks

Due: **3/5/15**

Weighting: **4%**

On-line quiz on rock identification (Rock practical)

On successful completion you will be able to:

- Competence in accessing, using and synthesising appropriate information
- Understanding that scientific knowledge is always advancing and changing
- Application of knowledge to solving problems and evaluating ideas and information

## On-line quiz, VFT

Due: **10/5/15**

Weighting: **2%**

On-line quiz on Virtual Fieldtrip computer exercise

On successful completion you will be able to:

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding of scientific methodology
- Understanding that scientific knowledge is always advancing and changing
- Distinguishing between complex and sometimes mutually exclusive hypotheses
- Capacity to present ideas clearly with supporting evidence

## On-line quiz on biomarkers

Due: **24/5/15**

Weighting: **4%**

On-line quiz on biomarker identification (Biomarker practical)

On successful completion you will be able to:

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding of scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Understanding that scientific knowledge is always advancing and changing
- Application of knowledge to solving problems and evaluating ideas and information

## Assignment 1

Due: **20/3/15**

Weighting: **11%**

Assignment 1: Paper Review (800 words approx.)

On successful completion you will be able to:

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding of scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Understanding that scientific knowledge is always advancing and changing
- Distinguishing between complex and sometimes mutually exclusive hypotheses
- Application of knowledge to solving problems and evaluating ideas and information
- Capacity to present ideas clearly with supporting evidence

## Assignment 2

Due: **27/4/15**

Weighting: **15%**

Assignment 2: ALH84001 table

On successful completion you will be able to:

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding of scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Understanding that scientific knowledge is always advancing and changing
- Distinguishing between complex and sometimes mutually exclusive hypotheses
- Application of knowledge to solving problems and evaluating ideas and information
- Capacity to present ideas clearly with supporting evidence

## Assignment 3

Due: **15/5/15**

Weighting: **20%**

Assignment 3: Lander project (1,500 words min., maximum 3000)

On successful completion you will be able to:

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding of scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Understanding that scientific knowledge is always advancing and changing
- Distinguishing between complex and sometimes mutually exclusive hypotheses
- Application of knowledge to solving problems and evaluating ideas and information
- Capacity to present ideas clearly with supporting evidence

## Unit exam

Due: **Session 1 Exam period**

Weighting: **30%**

Unit exam

On successful completion you will be able to:

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding of scientific methodology

- Competence in accessing, using and synthesising appropriate information
- Understanding that scientific knowledge is always advancing and changing
- Distinguishing between complex and sometimes mutually exclusive hypotheses
- Application of knowledge to solving problems and evaluating ideas and information
- Capacity to present ideas clearly with supporting evidence

## Delivery and Resources

The Unit will be presented in 4 broad themes:

- 1. Life and The Universe:** (*cosmology, Astronomy and space, Geoscience*). What is life? Concepts about the origin of life; Origin of life; Origin of the Universe; Formation of the Solar System; What meteorites tell us.
- 2. Life and Rocks on Early Earth and Mars:** (*Astronomy, Geoscience*). Formation of the Earth; Early Earth and Mars environments; The first billion years of life.
- 3. Biology of Life and Habitability** (*Biology, Astronomy, Chemistry*). The environments of the planets; Molecular biology and predictions about the earliest organisms; Biomarkers as proxies for life.
- 4. Life Elsewhere, SETI:** (*Astronomy, Chemistry, Astrobiology*). The diverse places that life can live (Extremophiles); The chemistry of space; Extra-solar planets; Are we alone (SETI)?

### Classes:

Attend one two hour lecture, and a one hour practical/tutorial each week.

**Lecture: W5A Price Theatre (W5A 230)**, Tuesday 16:00-17:00 and 17:00-18:00. This will usually be two separate lectures, stopping for a 10 min break approximately half way.

**Practicals/tutorials: E5A 210**, 7 classes:

1. Monday 10:00-11:00 (Practical 05)
2. Monday 11:00-12:00 (Practical 06)
3. Monday 12:00-13:00 (Practical 07)
4. Tuesday 11:00-12:00 (Practical 04)
5. Tuesday 12:00-13:00 (Practical 01)
6. Tuesday 14:00-15:00 (Practical 02)
7. Tuesday 15:00-16:00 (Practical 03)

Practicals and lectures start in Week 1 (23 to 27 February), please come along, it is important to start straight away! Note that this first week of study is also termed O-week.



## **Late enrolments**

If you enrol late in the unit, you will have already missed one or more lectures. It is your responsibility to catch up. Also, you will still be expected to submit all three assignments within the remaining time.

## **Lectures, availability of lecture material and attendance requirements**

It is the policy in this unit that students will normally attend the two hours of lectures per week, and one practical/tutorial, and make their own notes from the lectures. It is expected that many of the lectures will be interactive, with questions and answers throughout. Lectures will be recorded using Echo 360, and files of the lecture graphics will also be made available through iLearn. These will be particularly useful for revision purposes. Many of the practicals/tutorials are assessed, it is important that you attend one of these each week

## **Hours**

This is a 3 credit point unit. It is anticipated that you will spend >9 hours per week involved with the unit, including the 3-hour class contact time per week. It is particularly important that you spend plenty of time preparing the three major assignments.

## **Contacts and communication**

### **Convenor: Edward Saunders**

ed.saunders@mq.edu.au 02 9850 8416 Office: E7A 403

Department of Earth and Planetary Sciences (EPS), Macquarie University.

Please email for an appointment

EPS Admin (if Ed Saunders is not available): E7A 507, phone 02 9850 8426 or 02 9850 8373

Other staff teaching on unit and guest lecturers:

**Prof. Simon George** EPS

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**Dr Bruce Schaefer** EPS

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**Prof. Michael Gillings** Biological Sciences

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**Prof. David Christian** Modern History

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If sending email, please include GEOS204 in the subject line. We will communicate to you mainly through your student email account/iLearn at Macquarie University. Please make sure you check this email at least weekly.

### **Set textbook and background reading**

**Bennett, J, and Shostak, S (2011). Life in the Universe (3rd Ed). San Francisco, Pearson/ Addison Wesley. ISBN-10: 0-321-68767-1**

- This book should be purchased from the Co-op Bookshop or on the web. It is essential that you purchase this book by the end of the second week of semester. Lectures and some practicals refer to sections of this book, many sections of which it will be necessary to read.
- There may be some second hand copies of the 2nd edition (2007) available from past students; apart from different page numbers the content is only slightly out of date, so this is an acceptable alternative.
- Also see the booklist in the unit handout (available in class and on iLearn) for other places to obtain information. Note that this is not a "reading list" (i.e. you are certainly not expected to read all these books), nor are most of these books on reserve. The booklist is a resource to help you find information in the library.
- Some individual readings to complement the textbook will be suggested in some lectures.
- Astrobiology is an interdisciplinary subject involving aspects of astronomy, cosmology, geoscience, biology and chemistry. Few students (or indeed staff!) have a background in all of these areas, so even if you have done some science units before you must expect to do a lot of extra reading and research to be able to understand all the information that will be presented in the unit. For those students without a science background (e.g. those doing it for "Planet" purposes), this breadth provides you the opportunity to become familiar with several aspects of science over the course of the unit. No prior knowledge of any science will be assumed.

### **Technologies used and required**

Text book (see above)

Access to iLearn for quizzes and unit resources

You will use computers in some practicals/ tutorials

You will need to be able to access books and journal papers in the library

You will be exposed to a variety of materials and concepts in practicals

## Unit Schedule

**GEOS204: Life, the Universe and Everything (2015): Schedule: see unit handout.**

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](#). Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy [http://mq.edu.au/policy/docs/academic\\_honesty/policy.html](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

Assessment Policy <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Grievance Management Policy [http://mq.edu.au/policy/docs/grievance\\_management/policy.html](http://mq.edu.au/policy/docs/grievance_management/policy.html)

Disruption to Studies Policy [http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](http://www.mq.edu.au/policy/docs/disruption_studies/policy.html) *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of Policy Central.

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: [https://students.mq.edu.au/support/student\\_conduct/](https://students.mq.edu.au/support/student_conduct/)

## Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit [ask.mq.edu.au](http://ask.mq.edu.au).

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

## Learning Skills

Learning Skills ([mq.edu.au/learningskills](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)
- [Ask a Learning Adviser](#)

## Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

## IT Help

For help with University computer systems and technology, visit <http://informatics.mq.edu.au/help/>.

When using the University's IT, you must adhere to the [Acceptable Use Policy](#). The policy applies to all who connect to the MQ network including students.

## Graduate Capabilities

### Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

### Learning outcomes

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Competence in accessing, using and synthesising appropriate information
- Distinguishing between complex and sometimes mutually exclusive hypotheses
- Application of knowledge to solving problems and evaluating ideas and information
- Capacity to present ideas clearly with supporting evidence

### Assessment tasks

- Assignment 1

- Assignment 2
- Assignment 3
- Unit exam

## Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

### Learning outcomes

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding of scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Understanding that scientific knowledge is always advancing and changing
- Distinguishing between complex and sometimes mutually exclusive hypotheses
- Capacity to present ideas clearly with supporting evidence

### Assessment tasks

- On-line quizzes, lectures
- On-line quiz: solar system
- On-line quiz on meteorites
- On-line quiz, macroscopic life
- On-line quiz on rocks
- On-line quiz, VFT
- On-line quiz on biomarkers
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- Assignment 2
- Assignment 3
- Unit exam

## Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally

and socially.

This graduate capability is supported by:

## **Learning outcomes**

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding that scientific knowledge is always advancing and changing
- Distinguishing between complex and sometimes mutually exclusive hypotheses
- Application of knowledge to solving problems and evaluating ideas and information
- Capacity to present ideas clearly with supporting evidence

## **Assessment tasks**

- On-line quizzes, lectures
- Assignment 1
- Assignment 2
- Assignment 3
- Unit exam

## **Discipline Specific Knowledge and Skills**

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

## **Learning outcomes**

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding of scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Understanding that scientific knowledge is always advancing and changing
- Distinguishing between complex and sometimes mutually exclusive hypotheses

## **Assessment tasks**

- On-line quizzes, lectures
- On-line quiz: solar system

- On-line quiz on meteorites
- On-line quiz, macroscopic life
- On-line quiz on rocks
- On-line quiz, VFT
- On-line quiz on biomarkers
- Assignment 1
- Assignment 2
- Assignment 3
- Unit exam

## Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

### Learning outcomes

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding of scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Understanding that scientific knowledge is always advancing and changing
- Distinguishing between complex and sometimes mutually exclusive hypotheses
- Application of knowledge to solving problems and evaluating ideas and information
- Capacity to present ideas clearly with supporting evidence

### Assessment tasks

- On-line quizzes, lectures
- Assignment 1
- Assignment 2
- Assignment 3
- Unit exam

## Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and

they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

## **Learning outcomes**

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding of scientific methodology
- Competence in accessing, using and synthesising appropriate information
- Distinguishing between complex and sometimes mutually exclusive hypotheses
- Application of knowledge to solving problems and evaluating ideas and information

## **Assessment tasks**

- On-line quizzes, lectures
- On-line quiz: solar system
- On-line quiz on meteorites
- On-line quiz, macroscopic life
- On-line quiz on rocks
- On-line quiz, VFT
- On-line quiz on biomarkers
- Assignment 1
- Assignment 2
- Assignment 3
- Unit exam

## **Effective Communication**

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

## **Learning outcomes**

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding that scientific knowledge is always advancing and changing
- Application of knowledge to solving problems and evaluating ideas and information



- Capacity to present ideas clearly with supporting evidence

## **Assessment tasks**

- On-line quizzes, lectures
- On-line quiz: solar system
- On-line quiz on meteorites
- On-line quiz, macroscopic life
- On-line quiz on rocks
- On-line quiz, VFT
- On-line quiz on biomarkers
- Assignment 1
- Assignment 2
- Assignment 3
- Unit exam

## **Engaged and Ethical Local and Global citizens**

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

## **Learning outcomes**

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Competence in accessing, using and synthesising appropriate information
- Understanding that scientific knowledge is always advancing and changing

## **Assessment tasks**

- Assignment 1
- Assignment 2
- Assignment 3
- Unit exam

## **Socially and Environmentally Active and Responsible**

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and

country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

## **Learning outcomes**

- Understanding the origin of life on Earth and the possibility of finding life elsewhere in the Universe
- Understanding that scientific knowledge is always advancing and changing

## **Assessment tasks**

- Assignment 1
- Assignment 2
- Assignment 3
- Unit exam

## **Changes from Previous Offering**

Lectures and practicals have been slightly re-ordered