

The Searches for Life on Mars in Fact and Fiction

Otherwise known as Planetary Science 342
Semester: Spring 2019

Description, Course Objectives:

This course will cover both the scientific searches for life on Mars, and the way those searches have been translated into science fiction. Life on Mars is likely to be a scientific "hot topic" for the rest of your life. After this class, you should have a good understanding of what planetary scientists think about the chances of life on Mars, why they think that, and how current and future spacecraft missions plan to address that. In addition, since life on Mars has been the subject of some classic science fiction for more than 100 years, with no signs of letting up, you should understand how that science fiction relates to science. For the class, you will need to demonstrate your ability to connect works of science fiction about Mars to other Mars science fiction and to the understanding of Mars, and life on Mars, at the time the work was produced. My real goal is that as the current debate resolves itself, and as spacecraft explore Mars during the next few decades, you'll understand what's going on and which claims are important, and that as you read or watch science fiction dealing with Mars, you'll appreciate how it relates to past and present science and sci-fi.

Instructor and Contact Information:

Prof. Tim Swindle

tswindle@lpl.arizona.edu (best way to get in touch with me)

Office: Kuiper Space Sciences 323

Phone: 621-4128

Office hours:

Official: 12-12:30 and 1:45-2:30 (i.e., before and after class), on the days we have class.

Unofficial: If I'm in town, I'm usually on campus 9-5:30 every day, and we can either make an appointment (e-mail is the best way to do that), or you're welcome to drop in. However, you should probably call before stopping by on the spur of the moment, to make sure I'm available.

Schedule:

We are scheduled to meet WF 12:30 to 1:45. However, with the permission of the class, we will meet MWF at those times, but on only two-thirds of the possible dates, so that we end up with the same number of hours in class as the official schedule. The reason for the strange schedule is that I have a significant amount of travel, so there will be some days or weeks when I am not available. For students for whom Mondays will not work, we will make other arrangements. In addition to class time and the normal time for reading and class preparation, students will be required to spend one evening viewing Mars through a telescope, normally done through an overnight trip to the Mt. Lemmon Sky Center. The list below gives topics in something close to the order in which we will discuss them. However, some topics will take much longer than others, and we may change the order slightly to better fit schedules or take advantage of things in the news. As class sessions are canceled or added, they will be posted on D2L (d2l.arizona.edu). I will also announce them in class, and send email, but they'll always be on D2L.

Order of topics:

- 1 Introduction
- 2 Percival Lowell and the canals of Mars
(and why are there so many telescopes in Arizona)
- 3 1st generation Mars fiction
War of the Worlds - book, radio play & part of rock opera
“The Black Amazon of Mars” novella
- 4 Mars the planet and its potential for supporting life
Introduction to spacecraft exploration of Mars (including instrumentation and orbital considerations)
Short story – “Discovering Life”
The landscape and the climate
Meteorites from Mars
- 5 Origin of life on Earth and implications for Mars (Is all life based on carbon?)
- 6 Other 1st generation Mars fiction – Martian Chronicles
- 7 Generation 1a – Face on Mars (Why wouldn’t scientists believe it?)
- 8 Life on Mars at present
Viking biology
Methane on Mars
- 9 Life on Mars in the past – Climate history
Evidence for water
Mars Odyssey GRS
Phoenix Mars Lander
HiRISE evidence (we will schedule a tour of the HiRISE operations center on campus)
Was Mars warmer and wetter in the past?
Clay/sulfates transition
Meteorite ALH84001
Panspermia
Mars Exploration Rovers Spirit & Opportunity
Mars Science Laboratory Curiosity
- 10 Life on Mars in the future – terraforming
- 11 2nd generation Mars fiction
Books
Mars Underground (including discussion with author Hartmann)
Movies
Short story – “Arthur Sternbach Brings the Curveball to Mars”
- 12 Current and future spacecraft missions
Curiosity (again)
ExoMars
MAVEN
InSight
Mars 2020 and sample return
Other nations’ spacecraft
Planetary protection
- 13 Martian moons
Theories of origin
Potential for exploration
Mentions in fiction

Required reading:

H. G. Wells, “War of the Worlds,” 1898
Ray Bradbury, “Martian Chronicles,” 1950
W. K. Hartmann, “Mars Underground,” 1997
Leigh Brackett, “Black Amazon of Mars,” 1951
Kim Stanley Robinson, “Discovering Life” and “Arthur Sternbach Brings the Curveball to Mars”,
from a collection of short stories called “The Martians,” published in 2000
One other novel about life on Mars (or living on Mars) of the student’s choice
Various short science articles about searches for life on Mars

Required viewing:

“The Martian”, 2015, in class (unless most of the class has already seen it, in which case we’ll
vote on a substitution)
One other movie about life on Mars (or living on Mars) of the student’s choice

Readings:

You’ll be expected to read four novels that deal with life on Mars or the exploration of Mars, and
write a “book review” about each of them. One is the first great work of Mars fiction, “War of the
Worlds” by H. G. Wells, written in the 1890s. Another is “Mars Underground” by William K. Hartmann,
written almost exactly 100 years later. A third is “Martian Chronicles” by Ray Bradbury. All three are
available as e-books, and “War of the Worlds” is available free online at Project Gutenberg
(<http://www.gutenberg.org/ebooks/36>). The fourth is any novel involving life on Mars or living on Mars
(a list of possibilities will be given with the assignment – anything on the list is OK, many others also are,
but check with the instructor for those). For extra credit, you can read a fifth (again, of your choice).

The “book reviews” of the required books might better be called essays inspired by the books –
you need to write something relating to life on Mars and the way the book approaches it. Your essays
should reflect the things we discuss in class, but you don’t have to agree with the instructor to get a good
grade. It’s not a book report, so you don’t have to tell the story of the book (since we’ll discuss many of
these books in class). More details will be in the assignments.

There will also be short stories from two other authors, Leigh Brackett and Kim Stanley
Robinson, and some short scientific papers, which will be assigned reading in advance of specific class
discussions. From Brackett, it will be her “Black Amazon of Mars”, a novella that is also available
through Project Gutenberg (<http://www.gutenberg.org/ebooks/32664>). From Robinson, it will be two
stories from “The Martians”, which is available as an e-book. The stories are “Discovering Life” and
“Arthur Sternbach Brings the Curveball to Mars.” There will much shorter “book reviews” of these.
There will be in-class assignments about many or all of the books and short stories.

You will also be expected to do some reading to generate a paper on some aspect of the actual
searches for life on Mars. In the first few weeks of class, you should choose a topic. Many of the topics
that we discuss in class would be fine (although you probably would want to limit your paper to
something smaller than the topic titles on the previous page). There are other possible topics as well – you
will need to clear your topic with the instructor. Your information sources should be a combination of the
original scientific papers and articles from science-oriented magazines or websites.

Other requirements:

You will need to watch one movie about life on Mars or living on Mars. You’ll then be required
to write a short review of the movie, explaining how it fits in.

You will be expected to spend an evening at the Mt. Lemmon Sky Center observing Mars (among
other things) through a high-quality telescope, and sketch what you see. You will be observing Mars
under conditions similar to those experienced by the astronomers of the late 19th and early 20th Centuries,
and you can compare your sketches to what some of those astronomers (Percival Lowell, in particular)
sketched. You will need to compare the appearance with the spacecraft photos that you are used to seeing

and the images obtained with modern technology. If your artistic ability is no better than mine, you will need to spend more words describing the appearance than if you can produce a drawing that faithfully represents what you see. If you are unable to attend the evening on Mt. Lemmon, you can instead go to the public telescopes on campus at Steward Observatory (or Flandrau Planetarium, although their telescope is not open as often), and perform an equivalent exercise, although the viewing on Mt. Lemmon will be much better.

Since a lot of this course is about Mars-oriented science fiction, some students want to try their hand at writing a piece of science fiction. If you want to do that, you can write a short story, instead of a book review on a fifth book, for extra credit.

Other policies:

Absences: Attendance will not be taken, but class participation is a part of the grade (and attendance is a part of that). Attendance is required on days of exams, although absences will be excused in cases that are pre-approved by the UA Dean of Students or for holidays or special events observed by an organized religion for those students who show affiliation with that particular religion.

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>. The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>. Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>

Accessibility and Accommodations: At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520-621-3268 or drc-info@email.arizona.edu) to explore reasonable accommodation.

Classroom behavior: Use of cell phones, laptops, or other electronics in class is prohibited except as it specifically relates to the class (e.g., web searches related to an in-class discussion). I reserve the right to answer any cell phone that rings.

Code of Academic Integrity (Plagiarism): Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

Papers will be checked against an online database. If there are any questions about what constitutes plagiarism, ask. Also, the University Libraries have some excellent tips for avoiding plagiarism, available at <http://new.library.arizona.edu/research/citing/plagiarism>. In general, the penalty for the first instance of plagiarism is loss of credit on that assignment plus loss of one grade for the semester. For the second, a failing grade for the course will be given.

Notification of Objectionable Materials: This course will contain material of a mature nature, which may include explicit language, depictions of nudity, sexual situations, and/or violence. The instructor will provide advance notice when such materials will be used. Students are not automatically excused from interacting with such materials, but they are encouraged to speak with the instructor to voice concerns and to provide feedback.

The UA **Threatening Behavior by Students** Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

UA Nondiscrimination and Anti-harassment Policy: The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Confidentiality of Student Records:

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

Syllabus Subject to Change: Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.

Grading:

2% - Personal interview, class participation – If you stop by my office and talk to me for at least 10 minutes at least once before Spring Break, you get half of this 2% (it doesn't depend on what you say to me), if you attend class regularly and express an opinion at least occasionally, you get the other half.

38% - Average of four book reviews, movie review

10% - Various short assignments, including in-class activities and reviews of short stories

10% - Telescope night

15% - Paper on the real searches for life on Mars

10% - Mid-Term Exam

15% - Final Exam

5% - Extra credit review or short story

Other than in-class work, all assignments are due at 11:59 p.m. on the day that they are due, normally on D2L. There is a 10% late penalty for each Monday, Wednesday or Friday they are late. In other words, if you turn it in late, but before the next day we might have had class (whether or not we actually have class that day), your grade will be multiplied by 90%, if you turn it in before the next one, we'll multiply by 80%, etc., with the maximum penalty 60%. One thing that means is that any assignment turned in before the final exam is worth at least 40% of the grade it would have received if it had been turned in on time.

Final grade scale

>90% - A

80-90% - B

65-80% - C

50-65% - D

<50% - E

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

Important dates:

Note that due dates are subject to change, in the following sense: I reserve the right to move due dates later, but will not move them up. Work can always be turned in before the due date. The dates for the exams are fixed.

Jan. 23 – Review of “War of the Worlds” due

Feb. 4 – Review of “Martian Chronicles” due

Feb. 22 – Mid-term exam

March 18 – Movie review due

March 25 – Review of “Mars Underground,” part 1 due

April 8 – Review of “Mars Underground,” part 2 due

April 8 or 9 – Observing on Mt. Lemmon

April 15 – Writeup about observing due

April 22 – 4th book review due

April 29 – Paper on the real searches for life on Mars due

May 8, 10:30 a.m. – Final exam

Final Exam Regulations are at

<https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information>

Final Exam Schedule at <http://www.registrar.arizona.edu/schedules/finals.htm>