

ASTR 310: Astrobiology and the Search for Extraterrestrial Life
SPRING 2020
SECTION 01, SCHEDULE #20332

COURSE INFORMATION

Class Days: Monday-Wednesday-Friday

Class Times: 11:00-11:50 am

Class Location: GMCS-301

Email: wwelsh@sdsu.edu

Office Hours: Mon and Wed 2:30-3:30; or by appointment.

E-mail is the best way to contact me. I will normally answer within one business day.

Professor: William Welsh

Contact Information:

Office: Physics P-235

Telephone: (619) 594-2288

COURSE OVERVIEW

Official Course Catalog Description: The search for extraterrestrial life in our Solar System and other planetary systems; the formation of stars and planets; UFOs and SETI; origin and evolution of life on Earth; life in extreme environments; cosmology and the structure of the Universe.

Purpose and Course Content: The past two decades have produced many significant discoveries in astrobiology. For example, we now know of over 1000 exoplanets in orbit around stars beyond the Solar System. We have also discovered that life can thrive in environments that were once thought to be much too hostile for life to survive. In this course students will learn about these new discoveries and will develop an understanding of the size, structure, origin, content, and physical laws governing the Universe. Students will learn the basic biochemistry common to all terrestrial life, and will use this knowledge to understand how astronomers are searching for extraterrestrial life. Emphasis will be placed on how we know these things, and the importance of data and the testing of hypotheses, as opposed to philosophy, beliefs, or doctrine, will be stressed. Students will also develop their critical thinking skills.

Student Learning Outcomes: Upon successful completion of this course, the student will be able to:

- explain how we know the scale, content, and age of the universe
- summarize the origin of the elements essential for life
- state what “spectroscopy” is and what it can tell us
- define the term “exoplanet” and explain how they are discovered
- identify/recall the common themes of terrestrial biochemistry
- synthesize the evidence that points to a common origin of life on Earth
- describe characteristics of extremophiles and analyze their impact on the search for extraterrestrial life
- apply physical laws and knowledge of the distances to stars, appraise the likelihood of interstellar travel
- cite the Drake Equation, identify its key unknowns, assess contrasting estimates of its value.

Relation to Other Courses: This course helps fulfill the 9-unit requirement for Explorations in General Education.

ENROLLMENT INFORMATION

Prerequisites: Completion of GE requirement in Foundations II.A.1 Physical Sciences -or- Foundations II.A.2 Life Sciences

Mathematical Skills: Some basic mathematical skills are required, such as:

- The use of the metric system.
- The use of scientific notation, as in $M = 2 \times 10^{33}$ grams.
- The use of simple relations such as $y = 1/x^2$.

The use of mathematics will be kept to a minimum, and in most cases is not needed for a basic understanding of the *concepts*. However, in some cases a *quantitative* understanding is as important as a *qualitative* understanding. We will review the mathematical concepts as we go along.

Adding/Dropping Procedures: Students can enroll through the fifth day of classes. From the sixth day onwards, the instructor will need to generate an add code. The last day to add or drop the class or change the grading basis is 2020 Feb 4.

COURSE MATERIALS

Required Materials: The required textbook is *Life in the Universe* (4th edition), by Bennett and Shostak (ISBN-13: 978-0-13-408908-9). Digital eBook version available at: <https://shopaztecs.redshelf.com/book/600781/life-in-the-universe-600781-9780134080345-jeffrey-o-bennett-seth-shostak>

Students are also required to read and make use of free on-line resources such as *Astrobiology Magazine* (<https://www.astrobio.net/>) and NASA's *Mars Exploration Program* website.

The class website at <http://wwelsh.sdsu.edu/~wwelsh/CLASSES/ASTROBIO/astrobio.html> is an important resource. It contains the syllabus, homework assignments, course policies, safety procedures, class news, class notes, and links to recent discoveries and resources for this course.

Please note that *Blackboard* is not used for this course.

Recommended Materials: Links for additional information to help learn the course material and to explore beyond what is covered in the lectures and in the textbook are provided on the class webpage.

The Astronomy Department provides a free *Astronomy Help Room* for assistance and tutoring for all SDSU undergraduate astronomy courses. The schedule is posted on the class website.

Immediate Access Course: Some or all of the required course materials for this class are provided in a digital format by the first day of classes and are free through the add/drop date. Your SDSU student account will then be charged a special reduced price for use of the materials for the remainder of the semester unless you opt-out of the content by 11:59 PM on the add/drop date. Please visit www.shopaztecs.com/immediateaccess for additional information about Immediate Access pricing, digital subscription duration, print add-ons, opting out and other frequently asked questions.

Options for Accessing Course Materials: The publisher has options to obtain electronic access to the textbook. See: <https://shopaztecs.redshelf.com/book/600781/life-in-the-universe-600781-9780134080345-jeffrey-o-bennett-seth-shostak>

COURSE DESIGN

Style of the Course: This course will be a traditional lecture course.

The subjects covered include:

- The "Rules & Tools" of astronomy
- The big bang, cosmology, and the size & structure of the Universe
- Stars and planetary systems
- The Earth and the biology/biochemistry of terrestrial life; Life in extreme environments
- The possibility of extraterrestrial life in our Solar System: Mars and the icy Jovian moons
- Planets around other stars; how they are discovered and their significance
- The Drake equation, SETI, and the search for extraterrestrial life beyond the Solar System

Individual and Group Activities Required: Students may work and study together, but *exams and homework assignments must be completed individually*. Homework that is not done independently will result in a zero grade for the assignment and loss of any extra credit points. Cheating in any form will result in failure of the assignment or exam and be reported to the Center for Student Rights and Responsibilities.

Technology Utilized in the Course: An abbreviated set of class notes in .pdf format will be made available on the class website with the following restrictions. *The lecture notes will be available only for a limited time prior to the lecture.* Students should download and bring the notes to the lectures, and add content and updates to the notes in class. The notes will be posted on the class website a few days before the lecture, and will expire after the lecture on that topic is given and will no longer be available.

COURSE ASSESSMENT AND GRADING POLICY

Exam Dates:

Exam #1: Friday March 6

Exam #2: Friday April 10

Final Exam: Monday May 11 at 10:30-12:30

The exams will be closed-book. The exams will be multiple-choice format and require a ParScore Enrollment scantron form. Study guides will be posted on the class website.

Exam dates (except the Final Exam) are subject to change. *As per University regulations, the time of the final exam cannot be changed under any circumstances.* Please review the rules regarding final exams at http://registrar.sdsu.edu/calendars/final_exam_schedule/spring_2020_final_exam_schedule and the SDSU General Catalog.

Scored Activities and Weighting by Percentage of Total Score:

20% Written Homework Assignments (three or four assignments, 3-4 typed pages each)

25% Exam #1 (multiple choice format)

25% Exam #2 (multiple choice format)

30% Final Exam (comprehensive; multiple choice format)

+ a few % discretionary bonus for class participation and extra credit assignments.

Exams will be graded on a mild curve.

No individual extra credit projects will be accepted. However, extra credit projects that the whole class can do will be offered on an ad hoc basis. See the class webpage for additional details about homework, grading, incompletes, and plagiarism policies.

Please review the definitions of letter grades and the SDSU policies regarding grades on page 475-476 of the 2019-2020 General Catalog. If you are taking the course with the “credit/no-credit” option, you need a C or above to earn the credit (see pages 475-476 of the 2019-2020 General Catalog). An incomplete grade (“I”) for the course will only be given in cases involving serious medical or legal issues that prevent the student from completing the course on time. The entire responsibility for arranging to make up the lost work lies with the student.

Excused Absence Make-up Policies: No make-up exams will be allowed unless there is a serious, legitimate reason (e.g. medical emergency) and full documentation. If a make-up exam is deemed appropriate, an oral or essay exam may be administered instead of, or in combination with, multiple-choice questions.

Other Course Policies

The lectures and all material contained therein, including the course web pages and on-line lecture notes, are copyrighted - no material can be reused or reproduced in any fashion without written permission.

Students maintain intellectual property rights to products they create as part of this course.

Attendance Policy: Attendance is not mandatory, but be aware that much of the course material is not contained in the textbook. It will be much easier to earn a good grade if you come to class. It is expected

that you will attend all the lectures, read all the material assigned for homework - including the web pages assigned, and participate in class (e.g. ask questions, contribute to discussions, etc.). It is expected that you come to office hours for help should you need it. Email will work for simple clarification, but generally is inadequate for more challenging concepts.

UNIVERSITY POLICIES

Accommodations: If you are a student with a disability and are in need of accommodations for this class, please contact Student Ability Success Center at (619) 594-6473 as soon as possible. Please know that accommodations are not retroactive, and I cannot provide accommodations based upon disability until I have received an accommodation letter from Student Ability Success Center.

Student Privacy and Intellectual Property: The Family Educational Rights and Privacy Act (FERPA¹) mandates the protection of student information, including contact information, grades, and graded assignments. I will use Blackboard to communicate with you, and I will not post grades or leave graded assignments in public places. Students will be notified at the time of an assignment if copies of student work will be retained beyond the end of the semester or used as examples for future students or the wider public. Students maintain intellectual property rights to work products they create as part of this course unless they are formally notified otherwise.

Religious observances: According to the University Policy File, students should notify the instructors of affected courses of planned absences for religious observances by the end of the second week of classes.

Academic Honesty: The University adheres to a strict policy prohibiting cheating and plagiarism². Examples of academic dishonesty include but are not limited to:

- copying, in part or in whole, from another's test or other examination;
- obtaining copies of a test, an examination, or other course material without the permission of the instructor;
- collaborating with another or others in work to be presented without the permission of the instructor;
- falsifying records, laboratory work, or other course data;
- submitting work previously presented in another course, if contrary to the rules of the course;
- altering or interfering with grading procedures;
- assisting another student in any of the above;
- using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work);
- copying and pasting work from an online or offline source directly and calling it your own;
- using information you find from an online or offline source without giving the author credit;
- replacing words or phrases from another source and inserting your own words or phrases.

The California State University system requires instructors to report all instances of academic misconduct to the Center for Student Rights and Responsibilities. Academic dishonesty will result in disciplinary review by the University and may lead to probation, suspension, or expulsion. Instructors may also, at their discretion, penalize student grades on any assignment or assessment discovered to have been produced in an academically dishonest manner.

¹<https://bfa.sdsu.edu/oerc/students/ferpa.aspx>

²http://go.sdsu.edu/student_affairs/srr/cheating-plagiarism.aspx

Statement on Cheating and Plagiarism: Cheating in any form, which includes plagiarism, will not be tolerated. Cheating and plagiarism may warrant two separate and distinct courses of disciplinary action: (a) academic sanctions, such as grade modifications; and (b) disciplinary sanctions, such as probation, suspension, or expulsion. See page 486 of the University's 2019-2020 General Catalog for details. *Cheating will result in an automatic "F" for that assignment/exam and a letter grade deduction in the course grade.* Any evidence of cheating will be promptly reported to the Judicial Procedures Office. Executive Order 1006 mandates faculty to report all incidents to the Center for Student Rights and Responsibilities.

Resources for students: A complete list of all academic support services—including the Writing Center³ and Math Learning Center⁴—is available on the Student Affairs Academic Success website⁵. Counseling and Psychological Services (619-594-5220) offers confidential counseling services by licensed therapists; you can Live Chat with a counselor at http://go.sdsu.edu/student_affairs/cps/therapist-consultation.aspx between 4:00pm and 10:00pm, or call San Diego Access and Crisis 24-hour Hotline at (888) 724-7240.

Classroom Conduct Standards: SDSU students are expected to abide by the terms of the Student Conduct Code in classrooms and other instructional settings. Prohibited conduct includes:

- Willful, material and substantial disruption or obstruction of a University-related activity, or any on-campus activity.
- Participating in an activity that substantially and materially disrupts the normal operations of the University, or infringes on the rights of members of the University community.
- Unauthorized recording, dissemination, or publication (including on websites or social media) of lectures or other course materials.
- Conduct that threatens or endangers the health or safety of any person within or related to the University community, including
 - physical abuse, threats, intimidation, or harassment.
 - sexual misconduct.

Violation of these standards will result in referral to appropriate campus authorities.

Classroom Etiquette: I expect that the students will maintain a professional atmosphere and show respect to their fellow students. In particular, the following is prohibited in the classroom:

- Cell phones and similar devices (please silence them)
- Texting, tweeting, emailing, etc.
- The reading of newspapers, magazines, etc.
- Talking above a whisper
- Eating or drinking anything noisy
- Doing homework for this or any other course
- Disrupting class by handing in homework after the class lecture has started.

Use of laptops/tablets/iPads for taking notes is acceptable, however, if you wish to use such a device in the classroom, you may be asked to sit in a special section reserved for laptop users.

Any form of behavior deemed to be inappropriate by the instructor will not be tolerated. A student will be advised once by the instructor that his/her behavior is inappropriate. If this inappropriate behavior occurs again, the matter will be turned over to the University's Judicial Procedures Office for appropriate disciplinary action.

Medical-related absences: Students are instructed to contact their professor/instructor/coach in the event they need to miss class, etc. due to an illness, injury or emergency. All decisions about the impact

³<https://writingcenter.sdsu.edu>

⁴<https://mlc.sdsu.edu>

⁵http://go.sdsu.edu/student_affairs/academic_success.aspx

of an absence, as well as any arrangements for making up work, rest with the instructors. Student Health Services (SHS⁶) does not provide medical excuses for short-term absences due to illness or injury. When a medical-related absence persists beyond five days, SHS will work with students to provide appropriate documentation. When a student is hospitalized or has a serious, ongoing illness or injury, SHS will, at the student's request and with the student consent, communicate with the student instructors via the Vice President for Student Affairs and may communicate with the student Assistant Dean and/or the Student Ability Success Center⁷.

SDSU Economic Crisis Response Team: If you or a friend are experiencing food or housing insecurity, or any unforeseen financial crisis, visit sdsu.edu/ecrt, email ecrt@sdsu.edu, or walk-in to Well-Being & Health Promotion on the 3rd floor of Calpulli Center.

SAFETY ISSUES

The CSU takes the issue of classroom and campus safety very seriously. The office of Business and Financial Affairs has set up a web site where SDSU staff, faculty, and students can find information about San Diego State University's emergency preparedness plan and opportunities for training on many aspects of the classroom/workplace. See <http://bfa.sdsu.edu/emergency/>. In particular, please note the following:

Campus Safety:

- Be aware of your surroundings.
- If you see something suspicious, report it!
- If you have an emergency, call 911 from any phone on campus.
- Other incidents, call Campus Dispatch at 4-1911.
- In the evening, call Campus Escort if you would like an escort to your vehicle or campus dorm.

Classroom Safety

- If there is an emergency, stay calm, and follow the procedure in the flip book.
- Follow the Evacuation Route if you need to evacuate. *We evacuate to Centennial Mall*, and a roll call will occur there. Please show up at the evacuation area since your absence from roll call could cause resources to be used that could be used to help others who may actually be in trouble.
- "Shelter in place" is usually called when a person that is carrying a weapon on campus has become violent and has injured others, or is threatening to injure others. Lock the door from outsiders, only open to the Department Safety Officer, PDS, or other officials of the University.

Note that during any emergency, *students should not use their cell phones*. The lines of communication are critical to keep open for emergency information. Only Staff and Faculty should keep their cell phones on, and only receive calls if the situation calls for it.

⁶<https://sa.sdsu.edu/student-health-services>

⁷http://go.sdsu.edu/student_affairs/sds/