

Extremophiles (MMBio 110R)

Fall 2025 (1st term); Thursday 1:00-1:50 pm and field trips; 2146 LSB

Instructor: Dr. Scott Weber, 4007B LSB, 801-422-6259, scott_weber@byu.edu

Office Hours: Wednesday 10:00-11:00 am. Email for appointment outside of office hours

Course Prerequisites: None. **Required text:** None. There will be videos and articles posted on Learning Suite

TA: Alina Svitlana Rodriguez Bezruchko, Office hours: Tuesday 1:00-2:00 pm; 3126 LSB, ab089@student.byu.edu

I. Course Purpose

Extremophiles are organisms that can live in extreme environments. Studying them reveals how life adapts to harsh conditions and this course is a field trip-based investigation of microbial life in extreme environments and what we can learn from them. Studies of extremophiles have contributed to science in many ways including the origins of life, cold chain improvements, astrobiology, bioremediation, and critical enzymes for biotechnology. Understanding how cells adapt to extreme conditions (e.g., temperature, salt, methane etc.) provides important insights into biology and can also provide effective resilience strategies. This is a field of active research and there remains much to be discovered. This course includes field trips to Yellowstone National Park, Great Salt Lake, and a water treatment plant to investigate thermophiles, halophiles, and methanogens. Students will compare the strategies these microbes employ to thrive in extreme environments and what we can learn from their strategies.

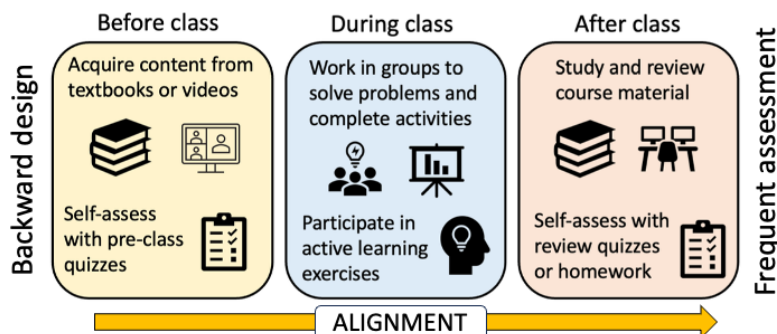
II. Course Schedule

Sept 4 (Thursday)	Introduction, class overview, and thermophile background	Thermophile pre-class breakout questions and in-class worksheet
Sept 11 (Thursday)	Yellowstone trip – Thurs 9/11 at 9am to Sat 9/13 at 8 pm	Participate in Yellowstone field trip
Sept 18 (Thursday)	Discussion of Yellowstone trip and halophile background	Halophile pre-class breakout questions and in-class worksheet
Sept 25 (Thursday)	Great Salt Lake trip: 9 am – 5 pm	Participate in Great Salt Lake field trip
Oct 2 (Thursday)	Discussion of Salt Lake spiral jetty trip and methanogen background	Methanogen pre-class breakout questions and in-class worksheet
Oct 9 (Thursday)	Wastewater treatment plant trip: 1 pm – 3 pm	Participate in wastewater plant field trip
Oct 16 (Thursday)	Discussion of wastewater trip and class conclusions	Slideshow, worksheet, and reflection

III. Course Learning Outcomes

Students will deepen their appreciation of life by investigating extreme environments that microorganisms have evolved to grow and thrive in. This course uses high structure course design to improve learning by scaffolding the process with pre-class content acquisition and assessment, in-class active learning and problem solving, and field trips experiences. Learning outcomes include:

1. Discovering microbiology fundamentals
2. Practicing effective communication of scientific concepts
3. Development of faith and resilience in Christ-like living



1. Haak, D. C., J. HilleRisLambers, E. Pitre and S. Freeman (2011). "Increased Structure and Active Learning Reduce the Achievement Gap in Introductory Biology." *Science* 332(6034): 1213-1216.
2. Eddy, S. L. and K. A. Hogan (2014). "Getting Under the Hood: How and for Whom Does Increasing Course Structure Work?" *CBE-Life Sciences Education* 13(3): 453-468.
3. Wilton, M., E. Gonzalez-Niño, P. McPartlan, Z. Turner, R. E. Christoffersen and J. H. Rothman (2019). "Improving academic performance, belonging, and retention through increasing structure of an introductory biology course." *CBE—Life Sciences Education* 18(4): ar53.

IV. Assessment Breakdown

Assessments	Points Possible	Percent of Semester Grade
Pre-class breakout questions	30	7.5%
In class worksheets	70	17.5%
Participation on field trips	200	50%
Writing assignment with photos	100	25%
Total:	400	100%

Participation in class: Watch the pre-class lectures and do the breakout questions before class. Come to class and complete the in-class worksheet. You need to complete your own worksheet, but you can (and should) work in a small group you will be assigned to. The pre-class breakout questions are 30 points, and the in-class worksheets are worth 70 points.

Participation on field trips: Come on the field trips to Yellowstone, the Spiral Jetty, and a water treatment plant. On the Yellowstone trip you will need to do five tasks to earn the points for attendance. Be sure to take pictures of you and someone else in class on each of the trips to use in your final writing assignment.

Yellowstone trip attendance and five tasks at 25 points each = 100 points

Great Salt Lake trip attendance = 50 points

Water treatment plant trip attendance = 50 points

Tasks for Yellowstone participation include the following:

- Get a van-driving card from BYU safety training and help drive a van

- Help setup tents

- Help cook a meal

- Help light and manage the fire, including putting the fire out

- Help clean up after a meal, including putting all food items in the bear-proof trailer

- Help take down tents

- Help clean up the camping area before departure

- Help clean tents back at campus after the trip

A sign-up list will be available and there will always be more than one person assigned to the same task. There are also repeat options of almost all these tasks (i.e. meals).

Final writing assignment with photos: The final writing assignment is designed for you to share your new understanding of extremophiles with a focus on thermophiles, halophiles, and methanogens. The assignment is also intended for you to reflect on your experience with each field trip, identify what you have learned (including photos of your experiences), and how the things you have learned from extremophiles survival strategies can be applied to improving your ability to develop reliance in your life. See final writing assignment for details on the final writing assignment.

Attendance: Attendance is required for class and for field trips. If you are sick on the day of a class, you must email the TA and request to have zoom running so that you can attend online and work with your small group to complete the in-class worksheet. Zoom recordings of the in-class time will not be made. If you cannot join class via Zoom, you can do a written make-up assignment (see make-up assignment instructions). If you are sick on the day of a field trip or have an obligation that prevents you from attending, you can make that up provided you do a written make-up assignment (see make-up assignment instructions).

Etiquette: You are expected to follow all park rules and regulations and the BYU honor code in your conduct and behavior. Any misconduct will lead to a failing grade in class and a report to the BYU Honor Code office.

V. Grading

Grading Procedures: No extra credit work is offered. Students must earn points according to the assessment breakdown defined in this syllabus. Grades will be calculated based on a point system where earned points will be divided by the total points possible. Final grades will be assigned using these percentage cutoffs:

A	93-100%	A-	90-92.9%	B+	87-89.9%
B	83-86.9%	B-	80-82.9%	C+	77-79.9%
C	73-76.9%	C-	70-72.9%	D+	67-69.9%
D	63-66.9%	D-	60-62.9%		

VI. Essential Values

Academic Honesty: BYU students should seek to be totally honest in their dealings with others. They should complete their own work and be evaluated based upon that work. They should avoid academic dishonesty and misconduct in all its forms, including plagiarism, fabrication or falsification, cheating, and other academic misconduct. Students are responsible not only to adhere to the Honor Code requirement to be honest <https://policy.byu.edu/view/academic-honesty-policy>. All course materials (e.g., outlines, handouts, syllabi, exams, quizzes, PowerPoint presentations, lectures, audio and video recordings, etc.) are proprietary. **Students are prohibited from posting or selling any such course materials without the express written permission of the professor teaching this course.** To do so is a violation of the Brigham Young University Honor Code.

Responsibility: This is a rigorous, senior level course; therefore, responsibility and self-motivation are expected. If for some reason you are unable to attend on the day of your presentation because of an interview or conference attendance or other reason, it is your responsibility to trade slots well in advance with another student in the class. Homework is designed to help you prepare for class and is due on Learning Suite at the start of class. Do not do your homework in class and turn it in after class is over. The point of the homework is to help you prepare ahead of time so you can learn more during class time. All exams are from Fridays to Tuesdays. Since there are 4 days to take the exams there will be few circumstances that would warrant taking an exam late. The final will be comprehensive and available to take in class on our assigned time.

Belonging Culture: We all belong at BYU. There should not be “prejudice of **any** kind, including that based on race, ethnicity, nationality, tribe, gender, age, disability, socioeconomic status, religious belief and sexual orientation.” We are united by our common primary identity as children of God (Acts 17:29; Psalm 82:6) and our commitment to the truths of the restored gospel of Jesus Christ (BYU Mission Statement). We strive to create a community of belonging composed of students, faculty, and staff whose hearts are knit together in love (Mosiah 18:21) where:

- All relationships reflect devout love of God and a loving, genuine concern for the welfare of our neighbor (BYU Mission Statement);
- We value and embrace the variety of individual characteristics, life experiences and circumstances, perspectives, talents, and gifts of each member of the community and the richness and strength they bring to our community (1 Corinthians 12:12–27);
- Our interactions create and support an environment of belonging (Ephesians 2:19); and
- The full realization of each student’s divine potential is our central focus (BYU Mission Statement).

VII. University Policies

Mission: The mission of Brigham Young University is to assist individuals in their quest for perfection and eternal life. That assistance should provide a period of intensive learning in a stimulating setting where a commitment to excellence is expected and the full realization of human potential is pursued.

Aims: BYU seeks to develop students of faith, intellect, and character who have the skills and the desire to continue learning and to serve others throughout their lives. Those who teach and those who direct activities outside the classroom are responsible for contributing to this complete educational vision. A BYU education should be spiritually strengthening, intellectually enlarging, character building, leading to lifelong learning and service.

Honor Code: Students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Students are also expected to adhere to dress and grooming principles and expectations. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. I wholeheartedly support the BYU Honor Code, including the Dress and Grooming Standards, and I expect the same from you. We have all agreed to adhere to these standards to be part of this University.

Preventing & Responding to Sexual Misconduct: In accordance with Title IX of the Education Amendments of 1972, BYU prohibits unlawful sex discrimination against any participant in its education programs or activities. The university also prohibits sexual harassment-including sexual violence-committed by or against students, university employees, and visitors to campus. As outlined in university policy, sexual harassment, dating violence, domestic violence, sexual assault, and stalking are considered forms of "Sexual Misconduct" prohibited by the university. University policy requires all university employees in a teaching, managerial, or supervisory role to report all incidents of Sexual Misconduct that come to their attention in any way, including but not limited to face-to-face conversations, class discussion, email, text, or social media post. Incidents of Sexual Misconduct should be reported to the Title IX Coordinator at t9coordinator@byu.edu or (801) 422-8692. Reports may also be submitted through <https://titleix.byu.edu/report> or 1-888-238-1062 (24-hours a day). BYU offers confidential resources for those affected by Sexual Misconduct, including the university's Victim Advocate. Additional information: <https://titleix.byu.edu>

Students with Disabilities: Brigham Young University is committed to providing an atmosphere that reasonably accommodates qualified persons with disabilities. A disability is a physical or mental impairment that substantially limits one or more major life activities. Examples include vision or hearing impairments, physical disabilities, chronic illnesses, emotional disorders (e.g., depression, anxiety), learning disorders, and attention disorders (e.g., ADHD). If you have a disability which impairs your ability to complete this course successfully, please contact the University Accessibility Center (UAC), 2170 WSC or 801-422-2767 to request a reasonable accommodation. The UAC can also assess students for learning, attention, and emotional concerns. If you feel you have been unlawfully discriminated against on the basis of disability, please contact the Equal Employment Office at 801-422-5895, D-285 ASB for help.

Academic Honesty Policy: BYU students should seek to be totally honest in their dealings with others. They should complete their own work and be evaluated based upon that work. They should avoid academic dishonesty and misconduct in all its forms, including plagiarism, fabrication or falsification, cheating, and other academic misconduct. Students are responsible not only to adhere to the Honor Code requirement to be honest but also to assist other students in fulfilling their commitment to be honest <https://policy.byu.edu/view/academic-honesty-policy>. All course materials (e.g., outlines, handouts, syllabi, exams, quizzes, PowerPoint presentations, lectures, audio and video recordings, etc.) are proprietary. Students are prohibited from posting or selling any such course

materials without the express written permission of the professor teaching this course. To do so is a violation of the Brigham Young University Honor Code.

Mental Health: Mental health concerns and stressful life events can affect students' academic performance and quality of life. BYU Counseling and Psychological Services (CAPS, 1500 WSC, 801-422-3035, caps.byu.edu) provides individual, couples, and group counseling, as well as stress management services. These services are confidential and are provided by the university at no cost for full-time students. For general information please visit <https://caps.byu.edu>; for more immediate concerns please visit <http://help.byu.edu>. You can also access help at the comprehensive clinic on campus, visit <https://comprehensiveclinic.byu.edu/> or call 801-422-7759.

Undocumented Student Support: In accordance with [BYU policy](#) and [Church stances](#), I am committed to supporting students regardless of their immigration status. I expect that every class member will heed President Russell M. Nelson's [call](#) to abandon attitudes and actions of prejudice. Each of us should strive to create a campus in which students and faculty are "no more strangers and foreigners, but fellow citizens with the saints, and of the household of God (Ephesians 2:19)." I am available to listen and support you in a safe, compassionate, and confidential manner. Without jeopardizing your student status, there are resources on campus to address concerns that may interfere with your academic, social, and personal success at BYU. To learn more, please contact the Office of International Student & Scholar Services at 801-422-2695 or visit dreamers.byu.edu.

Food Insecurity: If you are experiencing any kind of food insecurity, there are resources available to you. No one should go hungry in our community. Reach out to your bishop, or you can access resources including food pantry [here](#). Please reach out to me if you have needs that are not being addressed. The Dean of Students office has resources to help you with immediate food needs (3500 of the WSC/Student Center, 801-422-2731).

First Gen Students: A first-generation college student is someone whose parents did not complete a four-year college degree. We are SO glad you are here! Here is a website where you can get extra services and receive support from your BYU first-gen community. <https://enrollment.byu.edu/admissions/first-generation-applicants>

- There are no stupid questions. If you don't know what a certain "academic" word means (e.g., syllabus, testing center, stipend, graduate school, etc.), please feel free to ask me for help with these in person or by email!
- School costs more than just tuition (books, fees, etc.), there are extra services to help you figure out and thrive in the massive "system" that is BYU

You belong here! We are Children of God, Children of the Covenant, and Disciples of Christ. I hope that your time here as a BYU cougar will be fun and transformative, it was for me. I am so happy to have you in this class.