ASEN 5226: Medicine in Space and Surface Environments
Spring 2026

Instructional team:
The instructional team for this course includes several individuals involved in emergency medicine, space medicine, engineering, and wilderness medicine.

Your primary point of contact for the course is:

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Lecture: T 5:15 PM – 8:05 PM, AERO N250

See the “Schedule” section for additional pertinent information

1. Overview

To maintain astronaut health and safety, advanced medical care will be a critical component for exploration environments, such as the surface of the Moon or Mars. The unique challenges imposed on engineers and medical care providers in these extreme environments will necessitate unique preparation and technology solutions. Further, to successfully work in exploration medical environments, there is an increased need for cross-pollination between medical practitioners and engineers designing the hardware and software used for medical care delivery.

The objective of this course is to provide an in-depth, experiential analysis of exploration medical capabilities. This course provides a unique learning opportunity focused on the medical challenges of human spaceflight. This is done both in the classroom and in an immersive field simulation that allows participants to engage in medical care in simulated planetary surface environments. This is achieved by offering a unique, evidence-based curriculum delivered by expert physicians, medical professionals, and engineers.

Lectures will occur on campus at CU Boulder for classroom-based learning on medical care in remote austere environments. Students will learn about patient assessment in the field and gain certifications in Wilderness First Aid and CPR. The course will culminate in a week of field instruction conducted at the Mars Desert Research Station (MDRS) in Hanksville, Utah and will be an integral part of the learning experience. Medical simulations are standard practice in the medical community and will provide an opportunity for students to practice the material offered in the lecture portion of the course and learn about additional considerations that can be best taught in the field.

The key learning objectives of this course are:

1) Perform simulated high-quality medical care employing creative solutions to overcome challenges of working in space and surface medicine.
2) Prescribe actions associated with Wilderness First Aid (WFA) and Cardiopulmonary Resuscitation (CPR) training to perform basic medical skills for extreme environments.
3) Practice engineering under unique constraints associated with human spaceflight physiology and medical care in extreme environments.
4) Analyze differences between engineering and medicine learning devices to facilitate a common understanding across disciplines.

2. Assessment

Table 1 outlines the material by which students will be assessed. Details on this activity will be given during the first week of class and in the assignment document.

Table 1: Distribution of course assessments for ASEN 5226

Wilderness First Aid Exam	15%
CPR Certification	5%
Attendance	5%
Field Simulation Evaluations	35%
Project	20%
Final Exam	20%
	100%

Students will be graded using the standard grade scheme based on percentages. In other words, grades above 93% will receive an A, between 93% and above 90% will receive an A-, below 90% and above 87% a B+, etc.

CPR and Wilderness First Aid will be pass/fail, consistent with the certification thresholds to obtain credit for these components, but the class assessment component will be for a traditional grade. The field simulation evaluations will be based on individual participation, including preparation, simulation engagement, teamwork, and adherence to MDRS safety and guidelines. If a student must exit a simulation or field activity due to an emergency or safety-related concern, this will not negatively impact their standing in the course. Students are expected to communicate with the instructional team as soon as reasonably possible, and appropriate accommodations or alternative assessments will be determined on a case-by-case basis.

The Final Exam will be given in a format familiar to those in the medical community but may be considered nontraditional in the field of engineering. To prepare for the exam, the Field Simulations will provide an opportunity for students to think about medical events in a group setting and evaluate all choices. For the Final, students will read a case report and prepare an assessment and care plan. Students may confer with all other students and resources in preparing this open-ended report for their submission. Each student will then have an individual oral examination where they must respond to questions from the instructional team and defend their evaluation to a panel of instructors. The oral examination assesses individual understanding and reasoning. Individual evaluation times will be scheduled the week of March 30th and will primarily use the Tuesday class session. However, additional exam times may be required to accommodate all students. We will work with you to accommodate schedules.

3. Topics Covered

The following topics will be addressed across the classroom and field portions of the course:

- Brief overview of human physiological adaptation in space environments
- Brief overview of human psychological adaptation in space environments
- Brief overview of human decision-making in space and austere environments
- Brief overview of human spaceflight operational support paradigms
- Detailed lectures on a variety of clinical issues and methods likely to be encountered in space and surface environments, including radiation treatment, musculoskeletal injuries, psychological disruption, barotrauma, search and rescue, extrication, etc.
- Diagnosis in austere environments, including training of non-medical personnel and medical devices
- Treatment in austere environments, including trauma, acute, and chronic medical conditions
- Supply resource management and planning
- Physician, scientist, and engineer differences in thinking, training, and failure analysis
- Probabilistic risk assessments of medical events in space environments
- Medical device considerations, optimizing for flexible functionality, mass, power, and volume
- WFA and CPR training and certification

4. Textbook

The required textbook for the class will be associated with your WFA training. There may be additional readings distributed via Canvas as part of the course material to understand medical risk and care in the space environment.

The required textbook for the class is NOLS Wilderness Medicine, 7th Edition, by Tod Schimelpfenig. Other editions are acceptable as well. The reading schedule will be posted on Canvas, but the schedule may be subject to change since class progress may vary.

A supplemental textbook with optional readings for spaceflight-oriented background is Principles of Clinical Medicine for Space Flight, 2nd Edition by Barrett et al. Accessible online via CU Library.

5. Schedule

A detailed schedule will be posted to Canvas. Lectures will be held on Tuesday evenings from 5:15-8:05 pm. Key information that is important to note on the schedule include:

- Attendance to all aspects of the class for the full duration is required, except in cases of documented emergency or approved academic accommodation. Let the instructional team know if there is an academic conflict, such as a conference, during the lecture.
- We will have CPR certification in class. If you have previously been certified, this will be a good refresher. Please plan to attend, as this is included in the course lab fee.
- The final exam will primarily be held on Tuesday, March 31st, and scheduled as an individual oral exam. Additional slots the week of March 30th may be required to accommodate all students. We will work with you to accommodate schedules.

A key aspect of this class is the field component, which will be held March 15th through 21st at the Mars Desert Research Station (MDRS). A detailed field guide will be posted to Canvas. Key considerations for the field component include:

- You are expected to arrive in Hanksville by Sunday, March 15th, at 1:00 pm to settle into the field camp. You will be responsible for your own transportation via carpooling to and from MDRS, but we will help coordinate transportation among the students via Canvas. Additional information will be provided in class.
- Sunday, March 15th – Saturday, March 21st: We will complete additional lectures on specific medical risks, in-field medical simulations, project deployment, and the WFA course completion and exam.
- The Field component of the course will be completed on Saturday, March 21st. All participants MUST stay through the Saturday activities to help us secure and clean the facilities and may not leave early. Early departure is not permitted except in cases of documented emergency or religious obligations, which must be communicated to the instructional team as soon as practicable.

6. Packing list and Supplies

A detailed packing list can be found on the course Canvas website. Please review the packing list as soon as possible to determine what you are lacking. If you have issues finding any supplies, please let the instructional team know as soon as possible so we can help you find a solution. Note that the weather during the field component is anticipated to be cold, and the environment is lacking traditional facilities, so you should plan accordingly. These constraints reflect the operational realities of space and austere medical environments. We will have potable water and port-a-potty toilets, as well as common facilities to cook food. You will not have access to electricity or internet. You may be able to have small text messaging capability, but do not anticipate the ability to make phone calls, use cell phone data, or charge a phone.

7. Additional Considerations

Due to the nature of the class, we require all students to sign waivers and provide proof of insurance. These forms will be provided to you by the instructional team, and you will have an opportunity to review them and ask questions in the first few weeks of class. You must also fill out a medical form to disclose any relevant medical conditions. Note that only licensed physicians will review these forms, and it will not affect academic evaluation for the class other than to prepare for the in-field activity. The physicians will discuss with you any pertinent information on the form prior to arrival at MDRS, and this will be done on an individual basis under private circumstances. You must submit all forms by the stated deadline.

The State of Utah requires anyone driving an all-terrain vehicle (ATV) to take an online vehicle safety course. We use electric ATVs at MDRS as Mars Rovers; therefore, everyone in the course will be required to complete this course, as all students might need to drive one at some point. We will provide you additional details as we learn them.

Providing food in the field environment is challenging, especially when trying to accommodate the needs of a large group. At the time of applying for the course, you disclosed any dietary restrictions you may have. We will work with you to accommodate dietary requirements, but we may need to have additional conversations with you to understand the nature of your dietary requirements. Most of the food that we will consume is shelf stable, so if you have significant restrictions, you may need to supplement with your own food supply. Note that food is cooked in a communal setting collaboratively with your classmates, so it is critical you are also an advocate of your dietary needs.

Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the Honor Code may include but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. Understanding the course's syllabus is a vital part in adhering to the Honor Code.
All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: StudentConduct@colorado.edu. Students found responsible for violating the Honor Code will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Visit Honor Code for more information on the academic integrity policy.

Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or DSinfo@colorado.edu for further assistance. If you have a temporary medical condition, see Temporary Medical Conditions on the Disability Services website.
If you have a temporary illness, injury or required medical isolation for which you require adjustment, please alert the instructor as soon as possible to formulate a feasible plan of action to ensure you do not miss important course content.

Accommodation for Religious Obligations

Campus policy requires faculty to provide reasonable accommodations for students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Please communicate the need for a religious accommodation in a timely manner. In this class, it is essential that you communicate with the instructor at the beginning of the semester to work through any religious accommodations, especially for the week of field instruction in Utah. See the campus policy regarding religious observances for full details.

Preferred Student Names and Pronouns
CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

Classroom Behavior
Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, marital status, political affiliation, or political philosophy.
For more information, see the classroom behavior policy, the Student Code of Conduct, and the Office of Institutional Equity and Compliance.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation
CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits protected-class discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner abuse (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who have been subjected to misconduct can contact OIEC at 303-492-2127 or email CUreport@colorado.edu. Information about university policies, reporting options, and OIEC support resources including confidential services can be found on the OIEC website.
Please know that faculty and graduate instructors are required to inform OIEC when they are made aware of incidents related to these concerns regardless of when or where something occurred. This is to ensure that individuals impacted receive outreach from OIEC about their options and support resources. To learn more about reporting and support for a variety of concerns, visit the Don't Ignore It page.

Mental Health and Wellness
The University of Colorado Boulder is committed to the well-being of all students. If you are struggling with personal stressors, mental health or substance use concerns that are impacting academic or daily life, please contact Counseling and Psychiatric Services (CAPS) located in C4C or call (303) 492-2277, 24/7.

Free and unlimited telehealth is also available through Academic Live Care. The Academic Live Care site also provides information about additional wellness services on campus that are available to students.