

**ASEN 5016  
SPACE LIFE SCIENCES**

**Spring 2019**

**Tues/Thurs 2:0-3:15 pm  
ECCS 1B28**

**Instructor: Dr. David Klaus**  
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*email: klaus@colorado.edu*

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This course is intended to familiarize engineering students with factors affecting living organisms (ranging from single cells to humans) in the reduced-gravity and increased radiation environment of space flight, including orbital, lunar and Martian surface conditions. Unique insight will be gained regarding engineering design requirements for spacecraft habitats, life support systems and spacesuits, as well as space biology payloads. Life support needs, as they relate to basic human survival requirements, are covered initially. Next, the lectures turn to more detailed descriptions of the physiological adaptations that occur to people in space, with pertinent background information presented for each topic. Corresponding biomedical countermeasures used to maintain crew health for long duration missions will also be discussed. Finally, the underlying biophysical mechanisms affected by gravity, along with experiment design criteria, will be addressed. Current events within NASA's research and exploration mission programs and the emerging commercial human space flight sector are reflected throughout the lecture topics.

To further elaborate on the lecture material discussed in class, a series of integrated homework tasks provides a practical introduction to the process of journal article publishing and research proposal writing, including the anonymous peer review process used for each. The assignment involves writing a short journal article on an approved topic of your choice, your participation as a peer reviewer for the editor, revising your draft per the review comments you receive back, and resubmitting a final manuscript with a corresponding summary of changes made. From this background, you will subsequently prepare a research grant proposal that builds on your selected topic (along with a CV and budget), again goes through peer review, and culminates in a mock review panel. This end-to-end flow closely mimics the standard practice used in the scientific community and is a valuable generic process to experience regardless of your specific research interests.

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**GRADING**     **20% - Exam 1**  
**20% - Exam 2**

**10% - Quizzes (take home and in class) and Participation**

**20% - Homework 1, Review Article** – *grade based on final ‘revised and resubmitted’ version following peer review*

**5% - Homework 2, Journal Peer Review** – *your evaluation effort as a reviewer*

**20% - Homework 3, Research Proposal** – *grade based on proposal submittal with consideration of reviewer comments*

**5% - Homework 4, Proposal Peer Review** – *your evaluation as a reviewer and participation in the ‘Mock Panel Meeting’*

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**TEXT** *Space Physiology*, Buckley, Oxford University Press, 2006 (required)

Topic-relevant journal articles will be provided throughout the semester as well

Ancillary references for additional information on this field of study (not required)

*Textbook of Medical Physiology, 12<sup>th</sup> ed. Guyton and Hall, 2011*

*Fundamentals of Aerospace Medicine, 4<sup>th</sup> ed., Dehart and Davis, 2008*

*Going Higher – Oxygen, Man and Mountains, 5<sup>th</sup> ed., Houston, 2005*

*Fundamentals of Space Medicine*, Clement, Kluwer Academic Press, 2003

*Medicine for Mountaineering* – general title, various options

*Space Physiology and Medicine*, 3<sup>rd</sup> ed., Nicogossian, Huntoon and Pool, 1994  
(out of print, difficult to find)

*Bioastronautics Data Book*, 2<sup>nd</sup> ed., Parker and West (eds.), NASA SP-3006, 1973 (1<sup>st</sup> ed., Webb, 1964, both are out of print, difficult to find)

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*ASEN 5016 LECTURE TOPICS (order and topics subject to minor revision)*

## **Overview of Humans in Space**

Course Overview & Historical Perspectives on Human Space Flight  
Relevant Space Flight Environmental Parameters  
Human Spacecraft Life Support Requirements and Considerations  
Gravity-Dependent Physical Processes  
Respiration and the Oxygen Cascade  
Nutrition – Ch. 8 & Temperature Regulation  
Motor Control & Chronobiology  
*Wrap up / Exam Review*  
**Exam 1 – Tues Feb 12 (or Feb 14), travel pending government reopening status**

## **Human Physiological Adaptations to Space Flight**

Human Performance  
Miscellaneous Physiological Responses to Space  
Hormonal Regulation / Immunological Response  
Neuro-Sensory System – Ch. 6 (*balance*) & Ch. 9 (*space motion sickness*)  
Cardiovascular System – Ch. 7  
Muscular System – Ch. 4  
Skeletal System – Ch. 1  
Physiology of Extravehicular Activity (EVA) – Ch. 5  
Radiation Effects – Ch. 3  
Space Biology Experiment Design & Proposal Writing  
  
*-- Spring Break Week 3/25-29*  
  
*Wrap up / Exam Review*  
**Exam 2 – Thurs Apr 4**

## **Space Life Science Research**

Biomedical Countermeasures – Ch. 11 & 12 (partial)  
Operational Space Medicine – Ch. 12 (partial)  
0g & 1g Analogs (Earth-based and Space-based)  
Microbial Responses, Biotechnology & Related Crew Health Issues  
Plant and Animal Research in Space  
Psycho-Sociological Aspects – Ch. 2  
Astrobiology / Mock Review Panel prep  
Course wrap up

## **Mock Review Panel – Final Exam Period**

*Tuesday May 7, 2019 from 1:30 pm – 4:00 pm*

## **Aerospace Engineering Sciences & University Policies Spring 2019**

### **Accommodation for Disabilities**

If you qualify for accommodations because of a disability, please submit to your professor a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least one week prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at [dsinfo@colorado.edu](mailto:dsinfo@colorado.edu). If you have a temporary medical condition or injury, see guidelines for [Temporary Medical Conditions](#) under the Quick Links at the [Disability Services website](#) and discuss your needs with your professor.

### **Religious Observances**

[Campus policy regarding religious observances](#) states that faculty must make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. See the [campus policy regarding religious observances](#) for full details.

### **Classroom Behavior**

Students and faculty each have responsibility for maintaining an appropriate learning environment, *not only while in class, but also while working outside of class such as in labs and study areas*. Those who fail 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 differences of race, color, culture, religion, creed, politics, veteran's status, sexual orientation, gender, gender identity and gender expression, age, disability, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the [policies on classroom behavior](#) and [the student code of conduct](#).

### **Sexual Misconduct, Discrimination, Harassment, and/or Related Retaliation**

The University of Colorado Boulder (CU-Boulder) is committed to maintaining a positive learning, working, and living environment. CU-Boulder will not tolerate, *both in-class and outside of class*, acts of sexual misconduct, discrimination, harassment or related retaliation against or by any employee or student. CU's Sexual Misconduct Policy prohibits sexual assault, sexual exploitation, sexual harassment, intimate partner abuse (dating or domestic violence), stalking or related retaliation. CU-Boulder's Discrimination and Harassment Policy prohibits discrimination, harassment or related retaliation based on race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Individuals who believe they have been subject to misconduct under either policy should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127. Information about the OIEC, the above referenced policies, and the campus resources available to assist individuals regarding sexual misconduct, discrimination, harassment or related retaliation can be found at the [OIEC website](#).

## Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to [the Academic Integrity Policy](#) of the institution. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access, clicker fraud, resubmission, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the [Office of Student Conduct & Conflict Resolution](#). Students who are found responsible of violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the academic integrity policy can be found at [Student Honor Code Policy](#)

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Zoom meeting ID & connection information: **Meeting ID: 640-967-798**

- Connection options:

- Join via web browser: <https://cuboulder.zoom.us/j/640967798>
- Join via Zoom app (using meeting ID)
- Join via iPhone one-tap: US: +16699006833, 640967798# or +16465588656, 640967798#
- Join via telephone: US: +1-669-900-6833 or +1-646-558-8656

*This course requires the use of the Zoom conferencing tool, which is currently not accessible to users using assistive technology. If you use assistive technology to access the course material, please contact your faculty member immediately to discuss.*

If you need help with getting Zoom up and running, please visit the following link:

<http://www.colorado.edu/oit/services/conferencing-services/web-conferencing-zoom>

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