BMS 320 - Virtual Laboratory in Physiology

Course Coordinator / Instructor
Connie Vader-Lindholm, Ph.D.
970-491-5446
cvader@colostate.edu
Colorado State University

Overview

Each week’s coursework involves:
- Pre-lab tutorials using Draw It to Know It and selected on-line Tutorials*
- Concepts Tests (open book) on Canvas
- Laboratory Exercise using PhysioEx 10.0-Laboratory Simulations in Physiology*
- Optional: Completion of Data Charts to use for Data Analysis
- Completion of Lab Report on Canvas
- Upload PDF Activity Files from PhysioEx program
- Three (Closed Book) Unit Exams each covering four experiments.

*see page 3 for information on purchasing online content for course.

All tests, lab reports, and exams are done through: BMS 320 Virtual Laboratory in Physiology Canvas Course site. Access to this Course is automatic following your registration for the course.

To Log on, go to: canvas.colostate.edu

Pre-/Co-requisite

- Colorado State University Courses BMS 300 (Principles of Human Physiology), which is also available at Colorado State University Online Plus [http://www.online.colostate.edu/courses/BMS/BMS300.dot] or
- BMS 360 (Fundamentals of Physiology) or
- College level Physiology course at another institution (send unofficial transcript to Dr. Vader for approval)

Course Description and Goals

This course uses virtual laboratory exercises to study classic physiology experiments and is meant to meet the physiology lab pre-requisite for off-campus students applying for admission to post-graduate biomedical programs.

The course has been designed to fit the needs of students preparing for careers in health related fields such as Fitness and Athletics; Pre-Medicine; Pre-Physical and Occupational Therapy; Pre-Physician Assistant; Nursing; Bio-Education (Teachers), as well as students simply interested in how their body functions.

Be sure to check with post-graduate institutions of interest to insure this course meets their requirements. The laboratory exercises are simulations of experiments done in traditional "wet-lab" courses. The method of data collection differs, but the recording and analysis of data is similar and rigorous. Students will gain an increased understanding and appreciation for the functions (physiology) of the human body.
**Course Learning Objectives**

1. Evaluate different types of cell membrane transport mechanisms with respect to type of transport, rate of transport, conditions that affect the transport (membrane pore size, molecular weight, size, concentration of solutes), and role of carrier molecules and ATP.

2. Evaluate the physiology of neurons including ion concentration, channels, resting membrane potentials, stimuli strength, refractory periods, conduction velocity, and synaptic function.

3. Observe and explain the effect of increasing stimulus voltages (multiple motor unit summation); the effect of increasing stimulus frequencies (wave summation); and the effect of fatigue on skeletal muscle contraction.

4. Evaluate the interaction between thyroid hormones and metabolism, insulin and plasma glucose levels and their role in diabetes mellitus, benefits of hormone replacement therapy, and the role of ACTH on cortisol levels.

5. Explain the effect of blood vessel radius, blood viscosity, blood vessel length, and blood pressure on blood flow rate; and the effect of blood vessel radius and stroke volume on pump activity in the heart.

6. Explain the factors affecting the refractory period of cardiac muscle and the role of vagal nerve stimulation, the effect of temperature, chemical modifiers, and ionic changes on cardiac function.

7. Measure respiratory volumes and calculate capacities and explain the role of surfactant and intra-pleural pressure on respiration.

8. Explain the enzymatic processes involved in digestion of starches, proteins, and fats.

9. Describe the effect of arteriole radius and pressure on glomerular filtration; the renal response to altered blood pressure; the role of solute gradients and their impact on urine concentration; the role of carrier proteins in glucose reabsorption; and the effect of hormones on urine formation.

10. Explain the role of hyperventilation, rebreathing and renal responses in respiratory acidosis and alkalosis; and the respiratory responses to metabolic acidosis and alkalosis.

11. Explain how to measure and the importance of hematocrit, erythrocyte sedimentation rates, hemoglobin and blood cholesterol values; describe blood typing procedures and the importance of the blood type determination.

12. Describe the procedures used in and the importance of direct fluorescent antibody, ouchterlony double diffusion, indirect enzyme-linked immune-sorbent assay, and western blotting techniques.
**Course Materials for BMS 320**

- **Required (needed by the first day of class):**
  1. Purchase on-line access to the PhysioEX (10.0) program at http://www.physioex.com/. The price is $30.00 and:
  2. Draw It to Know It (Anatomy & Physiology) at https://drawittoknowit.com/course/anatomy-physiology. A six months subscription is $49.99 after a one week free trial. Use the Coupon Code FDW8YHZBJ for a 15% discount.

- **Highly Recommended:**

  **Vander's Human Physiology** is the text used for the pre-/co-requisite course (BMS 300) for BMS 320 and is highly recommended as additional reading for this course. Chapters are referenced in the Lab Report assignment. The referenced edition is the 13th, but anything from the 10th to the 15th would be acceptable. It can be found on-line. If you have another college level Physiology text, it can be used instead, but you will need to use the index to find the topics covered in each experiment. Some questions in the Lab Reports assume you are reading the assigned sections of the textbook. If you are going to be in the Biomedical field professionally, a good physiology text book is always a good resource.

  10th: 978-0073122861  
  11th: 978-0077216092  
  12th: 978-0077350017  
  13th: 978-0073378305  
  14th: 978-1259294099  
  15th: 978-1259903885

  If you do not have the current version, used texts and older editions can be purchased from Amazon.com at reduced prices.

Special needs statement: Students with disabilities are encouraged to contact the Resources for Disabled students at 491-6385 to arrange for accommodation and support services. Experiment assignments are not timed and double time is already allowed for the three exams.
Schedule

The course is divided into three units of four laboratory exercises each, followed by a Unit Exam. During Summer Semester two experiments will be due each week or one experiment and one Unit exam. Plan to spend up to 8-12 hours every week on this course during the 8 week summer session. Assignments/Exams will be due at 8 pm MDT on Mondays and 8 am on Fridays. This gives the student 3.5 days on each experiment. Because many students have jobs during the summer all of the assignments for each Unit are released with the first experiment in that unit so students can work ahead if they wish. Due dates remain the same for all experiments and Exams will only be released after the due date for the 4th experiment in the Unit.

Plan ahead and give yourself time to deal with illnesses, "technical difficulties" or other emergencies should they arise. A suggestion would be to plan on having the assignments completed 24 hours in advance of the due date/time to allow time to deal with problems, should they arise. Students who do this usually earn a letter grade higher than those who are submitting just prior to the deadline on a regular basis.

Available Date/Due Date: Assignment/Exam

June 12/June 17: Introduce Yourself: post message under Discussions

Unit I
June 15/June 19: Expt 1: -Cell Membrane Transport
June 19/June 22: Expt 2: -Skeletal Muscle Physiology
June 22/June 26: Expt 3: -Neurophysiology
June 26/June 29: Expt 4: -Endocrine System Physiology
June 29/July 3: Unit Exam I

Unit II:
July 3/July 6: Expt 5: -Cardiovascular Dynamics
July 6/July 10: Expt 6: -Cardiovascular Physiology
July 10/July 13: Expt 7: -Respiratory System Mechanics
July 13/July 17: Expt 8: -Chemical and Physical Processes of Digestion
July 17/July 20: Unit Exam II

Unit III:
July 20/July 24: Expt 9: -Renal System Physiology
July 24/July 27: Expt 10: -Acid-Base Balance (Fluid & Electrolyte Balance)
July 27/July 31: Expt 11: -Blood Analysis (Immune System)
July 31/Aug 3: Expt 12: -Serological Testing
Aug 3/ Aug 7: Unit Exam III

Aug 3/ Aug 7: Course Evaluations
Exams

There will be three written (closed book) unit exams all administered via Canvas. Each unit exam will emphasize the material in that unit (four experiments each). Each of the three exams will consist of 100 points (~80 questions evenly distributed over the tutorial information and laboratory information/exercises). Questions on these written exams will be taken from tutorials, lab exercises, Lab Reports, Concept Tests, and Pre- and Post-Lab quizzes found in PDF files.

Exam Proctoring:
For your convenience, this course will utilize ProctorU to proctor your online exams.

What is ProctorU?
ProctorU is a service that monitors you while you’re taking your exams online to ensure that no cheating takes place. Using this service allows you the convenience of testing from home, in your dorm, or in a private room at the library. They are available 24/7, so you can take your test whenever it’s most convenient for you.

Instructions for Using Proctor U
1. Go to CSU Online Exams
2. Click the ProctorU option
3. A pop-up box contains two buttons. Click both and follow the instructions
4. There are a few things to keep in mind:
   a. ProctorU has a 48 hour appointment window. If you schedule with less than 48 hours in advance, you may have to pay a fee ranging from $8 to $12.
   b. Mobile or other electronic devices are strictly prohibited. Laptops are acceptable.
   c. You’ll need to be in a well-lit, quiet area with a clear workspace and no one else can be in the room with you.
   d. In order to use ProctorU, you will need to have a strong broadband internet connection, a webcam (internal or external), microphone, a Windows or Mac Operating System, and a valid government issued photo ID.
   e. ProctorU recommends that you check your equipment (see instructions below) prior to your proctoring session.
   f. Your forms should be filled out and submitted at least two weeks prior to your first exam. You will only need to submit one Proctor ID Form per semester.
   g. Proctoring expenses are included when enrolled in a Division of Education section (801).

How does it work?
After you set up your account, you can schedule your test. At the time of your exam, you’ll log in to your account and be guided through a 10- to 15-minute start-up process that will verify your identity, review the rules of your exam, and get you into your exam. You will be monitored and recorded during your exam to make sure that no one has any unfair advantages while testing. If cheating is suspected, I’ll be notified.

If you experience any technical issues during the start-up process, they will work with you until the problem is resolved. In extreme cases when you cannot connect due to technical problem, you may have to reschedule.

Be sure to schedule each exam at least 48 hours in advance to avoid premium scheduling fees. If you want to know exactly what to expect on testing day, please review information at https://support.proctoru.com/hc/en-us/categories/115001818507.
Basic technical requirements:
Please test your equipment with ProctorU’s free helpdesk service: https://test-it-out.proctoru.com/. I recommend going beyond the automated system check - just scroll to the bottom of this page to be connected with a live technician who will answer any questions and troubleshoot if you have any issues. Keep in mind that this is a free service that ProctorU offers, so the wait times for the service can vary. I suggest you test your equipment at least one day prior to your exam so they can resolve any issues that may be detected.

Do you need special accommodations?
If you require special testing accommodations, I will need to let them know. Please work with me prior to your exam to make sure your accommodations are noted in their system.

What about the fees?
Currently Colorado State University will be assuming all costs associated with ProctorU.

Does it negatively interfere with my computer?
ProctorU does not permanently impact your computer in any way. The only time they will go into your computer settings is to secure your testing environment or troubleshoot issues that may cause you to not be able to connect to their proctoring system. Their proctors and technicians are right there with you every step of the way to provide free basic troubleshooting for common tech issues that can occur during your session, such as a slow connection. Depending on the requirements of your exam, your proctor may need to disable some settings and close any open programs. After your exam is over, the proctor will turn those settings back on for you. Once your exam is over and you have closed out of your chat session with ProctorU, it completely removes the testing client from your computer.

Does ProctorU breach my privacy rights?
Absolutely not! ProctorU takes your privacy very seriously. They stringently adhere to all Family Educational Rights and Privacy Act (FERPA) guidelines. No student information can be shared without your direct approval. If you have any privacy concerns, you can visit ProctorU’s Privacy Policy page. You may also contact their data protection officer: https://www.proctoru.com/privacy-policy

FAQs:
More questions? Please view ProctorU’s FAQs page here.

Still have questions or concerns?
ProctorU wants you to know that they are always available to help! You can always open a support ticket, start a live chat with their support representatives, or call (855) 772-8678.
Assignment Policies for BMS 320

- Weekly: Materials for the week’s experiment are released at 8 pm on Monday or at 8 am on Friday and are due at 8 am the following Friday or 8 pm the following Monday. See schedule for specific assignments on each date.
- Please plan ahead to allow for technical problems or extenuating circumstances.

Late Submissions: Assignments not submitted by the due date will be accepted with a 25% deduction for late submissions of up to 12 hours and a 50% deduction for late submissions of up to 24 hours. The assignment will be given a zero after 24 hours.

Early Submissions: In order to encourage students to submit assignments early (and spread out the grading process for the instructor), extra credit points will be added to the Lab Report grade for Experiments submitted 24 hours or more before the deadline. All exercises for the experiment including the Concept Test, uploaded PDF Activity Files and the Lab Report must be completed for the extra credit points to be awarded. An early release of Assignments will not be granted. Grades in this course are NOT curved, so the grades of students who chose to submit assignments according to the assigned due date will not be affected negatively by this policy.

Wednesday morning deadline:
   before 8 pm Sunday or 8 am Thursday: 5 points
   before 8 pm Saturday or 8 am Wednesday: 10 points

Assignment Completion Sequence

- Draw It to Know It tutorial (abbreviated DiKi from now on) and/or Animations on Canvas
- Concept Test on Canvas
- PhysioEx 10.1 Laboratory Simulation Exercise (abbreviated PEx from now on)
- Fill in Data Charts for the Lab Report (optional, but recommended if having difficulties analyzing data.)
- Lab Report on Canvas
- Upload PDF Activity Files to Canvas

Procedures

1. Do the assigned tutorials on DiKi and/or view the assigned animations.
2. Take Concept Test:
   Conditions for Test:
   - one attempt
   - untimed
   - open book
3. Download the optional Data Charts
4. Log onto PhysioEx 10.0.
   a. Select Exercise 1-Activity 1
   b. Read the Activity Objectives. Click [Next]
   c. Read Introduction and click [Next].
   d. Take the Pre-lab Quiz. Click [Next] after each question.
   e. [Submit] the Pre-lab Quiz.
   f. Read each instruction, do what it says. Then click [Next].
   g. **Be sure to answer the “Stop and Think” and “Predict” Questions as they are presented.** [Submit Question].
   h. Once you complete the Experimental procedures for Activity 1, [Submit] to record results of the Lab, then select [Submit] to record answers..., and proceed to the Post-lab Quiz.
   i. Answer Questions in Post-lab Quiz. You can review data by clicking View Experiment Results or use the Optional Data Charts if you completed them. Select [Next] to move to next Question.
   j. After completing the Post-lab Quiz, select "[Submit] to record your answers..., and proceed to the Review Sheet.”
   k. **When Review Sheet Question 1 is presented, click [Next] to by-pass it. Repeat for next three Review Sheet Questions. The questions will be answered as part of your Lab Report Assignment to follow.**
   l. Select [Submit] to record your answers in the Lab Report…
   m. Your completed Lab Report will be presented. **Click [Printable Version] at the bottom of the page.**
   n. Enter your name.
   o. Click [Print] at the top of the screen. **Print as a PDF file to a folder on your hard-drive that you can easily access.** Do not change the default name. Print a copy to be used in answering questions in the Lab Report and studying for exams.

5. Optional: Fill in the Data Charts for Activity 1. This will help you observe and evaluate the data you collected and the organization of the Data Charts should make evaluation of the data easier.

6. Repeat steps b-o above with all assigned Activities for that Lab Experiment.

7. Complete and submit the Lab Report on Canvas.
   **Conditions for Lab Report**
   - one attempt
   - untimed
   - open book (use your PhysioEx Exercise Activity x.pdf files).

8. Upload the PDF Activity files.
   **Submission of the Activity Files:**
   - Use the Submit Assignment link on the right side of the "Upload PDF Activity Files Here" window in Canvas.
   - **Repeat the upload process with each Activity PDF file saved while doing the Laboratory Exercises.** For example you will have the following Activity Reports for Experiment #1. **Do Not change the name** of the Activity Report pdf file. There will be a one point deduction for each changed name.
     - PhysioEx Exercise 1 Activity 1.pdf
     - PhysioEx Exercise 1 Activity 2.pdf
     - PhysioEx Exercise 1 Activity 3.pdf
     - PhysioEx Exercise 1 Activity 4.pdf
     - PhysioEx Exercise 1 Activity 5.pdf
Grading Policies for BMS 320

1. Assignment available dates and times and due dates and times are listed in the schedule. Anything not submitted by the deadline will receive a deduction/zero. Contact me concerning extenuating circumstances, but since you have 7 days to do the exercise associated with each experiment, it is expected that you will schedule your time to accommodate last minute problems or illnesses that might arise. This course moves quickly and it will be hard to catch up if you get behind.

2. You can define your own schedule within the week as long as the assignment deadlines are met, however, you must complete the activities in the order found on Canvas. The next set of assignments are released when the previous due date occurs.

3. The instructor will be available to answer questions from about 8 am to 5 pm Monday through Friday MST/MDT and will monitor emails during the evening and on week-ends but unless the problem is urgent, may not respond until the next morning or on Monday morning if contacted over the week-end.

4. Lab Reports will be graded and returned within 24 hours of the due date/time.

5. Concept Tests (on Canvas) are based on 50 points and have between 10-30 questions.

6. Lab Reports (on Canvas) are graded on a 100 point scale.

7. Uploaded PDF Activity files are worth 40 points and and based on completion of the experiment and the post-lab tests found in the PhysioEx program that are completed at the end of each activity in the experiment.

8. Unit Exams will each be 100 points distributed over about ~80 questions (20 from each topic in the Unit) and are closed book. The highest exam grade will be counted twice at the end of the semester.

- The Course Average will be calculated based on the following percentages:
  - Communication Assignments 5.0%
  - 12 Concept Tests (Open Book) 12.5%
  - 12 Lab Reports 20.0%
  - 12 PDF Activity File Uploads 12.5%
  - 3 (+1) Unit Exams 50.0%

- Communication Assignments help to develop a sense of community in the course and give the instructor insight into how the course is going for the students. Assignment Details will be given on Canvas at the beginning of the course.

- The lowest score for the Concept Tests, Lab Reports, and PDF Activity Files will be dropped at the end of the semester. Use this policy to address extenuating circumstances such as illnesses.

- The exam average will include 3 unit exams plus the score for the highest unit exam grade.

- Final Grades will be defined by the following breakdown. Note: scores are not rounded up.
  - 90.00-100% = A;
  - 60.00-69.99 % = D;
  - 80.00-89.99% = B, < 60% = F.
  - 70.00-79.99% = C;