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 9.1-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 CD or 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]
- BMS 360 (Fundamentals of Physiology)
- 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 (9.1) 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 $74.99

- **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 14th would be acceptable. It is available at the Colorado State bookstore, but can also 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

  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.

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 9/June 17:  
**Introduce Yourself:** post message under Discussions

**Unit I:**
June 12/June 16:  
Expt 1: -Cell Membrane Transport
June 16/June 19:  
Expt 2: -Skeletal Muscle Physiology
June 19/June 23:  
Expt 3: -Neurophysiology
June 23/June 26:  
Expt 4: -Endocrine System Physiology
June 26/June 30:  
**Unit Exam I**

**Unit II:**
June 30/July 3:  
Expt 5: -Cardiovascular Dynamics
July 3/July 7:  
Expt 6: -Cardiovascular Physiology
July 7/July 10:  
Expt 7: -Respiratory System Mechanics
July 10/July 14:  
Expt 8: -Chemical and Physical Processes of Digestion
July 14/July 17:  
**Unit Exam II**

**Unit III:**
July 17/July 21:  
Expt 9: -Renal System Physiology
July 21/July 24:  
Expt 10: -Acid-Base Balance (Fluid & Electrolyte Balance)
July 24/July 28:  
Expt 11: -Blood Analysis (Immune System)
July 28/Aug 1:  
Expt 12: -Serological Testing
July 31/Aug 4:  
**Unit Exam III**

July 31/Aug 4:  
**Course Evaluation**
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:

This course uses ProctorU.com to provide students in BMS 320 the most convenient, at home, on-line exam proctoring system. This system provides a secure, on-line proctor for all of the BMS 320 exams and allows the student to take all of the exams at home and on their own schedule. Exams in this course will be taken through ProctorU and depending on the contract between Colorado State University and ProctorU, the student may be assessed a small fee for each exam.

Please see system requirements below to ensure you have the necessary computer setup to use ProctorU.

Upon enrollment into BMS 320, students will register with ProctorU and establish a login name and password. This will give you access to all of ProctorU's services.

When ready, students will schedule their exams with ProctorU four days prior to taking that exam. Upon the exam day and hour, students will log in to ProctorU and click on “exams”. Following the procedures outlined at ProctorU’s web site, the student will log in to Canvas site, open the appropriate exam and the proctor will then allow student access to that exam.

Students will need to plan on, and schedule through ProctorU, a minimum of two hours for each of the three unit exams. You need not schedule all of the exams at once, but each one must be scheduled at least 4 days in advance of the actual exam date. Late fees may be imposed.

WARNING: Scheduling and then repeatedly cancelling scheduled exams, especially at the last minute, could result in the student losing their ProctorU service! Without ProctorU, the student will not be able to take exams and thus not be able to finish the course!

System requirements for use of ProctorU:
* A computer running Windows XP, Windows Vista, (or higher) or Mac OS X (or higher) with 256 MB of RAM or higher
* A web cam with 640x480 video pixel resolution
* Headphones or working speakers connected to the computer
* A microphone connected to the computer (We recommend having a web cam that has a built in microphone.)
* A web browser with Adobe Flash Player installed.
* A high-speed internet connection
* The ability to allow VNC connections to the computer you will be using.

If you do not have the necessary system requirements or for whatever other reason cannot use/access ProctorU, contact Colorado State University Online Plus for alternatives.
Assignment Policies for BMS 320

- Weekly: Materials for the week's experiment are released either at 8 pm on Mondays or at 8 am on Fridays. See schedule for specific assignments on each date.
  - Assignments released at 8 pm on Monday are due at 8 am Friday.
  - Assignments released at 8 am on Friday are due at 8 pm the next Monday.
  - 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.
  - Friday morning deadline:
    - before 8 am Thursday: 5 points
    - before 8 am Wednesday: 10 points
  - Monday evening deadline:
    - before 8 pm Sunday: 5 points
    - before 8 pm Saturday: 10 points

Assignment Completion Sequence

✎ Draw It to Know It tutorial and/or Animations on Canvas (abbreviated DiKi from now on)
✎ Concept Test on Canvas
✎ PhysioEx 9.1 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 DiKi and/or view the assigned animations.

2. Take Concept Test:
   - Conditions for Test:
     ○ one attempt
     ○ untimed
     ○ open book (you can use the Worksheets if you completed them)

3. Download the optional Data Charts
   a. Select Exercise 1 and read the Overview.
   b. Select Activity 1
   c. Read the Activity Objectives and Introduction.
   d. Take the Pre-lab Quiz.
   e. Select the Experiment tab.
   f. Follow the directions closely as described in the left panel of the experiment window. (The same instructions can also be found in the PhysioEx lab manual if you purchased the CD.)
   g. **Be sure to record all answers and data.** They will be saved to a PDF file that you will submit as part of your assignment.
   h. Once you complete the Experimental procedures for Activity 1, take the Post-lab Test. The introductory information (Overview) found in the lab manual and the information designated in Vander's Human Physiology textbook will be helpful in answering some of the questions.
   i. **Skip the Review Sheet.** The questions have been revised along with Activity questions found in the PhysioEx lab manual and will be answered as part of your lab report.
   j. Save the Activity Lab Report as a PDF file. You may wish to 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 the data you collected and the organization of the Data Charts should make evaluation of the data easier.

6. Complete questions in the Lab Report found on Canvas covering Activity 1. Do not submit your Lab Report on Canvas until you have completed all Activities and questions.

7. Repeat steps b-k above with all assigned Activities for that Lab Experiment.

8. Complete and submit the Lab Report on Canvas.
   **Conditions for Lab Report**
   - one attempt
   - untimed
   - open book (use your lab report and PEX-0x-0x.pdf files).

9. 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.
     - PEX-01-01.pdf
     - PEX-01-02.pdf
     - PEX-01-03.pdf
     - PEX-01-04.pdf
     - PEX-01-05.pdf
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  30.0%
  12 PDF Activity File Uploads  12.5%
  3 (+1) Unit Exams  40.0%

- 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.

- 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;