

**Cardiovascular Physiology  
Spring 2022 Syllabus  
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**Goals:**

- 1) In-depth understanding of normal function of the heart and blood vessels at the tissue and cellular level, and coordinated responses of the cardiovascular system
- 2) Knowledge of common cardiovascular diseases
- 3) Familiarity with the basic science literature in cardiovascular physiology and medicine

**Textbook:** *An Introduction to Cardiovascular Physiology*, 6th edition (5<sup>th</sup> and 4th editions are also okay), by J.R. Levick. The 5<sup>th</sup> edition and the companion study question book are available in SWEM Library. **FREE** online text through SWEM (<https://libraries.wm.edu/services/course-reserves>; search for “Cardiovascular Physiology”).

It is highly recommended that you read the relevant textbook sections and Blackboard slides **before** each lecture.

**Prerequisites:** “Human Physiology” or “Introduction to Molecules, Cell and Development”. In addition, a basic understanding of general cell structure/function is required.

**Grading:**

Test #1	30 pts	Feb. 18
Test #2	30 pts	Mar. 11
Test #3	30 pts	Apr. 8
Test #4	30 pts	Apr. 29
<b><u>Lowest test score will be dropped if all 4 tests are completed*</u></b>		
Final Exam	40 pts	Tues., May 18, 9:00-12:00
4 Paper Discussions	<u>32 pts (8 pts ea.)</u>	Feb. 9, Mar. 2, Mar. 30, May 4
	162 points total	

**\*If one of the tests is not taken, the “zero” score will be averaged into the final score.**

Final grading is based on the standard scale cut-points (e.g., A=93%, A-=90%, B+=87%, B=93%, B-=80%, etc.), however, if the course mean is <80%, then grading is on the curve, with the mean representing the lowest B-. Grades are generally not rounded up unless the final course score is within 0.5 points of the next grade bracket. **This course does not offer extra credit assignments.**

## Tests:

- Format is multiple choice.
- However, there is the option to explain any answers you choose. If a wrong answer is chosen, a logical, valid explanation may lead to partial or even full credit. If the correct answer is chosen, there will be no deductions for invalid explanations.
- If an alternate test date is needed due to scheduling conflicts, an **earlier** test date will be allowed if pre-arranged (1 week prior) with the professor. If you are ill the day before or day of the test, you may reschedule the test within the 3 days after the test day without penalty. If you are sick for more than 3 days or have a personal crisis, you should contact the Dean of Students for late accommodations from your professors, and you will be allowed to take the test late without penalty. Without an excuse, a late test will also be allowed, but points will be deducted (**5% if taken within a week of the test, 10% deduction after one week**).
- *Alternate dates for final exams must be approved by the Dean of Students.*
- Preparation for tests: Test questions typically require that you not only master the terminology and sequence of events in a physiological process, but also be able to apply the knowledge to new situations. It is recommended that you be able to explain each concept/process without looking at your notes and be able to predict what would happen if one of the elements in the pathway was blocked or enhanced. There will be both practice test questions posted on Blackboard (which are very representative of the types of questions on the tests) and study questions for each test.

## Paper Discussions:

Paper discussions will consist of reading an assigned original research paper/s, and then writing a brief (1-2 pages) summary of the paper (**4 points, due by 10:00 AM discussion day, turned in on Blackboard**), and being prepared to discuss the paper in class (**4 points**).

The written summary should explain (*in your own words*):

- 1) the purpose/hypothesis of the paper
- 2) the key methods or experimental strategies used
- 3) the data presented in each figure/table and what it means
- 4) conclusions and significance of the paper

Summaries can be written in paragraph or outline/bullet-point form (your choice). **Submit your summaries on Blackboard by the deadline.**

Before class, your small group will be assigned a figure or table to present. You will have time during class to organize your presentation with your group before presenting it to the class.

**Oral presentations (~3 min)** should be *equally* divided among the 4 group members and include:

- a) the overall purpose of the experiments performed in the figure
- b) an explanation of each panel in the figure – what measurement was made and what they mean (before sure that you explain the X and Y-axes in graphs)
- c) the overall conclusions of the figure
- d) an advanced analysis would include: limitations of the methods used, limitations of the conclusions made based on the evidence provided, ideas for future experiments, or ways to improve the experiments

Questions regarding the papers will appear on tests, so attendance and participation is important.

*If you are going to miss a paper discussion, you may turn in a more detailed written analysis (3-4 pages, written in essay form) instead, which will be **due by 5:00 on the day of the discussion**, or points will be deducted (5% if turned in within 1 week, 10% after 1 week). It should include a thorough discussion of rationale, detailed analysis of each figure/table, and detailed discussion of the significance and limitations of the study. Be advised, that this written analysis will be closely scrutinized and it is difficult to earn full credit, **and you are only allowed to make-up one missed paper discussion (except under extraordinary circumstances)**.*

## **LECTURE TOPICS**

- I. Overview (Chap. 1)
  - A. Overview of the Cardiovascular System and Disease Prevalence
  - B. Anatomy of the Cardiovascular System
- II. Cardiac Function
  - A. Cardiac Cycle (Chap. 2)
  - B. Cardiac Myocyte Excitation-Contraction Coupling (Chap. 3)
  - C. Electrical Activity of the Heart, Electrocardiography, Arrhythmias (Chaps. 4 & 5)
  - D. Control of Stroke Volume and Cardiac Output (Chap. 6)
  - E. Measuring Cardiac Output (Chap. 7)
- III. Hemodynamics (Chap. 8)
- IV. Vascular Endothelial Structure/Function (Chap. 9)
- V. Capillary Structure/Function
  - A. Solute Exchange (Chap. 10)
  - B. Fluid Exchange and the Lymphatic System (Chaps. 11)
- VI. Vascular Structure and Function
  - A. Vascular Smooth Muscle Contraction/Relaxation (Chap. 12)
  - B. Intrinsic Control of Blood Flow (Chap. 13)
  - C. Extrinsic Control of Blood Flow (Chap. 14)
- VII. Cardiovascular Reflexes and Neural Control (Chap. 16)
- VIII. Integrated Cardiovascular Response (Chap. 17)
- IX. Cardiovascular Adaptation and Pathologies (Chap. 18)

## **Discussion Papers:**

- 1a) Estruch, et al. Primary prevention of cardiovascular disease with a Mediterranean diet supplemented with extra-virgin olive oil or nuts. The New England Journal of Medicine 378:e34, 2018.
- 1b) Ridker, et al. Antiinflammatory therapy with canakinumab for atherosclerotic disease. The New England Journal of Medicine 377:1119-31, 2017.
- 2) D'Souza, et al. Exercise training reduces resting heart rate via downregulation of the funny channel HCN4. Nature Communications 13:3775, 2014.
- 3) Hirose, et al. Evidence for hormonal control of heart regenerative capacity during endothermy acquisition. Science 364:184-8, 2019.
- 4) Liu, et al. Lymphoangiokine signals promote cardiac growth and repair. Nature 588: 705-11, 2020.

## **Additional Resources**

American Heart Association ([www.americanheart.org](http://www.americanheart.org))

National Heart, Lung, and Blood Institute ([www.nhlbi.nih.gov](http://www.nhlbi.nih.gov))

Center for Disease Control ([cdc.gov](http://cdc.gov))

*William & Mary accommodates students with disabilities in accordance with federal laws and university policy. Any student who feels s/he may need an accommodation based on the impact of a learning, psychiatric, physical, or chronic health diagnosis should contact Student Accessibility Services staff at 757-221-2512 or at [sas@wm.edu](mailto:sas@wm.edu) to determine if accommodations are warranted and to obtain an official letter of accommodation. For more information, please see [www.wm.edu/sas](http://www.wm.edu/sas).*