Psychology 2650: Human Cardiovascular Psychophysiology
2014 SPRING TERM (Class # 27977)

Class Meeting:	Wednesdays, 2:00-4:55 PM
Class Location:	624 Old Engineering Hall (Conference Room)
Lab Location:	504 Old Engineering Hall
Instructors:	Drs. Pete Gianaros and Dick Jennings
Offices:	627 Old Engineering Hall (Gianaros); E1329 WPIC (Jennings)
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Office Hours:	Wednesdays: 12:00-1:15 (Gianaros)
	By appointment (Jennings)
Course Web Site:	http://www.courseweb.pitt.edu

Course Description:

This course is designed to provide students with (*i*) a working knowledge of the anatomy and physiology of the cardiovascular system and (*ii*) a basic understanding of how behavioral factors relate to cardiovascular function, dysfunction, and disease. To these ends, the course is divided into three blocks: *lectures*, *labs*, and *literatures*. In the *lectures* block, we will spend the first part of the semester covering the fundamentals of cardiovascular, respiratory, and autonomic anatomy and physiology. We will also relate this knowledge to two major forms of cardiovascular pathophysiology that are associated with behavioral factors: hypertension and atherosclerosis. In the *labs* block, we will spend the second part of the semester collecting, analyzing, and interpreting cardiovascular signals that can be measured non-invasively using psychophysiological methodologies. In the *literatures* block, we will spend the final part of the semester discussing and critiquing empirical and theoretical papers that span major topics of interest in the field of cardiovascular psychophysiology. At the end of these three blocks, students will use what they have learned to complete a substantive research proposal on a topic of their choice. The proposal must incorporate the collection (and strong justification and valid interpretation) of at least three cardiovascular, respiratory, or autonomic measures covered in the labs block.

Basic Course Goals:

(1) To gain a working knowledge of theoretical concepts in cardiovascular psychophysiology;
(2) To gain hands-on experience in applying common methodologies used in cardiovascular psychophysiology;
(3) To gain further experience in the writing of scientific documents, particularly a research proposal; and
(4) To gain further experience in leading a critical discussion of published research studies.

Textbooks:

There are no required texts for this course, but we suggest that students have access to these as essential references. Most of these texts are on Google Books! We will also post copies of materials when needed.

Handbook of Psychophysiology (3rd Edition), edited by J.T. Cacioppo, L.G. Tassinary, and G.G. Berntson. Cambridge University Press, 2007. (Note: New edition planned for 2015) Also available at https://www.hse.ru/data/2011/06/29/1216147786/Handbook%20of%20Psychophysiology.pdf

Psychophysiological Recording (2nd Edition), R.M. Stern, W.J. Ray, and K.S. Quigley. Oxford University Press, 2001.

Textbook of Medical Physiology (12th Edition), A.C. Guyton and J.E. Hall, Saunders/Elsevier Inc., 2011.

Primer on the Autonomic Nervous System, Third Edition *by David Robertson, Italo Biaggioni, Geoffrey Burnstock and Phillip A. Low (3rd edition), Elsevier Inc. 2011.*

Course Readings:

Some course readings will be made available electronically through CourseWeb or email distribution. Many of the articles for the three blocks can be accessed via PubMed or the Pitt library system, as noted in the schedule.

Course requirements and grading:

1. Course participation: **15 points.** This is an essential part of the course. Participating means attending classes, showing that you have read and understood assigned articles and chapters by asking questions during course discussions, and contributing to the completion of lab assignments with your team members. Missing class, coming to class late, and leaving class early without explanation, as well as silence during discussions and a lack of lab team contributions will be considered signs of not participating. It is also a requirement that you post questions on assigned readings for student led discussions for the Literatures Block (see below). Not posting questions will detract from your participation points.

2. Lecture Quizzes. 15 points. In the lectures block, the material on physiology and pathophysiology will be novel to many students. A clear understanding of the material is necessary to fully benefit from material later in the class. Brief quizzes at the end of 3 class periods will be administered to ensure that the material is adequately mastered. Because of this, all students, that is including those not taking the course for a grade, will take the quizzes. Each quiz will be worth 5 points.

3. Lab assignments: **15 points.** In the *labs block*, we will spend time collecting, analyzing, and interpreting different cardiovascular measures that will be obtained in the context of 'mini-experiments'. Each student is responsible for completing and submitting her or his own lab assignment; however, students will work in teams. Thus, completed assignments will essentially be 'team products'. To complete lab assignments, students will compute and enter values reflecting parameters of cardiovascular physiology acquired during different phases of the 'mini-experiments' (e.g., baseline, task, and recovery periods). For these assignments, students will also be asked interpretive questions that will be constructed to test for **an understanding of the readings assigned for a particular lab session**, as well as **a command over the material covered in the lectures block**. These assignments will be due in hard copy form in class no later than one week after we complete the lab sessions for a particular cardiovascular measure. In other words, lab assignments will be due most often on the Thursday one week after the last lab session (due dates will be listed on each assignment). Prior to the first day of each lab session, please be sure to print a copy of the lab worksheets bring them with you.

4. Discussion moderation and participation in discussions: 10 points for moderation. Those taking this course for a grade, as well as those auditing and 'sitting in' are required to lead a discussion of at least 2 articles in the same session during the *literatures block.* Depending on class size, we may need to modify this plan (e.g., by having teams lead discussions in pairs, etc.). We will determine the schedule for the moderators after the final add/drop date ends. The moderator is expected to keep the discussion going for the full time of the class. Note that moderating a discussion does NOT mean providing a descriptive overview of the readings. The format of the moderated sessions is flexible (e.g., students can prepare handouts with summaries and discussion questions, slides, or nothing at all). What matters most is the facilitated discussion and engagement of the participants.

When moderating a discussion of a research article, it is your job to answer these questions for your classmates:

1. What research questions are being addressed, and what is the importance of this study? Here, links can be made to the chapter readings each week.
2. Who are the subjects, and what is the design of the study?
3. What methods are used and what is being measured, manipulated, compared, or correlated?
4. What are the main findings?
5. What are the take home messages, and what can we conclude from the study?
6. What are the strengths of this study?

7. What next steps should researchers take in this area (i.e., what are the next studies that should be done?)

After addressing the questions above, it is then the students' job to offer a constructive critique of the work, focusing on the issues below. It is at this point where we should begin to consider and incorporate the questions posed on CourseWeb from fellow students:

1. Are the study's questions asked in the best possible way, or are there other ways in which the study's questions could have been better framed?
2. Is the study designed/executed in a way that enables the questions to be addressed? What are alternative ways this study could have been designed?
3. Were different constructs (e.g., socioeconomic status, ethnicity, etc.) measured in the best possible way? If not, then what could have been done differently?
4. Are the measures consistent or different with what other researchers in the field have done? And what are the implications of these similarities or differences in measurement approach? Here, it may be helpful to use the text for guidance about other research.
5. How well do the findings answer the research questions? To what extent do they raise new questions?
6. What could be done to improve the study and push the area of research forward?

Basically, your job here is to be a critic, and tell us everything that you think is wrong with the study. So, take a skeptical stance towards anything you read, and challenge your classmates to justify the actions taken in the study being presented.

In your presentations, you may find it helpful to refer to specific figures and tables in the article to explain results. You may find it helpful to create a handout, outline, or very short PowerPoint presentation answering the questions above or using them as an organizational framework. These could be shared with the class.

Note that asking and addressing the questions above is meant to help develop your skills in critically and creatively evaluating the evidence and basis for researchers' claims and beliefs, not only in this field but in others as well. Developing these skills may also help you to better appreciate and think about the basis of your own views and beliefs about different topics. In short, these are important skills that will extend to situations beyond this classroom and your college experience.

To ensure adequate class preparation, all students except for the moderator(s) must post at least one discussion question on each assigned research article on the CourseWeb site's discussion board no later than 9AM on the day of our class meeting (see course schedule below). In the event that CourseWeb is inaccessible, the questions should be emailed to Dr. Gianaros so that he can share them with the class. Students moderating a discussion are not required to post questions about the articles they will discuss. The questions should be theoretical or integrative in nature (i.e., they may point out a confound or problem with the methods of the study, a weakness or issue with the authors interpretations of their results, results that contradict ideas or findings presented in other readings or the course text, and even new ideas for future research on the topic under consideration, etc.). Questions are not to be about clarification (e.g., "I don't understand what the authors mean by the income-to-needs ratio. Can you please explain this?"), although clarification questions are welcome during the class meetings. These questions will generally form the basis of our in-class discussions.

Articles chosen by students must be approved by Drs. Jennings and Gianaors no later than March 11th. It is preferable that you seek approval as soon as possible, and earlier than this deadline. For approval, please send us PDFs of the articles you have in mind or schedule to meet with us in our office or after class. We need to make these articles available to students before Spring Break.

***5. Research proposal:* 45 points total - 15 points for a 5-page draft due at the end of the labs block, and 30 points for the final document submitted at the end of the semester.** Students taking this course for a grade are expected to write a research proposal that addresses a question of their own interest. Ideally, this question would be in line with the topic that students moderate a discussion of in the *literatures block*, but this is not necessary. The final document must include: (1) an introduction, 4 to 5 pp. in length, comprised of a literature review and a clear and testable question or set of questions with hypotheses; (2) a proposed method section, 5 to 7 pp. in length, comprised of a detailed description of the study protocol (and/or experiments), as well as the justification for at least 3 measures or parameters of physiology covered in the *labs block*; (3) a predicted results and discussion section, up to 8 pp. in length, that includes hypothetical figures and tables summarizing expected outcomes, as well as an interpretation of these expected outcomes; and (4) a reference section. The hypothetical results and discussion section should also include a paragraph or two on new directions for research on the chosen topic. The body of the proposal (introduction, method, and predicted results/discussion) should be no longer than 20 pp. total, and there can be no more than 30 references in total. Papers must be formatted following the APA manual of style (6th edition), and must use a 12-point font, double spacing, and 1" margins.

On April 2nd, a first draft of the paper is due in class (approximately 5 pages, 12-point font, double-spaced, 1" margins, following APA 6th edition format). This draft should signal a clear statement of the intentions for the final paper. It can be rough, but it should not be a simple outline. More complete drafts will elicit higher quality comments. Be sure to proofread the draft prior to turning it in. Comments will be returned in the following class meeting, unless there are unusual circumstances. These comments will include further guidance on the selected topic, other relevant readings, and feedback on writing. The proposal is due in class on **April 23rd** (it can be handed in before then, too). We will return the proposals to students with my comments after we grade them.

***5. Extra credit:* up to 4 points!** Students taking the course for a grade can earn up to 4 extra credit points by attending up to 4 prearranged visits to other laboratories and clinical departments. Note that these visits will occur outside of regular class time, and can last from 1 to 3 hours. The visits will involve viewing or learning about a particular invasive or non-invasive procedure in diagnostic cardiology or in cardiovascular epidemiology. The procedures can include: (1) an exercise tolerance (or stress) test; (2) angiography; (3) duplex ultrasonography; and (4) transesophageal echocardiography. Note that other visits may be available as well, and some of these visits may not be feasible this semester.

Students can earn 1 extra credit point per visit. To earn this point, the student must email me and Professor J. Richard Jennings (jenningsjr@upmc.edu) with a 3-5-sentence summary of what she or he learned. At the end of the *lectures block*, we will distribute sign-up sheets for students to indicate their interest in the different visits available. Auditors are welcome and encouraged to attend these visits.

After signing up, Dr. Jennings will provide further information and arrange the visits in small groups. Note that if you sign up for a visit on a particular date, and if you do not show up for that visit without advanced notice, then you will lose 1 point off of your grade, and you will be ineligible to receive any extra credit.

Grading Scale:

Grade	Minimum	Maximum
A+	98	100
A	93	97
A-	90	92
B+	87	89
B	83	86
B-	80	82
C+	77	79
C	73	76
C-	70	73
D+	67	69
D	63	66
D-	60	62
F	0	59

Policy on auditing:

Those who are auditing this course will be expected to attend class meetings and complete the participation, quiz, lab assignments, and moderation requirements detailed above. I do not expect auditors to write research proposals, but I am happy to provide feedback on them if they choose to do so. Again, auditors should feel free to sign up for the clinical visits if they are interested.

Disabilities:

If you have a disability that requires special testing accommodations or other classroom modifications, you need to notify both the instructor and the Disability Resources and Services no later than the 2nd week of the term. You may be asked to provide documentation of your disability to determine the appropriateness of accommodations. To notify Disability Resources and Services, call 648-7890 (Voice or TTD) to schedule an appointment. The Office is located in 140 William Pitt Union.

Academic integrity:

Students in this course will be expected to comply with the University of Pittsburgh's Policy on Academic Integrity. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. If you are unsure about what constitutes plagiarism, please see me. It is your responsibility to determine this *prior to* turning in lab assignments, outlines, and research proposals. All violations of academic integrity in this course, including plagiarism, will minimally result in having violation of academic integrity paperwork filed with your academic dean or department chair.

Statement on classroom recordings:

To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance permission of the instructor and other course participants, and any such recording properly approved in advance can be used solely for the student's own private use.

Class schedule:

MONTH	DAY	TOPIC	LECTURER, MODERATOR(S), Due Dates
Jan	8	**Course mechanics, introductions, and overview of psychophysiology** • Chapter 1 in Cacioppo, Tassinary, and Berntson **Cardiovascular anatomy, physiology, and function – Part 1** • Chapters 9 – 10 in Guyton and Hall (Heart as pump and rhythmical excitation) • Chapter 8 in Cacioppo, Tassinary, and Berntson (Cardiovascular Psychophysiology) pp. 182-183; 193-194.	Gianaros Jennings
	15	**Cardiovascular anatomy, physiology, and function – Part 2** • Chapters 14-15 in Guyton and Hall (Circulation and pressure) • Chapter 8 in Cacioppo, Tassinary, and Berntson (Cardiovascular Psychophysiology) pp. 184-187 (until Autonomic and Hormonal Control)	Jennings
	22	**ANS anatomy, physiology, and function** • Chapter 60 in Guyton and Hall (The ANS and adrenal medulla) • Chapter 8 in Cacioppo, Tassinary, and Berntson (Cardiovascular Psychophysiology) pp.187-190 • Supplemental (not required): Chapter 5 in Primer on the ANS (3rd Ed) • Supplemental (not required): Chapters 34-35 in Primer on the ANS (3rd Ed)	Gianaros QUIZ on Cardiovascular System
	29	**Lung anatomy, physiology, and function** • Chapter 10 in Stern, Ray, and Quigley (Respiratory system) • Bernston et al. (1993). Respiratory sinus arrhythmia: Autonomic origins, physiological mechanisms, and psychophysiological implications. Psychophysiology, 30, 183‑196. **Renal anatomy, physiology, and function** • Chapter 19 and 26, in Guyton and Hall (Role of the kidneys in long-term control of arterial pressure)	Ryan, Jennings QUIZ on ANS
Feb	5	**Vascular Disease – Part 1: Hypertension pathophysiology, epidemiology, prevention and treatment** • Chapter 45, Part VI – Preventive Cardiology – Systemic Hypertension: Mechanisms and Diagnosis. In Bonow: Braunwald's Heart Disease - A Textbook of Cardiovascular Medicine, 9th ed. (2011), Saunders, An Imprint of Elsevier. *Note that this is available only electronically through the HSLS library system. Follow MD|Consult -> Books -> Cardiology -> Bonow path to get to the chapter. *Read these sections in Chapter 45: Definitions, Pathogenesis, Mechanisms, and Diagnosis up to the section titled, "Identifiable (Secondary) Forms of Hypertension"* **Vascular Disease – Part 2: Atherosclerosis pathophysiology, epidemiology, prevention and treatment** • Chapter 43, Part VI – Preventive Cardiology – The Vascular Biology of Atherosclerosis. In Bonow: Braunwald's Heart Disease - A Textbook of Cardiovascular Medicine, 9th ed. (2011), Saunders, An Imprint of Elsevier. ▪ *Read these sections in Chapter 43*: Atherosclerosis initiation, Evolution of atheroma, and Complications of atherosclerosis (Please read the third section thoroughly but only skim the first two sections to glean the major points) • Also read the section in Chapter 44 on Risk Markers for Atherothrombotic	Jennings, Muldoon QUIZ on Lung and Renal Function

		Disease titled, "Conventional Risk Factors" • Supplemental (not required): Roger et al. (2011). Heart disease and stroke statistics--2011 update: a report from the American Heart Association. Circulation, 123(4), e18-e209. This is an excellent resource.	
Labs Block			
	12	**Blood pressure monitoring** • Shapiro et al. (1996). Blood pressure publication guidelines. Psychophysiology, 33, 1-12. *available at sprweb.org. Chapter 8 in Cacioppo, Tassinary, and Berntson (Cardiovascular Psychophysiology) pp. 197-200(??,handout) ❖ Supplemental (not required): Pickering et al. (2005). Recommendations for blood pressure measurement in humans and experimental animals part I: Blood pressure measurement in humans. Hypertension, 45, 142-161. • *For articles marked with an *, go to sprweb.org and click on the Journal tab, taking you to (http://www.sprweb.org/journal/index.cfm)	Jennings, Gianaros
	19	**The electrocardiogram (heart rate)** • Jennings et al (1981). Publication guidelines for heart rate studies in man. Psychophysiology, 18, 226-231.* • Putnam et al. (1992). Guidelines for reducing the risk of disease transmission in the psychophysiology laboratory. Psychophysiology, 29, 127-141.* • Download and print this document from CourseWeb: Mindware HRV User Guide 2.51.pdf	
	26	**Respiration (rate, depth)** ▪ Ritz et al. (2002). Guidelines for mechanical lung function measurements in psychophysiology. Psychophysiology, 39, 546-567.* **Heart rate variability** • Berntson et al. (1997). Heart rate variability: origins, methods, and interpretive caveats. Psychophysiology, 34, 623-648. *available at sprweb.org. • Mindware HRV User Guide 2.51.pdf ❖ Supplemental (not required): Berntson & Stowell. (1998). ECG artifacts and heart period variability: don't miss a beat! Psychophysiology, 35 (1), 127-132.	Gianaros, Jennings Lab sheets for HRV and BP due
Mar	5	**Photoplethysmography (pulse transit time)** • Smith et al. (1999). Pulse transit time: an appraisal of potential clinical applications. Thorax, 54 (5), 452-457. • Supplemental (not required): Jennings et al. (1980). Noninvasive measurement of peripheral vascular activity. In J. Martin & P.H. Venables (Eds.), Techniques in psychophysiology, pp. 69-137. New York: Wiley.	Jennings, Gianaros Lab sheets for HRV and RESP due
Spring Break	12	❖ **NO MEETINGS, SPRING BREAK!!**	
	19	**Impedance cardiography** • Sherwood et al. (1990). Methodological guidelines for impedance cardiography. Psychophysiology, 27, 1-23.* • Download/print this from CourseWeb: Mindware IMP User Guide 2.51.pdf	Jennings, Gianaros Lab sheets for Photopleth due
LITERATURE BLOCK			
	26	**Cardiovascular reactivity – Student led**	Lab sheets for IMP due

April	2	**Ambulatory monitoring of cardiovascular physiology – Student led**	*1st draft of the paper due in class*
	9	**Social support and social factors – Student led**	
	16	**Emotion and emotion regulation – Student led**	
	23	**Cognition and cardiovascular/autonomic physiology – Student led**	*Research proposals due in class 4/23*