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Sensory Perception

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**Sensory Perception
BIO45400**

**Summer 2019: June 3 – June 27 Syllabus
3 credits**

Instructor Adrián Rodríguez-Contreras, Ph.D.
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Class meets Monday, Tuesday, Wednesday and Thursday from 11:00 am to 1:30 pm in CDI 3.352

Course description: Different types of sensory systems with their functional modalities will be presented. The biological bases for how these functions are generated and modified will then be described. Scientific data will be integrated into the lectures, such that students use critical skills in interpreting data, proposing hypotheses and designing experiments.

Complementary courses: Biology 10050, 20700, 35400, 35500, 37900, 45100.

Course goals:

- Students will be able to identify the different sensory systems in humans and other animals.
- Students will learn basic mechanisms involved in sensation and perception.
- Students will be able to evaluate past and present theories of perception and critically evaluate evidence in favor or against those theories.

Learning outcomes: After completing this course, students should be able to:

- 1) describe what the different sensory modalities encompass.
- 2) describe the process of transduction in each sensory modality.
- 3) describe the basic brain circuits mediating the different sensory modalities.
- 4) design, perform, and interpret psychophysical experiments.
- 5) plot psychophysical data and generate psychometric functions from them.
- 6) explain how sensory processing can be modified by other brain processes such as attention or memory.
- 7) describe the relationship between brain activity and perceptual (behavioral) state.
- 8) interpret scientific data from primary research papers on sensory perception.
- 9) propose experiments to test hypotheses on sensory perception.

Learning assessment: Writing a successful term paper.

Required Text: There is no required text for this course. The instructor will make course materials available to registered students. Supplementary texts and readings will be available in blackboard. Contact the instructor if you need help accessing these resources.

For students interested in using library resources related to this course they may consult any edition of the following textbooks:

Yantis, Steven. *Sensation and Perception* (2nd edition). 2013. Worth Publishers. New York, NY.

Blake, Randolph; Sekuler Robert. *Perception* (5th edition). 2006. McGraw-Hill Companies.

Wolfe, Jeremy; et al. *Sensation and Perception* (5th Edition). 2018. Sinauer Associates, Inc.

Grading

Participation: 50%

Writing assignments: 5%

Student presentations: 5%

Term paper: 20%

Exam 1: 5%

Exam 2: 5%

Exam 3: 5%

Final Exam: 5%

Lectures and participation: Developing a sense of confidence and good communication with your peers and professors is a very important skill to succeed in the professional world. In this class we will organize group discussions centered on your understanding of the course materials and readings. So it is very important that you come prepared for class. Attendance is not mandatory, but if you do not participate in class and discussions, you will not get credit for participation.

Exams: There will be 4 exams. Each exam will cover topics since the start of the course or previous exam (i.e. exams are cumulative). All exams are essay format. Participation is based on your readings of the course material and from any other reading assigned that week (e.g., I might ask you to explain a figure from the readings).

Exams cannot be made up. Do not miss an exam unless you have a strong reason (e.g., medical, jury duty or getting married). I will expect you to have read the assigned readings for each lecture *before* class, since the lectures will typically assume that you have read the material. You will probably wish to read the assigned material again more carefully after the lecture. You will be responsible on the exams *both* for material covered in class and in other readings. In other words, I expect you to come to class and to do the readings.

Writing: In this course I would like you to exercise your scientific reading and writing skills. Your assignment will be to write a **one-page** critique on the selected articles your team will be presenting. Note that the writing assignment is a team effort. You and your partners will be responsible for writing and editing the text. For each paper assigned to your team write three paragraphs explaining a) the goal of the paper, b) the major strengths and c) weaknesses of the study or review. Turn your writing assignment at the start of the class. If you cannot attend a class, make sure you give advance notice to the instructor, and arrange for a time to turn in your assignment (before the due date). Writing assignments are to be delivered in hard copy. Emails are NOT accepted, late assignments are NOT graded.

You will also be expected to write a term paper. The term paper is an individual assignment. We will discuss the format in more detail in class, but the paper will be in the form of a research proposal in a topic directly related to sensory perception that interests you. The term

paper will consist of five sections: BACKGROUND: two or three paragraphs that explain the question or issue of interest, why is it important and the state of the art in that field.

HYPOTHESIS: what is the main goal of your experiment proposal? **APPROACH:** how are you going to test the hypothesis? what results do you expect?, what problems do you anticipate?, and consider alternative solutions. **SIGNIFICANCE:** If your experiment can successfully test the hypothesis, what happens next? **REFERENCES:** primary literature, books, book chapters. Web site links are not acceptable sources.

A draft of your term paper is due on June 13 (see class schedule below). I will read your draft and give it back to you with comments so you can improve your paper, and obtain a better grade. The final paper is due on June 27.

The scientific community relies on being able to accept at face value what is written in journals; the most serious act of dishonesty is to present something as being written by you when it has in fact been written by someone else. In this course we will use the standard that if more than a sentence is copied verbatim or text longer than a paragraph paraphrased without being given a source, that will be considered plagiarism, and will lead to a failing grade in the assignment or course (see statement on Academic Integrity policy below).

Student Presentations

In addition to the writing assignments we will have a group discussion of the assigned papers. Student presentations are on the same day the assignments are due. As indicated in the schedule every student team will be expected to lead at least one discussion during the summer session. Your presentation should include background and a clear explanation of the methods and results. You can use chalk and blackboard to sketch a graph or describe equations or hypotheses, if you want to use power point slides your team will be responsible for bringing a laptop. Every student will also have the opportunity to do an individual 2-minute presentation on their term paper. As with the paper discussions, you should be able to present to others using the classroom blackboard. Power point slides are allowed. Swapping a presentation date is allowed, but make sure to find someone who is willing to swap with you and contact the instructor at least a class before the date of your group presentation. Discussions will be based on the assignment for that class and everyone is expected to participate. Presenting students are encouraged to contact the instructor if they feel they need help preparing their presentation.

Extra readings and links

Additional readings and links to complementary information will be posted regularly in blackboard. Check the relevant folders, as this information will be updated throughout the course. You are also encouraged to use the web resources of the textbook.

Statement on Academic Integrity:

The CCNY policy on academic integrity will be followed in this course. The document can be found through the CCNY website by clicking on Current Students → Academic Services → Policy on Academic Integrity.

<http://www1.cuny.cuny.edu/upload/academicintegrity.pdf>

All students must read the details regarding plagiarism and cheating in order to be familiar with the rules of the college. Cases where academic integrity is compromised will be prosecuted according to these rules. In addition, the Policy of Academic Integrity can be found in the Undergraduate Bulletin 2007-09 in Appendix B.3 on pg 312.

Student teams. See the blackboard version of the syllabus.

COURSE CALENDAR

Date	Lecture topic	Assignments
June 3	Course introduction and definitions	A1 due on June 4
June 4	Methods to study sensation and perception	A2 due on June 5
June 5	Sensory stimuli	A3 due on June 10
June 6	Exam 1	
June 10	Vision: receptor organs	A4 due on June 11
June 11	Vision: neuroanatomical pathways	A5 due on June 12
June 12	Vision: Object recognition and space perception	Term paper draft due on June 13
June 13	Exam 2	A6 due on June 17
June 17	Hearing and vestibular: receptor organs	A7 due on June 18
June 18	Hearing and vestibular: neuroanatomical pathways	A8 due on June 19
June 19	Hearing: sound localization	A9 due on June 24
June 20	Exam 3	
June 24	Body senses: receptor organs	A10 due on June 25
June 25	Body senses: neuroanatomical pathways	A11 due on June 26
June 26	Synthesis: Attention and Awareness	Student term papers due on June 27
June 27	Exam 4	

Assignments

A1. Akre KL, Farris HE, Lea AM, Page RA, Ryan MJ (2011) Signal perception in frogs and bats and the evolution of mating signals. *Science*, 333: 751-752.

A2. Engels S, Schneider N-L, Lefeldt N, Hein CM, Zapka M, Michalik A, Elbers D, Kittel A, Hore PJ, Mouritsen H. Anthropogenic electromagnetic noise disrupts magnetic compass orientation in a migratory bird. *Nature*, 509: 353-356.

A3. Schuergers N, Lenn T, Kampmann R, Meissner MV, Esteves T, Temerinac-Ott M, Korvink JG, Lowe AR, Mullineaux CW, Wilde A (2016) Cyanobacteria use micro-optics to sense light direction. *eLife* 5:e12620.

A4. Sabesan R, Schmidt BP, Tuten WS, Roorda A (2016) The elementary representation of spatial and color vision in the human retina. *Sci Adv* 2:e1600797.

A5. Sheinberg DL, Logothetis NK (2001) Noticing familiar objects in real world scenes: The role of temporal cortical neurons in natural vision. *The Journal of Neuroscience* 21:1340-1350.

A6. Montie EW, anire CA, Mann DA (2011) Live CT imaging of sound reception anatomy and hearing measurements in the pygmy killer whale, *Feresa attenuata*. *The Journal of Experimental Biology* 214:945-955.

A7. Patel AD, Iversen JR, Bregman MR, Schulz I (2009) Experimental evidence for synchronization to a musical beat in a nonhuman animal. *Current Biology* 19:827-830.

A8. Garcia-Garibay O, Cadena-Valencia J, Merchant H, de Lafuente V (2016) Monkeys share the human ability to internally maintain a temporal rhythm. *Frontiers in Psychology* 7:1971

A9. Romo R, Hernandez A, Zainos A, Salinas E (1998) Somatosensory discrimination based on cortical microstimulation. *Nature* 392:387-390.

A10. Houweling AR, Brecht M (2008) Behavioural report of single neuron stimulation in somatosensory cortex. *Nature* 451:65-68.

A11. Sridharan D, Ramamurthy DL, Schwarz JS, Knudsen EI (2014) *PNAS* E2056-E2065.

Exam readings:

Rushton WAH, Barlow HB (1943) Single-fibre response from an intact animal. *Nature*, 152: 597.

Barlow HB (1972) Single units and sensation: A neuron doctrine for perceptual psychology? *Perception*, 1:371-394.

Sincich LC, Zhang Y, Tiruveedhula, Horton JC, Roorda A (2009) Resolving single cone inputs to visual receptive fields. *Nature Neuroscience* 12:967-969.

Mace E, Montaldo G, Trenholm S, Cowan C, Brignall A, Urban A, Roska B (2018) Whole-brain functional ultrasound imaging reveals brain modules for visuomotor integration. *Neuron* 100:1241-1251.

Geleoc GSG, Holt JR (2014) Sound strategies for hearing restoration. *Science* 344:596-605.

Mashour GA (2018) The controversial correlates of consciousness. *Science* 360:493-494.

Wickersham I, Groh JM (1998) Neurophysiology: electrically evoking sensory experience. *Current Biology* 8:R412-R414. Anton-Bolanos N, Sempere-Ferrandez, Guillamon-Vivancos T, Martini FJ, Perez-Saiz L, Gezelius H, Filipchuk A, Valdeolmillos M, Lopez-Bendito G (2019) *Science* 364:987-990.