Overview

A simple sound - air-pressure waves striking our eardrums - conveys a lot of information that our brain readily, easily, and effortlessly transform into a percept that we can remember, identify, and assign a value to. This course is an exploration of how sound is processed in the brain, providing an introduction to the stages of information processing from the ears to auditory cortex and beyond. Methods of data acquisition (e.g., fMRI, electrophysiology, psychoacoustics) are introduced along with their advantages and pitfalls. Sound and auditory perception are discussed, starting with the basic properties such as frequency, loudness, pitch, and timbre, progressing to human speech and music. We will explore what parts of the brain are necessary and sufficient to understand spoken, seen, or imagined words, jam to music, or recognize even your friend’s voice. We will investigate the how our brain processes the perceptual constancies of sound despite variations in acoustic features (e.g., your roommate’s voice here, there, and everywhere throughout last semester). We will touch upon how congenital or acquired diseases (deafness, aphasia, dyslexia, and amusia) alter the underlying molecular substrates and neural circuitry of sound perception and coding. The class format will be mixed (enrollment size determined): lectures, journal-club-like presentation of papers, and group oral and written presentations.

Learning Objectives

The objective of this course is to provide a thorough introduction to the biological and psychological study of sound, and the computational and neural mechanisms that underlie its sensation and perception. After participation in the course, the students will have developed a familiarity and appreciation of the behavioral and neuronal dynamics associated with the cognitive neuroscience of sound.

Required book


Online text for borrowing here:

Technology/Software Requirements

Software:
- Rutgers Box account: [https://box.rutgers.edu/](https://box.rutgers.edu/)
- Rutgers Zoom Account: [https://it.rutgers.edu/zoom/](https://it.rutgers.edu/zoom/)

Technology:
- Computer: Laptop or desktop computer. A tablet may be used in some cases.
- Internet Connectivity: Preferably a high-speed connection. You may also use a wireless hotspot through your mobile provider.
- Microphone (optional): This may be built into your device, but an external microphone or headset will provide better sound.
- Webcam (optional): Many computers have one built in, but you can easily connect an external USB camera.

Remote Learning Technology/Software Requirements (Week of 1/17/2022 and 1/24/2022)

Learning remotely presents new challenges. For assistance with learning how to address these challenges, please consult the resources available here: [https://rlc.rutgers.edu/remote_instruction](https://rlc.rutgers.edu/remote_instruction)

Please visit the Rutgers Student Tech Guide page for resources available to all students. If you do not have the appropriate technology for financial reasons, please email Dean of Students deanofstudents@echo.rutgers.edu for assistance. If you are facing other financial hardships, please visit the Office of Financial Aid at [https://financialaid.rutgers.edu/](https://financialaid.rutgers.edu/).

The Division of Student Affairs Diversity & Inclusion Statement

Excerpted [http://inclusion.rutgers.edu/](http://inclusion.rutgers.edu/):

“The Division of Student Affairs works to create an environment of inclusion which respects and affirms the inherent dignity, value, and uniqueness of all individuals, communities and perspectives. Our practices reflect awareness and understanding of the complexity of identity and the increasing interconnectedness of our world. It is our responsibility to promote and maintain a community of compassion, embracing the rich dimensions of diversity, and facilitating opportunities for understanding and the expression of both individual and shared truths.”

In other words, We understand that our members represent a rich variety of backgrounds and perspectives. The Psychology Department is committed to providing an atmosphere for learning that respects diversity. While working together to build this community we ask all members to:

- share their unique experiences, values and beliefs
- be open to the views of others
- honor the uniqueness of their colleagues
- appreciate the opportunity that we have to learn from each other in this community
- value each other’s opinions and communicate in a respectful manner
- use this opportunity together to discuss ways in which we can create an inclusive environment in this course and across the Rutgers U. community

Course requirements

There will be weekly quizzes/blogs on the first day of class of each week (typically on Mondays). Each quiz will cover the material from the previous week or based on the additional readings from the primary scientific literature. Each student will give an individual journal club presentation. In addition, each student must complete a final group presentation and a final report on the presentation. No provision will be made to “make-up” missed quizzes and final presentations. There will be no mid-term or final exams.

Weekly quizzes/Blogs

Either the first or last 10-15 minutes of the first class of each week, there will be a multiple-choice / brief answer quiz on the material covered in the previous week or based on additional readings from the primary scientific literature. This quiz/blog will be closed book. Anyone who is not present for the quiz will receive a zero
(no exceptions). The lowest 2 (of a planned 10) quiz grades will be automatically dropped and the remaining grades averaged to determine the final weekly quiz grade.

Journal Article Presentations The ability to read, understand, interpret, synthesize, and present the scientific literature is important for both scholar and layman. Throughout your academic career and beyond, you will be expected to read and interpret journal articles/data/reports, and summarize their content for colleagues and collaborators, in presentations, proposals, and publications. Students will be required to give an oral presentation of a scientific journal article. The presentation should be 30 mins long and include at least 5-10 PowerPoint slides. This may include a title slide, outline slide, and questions slide. The journal article topic will either supplement lectures or be related to the student’s group project.

Final presentations and Written Report Each student must participate in a final project that culminates in an oral presentation to the class on the final few meeting days of the semester. Each group must be 3-4 students. Each group must select a topic, either from the suggestions listed below, or of their own choosing (in consultation with the instructor). Groups are responsible for researching this topic on their own throughout the semester, developing a reading list covering the topic, creating an outline of the final presentation, and then presenting their material to the class (see handout for due dates for each). Grading of the final presentations will be determined by the instructor, the average peer grade assigned by classmates, and individual contributions to the group.

A written report is also part of the evaluation. Reports should be typed, single-spaced, using 12 point Times New Roman font with 1 1/2-inch margins and no more than 5 pages. Please include a cover page with your paper’s title, your name and ID#, my name, the date, and course (this should be the only page of the report showing your name). Every page of the term paper should be numbered at the bottom right-hand corner and have your student ID# only in the top right-hand corner. I will give specific guidelines about the structure and format of the paper in a separate handout, but in essence, it will follow you class presentation/lecture.

Grading scale and policy

Final grades will be determined by a weighted average of the following grades:

1. 5% Weekly quizzes/blog
2. 25% Journal Article Presentations
   
   15% your presentation (Rubric will be covered in class)
   
   10% your contribution to the discussion and your peer evaluation of the journal article presentation
3. 30% Final report (Rubric will be covered in class)
4. 40% Final presentations: see below for grade breakdown:

   Each group will receive a letter grade for the final presentations; however, individual grades will also depend on the contributions of each person to the group effort and peer evaluations.

Group Effort (10%): Specifically, each group participant must allocate points to members of the group to reflect the contributions of that member. Each group member will be given 100 points that they can assign amongst the group members (excluding themselves).

Instructor Evaluations (10%): Points will be tallied in a rubric (created by me) that will outline all the essential components of an effective presentation (i.e., for effective communication of your content) like speaking style, slide organization, slide appearance, pace, use of technology (like laser pointers, slide animations, etc.) in addition to the content of your talk. Part of this assessment will be based on the timeliness of adherence to deadlines (see schedule).
Peer Evaluations (15%): The peer evaluation will be anonymous and determined from the total number of points allocated to you by 3 of your classmates (randomly selected). Points will be tallied in a rubric (created by me) that will outline all the essential components of an effective presentation (i.e., for effective communication of your content) like speaking style, slide organization, slide appearance, pace, use of technology (like laser pointers, slide animations, etc.) in addition to the content of your talk. I will review each and every peer evaluation to verify that all assessments are fair and balanced. (5%) – your own participation in providing the peer evaluation.

Grade Conversion
The following scale and its numerical equivalents to letter grades:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>90% or above</td>
<td>A</td>
</tr>
<tr>
<td>85- 89%</td>
<td>B+</td>
</tr>
<tr>
<td>80- 84%</td>
<td>B</td>
</tr>
<tr>
<td>75- 79%</td>
<td>C+</td>
</tr>
<tr>
<td>70- 74%</td>
<td>C</td>
</tr>
<tr>
<td>60-69%</td>
<td>D</td>
</tr>
<tr>
<td>Below 60%</td>
<td>F</td>
</tr>
</tbody>
</table>

Current Academic Integrity Policy and Honor Pledge:
Overview: Rutgers University takes academic dishonesty very seriously. By enrolling in this course, you assume responsibility for familiarizing yourself with the Academic Integrity Policy and the possible penalties (including suspension and expulsion) for violating the policy. As per the policy, all suspected violations will be reported to the Office of Student Conduct. Academic dishonesty includes (but is not limited to):

- Cheating
- Plagiarism
- Aiding others in committing a violation or allowing others to use your work
- Failure to cite sources correctly
- Fabrication
- Using another person’s ideas or words without attribution—re-using a previous assignment
- Unauthorized collaboration
- Sabotaging another student’s work; in doubt, please consult the instructor

Honor pledge: All students will need to sign the Rutgers Honor Pledge on every major exam, assignment, or other assessment as follows:

- On my honor, I have neither received nor given any unauthorized assistance on this examination (assignment).

Summary:
http://nbacademicintegrity.rutgers.edu/home-2/academic-integrity-policy/

Resources for Students:
http://nbacademicintegrity.rutgers.edu/home-2/for-students/

Accommodations for students with disabilities: In compliance with the Rutgers University policy and equal access laws, I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first two weeks of the semester, except for unusual circumstances, so arrangements can be made. Students are encouraged to register with the RU Office of Disability Services to verify their eligibility for appropriate accommodations and provide me with appropriate documentation.

https://ods.rutgers.edu/
http://health.rutgers.edu/
Policy on attendance  Please use COVID common sense if you are feeling unwell. It is expected for students to isolate thanks to covid or other ailments and flexibility will be built in. HOWEVER, students are expected to attend class lectures and final presentations. Failure to attend the final presentation series will negatively affect your grade. In the case of a medical emergency or other extreme circumstances, it is the student’s responsibility to contact another student, determine what material / announcements they missed, and take appropriate action to catch up, as necessary. It is not the instructor’s responsibility to provide make-up materials to the student.

Policy on collaboration  As discussed above, much of the work for the class will be done in groups; in general, cooperation is encouraged. The exception to this rule are the weekly quizzes, which should reflect each student’s knowledge and understanding of the course materials.

SCHEDULE OF LECTURES (subject to change)

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics</th>
<th>Scheduling notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>week1</td>
<td>1/17/2022</td>
<td>Why Things Sound the Way They Do.</td>
<td>Remote: zoom* link below</td>
</tr>
<tr>
<td>week2</td>
<td>1/24/2022</td>
<td>Do We Need to Pay Attention? Part 1</td>
<td>Remote: zoom* link below</td>
</tr>
<tr>
<td>week3</td>
<td>1/31/2022</td>
<td>The Ear. Subcortical coding.</td>
<td>weekly quizzes/blog begin</td>
</tr>
<tr>
<td>week4</td>
<td>2/07/2022</td>
<td>Periodicity and Pitch Perception: Physics, Psychophysics, and Neural Mechanisms.</td>
<td>project groups &amp; topic requests due</td>
</tr>
<tr>
<td>week5</td>
<td>2/14/2022</td>
<td>Hearing Speech. Auditory Scene Analysis.</td>
<td>journal article presentations begin</td>
</tr>
<tr>
<td>week6</td>
<td>2/21/2022</td>
<td>Auditory Scene Analysis. / Neural Basis of Sound Localization.</td>
<td>small group meetings</td>
</tr>
<tr>
<td>week7</td>
<td>2/28/2022</td>
<td>Development, Learning, and Plasticity.</td>
<td>small group meetings</td>
</tr>
<tr>
<td>week8</td>
<td>3/7/2022</td>
<td>Cortical processing; Attention Part 2.</td>
<td>project reading list due</td>
</tr>
<tr>
<td>week9</td>
<td>3/14/2022</td>
<td>Spring Break</td>
<td></td>
</tr>
<tr>
<td>week10</td>
<td>3/21/2022</td>
<td>Sound Perception Across the Senses.</td>
<td></td>
</tr>
<tr>
<td>week11</td>
<td>3/28/2022</td>
<td>Sound Perception Across the Animal Kingdom.</td>
<td>Draft presentation due</td>
</tr>
<tr>
<td>week12</td>
<td>4/04/2022</td>
<td>Auditory Prostheses: From the Lab to the Clinic and Back Again.</td>
<td>small group meetings</td>
</tr>
<tr>
<td>week13</td>
<td>4/11/2022</td>
<td>Final Presentations</td>
<td></td>
</tr>
<tr>
<td>week14</td>
<td>4/18/2022</td>
<td>Final Presentations</td>
<td></td>
</tr>
<tr>
<td>week15</td>
<td>4/25/2022</td>
<td>Final Presentations</td>
<td></td>
</tr>
<tr>
<td>week16</td>
<td>5/02/2022</td>
<td>Monday, May 02,2022 – last day of class Final Reports Due Monday, May 02,2022 at 11:00 PM EST</td>
<td>Catchup/overview</td>
</tr>
</tbody>
</table>
Project Ideas:

- Ototoxic drugs
- Auditory nerve and brainstem implants
- Biosonar
- Human echolocation
- Vocal learning
- Flash-beep illusion
- Ventriloquism effect
- Sonification
- Simulating auditory nerve responses
- fMRI data analysis
- EEG data analysis
- Auditory neural plasticity
- Aging
- American Sign Language vs Language

Zoom Link:

Topic: 01:185:413:01

Join Zoom Meeting
https://rutgers.zoom.us/j/99323458903?pwd=REJURUk4bXN2elhmWjBZc0l3cGFkdz09

Join by SIP
99323458903@zoomcrc.com

Meeting ID: 993 2345 8903
Password: 725947
One tap mobile
+16465588656,,99323458903# US (New York)
+13017158592,,99323458903# US (Washington DC)

Join By Phone
- +1 646 558 8656 US (New York)
- +1 301 715 8592 US (Washington DC)
- +1 312 626 6799 US (Chicago)
- +1 669 900 9128 US (San Jose)
- +1 253 215 8782 US (Tacoma)
- +1 346 248 7799 US (Houston)

Meeting ID: 993 2345 8903
Find your local number: https://rutgers.zoom.us/u/acDuP1LDwz

Join by Skype for Business
https://rutgers.zoom.us/skype/99323458903

If you have any questions, please contact the Office of Information Technology Help Desk.