SLHS 588A
Physiological Evaluation of the Auditory System: FALL 2014

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Class Meeting: SpH Sci. Room 409, MW 2:00 to 3:15 pm; Lab: TBD.

Office hours: By appointment

Course Overview: Students will participate in lecture, discussion, and practica regarding the use of otoacoustic emissions and auditory evoked potentials from the cochlea, auditory nerve and brainstem to assess the auditory system in infants, children and adults. Students will learn the theory and technique of auditory brainstem responses (ABR), auditory steady-state evoked responses (ASSR) and electrocochleography (ECoG), as evoked by acoustic and electric stimuli. Students will also learn the theory and technique of evoked otoacoustic emissions in the evaluation of the cochlea and efferent (olivo-cochlear bundle) auditory system. There will be an emphasis on the neurophysiologic bases of auditory evoked potentials and otoacoustic emissions and the way they are applied in the clinic and in research. Understanding the acoustic and pathologic variables that can affect auditory evoked potentials (latency, amplitude, and morphology) and otoacoustic emissions is paramount.

Course Structure: All notes and ancillary materials will be posted on D2L. Material will be discussed in class in the form of structured lectures and discussions. Student discussion will contribute importantly to understanding of various topics. You are expected to participate. Notification: if the instructor believes necessary, students will be warned that some course content may be deemed offensive by some students.

The lab sessions will give participants the opportunity to learn proper technique for obtaining high quality auditory evoked potentials and otoacoustic emissions.

Students will be assessed on the basis of the 3 written assignments/exams and a final examination (4 total). This class must be taken concurrently with the 588L Lab. There will be no written exam for the lab practicum, but there will be writing and practical assignments which must be completed on schedule to receive a passing grade in lab.

Learner Outcomes: As a result of completing the assigned reading, attending lecture and participating in discussion and labs the learner will be able to:

1) Define the principles of signal processing for auditory evoked potentials and OAEs.
2) Determine the amount of amplification, number of averages, filtering requirements and the artifact reject levels needed to obtain the ABR (+ RF Chirp), ASSR, ECoG, TEOAEs and DPOAEs.
3) Define the neural generators of the ABR, ASSR, ECOchG, and of spontaneous and evoked OAE suppression effects.
4) Discuss the stimulus variables that affect the latency and amplitude of ABR, ASSR, ECOchG, and evoked OAEs.
5) Discuss the subject-related variables, including subject state and age, that affect the latency and amplitude of the ABR, ASSR, ECOchG, spontaneous and evoked OAEs.
6) Summarize the effect of hearing loss and nervous system pathology on the ABR, ASSR, ECOchG, spontaneous and evoked OAEs and their suppression.
7) Analyze each of the evoked potentials and OAEs in the time or frequency domain, as appropriate.
8) Analyze, interpret and summarize the results of ABR, ASSR, ECOchG, RF Chirp and evoked OAE tests.
9) Compose/prescribe ABR, ASSR, ECOchG, RF Chirp and OAE test protocols that can be used clinically.
10) Critique the literature pertaining to clinical applications of ABR, ECOchG, ASSR, RF-Chirp & OAE tests.
11) Perform, analyze, interpret and summarize an ABR, ECOchG, ASSR, RF-Chirp and OAE test on a normally-hearing adult.

Weighting of Assignments/Exams
3 Written assignments/exams during the semester = 50 points each.
Final Comprehensive Exam = 100 pts

The written assignments/exams may be given as take-home assignments. At least one week advance notice will be given when this occurs.

Grading Scale:
90%-100% = A
80-89% = B
70-79% = C
>70% Don’t go there...

If you are having difficulty with the material or are concerned about your progress, then PLEASE see me. I’m happy to work with you to find learning methods to reinforce the material. Don’t WAIT!!

Grade Revision: With the exception of the final exam, students have 7 days from the posting of exam scores on D2L to dispute a grade. For the final exam, students will have 2 days from the posting of exam scores on D2L to dispute a grade before the final grades are submitted.

Confidentiality of Student Records: http://www.registrar.arizona.edu/ferpa/default.htm

REQUIRED texts are:

There may be other book chapters and journal articles. These will posted on D2L. You will be responsible for their content.

**Recommended texts: Not required, but may be useful to you...**


**Attendance Policy:** This is a graduate course, you are expected to attend class sessions. If you are unable to attend class, then you must notify the instructors. If you miss class material, then it is your responsibility to obtain the information from your classmates.

- All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion.
- Absences pre-approved by the UA Dean of Students (or Dean’s designee) will be honored

**Classroom Behavior:** Please turn off all cell phones and pagers. If you MUST take a call, please step out of the room.

- Plagiarism within the Student Code of Academic Integrity: [http://deanofstudents.arizona.edu/codeofacademicintegrity](http://deanofstudents.arizona.edu/codeofacademicintegrity)
- Threatening behavior by students: [http://policy.web.arizona.edu/threatening-behavior-students](http://policy.web.arizona.edu/threatening-behavior-students)

**Academic Integrity:** Course participants are expected to adhere to the University Of Arizona Code Of Academic Integrity. Requirements of the code may be found at: [http://deanofstudents.arizona.edu/codeofacademicintegrity](http://deanofstudents.arizona.edu/codeofacademicintegrity)

**Special Needs and Accommodations Statement:** Students who need special accommodation or services should contact the Disability Resources Center, 1224 East Lowell Street, Tucson, AZ 85721, (520) 621-3268, FAX (520) 621-9423, email: uadrc@email.arizona.edu, http://drc.arizona.edu/. You must register and request that the Center or DRC send me official notification of your accommodations needs as soon as possible. Please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact
your ability to fully participate. The need for accommodations must be documented by the appropriate office.

**Subject to Change Statement:** Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.

**Lecture Schedule:** *This schedule is a guideline. Adjustments will likely be made as the semester progresses. If exam times change, you will have at least 1 week’s notice and they will always change to a later time period.*

**Mon 25 August:** Assessment of prior knowledge. Review the syllabus and learning objectives. Brief history of AEP in the study of hearing and clinical audiology.

   Textbook: Chapter 1, Introduction: Past, Present and Potential (Picton)

**Wed 27 August:** Signal Processing I: Bio-electric safety. Principles of signal averaging in the time and frequency domains

   Textbook: Chapter 2 Recording Evoked Potentials: Means to an End (Picton)

**Mon 01 September:** Labor Day, No Class

**Wed 03 September:** Signal Processing II: Filters, amplifiers, artifact reject

   Textbook: Chapter 2 Recording Evoked Potentials: Means to an End (Picton)

**Mon 08 September:** ABR I: Neural Generators, neural substrates

   Textbook: Chapter 4 Finding Sources: Forward and Backward (Picton)

**Wed 10 September:** ABR II: Normal click evoked response, effect of level

   Textbook: Chapter 2 Recording Evoked Potentials: Means to an End (Picton)

   Reading: Handout: Calibration of clicks from Glattke, T.J. Short-latency auditory evoked potentials, AEPs chapter 3 (Durrant and Boston)

**Mon 15 September:** ABR III: Non pathologic variables; gender, aging, montage, rise-time, rate, tone-bursts

   Textbook: Chapter 8 Auditory Brainstem: Peaks Along the Way (Picton)

**Wed 17 September:** ABR IV: Recording ABR to tone bursts

   Textbook: Chapter 8 Auditory Brainstem: Peaks Along the Way (Picton)
**Mon 22 September:** ABR V: Pathology: Effects of conductive and sensory hearing loss.

   Reading: New Handbook of AEPs (Hall) Chapters 7, 10 Handout

**Wed 24 September** ABR VI, Pathology: Effects of neural and retrocochlear disorders.

   Textbook: Chapter 14 Neurotology and Neurology: From Cochlea to Cortex (Picton)

**Mon 29 September:** ABR VII: Effects of Maturation Estimation of thresholds in infants and children, predicting the audiogram with tone evoked responses.

   Textbook: Infant Hearing Assessment: Opening Ears (Picton)

**Wed 01 October:** **Written Assignment Exam I**

**Mon 06 October:** ABR VIII Automatic detection algorithms, Fsp, newborn hearing screening applications, Rising Frequency Chirp.

   Textbook: Chapter 6 Interpreting the Waveforms: Time and Uncertainty (Picton)

**Wed 08 October:** ABR IX: Wrap up with ABR; Bone-conduction responses.

   Handout: ABR Bone Conduction Tests (Cone-Wesson)

**Mon 13 October:** Case Interpretation Discussion


**Wed 15 October:** ASSR I Neural generators, stimulus-response characteristics

   Textbook: Chapter 3 Frequency Domain: Music of the Hemispheres
   Chapter 10 Auditory Steady State Responses and Following Responses: Dancing to the Rhythms (Picton)

**Mon 20 October:** ASSR II Detection algorithms, phase coherence

   Reading: Cone-Wesson and Dimitrjievic (Handout)
**Wed 22 October:** ASSR III Multi-frequency techniques, comparison of methods. Clinical applications

**Mon 27 October:** Review ABR/ASSR

**Wed 29 October** *Written Assignment/Exam II (ABR and ASSRs).*

**Mon 03 November:** ECochG I: Physiology of cochlear potentials: cochlear microphonic, summating potentials, compound action potential. ECOG II: Stimulus-response characteristics, technical variables, effects of hearing loss.

Reading: AEPs Chapter 9 (Schoonhoven)

**Wed 05 November:** ECochG II: Stimulus-response characteristics, technical variables, effects of hearing loss. ECochG III: Effects of hearing loss; ECOG and endolymphatic hydrops

Textbook: Chapter 7 Electrocochleography: From Song to Synapse
Supplemental reading: Hall New Handbook: Chapters 4 and 5

**Mon 10 November:** Electrically Evoked AEPs: ECAP (NRT)

Textbook: Cochlear Implants: Body Electric


**Wed 12 November:** Electrically evoked AEPs: ABR (maybe MLR and CAEP)

**Mon 17 November** OAE I, Origins and potential applications of OAE measurements.
Reading: Robinette and Glattke, 3rd Edition Chapters 1 (Kemp) and 2 (Ryan)

**Wed 19 November** OAE II, SOAEs,

Reading: Robinette and Glattke, 3rd Edition Chapter 3 (Bright), Chapter 7 (Keefe)

**Mon 24 November**: OAE III, TEOAE

Reading: Robinette and Glattke, 3rd Edition, Chapter 4 (Glattke and Robinette), Chapter 9 (Robinette, Cevette & Probst)

**Wed 26 November** OAE IV: DPOAEs,

Reading: Robinette and Glattke, 3rd Edition, Chapter 5 (Lonsbury-Martin and Martin), Chapter 8 (Gorga et al)

**Mon 01 December** OAE V: Suppression of OAEs, OAE VI Differential Diagnosis/Pathology

Reading: Robinette and Glattke, 3rd Edition, Chapter 6 (Velenovsky and Glattke) and Chapter 11 (Hood), Robinette and Glattke, 3rd Edition, Chapter 10 (Durrant and Collet)

**Wed 03 December** **Written Assignment/Exam III (OAEs)**

**Mon 08 December** OAE VII + OAE VIII: Special Populations: Neonates, Children

Reading: Robinette and Glattke, 3rd Edition, Chapter 13 (Prieve) and Chapter 14 (Widen)

**Wed 10 December** Finish up...

**Lab Schedule:**

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<tr>
<th>Date</th>
<th>Week</th>
<th>Description</th>
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<tbody>
<tr>
<td>08/25-27</td>
<td>Week 1</td>
<td>NO LAB</td>
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<tr>
<td>09/01-03</td>
<td>Week 2</td>
<td>ABR Lab I The basics</td>
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<tr>
<td>09/08-10</td>
<td>Week 3</td>
<td>ABR Lab II Stimulus calibration, psychophysics of clicks</td>
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<tr>
<td>09/15-17</td>
<td>Week 4</td>
<td>ABR Lab III Affect of stimulus and recording parameters</td>
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<td>09/22-24</td>
<td>Week 5</td>
<td>ABR Lab IV Tone bursts</td>
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<td>09/29-10/01</td>
<td>Week 6</td>
<td>Lab TBA</td>
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<td>10/06-08</td>
<td>Week 7</td>
<td>ABR Lab V Rising Frequency Chirp, and bone cond. ABR</td>
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<td>10/13-15</td>
<td>Week 8</td>
<td>Lab ASSR</td>
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<td>10/20-22</td>
<td>Week 9</td>
<td>Lab TBA</td>
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<td>10/27-29</td>
<td>Week 10</td>
<td>ECochG Lab</td>
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<td>11/03-05</td>
<td>Week 11</td>
<td>OAE Lab I TEOAE: reading the screen, interpretation</td>
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11/10-12  Week 12 OAE Lab II TEOAE continued
11/17-19  Week 13 TEOAEs Continued
11/24-26  Week 14 OAE Lab III DPOAE
12/01-03  Week 15 No Lab or catch up

Final Exam: Friday, December 12th 1:00 pm - 3:00 pm