Course Syllabus

Electrophysiological Measurements

HESP 630
Fall 2019

Samira Anderson, Au.D., Ph.D.
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Class Meets
Wednesdays
3:30-6pm
LEF 1220

Office Hours
LEF 0119C
By appointment

Prerequisites
HESP 606 and 706

Course Communication
I will send time-sensitive information to students via ELMS announcement. Please contact me via my email address to discuss questions, absences, or accommodations.

Campus Policies
See http://ugst.umd.edu/courserelatedpolicies.html. Topics that are addressed in these various policies include academic integrity, student and instructor conduct, accessibility and accommodations, attendance and excused absences, grades and appeals, and copyright and intellectual property. Please contact the instructor with any questions.

Learning Outcomes

This course covers the clinical use of electrophysiological methods for assessment, diagnosis, and management of individuals who may have peripheral or central hearing loss.

After successfully completing this course you will be able to:

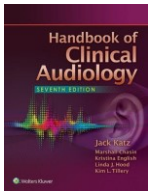
- Describe principles of EEG recording
- Administer and interpret electrophysiological measures (ABR, ECochG, ASSR) to
- Estimate hearing thresholds in infants and other individuals who are difficult-to-test
- Perform differential diagnosis
- Describe applications of FFR, MLR, and LLR in assessment of development, auditory processing, and brain injury
- Describe applications of EEG measurements for evaluation of cochlear implant, hearing aid, and treatment outcomes
- Critically evaluate new research that aims to improve diagnosis and management of auditory disorders

ASHA Certification Standards (KASA)

A1, A2, A3, A9, A10, A13, A14, A18, A24, A25, A26, A29, B1, B2, B3, C1, C2, C5, C6, C8

Required Resources

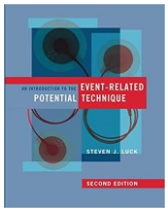
Course website: www.elms.umd.edu



Katz et al. (2015). Handbook of Clinical Audiology, Seventh Edition. Philadelphia: Lippincott Williams & Wilkins

Selected Articles

Recommended Resources



Luck, S. J. (2014). An Introduction to the Event-Related Pot press ential Technique, Second Edition: MIT.

Learning Assessments

On-line Quizzes: Quizzes will cover assigned readings and lecture materials. They will serve as reviews for the midterm and final.

Date Assigned	Topic	Date Due
September 4	Neurophysiology; Instrumentation; Acquisition; Recording	September 11
September 11	Principles of analysis and interpretation; Electrocochleography	September 18
September 18	Differential diagnosis	September 25
September 25	Hearing Threshold Estimation – Tone-burst ABR	October 2
October 16	Auditory Steady-state Response	October 23
October 23	Intraoperative Monitoring	October 30
October 30	CAPD - FFR	November 6
November 13	CAPD – MLR and CAEP	November 20

Article Reviews: Student will choose one article from the syllabus and will prepare and present powerpoint slides that summarize the article's introduction, method, results (review each figure), and discussion.
In addition, students will critique the article, suggest ways to improve the research, and propose a new research question. The presentation should not exceed 15 minutes. A grading rubric will be posted on ELMS.

Date	Student
September 11	
September 18	
October 2	
October 16	
October 23	
October 30	

Guidelines for Practical Lab Exercises & Reports

The lab exercises are designed to help you put into practice the concepts and procedures we cover in class. Handouts outlining instructions for the test procedures and reports can be obtained on ELMS.

Lab Reports

The typed portion of the lab report should be limited to one page or less. Please submit all assignments in electronic format online by midnight on the due date. Although you may consult your textbooks and other resources, including your classmates, as you work on each lab, please make sure your write-up is your own. Three points will automatically be deducted from your lab grade for every day the report is late. The labs will cover the following topics:

Date Assigned	Topic	Date Due
September 4	Recording parameters	September 18
September 11	ECochG	September 25
September 18	Two-channel recording	October 3
September 25	Threshold estimation	October 9
October 16	Auditory steady-state response	October 30
October 30	Frequency-following response	November 13
November 6	Middle latency response	November 20
November 20	Cortical auditory-evoked potential	December 4

Questions/Difficulties

Please contact me as soon as possible if you have difficulties with or questions about a particular lab assignment, so that they can be resolved in plenty of time for you to complete the lab by the due date, and so that you have a better understanding the relevant concepts prior to exams. If there are any equipment problems or malfunctions, the due dates will be extended.

Course Schedule

Date	Topics	Readings
Module 1 – ABR Recording Principles and Neurophysiology		
August 28	Introduction; Overview of electrophysiological measurement; Patient preparation and recording tips; Neurophysiology	1. Katz, Text, Chapter 11 2. http://www.asha.org/policy/KS2003-00020/ 3. AAA Audiology Protocol – Electrophysiologic (EP) Evaluation
September 4	Neurophysiology; Instrumentation; Acquisition; Recording	1. * Parthasarathy, T. K., Borgsmiller, P., & Cohlan, B. (1998). Effects of repetition rate, phase, and frequency on the auditory brainstem response in neonates and adults. *J Am Acad Audiol*, 9(2), 134-140
September 11	Principles of analysis and interpretation Electrocochleography	1. Katz, Text, Chapter 12 2. Gibson, W. P. (2017). The Clinical Uses of Electrocochleography. Frontiers in Neuroscience, 11, 274, 1-8. 3. *Stuermer, K. J., Beutner, D., Streicher, B., Foerst, A., Felsch, M., Lang-Roth, R., et al. (2015). The correlation between ECochG parameters and early auditory behavior after cochlear implantation in children. Int J Audiol, 55(7), 412-418. 4. *Hornibrook, J. 2017. Tone Burst Electrocochleography for the Diagnosis of Clinically Certain Meniere's Disease. Front Neurosci 11, 301.
Module 2 – ABR Clinical Applications		
September 12	Differential diagnosis	1. Katz, Text, Chapter 13 2. *Keesling, D. A., Parker, J. P., & Sanchez, J. T. (2017). A Comparison of Commercially Available Auditory Brainstem Response Stimuli at a Neurodiagnostic Intensity Level. Audiol Res, 7(1), 15-22. 3. *Don, Manuel, Kwong, Betty, & Tanaka, Chiemi. (2012). Interaural stacked auditory brainstem response measures for detecting small unilateral acoustic tumors. Audiol Neurotol, 17(1), 54-68.
September 25	Hearing Threshold Estimation – Tone-burst ABR	1. Katz, Text, Chapter 14 2. Norrix, L.W., Velenovsky, D. 2017. Unraveling the Mystery of Auditory Brainstem Response Corrections: The Need for Universal Standards. J Am Acad Audiol 28, 950-960. 3. * Dzulkarnain, A. et al. (2018). Effects of different electrode configurations on the narrow band level-specific ce-chirp and tone-burst auditory brainstem response at multiple intensity levels and frequencies in subjects with normal hearing. American Journal of Audiology, 1-12. 4. * McCreery, R. W., Kaminski, J., Beauchaine, K., Lenzen, N., Simms, K., & Gorga, M. P. (2015). The impact of degree of hearing loss on auditory brainstem response predictions of behavioral thresholds. Ear and Hearing, 36(3), 309-3019. 5. *Wiegers, J.S., Bielefeld, E.C., Whitelaw, G.M. 2015. Utility of the Vivosonic Integrity auditory brainstem response system as a hearing screening device for difficult-to-test children. Int J Audiol 54, 282-8.
October 2	Pediatric clinical applications; ABR Wrap-up	
October 9	Midterm	
Module 3 – Advanced EEG		
October 16	Auditory Steady-State Response	1. Katz, Text, Chapter 15 2. *Beck, R. M. d. O., Grasel, S. S., Ramos, H. F., Almeida, E. R. d., Tsuji, R. K., Bento, R. F., et al. (2015). Are auditory steady-state responses a good tool prior to pediatric cochlear implantation? International Journal of Pediatric Otorhinolaryngology, 79(8), 1257-1262. 3. *Sininger, Y.S., Hunter, L.L., Hayes, D., Roush, P.A., Uhler, K.M. 2018. Evaluation of Speed and Accuracy of Next-Generation Auditory Steady State Response and Auditory Brainstem Response Audiometry in Children With Normal Hearing and Hearing Loss. Ear Hear 39, 1207-1223
October 23	Intraoperative neurophysiological monitoring	1. Katz, Text, Chapter 16 2. *Attias, J., Nageris, B., Ralph, J., Vajda, J., & Rappaport, Z. H. (2008). Hearing preservation using combined monitoring of extra-tympanic electrocochleography and auditory brainstem responses during acoustic neuroma surgery. International Journal of Audiology, 47(4), 178-184. 3. *Mastronardi, L., Di Scipio, E., Cacciotti, G., Roperto, R. 2018. Vestibular schwannoma and hearing preservation: Usefulness of level specific CE-Chirp ABR monitoring. A retrospective study on 25 cases with preoperative socially useful hearing. Clinical neurology and neurosurgery 165, 108-115.

October 30	Central auditory processing, Part I – cABR/FFR	1. *Rocha-Muniz, C. N., Befi-Lopes, D. M., & Schochat, E. (2014). Sensitivity, specificity and efficiency of speech-evoked ABR. Hearing Research, 317(0), 15-22. 2. *Bonacina, S., Otto-Meyer, S., Krizman, J., White-Schwoch, T., Nicol, T., Kraus, N. 2019. Stable auditory processing underlies phonological awareness in typically developing preschoolers. Brain Lang 197, 104664. 3. Kraus, N., & Anderson, S. (2017). Auditory Processing Disorder: Biological basis and treatment efficacy. In R. R. Fay & A. N. Popper (Eds.), *Translational Research in Audiology and the Hearing Sciences: An Essential Guide for Scientists and Clinicians* (Vol. Springer Handbook of Auditory Research, pp. 299-318). New York: Springer.
November 6	Central auditory processing, Part II – Middle Latency Response	1. Katz Handbook Chapter 17 2. *Weihing, J., Schochat, E., & Musiek, F. (2012). Ear and electrode effects reduce within-group variability in middle latency response amplitude measures. Intl J Audiol, 51(5), 405-412.
November 13	Central auditory processing, Part III – Cortical Auditory-Evoked Potentials	1. Katz Handbook Chapter 18 2. Martin, B. A., Tremblay, K. L., & Korczak, P. (2008). Speech evoked potentials: from the laboratory to the clinic. Ear and Hearing, 29(3), 285-313 3. *Roque, L., Gaskins, C., Gordon-Salant, S., Goupell, M.J., Anderson, S. 2019. Age effects on neural representation and perception of silence duration cues in speech. J Speech Lang Hear Res 62, 1099-1116. 4. *Anderson, S., Chandrasekaran, B., Yi, H.-G., & Kraus, N. (2010). Cortical-evoked potentials reflect speech-in-noise perception in children. Eur Jour Neurosci, 32(8), 1407-1413. 5. *White-Schwoch, T., Anderson, S., Krizman, J., Nicol, T., Kraus, N. 2019. Case studies in neuroscience: Subcortical origins of the frequency-following response. J Neurophysiol.
Module 4 – Advanced EEG Applications		
November 20	Challenging populations: Management of CIs and hearing aids using evoked potentials	1. *Munro, Kevin J, Purdy, Suzanne C, Ahmed, Sadia, Begum, Rushanara, & Dillon, Harvey. (2011). Obligatory cortical auditory evoked potential waveform detection and differentiation using a commercially available clinical system: HEARLab™. Ear Hear*, 32*(6), 782-786. 2. *Cardon, G., & Sharma, A. (2013). Central auditory maturation and behavioral outcome in children with auditory neuropathy spectrum disorder who use cochlear implants. Intl J Audiol (0), 1-10. 3. *Jenkins, K. A., Fodor, C., Presacco, A., & Anderson, S. (2018). Effects of amplification on neural phase locking, amplitude, and latency to a speech syllable. Ear and Hearing, 39(4), 810-824 4. *Karawani, H., Jenkins, K., & Anderson, S. (2018). Restoration of sensory input may improve cognitive and neural function. *Neuropsychologia, 114*, 203-213
December 4	Objective assessment of treatment efficacy; Review for final	1. *Whitton, J.P., Hancock, K.E., Shannon, J.M., Polley, D.B. 2017. Audiomotor Perceptual Training Enhances Speech Intelligibility in Background Noise. Current Biology, 27, 3237-3247.e6. 2. *Anderson, S., White-Schwoch, T., Parbery-Clark, A., & Kraus, N. (2013). Reversal of age-related neural timing delays with training. Proc Natl Acad Sci - USA, 110(11), 4357-4362. 3. *Xie, Z., Reetzke, R., & Chandrasekaran, B. (2018). Taking Attention Away from the Auditory Modality: Context-dependent Effects on Early Sensory Encoding of Speech. Neuroscience, 384, 64-75.
December 11		**Final**

Learning Assessments	#	Points Each	Category Total	Category Weight
Reading Quizzes	8	20	160	22%
Article presentations	1	25	25	4%
Labs	8	25	200	28%
Midterm (125 written, 25 practical)	1	150	150	21%
Final (150 written, 25 practical)	1	175	175	25%
		Total Points:	**710**	

Final Grade Cutoffs										
+	98.00%	+	88.00%	+	78.00%	+	68.00%			
A	94.00%	B	84.00%	C	74.00%	D	64.00%	F	<60.0%	
-	90.00%	-	80.00%	-	70.00%	-	60.00%			

Academic Integrity

It is the responsibility of all students to read and understand the misconduct guidelines of the University of Maryland College Park (https://www.president.umd.edu/administration/policies/section-iii-academic-affairs/iii-100a). Any suspicion of academic dishonestly will result in a report filed with the Student Honor Council. Any of the following acts, when committed by a student, shall constitute academic dishonesty:

- CHEATING: intentionally using or attempting to use unauthorized materials, information, or study aids in any academic exercise.
- FABRICATION: intentional and unauthorized falsification or invention of any information or citation in an academic exercise.
- FACILITATING ACADEMIC DISHONESTY: intentionally or knowingly helping or attempting to help another to violate any provision of this Code.
- PLAGIARISM: intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise.

Special Accommodations

I will make every effort to accommodate students who are registered with the Accessibility and Disability Service (ADS) Office and who provide me with a University of Maryland ADS Accommodation form. Only written ADS documentation of the accommodation will be considered. This form must be presented to me no later than **September 14, 2019**. I am not able to accommodate students who are not registered with ADS or who provide me with documentation which has not been reviewed and approved by the University of Maryland's ADS Office after **September 14, 2019**.

Religious Inclusiveness

It is the policy of the University of Maryland College Park to not schedule exams on religious holidays. If I have accidentally scheduled an exam on a religious holiday that you observe, please let me know no later than **September 14, 2019**. I will reschedule the exam for the entire class to a more appropriate date.

Copyright

Class lectures and other materials are copyrighted and may not be reproduced for anything other than personal use without written permission from the instructor. Lectures, materials, quizzes, and tests may not be sold to other parties.

Campus Emergencies

In the event that the University is closed for an emergency or extended period of time, I will communicate to you via email to indicate schedule adjustments, including rescheduling of examinations and assignments due to inclement weather and campus emergencies. Course requirements, deadlines, and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Official closures and delays are announced on the campus website http://www.umd.edu. The snow phone line is 301-405-7669, and local radio and TV stations may also provide closure information.