CAUD803

Theoretical Bases of Audiology

S1 Day 2016

Dept of Linguistics

Contents

General Information

Unit convenor and teaching staff
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Credit points
4

Prerequisites
Admission to MClinAudiology

Corequisites
CAUD802 and CAUD804 and CAUD819

Co-badged status

Unit description
This unit will: - equip students with the theoretical concepts underpinning audiological assessment techniques and aural rehabilitation strategies. This includes an in-depth review of the anatomy and physiology of the auditory system; - provide core acoustic concepts including the nature of sound and the principles of sound transmission and room acoustics and discuss how these apply to audiometric test environments and equipment calibration; and - facilitate the development of problem-solving and clinical reasoning skills, particularly when audiometric information appears inconsistent.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

To develop an understanding of the auditory system and how it functions and the need

for binaural hearing

To develop an understanding of common disorders of the auditory system and the underlying pathophysiology

To develop an understanding of acoustics, sound transmission and instrument calibration

Assessment Tasks

Name	Weighting	Due
Anatomy & Physiology Quiz	15%	16/03/2015
Acoustics Quiz	15%	26/03/2015
Case-based Assessment	30%	11/05/2015
Exam	40%	Exam period

Anatomy & Physiology Quiz

Due: **16/03/2015**
Weighting: **15%**

This exercise aims to integrate and apply the knowledge of auditory anatomy and physiology that you have acquired throughout lectures A1-4 of this unit.

On successful completion you will be able to:

- To develop an understanding of the auditory system and how it functions and the need for binaural hearing

Acoustics Quiz

Due: **26/03/2015**
Weighting: **15%**

This exercise aims to integrate and apply the knowledge of acoustics that you have acquired throughout lectures B1-4 of this unit.

On successful completion you will be able to:

- To develop an understanding of acoustics, sound transmission and instrument calibration

Case-based Assessment

Due: **11/05/2015**

Weighting: **30%**

This case-based assignment aims to evaluate your understanding of a specific auditory disorder and classroom acoustics in your application to a clinical case. This will be provided on the CAUD803 iLearn website.

On successful completion you will be able to:

- To develop an understanding of common disorders of the auditory system and the underlying pathophysiology

Exam

Due: **Exam period**
Weighting: **40%**

The aim is to integrate and apply the theory learned in this unit.

On successful completion you will be able to:

- To develop an understanding of the auditory system and how it functions and the need for binaural hearing

Delivery and Resources

Recommended Readings

See also e-reserve in the library for electronic versions of many of these articles.

General Acoustics Reference: Note workbook has worked examples.

Speaks, C. E. (1999). Introduction To Sound: Acoustics for the Hearing and Speech Sciences (3rd ed.). Singular.

Speaks, C. E., Harvey, S., Trine, T., & Carney, E. (1999). Course Notes and Workshop for Introduction to Sound (3rd ed.). Singular.

Lectures A1-3:

Hudspeth, A.J. (2000). Hearing. In: E.R. Kandel, J.H. Schwartz, & T.M. Jessell. *Principles of Neural Science.* (pp590-613). New York: McGraw Hill. QP355.2 .P76/2000

Hudspeth, A.J. (2000). Sensory transduction in the ear. In: E.R. Kandel, J.H. Schwartz, & T.M. Jessell. *Principles of Neural Science*. (pp 614-624). New York: McGraw Hill.

QP355.2 .P76/2000

Lecture A4:

Koester J. & Seigelbaum, S.A. (2000). Membrane potential. In: E.R. Kandel, J.H. Schwartz, & T.M. Jessell. *Principles of Neural Science*. (pp 125-139). New York: McGraw Hill.

QP355.2 .P76/2000

Koester J. & Seigelbaum, S.A. (2000). Local signalling: passive electrical properties of the neuron. In: E.R. Kandel, J.H. Schwartz, & T.M. Jessell. *Principles of Neural Science*. (pp 140-149). New York: McGraw Hill.

QP355.2 .P76/2000

Koester J. & Seigelbaum, S.A. (2000). Propagated signalling: the action potential. In: E.R. Kandel, J.H. Schwartz, & T.M. Jessell. *Principles of Neural Science*. (pp 150-170). New York: McGraw Hill.

QP355.2 .P76/2000

Lectures A5-6:

Moller, A.R. (2000). Anatomy of the auditory nervous system. In: A.R. Moller (Ed) *Hearing: Its physiology and pathophysiology.* pps 129-150. California: Academic Press.

Moller, A.R. (2000). *Hearing: Its physiology and pathophysiology.* pps 243-259. California: Academic Press.

Lectures B1-5:

Haughton, P. M. (2002). *Acoustics for audiologists*. San Diego : Academic Press.

RF291 .H38 2002

Speaks, C. E. (1999). *Introduction to sound: Acoustics for the hearing and speech sciences.* (3rd ed.). San Diego: Singular Pub. Group

QC225.15 .S64/1999

Unit Schedule

Stream A: Anatomy & Physiology of the Auditory System (Monday 9am-12pm)

A1. Unit overview / Overview of Outer, Middle & Inner ear: An overview of the auditory pathway with emphasis on the role of localisation in mammals and speech and communication for humans. A discussion of the three functional parts of the ear, focussing on the outer and middle ear and their role in the conduction of sound to the inner ear. In particular, the components of the middle ear, including the tympanic membrane and ossicles and their role in impedance-matching, and the Eustachian tube and its role in pressure equalisation and protection of the middle ear.

Some nice downloadable 3-D Models of the ear, temporal bone, etc.

http://www.masseyeandear.org/research/ent/eaton-peabody/epl-imaging-resources/

A2. Cochlear anatomy / physiology: An overview of the different compartments of the cochlea, an understanding of passive and active cochlear tuning.

A3. Cochlear transduction: A discussion of the role of the outer and inner hair cells in the transduction process and two-tone suppression as a function of normal OHC activity.

A4. Neural function & models of pitch perception: The cellular mechanisms underlying neural

impulses (action potentials) and their subsequent refractory periods. Neural firing and the post-stimulus time histogram (PSTH) and concepts such as phase-locking and forward masking. An overview of concepts such as recruitment, neural tuning curves and the effect of OHC damage. A discussion of the two theories of pitch perception (place, temporal / volley and place-temporal theories) in the cochlea and the physiological mechanisms underlying these.

Basic “Readings” explaining neural transduction and communication: http://outreach.mcb.harvard.edu/animations/synaptic.swf

http://www.bristol.ac.uk/synaptic/basics/basics-0.html

A5. Central pathways / binaural hearing: The role of parallel processing in the auditory pathway with reference to the anatomical pathways and the physiological bases of sound localisation. Differences in the processing of pure tones and speech and the implications of hearing loss upon each.

A6. Disorders of the ear: A discussion of the types of common auditory pathologies, their symptoms and clinical findings.

Stream B: Acoustics (Thursday 9am-12pm)

B1. Nature of sound waves & simple harmonic motion: The nature of sound waves and concepts of simple harmonic motion, including sinusoids, frequency, phase, amplitude and vibration.

Useful link, runs through the basic physics of mechanical motion with equations and pretty animations

http://www.animations.physics.unsw.edu.au/mechanics/introduction.html

This is a second section specifically related to sound and waves and may be useful across the whole lecture series

http://www.animations.physics.unsw.edu.au/waves-sound/introduction.html

B2. Logarithms, sound intensity & sound pressure: Introduction to logarithms & solving logarithm problems with reference to the decibel measurement of sound.

Useful link for converting and checking calculations

http://www.sengpielaudio.com/calculator-soundlevel.htm

B3. Measurement of sound & complex sounds: Phase calculations and the measurement of sound pressure & sound intensity including reference pressures, RMS, peak and peak-to-peak and sound levels from equal and unequal sources. Complex sounds will include Fourier analysis & synthesis, harmonics, summation of sine waves and types of complex waves (sawtooth, square, triangular, white noise, pink noise), waveform and their spectra.

Basic “reading” a refresher on trigonometry

http://www.clarku.edu/~djoyce/trig/

Basic Reading on Power, Intensity and the decibel (many other nice explanations and examples to explore on different pages as well).

http://www.physicsclassroom.com/class/sound/u11l2b.cfm

B4. Resonance, distortion & filtering: Resonance & damping of sounds, sound distortion and filtering using band-pass, low-pass and high-pass filters.

B5. Sound transmission: A discussion of the inverse square law, reflections, standing waves.

B6. Room acoustics: Discussion of how sound behaves in a room and how this can be modified with absorption, reflection & diffusion, clinical and practical applications to Audiology.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

New Assessment Policy in effect from Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/support/student_conduct/

Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students
- Ask a Learning Adviser

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

PG - Discipline Knowledge and Skills

Our postgraduates will be able to demonstrate a significantly enhanced depth and breadth of knowledge, scholarly understanding, and specific subject content knowledge in their chosen fields.

This graduate capability is supported by:

Learning outcomes

- To develop an understanding of the auditory system and how it functions and the need for binaural hearing
- To develop an understanding of common disorders of the auditory system and the underlying pathophysiology
- To develop an understanding of acoustics, sound transmission and instrument calibration

Assessment tasks

- Anatomy & Physiology Quiz

- Acoustics Quiz
- Case-based Assessment
- Exam

PG - Critical, Analytical and Integrative Thinking

Our postgraduates will be capable of utilising and reflecting on prior knowledge and experience, of applying higher level critical thinking skills, and of integrating and synthesising learning and knowledge from a range of sources and environments. A characteristic of this form of thinking is the generation of new, professionally oriented knowledge through personal or group-based critique of practice and theory.

This graduate capability is supported by:

Learning outcomes

- To develop an understanding of the auditory system and how it functions and the need for binaural hearing
- To develop an understanding of common disorders of the auditory system and the underlying pathophysiology
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Assessment tasks

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PG - Research and Problem Solving Capability

Our postgraduates will be capable of systematic enquiry; able to use research skills to create new knowledge that can be applied to real world issues, or contribute to a field of study or practice to enhance society. They will be capable of creative questioning, problem finding and problem solving.

This graduate capability is supported by:

Learning outcomes

- To develop an understanding of the auditory system and how it functions and the need for binaural hearing
- To develop an understanding of common disorders of the auditory system and the underlying pathophysiology
- To develop an understanding of acoustics, sound transmission and instrument

calibration

Assessment tasks

- Anatomy & Physiology Quiz
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- Case-based Assessment
- Exam

PG - Effective Communication

Our postgraduates will be able to communicate effectively and convey their views to different social, cultural, and professional audiences. They will be able to use a variety of technologically supported media to communicate with empathy using a range of written, spoken or visual formats.

This graduate capability is supported by:

Learning outcomes

- To develop an understanding of the auditory system and how it functions and the need for binaural hearing
- To develop an understanding of common disorders of the auditory system and the underlying pathophysiology
- To develop an understanding of acoustics, sound transmission and instrument calibration

Assessment tasks

- Case-based Assessment
- Exam