



# CAUD803

## Theoretical Bases of Audiology

S1 Day 2015

*Dept of Linguistics*

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## General Information

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Credit points

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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
<a href="#">Anatomy &amp; Physiology Quiz</a>	15%	16/03/2015
<a href="#">Acoustics Quiz</a>	15%	26/03/2015
<a href="#">Case-based Assessment</a>	30%	11/05/2015
<a href="#">Exam</a>	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*. (3<sup>rd</sup> 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/u1112b.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](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

Assessment Policy <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy <http://mq.edu.au/policy/docs/grading/policy.html>

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

Grievance Management Policy [http://mq.edu.au/policy/docs/grievance\\_management/policy.html](http://mq.edu.au/policy/docs/grievance_management/policy.html)

Disruption to Studies Policy [http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](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/](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](http://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](http://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](http://ask.mq.edu.au)

## IT Help

For help with University computer systems and technology, visit <http://informatics.mq.edu.au/help/>.

When using the University's IT, you must adhere to the [Acceptable Use 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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- Exam

## **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
- Acoustics Quiz
- 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