

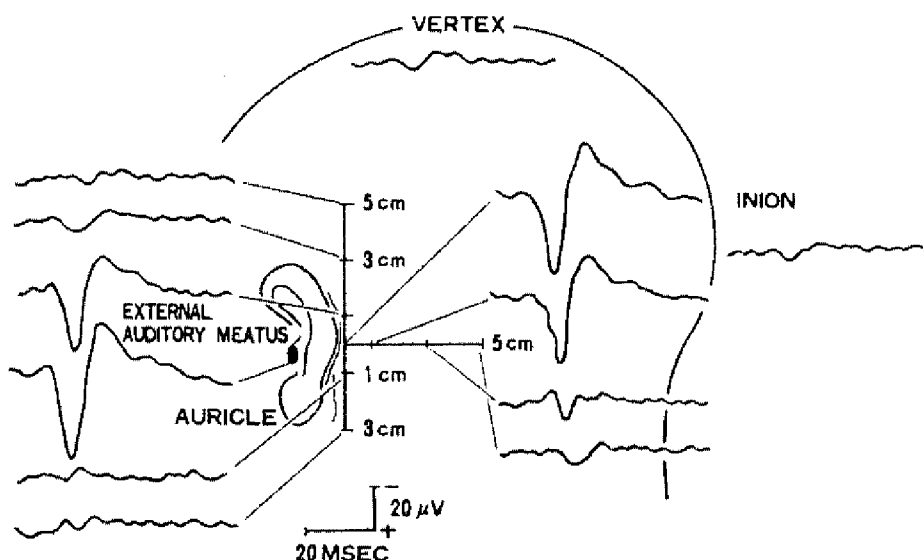
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STUDENT NUMBER: _____



*The University of Western Australia
Master of Clinical Audiology*

AUDIOLOGY IN THE FACULTY OF MEDICINE & DENTISTRY



EVOKED RESPONSES IN CLINICAL DIAGNOSIS 514 SECOND SEMESTER NOVEMBER 2001

This paper is a three hour examination and contains three sections.

Section A is a multiple choice question section of 20 questions (total time 30 minutes)

Section B is a short answer section with 6 questions (total time 50 minutes)

Section C is an essay section requiring 4 out of 5 essays (total time 100 minutes)

Marks are allocated pro rata (e.g. the essay section is worth 100/180th of the exam mark).

Answer sections A & B on this paper.

Answer Section C with one essay per answer book.

You have 10 minutes of reading time.

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PART A MULTIPLE CHOICE SECTION (about 30 minutes)

Clearly CIRCLE the most correct response.

There should be only one response for each question.

Marks will be corrected for incorrect responses (1/5th mark deducted for a wrong response)

1. With a stimulus of fixed intensity, a person with a conductive hearing loss would
 - a. show little or no change in response amplitude relative to normal
 - b. show little or no change in response latency relative to normal
 - c. demonstrate pronounced recruitment relative to normal
 - d. show a change in amplitude and latency relative to normal
 - e. none of the above

2. With the steady state evoked potential response, or SSEP, the response
 - a. is produced by a pure tone stimulus of about 90Hz
 - b. is produced by repetitive clicks which are of alternating polarity
 - c. is determined by the phase of the stimulus relative to the trigger pulse
 - d. is evoked by an amplitude modulated tone where the carrier frequency is changed
 - e. is a muscle response from the muscles overlying the temporal cortex.

3. With the steady state evoked potentials or SSEPs, the response
 - a. has a phase relative to the stimulus that is analogous to the latency of the AMLR
 - b. is derived from the occipital cortex overlying the dura
 - c. has the advantage that amplitude does not vary significantly with hearing loss
 - d. is only steady if the electrical stimulus is an amplitude modulated tone
 - e. is best recorded with prolonged pure tones

4. Otoacoustic emissions are
 - a. not affected by conductive losses, but only by changes to outer hair cells
 - b. generated by rapid firing of action potentials which cause hair cells to contract
 - c. altered usually by sound in the contralateral ear, due to a crossed neural reflex
 - d. delayed by the synaptic delay typical of all neurones
 - e.

6. The Kemp echo
 - a. can be evoked by repetitive clicks and tone bursts
 - b. is slightly different from the TEOAE in amplitude and phase
 - c. is best obtained with clicks of alternating polarity
 - d. is unaffected by middle ear pressure
 - e. is unaffected by efferent neurones

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7. Auditory neuropathy is characterised by
 - a. a degeneration of the auditory nerve trunk or eighth nerve
 - b. a fluctuating hearing loss and pronounced recruitment
 - c. changes in SOAEs and DPOAEs, but not TEOAEs
 - d. is associated with normal OAEs but recruitment
 - e. none of the above

8. The ABR and BAER are similar in many respects, except for
 - a. the latency of peak III, which is smaller and more delayed in the BAER
 - b. the neural origin of each: one is from the AVCN while the other is from the DCN
 - c. the difference in amplitude, which is why the ABR is preferred in neonatal screening
 - d. the loss of synchrony in the BAER at low frequencies reduces its use in screening
 - e. none of the above.

9. DPOAEs are evoked using stimuli that are
 - a. pure tones with a fixed frequency ratio
 - b. AM tones with a fixed modulation frequency
 - c. phase locked using tone gates
 - d. two tones of difference frequency presented alternatively in rapid succession
 - e. none of the above

10. When a DPOAE is described as f_2-f_1 or $2f_1-f_2$, we mean that the two tones
 - a. are subtracted simply (f_2-f_1) or in a more complex way ($2f_1-f_2$) before presentation
 - b. produce intermodulation distortion within the inner ear at these frequencies
 - c. should be tested in that order for maximal efficiency in testing
 - d. f_1 and f_2 produce acoustic intermodulation at these frequencies
 - e. are higher or lower than the primary frequencies f_1+f_2 and f_2-f_1 .

11. The cubic and quadratic distortion tones are
 - a. other terms for the cubic and simple difference combination tones
 - b. are easily removed with filtering and averaging before interpretation of OAEs
 - c. can be generated by the equipment as well as the ear
 - d. a and b
 - e. a and c

12. DPOAEs are commonly
 - a. absent in healthy ears, just like the acoustic reflex
 - b. are insensitive to the endocochlear potential because the hair cells are unaffected
 - c. typically about 30dB to 40dB below the primary tone levels in a good ear
 - d. evoked using repetitive clicks at about 21/s
 - e. none of the above

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13. EMG interference
 - a. is a neural response from the mesoderm
 - b. always asynchronous and removed by averaging
 - c. easily removed by filtering without altering the response
 - d. the origin of the PAMR behind the ear
 - e. is conducted across the whole skin surface equally

14. ENG
 - a. is derived from muscle electrical activity
 - b. is enhanced easily by averaging
 - c. includes the vestibulo-ocular reflex but not saccadic activity
 - d. best measured between the two pinnae
 - e. requires post measurement analysis to allow differential diagnosis

15. Caloric irrigation
 - a. clears toxins from the body if performed regularly
 - b. evokes a bilateral eye response to test the vestibulo-ocular reflex
 - c. fortunately does not involve a crossed reflex
 - d. is often confused with optokinetic nystagmus
 - e. is unnecessary if a Barany chair is available

16. Vestibular asymmetry and directional preponderance
 - a. are two names for the same abnormal trace
 - b. can be indicators of peripheral and central lesions
 - c. can be derived from responses evoked by a Barany chair
 - d. should read 'vestibular preponderance' and 'directional asymmetry'
 - e. indicate a malformation of the labyrinth on one side and its symptom

17. The PAMR
 - a. requires sound presented to both ears simultaneously
 - b. is only evoked on one side by sound on the other
 - c. is an example of a vestibulo-spinal reflex
 - d. is unaffected by a hearing loss
 - e. is an example of synchronous electromyography

18. The amplitude and latency of the auditory brainstem response
 - a. are altered by a hearing loss
 - b. are altered by attention state
 - c. are a test of central lesions but not peripheral lesions
 - d. both a and b
 - e. both a and c

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19. The electrically evoked somatosensory response
- a. involves muscle spindles and alpha-gamma coactivation
 - b. involves neural conduction velocity and synaptic delay
 - c. is a single fibre response, unlike the PAMR or ABR
 - d. is quite unlike the PAMR or the tendon tap response
 - e. bypasses synaptic events
 - f. is of educational worth, but is now replaced clinically by MRI
20. Which of the following is correct?
- a. Evoked response averaging is a cruel system of punishment for young students
 - b. It would be better if academics were attached to electrodes plugged into the mains
 - c. I have been convinced never to consider neurology as a career option
 - d. I am not stupid enough to answer questions like this without consulting a lawyer
 - e. All of the above

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PART B SHORT ANSWER SECTION (about 10 minutes per short answer)

(a) A reflex muscle response can be elicited by stimulating the sensory afferent neurones: for example in the usual tendon hammer reflex test. Similar reflexes can be stimulated by electrically stimulating the sensory neurones. Briefly explain which aspects of a neural reflex arc determine to the latency of the muscle response.

(b). Briefly explain how cochlear hearing loss and recruitment due to outer hair cell impairment would appear in responses of the brainstem auditory evoked response.

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(c) Briefly describe the measurement procedure for used to measure the post-auricular muscle response produced by a brief acoustic click. How can the PAMR be used clinically?

(d) Briefly describe the measurement procedures for assessing nystagmus using electrophysiological techniques (ENG), and explain the role of EMG and caloric irrigation in this procedure. Also explain briefly the significance of directional preponderance and vestibular asymmetry.

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(e). Briefly explain the saccular evoked response, including the stimuli used, the response waveform, and the use of the response diagnostically.

(f). Briefly explain how electrode positioning affects the magnitude of a response peak in evoked response averaging. You should mention at least the relative position of the differential pair and the location and nature of the cell generators of the evoked response.

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PART C ESSAY SECTION

Write essays on FOUR of the five topics (about 30 minutes per essay).

1. An elderly woman with osteoporosis is experiencing problems in lifting her arm after surgery to replace a shoulder joint damaged in a fall. The exercise physiotherapists at the hospital suspect that she has a problem with control of the muscles of her shoulder and back. Describe the type of somatosensory evoked response test that would be performed to assay the function of the motor neurones controlling these muscles. You should address the issues of the type and placement of the stimulation and recording electrodes, the types of stimulation used, the types of responses expected, and the analysis that should be performed on these recordings.
2. A commercial jet aircraft has had problems with rapid loss of cabin pressure, dropping from 32,000 feet to 10,000 feet rapidly. Eight passengers have been admitted to hospital with vertigo, hearing loss and tinnitus, and are suspected of having vestibular problems due to barotrauma. Some have clear signs of nystagmus. Explain the objective tests a neurologist might perform to determine whether there is vestibular involvement. Explain the measurement procedures, and the theoretical basis for these tests, whether each test can distinguish between unilateral or bilateral problems, whether the test can identify which component of the vestibular apparatus is affected, and whether the problem is central or peripheral.
3. Auditory brainstem evoked responses (ABR or BAER) are used for neonatal hearing screening, and for differential diagnosis of hearing disorders. Describe the normal BAER responses (waveforms), including the waveshape and latencies of the response peaks, and explain how these components of the BAER can be used in differential diagnosis of the auditory system. For example, what is the significance of response amplitude and latency, and how do changes in the waveform help in differential diagnosis.
4. Describe the auditory middle latency response (its waveform and behaviour) and the procedures used to record it, including the required electrode placement, recording bandwidth, and likely number of averages required. What is the relationship between the AMLR, the PAMR and SSEPs, and how can the AMLR used for audiological diagnosis?
5. Describe the various otoacoustic emissions that can be measured, and the recording techniques used to obtain them. What is their origin within the auditory system, what pathologies affect them, and what is their clinical diagnostic value?