

**OTOACOUSTIC EMISSIONS  
AND  
ELECTRONYSTAGMOGRAPHY**

**ASLP 618**

**David L. McPherson, Ph.D.**  
**378-6458 (office)**  
**375-9166 (home)**



## **OTOACOUSTIC EMISSIONS AND ELECTRONYSTAGMOGRAPHY**

### **Educational Psychology 618**

**Winter 1998**

1:00 p.m. – 3:50 p.m.

MW

106 TLRB

**David L. McPherson, Ph.D.<sup>1</sup>**

**378-6458 (office)**

**375-9166 (home)**

**Course Description:** This three credit course is required of all graduate students in Audiology and is the second in a two series course on electrophysiological assessments of the auditory and vestibular systems. The knowledge and skills presented in this course are necessary in order to be competitive in the job market and are basic to the practice of audiology in a non-school environment, and for those in school environments represent the standard of practice in the community. The material presented in this course is required for passing the national examination and certification by the American Speech-Language-Hearing Association (ASHA).

This course presents both basic and applied neurophysiology and electrophysiology of the auditory, vestibular, and related systems. As the second of a two series course the student will be required to gain a theoretical knowledge of the normal and pathophysiology of the auditory system and how the nervous system responds to acoustic and vestibular stimuli, including its ontogeny. The student will develop applied skills in the use of biophysical measurements for hearing assessment of the auditory and vestibular systems.

#### **Course Objectives**

- A. To develop a theoretical and practical knowledge of the neurophysiology of the auditory and the vestibular systems.
- B. To become proficient in the administration of evoked otoacoustic and vestibular measures of hearing and balance.
- C. To understand the normal and pathophysiology of the auditory and vestibular system, and their relation to audition, balance, and medical management.
- D. To understand the importance of continued reading of professional journals and develop critical thinking in the area of auditory and vestibular neurophysiology.

#### **Textbooks**

1. Jacobson, G.P., Newman, C.W., Kartush, J.M. Handbook of Balance Function Testing. Baltimore: Mosby Year Book, 1993. [Required text. It is highly recommended that this text be purchased and kept for future reference].
2. Robinette, M.S. & Glatke, T.J. Otoacoustic Emissions: Clinical Applications. New York: Thieme, 1997. [Required text. It is highly recommended that this text be purchased and kept for future reference].
3. Stockwell, C.W. ENG Workbook. Texas: Pro-Ed, Inc., 1983. [Required text]
4. Katz, J. (ed.). Handbook of Clinical Audiology (Third edition). Baltimore: William & Wilkins, 1985. (Although not required, assignments will be made from this book. This is an excellent resource book and should be part of the professional's library.)

Order forms for the textbook are located at the end of the syllabus. The textbooks are NOT available through the bookstore.

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<sup>1</sup>Office hours by appointment only.

### **Special Needs**

Students that are registered with the Services for Students with Disabilities or the Counseling and Development Center may receive special considerations in the timing and execution of assigned class work or examinations, but may not receive special consideration in completing class assignments or grading. That is, competency will be expected at the level this course is taught, but special considerations may be given as to the implementation and timing of the coursework. Any considerations must be discussed with the professor by the end of the fourth class period.

### **Archiving of Student Work**

All materials not claimed by the end of the fourth week of the term following this class will be destroyed. After that date it will not be possible to contest scores or grades. The instructor reserves the right to fully review all contested material and adjust scores accordingly.

### **Honor Code**

The Honor Code is part of the course requirements and is also a matter of personal commitment of the instructor.

“Brigham Young University exists to provide a university education in an atmosphere consistent with the ideals and principles of The Church of Jesus Christ of Latter-day Saints. This atmosphere is preserved through commitment to conduct that reflects those ideals and principles.” [Undergraduate Catalog, Brigham Young University, 1996-97]

### **Devotionals**

Brigham Young University provides devotionals and forums throughout the year on most Tuesdays from 11:00 am to 11:50 am. On days that these enriching experiences are provided the instructor is not available nor should any of the facilities be used as part of this course during that time period.

## **COURSE REQUIREMENTS<sup>2</sup>**

**Examinations:** There will be a final examination worth 40% of your grade and a mid term examination worth 28% of your final grade. Each of the examinations will consist of a practical as well as a closed book examination. Grading is based on not only accuracy of the response, but the clarity and logic in which it is presented. Additional points on each question may be awarded for exceptional answers without penalizing other students. Students are encouraged to meet with the instructor following each examination to discuss the examination. Examinations are given **ONLY** on the schedule day and times. Make-up examinations are not given. The student has four class periods to contest scores or grades from the date the examination is first returned to the class. The instructor reserves the right to fully review all contested material and adjust scores accordingly.

**Quizzes:** There will be four quizzes throughout the term. Quizzes are given **ONLY** on the schedule day and times. Make-up quizzes are not given. The student has four class periods to contest scores or grades from the date the quiz is first returned to the class. The instructor reserves the right to fully review all contested material and adjust scores accordingly.

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<sup>2</sup>All assignments must be typewritten unless otherwise noted. If computer generated an easily readable font must be used. Originals and copies must be clear with dark print.

**Laboratory Assignments:** There will be six laboratory assignments. A cover sheet is included in the back of the syllabus for each laboratory assignment. Laboratory assignments are to be stapled. Do not submit in folders etc.

Lab no.	Topic	Due (Class no.)
1	Calibration & Eyemovement	4
2	Optokinetic Testing	6
3	Gaze & Positional Testing	9
4	Caloric Testing	11
5	Rotary Chair Evaluation	13
6	Otoacoustic Emissions	15

**Class Preparation:** Although a class role is not usually obtained on a routine basis, students will be called upon from time-to-time to participate. Those students that are absent or unprepared will be penalized by 1 point for each occurrence.

**Style:** Student name, date, course identification and assignment (including assignment number) must be included on all materials (see appendices for examples and preferred style). Assignments not correctly identified will not be accepted.

**Extra Credit:** In some instances extra credit may be given, at the discretion of the instructor, for participating in projects, attending seminars or other professional experiences.

**Late Assignments:** All assignments are due by 1:15 am on the day of the class. Late assignments will be accepted up to and including five days from time of assignment and not later than 5:00 p.m. of the fifth day. A 50% penalty may be assessed on late assignments.

<sup>3</sup>**Grading Standard:** Each of the above areas is weighted for a total of 100 points. The distribution is accordingly:

Final examination	40 pts
Written (2 pts)	
Practical (20 pts)	
Mid term Examination	28
Written (15 pts)	
Practical (13 pts)	
Four Quizzes (5 pts each)	20
Six laboratory assignments (2 pts each)	12 pts
TOTAL	100 pts

A	95-100 pts	C+	78-80 pts
A-	90-94 pts	C	75-77 pts
B+	87-89 pts	C-	70-74 pts
B	84-86 pts	D	65-69 pts
B-	81-83 pts	E	64 & below

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<sup>3</sup>CHEATING AND/OR PLAGERISM RESULTS IN CLASS FAILURE, at instructor's option.

## COURSE SCHEDULE AND OUTLINE ASLP 618

Class Number	Date of Class	Lecture topic	Assignments <sup>4</sup>	Comments
1	Jan 5	Orientation to Laboratory Lecture: Physiology of the Vestibular	Jacobson et al., Chpt 2& 3	
2	Jan 12	Lecture: VOR and Electro-oculography Lecture: Ocular motility evaluations. Lecture: Video tape of ENG testing Lab: Patient preparation and electrode placement. Lab: Demonstration of eyemovement and motor responses I. a: Calibration b: Saccade Testing. c: Smooth Pursuit Testing.	Jacobson et al., Chpt 4 Jacobson et al., Chpt 5	
3	Jan 19	Lecture: Interpretation of ocular motility evaluations. Lab : Demonstration of eyemovement and motor responses II. a: Optokinetic Testing. b: Gaze (fixation) testing	Jacobson et al., Chpt 6	
4	Jan 26	Lecture: Positional and Positioning Evaluation. Lab: Demonstration of positional and positioning evaluation.	Jacobson et al., Chpt 7	Quiz 1 (Class nos. 1,2,3) Lab assignment 1 due
5	Feb 2	Lecture: Caloric Evaluation.	Jacobson et al., Chpt 8	
6	Feb 9	Lab: Demonstration of caloric evaluation.		Lab assignment 2 due PART I: MID TERM EXAMINATION distributed in class
7	Feb 17 (Tuesday)	PART II: WRITTEN MID TERM EXAMINATION in class		Instructor out of town. PART II: WRITTEN MID TERM in class
8	Feb 23	Lab: The complete ENG evaluation. Lecture: Interpretation of ENG	Jacobson et al., Chpt 9	
9	Mar 2	Lecture: Rotational Testing Lab: Orientation to equipment and patient preparation	Jacobson et al., Chpt 10	Quiz 2 (class nos.5,8) Lab assignment 3 due
10	Mar 9	Lab: Rotational Testing Lecture: Interpretation of Rotational Testing.	Jacobson et al., Chpt 11	
11	Mar 16	Laboratory: The complete Vestibular Evaluation I.		Lab assignment 4 due
12	Mar 23	Lecture: The complete Vestibular Evaluation: Interpretation and Reporting.		Quiz 3 (class nos. 9,10)

<sup>4</sup>Reading assignments are to be completed prior to the beginning of the class period.

**COURSE SCHEDULE AND OUTLINE cont'd**  
**ASLP 618**

<b>Class Number</b>	<b>Date of Class</b>	<b>Lecture topic</b>	<b>Assignments<sup>5</sup></b>	<b>Comments</b>
<b>13</b>	<b>Mar 30</b>	Lecture: Introduction to OAE Lecture: Neurophysiology of Otoacoustic Emissions. Lab: Oreintation to OAE equipment	Robinette&Glatke, Chpts 13,14,1,2.	Lab assignment 5 due.
<b>14</b>	<b>Apr 6</b>	Lecture: SOAEs, TOAEs, and DPOAEs. Lab: SOAEs, TOAEs, and DPOAEs.	Robinette&Glatke, Chpts 3,4,5.	PART I: PRACTICAL PORTION OF THE FINAL DISTRIBUTED. Quiz 4 (class nos. 11, 12,13)
<b>15</b>	<b>Apr 13</b>	Lecture: Ipsilateral suppression of TOAEs. Lecture: Clinical Use of OAEs. Lab: Iplilateral suppression of OAEs.	Robinette&Glatke, Chpts 6,7,8,9,10,11,12.	Lab assignment 6 due
	<b>Apr 20</b>	FINAL EXAMINATION	3:00pm-6:00pm 106 TLRB	Written and Practical final examinations due at 6:00 p.m..

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<sup>5</sup>Reading assignments are to be completed prior to the beginning of the class period.

## SAMPLE ESSAY EXAM QUESTION

**Blue books, using double spacing, are to be used in all examinations except for 'take home' examinations which are to be typewritten, double spaced.**

*(Student name)*

*(Course)*

*(Date)*

Exam question: Describe and characterize the measures used in the auditory brainstem evoked potential recording and their relationship to stimulus intensity.

Response: The auditory brainstem evoked potential may be described as a biphasic waveform with quantitative properties of amplitude and latency. In addition a qualitative feature may be described in terms of its morphology.

Amplitude may either be described in voltage, usually microvolts, from the baseline to corresponding peak, or from positive peak to corresponding negative peak. As stimulus intensity increase, the amplitude of the response increases. The converse is also true. The first amplitude changes from baseline, in ideal recording conditions, may be seen as early as 10 dB above behavioral threshold for the stimulus; especially sharply rising (i.e. clicks) stimuli.

Latency is defined as the time, in milliseconds, from the onset of the stimulus to a peak. For consistency, wave V, which may be broad, is defined as the breaking point, or departure point, from the linear descending slope. Latency decreases as stimulus intensity increases. The converse is also true.

It should be noted that there is a point where both amplitude and latency asymptote.

In formulating this question one point is awarded for each correct identification and discussion of the pertinent areas:

1. Description of amplitude
2. Description of latency
3. Description of morphology
4. Use of microvolts
5. Use of milliseconds
6. Relationship of amplitude to intensity
7. Relationship of latency to intensity
8. Statement of how amplitude is measured
9. Statement of how latency is measured
10. Relationship of amplitude and latency to morphological features

It should be noted that areas 1, 2, 4, 5, 6, 7 and 8 were covered providing 7 points for this answer. However additional discussion in some areas were significant enough that extra points were awarded:

1. Acknowledging that the response is biphasic.
2. Amplitude may be measured using one of two references.
3. Amplitude of a wave may first appear at about 10 dB SL.

Consequently, an additional three points are awarded for this question providing a total of 10 points. Such additional points are solely at the discretion of the instructor. Since a grading curve is not used, other students are not penalized.

**Study Questions**  
**OTOACOUSTIC EMISSIONS AND ELECTRONYSTAGMOGRAPHY**  
**Educational Psychology 618**

Jacobson, G.P., Newman, C.W., Kartush, J.M. Handbook of Balance Function Testing. Baltimore: MosbyYear Book, 1993.

The study questions are based upon your reading assignment and concepts that are necessary to the understanding of the reading. In some cases you may need to refer to other sources for definition or understanding of the concepts. The intent, however, is to clarify your reading and understanding of the topic.

**Chapter 1**

1. What is the difference between ocular motor testing and balance testing ?

**Chapter 2**

1. What is the role of the vestibular system?
2. What is meant by *orientation*?
3. How is gaze stabilization achieved?
4. What is meant by *synergistic* activity?
5. What is meant by *antagonistic* activity?
6. The vestibular mechanism has been described in terms of control theory (i.e., control systems).
7. Schematically diagram the control mechanism (see Figure 2-1).
8. What is the VOR and why is it important as an adaptive mechanism?
9. What are the four basic elements of the vestibular reflex?
10. Diagram, schematically (see Figure 2-2) and discuss the VOR to clockwise rotation. Remember that for counter clockwise rotation that system works the same, but using opposite systems.
11. What is conjugate pairs, or conjugate eyemovement?
12. What is disconjugate eyemovement?
13. What is meant by the following "The control of motor responses by the labyrinth is a two-way process with each [labyrinth] having two modes of action...?"
14. What are the three major functional roles of the vestibular reflexes and what part of the sensory system are the primary 'control' or 'reflex'?
15. Why is isolating various parts of the vestibular system not a sufficient means of evaluating the vestibular system?
16. Why is it possible to evaluate the VOR through the measurement of eyemovement?
17. What is *cupulometry* and why is it not used in clinical evaluation of the vestibular system?
18. Discuss the differences (or similarities) between motion, velocity and accelerations. Identify which the vestibular sense organs measure.
19. What are the four parts of the temporal bone and which part 'houses' the vestibular portion?
20. What nerves are generally affected by lesions of the internal auditory canal?
21. Within what labyrinth do the auditory and vestibular sensory organs contained?
22. What are, and where do, the labyrinthine fluids reside?
23. What is the supposed mechanism of Meniere's disease?
24. Draw and label the major features of the inner ear, detailing the vestibular system and only showing the three ducts of the cochlear system (see Fig 2-8).
25. What is the basic sensory unit that transduces the mechanical action of the vestibular system into the nerve action potential?
26. Diagram, label and describe the various types of hair cells in the vestibular system.
27. Describe the 'adequate' stimulus for hair cell transduction and how the activation of the hair cell occurs, including differences based upon the type of stimulation (or direction).
28. Explain hair cell transduction.
29. Explain the general theory of hair cell displacement in the vestibular system (i.e., this would not be specific differences, but the overall theory).
30. What functional differences do the hair cells of the macula and cristae exhibit?

31. What is the relationship between the direction of angular flow, the relative endolymphatic flow and cupular displacement ?
32. Define *orthogonal*.
33. What is the functional organization and basis of the semicircular canals and how are the afferent nerve fibers stimulated.
34. Describe, briefly and qualitatively, the pendulum model of vestibular function.
35. What is the relationship between stimulus velocity and cupular deviation as a function the low frequency and high frequency time constants?
36. What is the phase relationship between stimulus and response as a function of frequency?
37. What two sets of neurons comprise the vestibular portion of the 8th cranial nerve?
38. Nerve cells innervating the crista and the macula form what branch of what nerve?
39. What is a  $\mu\text{m}$ .
40. Discuss the differences in the size of fibers and the hair cells they innervate (including type of hair cells). Relative sizes are sufficient.
41. What occurs in the cristae during prolonged angular acceleration?
42. Why would adaptation not be predicted by the pendulum model?
43. Explain the relationship between head acceleration and gravitational pull on the response of the macula.
44. Why does displacement of the macula cause opposing activity on the hair cells of the macula?
45. Why is the macula multidirectionally sensitive?
46. What is the difference between the adequate stimulus for the utricle macula and the saccule macula?
47. What is the difference between regular and irregular firing afferent neurons?
48. What is the input to the vestibular nuclei?
49. What is the difference between type I and type II secondary neurons?
50. During head rotation, describe the function and relationship between type I and type II secondary neurons.
51. Diagram and discuss the VOR (see Figure 2-19).
52. Name the six extraocular muscles and describe how they interact with each other.
53. Name the nerves that innervate each of the extraocular muscles.
54. Briefly describe how the vestibulo-ocular pathway performs a spatial transformation (i.e., the need since the semicircular canals are not aligned).
55. What problem does the lack of exact alignment of the semicircular canals have on eyemovement and how does the vestibulo-ocular pathway compensate for this?
56. Why are the otolith-oculomotor connections less well defined than those from the semicircular canals?
57. What is meant by a compensatory eyemovement?
58. What is the 'natural stimulus' for the semicircular canals?
59. Define nystagmus.
60. What is an EBN as it relates to rapid eyemovement and what is the origin of the EBN for rapid eyemovement?
61. What, if any, are the differences between the firing rates of oculomotor neurons produced by visual versus vestibular stimuli?
62. Explain the relationship between the firing rate of the oculomotor neurons and eyemovement, both in terms of movement and stationary position.
63. What three receptor systems are responsible in ocular stabilization?
64. What is meant by compensatory eyemovement?
65. What is a saccade?
66. What is an agonistic muscles?
67. What is an antagonistic muscle?
68. During neck movement, what happens to the extra ocular muscles during compensatory eyemovement?
69. What evidence is there to show that the vestibular nuclei is the major center for vestibular-visual interaction?
70. What is the *smooth pursuit* system?
71. What is the *optokinetic* system?
72. What is the 'best' movement of the stimuli to produce optokinetic nystagmus?

73. What is an 'afoveate animal'?
74. What is a 'foveate' animal?
75. What is the function of outflow of electrical activity from the cerebellum on the vestibular nuclei?
76. What is the apparent function of the nucleus of the optic tract?
77. What pathway does the 'smooth pursuit' system depend on?
78. What are the apparent effects of lesions of the parieto-temporal cortex and the dorsal-pontine nucleus have?
79. What is an 'effector' organ?
80. Discuss the similarities and differences in the ocular vestibular reflex and the spinal vestibular reflex.
81. What are the effector organs for the vestibulo-ocular reflexes?
82. What are the effector organs for the vestibulospinal reflexes?
83. What does this statement mean: "Comparable push-pull mechanisms exist for controlling the balance between the extensor and flexor skeletal muscles as for eye muscles"?
84. What is an 'extensor'?
85. What is an 'abductor'?
86. What is an 'agonist' muscle?
87. What is an 'antagonist' muscle?
88. What are the three major pathways of the vestibulospinal pathway?
89. What portion of the spinal cord 'houses' the vestibulospinal pathway?
90. Which of the three tracts of the vestibulospinal pathway arise from the vestibular nuclei?
91. Which of the three tracts of the vestibulospinal pathway arise from the reticular formation?
92. What is meant by a 'somatotopic' pattern?
93. What is the origin of the fibers within the lateral vestibulospinal tract?
94. What may account for the bilateral effects seen in stimulation of the lateral vestibular nucleus?
95. What are the origins of the fibers of the lateral vestibulospinal tract?
96. What are the origins of the fibers of the medial vestibulospinal tract?
97. What are the origins of the fibers of the reticulospinal tract?
98. What is a primary nerve fiber?
99. What is a secondary nerve fiber?
100. What is an *otolith* unit?
101. What is an *alpha* neuron?
102. What is a *beta* neuron?
103. What is a *gamma* neuron?
104. What is a *delta* neuron?
105. What is a *primary or first-order otolith unit*?
106. What is a *second-order otolith unit*?

### **Chapter 3**

1. Why does is knowledge of eyemovement (i.e., the physiology and anatomy) important in ENG?
2. What is *conjugate* eyemovement and what is its importance?
3. Explain, in detail, *saccades*.
4. If saccadic movement is abnormal what might that suggest?
5. Explain, in detail, *smooth pursuit*.
6. What is the goal of the smooth pursuit system?
7. Explain, in detail, *vestibular eyemovement*
8. Explain, in detail, *optokinetic nystagmus*.
9. Explain, in detail, *Fixation*.
10. Explain, in detail, *disjunctive eyemovement*.
11. Explain, in detail, *vergence*
12. Explain, in detail, *Hering's Law of Equal Innervation*
13. Explain, in detail, *ocular torsions*.
14. What is the role of the cerebellum in eyemovement?
15. What is the *final common pathway* and what is its contribution?
16. During eyemovement how many of the extraocular muscles may be responsible, at any one time, for the eyemovement.

17. What is the significance of *adaptation* in eyemovement?
18. Name, and list each function individually, of the six extraocular muscles.
19. What is an *agonist* muscle?
20. What is an *antagonist* muscle?
21. Name the innervation of the extraocular muscles.
22. What occurs when one of the extraocular muscles are damaged and how can one determine which muscle is involved?
23. What happens to eyemovement during a cranial nerve lesion?
24. What are the characteristics of an oculomotor nerve disorder?
25. What are the characteristics of the trochlear nerve disorder?
26. What are the characteristics of an abducens nerve disorder?
27. What is the purpose of the brainstem in eyemovement.
28. What is the relationship of neural firing rates in the brainstem to eye position?
29. Partially from your reading, but more from lecture, what is the *step-pulse generator* and how does it work?
30. What are craniotopic coordinates?
31. What is meant by *visuospatial organization*?
32. Why is horizontal eyemovement studied as opposed to generally studying vertical eyemovement?
33. What is thought to be the primary area in the cortex for saccadic eyemovements?
34. What is thought to be the primary area in the cortex for pursuit eyemovement?

#### **Chapter 4**

1. In EOG, what are the features of the response that are measured and how are they obtained?
  2. Why and how are eyemovements converted into voltage?
  3. How is the corneoretinal potential generated?
  4. What type of disease can affect the corneoretinal potential?
  5. Discuss, compare and contrast monocular versus bitemporal recordings.
  6. How are blink artifacts controlled?
  7. When is EOG not to be done and how do you know such?
  8. Why is the SPV measured instead of the fast component?
  9. What is the difference and function of the 'gain' and/versus 'offset'?
  10. Why do we use a DC coupled amplifier?
  11. What is a time constant and how is it determined?
  12. Diagram and discuss the placement of monocular versus bitemporal electrode placement. Be sure and discuss critical alignment.
  13. In the absence of eye blinks if deviations are seen on the vertical channel what artifact might be contributing to vertical recording during horizontal movement (hint: This would be iatrogenic in nature).
  14. Once electrodes are applied how much time should be allowed before calibration or measures and why?
  15. How so SPV calculated (i.e. what is the formula, not the procedure)
- Briefly discuss the advantages and limitations of: 1) Visual inspection of eyemovement; 2) EOG; 3) Infrared recording of eyemovement; 4) Magnetic search coil; 5) Photographic recording of eyemovement; and 6) 'Image analysis. One or two sentences each is sufficient.

#### **Chapter 5**

1. What are the four types of eyemovement recorded in ocular motility testing
2. What electrode configurations are used in measuring saccadic eyemovement?
3. What amplifier filter settings are used in measuring saccadic eyemovement?
4. What is meant by 'eccentricity', how is it determined, and why is it important.
5. Why is a random paradigm in saccadic eyemovement testing important?
6. What are the four types of saccade paradigms and which ones are used clinically?
7. In detail, explain the procedure for *random paradigm* testing of saccades.

8. What parameters are measured in saccadic eyemovement, what is their significance, and what is the general range of 'normal'?
9. What is meant by 'latency' of a saccade. Diagram how this is identified.
10. What is meant by 'peak velocity' of a saccade and how is it determined. Diagram the procedure.
11. What is meant by 'accuracy' of a saccade and how is it determined (i.e. computed). Draw a diagram of 1) hypometric saccade; and 2) hypermetric saccade.
12. What is meant by 'overshoot' and 'undershoot'. Draw an example of each.
13. When is hypermetric considered abnormal ?
14. When is hypometric considered abnormal?
15. What is a 'glissade' and how is it measured (use a diagram).
16. What is another name for a 'glissade'?
17. What is a 'pulsion' and how is it measured.
18. In recording saccadic eyemovement what is the preferred electrode configuration and why?
19. Discuss, compare and contrast 'predictive' pursuit versus 'random' pursuit.
20. What are the adequate stimulus for producing smooth pursuit and which one is used in ocular motility testing?
21. What is the smooth pursuit pathway and how does the pathway differ between the two types of pursuits?
22. Compare and contrast the use of a pendulum paradigm versus a sinusoidal paradigm in pursuit testing.
23. Compare and contrast sinusoidal paradigm versus a ramp paradigm (also called a triangular paradigm).
24. What parameters are used to quantify smooth pursuit and how are they determined.
25. What is the difference between peak velocity and average velocity and under what conditions are each of the types of velocities obtained and why?
26. Briefly describe the 'Rashbass' and 'sum-of-sines' paradigms and state their clinical use.
27. What is meant by 'gain' and how is it measured?
28. What is meant by 'phase' and how is it measured?
29. What is meant by 'acceleration' and how is it measured?
30. What is 'phase lag' as it relates to eyemovement?
31. Discuss the adequate stimulus for pursuit testing and the preferred method.
32. Discuss the filtering for the measurement of pursuit eyemovement.
33. Discuss, compare and contrast the three types of methods for recording OKN and clearly state the preferred method and why. The three possibilities are: small handheld drum; light bar, and full-field stimulator.
34. What is OKAN and when is it abnormal.
35. Where in the CNS is OKAN generated?
36. What is the effect of room luminance in the recording of pursuit, OKN and OKAN.
37. What type of analysis is done on the OKN recordings and when are they considered abnormal?
38. Why is OKAN used marginally clinically?
39. in Fixation paradigms what are the three common types of disturbances and where in the CNS do they occur.
40. In detail discuss the paradigm, sequences etc. in fixation testing. Include filter settings, eye position, eye open versus eye closed, and room luminance.
41. What is the 'fixation index', how is it measured, and what is its clinical value?
42. What re Frenzel's goggles and how are they used?

## **Chapter 6**

1. What constitutes an abnormal recording of saccadic velocity and what is the area of CNS that such abnormalities represent?
2. What conditions will cause abnormal recordings when no CNS pathology exists and how does one account/determine such errors?
3. When is saccadic slowing abnormal and what category of drugs may cause saccade slowing?
4. Know Tables 6-1, 6-3, 6-4 and 6-5.
5. Name the major diseases that may cause saccadic slowing.
6. What is the most common cause of abnormally fast saccades that is not disease specific?
7. What are the organic causes of abnormally fast saccades?

8. Discuss internuclear ophthalmoplegia (INO) and the results of saccadic testing in the presence of this disease process.
9. In determining the latency of a saccade, what non-pathological effects will affect the latency and what saccadic paradigm must be used to accurately record this feature?
10. List and describe the four most common patterns of saccadic inaccuracy.
11. What is another term for 'hypermetric dysmetria.'?
12. What is another name for 'hypometric dysmetria'?
13. What types of stimuli are used clinically in pursuit testing and what do each of the types identify?
14. What non-pathological states of the patient affect pursuit testing?
15. What are the most common causes of a disorder of pursuit gain?
16. How is pursuit gain calculated?
17. What are the causes of asymmetrical pursuit?
18. When is 'reversed' pursuit seen?
19. What does OKN mean?
20. How is OKN usually tested and how should it be tested?
21. What is the adequate stimulus for actually recording true OKN?
22. What are the five causes of abnormal OKN recordings?
23. Under what conditions does 'reversed' or 'inverted' OKN occur?
24. What is after nystagmus and what is its significance?
25. Discuss 'asymmetrical' reduction of OKAN what abnormality causes it.
26. What is the utility of the fixation test and what five abnormalities does it identify?
27. What is meant by 'impaired fixation suppression' and under what conditions is it observed?
28. What is meant by 'gaze-evoked nystagmus' and under what conditions is it observed?
29. What is meant by 'rebound nystagmus' and under what conditions is it observed?
30. What is meant by 'congenital nystagmus' and under what conditions is it observed?
31. What is meant by 'square wave jerks' and under what conditions is it observed?

## **Chapter 7**

- 1.
- 2.

Student Name: \_\_\_\_\_

**Laboratory Assignment 1**

Complete and label the following on two different individuals:

1. Calibration of eyemovement
2. Saccade Testing
3. Smooth Pursuit Testing

Tracings are to be clearly labeled and calculations made. You may use class members but they may NOT help or assist you in any manner.

**INSTRUCTOR'S COMMENTS:**

Quality of Recording	

Quality of Quantitative Analysis	

Quality of Interpretation	

Quality of Discussion	

**Pts Awarded: /2**

Student Name: \_\_\_\_\_

**Laboratory Assignment 2**

Complete and label the following on two different individuals:

1. Calibration of eyemovement
2. Saccade Testing
3. Smooth Pursuit Testing
4. Optokinetic Testing
5. Gaze(fixation) Testing

Tracings are to be clearly labeled and calculations made. You may use class members but they may NOT help or assist you in any manner.

**INSTRUCTOR'S COMMENTS:**

Quality of Recording	

Quality of Quantitative Analysis	

Quality of Interpretation	

Quality of Discussion	

**Pts Awarded: /2**

Student Name: \_\_\_\_\_

**Laboratory Assignment 3**

Complete and label the following on two different individuals:

- |                               |                           |
|-------------------------------|---------------------------|
| 1. Calibration of eyemovement | 5. Gaze(fixation) Testing |
| 2. Saccade Testing            | 6. Positional Testing     |
| 3. Smooth Pursuit Testing     | 7. Positioning Testing    |
| 4. Optokinetic Testing        |                           |

Tracings are to be clearly labeled and calculations made. You may use class members but they may NOT help or assist you in any manner.

**INSTRUCTOR'S COMMENTS:**

Quality of Recording	

Quality of Quantitative Analysis	

Quality of Interpretation	

Quality of Discussion	

**Pts Awarded:     /2**

Student Name: \_\_\_\_\_

**Laboratory Assignment 4**

Complete and label the following on two different individuals:

- |                               |                            |
|-------------------------------|----------------------------|
| 1. Calibration of eyemovement | 5. Gaze (fixation) Testing |
| 2. Saccade Testing            | 6. Positional Testing      |
| 3. Smooth Pursuit Testing     | 7. Positioning Testing     |
| 4. Optokinetic Testing        | 9. Caloric Testing         |

Tracings are to be clearly labeled and calculations made. You may use class members but they may NOT help or assist you in any manner.

**INSTRUCTOR'S COMMENTS:**

Quality of Recording	

Quality of Quantitative Analysis	

Quality of Interpretation	

Quality of Discussion	

**Pts Awarded: /2**

Student Name: \_\_\_\_\_

**Laboratory Assignment 5**

Complete a Rotary Chair evaluation on two different individuals.

**INSTRUCTOR'S COMMENTS:**

Quality of Recording	

Quality of Quantitative Analysis	

Quality of Interpretation	

Quality of Discussion	

**Pts Awarded:     /2**

Student Name: \_\_\_\_\_

**Laboratory Assignment 6**

Complete and label the following on three different individuals:

1. Pure Tone thresholds for 250, 500, 1000, 2000, 4000, and 6000 Hz
2. Tympanometry (multi-frequency)
3. Acoustic reflex testing
4. Spontaneous OAEs
6. Transient OAEs (click)
7. Distortion Product OAEs

**INSTRUCTOR'S COMMENTS:**

Quality of Recording	

Quality of Quantitative Analysis	

Quality of Interpretation	

Quality of Discussion	

**Pts Awarded:     /2**

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