Vision Science II - Monocular Sensory Aspects of Vision

Lecture 13 - Study topics for Exam 1

General suggestions for Exam 1

- Bring calculator and small ruler (straight edge)
- Don't need to memorize formulas; know how to use them.
- Don't' need to memorize numerical values beyond those specified in class
- Review old exams
- Understand all Schwarz figures

Lab 1 - Clinical aberrometry

- What do aberrometers measure?
- What are aberrations?
- In what clinical situations would you use aberrometry?
- What happens to the aberrations values (RMS and Zernike coefficients) when you change pupil size?
- What unit is used when reporting higher-order aberrations?

Lecture 1 - Introduction & Aberrometry I

- The entrance pupil and its importance in aberrometry
- The line of sight and its importance in aberrometry

Lecture 2 - Aberrometry 2

- What are higher-order aberrations?
- These are not Seidel aberrations - know why.
- We're talking about monochromatic aberrations, not chromatic
- How does pupil size affect image quality when aberrations are present?
- Why are aberrations important in clinical eye care?
- What the difference between aberrometers, autorefractors and corneal topographers?
- Dr. Junzhong Liang's work
- What exactly do aberrometers measure?
- How do we report the results of aberrometer measurements?
- What do the color maps show?
- What do Zernike coefficients tell us about the wavefront and the eye?
- Understand the Zernike pyramid and Zernike numerical indices
- Know the names for all third order Zernike modes and Z(4,0)

Lecture 3 - Aberrometry 3

- What can be done to help a patient with large HOAs?
- What is the normal RMS value to be expected for a 6.0-mm pupil?
- Why is it difficult to precisely predict VA from aberrometry data?
- How can we improve the vision of a patient with large aberrations?
- Converting Zernike coefficients to another pupil size
- Computing RMS wavefront error
- Aberration balancing in the human eye
- Changes in total ocular aberrations with age
- Benefits of correcting aberrations (monochromatic, chromatic, Fig. 4)

Lab 2 – Visual fields

- Threshold, sensitivity, visual performance, visual field test scores (decibels)
- Static v. dynamic perimetry
- Meaning of decibel deviation scores
- Computing between decibels and apostilbs in the Humphrey Visual Field Analyzer
- Extend of the normal visual field

Lecture 4 – Approaches to vison science

- Image processing begins in the retina
- What are psychophysical tests?
- What are advantages of psychophysical tests?

- Which clinical optometry tests use a psychophysical approach?

Lecture 5 – Absolute sensitivity of the eye
- Minimum number of quantal absorptions necessary for detection
- Minimum number of quanta that can activate a rod

Lecture 6 - Photometry I
- Radiometry vs. photometry
- Radiance vs. irradiance
- Photopic V lambda function definition and characteristics
- Heterochromic flicker photometry
- Definition, usage of luminance and illuminance

Lab 3 - Photometry
- How to determine illuminance using a luminance meter and a Lambertian surface
- HFP
- The 1924 CIE photopic V lambda function

Lecture 7 - Photometry II
- Normal values for extend of visual fields
- Luminance – no change with distance
- Illuminance changes with distance
- Converting nits to apostilbs
- Relationship between illuminance and luminance for a Lambertian reflector
- Computing retinal illumination
- Standard illuminant C
- Color temperature

Lecture 8 – Duplex retina I
- Rods and cones distribution
- Phototransduction definition
- Rhodopsin absorption, transmission spectra
- Scotopic sensitivity, threshold spectra

Lecture 9 – Duplex retina II
- S, M, L cones not blue, green, red cones
- No S cones in fovea; L & M cone input to make V lambda function
- Photochromic interval
- Purkinje shift
- Dark adaptation with different wavelengths, stimulus sizes, retinal location
- Schwartz Fig. 3-11
- Photostress test

Lab 4 – Visual acuity
- Conversions between logMAR and Snellen acuities
- Advantages of the ETDRS chart compared to a conventional Snellen chart
- How to interpret logMAR acuity scores

Lecture 10 – Duplex retina III
- Clinical applications of light adaptation and Weber's law
- Trade-off between spatial resolution and sensitivity
- Ricco's law

Lecture 11 – Duplex retina IV
- Temporal resolutions versus temporal sensitivity (temporal summation)
- Bloch's law
- Stiles-Crawford effect (SCE) definition
- Clinical applications of the SCE
- Comparison of photopic and scotopic systems (purpose, capabilities)

Lecture 12 – Power vectors

- Why are power vectors necessary?
- Convert S, C, A to power vectors
- Add, subtract, compute mean power vectors
- Convert back from power vectors to S, C, A
- Convert 2nd order Zernike coefficient to S, C, A