

# Vision Science

Vision is one of the most valuable sensory modalities. It is also the source of a rich array of research questions relating to how we see, how and why vision fails, and what can be done about it. Investigators in Vision Science conduct human and animal research and modeling, yielding cutting-edge discoveries and applications in disciplines that include molecular genetics, clinical care, adaptive optics, neurobiology, cell biology, infectious disease, bioengineering, perception, and public health.

This PhD program (<http://vision.berkeley.edu>) emphasizes the interdisciplinary nature of vision science research through broad exposure to the basic concepts and techniques used in specialized fields. Engaged in both laboratory-based and clinical research, our students ([http://vision.berkeley.edu/?page\\_id=37](http://vision.berkeley.edu/?page_id=37)) are working with faculty (<http://vision.berkeley.edu/?cat=2>) advisers whose research matches their own interests. Current research topics include biomedical optics, perception and visual cognition, molecular and cell biology, neuroscience, computational vision, genetics, immunology, microbiology and clinical science.

Vision Science alumni ([http://vision.berkeley.edu/?page\\_id=2019](http://vision.berkeley.edu/?page_id=2019)) are represented on the faculty of world-class universities—in medical schools, schools of optometry, and a wide range of other disciplines spanning psychology, physiology, bioengineering, and ophthalmology. Many others hold research positions in private institutes and federally sponsored agencies, including NASA and the NIH. Still others are to be found in the research and development divisions of industry; currently, ophthalmic and biotechnology companies are among the major recruiters of our graduates.

Due to the interdisciplinary nature of the program, we accept students with various backgrounds including psychology, optometry, engineering, computer science, physics, chemistry, biophysics, neuroscience, mathematics, molecular and cell biology, and integrative biology. Because this program is designed to develop research scientists, it is also important that applicants are familiar with an experimental lab setting.

Due to the interdisciplinary nature of the program, we accept students with various backgrounds including psychology, optometry, engineering, computer science, physics, chemistry, biophysics, neuroscience, mathematics, molecular and cell biology and integrative biology. Because this program is designed to develop research scientists, it is also important that applicants are familiar with an experimental lab setting. Program specific admissions guidelines can be found here ([http://vision.berkeley.edu/?page\\_id=165](http://vision.berkeley.edu/?page_id=165)).

## Admission to the University

### Minimum Requirements for Admission

The following minimum requirements apply to all graduate programs and will be verified by the Graduate Division:

1. A bachelor's degree or recognized equivalent from an accredited institution;
2. A grade point average of B or better (3.0);
3. If the applicant comes from a country or political entity (e.g., Quebec) where English is not the official language, adequate proficiency in English to do graduate work, as evidenced by a TOEFL score of at least 90 on the iBT test, 570 on the paper-and-pencil test, or an

IELTS Band score of at least 7 (note that individual programs may set higher levels for any of these); and

4. Sufficient undergraduate training to do graduate work in the given field.

## Applicants Who Already Hold a Graduate Degree

The Graduate Council views academic degrees not as vocational training certificates, but as evidence of broad training in research methods, independent study, and articulation of learning. Therefore, applicants who already have academic graduate degrees should be able to pursue new subject matter at an advanced level without need to enroll in a related or similar graduate program.

Programs may consider students for an additional academic master's or professional master's degree only if the additional degree is in a distinctly different field.

Applicants admitted to a doctoral program that requires a master's degree to be earned at Berkeley as a prerequisite (even though the applicant already has a master's degree from another institution in the same or a closely allied field of study) will be permitted to undertake the second master's degree, despite the overlap in field.

The Graduate Division will admit students for a second doctoral degree only if they meet the following guidelines:

1. Applicants with doctoral degrees may be admitted for an additional doctoral degree only if that degree program is in a general area of knowledge distinctly different from the field in which they earned their original degree. For example, a physics PhD could be admitted to a doctoral degree program in music or history; however, a student with a doctoral degree in mathematics would not be permitted to add a PhD in statistics.
2. Applicants who hold the PhD degree may be admitted to a professional doctorate or professional master's degree program if there is no duplication of training involved.

Applicants may apply only to one single degree program or one concurrent degree program per admission cycle.

## Required Documents for Applications

1. **Transcripts:** Applicants may upload *unofficial* transcripts with your application for the departmental initial review. *If the applicant is admitted*, then *official* transcripts of all college-level work will be required. Official transcripts must be in sealed envelopes as issued by the school(s) attended. If you have attended Berkeley, upload your unofficial transcript with your application for the departmental initial review. *If you are admitted*, an official transcript with evidence of degree conferral *will not* be required.
2. **Letters of recommendation:** Applicants may request online letters of recommendation through the online application system. Hard copies of recommendation letters must be sent directly to the program, not the Graduate Division.
3. **Evidence of English language proficiency:** All applicants from countries or political entities in which the official language is not English are required to submit official evidence of English language proficiency. This applies to applicants from Bangladesh, Burma, Nepal, India, Pakistan, Latin America, the Middle East, the People's Republic of China, Taiwan, Japan, Korea, Southeast Asia, most European countries, and Quebec (Canada). However, applicants who, at the time of application, have already completed at least one year of full-time academic course work with grades of B or better at a

US university may submit an official transcript from the US university to fulfill this requirement. The following courses will not fulfill this requirement:

- courses in English as a Second Language,
- courses conducted in a language other than English,
- courses that will be completed after the application is submitted, and
- courses of a non-academic nature.

If applicants have previously been denied admission to Berkeley on the basis of their English language proficiency, they must submit new test scores that meet the current minimum from one of the standardized tests.

## Where to Apply

Visit the Berkeley Graduate Division application page (<http://grad.berkeley.edu/admissions/apply>) .

## Curriculum

### Courses Required

VIS SCI 201A	Seminar in Vision Science	2
VIS SCI 299	Research in Vision Science (two required lab rotations)	1-12
Select five of the following Proseminars:		10
VIS SCI 212A	Optics and Dioptrics of the Eye	
VIS SCI 212B	Visual Neurophysiology and Development	
VIS SCI 212D	Anatomy and Vegetative Physiology of the Eye	
VIS SCI 212E	Color Vision and Visual Sensitivity	
VIS SCI 212F	Spatial and Binocular Vision, Eye Movements, and Motion Perception	
VIS SCI 212G	Molecular Genetics of Vertebrate Eye Development and Diseases	
VIS SCI 298	Group Studies, Seminars, or Group Research (sect 1) (year 1-2)	1-6
VIS SCI 298	Group Studies, Seminars, or Group Research (sect 3) (year 1-2)	1-6
VIS SCI 230	Ethics in Scientific Research	2
VIS SCI 300	Teaching Methods in Vision Science	1

Electives per approved individualized study list

## Vision Science

### VIS SCI 201A Seminar in Vision Science 2 Units

Offered through: Optometry

Terms offered: Fall 2015, Fall 2014, Fall 2013

Graduate seminar in vision science.

Seminar in Vision Science: [Read More](#) [+]

#### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit.

#### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of seminar per week

#### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**Instructor:** VS faculty

Seminar in Vision Science: [Read Less](#) [-]

### VIS SCI 201B Seminar in Vision Science 2 Units

Offered through: Optometry

Terms offered: Spring 2018, Spring 2017, Spring 2016

Graduate seminar in vision science.

Seminar in Vision Science: [Read More](#) [+]

#### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit.

#### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of seminar per week

#### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**Instructor:** Gronert

Seminar in Vision Science: [Read Less](#) [-]

## VIS SCI 203A Geometric Optics 4 Units

Offered through: Optometry

Terms offered: Fall 2016, Fall 2015, Fall 2014

Geometrical methods applied to the optics of lenses, mirrors, and prisms. Thin lens eye models, magnification, astigmatism, prism properties of lenses, thick lenses.

Geometric Optics: [Read More](#) [+]

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture, 1 hour of discussion, and 2 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** 101

Geometric Optics: [Read Less](#) [-]

## VIS SCI 203B Optical System and Physical Optics 4 Units

Offered through: Optometry

Terms offered: Spring 2016, Spring 2015, Spring 2014

Principles of optical systems, principles and clinical applications of apertures and stops, aberrations and optical instruments. Optics of the eye. Selected topics in physical optics, diffraction, interference, polarization.

Optical System and Physical Optics: [Read More](#) [+]

### Rules & Requirements

**Prerequisites:** 203A

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture, 1 hour of discussion, and 2 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** 102

Optical System and Physical Optics: [Read Less](#) [-]

## VIS SCI 205 Visual Perception Sensitivity 4.5 Units

Offered through: Optometry

Terms offered: Fall 2016, Fall 2015, Fall 2014

Psychophysical basis for clinical tests in acuity, perimetry, and color vision. The visual stimulus and photometry. Visual receptors. Psychophysical method and visual threshold. Light sensitivity. Contrast sensitivity. Light and dark adaptation. Temporal and spatial properties of visual function. Color vision and abnormalities. Changes with age and disease. Visual illusion. Basis for advanced diagnostic procedures.

Visual Perception Sensitivity: [Read More](#) [+]

### Hours & Format

**Fall and/or spring:** 15 weeks - 3.5 hours of lecture and 2 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** 104

Visual Perception Sensitivity: [Read Less](#) [-]

## VIS SCI 206A Anatomy and Physiology of the Eye 2 Units

Offered through: Optometry

Terms offered: Fall 2015, Fall 2014, Fall 2013

This course focuses on the anatomy and physiology of the eyeball. Overview of the gross anatomy of the eye followed by eye-relevant cellular and molecular biology. Cellular and molecular details of structure and function of each of the various non-neural components.

Anatomy and Physiology of the Eye: [Read More](#) [+]

### Hours & Format

**Fall and/or spring:** 7.5 weeks - 4 hours of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Instructors:** Gong, Fleiszig

Anatomy and Physiology of the Eye: [Read Less](#) [-]

## VIS SCI 206B Anatomy and Physiology of the Eye and Visual System 3 Units

Offered through: Optometry

Terms offered: Spring 2018, Spring 2017, Spring 2016

Structure and function of the tissues of the eye, ocular appendages, and the central visual pathways. Basic concepts of physiological, neurological, embryological, and immunological processes as they relate to the eye and vision. Foster an appreciation of the pathophysiology of various disease processes. Convey the importance of anatomy and physiology in the medical approach to ocular disease processes.

Anatomy and Physiology of the Eye and Visual System: Read More [+]

### Rules & Requirements

**Prerequisites:** ViS Sci 206A

**Repeat rules:** Course may be repeated for credit.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2.5 hours of lecture and 0.5 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

Anatomy and Physiology of the Eye and Visual System: Read Less [-]

## VIS SCI 206C Anatomy and Physiology of the Eye and Visual System 2 Units

Offered through: Optometry

Terms offered: Spring 2018, Spring 2017, Spring 2016

Problem-based learning approach using clinical case examples.

Continuation of 206A-206B.

Anatomy and Physiology of the Eye and Visual System: Read More [+]

### Rules & Requirements

**Prerequisites:** 206A-206B

**Repeat rules:** Course may be repeated for credit.

### Hours & Format

**Fall and/or spring:** 7.5 weeks - 4 hours of seminar per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** 106C

Anatomy and Physiology of the Eye and Visual System: Read Less [-]

## VIS SCI 206D Neuroanatomy and Neurophysiology of the Eye and Visual System 2 Units

Offered through: Optometry

Terms offered: Fall 2015, Fall 2014, Fall 2013

Structure and function of the neurosensory retina, photoreceptors, RPE including blood supply. Current concepts of etiology and management of major retinal conditions. Overview of diagnostic techniques in retinal imaging, electrophysiologic testing and new genetic approaches.

Structure and function of the early visual pathway including retinal ganglion cells, optic nerves, lateral geniculate nucleus and visual cortex. Pupillary responses. Specialization in the visual cortex.

Neuroanatomy and Neurophysiology of the Eye and Visual System: Read More [+]

### Rules & Requirements

**Prerequisites:** 206A (must be taken concurrently)

### Hours & Format

**Fall and/or spring:** 7.5 weeks - 4 hours of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Instructors:** Flannery, Freeman

**Formerly known as:** half of 206A

Neuroanatomy and Neurophysiology of the Eye and Visual System: Read Less [-]

## VIS SCI 212A Optics and Dioptrics of the Eye 2 Units

Offered through: Optometry

Terms offered: Fall 2015, Fall 2014, Fall 2013

Introduction for graduate students to basic principles of classic and modern geometric optics (thick lens systems, mirrors, prisms, apertures, and stops) and physical optics (interference, diffraction, and polarization) with emphasis on dioptrics of the human eye (including schematic eyes, aberrations, and entoptic phenomena).

Optics and Dioptrics of the Eye: Read More [+]

### Rules & Requirements

**Prerequisites:** Consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

Optics and Dioptrics of the Eye: Read Less [-]

## VIS SCI 212B Visual Neurophysiology and Development 2 Units

Offered through: Optometry

Terms offered: Fall 2016, Fall 2015, Fall 2014

Introduction for graduate students. Visual pathways will be considered from retina to lateral geniculate to visual cortex. Basic organization at each stage will be covered. Primary focus will be studies of receptive field characteristics and associated visual function. Development and plasticity of the same visual pathways will also be covered. Evidence and implications will be explored from controlled rearing procedures and studies of abnormal visual exposure.

Visual Neurophysiology and Development: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

Visual Neurophysiology and Development: Read Less [\[-\]](#)

## VIS SCI 212D Anatomy and Vegetative Physiology of the Eye 2 Units

Offered through: Optometry

Terms offered: Fall 2015, Fall 2014, Fall 2013

Introduction for graduate students to a general survey of the orbit, anterior and posterior segment of the eye, extraocular muscles, and neuroanatomy of the eye. Vegetative physiology of the cornea and tear film, aqueous humor, crystalline lens, vitreous humor, epithelial tissue (iris, ciliary body and retina), and photochemistry.

Anatomy and Vegetative Physiology of the Eye: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

Anatomy and Vegetative Physiology of the Eye: Read Less [\[-\]](#)

## VIS SCI 212E Color Vision and Visual Sensitivity 2 Units

Offered through: Optometry

Terms offered: Spring 2017, Spring 2016, Spring 2015

Introduction for graduate students to sensory aspects of light and color vision including: psychophysical methods, spectral response of the eye, mechanisms of sensitivity control, dark adaptation, color discrimination, mechanisms of normal and defective color vision.

Color Vision and Visual Sensitivity: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

Color Vision and Visual Sensitivity: Read Less [\[-\]](#)

## VIS SCI 212F Spatial and Binocular Vision, Eye Movements, and Motion Perception 2 Units

Offered through: Optometry

Terms offered: Spring 2017, Spring 2016, Spring 2015

Introduction for graduate students to human spatial vision including contrast sensitivity, visual acuity, and spatial localization. Introduction to eye movements, motion perception, and motor and sensory aspects of binocular vision including pursuit, vergence, and saccadic eye movements, accommodation, stereopsis, and binocular space perception. Perception of real and apparent motion.

Spatial and Binocular Vision, Eye Movements, and Motion Perception: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Consent of instructor

### Hours & Format

**Fall and/or spring:** 6 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Instructors:** Banks, Malik, Schor

Spatial and Binocular Vision, Eye Movements, and Motion Perception: Read Less [\[-\]](#)

## VIS SCI 212G Molecular Genetics of Vertebrate Eye Development and Diseases 2 Units

Offered through: Optometry

Terms offered: Spring 2017, Spring 2016, Spring 2015

The primary focus of this course is to teach the molecular basis of vertebrate eye development and related disease. This course will cover some of the basic principles of molecular and cell biology, commonly used techniques and experimental approaches, as well as the biological mechanisms for vertebrate eye development and related eye diseases. Recent progress in identifying important ocular genes and the approaches used to identify them will be discussed.

Molecular Genetics of Vertebrate Eye Development and Diseases: Read More [+]

### Rules & Requirements

**Prerequisites:** Graduate student in vision science or consent of instructor in charge

### Hours & Format

**Fall and/or spring:** 5 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Instructor:** Gong

Molecular Genetics of Vertebrate Eye Development and Diseases: Read Less [-]

## VIS SCI 215 Visual System Development 2 Units

Offered through: Optometry

Terms offered: Fall 2015, Fall 2014, Fall 2013

Development of the eye and visual system. Normal development of the eye, retina, and central visual pathways. Effects of visual deprivation. Assessment of optical and visual function in human infants. Refraction and refractive error in infants and children. Development of visuomotor function, spatial vision, color vision, binocular vision, and depth perception.

Visual System Development: Read More [+]

### Rules & Requirements

**Prerequisites:** 206B

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** 115

Visual System Development: Read Less [-]

## VIS SCI 217 Oculomotor Functions and Neurology 2 Units

Offered through: Optometry

Terms offered: Spring 2016, Spring 2015, Spring 2014

Neuro-anatomical pathways for the control of eye position and movement; gaze holding, image stabilization and tracking eye movement systems; oculomotor signs of disorders of the central nervous system (palsies, nystagmus, ophthalmoplegia, cog-wheel pursuits, saccadic dysmetria); the near visual-motor response and the synergistic coupling of accommodation and convergence; binocular misalignment (heterophoria and fixation disparity); and presbyopia.

Oculomotor Functions and Neurology: Read More [+]

### Rules & Requirements

**Prerequisites:** 203B or consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 1.5 hours of lecture and 10 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** 117

Oculomotor Functions and Neurology: Read Less [-]

## VIS SCI 219 Binocular Vision and Space Perception 2 Units

Offered through: Optometry

Terms offered: Spring 2016, Spring 2015, Spring 2014

Perception of space, direction, and distance. Binocular retinal correspondence, horopters, differential magnification effects and anomalies of binocular vision development. Sensory vision, local stereopsis, static and dynamic stereopsis, binocular depth cues. Binocular Vision and Space Perception: Read More [+]

### Rules & Requirements

**Prerequisites:** 203A-203B

### Hours & Format

**Fall and/or spring:** 15 weeks - 1.5 hours of lecture and 10 hours of laboratory per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** 118

Binocular Vision and Space Perception: Read Less [-]



## VIS SCI 230 Ethics in Scientific Research 2 Units

Offered through: Optometry

Terms offered: Spring 2016, Spring 2015, Spring 2014

This seminar will examine a range of ethical issues that arise in the process of doing science. Beginning with the philosophical and social foundations, we will consider the pathogenesis of fraud, statistics and deception, the ethics of authorship and publication, research with human subjects, the use of animals, the definition(s) of misconduct and the difference between misconduct and questionable research practices, the relationship between industry and science, and finally, the responsibilities and obligations of the scientist in society.

Ethics in Scientific Research: [Read More](#) [+]

### Hours & Format

**Fall and/or spring:** 15 weeks - 30 hours of seminar per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

Ethics in Scientific Research: [Read Less](#) [-]

## VIS SCI 260A Optical and Neural Limits to Vision 3 Units

Offered through: Optometry

Terms offered: Fall 2017

The course will provide an overview of the early stage limits to human vision, from the eye's optics to sampling and processing in the retina. Students will learn basic optical properties of the eye as well as objective and subjective techniques on how to measure limits of human vision. The class will comprise a combination of lectures and active learning by the students in the form of a project, to be presented at the end of the semester. This is one of the four courses that form the Vision Science core curriculum.

Optical and Neural Limits to Vision: [Read More](#) [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit when topic changes.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Instructor:** Austin Roorda

Optical and Neural Limits to Vision: [Read Less](#) [-]

## VIS SCI 260B Introduction to Ocular Biology 3 Units

Offered through: Optometry

Terms offered: Fall 2017

The course will provide an overview of eye development, anterior eye ocular anatomy and physiology and ocular disease. The course will be a combination of didactic lectures and problem-based learning. This is one of the four courses that form the Vision Science core curriculum.

Introduction to Ocular Biology: [Read More](#) [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit when topic changes.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Instructor:** Suzanne Fleiszig

Introduction to Ocular Biology: [Read Less](#) [-]

## VIS SCI 260C Introduction to Visual Neuroscience 3 Units

Offered through: Optometry

Terms offered: Not yet offered

The course will provide an overview of the neuroscience of vision, spanning the entire neural pathway from retinal neurobiology to cortical processing of visual signals. The class will comprise a combination of lectures and active learning by the students in the form of a project, to be presented at the end of the semester. This is one of the four courses that form the Vision Science core curriculum.

Introduction to Visual Neuroscience: [Read More](#) [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit when topic changes.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Instructor:** Michael Silver

Introduction to Visual Neuroscience: [Read Less](#) [-]

## VIS SCI 260D Seeing in Time, Space and Color 3 Units

Offered through: Optometry

Terms offered: Not yet offered

The course will provide an overview of how we see in time (temporal signal processing, eye motion, motion detection), space (stereo vision, depth perception), and color as well as the anatomical and physiological factors that facilitate these capabilities. The course will be series of didactic lectures. This is one of the four courses that form the Vision Science core curriculum

Seeing in Time, Space and Color: Read More [+]

### Rules & Requirements

**Repeat rules:** Course may be repeated for credit when topic changes.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 1 hour of discussion per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Instructor:** Martin Banks

Seeing in Time, Space and Color: Read Less [-]

## VIS SCI 262 Visual Cognitive Neuroscience 3 Units

Offered through: Optometry

Terms offered: Spring 2016, Spring 2015, Spring 2013

The course will provide an overview of visual cognitive neuroscience, drawing from neuroanatomy, neurophysiology in humans and animal models, psychophysics, neuroimaging, neuropharmacology, neuropsychology, and computational models of vision and cognition. Topics will include basic anatomy and physiology of the mammalian visual system, motion perception and processing, depth perception and representation of visual space, brightness and color, object and face recognition, visual attention, developmental and adult plasticity, perceptual learning, multisensory integration, and visual awareness.

Visual Cognitive Neuroscience: Read More [+]

### Rules & Requirements

**Prerequisites:** Consent of instructor

**Repeat rules:** Course may be repeated for credit.

### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Instructor:** Silver

Visual Cognitive Neuroscience: Read Less [-]

## VIS SCI 265 Neural Computation 3 Units

Offered through: Optometry

Terms offered: Fall 2016, Fall 2015, Fall 2014

This course provides an introduction to the theory of neural computation. The goal is to familiarize students with the major theoretical frameworks and models used in neuroscience and psychology, and to provide hands-on experience in using these models. Topics include neural network models, supervised and unsupervised learning rules, associative memory models, probabilistic/graphical models, and models of neural coding in the brain.

Neural Computation: Read More [+]

### Rules & Requirements

**Prerequisites:** Calculus, differential equations, basic probability and statistics, linear algebra, and familiarity with high level programming languages such as Matlab

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Instructor:** Olshausen

Neural Computation: Read Less [-]

## VIS SCI C265 Neural Computation 3 Units

Offered through: Optometry

Terms offered: Prior to 2007

This course provides an introduction to the theory of neural computation. The goal is to familiarize students with the major theoretical frameworks and models used in neuroscience and psychology, and to provide hands-on experience in using these models. Topics include neural network models, supervised and unsupervised learning rules, associative memory models, probabilistic/graphical models, and models of neural coding in the brain.

Neural Computation: Read More [+]

### Rules & Requirements

**Prerequisites:** Calculus, differential equations, basic probability and statistics, linear algebra, and familiarity with high level programming languages such as Matlab

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Instructor:** Olshausen

**Also listed as:** NEUROSC C265

Neural Computation: Read Less [-]



## VIS SCI C280 Computer Vision 3 Units

Offered through: Optometry

Terms offered: Spring 2018, Spring 2017, Spring 2016

Paradigms for computational vision. Relation to human visual perception.

Mathematical techniques for representing and reasoning, with curves, surfaces and volumes. Illumination and reflectance models. Color perception. Image segmentation and aggregation. Methods for bottom-up three dimensional shape recovery: Line drawing analysis, stereo, shading, motion, texture. Use of object models for prediction and recognition.

Computer Vision: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Knowledge of linear algebra and calculus. Mathematics 1A-1B, 53, 54 or equivalent

### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

**Instructor:** Malik

**Also listed as:** COMPSCI C280

Computer Vision: Read Less [\[-\]](#)

## VIS SCI 298 Group Studies, Seminars, or Group Research 1 - 6 Units

Offered through: Optometry

Terms offered: Spring 2018, Fall 2017, Spring 2017

Group studies of selected topics. Advanced studies in various subjects through special seminars on topics to be selected each year, informal groups studying special problems, group participation in experimental problems and analysis.

Group Studies, Seminars, or Group Research: Read More [\[+\]](#)

### Hours & Format

**Fall and/or spring:** 15 weeks - 2-6 hours of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

Group Studies, Seminars, or Group Research: Read Less [\[-\]](#)

## VIS SCI 299 Research in Vision Science 1 - 12 Units

Offered through: Optometry

Terms offered: Spring 2018, Fall 2017, Summer 2017 Second 6 Week Session

Research.

Research in Vision Science: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Consent of instructor

### Hours & Format

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### Summer:

6 weeks - 1-16 hours of independent study per week

8 weeks - 1-12 hours of independent study per week

### Additional Details

**Subject/Course Level:** Vision Science/Graduate

**Grading:** Letter grade.

Research in Vision Science: Read Less [\[-\]](#)

## VIS SCI 300 Teaching Methods in Vision Science 1 Unit

Offered through: Optometry

Terms offered: Spring 2018, Fall 2017, Spring 2017

Instruction in teaching methods and materials, in vision science and optometry; practice teaching in classrooms and laboratory.

Teaching Methods in Vision Science: Read More [\[+\]](#)

### Rules & Requirements

**Prerequisites:** Graduate standing in vision science

### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of lecture per week

### Additional Details

**Subject/Course Level:** Vision Science/Professional course for teachers or prospective teachers

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**Instructor:** Silver

Teaching Methods in Vision Science: Read Less [\[-\]](#)

## **VIS SCI 601 Individual Study for Master's Students 1 - 6 Units**

Offered through: Optometry

Terms offered: Spring 2018, Spring 2017, Spring 2016

Individual study for the comprehensive requirements in consultation with the adviser in vision science.

Individual Study for Master's Students: [Read More](#) [+]

### **Rules & Requirements**

**Prerequisites:** Consent of instructor

**Credit Restrictions:** Course does not satisfy unit or residence requirements for master's degree.

### **Hours & Format**

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### **Additional Details**

**Subject/Course Level:** Vision Science/Graduate examination preparation

**Grading:** Offered for satisfactory/unsatisfactory grade only.

Individual Study for Master's Students: [Read Less](#) [-]

## **VIS SCI 602 Individual Study for Doctoral Students 1 - 6 Units**

Offered through: Optometry

Terms offered: Spring 2018, Fall 2017, Spring 2017

Individual study in consultation with the adviser in vision science, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required for the Ph. D.

Individual Study for Doctoral Students: [Read More](#) [+]

### **Rules & Requirements**

**Prerequisites:** Consent of instructor

**Credit Restrictions:** Course does not satisfy unit or residence requirements.

### **Hours & Format**

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

### **Additional Details**

**Subject/Course Level:** Vision Science/Graduate examination preparation

**Grading:** Offered for satisfactory/unsatisfactory grade only.

Individual Study for Doctoral Students: [Read Less](#) [-]