

INDIANA UNIVERSITY

University Graduate School
2005-2006
Academic Bulletin

Vision Science

School of Optometry
Bloomington

Departmental E-mail
opt@indiana.edu

Departmental URL
www.opt.indiana.edu

Director
Professor Graeme Wilson

Graduate Faculty

(An asterisk [*] denotes membership in the University Graduate School faculty with the endorsement to direct doctoral dissertations.)

Professors

Carolyn B. Begley*, Joseph A. Bonanno*, Arthur Bradley*, Robert DeVoe* (Emeritus), David A. Goss*, S. Lee Guth* (Emeritus), Gary S. Hafner*, Gerald Eugene Lowther*, Edwin C. Marshall*, Paul Pietsch* (Emeritus), P. Sarita Soni*, Larry Thibos*, Graeme Wilson*

Associate Professors

Clifford W. Brooks, Ronald Everson* (Emeritus), Daniel R. Gerstman, Sally Hegeman (Emerita), Douglas G. Horner*, Donald T. Miller, S. P. Srinivas

Assistant Professors

T. Rowan Candy*, Hubert D. Riley, Suresh Viswanathan*

Academic Advisor

Professor Graeme Wilson*, Optometry Building 511, (812) 855-7595

Degrees Offered

Master of Science and Doctor of Philosophy

Program Information and Requirements

The Vision Science Program is designed primarily for students wishing to prepare themselves for teaching and research in the sciences that relate to vision.

Admission Requirements

Course requirements are flexible to accommodate students with interests in vision science but with varying backgrounds. A bachelor's degree (or equivalent) is required. Course work with appropriate laboratories in the following areas is strongly recommended: optics, computing and engineering, physics,

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biology, mathematics through differential and integral calculus, statistics, and psychology of sensation and perception.

Degree Requirements

Students must demonstrate breadth of knowledge in vision science. This requirement is normally fulfilled by completion of V700 and V701 with a minimum grade of B in each course.

Each semester, students are required to register for and participate in the weekly Vision Science Seminar (V765) known as "Oxyopia." Participation implies that the seminar will be taken for credit and that the student will make an annual presentation.

Students commence their research training by joining an ongoing research project directed by a faculty member chosen by the student during the first few weeks in residence. The research topic will be formulated in consultation with the faculty member and an advisory committee. The topic may or may not be in the same field in which the student expects to do dissertation research.

Master of Science Degree

Course Requirements

A total of 30 credit hours is required, of which 15 credit hours must be didactic hours in vision science (or approved substitutes), generally excluding seminars. Students holding the O.D. degree or enrolled concurrently in the O.D. and M.S. programs may accelerate progress by receiving graduate credit for relevant work completed in the optometry curriculum. In regard to credits for prior or concurrent O.D. work, no more than 4 credit hours may apply to the requirement of 15 didactic credit hours.

Research Requirements

Candidates must submit a written research report by the end of the first year in residence. Students enroll in 3 hours of research credit per semester. A thesis research proposal must be submitted and approved by the end of the first year of study.

Thesis

Required.

Doctor of Philosophy Degree

Course Requirements

A total of 90 credit hours is required. Of these, a minimum of 30 credit hours will come from didactic courses, including courses in the minor subject, but generally excluding seminars.

Because students are expected to read the important literature in their chosen field, study of a foreign language may be required by the student's advisory committee.

Students who hold recent optometric degrees from recognized institutions or who are enrolled concurrently in the O.D. and Ph.D. programs may accelerate progress by receiving graduate credit for relevant work completed in the optometry curriculum. In regard to credit for prior or concurrent O.D. work, no more than 6 credit hours may apply to the requirement of 30 didactic credit hours.

Minor Subject

Students will select at least one minor in any relevant field of study, subject to formal approval by their advisory committee. Interdepartmental minors, as described in the University Graduate School Bulletin, are permissible.

Qualifying Examination

A student will be nominated to candidacy for the Ph.D. degree only after successful completion of written and oral qualifying examinations specified by the advisory committee. The requirements for 30 credit hours of didactic course work and two annual research reports must be fulfilled prior to the qualifying examination. Enrollment in the program will be terminated if the student twice fails the qualifying examination.

Ph.D. Minor in Vision Science

Students from other departments who wish to minor in vision science should complete V700 and V701, Introduction to Vision Science I and II, and at least one other course from the following group: V705, V723, V754, V783, and V791.

Courses

General

V595 First-Year Research (1-5 cr.)** Required to complete with a grade of A-F within the first year.

V695 Second-Year Research (1-5 cr.)

V700 Introduction to Vision Science I (4 cr.) The first of a two-semester sequence of courses that provides a comprehensive introduction to vision science. The course is designed for graduate students enrolled in the Vision Science Program, but is also suitable for students from other disciplines who are interested in the eye and vision.

V701 Introduction to Vision Science II (4 cr.) The second of a two-semester sequence of courses on vision science. V700 and this course constitute a breadth requirement for Ph.D. students in Vision Science.

V703 Refractive Anomalies I (3 cr.) Optics and epidemiology of refractive anomalies of the human eye.

V704 Refractive Anomalies II (3 cr.) Development, progression, and management of myopia.

V705 Ocular Surface I: Basic Biology and Physiology (4 cr.) Basic biology and physiology of the ocular surface, including the cornea, conjunctiva, and tear film.

V706 Ocular Surface II: Current Issues (4 cr.) Current issues affecting the ocular surface, including contact lenses, disease, and surgery.

V707 Clinical Vision Research Techniques Course (1-6 cr.) Techniques and procedures used to record and quantify ocular function and changes in clinical research including ocular photography, digital imaging, corneal and retinal topography, confocal microscopy, endothelial microscopy, image processing, surface cell analysis.

V716 The Visual Pathways (4 cr.) P: permission of the instructor. For students in the visual sciences, comprehensive study of the human optic pathways.

V717 Noninvasive Assessment of Visual Function (3 cr.) Focuses on the clinical application of psychophysical techniques for the detection and diagnosis of visual anomalies and ocular disease.

V718 Visual Functions in Low Vision (3 cr.) Studying behavioral aspects of visual function measurements in the low-vision population.

V723 The Eye as an Optical Instrument (4 cr.) P: V663 or equivalent.

V754 The Motility of the Eye (4 cr.) P: V665 or equivalent. Quantitative and qualitative study of eye movements and myologic reflexes, monocular and binocular, and related phenomena.

V764 Cellular and Molecular Aspects of Ocular Disease and Injury (4 cr.) Study of selected reports dealing with corneal-wound healing, the cataractous lens, and retinal degenerations.

V765 Vision Sciences Seminar (1 cr.) Students in the Ph.D. program in Vision Science are required to take this seminar and make a presentation annually.

V767 Electrophysiology of Vision (3 cr.) Review of techniques of recording neural events, development of a neural hypothesis, experimental testing of hypothesis, writing and presenting of data and conclusions.

V768 Special Topics in Vision Science (1-4 cr.) Covers topics not offered on a regular basis. Possible topics include cell and molecular biology as it relates to the eye and vision, comparative studies of the vertebrate eye, current research, experimental design, optical and ophthalmic instruments, pathology, and pharmacology. May be taken more than once when different topics are covered.

V773 Classics in Physiological Optics (1 cr.) Study of selected scientific articles of early contributors to our understanding of ocular motility, monocular and binocular functions, the optics of the eye, and ocular physiology.

V783 Monocular Sensory Aspects of Vision (4 cr.) P: V664 or equivalent. Analysis of visual stimulus and its perception in color, form, brightness, motion, etc.

V784 Binocular Sensory Aspects of Vision (4 cr.) P: V666 or equivalent. A study of perceptual phenomena and responses facilitated by binocular vision.

V785 The Vertebrate Eye (3 cr.) Comparative anatomy of the vertebrate retina. Primate retina used as a model. Accommodative mechanisms discussed. Laboratory exercises required.

V791 Quantitative Methods for Vision Research (3 cr.) Introduction to communication theory approach to problems in vision. Topics include the sensory nerve code, representation of nerve messages by orthogonal functions, sampling theorem, linear filters, Fourier analysis in one and two dimensions, analysis of directional data, stochastic processes, and signal detection theory.

V792 Ethical Issues in Scientific Research (1 cr.) This course explores the ethical issues and dilemmas raised by research in the biological sciences.

V795 Third-Year Research (3 cr.)

V799 M.S. Thesis Research (1-10 cr.)

V801 Basic Experimental Design and Methods in Vision Science (3 cr.) An introduction to basic research skills in vision science.

V899 Ph.D. Dissertation Research (1-12 cr.)

**These courses are eligible for a deferred grade.

Doctor of Optometry Curriculum Courses

V512 Ocular Anatomy (2 cr.) P: V511 Human Gross Anatomy, or equivalent. A detailed study of the normal anatomy and embryology of the eye and its adnexa. The organization of various components of the eye is studied at the light and electron microscopic level and this organization is related to the molecular structure where it is known.

V514 Neuroanatomy (1.5 cr.) P: V511 Human Gross Anatomy, or equivalent. Functional anatomy of the human brain, with emphasis on the visual system.

V516 Ocular Physiology (2.5 cr.) C: V512 or equivalent. Vegetative physiology of the eye, with attention to the chemical constitution, intermediary metabolism, regulation of hydration and intraocular pressure, transparency of the ocular components, and retinal physiology.

V648 Neurophysiology of Vision (1 cr.) Introduction to the functional organization of the visual system and the physiological basis of vision. This course treats the visual system as a biological image processor to reveal how the structure and function of the retina and brain determine visual performance and constrain the quality of vision.

V663 Physiological Optics I: Visual Optics (3.5 cr.) P: V522 Geometric Optics II, or equivalent. The eye as an optical instrument.

V664 Physiological Optics II: Visual Function (2.5 cr.) The basic aspects of monocular vision, including light and dark adaptation, color vision, and both spatial and temporal resolution. The science of measuring visual performance and its application to clinical optometry.

V665 Physiological Optics III: Ocular Motility (3.5 cr.) Characteristics, control, and deficits of the five somatic eye-movement systems (convergence, saccadic version, pursuit version, fixation maintenance, vestibular reflex) and the autonomic systems subserving accommodation and pupillary diameter reflexes.

V666 Physiological Optics IV: Binocular Function (2.5 cr.) Binocular sensory mechanisms of vision. Summary of the geometry of three-dimensional space and stereo vision, underlying neuroanatomy and physiology of binocular vision, prerequisites for normal stereopsis, and commonly encountered anomalies of binocular vision.

Cross-Listed Courses

Biology

L586 Cell Biology (4.5 cr.)

Psychology

P553 Advanced Statistics in Psychology I (3 cr.)

P554 Advanced Statistics in Psychology II (3 cr.)