BASIC VISION SCIENCES (BVS)

BVS 511: Applied Biomedical Science. (3.00 credit hours)
Three lecture hours per week. This course integrates a review and clinical applications of Biochemistry, Genetics, Immunology and Microbiology. Clinically important aspects of biochemistry and microbiology as it relates to normal and abnormal vision function are presented. Basic and clinical aspects of bacteriology, virology, mycology and parasitology are covered. Infections of the eye are discussed in relation to techniques for laboratory isolation, culturing and identification of the infectious agents. The genetic component of this course introduces the fundamental concepts of molecular genetics through an understanding of DNA, RNA, mRNA and tRNA. Immunology content introduces the types of immunity in humans. Allergies are presented with emphasis on those allergies important to optometrists. The response of the normal human immune system to infection and the collapse of the immune system during the development of AIDS is included.

BVS 513: Neurophysiology. (4.50 credit hours)
Three lecture hours and three laboratory hours per week. This course presents the study of the central nervous system, including cellular neurophysiology, organization of sensory pathways, voluntary control of movement and the physiology of central visual pathways. Laboratory instruction includes the gross and microscopic anatomy of the nervous system, the study of the major sensory and motor pathways of the brain, as well as discussion of the clinical correlations of neuro-anatomical structure.

BVS 515: Pharmacology I. (3.00 credit hours)
Three lecture hours per week. This fundamental course in pharmacology introduces the student to basic concepts of drug effects on the body organs and systems, including the eye. The pharmacological actions, mechanisms, clinical applications and potential adverse effects of systemic drugs in current clinical use are considered in detail.

BVS 530: Ocular Anatomy and Physiology I. (5.00 credit hours)
Four lecture hours and two laboratory hours per week. This course presents a systematic study of the anatomy and physiology of the eye. Lecture topics include the structure and function of the head and neck, ocular orbit, lids, lacrimal apparatus, conjunctiva, and cornea. Topics are approached from a gross anatomical, physiological, histological, and embryological perspective within the scope of contemporary primary care optometric practice.

BVS 531: Ocular Anatomy and Physiology II. (3.00 credit hours)
Two lecture hours and two laboratory hours per week. This course presents a systematic study of the anatomy and physiology of the eye. Lecture topics include the structure and function of the uveal tract, intraocular fluids, lens, retina and optic nerve. Topics are approached from a gross anatomical, physiological, histological, and embryological perspective within the scope of contemporary primary care optometric practice.

BVS 540: Optics I. (5.00 credit hours)
Four lecture hours and two laboratory hours per week. This course is an introduction to the geometrical optics of prisms, mirrors and lenses. Emphasis is placed on the characteristics of optical images formed by these basic elements and their combinations. Applications of the subject matter to vision and clinical optometry are discussed.

BVS 541: Optics II. (5.00 credit hours)
Four lecture hours and two laboratory hours per week. This course presents advanced topics in geometrical optics and an introduction to physical optics. Of primary interest are optical instruments and their properties, chromatic and monochromatic aberrations, interference, diffraction and polarization. Applications to vision science and clinical optometry are discussed.

BVS 542: Ophthalmic Optics I. (3.00 credit hours)
Two lecture hours and two laboratory hours per week. This introductory course in ophthalmic prescription measurement includes the use of instruments to design and measure spherical, cylindrical, and prismatic lens powers, as well as the determination of surface powers and base curves. The course emphasizes basic calculation principles and use of ophthalmic lens measuring devices, as well as discussion of lens materials and designs, and frame and spectacle measurements.

BVS 550: Eye Movements. (4.25 credit hours)
Three and one-half lecture hours and one and one-half laboratory hours per week. Eye movements are described with an emphasis on their functional characteristics. The anatomy and physiology of the extraocular muscles and the various neural pathways serving eye movements are presented within a framework of the functions they serve. Emphasis is placed on the basic oculomotor kinematics that will be necessary for clinical interpretation of eye movement disorders. Classes of eye movements that are considered in detail include vestibulo-ocular and optokinetic eye movements, pursuits, saccades, vergence, fixational eye movements and reading eye movements.

BVS 551: Visual Optics. (4.00 credit hours)
Three and one-half lecture hours and one laboratory hour per week. The eye is studied as the physiological optical element of the visual system. The optical components of the eye are discussed in terms of their geometrical, physical, physiological, psychophysical and optical properties. The eye is considered as an image-forming mechanism, where each component contributes to the nature and quality of the retinal image. The relationship between optics and visual performance is discussed, including the effects of ametropias and oculomotor systems on vision.

BVS 552: Visual Psychophysics. (4.25 credit hours)
Three and one-half lecture hours and one and one-half laboratory hours per week. This course is primarily concerned with the study of visual stimuli and the subjective perceptual responses they evoke from the human visual system. Included are the principles of photometry as well as topics related to the visual response to basic light stimuli at absolute threshold, in intensity discrimination as used in visual fields, and during light and dark adaptation. More complex visual stimuli used for clinical visual acuity testing is explored in detail. The psychophysical methods used to investigate these aspects of the human visual system are emphasized as they underlie all types of clinical optometric subjective testing.

BVS 616: Pharmacology II. (2.00 credit hours)
This course presents the pharmacology of systemic and ocular drugs used for the prevention, diagnosis and treatment of diseases. The pharmacological actions, mechanisms, clinical applications and potential adverse effects of systemic drugs that are important to optometrists are discussed in detail.

BVS 617: Pharmacology III. (2.00 credit hours)
This course presents the pharmacology of systemic and ocular drugs used for the prevention, diagnosis and treatment of diseases. The pharmacological actions, mechanisms, clinical applications and potential adverse effects of systemic drugs that are important to optometrists are discussed in detail.

BVS 618: Pharmacology IV. (2.00 credit hours)
This course presents the pharmacology of systemic and ocular drugs used for the prevention, diagnosis and treatment of diseases. The pharmacological actions, mechanisms, clinical applications and potential adverse effects of systemic drugs that are important to optometrists are discussed in detail.

BVS 640: Ophthalmic Optics II. (3.00 credit hours)
Two lecture hours and two laboratory hours per week. This course presents advanced optical principles and concepts of ophthalmic lens parameters and characteristics including lens thickness, impact resistance, multifocal and progressive design, absorptive tints and coatings, lens power effectivity, tilt effects, and lens magnification. Clinical applications of specific lens designs for occupational use and for compensation of prismatic imbalance are also discussed. The laboratory includes instruction in the fitting, adjusting, and repair of ophthalmic frames and eyewear.

BVS 650: Sensory Vision. (4.25 credit hours)
Three and one-half lecture hours and one and one-half laboratory hours per week. This course emphasizes the scientific and clinical fundamentals of color vision and contrast sensitivity (spatial and temporal). Additionally, the differences in the vision function of the infant and geriatric visual systems are discussed with application to clinical care. The subject matter is explored both from the basic anatomical and physiological mechanisms involved in these sensory processes, as well as the clinical tests and procedures used to evaluate them. Clinical proficiency in the diagnosis and management of color vision deficiencies, as well as contrast sensitivity testing, is obtained in this course.

BVS 655: Binocular Vision & Space Perception. (2.50 credit hours)
This fundamental course in theoretical binocular vision discusses, in detail, topics such as physical and perceived space, the horopter, retinal correspondence, fusion, fixation disparity and stereopsis. Clinical relevancy of these fundamental concepts is emphasized. Additional topics concerned with visual perception will be presented including perception of size, visual direction and visual attention. Information processing theory will be used to develop a model for visual perception. Various clinical and visual phenomena including figure ground relationships, visual illusions and neurological deficits will be used to illustrate the model.

BVS 801: Nutrition and Preventative Health. (1.00 credit hours)
This course is designed to address the growing student, practitioner, and public interest in nutrition and preventative healthcare. This course will introduce students to the basics of nutrition and health for both ocular and systemic conditions. Additional focus will be placed on ocular nutrition and supplements. This course also aims to expand student knowledge regarding ocular nutrition to improve patient education. Students will be exposed to up-to-date research and resources to stay current on nutrition and preventative healthcare recommendations. The assignments and final project will require students to apply and share their knowledge.

BVS 860: Research Elective. (0 credit hours)
The research elective is a quarter-long course intended to introduce students to conducting research in basic and/or clinical laboratory Individual faculty members will sponsor and supervise research projects jointly developed by the individual students and the faculty member. Credit and duration of each project will be variable, based upon the amount of time the student wishes to devote to the project.

BVS 900: Special Topics. (0 credit hours)
Individual study and advanced topics in the vision sciences.

BVS 901: Teaching in the Visual Sciences. (2.00 credit hours)
Clinicians with additional scientific/research training (clinician-scientists) are invaluable to the growth of the vision field. In particular, such individuals can contribute greatly to higher education programs in optometry and vision science. A foundation in teaching those aspects specific to vision science is critical to acquire for future success in academia. Teaching methodology can be broadly applied to both didactic and clinical courses. This course will be presented in seminar format with assigned readings and several practical assignments to assess whether the learning objectives have been met.

BVS 902: Biostatistics. (2.00 credit hours)
Statistics is an essential discipline in the field of research, important first in understanding the scientific literature relative to validity and appropriateness, and later to the conduct of the student's thesis project. A researcher needs to have a solid working knowledge of the various types of research data and how these were obtained, the distribution of those data, and formal hypothesis testing using those data to draw conclusions regarding the import of the findings. This course will examine the numerical and graphical representation of data, the concepts of sample size, data distributions and appropriate hypothesis testing, inferences regarding dependent and independent data, and parametric and non-parametric evaluation. A free statistical shareware, "R" software, will be used by the student to undertake sample problem analysis to further cement the understanding of the lecture concepts.

BVS 910: Ocular Anatomy & Physiology. (2.00 credit hours)
Knowledge of the anatomy and physiology of ocular structures is one of the requirements for not only the practice of optometry but also research in this field. This course will supplement the ocular anatomy and ocular physiology courses taught to all Optometry students and concentrate on areas which are most likely to be studied in optometric research. The course will require independent study and group discussion. Each student will prepare and conduct a literature review on an anatomic area and present it in a seminar format.

BVS 910A: Ocular Anatomy & Physiology - A. (4.00 credit hours)
Knowledge of the anatomy and physiology of ocular structures is one of the requirements for not only the practice of optometry but also research in this field. This course will review the basic ocular anatomy and ocular physiology material taught to all Optometry students and concentrate on areas which are most likely to be studied in optometric research. The course will require independent study and group discussion. Each student will prepare and conduct a literature review on an anatomic area and present it in a seminar format.

BVS 911: Vegetative Physiology of the Eye. (3.00 credit hours)
This course will cover the chemical properties of the various structures in the eye (i.e., aqueous humor, lens, vitreous body). The swelling pressure, transport processes, and optics of the cornea and sclera will be covered. The metabolism of the cornea, lens and retina will also be discussed.

BVS 912: Visual Physiology of the Eye. (3.00 credit hours)
This course covers fundamental information and concepts on the anatomy, cell and molecular biology, biochemistry and physiology of the retina and vision related areas of the brain, and fundamental information and concepts on visual optics, and sensory aspects of vision.

BVS 913: Current Topics Tear Film & Dry Eye. (3.00 credit hours)
In recent years the tear film and ocular surface has been the subject of intense interest and research, due in part to the recognition that ocular surface disease is a common condition with major implications for sufferers' quality of life. This course will provide an overview of current knowledge relative to ocular surface and tear film structure and dynamics, including what is currently known and unknown concerning tear composition and behavior. Clinical topics such as the factors that influence tear film stability and the mechanisms of corneal staining will be examined from current evidence to provide a translational understanding of basic mechanisms that influence the human ocular surface in health and disease. The course will be taught in a lecture format with hands-on sessions for demonstration and experience with instruments and techniques aimed at generating ocular surface and tear film information.

BVS 914: Vegetative Physiology of the Cornea. (3.00 credit hours)
This course will describe the anatomy and physiology of the normal cornea in depth. It will provide an understanding of the various diseases and dystrophies of the cornea from an etiological basis. The course will allow the student to understand the interplay between contact lens complications and normal/abnormal corneal physiology. This will be accomplished by reviewing the literature in this area.

BVS 920: Sensory Neuroscience. (2.00 credit hours)
Sensory neuroscience is a subfield of neuroscience which explores the anatomy and physiology of neurons that are part of sensory systems such as vision, hearing, and olfaction. This course will focus on vision. Visual neuroscience is the study of the visual system including the visual cortex. Its goals are to understand the neurophysiology of the visual system, and to understand how neural activity results in visual perception and behaviors that depend on vision.

BVS 920A: Sensory Neuroscience A. (4.00 credit hours)
Sensory neuroscience is a subfield of neuroscience which explores the anatomy and physiology of neurons that are part of sensory systems such as vision, hearing, and olfaction. This course will focus on vision. Visual neuroscience is the study of the visual system including the visual cortex. Its goals are to understand the neurophysiology of the visual system, and to understand how neural activity results in visual perception and behaviors that depend on vision.

BVS 921: Color Vision. (3.00 credit hours)
Color vision is an active area of both clinical and basic science research. Clinical color vision research requires an understanding of more rigorous testing and research methods used in color vision studies. The course will be presented through a roughly equal division between lecture and laboratory and will require presentation of a well-developed experimental design proposal for a research study.

BVS 924: Neurophysiology of Amblyopia. (3.00 credit hours)
Our knowledge of the anatomy and physiology of the visual pathway has expanded greatly over the last few decades. This increase in knowledge has to a large extent been driven by investigations into the neural abnormalities resulting from amblyopia. Without a clear understanding of the neurophysiological basis of amblyopia, treatments for this condition cannot be developed. This course will supplement the Neurophysiology course taught to all SCCO students and concentrate on areas dealing with amblyopia. The course will require independent study and group discussion. Each student will prepare and conduct a literature review on an area of interest and present it in a seminar format.

BVS 932: Ocular Pathology. (3.00 credit hours)
This course is designed to introduce the graduate student to concepts in ocular diseases. Topics will include genetics and pathophysiology of glaucoma, photoreceptor degenerations, dry eye, contact lens effects on the eye and infection/inflammation, new therapeutic approaches and current research topics.

BVS 940: Visual Optics. (2.00 credit hours)
The eye is studied as the physiological optical element of the visual system. The optical components of the eye are discussed in terms of their geometrical, physical, physiological, psychophysical, and optical properties. The eye is considered as an image forming mechanism, where each component contributes to the nature and quality of the retinal image. The relationship between optics and visual performance is discussed, including the effects of ametropias and oculomotor systems on vision. Students will demonstrate their ability to search and evaluate the visual optics literature and to communicate effectively through writing and in small group discussions.

BVS 940A: Visual Optics A. (4.00 credit hours)
Students in this course will learn about the optics of the human eye. They will rely on their present knowledge of geometrical and physical optics, and apply this knowledge to a study of the eye. They will understand how the optical characteristics of the eye relate to the performance of the visual system as a whole. Importantly, they will learn how the optics of the eye affects performance in everyday activities. They will learn about normal variation in the optical characteristics of the eye, and the optical consequences of various ocular conditions and clinical treatments and procedures. Students will be able to integrate what they know to find solutions to practical problems in vision. They will demonstrate their ability to search and evaluate the scientific literature, and to communicate effectively through writing and in small group discussions.

BVS 950: Sensory Processes & Perception. (2.00 credit hours)
The purpose of the course is the study of sensory processes which encompass three areas of vision function important to scientists: the perception of light, form, and color. Students will examine spatial vision and temporal vision, the field of vision, the range of color vision and many other areas of current vision research. The course will be presented through a roughly equal division between lecture and laboratory and will require presentation of a proposal for a research study related to the material in the course.

BVS 950A: Sensory Processes & Perception A. (4.00 credit hours)
A foundation in vision science is rooted in the underpinnings of basic sensory processes. The study of sensory processes encompasses three areas of vision function important to scientists: the perception of light, form, and color. This knowledge is routinely used by vision scientists when conducting research studies examining spatial vision and temporal vision, the field of vision, the range of color vision, and many other areas of current vision research. The course will be presented through a roughly equal division between lecture and laboratory and will require presentation of a proposal for a research study related to the material in the course.

BVS 951: Psychophysical Mthd & Exprmntl Dsgn. (2.00 credit hours)
The purpose of this course is to provide a framework into which study methodologies are executed. Content of the course includes photometry and luminance calibration, signal detection theory, ROC analysis and systematic experimental design. The course will be presented through a roughly equal division between lecture and laboratory and will require presentation of a well-developed experimental design proposal for a research study.

BVS 951A: Psychophysical Mth & Expmntl Dsgn A. (4.00 credit hours)
A foundation in vision science is rooted in the underpinnings of the various methods and experimental designs used to answer the scientific questions that are asked. The psychophysical methodology/approach is the historical root of vision science. It often precedes, and often drives, the neurophysiological studies that seek to resolve and/or explain the psychophysical findings. Knowledge of the general methods/designs used in psychophysical based research serves to provide a framework into which study methodologies are executed within. The course will be presented through a roughly equal division between lecture and laboratory and will require presentation of a well-developed experimental design proposal for a research study.

BVS 952: Ethics in Research. (2.00 credit hours)
Through reading, discussion and writing, students will gain sensitivity for and knowledge of social ethics and the social context of scientific research. They will have knowledge of those elements of ethics, good scientific practice and law that are essential to perform research in the biomedical disciplines, with or without human subjects. They will have knowledge and skills to develop and implement effective, ethical research projects. The course content is organized in three strands: an introduction to ethics, the human subject and research integrity.

BVS 957: Accommodation. (3.00 credit hours)
Human ocular accommodation is studied from a functional viewpoint, with an aim of understanding its role in daily life. Accommodation is introduced by way of J. J. Gibson's question of how depth is extracted from retinal images. Empirical data on the nature of the steady state and dynamic characteristics of accommodation are reviewed. Then, the stimuli to accommodation are studied within Heath's system of operational classification. Various external and internal factors in the accommodation response are investigated. The development of accommodation in infancy and childhood, and its normal decline with age (presbyopia), are studied. Theories of the ocular mechanism of accommodation are studied, including geometrical-optical and physical models of the crystalline lens in accommodation. Control system approaches to accommodation are introduced. The synkinesis between accommodation and vergence is discussed. The nature and causes of presbyopia and other accommodative anomalies are studied. Procedures and apparatus for measuring accommodation are studied, with opportunity to design and implement simple accommodation experiments with two common instruments.

BVS 959: Vision and Reading. (3.00 credit hours)
This course will provide an integrative approach to investigating associations between vision and reading. The first part of the course will review the basic processes that are involved in reading and learning to read. The next part of the course will investigate how specific vision processes are involved in reading. This includes contrast sensitivity, temporal processing, fixation disparity, and span of recognition. Finally, clinical approaches to analyze the relationship between vision and reading will be discussed.

BVS 960: Thesis. (0 credit hours)
The Master of Science in Vision Science emphasizes the development and execution of an original vision research project. Each student must write a paper based on the student's research activities. The paper must be of publication quality. A Master's thesis describing this project is required for completion of the program and will be reviewed by a Thesis Committee. Time spent planning, carrying out the research project, data analysis and writing the thesis will be assigned BVS 960. This can be from 1-12 credit hours per quarter. Total minimum credit hours required for the thesis is 40 credit hours. This also requires a defense of the thesis. The maximum number of credits that can be taken for BVS 960 is 50.