800. *Research Methods*

Fall, Winter, Spring, Summer. 2(0-6) May reenroll for a maximum of 6 credits. Beginning graduate students. Interdepartmental with and administered by the Department of Physics.

Problems and techniques of current research by taking part in the design and setup of experiments, data taking and reduction; study and practice of theoretical methods. Areas of study: solid state and molecular structure, nuclear, elementary particles, astronomy, astrophysics.

801. *Seminar*

Winter. 1(1-0) May reenroll for a maximum of 2 credits. Graduate students or approval of department.

Seminars to be presented by both faculty and students to review papers in the current astronomical research literature.

819. *Stellar Structure*

Spring of even-numbered years. 3(3-0) AST 458 or PHY 395 or approval of department.

Physical properties of the stellar interior. Methods of calculating models. Stellar evolution. Comparison of theory with current observations.

Approved through Winter 1982.

820. *Advanced Topics in Astrophysics*

Winter. 3(3-0) May reenroll for a maximum of 15 credits. AST 452 or PHY 395 or PHY 429 or approval of department.

Possible topics include dynamics of stars in galaxies, astrophysical fluid dynamics, quasar theory, stellar atmospheres, stellar interiors, stellar spectroscopy, and stellar photometry.

850. *Electrodynamics of Plasmas I*

Fall. 3(3-0) E E 835 or PHY 448; E E 874. Interdepartmental with Electrical Engineering and the Department of Physics and administered by Electrical Engineering.

Boltzmann equation; moment equations; two-fluid theory of plasma, waves in cold, warm and anisotropic infinite plasma; waves in bounded plasma structures, energy flow in anisotropic plasmas.

860. *General Relativity and Cosmology I*

Fall of even-numbered years. 3(3-0) PHY 858 or approval of department. Interdepartmental with and administered by the Department of Physics.

Conceptual foundations of general relativity theory; elements of tensor calculus; Riemann-Christoffel curvature tensor; the field equations; experimental tests; special solutions; the extension to cosmology.

861. *General Relativity and Cosmology II*

Winter of odd-numbered years. 3(3-0) PHY 860. Interdepartmental with and administered by the Department of Physics.

Relativistic cosmology: the model universes; stead-state theory; observational evidence and possibilities for decision among models; current problems.

984. *Advanced Readings in Physics or Astronomy*

Fall, Winter, Spring, Summer. Variable credit. Interdepartmental with and administered by the Department of Physics.

989. *Electrodynamics of Plasmas II*

Winter of odd-numbered years.3(3-0) E E 850. Interdepartmental with the Department of Physics, and Electrical Engineering. Administered by Electrical Engineering.

One fluid plasma model, magnetohydrodynamics, Maxwell's stress tensor, low frequency waves, transport phenomena, Landau damping, collision and rate coefficients. Diffusions in a magnetic field; investigation of dc, rf and microwave discharges.

AUDIOLOGY AND SPEECH SCIENCES ASC

College of Communication Arts and Sciences

108. *Voice and Articulation*

Fall, Winter, Spring, Summer. 3(4-0)

The study and development of the skills of voice and articulation.

201. *Introduction to Communication Disorders*

(372.) Fall, Winter. 3(3-0)

Speech, hearing and language disorders in adults and children.

222. *Oral Language Development*

Winter, Summer. 3(2-0)

Emergence and development of receptive and expressive aspects of oral language of the child.

227. *Physics for Audiology and Speech Sciences*

Fall, Spring. 4(4-0) MTH 108. Not open to students with credit in PHY 237. Interdepartmental with and administered by the Department of Physics.

Introductory physics for Audiology and Speech Sciences majors: kinematics, Newtons' Law, conservation of energy and momentum, waves and vibrations, sound propagation, resonance, speech production.

274. *Structures and Functions of Speech and Hearing Mechanisms*

Fall, Winter. 5(4-2) ASC 108 or approval of department.

Peripheral and central auditory mechanisms and the respiratory, phonatory and articulatory mechanisms for speech.

276. *Descriptive Phonetics*

Winter, Spring. 3(3-0) ASC 274 or approval of department.

Detailed description of the principles that underlie the production of speech sounds.

277. *Scientific Bases of Voice Communication Process*

Fall, Spring. 3(3-0) ASC 276 and PHY 237 or approval of department.

Scientific bases of voice communication with special reference to the acoustic aspect of production.

373. *Clinical Procedures in Speech Pathology and Audiology*

Winter, Spring. 4(2-2) 2.00 grade-point average in ASC 277 and ASC 372 or approval of department.

Principles underlying the clinical interview and client relationships essential to diagnosis and therapy. Procedures in obtaining, recording, and evaluating test results and therapeutic methods.

444. *Oral Language of Urban Areas*

Winter, Summer. 3(3-0)

Concentration in the characteristics of language and human communication as these relate to studies and practices of those involved in urban affairs.

445. *Communication Disorders: Social and Emotional Components*

Spring. 3(3-0) Juniors.

Analysis and management of the social and emotional components of speech, language, and hearing problems.

454. *Introduction to Audiology*

Fall, Spring. 5(4-1) ASC 276, ASC 277.

Fundamental aspects of normal hearing; hearing disorders, hearing tests.

460. *Aural Rehabilitation*

Winter, Summer. 5(4-1) ASC 454 or approval of instructor.

Fundamental aspects of hearing aids, auditory training, and speechreading for the hearing-impaired person.

470. *Communication Disorders*

Spring, Summer. 3(3-0) Juniors. Not open to Audiology and Speech Sciences majors.

An overview of communication disorders; the professions of speech and language pathology and audiology and their relationships to allied professions.

474. *Clinical Practicum in Speech and Language Pathology*

Fall, Winter, Spring, Summer. 1 credit. May reenroll for a maximum of 2 credits. Grade of 2.0 or better in both ASC 372 and ASC 373.

Therapeutic experience in speech and language pathology.

476. *Speech Pathology II: Diagnostics*

Fall, Winter, Spring, Summer. 5(3-2) ASC 474 or approval of department.

Test procedures and analysis; spervised clinical experience in language and speech evaluations and report writing.

477. *Methods in Public School Speech and Hearing Therapy*

Fall, Winter, Spring. 4(3-4) ASC 372. Must be taken prior to term of student teaching.

Administration and organization, procedures and materials in public school speech and hearing therapy.

480. *Basic Laboratory in Experimental Audiology*

Fall, Spring. 3(1-4) MTH 108, PHY 227, ASC 454; Juniors.

Contemporary experimental procedures in basic audiological research. Projects include systematic exercises in equipment use, calibration, psychophysical methods, and data analysis.

499. *Independent Study*

Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 12 credits. Approval of department.

801. *Advanced Study of Articulatory Behavior*

Summer. 4(3-2) Approval of department.

Theoretical and pragmatic implications of the interrelationships of articulatory behavior and language production, especially as related to investigating procedures and results.

810. *Audiologic Calibration Standards*

Summer. 4(3-2) ASC 854 or ASC 833A and ASC 833B; ASC 880A; approval of department.

Contemporary electro-acoustic and other measurement standards for audiometers, sound level meters, earphones, hearing aids, and related devices; current issues in standards development; laboratory in applied measurement.

832. *Speech and Hearing Evaluation and Therapy*

D. Mental Retardation

Summer. 4(3-0)

Language behavior and speech development of the mentally retarded as related to all facets of personal-social development and adjustment. *Approved through Spring 1982.*

833. *Specialized Clinical Audiology.*

A. Differential Audiometry

Fall. 4(3-2)

Pure tone audiometric tests as an aid to the otologist in evaluating the pathology of hearing loss; including the development of norms. Consideration of nonorganic loss.

B. Speech Audiometry

Fall. 4(3-2)

Evaluation of speech and speech-like signals; detection, discrimination and recognition.

C. Industrial Audiology

Spring. 4(2-2)

Evaluation of the role of the audiologist in industry emphasizing identification procedures, damage-risk criteria, measurement and control of noise, conservation procedures, and medico-legal problems.

D. Advanced Audiological Evaluation

Winter. 4(3-2)

Theory, administration and evaluation of selected tests of the peripheral and central auditory system.

E. Pediatric Audiology

Winter. 4(2-2)

Evaluative procedures including play audiometry, language assessment, and case studies as aids to the differential diagnosis of auditory disorders in children; habilitative procedures for the acoustically handicapped child.

F. Geriatric Audiology

Summer. 4(4-0) ASC 460 or approval of department.

Causes and descriptions of hearing loss associated with aging; audiologic evaluation and rehabilitation of older people with emphasis on amplification needs.

G. Auditory Habilitation of the Hearing Impaired

Spring. 4(4-0) ASC 460; ASC 833B or approval of department.

Communication skills development, early identification, differential diagnosis, personal and classroom amplification systems, methodological controversies and public laws affecting education of the hearing impaired.

H. Electrophysiological Methods of Auditory and Vestibular Assessment

Spring. 4(3-2) ASC 854 or approval of department.

Electroencephalic and brain stem audiometry, electrococh leography, electrocardiac audiometry, respiration audiometry, electrodermal audiometry, impedance audiometry and electronystagmography.

I. Amplification Systems for the Hearing Impaired

Winter. 4(3-2) ASC 833B.

Form, function and clinical application of group and personal amplification systems for the hearing impaired.

J. Tinnitus and Vestibular Disorders

Winter. 3(2-2) ASC 833I or approval of department.

Anatomy, physiology, evaluation, interpretation and management of tinnitus.

841. *Evaluation and Treatment of Speech and Language Disorders*

A. Aphasia

(831A.) Fall. 4(4-0)

Neuropathology, symptomatology, and speech and language habilitation and rehabilitation of individuals with aphasia.

B. Apraxia and Dysarthria

(832B.) Spring. 4(4-0)

Neuropathology, symptomatology, and speech and language habilitation and rehabilitation of individuals with apraxia and dysarthria, including those with cerebral palsy.

C. Voice Disorders

(831B.) Winter. 4(4-0)

Etiology, symptomatology, diagnosis, and treatment of voice disorders including the specific communication problems of the laryngectomized.

D. Stuttering

(832E.) Fall. 4(4-0)

History, symptomatology, development, evaluation, and theories of stuttering. Focus is to facilitate clinical involvement with stutterers.

E. Orofacial Anomalies

(832F.) Spring. 4(4-0)

Etiology, symptomatology, diagnosis, and treatment of various orofacial anomalies including lip and/or palatal cleft, glossectomy, jaw resection, dental anomalies, and tongue thrust.

F. Delayed Language Assessment

(832C.) Winter. 4(4-0)

Evaluative techniques including audiometry, psychometry, and case history as aids to the differential evaluation of delayed language development.

G. Language Intervention: Early Stages

Spring. 4(4-0) Approval of department.

Language intervention for those children functioning at or below a four-year-old level in their language behavior; mental retardation, autism, and other developmental delays associated with severe language impairments.

H. Language Intervention: Later Stages

Summer. 4(4-0) Approval of department.

Treatment of developmental language delays and disorders with emphasis upon children functioning at or above the four-year-old level in language behavior; preadolescent and adolescent language disorders are included.

842. *Augmentative and Alternative Communication Systems*

Spring. 4(4-0) Approval of department.

Historical perspective and philosophy of augmentative/alternative communication systems. Aided and unaided nonspeech communication systems. Assessment, selection, and intervention procedures.

843. *Transfer and Maintenance of Speech Behaviors*

Winter. 4(4-0)

Various clinical procedures; assisting others in transferring and maintaining these behaviors outside the clinical environment.

853. *Speech Perception: Theory and Measurement*

Spring. 4(4-0) Approval of department.

Evaluation and analysis of various theories of speech perception and their implications for speech and language pathologists, audiologists, and speech and hearing scientists.

854. *Psychophysics and Theories of Audition*

Fall. 4(4-0) Approval of instructor.

Nature of auditory stimuli and the results of psychophysical experimentation in audition.

874. *Speech and Hearing Problems in Public Schools*

Summer. 4(3-0) May reenroll for a maximum of 16 credits.

Graduate seminar in speech and hearing involving problems that arise in relation to speech and hearing therapy in the public schools.

875A. *Clinical Practicum in Speech and Language Pathology*

Fall, Winter, Spring, Summer. 1 credit. ASC 474. May reenroll for a maximum of 8 credits.

Directed diagnostic, therapeutic, and prognostic experience in speech and language pathology.

875B. *Clinical Practicum in Audiology*

Fall, Winter, Spring, Summer. 1 credit. ASC 454. May reenroll for a maximum of 8 credits.

Directed diagnostic, therapeutic and prognostic experience in audiology in various clinical settings.

876. *Communication Disorders: Neuroanatomy-Neurophysiology*

Fall. 4(3-1) Approval of department.

Neuroanatomical and neurophysiological correlates of speech, language, and hearing.

880A. *Algorithms for Speech and Hearing Sciences*

Fall. 4(4-0)

A discussion of useful algorithms applicable to quantification of phenomena related to audiology and speech sciences.

880B. *Acoustic Phonetics*

Winter. 4(2-2) ASC 880A or approval of department.

An analytic study of the acoustics of speech.

880C. *Instruments and Electronics for Audiology and Speech Sciences*

Spring. 4(3-3) ASC 880B or approval of department.

A discussion of the electronic principles and instruments necessary to measure parameters related to hearing and speech processes.

880D. *Experimental Phonetics*

Summer. 4(4-0) ASC 880C or approval of department.

Critical review of the literature in experimental phonetics. Selected papers on acoustic and physiological phonetics and realted fields are presented in seminar fashion.

899. *Master's Thesis Research*

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

931. *Hearing Handicap*

(832A.) Summer. 4(3-2)

A theoretical approach to the aural rehabilitative process.

940. Seminar in Audiology and Speech Sciences
Fall, Winter, Spring, Summer. 4(4-0) May reenroll for a maximum of 16 credits.

990. Special Problems in Audiology and Speech Sciences
Fall, Winter, Spring, Summer. 1 to 6 credits.
Special projects in audiology and speech sciences.

999. Doctoral Dissertation Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

BIOCHEMISTRY BCH

College of Agriculture and Natural Resources
College of Human Medicine
College of Natural Science
College of Osteopathic Medicine

200. Introduction to Biochemistry
Winter, Summer. 5(5-0) Credit may not be earned in both BCH 200 and BCH 401. General chemistry; one term organic chemistry. Not acceptable for a B.S. degree in biochemistry.
Survey of biochemistry emphasizing the major metabolic activities of living organisms.

400H. Honors Work
Fall, Winter, Spring. Variable credit. Approval of department.
Assigned reading and experimentation.

401. Basic Biochemistry
Fall, Spring, 5(5-0) Credit may not be earned in both BCH 200 and BCH 401. One year organic chemistry or CEM 242; not open to biochemistry majors.
A one-term presentation of biochemistry emphasizing structure and function of major biomolecules, metabolism and regulation. Examples used for illustrative purposes will emphasize the mammalian organism.

404. General Biochemistry Laboratory
Winter. 3(1-6) Analytical chemistry; BCH 401 or BCH 451.
Experimental aspects of biochemistry.

405. Biochemistry Laboratory
Fall, Spring. 3(0-9) BCH 453 or concurrently; BCH 404; undergraduate biochemistry majors or approval of department.
Advanced undergraduate laboratory to illustrate modern biochemical methods and techniques.

412. Clinical Biochemistry
(363.) Winter, Summer. 3(2-3) BCH 401; CEM 162. Medical Technology majors. Not acceptable for a B.S. degree in biochemistry. Others: approval of department.
Quantitative clinical laboratory methods.

451. Biochemistry
Fall. 3(3-0) Credit may not be earned in both BCH 401 and BCH 451. One year organic chemistry or CEM 242.
A comprehensive survey of biochemistry with emphasis on the properties and functions of biomolecules, energy-yielding and energy-requiring processes, and the transfer of genetic information.

452. Biochemistry
Winter. 3(3-0) BCH 451.
Continuation of BCH 451.

453. Biochemistry
Spring. 3(3-0) BCH 452.
Continuation of BCH 452.

IDC. Biological Membranes
For course description, see Interdisciplinary Courses.

499. Research
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department.
A course designed to give qualified undergraduate students an opportunity to gain experience in biochemical research.

501. Medical Biochemistry
Summer. 3(3-0) Open only to students in the professional programs in the College of Human Medicine and the College of Osteopathic Medicine.
Basic Biochemical principles and terminology of importance in medical biology.

502. Medical Biochemistry
Fall. 3(3-0) BCH 501 or approval of department.
A continuation of BCH 501.

503. Cell Biology
Fall. 5(5-0) Admission to the College of Human Medicine. Interdepartmental with the departments of Microbiology and Public Health, Physiology, and Pharmacology and Toxicology. Administered by the Department of Microbiology and Public Health.
Principles of cell biology for medical students.

511. Medical Biochemistry I
Winter. 3(3-0) One year of organic chemistry. Open only to students in the professional programs in the College of Human Medicine and the College of Osteopathic Medicine.
Basic biochemical principles and terminology with emphasis on metabolism and function of biomolecules of importance in medical biology.

512. Medical Biochemistry II
Spring. 4(4-0) BCH 511.
Basic biochemical principles and processes pertinent to specific areas of human pathophysiology.

801. Biochemical Research Methods
Fall. 1(1-1) or 2(2-1) May reenroll for a maximum of 2 credits. One year of organic chemistry or CEM 242; BCH 451 or BCH 811, or concurrently.
Discussions and demonstrations of selected experimental techniques of wide application in biochemistry.

811. Advanced Biochemistry
Fall. 4(4-0) One year of organic chemistry, one year of physical chemistry, one term of introductory biochemistry, BCH 801 taken previously or concurrently, or approval of department. Limited to graduate students in biochemistry or other students needing a similar professional preparation.
The structure and function of biomolecules, energy transformations and chemical reactions in living cells, regulation of cell reactions, and the replication of living organisms.

812. Advanced Biochemistry
Winter. 4(4-0) BCH 811.
Continuation of BCH 811.

813. Advanced Biochemistry
Spring. 4(4-0) BCH 812.
Continuation of BCH 812.

821. Biochemical Mechanism and Structure I
Fall. 2(2-0) BCH 401, one year of organic chemistry and physical chemistry or concurently; or approval of department.
Structures, methods of structural analysis, synthesis, and reactions mechanisms of biological substances including protein, carbohydrates, lipids, porphyrins, phosphate esters, enzymes and coenzymes.

822. Biochemical Mechanism and Structure II
Winter. 2(2-0) BCH 821 or approval of department.
Continuation of BCH 821.

831. Physiological Biochemistry I
Winter. 3(3-0) BCH 401.
Physiological biochemistry, with emphasis on metabolic interpretation of normal and altered physiological states of the human organism and appropriate animal models.

832. Physiological Biochemistry II
Spring. 3(3-0) BCH 831.
Continuation of BCH 831.

855. Special Problems
Fall, Winter, Spring, Summer. Variable credit. May reenroll for a maximum of 12 credits. Approval of department.
Consideration of current problems.

864. Plant Biochemistry
Spring. 4(4-0) BCH 401, BOT 301 or approval of department. Interdepartmental with the Department of Botany and Plant Pathology.
Metabolism of nitrogen-compounds, carbohydrates, and lipids unique to plants' cell organelles; photosynthesis; photorespiration; dark respiration; cell walls; lectins; nitrogen cycle including nitrogen fixation; sulfur cycle.

888. Laboratory Rotation
Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 15 credits. Graduate student majors; approval of department.
Participation in research laboratories to learn experimental techniques and research approaches, broaden research experience, and assess research interests prior to selecting a thesis adviser.

899. Master's Thesis Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

960. Selected Topics in Biochemistry
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits. Approval of department.
Topics will be selected from the areas of biochemical genetics, biochemistry of development, biochemical evolution, complex proteins, lipid metabolism, immunochemistry, hormones, control mechanisms and structure of biological macromolecules.