### Courses

**800. Research Methods**
- Fall, Winter, Spring, Summer. 3(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. 4(3-0)
- AST 458 or PHY 395 or approval of department.

**820. Advanced Topics in Astrophysics**
- Winter. 3(3-0)
- May reenroll for a maximum of 15 credits. AST 452 or PHY 395 or PHY 428 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.

**840. Electrodynamics of Plasmas I**
- Fall. 3(2-1)
- E E 448 or PHY 449 or PHY 381 or PHY 481.
- 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.

**861. General Relativity and Cosmology II**
- Winter, Fall, Spring. 3(3-0)
- PHY 860.
- Interdepartmental with and administered by the Department of Physics.
- Relativistic cosmology: the model universe; steady-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 859.
- 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

**College of Communication Arts and Sciences**

**108. Voice and Articulation**
- Fall, Winter, Spring, Summer. 3(0-4)
- The study and development of the skills of voice and articulation.

**201. Introduction to Communication Disorders**
- Fall, Winter. 3(3-0)
- Speech, hearing and language disorders in adults and children.

**222. Oral Language Development**
- Winter, Summer. 3(3-0)
- 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, Newton's 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, Spring. 3(3-0)
- Peripheral and central auditory mechanisms and their respiratory, phonatory and articulatory mechanisms for speech.

**275. 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.

**276. Scientific Bases of Voice Communication Process**
- Fall, Spring. 3(3-0) ASC 376 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)
- 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. 3(4-1) ASC 454 or approval of instructor.
- Fundamental aspects of hearing aid, 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. 4(3-3) JUNIORS.
- Field work in various areas of communication disorders and to satisfy requirements of the profession.

**476. Speech Pathology II: Diagnostics**
- Fall, Winter, Summer. 5(3-2)
- ASC 474 or approval of department.
- Test procedures and analysis; supervised clinical experience in language and voice evaluations and report writing.

**477. Methods in Public School Speech and Hearing Therapy**
- Fall, Winter. 4(2-2) ASC 372.
- Must be taken prior to 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, Summer. 1 to 6 credits.
- May reenroll for a maximum of 12 credits. Approval of department.

**501. 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. Audiology Calibration Standards
Summer. 4(3-2) ASC 854 or ASC 833A and ASC 833B; ASC 880A; approval of department.
Contemporary electroacoustics and other measurement standards for audiometers, sound level meters, earphones, hearing aids, and related devices; current issues in standards development; laboratory applied measurement.

822. 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 Audiology
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 Audiology
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 medical problems.
D. Advanced Audiological Evaluation
Winter. 4(3-2)
Theory, administration and evaluation of selected test of the peripheral and central auditory systems.
E. Pediatric Audiology
Winter. 4(2-2)
Evalitative procedures including play audiology, language assessment, and case studies as aids to the differential diagnosis of auditory disorders in children; rehabilitative 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.

851. 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 clinicl involvement with stutters.
E. Orofacial Anomalies
(832F) Spring. 4(4-0)
Etiology, symptomatology, diagnosis, and treatment of various oral-facial anomalies including lip and/or palatal cleft, glossectomy, jaw resection, dental anomalies, and tongue thrust.
F. Delayed Language Assessment
(832C) Winter. 4(4-0)
Evalulative techniques including audiology, psychiatry, 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; preschool 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 microphone 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.

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.

873. Speech and Hearing Problems in Public Schools
Fall, Winter, Spring, Summer. 1 credit.
ASC 474. May renew 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 renew for a maximum of 8 credits.
Directed diagnostic, therapeutic and prognostic experiences in audiology in various clinical settings.

876. Communication Disorders: Neuroanatomy-Neurophysiology
Fall, Winter, Spring. 4(4-0) 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 880B 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 880C 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 880D or approval of department.
Critical review of the literature in experimental phonetics. Selected papers on acoustics and physiological phonetics and related fields are presented in seminar fashion.

899. Master's Thesis Research
Fall, Winter, Spring. 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. 3(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 biochemis-
try.
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 em-
phasizing structure and function of major
biomolecules, metabolism and regulation.
Examples used for illustrative purposes will
emphasize the mammalian organism.

404. General Biochemistry
Laboratory
Wor. 2(1-6) Analytical chemistry; BCH 401 or BCH 451.
Experimental aspects of biochemistry.

405. Biochemistry Laboratory
Fall, Spring. 30-9 BCH 453 or con-
currently. BCH 404; undergraduate biochem-
istry majors or approval of department.
Advanced undergraduate laboratory to illustrate
modern biochemical methods and techniques.

412. Clinical Biochemistry
(Winter, Spring. 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 or-
ganic 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.

1DC. Biological Membranes
For course description, see Interdisci-
plinary Courses.

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

501. Medical Biochemistry
Summer. 3(2-0) Open only to students in
the professional programs in the College of
Human Medicine and the College of Oste-
opathic 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 To-
xicology. 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 profes-

tional programs in the College of Human
Medicine and the College of Osteopathic
Medicine.
Basic biochemical principles and terminology
of importance in medical biology.

512. Medical Biochemistry II
Spring. 4(4-0) BCH 511.
Basic biochemical principles and processes per-
tinent to specific areas of human pathophysiol-
y.

801. Biochemical Research Methods
Fall. 3(1-1) or 2(2-1) May reenroll for a
maximum of 2 credits. One term of intro-
duction to biochemistry, BCH 821 or
concurrently.
Discussions and demonstrations of selected ex-
perimental techniques of wide applica-
tion in biochemistry.

811. Advanced Biochemistry
Fall. 4(4-0) One year of organic
chemistry, one year of physical chemistry, one
term of introduction to biochemistry, BCH 801
or BCH 821 taken previously or concurrently, or approval of department. Limited to graduate students in
biochemistry or others students needing a simi-
lar professional preparation.
The structure and function of biomolecules, en-
ergy 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(3-0) BCH 401, one year of or-
ganic chemistry and physical chemistry or con-
currently; or approval of department.
Structures, methods of structural analysis, syn-
thesis, and reactions mechanisms of biological
substances including proteins, carbohydrates,
lipids, porphyrins, phosphate esters, enzymes
and coenzymes.

822. Biochemical Mechanism and
Structure II
Winter. 2(3-0) 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 cred-
its. Approval of department.
Consideration of current problems.

864. Plant Biochemistry
Spring. 4(4-0) BCH 401, BOT 301 or
approval of department; in cooperation with the
Department of Botany and Plant
Pathology.
Metabolism of nitrogen-compounds, carbohy-
drates, and lipids unique to plants' cell organ-
elles; photosynthesis, photorepiration; 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 cred-
its. Graduate student majors; approval of de-
partment.
Participation in research laboratories to learn
experimental techniques and research ap-
proaches, broaden research experience, and ac-
sess 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 cred-
its. Approval of department.
Topics will be selected from the areas of
biochemical genetics, biochemistry of develop-
ment, biochemical evolution, complex pro-
teins, lipid metabolism, immunobiochemistry,
hormones, control mechanisms and structure of
biological macromolecules.