304  Stars
Spring of odd years. 3(3-0) P:M: (PHY 184 or PHY 184B or PHY 294H) and (AST 303) and (MTH 234 or concurrently or MTH 254H or concurrently or LBS 220 or concurrently) SA: AST 401

307  The Milky Way
Fall of odd years. 3(3-0) P:M: (PHY 183 or PHY 193H or PHY 193E) and (MTH 132 or MTH 152H or LBS 118) SA: AST 202

308  Galaxies and Cosmology
Spring of even years. 3(3-0) P:M: (AST 307) and (PHY 184 or PHY 194B or PHY 294H) and (MTH 234 or concurrently or MTH 254H or concurrently or LBS 220 or concurrently) SA: AST 402
Structure and content of galaxies beyond the Milky Way. Active galaxies and quasars. The expanding universe. Modern cosmological models.

310  Directed Studies
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 4 credits in all enrollments for this course. R: Approval of department. Individual study or project in astronomy or astrophysics under the direction of a faculty member.

312  Observational Astronomy
Spring. 1(0-2) P:M: (AST 303 or AST 307)
Basic observational techniques in astronomy. Stellar photometry and spectroscopy.

410  Senior Thesis
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 5 credits in all enrollments for this course. P:M: (AST 301) and completion of Tier I writing requirement.
Design and execute an original experiment or computation. A written and oral report of the research is required.

800  Research Methods
Fall, Spring, Summer. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course. RB: (AST 801) Apprenticeship in astrophysical research; student will work closely with individual faculty member learning research techniques.

801  Introduction to Astrophysics
Fall. 3(3-0)
Survey of contemporary astrophysics. Stellar evolution, the structure of the Milky Way, the properties of external galaxies, and cosmology.

802  Techniques of Modern Astrophysics
Fall, Spring. 3 credits. RB: (AST 801) Students are introduced to modern astrophysics through participation in short projects involving literature surveys, professional planning, and research in observational, theoretical, and computational astrophysics.

810  Radiation Astrophysics
Spring of odd years. 3(3-0) RB: (AST 801 and PHY 841)
Transfer of radiation through plasmas and processes for emission and absorption of photons. Interpretation of the spectra of stars, interstellar medium, and galaxies.

820  Advanced Topics in Astrophysics
Fall, Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. RB: (AST 801)
Advanced work in a specialized astrophysical topic.

830  Galactic and Extragalactic Dynamics
Fall of even years. 3(3-0) RB: (AST 801 and PHY 820)
Implications of gravitational dynamics and stellar evolution on galactic and extragalactic systems.

840  Stellar Astrophysics
Spring of even years. 3(3-0) RB: (AST 801)

850  Electrodynamics of Plasmas
Spring of odd years. 3(3-0) Interdepartmental with Electrical and Computer Engineering. Physics. Administered by Department of Electrical and Computer Engineering. RB: (ECE 835 or PHY 488) SA: EE 850

860  Gravitational Astrophysics
Fall. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course. RB: (PHY 820 and PHY 841)
Experimental foundations, theory, and applications of gravitational physics and general relativity. Tests of the equivalence principle, modern solar system tests of general relativity, Schwarzschild metric, Hawking effect; Einstein's field equations.

861  Cosmology
Spring. 3(3-0) R: Open only to graduate students in the Department of Physics and Astronomy. SA: AST 860A
Current research in cosmology: observational basis for the Big Bang, the cosmic background radiation, primordial nucleosynthesis, content and distribution of matter, cosmic geometry, growth of perturbations.

870  Astronomical Instrumentation and Data Analysis
Fall of odd years. 3(3-0) RB: (AST 801)
Theory and techniques of astronomical data acquisition and analysis.

899  Master's Thesis Research
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Open only to graduate students in Astronomy and Astrophysics. MS Thesis Research

999  Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 120 credits in all enrollments for this course. R: Open only to doctoral students in Astronomy and Astrophysics.
Doctoral dissertation research.
Evaluation procedures in speech-language pathology, test procedures, evaluation of results, and report writing.

Observation and Analysis of Clinical
394  Observation and Anal ysis of Clinical and report writing.


Communication Sciences and Disorders
403  Communication Sciences and Disorders based programs for persons with communication disorders.


Language Dialect Differences in Applied Contexts
433  Language Dialect Differences in Applied Contexts Regional, ethnic, and cultural characteristics of American English. Comparison of speech-language differences and disorders.

Aural Rehabilitation
443  Aural Rehabilitation Fundamental aspects of auditory rehabilitation, including individual and group amplification systems, auditory training, speechreading, and counseling with children and adults.

Intervention Procedures in Speech-Language Pathology
463  Intervention Procedures in Speech-Language Pathology Intervention procedures for individuals with developmental and acquired communication disorders.

Phonological Disorders in Children
473  Phonological Disorders in Children Phonological theory, speech perception and production, nature of normal/abnormal phonological development. Preparing assessment and treatment plans, applying treatment principles to different populations and cultural groups. Practice with narrow phonetic transcription of speech and phonological process analysis.

School-Based Communication Disorders Programs
483  School-Based Communication Disorders Programs Administrative and regulatory aspects of school-based programs for persons with communication disorders.

Independent Study
490  Independent Study Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Approval of department.

Individualized student activities in human communication sciences and disorders.

Clinical Practicum in Communication Disorders
494  Clinical Practicum in Communication Disorders Fall, Spring, Summer. 2 credits. A student may earn a maximum of 4 credits in all enrollments for this course. P.M: (394 and 463) RB: A minimum of 25 hours of approved clinical observation. R: Open only to juniors or seniors in the Department of Audiology and Speech Sciences. Approval of department.

Supervised clinical experiences, working with individuals who have speech, language and/or hearing disorders.

Research Methods in Communication Sciences and Disorders
803  Research Methods in Communication Sciences and Disorders Fall. 3(3-0) R: Open only to graduate students in Audiology and Speech Sciences.

Hypothesis generation, experimental design, data collection, data analysis and presentation.

Neuroanatomy and Neuropsychology of Speech, Language, and Hearing
813  Neuroanatomy and Neuropsychology of Speech, Language, and Hearing Fall. 3(3-0) R: Open only to graduate students in Audiology and Speech Sciences. Structural and functional descriptions of the nervous system as it relates to communication sciences and disorders.

Acquired Language Disorders
823A  Acquired Language Disorders Spring. 3(3-0) RB: (ASC 813 or concurrently) R: Open only to graduate students in Audiology and Speech Sciences.

Neuropathology, symptomatology, and speech-language rehabilitation of individuals with aphasia and related disorders.

Motor Speech Disorders
823B  Motor Speech Disorders Fall. 3(3-0) RB: (ASC 813 or concurrently) R: Open only to graduate students in Audiology and Speech Sciences.

Neuropathology, symptomatology, and speech-language habilitation and rehabilitation of individuals with motor speech disorders.

Voice Disorders
823C  Voice Disorders Summer. 3(3-0) R: Open only to graduate students in Audiology and Speech Sciences.

Etiology, symptomatology, diagnosis, and treatment of voice disorders in children and adults.

Fluency Disorders
823D  Fluency Disorders Fall. 3(3-0) R: Open only to graduate students in Audiology and Speech Sciences.


Assessment of Childhood Language Disorders
823E  Assessment of Childhood Language Disorders Fall. 3(2-2) R: Open only to graduate students in the Department of Audiology and Speech Sciences.

Evaluation of language disorders of preschool, school-aged, and adolescent populations.

Language Intervention: Early Stages
823F  Language Intervention: Early Stages Spring. 3(3-0) RB: (ASC 823E) or approval of department. R: Open only to graduate students in Audiology and Speech Sciences.

Principles of intervention in language disorders for children functioning at or below preschool levels, regardless of chronological age.

Language Intervention: Later Stages
823G  Language Intervention: Later Stages Summer. 3(3-0) RB: (ASC 823E) or approval of department. R: Open only to graduate students in Audiology and Speech Sciences.

Principles of intervention in language disorders for school-age children and adolescents functioning above preschool levels.

Cognitive-Communicative Disorders
823I  Cognitive-Communicative Disorders Spring. 3(3-0) P.M: (ASC 813 and ASC 823A and ASC 823B) Neuropsychological, speech-language, cognitive, neuropsychological, and social/emotional rehabilitation associated with traumatic brain injury, dementia, and right hemisphere neurological disorders.

Medical Aspects of Speech-Language Pathology
823J  Medical Aspects of Speech-Language Pathology Fall. 3(2-0) P.M: (ASC 813 and ASC 823C) R: Open only to graduate students in Audiology and Speech Sciences.


Assessment and Treatment of Dysphagia
823K  Assessment and Treatment of Dysphagia Summer. 3(3-0) P.M: (ASC 813) RB: (ASC 823A and ASC 823C) R: Open only to graduate students in Audiology and Speech Sciences.

Introduction to assessment, intervention, and management of persons with swallowing disorders.

Counseling in Communication Disorders
823L  Counseling in Communication Disorders Summer. 3(3-0) P.M: (ASC 364 or ASC 344) Overview of counseling issues related to communication disorders.

Augmentative Communication
823X  Augmentative Communication Fall. 3(3-0) R: Open only to graduate students in Audiology and Speech Sciences.

History and philosophy of augmentative communication. Assessment, system selection, and intervention considerations for aided and unaided systems. Topics include synthesized voice output and micro-processor-based systems.

Auditory Psychophysics
853  Auditory Psychophysics Spring. 3(3-0) P.M: (ASC 803 or concurrently) R: Open only to graduate students in Audiology and Speech Sciences.

Psychophysical theory and methods as applied to the study of hearing phenomena.

Diagnostic Audiology I
843A  Diagnostic Audiology I Fall. 3(3-0) RB: (ASC 443 and ASC 443) R: Open only to graduate students in Audiology and Speech Sciences.

Behavioral audiologic assessment of the peripheral and central auditory system.

Diagnostic Audiology II
843B  Diagnostic Audiology II Spring. 3(3-0) P.M: (ASC 843A) RB: (ASC 843A) Electrophysiologic audiologic assessment of the peripheral and central auditory system.
Audiology and Speech Sciences—ASC

843C Hearing Amplification I
Fall, 3(3-0)
Historical and contemporary overview of personal amplification for individuals with hearing impairment. Emphasis on theoretical and clinical strategies for evaluating and fitting contemporary hearing aids.

843E Pediatric Audiology
Summer, 3(3-0) P:M: (ASC 843A and ASC 843B)
Audiologic diagnostic procedures for the pediatric population. Includes the impact of disabilities other than hearing loss.

843F Advanced Rehabilitative Audiology
Fall, 3(2-2) P:M: (ASC 443) RB: (ASC 894A or ASC 894B) R: Open only to graduate students in Audiology and Speech Sciences.
Impact of hearing impairment on communication processes. History of and current practices in intervention for children and adults who have hearing impairment.

843G Medical Aspects of Audiology
Fall, 3(3-0) R: Open only to graduate students in the Department of Audiology and Speech Sciences.
Nature and bases of hearing impairment, and management principles from a medical perspective.

843I Hearing Amplification II
Spring, 3(3-0)
Advanced theoretical and clinical strategies for evaluating and fitting contemporary hearing aids. Assistive listening devices, classroom amplification, hearing aid dispensing, and contemporary clinical and research issues in amplification.

843J Manual Communication for Clinical Settings
Summer, 3(3-0) P:M: (ASC 344)
Introduction to the use of manually coded English sign systems and Pidgin Sign English in diagnostic and treatment sessions.

890 Independent Study
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences. Approval of department. Individualized study under faculty direction.

894A Clinical Practicum in Speech-Language Pathology
Fall, Spring, Summer. 1 credit. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences. Approval of department. Supervised clinical experience in the management of clients with speech-language disorders.

894B Clinical Practicum in Audiology
Fall, Spring, Summer. 1 credit. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences. Approval of department. Supervised clinical experience in the management of clients with hearing disorders.

899 Master's Thesis Research
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences. Approval of department. Master's thesis research.

914A Speech Production and Perception I
Fall of even years, 4(3-2) RB: (ASC 803 or concurrently) R: Open only to graduate students in Audiology and Speech Sciences.
Classroom and laboratory study of issues regarding speech production and perception.

914B Speech Production and Perception II
Spring of odd years, 4(3-2) RB: (ASC 914A)
R: Open only to graduate students in Audiology and Speech Sciences.
Further classroom and laboratory study of issues regarding speech production and perception.

990 Independent Study
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 16 credits in all enrollments for this course. R: Open only to Ph.D. students. Approval of department. Individualized study under faculty direction.

991 Special Topics in Communication Sciences and Disorders
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Open only to students in Audiology and Speech Sciences.
Topics vary.

992 Seminar in Communication Sciences and Disorders
Fall, Spring, Summer, 3(3-0) A student may earn a maximum of 12 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences.
Topics vary.

994 Research Practicum in Communication Sciences and Disorders
Fall, Spring, Summer. 1 credit. A student may earn a maximum of 12 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences. Approval of department. Supervised clinical experience in the management of clients with hearing disorders.

999 Doctoral Dissertation Research
Fall, Spring, Summer, 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to Ph.D. students in Audiology and Speech Sciences. Approval of department. Doctoral dissertation research.

-- BIOCHEMISTRY AND MOLECULAR BIOLOGY --

BMB

Department of Biochemistry and Molecular Biology
College of Human Medicine
College of Natural Science
College of Osteopathic Medicine

100 Current Issues in Biochemistry
Spring. 1(1-0) R: Open only to freshmen or sophomores. SA: BCH 100 Not open to students with credit in BMB 100.
Contemporary biochemistry: its impact on environmental, medical, and social sciences.