

Audiology and Speech Sciences—ASC

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

Physical processes that determine the structure and evolution of stars. Observations of stars and star clusters. Spectra of stars.

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

Structure and history of the Milky Way Galaxy. Stellar populations. Interstellar medium.

308 Galaxies and Cosmology
Spring of even years. 3(3-0) P:M: (AST 307) and (PHY 184 or PHY 184B 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)
Physics of stellar interiors. Methods for calculating stellar models. Principles of stellar evolution.

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

Plasma kinetic and macroscopic plasma transport theory. Electromagnetic wave propagation and charged particle diffusion processes in plasma. Electromagnetic energy absorption via elastic and inelastic collisions. Dc, rf, and microwave discharges.

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.

AUDIOLOGY AND SPEECH SCIENCES ASC

Department of Audiology and Speech Sciences College of Communication Arts and Sciences

113 Oral Communication Principles and Skills
Fall, Spring, Summer. 3(2-2)
Study, development and enhancement of oral communication skills including speech, voice, language and listening.

203 Introduction to Communication Sciences and Disorders
Fall, Spring. 3(3-0) Not open to students with credit in ASC 403.

Survey of research and practice regarding speech, hearing and language disorders in children and adults.

214 Anatomy and Physiology of the Speech and Hearing Mechanism
Fall. 4(3-2) P:M: (ASC 203 or concurrently)

Structural and functional analyses of the central and peripheral auditory mechanisms, and of the respiratory, phonatory, and articulatory mechanisms for speech.

232 Descriptive Phonetics
Fall. 2(1-2)
Principles of speech production. Transcription of speech using the International Phonetic Alphabet.

303 Hearing Science
Fall. 3(2-2) P:M: (MTH 106 or MTH 152H or MTH 110 or MTH 201 or MTH 116 or STT 200 or MTH 124 or STT 201 or MTH 132) RB: Completion of one ISP course. SA: ASC 255

Physical and psychological aspects of sound and their measurement. Emphasis on the understanding of human communication and its disorders.

313 Speech Science
Spring. 3(2-2) P:M: (ASC 214 and ASC 232) SA: ASC 255

Processes underlying the production and perception of speech. Emphasis on the understanding of human communication and its disorders.

333 Oral Language Development
Fall, Spring. 3(3-0) P:M: (PSY 101) and (LIN 401 or ENG 302 or LIN 200) R: Not open to freshmen.

Development of receptive and expressive aspects of child language.

344 Evaluation Procedures in Audiology
Fall. 4(3-2) P:M: (ASC 255) and completion of Tier I writing requirement. R: Open only to juniors or seniors in the Department of Audiology and Speech Sciences.

Classification of hearing disorders. Behavioral and electrophysiological measurement of hearing, including subjective and objective testing procedures.

- 364 Evaluation Procedures in Speech-Language Pathology**
Fall. 4(3-2) P:M: (ASC 255 and ASC 333) and completion of Tier I writing requirement. R: Open only to juniors or seniors in the Department of Audiology and Speech Sciences.
Evaluation procedures in speech-language pathology, test procedures, evaluation of results, and report writing.
- 394 Observation and Analysis of Clinical Practice**
Fall, Spring. 1(0-2) P:M: (ASC 344 and ASC 364)
Case presentations. Interviewing techniques. Behavioral observation and data collection. Behavior management. Counseling. Session plan and report writing.
- 403 Communication Sciences and Disorders**
Fall. 3(3-0) R: Not open to freshmen or sophomores. Not open to students in the Department of Audiology and Speech Sciences. Not open to students with credit in ASC 203.
Research and practice regarding communication disorders and the professions of speech-language pathology and audiology.
- 433 Language Dialect Differences in Applied Contexts**
Spring. 3(3-0) P:M: (ASC 364)
Regional, ethnic, and cultural characteristics of American English. Comparison of speech-language differences and disorders.
- 443 Aural Rehabilitation**
Spring. 3(3-0) P:M: (ASC 344) R: Open only to juniors or seniors in the Department of Audiology and Speech Sciences.
Fundamental aspects of auditory rehabilitation, including individual and group amplification systems, auditory training, speechreading, and counseling with children and adults.
- 463 Intervention Procedures in Speech-Language Pathology**
Spring. 3(3-0) P:M: (ASC 364) R: Open only to juniors or seniors in the Department of Audiology and Speech Sciences.
Intervention procedures for individuals with developmental and acquired communication disorders.
- 473 Phonological Disorders in Children**
Spring. 3(3-0) P:M: (ASC 463 or concurrently)
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.
- 483 School-Based Communication Disorders Programs**
Spring. 3(3-0) P:M: (ASC 463 or concurrently) and (ASC 394 or concurrently) R: Open only to juniors or seniors in the Department of Audiology and Speech Sciences.
Administrative and regulatory aspects of school-based programs for persons with communication disorders.
- 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.
- 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.
- 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.
- 813 Neuroanatomy and Neurophysiology 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.
- 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.
- 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.
- 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.
- 823D Fluency Disorders**
Fall. 3(3-0) R: Open only to graduate students in Audiology and Speech Sciences.
History, theories, symptomatology, diagnosis, and treatment of fluency disorders in children and adults.
- 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.
- 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.
- 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.
- 823I Cognitive-Communicative Disorders**
Spring. 3(3-0) P:M: (ASC 813 and ASC 823A and ASC 823B)
Neurophysiological, speech-language, cognitive, neuropsychological, and social/emotional rehabilitation associated with traumatic brain injury, dementia, and right hemisphere neurological disorders.
- 823J Medical Aspects of Speech-Language Pathology**
Fall. 3(2-2) P:M: (ASC 813 and ASC 823C) C: ASC 823B concurrently.
Introduction to assessment, intervention, and management of persons with laryngectomy, tracheostomy, ventilator-dependence, and cleft lip and palate. Intensive study of the clinical procedures and instrumentation employed by speech-language pathologists who practice in medical settings.
- 823K Assessment and Treatment of Dysphagia**
Summer. 3(3-0) P:M: (ASC 813) RB: (ASC 823A and ASC 823C)
Introduction to assessment, intervention, and management of persons with swallowing 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.
- 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.
- 833 Auditory Psychophysics**
Spring. 3(3-0) RB: (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.
- 843A Diagnostic Audiology I**
Fall. 3(3-0) RB: (ASC 344 and ASC 443) R: Open only to graduate students in Audiology and Speech Sciences.
Behavioral audiologic assessment of the peripheral and central auditory system.
- 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 M.A. 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. 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.
- 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. RB: (ASC 803 or concurrently) R: Approval of department.
Individual research under faculty supervision.
- 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 101.
Contemporary biochemistry: its impact on environmental, medical, and social sciences.

- 101 Frontiers in Biochemistry**
Fall. 1(1-0) R: Open only to freshmen or sophomores. SA: BCH 101 Not open to students with credit in BMB 100.
Description of topics in biochemistry research.
- 200 Introduction to Biochemistry**
Fall. 4(4-0) P:M: (CEM 143) SA: BCH 200 Not open to students with credit in BMB 401 or BMB 461.
Basic structures of major classes of biologically important molecules and metabolic activities of major importance in living organisms.
- 401 Basic Biochemistry**
Fall, Spring. 4(4-0) P:M: (CEM 252 or CEM 352) R: Not open to students in the Biochemistry or in the Biochemistry/Biotechnology major. SA: BCH 401 Not open to students with credit in BMB 200 or BMB 461.
Structure and function of major biomolecules, metabolism, and regulation. Examples emphasize the mammalian organism.
- 461 Biochemistry I**
Fall. 3(4-0) P:M: (CEM 252 or CEM 352) and (BS 110) and (MTH 124 or MTH 132 or MTH 152H or LBS 118) and (BS 111L or LBS 145 or LBS 158H or LBS 159H) SA: BCH 461 Not open to students with credit in BMB 200 or BMB 401.
Protein structure and function, enzymology, bioenergetics, and intermediary metabolism.
- 462 Biochemistry II**
Spring. 3(4-0) P:M: (BMB 461) SA: BCH 462
Continuation of BMB 461 with emphasis on metabolic regulation and nucleic acid structure, replication and protein synthesis.
- 471 Biochemistry Laboratory (W)**
Spring. 3(0-9) P:M: (BMB 401 or BMB 461) and (BS 110 and CEM 262 and CEM 356 and CSE 101) and (MTH 124 or MTH 132 or MTH 152H or LBS 118) and (BS 111L or LBS 145 or LBS 158H or LBS 159H) and completion of Tier I writing requirement. SA: BCH 471
Biochemical methods and principles used in the study of enzymes (proteins), carbohydrates, lipids, and cell organelles.
- 472 Biochemistry Laboratory**
Fall. 3(0-9) P:M: (BMB 462) and (CEM 262) R: Open only to Biochemistry or Biochemistry/Biotechnology majors or approval of department. SA: BCH 472
Methods of molecular biology and the underlying principles on which these methods are based.
- 490 Biochemistry Research**
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Total credits in BMB 490 and BMB 499 may not exceed 8. Approval of department. SA: BCH 490
Participation in laboratory or library research projects.
- 495 Undergraduate Seminar**
Spring. 2(2-0) P:M: (BMB 462 or concurrently) R: Open only to students in the Biochemistry or Biochemistry/Biotechnology majors. SA: BCH 495
Extension and synthesis of concepts of biochemistry. Relationships to societal issues.