377. **Speech Pathology I**
Fall, Winter. 5(3-0) 276, 277.
Etiology, symptomatology, and rationale of therapy for speech and language problems.

378. **Clinical Procedures in Speech Pathology and Audiology**
Winter, Spring. 4(2-2) 2.00 grade-point average in 277 and 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(2-0)
Concentration in the characteristics of language and human communication as these relate to studies and practices of those involved in urban affairs.

454. **Audiology I**
Fall, Spring. 5(4-1) 276, 277.
Fundamental aspects of hearing; nature, testing and rehabilitation.

460. **Audiology II**
Winter, Summer. 5(3-0) 454 or approval of department.
Theory and methodology in the teaching of lip-reading and auditory training to the acoustically handicapped.

470. **Speech Correction for Teachers**
Fall, Winter, Spring, Summer. 3(3-0) Juniors. Not open to speech pathology and audiology majors.
Meeting needs of the speech handicapped child in classroom.

474. **Clinical Practice in Speech Correction**
Fall, Winter, Spring, Summer. 1 to 3 credits. May not be enrolled for credit. Six credits required for certification. No more than 2 credits may be taken during the preprofessional program. 572.

476. **Speech Pathology II: Diagnostics**
Fall, Winter, Spring, Summer. 5(3-2) 572 or approval of department.
Test procedures and analysis; supervised 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) 372.
Must be taken prior to term of student teaching. Administration and organization, procedures and materials in public school speech and hearing therapy.

499. **Independent Study**
Fall, Winter, Spring, Summer. 1 to 6 credits. May re-enroll for a maximum of 12 credits. Approval of department.

501. **Advanced Study of Articulatory Behavior**
Fall. 4(3-1) Approval of department.
Theoretical and pragmatic implications of the interrelationships of articulatory behavior and language production, especially as related to investigating procedures and results.

833. **Specialized Clinical Audiology**

A. **DIFFERENTIAL AUDIOMETRY**
Fall. 4(3-0)
Etiology, symptomatology, and therapeutic procedures for the assessment and treatment of hearing disorders.

B. **VOICE DISORDERS**
Spring. 4(3-0)
Etiology, symptomatology, and therapeutic procedures for disorders of voice. Speech pathologists and audiologists in relation to other disciplines in the rehabilitation of adults with voice disorders.

832. **Speech and Hearing Evaluation and Therapy**

A. **HEARING HANDICAP**
Summer. 4(2-2)
A theoretical approach to the study of the aural rehabilitative process.

B. **CEPHRAL PALSY**
Spring. 4(3-0)
Etiology, symptomatology, structural and functional consideration of cerebral palsy. Therapeutic procedures for the speech of the cerebral palsied.

C. **DELAYED LANGUAGE DEVELOPMENT**
Winter. 4(3-0)
Evaluative techniques including audiometry, psychometry, and case history as aids to the differential evaluation of delayed language development.

D. **MENTAL RETARATION**
Summer. 4(3-0)
Language behaviors and speech development of the mentally retarded as related to all facets of personal-social development and adjustment.

E. **STUTTERING**
Summer. 4(3-0)
Longitudinal studies of stuttering theories and the therapies accompanying them.

F. **CELF PALATE**
Fall. 4(3-0)
Etiology, symptomatology, structural and functional consideration of cleft palate. Therapeutic procedures for the speech habilitation of cleft palate individuals.

854. **Psychophysics and Theories of Audition**
(854E.) Summer. 4(3-0)
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 re-enroll 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.

896. **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**
(875C.) Winter. 4(2-2) 580 or approval of department.
An analytic study of the acoustics of speech.

880C. **Instruments and Electronics for Audiology and Speech Sciences**
(875A.) Spring, 4(3-3) 850B 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**
(875B.) Summer. 4(2-2) 850C or approval of department.
Critically review the literature in experimental phonetics with special reference to the historical development of the field and subsequent experimentation in physiological and acoustical phonetics.

899. **Research**
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

940. **Seminar in Audiology and Speech Sciences**
Spring, Summer. 4(3-0) May re-enroll for a maximum of 16 credits.

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

999. **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

163. **Biochemistry Laboratory**
Spring, 2(0-0) Honors section of CRM 162, and approval of department.
Experimental aspects of biochemistry for biochemistry majors with an honors chemistry background.
200. Introduction to Biochemistry
Winter, Summer. 3(5-0) Credit may not be earned in both 200 and 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.

205. Advanced Biochemistry Laboratory
Winter. 3(1-6) 804; 812 concurrently. Experiments to be selected from a representative group illustrating modern biochemical research.

363. Clinical Biochemistry
Spring. 3(2-3) 401; CEM 162. Primarily for Medical Technology majors; not acceptable for a B.S. degree in biochemistry. Quantitative clinical laboratory methods.

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

401. Basic Biochemistry
Fall, Spring. 3(5-0) Credit may not be earned in both 500 and 401. One year organic chemistry or CEM 243; not open to biochemistry majors.

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

451. Biochemistry
Winter, Spring. 4(4-0) Credit may not be earned in both 401 and 451. One year organic chemistry or CEM 242. A comprehensive presentation of biochemistry designed for undergraduate biochemistry majors, students of medicine, and other students desiring an intensive treatment of the subject. In the winter term, students in the College of Human Medicine are given enrollment priority and the course emphasizes examples from the mammalian organism in contrast to the more cellular approach used in the fall term.

452. Biochemistry
Winter, Spring. 4(4-0) 451. Continuation of 451. In the spring term, students in the College of Human Medicine are given enrollment priority and the course emphasizes examples from the mammalian organism in contrast to the more cellular approach used in the winter term.

478. Senior Seminar
Fall, Winter, Spring. 0 or 11-0. May re-enroll for a maximum of 2 credits. Undergraduate biochemistry major or approval of department. Discussion by undergraduate students and staff of recent advances in biochemistry.

499. Research
Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll for a maximum of 12 credits. Approval of department.

501. Biochemical Research Methods
Fall. 1(0-3) One year of organic chemistry or CEM 242; BCH 451 or 811, or concurrently. Discussions and demonstrations of selected experimental techniques of wide application in biochemistry.

504. Advanced Biochemistry Laboratory
Fall, Winter, Spring. 3(1-6) Analytical chemistry, 801 and 811, or concurrently; biochemistry majors or approval of department. Experiments to be selected from a representative group illustrating modern biochemical research.

505. Advanced Biochemistry Laboratory
Winter. 3(1-6) 804; 812 concurrently. Experiments to be selected from a representative group illustrating modern biochemical research.

506. Advanced Biochemistry Laboratory
Spring. 3(1-6) 805; 813 concurrently. Special experiments in advanced laboratory techniques.

801. Advanced Biochemistry
Fall. 4(4-0) One year of organic chemistry, one year of physical chemistry, one term of introductory biochemistry, 801 taken previously or concurrently, or approval of department. Limited to graduate students in biochemistry or other students needing a similar professional preparation.

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

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

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

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

952. Plant Physiology and Biochemistry I
Winter of odd-numbered years. 3(3-0) Approval of department. Interdepartmental with the Botany and Plant Pathology Department. Selected topics concerning photosynthesis and related processes.

955. Plant Physiology and Biochemistry II
Winter of even-numbered years. 3(3-0) Approval of department. Interdepartmental with the Botany and Plant Pathology Department. Metabolic pathways of unique significance to plants.

980. Selected Topics in Biochemistry
Fall, Winter, Spring. Summer. 1(1-0) or 2(2-0) May re-enroll for a maximum of 6 credits if a different topic is taken. Approval of department. Topics will be selected from the areas of biochemical genetics, biochemistry of development, biochemical evolution, complex proteins, lipid metabolism, immunobiochemistry, hormones, control mechanisms and structure of biological macromolecules.

981. Selected Topics in Biochemistry
Fall, Winter, Spring. Summer. 1(1-0) or 2(2-0) May re-enroll for a maximum of 6 credits if a different topic is taken. Approval of department. Topics will be selected from the areas of bioenergetics, bioinstrumentation, complex carbohydrates, mechanisms of enzyme action, natural products, carbohydrate metabolism, mass spectrometry and biochemistry of isoprenoid compounds.

978. Seminar in Biochemistry
Fall, Winter, Spring. 0 or 1(1-0) Presentation and discussion of reports by graduate students on biochemical topics of current interest.

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

**BIOLOGICAL SCIENCE B.S.**

**College of Natural Science**

302. Biological Science for Elementary Teachers
Fall, Winter. 4(3-3) Fundamental principles of biology which provide background appropriate for preparation for elementary education teaching.

310. General Biology
Fall, Winter. 4(4-2) CEM 130 or high school chemistry. Not open to students with credit in LBC 140. The structure and behavior of cells and their subunits, interactions of tissues, genetics, and the development, history and relations of organisms.

312. General Biology
Fall, Winter. 4(4-2) Not open to students with credit in LBC 141. Continuation of 311.

410. Biological Science for Teachers
Fall. 4(3-3) Bachelor's degree. Designed to show the nature of biological science in both its empirical and conceptual aspects. Emphasis is placed on life processes. The theories of the gene and of evolution are stressed. Macroanatomy and microanatomy are covered as well as the topics of reproduction, metabolism, physiology, nutrition, oxygen, taxonomy and ecology. Quantitative developments are included whenever possible.

420. Biological Science for Teachers
Fall, Winter. 4(3-3) 401. Continuation of 401.

425. Biological Science for Teachers
Spring. 4(3-3) 402. Continuation of 402.

410. Biotic and Environmental Relationships
Summer. 6 credits. Approval of department. Glenn or W. R. Kellogg Biological Station. Interrelationship of the biota with its environment. Factors determining distribution and abundance. Interaction of organisms.

420. Seminar in Recent Advances in Biological Science
Fall, Winter, Spring. 3(3-0) May re-enroll for a maximum of 6 credits if a different topic is taken. Approval of department. A series of lectures by senior faculty of topics on the history, development, the most recent advances and the possible future and limits of the Biological Sciences.

*For prerequisite purposes, the introductory biology sequence in Lyman Briggs College, LBC 140, 141, 242, may be used instead of this sequence.*