841. Evaluation and Treatment of Speech and Language Disorders
A. Aphasia
   Winter. 4(4-0) ASC 876 or approval of department.
   Neuropathology, symptomatology, and speech and language habilitation and rehabilitation of individuals with aphasia.
B. Agrania and Dysarthria
   Spring. 4(4-0) ASC 876 or approval of department.
   Neuropathology, symptomatology, and speech and language habilitation and rehabilitation of individuals with apraxia and dysarthria, including those with cerebral palsy.
C. Voice Disorders
   Fall. 4(4-0)
   Etiology, symptomatology, diagnosis, and treatment of voice disorders including the specific communication problems of the laryngotomized.
D. Stuttering
   Winter. 4(4-0)
   History, symptomatology, development, evaluation, and theories of stuttering. Focus is to facilitate clinical involvement with stutterers.
E. Orofacial Anomalies
   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
   Fall. 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
   Winter. 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
   Spring. 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
   Winter. 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
   Fall. 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.

875A. Clinical Practicum in Speech and Language Pathology
   Fall, Winter, Spring, Summer. 1 credit. May reenroll for a maximum of 5 credits. ASC 474 and satisfactory completion of a speech, language, and hearing screening/examination at the MSU Speech and Hearing Clinic. Directed diagnostic, therapeutic, and prognostic experience in speech and language pathology.
875B. Clinical Practicum in Audiology
   Fall, Winter, Spring, Summer. 1 credit. May reenroll for a maximum of 5 credits. ASC 454 and satisfactory completion of a speech, language, and hearing screening/examination at the MSU Speech and Hearing Clinic. Directed diagnostic, therapeutic, and prognostic experience in audiology in various clinical settings.

876. Communication Disorders: Neuroanatomy-Neurophysiology
   Fall. 4(3-2) Approval of department.
   Neuroanatomical and neurophysiological correlates of speech, language, and hearing.

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

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 9 credits. May reenroll for a maximum of 24 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

100. Lectures in Biochemistry
   Spring. 1(1-0) Biochemistry majors; others by approval of department.
   An introduction to modern biochemistry using an historical approach.

200. Introduction to Biochemistry
   Winter, Summer. 3(3-0) 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.

210. General Biology
   Fall, Spring. 4(4-2) Not open to students with credit in LBS 141. Interdepartmental with the Biological Science Program and the departments of Microbiology and Public Health, and Physiology. Administered by Biological Science Program.
   Principles of biological organization: scientific method, biochemistry, cell biology, and evolution.

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. Biochemistry Laboratory
   Winter. 3(0-9) CEM 152, CEM 162, one year organic chemistry with laboratory; MTH 113, BCH 451 or BCH 401 with approval of department.
   Enzymes (proteins), lipids, and cell organelles.

405. Biochemistry Laboratory
   Spring. 3(0-9) BCH 453 or concurrently; undergraduate biochemistry majors or approval of department.
   Modern biochemical techniques to study nucleic acid structure and function.

451. Biochemistry I
   Fall. 3(4-0) Credit may not be earned in both BCH 401 and BCH 451. One year organic chemistry or CEM 342.
   A comprehensive survey of biochemistry, with emphasis on protein structure and function, enzymology, and bioenergetics.

452. Biochemistry II
   Winter. 3(4-0) BCH 451.
   Continuation of BCH 451, with emphasis on intermediary metabolism.

453. Biochemistry III
   Spring. 3(4-0) BCH 452.
   Continuation of BCH 452, with emphasis on the replication and expression of genetic information.

470. Biological Membranes
   (IDC 470.) Spring. 3(3-0) BCH 401. Interdepartmental with the departments of Microbiology and Public Health, and Physiology. Administered by the Department of Physiology.
   The chemistry, physics and mathematics of the permeability, energy transduction and surface functions of differentiated cell membranes and membranous organelles are compared. A brief discussion of the theoretical and experimental models is included.

499. Research
   Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 12 credits. Undergraduate; approval of department. Participation in research projects.

501. Medical Biochemistry
   Fall. 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.
### Medical Biochemistry Courses

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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>BCH 501</td>
<td>Medical Biochemistry I</td>
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<tr>
<td>BCH 451</td>
<td>Medica/Biochemistry II</td>
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<tr>
<td>BCH 453</td>
<td>Plant Genetics and Molecular Biology</td>
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**502. Medical Biochemistry I**
Winter. 4(4-0) BCH 501 or approval of department.
A continuation of BCH 501.

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

**813. Metabolism and Its Regulation**
Spring. 4(4-0) One year of organic chemistry, one year of physical chemistry, and one year of basic biochemistry or BCH 453; or approval of department. A course in fundamental biology is strongly recommended. Limited to students wishing to major in biochemistry or other students needing a similar professional preparation.

**821. Biochemical Mechanisms and Structure**
Winter. 4(4-0) One year of organic chemistry; introductory biochemistry; and physical chemistry or concurrently.

**825. Cell Structure and Function**
Spring. 4(4-0) BCH 451 or BCH 401 or approval of instructor. Interdepartmental with the departments of Microbiology and Public Health, and Physiology.

**829. Methods of Macromolecular Analysis and Synthesis**
Fall. 3(3-0) BCH 452.
Technical approaches to isolation, purification, and characterization of macromolecules. Emphasis will be placed on the use of the computer in structure-function analysis of macromolecules.

**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. 1 to 6 credits. May reenroll for a maximum of 12 credits.
Approval of department. Consideration of current problems.

**856. Plant Genetics and Molecular Biology**
Spring. 3(3-0) Approval of department and a course in introductory genetics. Interdepartmental with Genetics, and the Department of Botany and Plant Pathology. Administered by the Department of Botany and Plant Pathology.
Recent advances in genetics and molecular biology of higher plants.

**975. Seminar in Biochemistry**
Fall, Winter, Spring. 1(1-0). May reenroll for a maximum of 8 credits. Approval of department.

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

### BIOLOGICAL SCIENCE B.S.

**College of Natural Science**

The content of courses 400 and 405, as well as the research and problems courses 499, 800 and 899, may vary from term to term. Brochures giving detailed information about individual courses are available in the Office of the Assistant Dean for Lifelong Education in the College of Natural Science. These courses are primarily designed for in-service teachers and interested adults and are offered in off-campus locations.

**202. Introductory Biology for Non-Science Majors**
Fall, Winter, Spring, Summer. 4(3-3) 12 credits in general education natural science courses.
Concepts, procedures, and perspectives appropriate to developing a basic literacy in biology with emphasis on fundamental biological principles and their relation to world society. Appropriate preparation for pre-service elementary teachers.

**210. General Biology**
Fall, Spring. 4(4-2) Not open to students with credit in LBS 141. Interdepartmental with the departments of Biochemistry, Microbiology and Public Health, and Physiology.
Principles of biological organization: scientific methods, biochemistry, cell biology, and evolution.

**211. General Biology**
Fall, Winter, Summer. 4(4-2) CEM 140 or high school chemistry. Not open to students with credit in LBS 142. Interdepartmental with the departments of Botany and Plant Pathology, and Zoology.
Principles of biological regulation and integration: genetics, development, and selected physiological topics.

**212. General Biology**
Winter, Spring, Summer. 4(4-2) Not open to students with credit in LBS 140. Interdepartmental with the departments of Botany and Plant Pathology, and Zoology.
Principles of biological diversity; taxonomy and systematics, comparative physiology, and ecology.

**400. Biological Science for Teachers**
Fall, Winter, Spring. 1 to 6 credits. May reenroll for a maximum of 12 credits. Teacher certification with science major or minor.
A course for in-service teachers, topics will be selected from actual classroom problems of the participants. Stress will be placed on field, laboratory and inquiry teaching.

**405. Topics in Biological Science**
Fall, Winter, Spring. 1 to 4 credits. May reenroll for a maximum of 8 credits if different topic is taken. Approval of department.
Presentation of single topics from the biological sciences by senior faculty and guest lecturers.
Topics are selected to facilitate development of strong biological science programs in schools.