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

F. CLEFT PALATE  
Fall. 4(2-0)  
Etiology, symptomatology, structural and functional consideration of cleft palate. Therapeutic procedures for the speech habilitation of cleft palate individuals.

533. Specialized Clinical Audiology  
A. Differential Audiometry  
Winter. 4(3-0)  
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 Audiometry and Evaluation of Hearing Aids  
Fall. 4(4-0)  
Speech audiometry, principles and methods in the selection of hearing aids; physical characteristics of hearing aids.

C. Industrial Audiology  
Summer. 4(3-2)  
Evaluation of the role of the audiologist in industry emphasizing identification procedures, damage-risk criteria, measurement and control of noise, conservation procedures, and medical-legal problems.

D. Advanced Audiological Evaluation  
Spring. 4(2-2)  
Theory, administration and evaluation of selected tests including Bekesy, EDB, EEG, and advanced speech-audimetric tests.

E. Pediatric Audiology  
Spring. 4(2-2)  
Evaluative procedures including play audiometry, language assessment, and case studies as aids to the differential diagnosis of auditory disorders in children; rehabilitative procedures for the acoustically handicapped child.

554. Psychophysics and Theories of Audition  
(854B). Spring. 4(3-0)  
Nature of auditory stimuli and the results of psychophysical experimentation in audition.

574. Speech and Hearing Problems in Public Schools  
Summer. 4(3-0)  
May re-enroll for a maximum of 12 credits. Graduate seminar in speech and hearing involving problems that arise in relation to speech and hearing therapy in the public schools.

580A. Mathematical Measurement of Speech and Hearing Variables  
Fall. 4(4-0)  
Application of mathematical models in the analysis of hearing and speech processes.

580B. Acoustic Phonetics  
(875C). Winter. 4(2-2)  880A or approval of department.  
An analytic study of the acoustics of speech.

580C. Instruments and Electronics for Audiology and Speech Sciences  
(875A). Spring. 4(2-0)  890B 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(3-0)  880C or approval of department.  
Critical review of the literature in experimental phonetics with special reference to the historical development of the field and subsequent experimentation in physiological and acoustical phonetics.

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

940. Seminar in Audiology and Speech Sciences  
Spring, Summer. 4(2-0)  
May re-enroll 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. 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

200. Introduction to Biochemistry  
Winter, Summer. 5(3-0)  
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.

363. Clinical Biochemistry  
Spring. 3(2-3)  200; CEM 162. Primarily for Medical Technology majors; not acceptable for a B.S. degree in biochemistry. Qualitative clinical laboratory methods.

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

401. General Biochemistry I  
Fall, Spring. 5(5-0)  
One year organic chemistry or CEM 242. General biochemistry, emphasizing metabolism, structure and function of the major components of living cells.

402. General Biochemistry II  
Winter. 3(3-0)  401.  
Continuation of 401 with special emphasis on regulatory processes.

403. General Biochemistry III  
Spring. 2(2-0)  401; physical chemistry recommended.  
Continuation of 401 with special emphasis on enzymology.

404. General Biochemistry Laboratory I  
Fall, Winter, Spring. 3(1-6)  
Analytical chemistry; 401. Laboratory course based on the subject matter of 401.

478. Senior Seminar  
Fall, Winter, Spring. 0 or 1(1-0). May re-enroll for a maximum of 2 credits. Undergraduate biochemistry major or approval of department.  
Dissertation 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.  
A course designed to give qualified undergraduate students an opportunity to gain experience in biochemical research.

801. Biochemical Research Methods  
Fall. 1(0-3). One year organic chemistry or CEM 242; 401 or concurrently.  
Dissensions and demonstrations of selected experimental techniques of wide application in biochemistry.

802. Advanced Biochemistry I  
Winter. 3(3-0)  401, physical chemistry; advanced organic chemistry desirable. Physical biochemistry, enzyme structure and function.

803. Advanced Biochemistry II  
Spring. 3(3-0)  401, physical chemistry. Nucleic acids, protein biosynthesis, and regulatory mechanisms.

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

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

806. Advanced Biochemistry Laboratory III  
Spring. 3(1-6)  805; 803 concurrently.  
Special experiments in advanced laboratory techniques.

855. Special Problems  

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

960. 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, immunochemistry, hormones, control mechanisms and structure of biological macromolecules.

961. 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.
BIOLOGICAL SCIENCE

College of Natural Science

202. Foundations of Biological Science

211. General Biology
Fall, Winter, Spring. 5(4-3) Organic chemistry or concurrently. Integrated course emphasizing cell structure and function, genetics, comparative morphology and physiology of living organisms and their developmental and community relationships.

212. General Biology
Fall, Winter, Spring. 5(4-3) 211. Continuation of 211.

401. 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. Macromorphology and micromorphology are covered as well as the topics of reproduction, metabolism, physiology, nutrition, enzymes, taxonomy and ecology. Quantitative developments are included whenever possible.

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

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

410. Biotic and Environmental Relationships

420. Seminar in Recent Advancements in Biological Science
Fall, Winter, Spring, Summer. 3(2-0) May re-enroll for a maximum of 6 credits if 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.

421. Seminar on Man, “The Human Organism”
Fall, Winter, Spring, Summer. 3(3-0) Approval of department. The importance of new discoveries in biology for our understanding of the human organism with emphasis from the fields of genetics, molecular biology, behavior, developmental biology, physiology, and ecology.

800. Problems in Biological Science
Fall, Winter, Spring. Variable credit. B.S. degree in biological science.

899. Research
Fall, Winter, Spring. Variable credit. M.S. degree in biological science or equivalent. Research in some phase of biological science. Data to form the basis for the thesis required for the doctoral degree in biological science.

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

999. Research
Fall, Winter, Spring. 1 credit. May re-enroll for a maximum of 3 credits. Approval of department.

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

BOTANY AND PLANT PATHOLOGY

College of Natural Science

200. Resource Ecology and Man
For course description, see Interdisciplinary Courses.

301. Elementary Plant Physiology
Fall, Winter, Spring. 4(2-4) B S 212 or one course in biology. Not open to majors. Processes concerned in plant life.

302. Introductory Morphology
Fall, Winter. 4(2-4) B S 212 or approval of department. Structures and life cycle of representative plant groups showing progressive evolutionary development.

304. Plant World
(432) Fall, Winter, Spring, Summer. 4(2-6) N S 194 or approval of department. Basic plant science and its use in teaching. Lectures cover basic subject matter necessary to understanding plant kingdom, evidence and trends of evolution, economic uses and important basic principles of ecology. Laboratories give students opportunity to expand subject matter in one of several types of special projects: greenhouse, trees and shrubs, spring or summer flora, what plants do for man.

305. Poisonous Plants
Spring. 2(2-0) N S 195. Primarily for Veterinary Medicine students. Plants poisonous to livestock and human beings, particularly those occurring in Michigan.

318. Introductory Plant Taxonomy
Spring. 3(2-3) 302 or B S 212 or approval of department. Principles of identification, classification, nomenclature, and evolutionary relationships of vascular plants.

336. Economic Plants
Fall. 3(3-0) Histories, characteristics, and origins of plants used in industrial processes, drug manufacture, and agriculture. Nontechnical to broaden student's cultural interest in plants.

400. Aquatic Plants
Spring. 3(1-4) One year of botany and zoology or approval of department. Aquatic plants, their classification, ecology and economic importance. Relationships to problems in fisheries, in wildlife management, and to role in limnology. Experience for student in plant ecology, aquatic biology, and water sanitation.