499. Landscape Architecture Design Thesis
Spring, Summer. 5(1-8) Senior majors.
Demonstration of analytical, creative and technical competencies in the development of methods and/or concepts leading to design solutions for contemporary landscape architecture problems.

VETERINARY MEDICINE (COLLEGE OF)

500A. Introduction to Veterinary Medicine I
(SSM 501.) Summer. 2(2-0) Admis-
sion to professional veterinary program.
Species and breed identification, predisposition for specific diseases, basic care and feeding, restraint and handling of small domestic animals, unusual pets, and laboratory animals.

500B. Introduction to Veterinary Medicine II
Fall. 3(3-0) Second-term Veterinary
Medicine students.

500C. Introduction to Veterinary Medicine III
(LSM 503.) Winter. 4(3-3) Third-
term Veterinary Medicine students.
Physical and systemic examination of the various domestic and laboratory species. Common restraint procedures, clinical skills, diagnostics and an approach to clients are included.

500D. Introduction to Veterinary Medicine IV
(SSM 502.) Spring. 4(3-3) Fourth-
term Veterinary Medicine students.
Anesthetic principles, agents and techniques. Basic surgical principles, including aseptic technique, hemostasis, wound healing, suturing and suturing materials. Fundamentals of radiology.

500E. Introduction to Veterinary Medicine V
Spring. 3(3-0) Fourth-term Veter-
inary Medicine students.
Emphasis on behavior of animals relating to disease prevention and treatment. Lectures, discussions and demonstrations on veterinary ethology including animal communications, reproduction, restraint, handling, housing and feeding habits.

501. Client Communication
(500.) Spring. 1(0-3) Fourth-term
Veterinary Medicine students.
Communication and interviewing skills as the basis for establishing and maintaining effective client relationships.

502. Metabolic Diseases, Endocrinology and Epidemiology
Summer. 4(4-0) Fifth-term Veter-
inary Medicine students.
Biochemical and physiological basis of metabolic and endocrine diseases of animals including diagnosis, treatment and management. Principles of epidemiology and their application in the study of diseases in animal populations.

504. Urinary and Hematopoietic Systems
Summer. 6(4-8) Fifth-term Veter-
inary Medicine students.
Integrative approach to the understanding of the urinary system in health and disease of animals. Pathogenesis, diagnosis, and clinical management of diseases of the hematopoietic and lymphoid organs and tissues.

510. Survey of Infectious Agents
Fall. 4(4-0) Sixth-term Veterinary
Medicine students.
Host-parasitism relationship in diseases of animals; laboratory diagnosis, treatment, control, and public health significance will be emphasized.

512. Nervous System
Fall. 3(2-1) Sixth-term Veterinary
Medicine students.
Normal and abnormal neural structure and function in animals with emphasis on clinical neurology and neuropathology.

514. Cardiovascular and Respiratory Systems
Fall. 7(5-6) Sixth-term Veterinary
Medicine students.
Pathogenesis, diagnosis, and management of cardiovascular and respiratory diseases of animals; anatomical, physiological, and pharmacological principles providing basis for medical and surgical treatment will be emphasized.

516. Reproductive System
Fall. 5(4-3) Sixth-term Veterinary
Medicine students.
Reproductive diseases of animals with emphasis on genital structure and function, endocrine interrelationships; methods for examination of mammary gland and reproductive tract, diagnosis, and treatment.

518. Diagnostic and Surgical Procedures
Fall. 2(0-6) Sixth-term Veterinary
Medicine student.
Demonstration and performance of some procedures applicable to nervous, reproductive, and respiratory systems.

520. Veterinary Public Health
Winter. 5(3-0) Seventh-term Veter-
inary Medicine students.
Public health aspects of veterinary medicine; the nature of laws, ordinances, and regulations; and veterinary medicine's role in the protection of the environment, ecology, and assurance of food hygiene.

522. Digestive System and Nutrition
Winter. 9(6-9) Seventh-term Veter-
inary Medicine student.
Pathogenesis, diagnosis, and treatment of diseases of the alimentary tract and digestive organs of animals. Recognition and rational therapy of nutritional diseases in animals.

524. Integumentary System
Winter. 4(3-3) Seventh-term Veter-
inary Medicine students.
Diseases of the integumentary system of animals with emphasis on laboratory examinations, interpretations of pathological features, diagnosis, and treatment.

526. Musculoskeletal System I
Winter. 4(2-8) Seventh-term Veter-
inary Medicine students.
Diagnosis and treatment of musculoskeletal diseases of animals with emphasis on pathological changes, radiological techniques, and interpretation of radiographs. Surgical procedures applicable to small animals will be demonstrated.

530. Veterinary Toxicology
Spring. 4(4-0) Eighth-term Veter-
inary Medicine students.
Pharmacological basis and pathological features of diseases of animals caused by common toxic chemicals with emphasis on clinical manifestations, diagnosis, prevention, and treatment.

532. Visual and Auditory Systems
Spring. 3(2-3) Eighth-term Veter-
inary Medicine students.
Methods of examination, diagnosis, and treatment of diseases involving the eyes or ears of animals with emphasis on the anatomical, physiological, and pathological features.

534. Musculoskeletal System II
Spring. 3(2-9) Eighth-term Veter-
inary Medicine students.
Diagnosis, prognosis, and management of musculoskeletal diseases of the equine with emphasis on anatomical relationships to normal and abnormal function. Surgical procedures applicable to equine and ruminant will be performed.

536. Orthopedic Surgery
Spring. 6(4-6) Eighth-term Veter-
inary Medicine students.
Principles of orthopedic surgery and anatomical relations of the musculoskeletal systems in the canine and feline.

538. Veterinary Medical History, Ethics, Jurisprudence, and Epidemiology
Spring. 2(2-0) Eighth-term Veter-
inary Medicine students.
Historical background, ethical principles, and legal responsibilities of the veterinary medical profession. Epidemiological problems will be resolved and discussed.

ZOOLOGY ZOL

College of Human Medicine
College of Natural Science
College of Osteopathic Medicine

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

301. Nature and Man
Spring. 4(2-6) Three terms of natural science; not open to zoology majors.
Relates man to his natural environment. Chief emphasis on identifying characteristic animal life in broad areas of nature and how man fits or misfits into these. Lectures, laboratory and field trips illustrate this relationship.
302. Vertebrate Life of the Past  
Fall. 3(3-0) One course in physical or biological science or Juniors. Interdepartmental with and administered by the Geology Department.  
Fossil vertebrates from fish to man.

303. Introductory Animal Systematics  
Fall. 4(4-0) B S 212, LBC 314 concurrently. Not open to zoology majors. Students may not receive credit in 303 and 303 or 303 and 381. 
A general survey of the animal kingdom. Topics include origin, evolution and diversity of invertebrate and vertebrate groups, their systematic and present status.

304. Biology, Behavior and Man  
Winter. 3(3-0) Juniors; not open to zoology majors. 
Examines philosophical and biological issues which make the study of animal behavior relevant to man. Emphasizes history of animal behavior, current theories, and experiments relating biological and environmental determinants of adaptive and non-adaptive behavior patterns.

305. Biology of Vertebrates  
Fall. 4(3-2) B S 212. Students may not receive credit in both 305 and 303. 
Primarily concerned with natural history of vertebrates. Topics include morphological characteristics, ecology, zoogeography, and taxonomy of vertebrate animal groups. Laboratory involves recognition of representative species within the various classes.

314. Comparative Anatomy of Vertebrates  
Fall, Winter. 5(3-6) B S 212. 
Comparative anatomy and evolution of vertebrates. The dogfish and a mammal dissected in the laboratory.

317. Principles of Development  
Fall, Spring. 3(3-0) B S 212. 
Development of animals, especially vertebrates. Principles are illustrated by modern experimental studies of developmental problems.

318. Principles of Development Laboratory  
Fall, Spring. 2(0-6) 317 or concurrently; B S 212. 
Principles of development illustrated by analysis of the development of selected organisms.

341. Human Heredity  
Fall, Winter, Spring, Summer. 4(3-3) Three terms of Natural Science; Sophomores; not open to zoology majors. Students may not receive credit in more than one of the following: 341, 441. 
Inheritance of human, physical, physiological, and psychological traits, and forces that influence human evolution. Foundation is laid on which applications of heredity in fields of education, sociology, anthropology, psychology, dentistry, and medicine must rest. Course includes field trips to state institutions.

344. Introductory Animal Systematics Laboratory  
Fall. 1(0-3) 393 concurrently. Interdepartmental with and administered by Lyman Briggs College. 
Laboratory examination of form and function of representative vertebrate and invertebrate animals.
438. Paleocology
Spring. 4(3-4) GLG 202 or ZOL 239 or approval of department. Interdepartmental with and administered by the Geology Department.
Distribution and abundance of marine fossils; response of skeletal morphology to environmental conditions; study of fossils in reconstructing ancient climates and depositional environments.

441. Fundamental Genetics
Fall, Spring. 5(5-0) B S 212. Students may receive credit in more than one of the following: 341, 441.
Survey of principles of heredity in animals, plants, and microorganisms. Serves as single course in genetics for majors in any of the biological sciences, and as prerequisite for further work in genetics.

442. Advanced Genetics
Winter. 3(3-0) or 5(2-5) 441; MTH 108 or 111 recommended.
Population genetics and the genetic analysis of evolution. Optional laboratory with individual research projects.

443. Developmental Genetics
Spring. 4(4-0) 441 and 317.
Mechanisms of gene action. Role of genes in the embryology, morphology, and physiology of organisms.

456. Foundations of Developmental Biology
Winter of odd-numbered years. 3(3-0) 317; 417 recommended.
Reading and discussion of original research which posed significant problems of modern developmental biology.

460. Field Ornithology
Summer. 3 credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station.
The study of birds of the regional area, with emphasis on field techniques in relation to problems in avian identification, ecology and behavior.

461. Ornithology
Spring. 5(3-0) 305.
Principles of classification, structure, distribution, migration, behavior, and habitats. Laboratory and field identification of birds by size, form, color, song, and habitat.

476. Limnology
Winter. 3(3-0) B S 212. Interdepartmental with and administered by the Fisheries and Wildlife Department.
Ecology of lakes and streams with special reference to physical, chemical, and biological factors affecting their productivity.

477. Limnological Methods
Winter. 3(3-0) 461; F W 476 concurrently; ENT 301, 302 recommended. Interdepartmental with and administered by the Fisheries and Wildlife Department.
Methods and instruments of limnological field investigation on lakes and streams.

479. Soil Zoology
Fall. 4(2-6) B S 212.
Ecology and biology of soil-dwelling animals, with emphasis placed on protozoa, annelids and arthropods.

490. Biogeography of Fresh-Water and Terrestrial Invertebrates
Spring. 6 credits. 361 or B S 212 and approval of department. Given at W. K. Kellogg Biological Station.
Methods and systems of ecology invertebrates with emphasis on the local fauna.

491. Invertebrate Zoology
Fall. 5(3-6) 361 or B S 212 and approval of department.
Biogeography of invertebrates with special reference to their natural history, classification, distribution, and economic importance.

492. Biology of the Protozoa
Winter. 3(3-0) or 5(3-6) B S 212.
Morphology, physiology, and natural habitats of protozoa.

493. Physiological Zoology
Fall. 4(3-3) B S 212.
Physiological aspects of basic ecological principles and concepts.

494. Herpetology
Spring. 5(3-6) 305 or 314.
Classification and natural history of amphibians and reptiles, with emphasis on Michigan species.

495. Mammalogy
Fall. 4(2-6) 305 or 314.
Classification, natural history of mammals, with emphasis on Michigan species. Field studies, preparation of study specimens.

498. Animal Distribution
Winter. 3(3-0) 441; 389 recommended.
Principles and patterns of animal distribution. Emphasis on major faunal regions, centers of origination, and concepts relating to the distribution of modern vertebrates.

499. Quantitative Biology
Fall. 4(4-0) W. 423 or approval of department.
Application of biometrical techniques to biological problems.

492. Cytochemistry
Spring. 4(3-3) B S 212.
General principles of microscopy, microtomy, fixation, embedding and sectioning of animal tissues; study of various cellular organelles and the localization of lipids, carbohydrates, proteins, nucleic acids and various hydrolytic enzymes in the cell.

495. Undergraduate Seminar
Fall, Winter, Spring. 1(1-0) May re-enroll for a maximum of 3 credits. Juniors, and approval of department.
Reading and discussion of articles relating to economic, social and environmental impact of new discoveries in biological sciences.

497. Principles of Endocrinology
Winter. 4(4-0) One year organic chemistry. 317. Interdepartmental with the Department of Physiology.
Hormonal principles, illustrated by experimental observations, in vertebrates and invertebrates. Emphasis on endocrinology. Group discussion, background in organic chemistry and cell biology strongly recommended. Term paper required.

817. Ecology of Zooplankton
Summer of every third year. Given in 1974, 3 credits. Given at W. K. Kellogg Biological Station.
Ecology, distribution, and abundance of planktonic animals with special emphasis on life tables, filtering rates, food selection, production dynamics, fish predation, niche, and species diversity.

820. Behavior of Animal Populations
Fall. 4(4-0) 413 and written approval of department.
Behavior on the ecological level. Characteristics of populations rather than individuals will be stressed. Evolution will be considered on the population level.

821. Ontogeny of Behavior
Winter. 4(4-0) 317, 413.
Changing patterns of behavior during the development of individual animals; effects of experimental control of external environment, and neurological and chemical intervention upon behavior.

822. Behavior of Aquatic Animals
Fall. 4(3-3) 413; W F 476 recommended.
Emphasis will be upon vertebrates. Approach will be primarily ecological on adaptation to special aquatic environments.

823. Neurological and Hormonal Correlates of Animal Behavior
Spring. 4(4-0) 414, 415.
Lectures, papers and discussions on the neural and hormonal determinants of animal behavior. Emphasis will be placed upon mammalian behavior.

825. Tropical Biology: An Ecological Approach
Winter, Summer. 12 credits. Approval of department and acceptance by Organization for Tropical Studies. Interdepartmental with and administered by the Botany and Plant Pathology Department.
An introduction in the field to the principles of ecology as they operate in the tropics, especially concerning the tropical environment and biota, ecological relations, communities and evolution in the tropics. Given in Costa Rica by Organization for Tropical Studies.

830. Advanced Vertebrate Zoology
Winter. 4(4-0) May re-enroll for a maximum of 12 credits. 395; two years of undergraduate zoology and approval of department.
Advanced vertebrate biology including systematics, ecology, distribution, morphology.

833. Advanced Invertebrate Paleontology
B. Quantitative Paleontology
Spring. 3(2-4) 437 or 438. Interdepartmental with and administered by the Geology Department.
Application of mathematical tools to paleontological problems, including statistical applications and numerical taxonomy; computer applications.

C. Paleobiology
Spring. 3(2-4) 437 or 438. Interdepartmental with and administered by the Geology Department.
Advanced problems in the distribution and abundance of fossil invertebrates; morphological adaptations to environmental pressures.

D. Fossil Morphology
Spring. 3(2-4) 437 or 438. Interdepartmental with and administered by the Geology Department.
Systematic morphology of fossil invertebrates, emphasizing the multivariate morphometric approach and other modern methods of morphological analysis.
834. Advanced Vertebrate Paleontology
Winter of even-numbered years. 3(3-0) 430 or approval of department. Interdepartmental with an administered by the Geology Department.
Recent advances and controversial issues in vertebrate paleontology including origin, classification, phylogeny, and stratigraphic relationships of fossil vertebrates.

839. Population Ecology
Summer. 6 credits. Approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with the Botany and Plant Pathology Department.
An experimental-field approach to the study of populations and communities. Selected topics will deal with population growth, composition, predation, community structure and species abundance. This course is intended to complete 892.

843. Ecosystem Analysis, Design and Management
Spring. 3(3-0) SYS 443 or ZOL 404. Interdepartmental with and administered by Systems Science.
Groups of students from various biological and non-biological disciplines will synthesize and analyze models of selected ecological systems. Projects should yield information relevant to solution of contemporary ecological problems.

844. Problems in Human Genetics
Spring. 5(5-0) 441 or approval of department.
Methods used in the study of human genetics and their application to medical, physiological and social problems. Laboratory consists of field trips and independent study selected by the student in consultation with the instructor.

845. Organic Evolution
Winter. 4(3-0) 441 and a course in comparative biology.
A historical view of evolutionary thought, a presentation of the evolution of prebiological systems and a critical evaluation of the evolution of genetic systems.

847. Analysis of Gene Organization and Transmission
Winter of odd-numbered years. 4(4-0) 441 and approval of department.
Formal and molecular analysis of gene organization and transmission in higher eukaryotes. Intended for graduate students with background in genetics and/or cytogentic.

850. Ultrastructure
Fall. 4(2-6) BOT 427.
New developments in instrumentation and techniques of electron microscopy and their practical application in studying morphological and physiological changes in various organ systems.

857. Experimental Morphology
Spring. 4(3-1) 317.
Analysis of mechanisms of morphogenesis, particularly as these occur in post-gastrular stages of development. The significance of tissue interactions in developing and regenerating systems will be emphasized.

858. Advanced Neurobiology
Winter. 3(3-0) BYF 855. Interdepartmental with the departments of Biophysics, Biochemistry, Physiology and Psychology and administered by the Department of Biomechanics.
Basic organization, structure and function of neural networks comprising sensory, motor, and autonomic systems including examples from invertebrates and vertebrates.

871. Ecology of Fishes
Summer. 8 credits. Approval of instructor or 389 or FW 473. Given at the W. K. Kellogg Biological Station. Interdepartmental with the Department of Fisheries and Wildlife.
Exploration of ecological problems with particular emphasis on growth, food and habitat selection, population biology and niche relations. Field and experimental investigations of fish communities.

881. Biology of the Arthropoda
Winter. 5(3-6) 481 or approval of department. Interdepartmental with the Entomology Department.
Ecology, life cycles, morphology, taxonomy, and distribution of arthropods other than insects.

891. Current Topics in Ecological Research
Fall. Winter. Spring. Summer. 1 credit.
May re-enroll for a maximum of 4 credits. Approval of department. Given at W. K. Kellogg Biological Station.
Discussions and special problem work; current theoretical views and investigations; treatment of the dynamics of energy and biomass in terrestrial and aquatic ecosystems; methods of analysis.

928. Dynamics of Biologic Populations
Winter. 5(4-3) 481; one course in ecology or approval of department.
Quantitative analyses of the dynamics, production, regulation, energetics and distribution of animal populations.

935. Fertilization and Early Embryogenesis
Fall. 3(3-0) Developmental biology, biochemistry and approval of department. Recommended concurrently.
Developmental biology of early stages of animal life, emphasis on physiology and biochemistry of marine invertebrate eggs.

990. Special Problems
Fall, Winter, Spring, Summer. 1 to 15 credits. Two years of undergraduate zoology. Approval of department.
Consideration of current problems.

991. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.
Research for the master's degree in genetics, morphology, mammalogy, wildlife management, ornithology, fisheries biology, limnology, quantitative biology, invertebrate, experimental embryology, animal behavior, herpetology.