453. Women and Work: Issues and Policy Analysis

462. Theory and Practice of Feminist Literary Criticism
Spring, 3(3-0) Interdepartmental with English. Administered by English.
P: ENG 353 or WS 202. R: Not open to freshmen and sophomores. Open only to students in English and Women’s Studies, and to students in English teaching minor.
Feminist literary critical theory and its implications for reading and studying literature.

490. Independent Study
Fall, Spring. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course.
P: WS 201; WS 202 or WS 203. R: Open only to juniors and seniors; approval of program.
Individual research and reading on women and gender.

491. Special Topics
Spring. 3 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course.
P: WS 201; WS 202 or WS 203. R: Not open to freshmen and sophomores.
In-depth study of special topic emphasizing women and gender.

492. Women’s Studies Senior Seminar
Spring, 4(4-0) Interdepartmental with English.
P: WS 201, WS 202, WS 301 or WS 302. R: Not open to freshmen and sophomores.
Synthesis and elaboration of ideas and perspectives central to Women’s studies. Current areas of interest and research in feminist scholarship.

493. Internship
Fall, Spring, Summer. 2 to 4 credits. A student may earn a maximum of 4 credits in all enrollments for this course.
P: WS 201; WS 202 or WS 203. R: Not open to freshmen and sophomores. Approval of program.
Integration of feminist knowledge through work experience related to women’s concerns. Experience in legislative, community, or educational settings.

490. Individual Reading
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course.
R: Approval of program.
Faculty supervised graduate level reading in special topics.

ZOOLOGY

Department of Zoology
College of Natural Science

141. Introductory Human Genetics
Spring, 3(3-0) R: Not open to students in Biochemistry, Botany, Entomology, Medical Technology, Clinical Laboratory Sciences, Physiology, Zoology, Microbiology or Interdepartmental Biological Science or to students in the corresponding Lyman Briggs School coordinate major or to students in the Lyman Briggs School Biology Field of concentration. Not open to students with credit in ZOL 341 or ZOL 344.

306. Invertebrate Biology
Fall, 3(3-3) P: BS 110
Systematics, morphology, and natural history of invertebrate animals. Identification of live and preserved specimens. Recognition of selected groups.

313. Animal Behavior
Fall, 3(3-3) P: BS 110, BS 111 or LBS 144, LBS 145. R: Not open to freshmen.
Mechanisms and evolution of behavior (ethology).
SA: ZOL 213

316. General Parasitology
Spring, 2(0-4) P: BS 110, BS 111 or LBS 145.
Identification, life history, host-parasite relationships, and epidemiology of protozoa, helminths, acanthocephalans, cestodes, and arthropod parasites of animals and humans.

316L General Parasitology Laboratory
Spring, 10(6) P: BS 110, BS 111 or LBS 145. C: ZOL 316.
Laboratory diagnosis of protozoa, helminths, acanthocephalans, cestodes, and arthropods that infect humans and animals. Animal necropsy.

320. Developmental Biology
Fall, 4(3-3) P: BS 110, BS 111 or LBS 144, LBS 145.
Principles of development, emphasizing vertebrates. Illustrations from morphological and experimental investigations.
SA: ZOL 226

325. Comparative Anatomy and Biology of Vertebrates
Spring, 4(3-3) P: BS 110 or LBS 144.
Comparative morphology and natural history of vertebrates. Dissection of representatives of most vertebrate classes.
SA: ZOL 228

331. Vertebrate Life of the Past
Spring, 3(3-0) Interdepartmental with Geological Sciences. Administered by Geological Sciences.
P: BS 110 or BS 111 or juniors and above. R: Not open to Zoology majors. Not open to students with credit in GLG 435.
Evolution and diversity of fossil vertebrates from fish to humans with emphasis on dinosaurs and Pleistocene events.

341. Fundamental Genetics
Fall, Summer, 4(4-0) Interdepartmental with Botany and Plant Pathology.
P: BS 110 or LBS 144.
Principles of heredity in animals, plants and microorganisms. Formal and molecular methods in the study of gene structure, transmission, expression and evolution.

342. Advanced Genetics
Spring, 3(3-0) P: ZOL 341.
Advanced topics in classical and molecular genetics including various forms of genetic mapping.

343. Genetics Laboratory
Spring, 2(0-4) P: ZOL 341 or concurrently.
Experiments involving genetics of Drosophila and other eucaryotic organisms.

344. Human Genetics
Spring, 3(3-0) P: ZOL 341. R: Not open to freshmen.

350. Histology
Fall, 4(3-3) P: BS 111 or LBS 145.
The structure of cells and their interactions to form tissues.

353. Marine Biology
Fall of even-numbered years, 4(4-0) P: BS 110; BOT 250 or ZOL 250 or ZOL 306.

355. Ecology
Fall, 4(3-3) Summer. 4 credits. Given at W.K. Kellogg Biological Station. Interdepartmental with Botany and Plant Pathology.
P: BS 110 or LBS 144. R: Completion of Tier I writing requirement.
Biological and animal ecology. Interrelationships of plants and animals with the environment. Principles of population, community, and ecosystem ecology. Application of ecological principles to global sustainability.
SA: ZOL 250

360. Biology of Birds
Spring, 4(3-3) Summer. 4 credits. Given at W.K. Kellogg Biological Station.
P: BS 110 or LBS 144.
The behavior, ecology, evolution, and systematics of birds with emphasis on biodiversity. Laboratories emphasize diversity of form and function, life history patterns, and identification.

365. Biology of Mammals
Fall, 4(3-3)
P: BS 110 or LBS 144.
Analysis of the behavior, ecology, evolution, and systematics of birds with emphasis on biodiversity. Laboratories emphasize diversity of form and function, life history patterns, and identification. Field trips required.

384. Biology of Amphibians and Reptiles
Fall of odd-numbered years, 3(2-3) Summer.
P: BS 110.
Analysis of the behavior, ecology, evolution, and systematics of birds with emphasis on biodiversity. Laboratories emphasize diversity of form and function, life history patterns, and identification. Field trips required.

Zoology — Descriptions of Courses
400H. Honors Work
Fall, Spring. 1 to 5 credits. A student may earn a maximum of 5 credits in all enrollments for this course. 
R: Not open to freshmen and sophomores. Approval of department. Honors work on a topic in zoology.

402. Neurobiology
Fall. 3(3-0)
P: BS 110, BS 111 or LBS 144, LBS 145. R: Not open to freshmen and sophomores. 
Structure and function of nerve cells and nervous systems.

412. Invertebrate Ecology
Summer of odd-numbered years. 4 credits. 
Given only at W.K. Kellogg Biological Station. P: BS 110. 
Ecology and systematics of selected invertebrate phyla with emphasis on the local fauna. Extensive field and laboratory work with living animals.

415. Ecological Aspects of Animal Behavior
Spring. 3(3-0)
R: sophomore. 
Advanced topics in the ecology and evolution of animal behavior.

417. Advanced Developmental Biology
Spring. 3(3-0)
R: sophomore. 
Multidisciplinary approaches to major current concepts. Historic perspectives, analyses from molecular to organismal level, and practical applications. SA: ZOL 417H

420. Stream and Aquatic Insect Ecology
Fall. 4(3-3) Interdepartmental with Fisheries and Wildlife, and Entomology. Administered by Fisheries and Wildlife. P: BS 110, CEM 141. 
Biological and environmental factors determining structure and function of stream and aquatic insect communities. Aquatic insect systematics.

421. Hormones and Development
Spring. 3(3-0) Interdepartmental with Physiology. P: ZOL 220. 
Hormonal regulation of development, growth and cancer. Hormonal decline in aging.

425. Biogeochemistry
Summer. 3 credits. Given only at W.K. Kellogg Biological Station. Interdepartmental with Microbiology, Geologic Sciences, and Crop and Soil Sciences. Administered by Microbiology. P: BS 110 or BS 111, CEM 145 or CEM 251. 
Integration of the principles of ecology, microbiology, geochemistry, and environmental chemistry. Social applications of research in aquatic and terrestrial habitats.

431. Comparative Limnology
Summer. 4 credits. Given only at W.K. Kellogg Biological Station. Interdepartmental with Botany and Plant Pathology, and Fisheries and Wildlife. P: CEM 141 or CEM 151; ZOL 250. R: Not open to students with credit in FW 472. Not open to students with credit in FW 472. 
Physical, chemical, and biological aspects of lakes and streams. Introduction to freshwater biology, and population and community ecology.

433. Vertebrate Paleontology
Fall of even-numbered years. 4(3-2) Interdepartmental with Geological Sciences. Administered by Geological Sciences. P: ZOL 228. R: Not open to students with credit in GLG 351. 
Fossil vertebrates with emphasis on evolution of major groups. Modern techniques of collection, identification and interpretation of fossils.

434. Evolutionary Paleobiology
Fall of even-numbered years. 4(3-2) Interdepartmental with Geological Sciences. Administered by Geological Sciences. P: BS 110 or GLG 201. 
Patterns and processes of evolution known from the fossil record including speciation, phylogeny, extinction, heterochrony and biogeography.

444. Conservation Biology
Fall. 3(3-0) Interdepartmental with Fisheries and Wildlife. Administered by Fisheries and Wildlife. P: BS 110. 
Ecological theories and methodologies to manage species, communities and genetic diversity on a local and global scale.

445. Evolution
Fall. 3(3-0) Interdepartmental with Botany and Plant Pathology. P: ZOL 341. R: Not open to freshmen. 
Processes of evolutionary change in animals, plants, microbes. Population genetics, microevolution, speciation, adaptive radiation, macroevolution. Origin of Homo sapiens. SA: ZOL 545

446. Environmental Issues and Public Policy
Spring. 3(3-0) Interdepartmental with Resource Development. R: Not open to freshmen and sophomores. 
The interrelationship of science and public policy in resolving environmental issues. Technical, social, economic, and legal influences. Case study approach.

450. Cancer Biology
Spring. 3(3-0) Interdepartmental with Medicine. P: BCH 200 or BCH 401; ZOL 221. 

453. Field Studies in Marine and Estuarine Biology
Summer. 2 to 3 credits. A student may earn a maximum of 3 credits in all enrollments for this course. 
R: Approval of instructor. Marine and estuarine communities emphasizing ecology, life histories, behavior, and resource ecology of the organisms present. Field trip to southeast.

457. Foundations of Evolutionary Biology
Spring. 3(3-0)
R: BS 110. 
Reading and discussion of original works in evolutionary biology which have shaped modern evolutionary thought.

471. Ichthyology
Fall. 3(3-0) Interdepartmental with Fisheries and Wildlife. Administered by Fisheries and Wildlife. P: ZOL 225. 
Fish morphology, physiology, development, behavior, evolution and ecology. World fishes with emphasis on freshwater fishes.

472. Limnology
Fall. 3(3-0) Interdepartmental with Fisheries and Wildlife. Administered by Fisheries and Wildlife. P: CRM 141, ZOL 250. R: Not open to students with credit in ZOL 351. 
Ecological processes with emphasis on interacting physical, chemical, and biological factors affecting their structure and function.

474. Fishery and Limnological Techniques
Fall. 3(1-6) Interdepartmental with Fisheries and Wildlife. P: FW 472 or concurrently. 
Field and laboratory investigations of physical, chemical, and biological parameters of lakes and streams.

475. Tropical Biology
Spring. 3(3-0) Interdepartmental with Botany and Plant Pathology, and Entomology. P: ZOL 250. R: Open only to juniors and seniors. 
Tropical plants emphasizing evolutionary and ecological principles compared across tropical ecosystems.

485. Field Tropical Biology
Spring, Summer. 2 credits. Interdepartmental with Botany and Plant Pathology, and Entomology. P: ZOL 486 or concurrently. 
Open only to juniors and seniors. Approval of department. Intensive field experience to study tropical ecosystems. Individual project required. Given at various sites in Costa Rica by the Organization for Tropical Studies.

494. Capstone: Independent Study 
Fall. 1 to 6 credits. A student may earn a maximum of 9 credits in all enrollments for this course. R: Approval of department. Supervised research on a topic not normally covered in the classroom.

495. Capstone: Undergraduate Seminar
Fall, Spring. 1(1-0) A student may earn a maximum of 3 credits in all enrollments for this course. 
R: Open only to senior Zoology majors. 
Economic, social and environmental impact of current developments in Zoology.

496. Capstone: Internship in Zoology
Fall, Spring. Summer. 1 to 6 credits. Given only at various off-campus sites. A student may earn a maximum of 8 credits in all enrollments for this course. 
R: Open only to seniors. Approval of department. Practical experience applying Zoology training in a setting outside the University.

499. Capstone: Undergraduate Thesis
Fall, Spring. Summer. 1 to 6 credits. A student may earn a maximum of 8 credits in all enrollments for this course. 
R: Open only to seniors. Approval of department. Laboratory research culminating in the preparation and defense of an undergraduate thesis.
811. Cellular and Neurophysiology  
Fall, 6 credits. Interdepartmental with Physiology. Administered by Physiology.  
P: BCH 462, PSL 432. 
Advanced bioenergetics, transport, regulation of metabolic reactions, specialized cell functions, and neurophysiology.

817. Ecology and Evolution in Aquatic Systems  
Summer. 4 credits. Given only at W.K. Kellogg Biological Station. Interdepartmental with Botany and Plant Pathology, and Fisheries and Wildlife.  
P: ZOL 260 or ZOL 411. 
Experimental field studies of population and community ecology of freshwater lakes and streams. Emphasis on interactions among species and between biotic and abiotic factors.

822. Topics in Ethology and Behavioral Ecology  
Spring of odd-numbered years. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course.  
P: ZOL 415. R: Open only to graduate students. Critical analysis through seminar-discussions of the primary research literature.

826. Tropical Biology: An Ecological Approach  
Spring, Summer. 6 credits. Interdepartmental with Botany and Plant Pathology. Administered by Botany and Plant Pathology.  
R: Approval of department; application required. 
Principles of tropical ecology at the population, community, and ecosystem levels. Given at various sites in Costa Rica by the Organization for Tropical Studies.

827. Advanced Neurobiology  
Fall. 4(4-0) Interdepartmental with Physiology, Pharmacology and Toxicology.  
R: Approval of department. 
Nervous system function at the cellular level: membrane biophysics and potentials, synaptic transmission.

830. Neuroendocrine Aspects of Behavior  
Spring of odd-numbered years. 3(3-0)  
P: ZOL 402. 
Neural mechanism by which hormones influence the reproductive, parental, and aggressive behavior of vertebrates. Plasticity.

831. Quantitative Paleobiology  
Spring of even-numbered years. 3(2-2) Interdepartmental with Geological Sciences. Administered by Geological Sciences.  
P: GLG 431 or ZOL 346. 
Analysis of paleobiological problems using quantitative techniques such as cladistics, morphometrics, ordination, and sterology.

841. Chromosome Structure and Genetics  
Spring of even-numbered years. 3(3-0) Interdepartmental with Genetics.  
R: Approval of department. 
Classical and molecular genetics of chromosome structure and behavior in mitosis and meiosis. Synapsis and disjunction, exchange, centromeres, euchromatin, heterochromatin and transposeable elements.

842. Application of Ecological Principles  
Fall. 6 credits. Given only at W.K. Kellogg Biological Station. A student may earn a maximum of 8 credits in all enrollments for this course. Interdepartmental with Botany and Plant Pathology. Administered by Botany and Plant Pathology.  
R: Approval of department. 
Workshops and discussions with experts from industry, regulatory agencies, conservation groups, and academia on application of basic ecology and evolutionary biology to real-world problems.

843. Selected Topics in Human Genetics  
Fall. 3(3-0)  
P: ZOL 344. R: Open only to seniors and graduate students. 
Inheritance of human traits including medical, physiological, forensic, biochemical, molecular and chromosomal areas.

844. Organelle Genetics  
Spring of odd-numbered years. 3(3-0) Interdepartmental with Botany and Plant Pathology. Administered by Botany and Plant Pathology.  
P: BCH 811 or BOT 456, ZOL 341. 
Organizational structure, function, heredity, molecular biology and manipulation of chloroplasts and mitochondria. Biological interaction between nuclear and organelles.

845. Ecology and Evolution: the Interface  
Fall. 3(3-0) Interdepartmental with Botany and Plant Pathology, and Entomology. 
Conceptual and methodological issues common to both ecology and evolutionary biology.

849. Evolutionary Biology  
Spring. 3(3-0) Interdepartmental with Botany and Plant Pathology. Administered by Botany and Plant Pathology.  
P: ZOL 341, STT 422 or concurrently, C: STT 422. 
Major conceptual, theoretical and empirical questions in evolutionary biology. Readings and lectures are synthesized in student discussions and on paper.

851. Quantitative Methods in Ecology and Evolution  
Fall. 3(3-0) Interdepartmental with Botany and Plant Pathology.  
P: STT 486. 
Interpretation and analysis of ecological and evolutionary biology data. Statistical computer software.

850. Ecology and Evolution in Terrestrial Systems  
Summer. 4 credits. Given only at W.K. Kellogg Biological Station. Interdepartmental with Botany and Plant Pathology, and Crop and Soil Sciences. Administered by Botany and Plant Pathology.  
P: STT 425. 
Field experimental and quantitative approaches to ecological and evolutionary mechanisms.

888. Molecular and Cellular Aspects of Development  
Spring. 4(4-0)  
R: Approval of department. 

890. Special Problems  
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 10 credits in all enrollments for this course.  
R: Approval of department. 
Current problems in Zoology.

891. Current Topics in Ecology and Evolution  
Summer. 1 credit. Given only at W.K. Kellogg Biological Station. A student may earn a maximum of 8 credits in all enrollments for this course. Interdepartmental with Botany and Plant Pathology, and Crop and Soil Sciences. 
Presentation and critical evaluation of theoretical and empirical developments by visiting scientists.

892. Biodiversity  
Spring. 3(2-0) A student may earn a maximum of 4 credits in all enrollments for this course. Interdepartmental with Fisheries and Wildlife.  
P: ZOL 250. 
Status of world biota and factors in the decline and extinction of major groups of plants and animals. Theory and design of natural reserves. Assessment and ecological meaning of diversity. Management for global and local diversity.

895. Seminar  
Fall, Spring. 1(1-0) A student may earn a maximum of 6 credits in all enrollments for this course. Graduate seminar on current research topics in Zoology.

896. Population and Community Ecology  
Fall. 4(4-0) 

897. Community and Ecosystem Ecology  
Spring. 4(4-0) Interdepartmental with Botany and Plant Pathology, and Fisheries and Wildlife. 
Structure and function of natural communities and ecosystems. Community analysis along environmental gradients. Succession, food web analysis, energy flow, nutrient cycling, and effects of human activities on ecosystems.

899. Master's Thesis Research  
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 24 credits in all enrollments for this course.

989. Doctoral Dissertation Research  
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 90 credits in all enrollments for this course.