

## ZOOLOGY

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## ZOL

- 213. Animal Behavior**  
Spring, 3(3-0)  
P: BS 110, BS 111 or LBS 144, LBS 145. R: Not open to freshmen.  
Mechanisms and evolution of behavior (ethology).  
QP: BS 210 BS 211BS 212ORLBS 140 QA: ZOL 313
- 220. 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.  
QP: BS 211 ORLBS 141 QA: ZOL 317 ZOL 318
- 221. Cells and Development**  
Spring, 4(3-3)  
P: BS 110, BS 111 or LBS 144, LBS 145.  
The role of cells in growth, differentiation and development of animals from protozoa to mammals.  
QP: BS 210 BS 211BS 212ORLBS 140 QA: ZOL 409 ZOL 482
- 228. Comparative Anatomy and Biology of Vertebrates**  
Spring, 4(2-6)  
P: BS 110 or LBS 144.  
Comparative morphology and natural history of vertebrates. Dissection of representatives of most vertebrate classes.  
QP: BS 212 ORLBS 140 QA: ZOL 428 ZOL 307
- 250\*. Ecology**  
Fall, Summer, 4(3-3)  
Interdepartmental with the Department(s) of Botany and Plant Pathology.  
P: BS 110 or LBS 144.  
Plant 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.  
QP: BS 212 ORLBS 141 QA: ZOL 389 BOT 450
- 306\*. Invertebrate Biology**  
Fall, 4(3-3)  
P: BS 110.  
Systematics, morphology, and natural history of invertebrate animals. Identification of live and preserved specimens. Recognition of selected groups.  
QP: BS 212 QA: ZOL 306
- 316. General Parasitology**  
Spring of even-numbered years, 3(2-3)  
P: BS 110, BS 111 or LBS 144, LBS 145.  
Identification, life history, host-parasite relationships (including physiology, immunology, immunopathology and pathology) and epidemiology of selected groups and species of protozoan, trematode, cestode and nematode parasites.  
QP: BS 210 BS 211BS 212ORLBS 141 QA: MPH 416 MPH 418
- 341\*. Fundamental Genetics**  
Fall, Spring, Summer, 4(4-0)  
Interdepartmental with the Department(s) of 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.  
QP: BS 210 BS 211 QA: ZOL 441 ZOL 442

- 342. Advanced Genetics**  
Spring of odd-numbered years, 3(3-0)  
P: ZOL 241.  
Advanced topics in classical and molecular genetics including various forms of genetic mapping.  
QP: ZOL 441 ZOL 317 QA: ZOL 442 ZOL 443
- 343. Genetics Laboratory**  
Spring, 2(0-4)  
P: ZOL 341.  
Experiments involving genetics of *Drosophila* and other eucaryotic organisms.  
QP: ZOL 441
- 344\*. Human Genetics**  
Spring, 3(3-0)  
P: ZOL 341 R: Sophomore and above  
Inheritance of human traits with emphasis on medical, physiological & forensic applications. Biochemical & molecular genetics of human disease. Chromosomal disorders & their consequences. Prenatal & pre-symptomatic diagnosis. Legal & ethnical considerations.  
QA: 341
- 345\*. Evolution**  
Fall, 3(3-0) Interdepartmental with the Department(s) of 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*.  
QP: BS 212 QA: ZOL 445 BOT 445
- 350. Histology**  
Fall, 4(3-3)  
P: BS 111 or LBS 145.  
The structure of cells and their interactions to form tissues.  
QP: BS 210 ORLBS 141 QA: ZOL 450
- 353\*. Marine Biology**  
Fall of even-numbered years, 4(4-0)  
P: BS 110; BOT 250 or ZOL 250 or ZOL 306.  
Analysis of marine and estuarine systems. Integration of biology, chemistry, and physics. Life histories of marine organisms. Biology of special marine habitats. Physiological problems of marine life.  
QP: BS 212 QA: ZOL 453
- 360. Biology of Birds and Mammals**  
Spring, Summer, 4(3-3)  
P: BS 110 or LBS 144.  
The behavior, ecology, evolution and systematics of birds and mammals with emphasis on biodiversity. Laboratories emphasize diversity of form and function, life history patterns and identification.  
QP: BS 212 ORLBS 140 QA: ZOL 461 ZOL 486
- 384\*. Biology of Amphibians and Reptiles**  
Fall of odd-numbered years, Summer of even-numbered years, 3(2-3)  
P: ZOL 228.  
Biology of amphibians and reptiles. Laboratory emphasis on diversity and on Michigan species. Field trips required.  
QP: ZOL 307 ZOL 428 QA: ZOL 484
- 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.  
QP: BS 210 BS 211BS 212ORLBS 140 QA: ZOL 402

- 412\*. Invertebrate Ecology**  
Summer of even-numbered years, 4(-)  
P: BS 110.  
Ecology and systematics of selected invertebrate phyla with emphasis on the local fauna. Extensive field and laboratory work with living animals.  
QP: BS 212 QA: ZOL 412
- 415. Ecological Aspects of Animal Behavior**  
Fall, 3(3-0)  
P: ZOL 213. R: Not open to freshmen.  
Advanced topics in the ecology and evolution of animal behavior.  
QP: ZOL 313 QA: ZOL 415
- 421\*. Hormones and Development**  
Spring, 3(3-0) Interdepartmental with the Department(s) of Physiology.  
P: BS 110, BS 111 or LBS 144, LBS 145.  
Hormonal regulation of development, growth and cancer. Hormonal decline in aging.  
QP: ZOL 317 QA: ZOL 421
- 431\*. Comparative Limnology**  
Summer, 4(2-4) Interdepartmental with the Department(s) of Botany and Plant Pathology, Fisheries and Wildlife.  
P: CEM 141 or CEM 151 or equivalent, and ZOL/BOT 250  
Physical, chemical and biological aspects of lakes and streams. Introduction to freshwater biology, and population and community ecology.  
QP: CEM 141 ORCEM 151ANDZOL 389 QA: BOT 431 ZOL 431 BOT 432 ZOL 432
- 444\*. Environmental Issues Management**  
Spring, 3(3-0) Interdepartmental with the Department(s) of Resource Development.  
R: Juniors or above  
Case study approach to explore the interactions of technical, social, economic and legal influences on the management of environmental issues.  
QA: ZOL 301 RD 439
- 450\*. Cancer Biology**  
Spring, 3(3-0) Interdepartmental with the Department(s) of Medicine.  
P: ZOL 221, BCH 200 or BCH 401  
A comprehensive, integrated approach to problems in cancer biology. Topics span cellular and molecular aspects and applications of modern biotechnology, to the causes, treatment and prevention. World distribution and risk factors.  
QP: ZOL 221 BCH 200ORBCH 401
- 453\*. Field Studies in Marine and Estuarine Biology**  
Summer, 2 to 3 credits. May reenroll for a maximum of 5 credits.  
R: Approval of instructor.  
Marine and estuarine communities emphasizing ecology, life histories, behavior, and resource ecology of the organisms present. Field trip to seacoast.  
QA: ZOL 454
- 457\*. Foundations of Evolutionary Biology**  
Spring, 3(3-0)  
P: BS 110.  
Reading and discussion of original works in evolutionary biology which have shaped modern evolutionary thought.  
QP: BS 212 QA: ZOL 457 ZOL 456
- 482. Cytochemistry**  
Spring, 4(3-3)  
P: ZOL 350.  
Principles of microscopy, microtomy. Cells and organelles. Localization of lipids, carbohydrates, proteins, nucleic acids and enzymes using cytochemical, immunological and autoradiographic methods.  
QP: BS 212 QA: ZOL 450

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**483\*.** **Environmental Physiology**  
 Spring. 4(4-0) Interdepartmental with the Department(s) of Physiology.  
 P: ZOL 228 or ZOL 250.

Aspects of physiology important to the environmental relations of vertebrates and invertebrates: energetics, thermal relations, osmotic-ionic relations, and exercise physiology.  
 QP: BS 212 ORLBS 140 QA: ZOL 483

**485\*.** **Tropical Biology**  
 Spring. 3 to 5 credits in increments of 2 credits. Interdepartmental with the Department(s) of Botany and Plant Pathology, Entomology.  
 P: ZOL 250 or equivalent R: Juniors

and Seniors  
 Tropical biota emphasizing evolutionary and ecological principles compared across a diverse tropical ecosystems.  
 QP: ZOL 389 BOT 450

**494\*.** **Capstone: Independent Study**  
 Fall. 1 to 6 credits. May reenroll for a maximum of 8 credits.  
 R: Open only to juniors and seniors.

Approval of department.  
 Supervised research on a topic not normally covered in the classroom.  
 QA: ZOL 391

**495\*.** **Capstone: Undergraduate Seminar**  
 Fall, Spring. 1(1-0) May reenroll for a maximum of 3 credits.  
 R: Open only to senior Zoology majors.

Approval of department.  
 Economic, social and environmental impact of current developments in Zoology.  
 QA: ZOL 495

**496\*.** **Capstone: Internship in Zoology**  
 Fall, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 8 credits.

P: Approval of Department R: Senior  
 Practical experience applying Zoology training in a setting outside the University.

**499\*.** **Capstone: Undergraduate Thesis**  
 Fall, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 8 credits.

R: Open only to seniors. Approval of department.  
 Laboratory research culminating in the preparation and defense of an undergraduate thesis.  
 QA: ZOL 499

**817\*.** **Ecological and Evolutionary Mechanisms-Aquatics**  
 Summer. 4(-) Interdepartmental with the Department(s) of Botany and Plant Pathology, Fisheries and Wildlife.  
 P: ZOL/BOT 250, or ZOL/FW 431

Experimental field studies of population and community ecology of freshwater lakes and streams, emphasizing interactions among species and between biotic and abiotic factors.  
 QP: ZOL 389 ZOL 432 QA: ZOL 817 ZOL 871

**822\*.** **Topics in Ethology and Behavioral Ecology**  
 Spring of odd-numbered years. 3(3-0) May reenroll for a maximum of 6 credits.

P: Zoology 415 R: Graduate students  
 Topics in ethology and behavioral ecology. Critical analysis through seminar-discussions of the primary research literature.  
 QP: ZOL 313 QA: ZOL 822

**827\*.** **Advanced Neurobiology**  
 Fall. 4(4-0) Interdepartmental with the Department(s) of Physiology, Pharmacology and Toxicology.

Function of nervous system at cellular level: membrane biophysics and potentials, synaptic transmission, receptor transduction, neural development.  
 QA: ZOL 827

**842\*.** **Chromosome Structure and Genetics**  
 Spring of even-numbered years. 3(3-0) Interdepartmental with the Department(s) of .

P: ZOL 341 R: Graduate Students  
 Classical and molecular genetics of chromosome structure and behavior in mitosis and meiosis. Topics include: synapsis and disjunction, exchange, centromeres, euchromatin, heterochromatin and transposable elements.  
 QP: ZOL 441 QA: ZOL 842 GEN 842

**844\*.** **Selected Topics in Human Genetics**  
 Fall. 3(3-0)  
 P: ZOL 344 R: Senior or Graduate

Students  
 Advanced Training in inheritance of human traits including medical, physiological, forensic, biochemical, molecular and chromosomal areas.  
 QP: ZOL 441 ZOL 341 QA: ZOL 844

**845\*.** **Ecology and Evolution: the Interface**  
 Fall. 3(3-0) Interdepartmental with the Department(s) of Botany and Plant Pathology, Entomology.  
 P: Graduate Students

Conceptual and methodological issues common to both ecology and evolutionary biology  
 QA: ZOL 845

**851\*.** **Quantitative Methods in Ecology and Evolution**  
 Fall. 3(3-0) Interdepartmental with the Department(s) of Botany and Plant Pathology.  
 P: STT 465

Interpretation and analysis of ecological and evolutionary biology data. Introduction to statistical computer software.  
 QP: STT 423 QA: BOT 851

**881\*.** **Soil Zoology**  
 Spring of even-numbered years. 4(2-6)  
 P: ZOL 306 or ENT 404 R: Seniors

and graduate students  
 Soil animals and their ecology, biology and systematics.  
 QP: ZOL 306 QA: ZOL 881

**888\*.** **Molecular and Cellular Aspects of Development**  
 Spring. 4(4-0)  
 P: Permission of Department

Current research topics in Developmental Biology. Emphasizing cell interactions and molecular regulation of cellular function in fertilization, morphogenesis, differentiation, oncogenesis, teratogenesis and regeneration.

**890\*.** **Special Problems**  
 Fall, Spring, Summer. 1 to 3 credits.  
 P: Approval of department. R: Graduate

ate  
 Current problems in Zoology  
 QA: ZOL 890

**891\*.** **Current Topics in Ecology and Evolution**  
 Summer. 1(-) May reenroll for a maximum of 12 credits.

Interdepartmental with the Department(s) of Botany and Plant Pathology, Crop and Soil Sciences.  
 R: Graduate students  
 Discussions of current research topics in ecology and evolution with distinguished visiting scientists. Critical evaluation of theoretical and empirical developments and methods of analyses are emphasized.  
 QA: ZOL 891

**892\*.** **Global Biodiversity and Conservation Issues**  
 Spring. 2(2-0) May reenroll for a maximum of 4 credits.

Interdepartmental with the Department(s) of Fisheries and Wildlife.  
 P: ZOL 250 R: Graduate students  
 Status of world biota and factors in the decline and extinction of major groups of plants and animals. Theory & design of natural reserves; Assessment & ecological meaning of diversity. Management of global & local diversity.  
 QP: ZOL 250

**895\*.** **Seminar Topics**  
 Fall, Spring. 1 to 0 credits. May reenroll for a maximum of 6 credits.  
 P: Approval of department R: Graduate students

Graduate seminar on current research topics in Zoology.  
 QA: ZOL 895

**896\*.** **Population and Community Ecology**  
 Fall. 4(4-0)  
 R: Graduate students

Population dynamics of animals and plants utilizing life tables and projection matrices; species interactions; life history theory; structure and dynamics of communities; succession.  
 QA: ZOL 892

**897\*.** **Community and Ecosystem Ecology**  
 Spring. 4(4-0) Interdepartmental with the Department(s) of Botany and Plant Pathology, Fisheries and Wildlife.  
 P: Graduate status R: Graduate students

Structure and function of natural communities & ecosystems. Topics include community analysis along environmental gradients, succession, food web analysis, energy flow, nutrient cycling, & effects of human activities on ecosystems.  
 QP: ZOL 389 BOT 450 QA: ZOL 897

**899\*.** **Master's Thesis Research**  
 . 1 to 2 credits. May reenroll for a maximum of 12 credits.  
 P: Approval of department R: Graduate

ate  
 Research for the master's degree in Zoology including animal behavior, cell and developmental biology, ecology, evolution, organismal biology, neurobiology, genetics.

**999\*.** **Doctoral Dissertation Research**  
 Fall, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 48 credits.

P: Approval of department  
 Research for the Ph.D. degree in Zoology including Animal Behavior, Cell and Developmental Biology, Ecology, Evolution, Organismal Biology, Neurobiology, Genetics