

BIOLOGICAL SCIENCE **BS**

College of Natural Science

- 110 Organisms and Populations**
Fall, Spring. 4(3-3) Not open to students with credit in LBS 144 or LBS 148H.
Biological diversity and organismal biology. Principles of evolution, population biology, and community structure.
- 111 Cells and Molecules**
Fall, Spring, Summer. 3(3-0) P: (CEM 141 or CEM 151 or LBS 171 or CEM 181H) Not open to students with credit in LBS 145 or LBS 149H.
Macromolecular synthesis; energy metabolism; molecular aspects of development; principles of genetics.
- 111L Cell and Molecular Biology Laboratory**
Fall, Spring, Summer. 2(1-3) Interdepartmental with Microbiology and Molecular Genetics; Plant Biology; Zoology. P: (BS111 or concurrently) Not open to students with credit in LBS 159H.
Principles and applications of common techniques used in cell and molecular biology.
- 148H Honors Organismal Biology**
Fall. 3(3-0) Interdepartmental with Lyman Briggs School. Administered by Lyman Briggs School. R: Honors College student or approval of school. Not open to students with credit in BS 110 or LBS 144.
Diversity and basic properties of organisms, with emphasis on genetic principles, ecological interactions, and the evolutionary process. Historical approach to knowledge discovery.
- 149H Honors Cell and Molecular Biology**
Spring. 3(3-0) Interdepartmental with Lyman Briggs School. Administered by Lyman Briggs School. P: (CEM 141 or concurrently or CEM 151 or concurrently or CEM 181H or concurrently or LBS 171 or concurrently) R: Honors College student or approval of school. Not open to students with credit in BS 111 or LBS 145.
Exploration of the physicochemical and molecular organization of cells as the unifying framework for genetics, evolution, and the social relevance of biology.
- 158H Honors Organismal Biology Laboratory**
Fall. 2(1-3) Interdepartmental with Lyman Briggs School. Administered by Lyman Briggs School. Not open to students with credit in BS 110 or LBS 144. C: LBS 148H concurrently.
Basic procedures used by organismal biologists, including experimental design and statistical methods. Development and implementation of research projects to test hypotheses in genetics, ecology, and evolution.

- 159H Honors Cell and Molecular Biology Laboratory**
Spring. 2(1-3) Interdepartmental with Lyman Briggs School. Administered by Lyman Briggs School. Not open to students with credit in BS 111L or LBS 145. C: LBS 149H concurrently.
Basic techniques of cellular and molecular biology including experimental design and hypothesis formulation. Student-initiated projects to test hypothesis-driven projects in biochemistry, molecular biology or genetics.
- 815 Instrumentation for Biosystems Engineering**
Fall. 3(3-0) R: Open only to graduate students in the College of Engineering. SA: AE 815
Theory and techniques of measuring temperature, pressure, flow, humidity, and moisture in biological materials.
- 818 Comprehensive Nutrient Management Planning**
Fall. 3(2-2) Interdepartmental with Animal Science. Administered by Department of Animal Science.
Development of comprehensive nutrient management plans (CNMP) for animal feeding operations. Trends in animal production, environmental issues, and diet formulation and their impact on manure production. Development of CNMP for a specific animal feeding operation.
- 820 Research Methods in Biosystems Engineering**
Fall. 1(1-0) R: Open only to graduate students in the College of Agriculture and Natural Resources or College of Engineering. SA: AE 820
Procedures and methods for designing and executing research projects.
- 832 Network Design and Optimization of Biological Systems**
Spring. 3(2-2) RB: (BE 431 or BE 831)
Techniques of process network theory and multi-criteria optimization for designing environmentally sound and economically beneficial biosystems.
- 850 Dimensional Analysis and Theory of Models**
Fall of odd years. 3(2-2) R: Open only to graduate students in the College of Agriculture and Natural Resources or College of Engineering. SA: AE 850
Dimensional concepts, systems of measurements and transformation of units, and formation of dimensionless groups. Development of prediction equations, concepts of similarity, and scaling laws. Distortion.
- 852 Systems Modeling and Simulation**
Fall of even years. 3(3-0) Interdepartmental with Fisheries and Wildlife; Forestry; Resource Development. Administered by Department of Fisheries and Wildlife. RB: (STT 422 or STT 442 or STT 464 or GEO 463)
General systems theory and concepts. Modeling and simulation methods. Applications of systems approach and techniques to natural resource management, and to ecological and agricultural research.

- 853 Applied Systems Modeling and Simulation for Natural Resource Management**
Spring of odd years. 3(2-2) Interdepartmental with Fisheries and Wildlife; Forestry; Resource Development; Zoology. Administered by Department of Fisheries and Wildlife. RB: (FW 820 or BE 486 or ZOL 851) or approval of department. R: Open only to seniors and graduate students
Mathematical models for evaluating resource management strategies. Stochastic and deterministic simulation for optimization. System control structures. Team modelling approach.
- 882 Irrigation and Water Management Engineering**
Spring of even years. 3(3-0) RB: (BE 481 and CE 321) SA: AE 882
Design and management of systems for supplemental irrigation. Water supply and transport. Economic and engineering optimization of irrigation design.
- 890 Special Problems**
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department; application required. SA: AE 890
Individual study in biosystems engineering.
- 891 Advanced Topics in Biosystems Engineering**
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to graduate students in the College of Engineering. Approval of department. SA: AE 891
Biosystems engineering topics not covered in regular courses.
- 892 Biosystems Engineering Seminar**
Spring. 1(1-0) R: Open only to graduate students in the College of Agriculture and Natural Resources or College of Engineering. SA: AE 892
Current topics in biosystems engineering.
- 899 Master's Thesis Research**
Fall, Spring, Summer. 1 to 10 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to master's students in the Biosystems Engineering major. SA: AE 899
Master's thesis research.
- 999 Doctoral Dissertation Research**
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to doctoral students in the Biosystems Engineering major. SA: AE 999
Doctoral dissertation research.