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**BIOLOGICAL SCIENCE**

111. Cells and Molecules
Fall, Spring. 4(3-3)
F: CEM 141 or CEM 151.
Cell structure and function; macromolecular synthesis; energy metabolism; molecular aspects of development; principles of genetics.

**BIOMECHANICS**

590*. Special Problems in Biomechanics
Fall, Spring, Summer. 1(01-00) May reenroll for a maximum of 22 credits.
R: Not open to freshmen and sophomores.
Approval of department.
Each student works under faculty direction on an experimental, theoretical, or applied problem.
QP: DEPT.APP QA: BIM 590

611*. Osteopathic Manipulative Medicine Clerkship
Fall, Spring, Summer. 4 to 12 credits in increments of 2 credits.
P: Unis 1 and II. R: Open only to graduate professional students in the College of Osteopathic Medicine.
Advanced training in the diagnosis of musculoskeletal dysfunction and application of osteopathic manipulative techniques.
QA: BIM 601

620*. Directed Studies
Fall, Spring, Summer. 2 to 10 credits in increments of 2 credits.
R: Open only to graduate professional students in the College of Osteopathic Medicine. Approval of department.
Individual or group work on special problems related primarily to the biomechanics of the musculoskeletal system.
QA: BIM 620

800*. Special Topics
Fall, Spring, Summer. 1(01-00) May reenroll for a maximum of 3 credits.
R: Open only to graduate students.
Approval of department.
Directed study in topics of biomechanics.
QP: DEPT.APP QA: BIM 800

810*. Tissue Biomechanics
Fall. 3(02-02)
R: Open only to Biomechanics graduate students.
Integrate concepts of tissue mechanics and microstructure, develop experimental methods to study connective tissue mechanics using engineering principles.
QA: BIM 811 BIM 871

811*. Biomechanical Analysis
Fall. 3(02-00)
R: Open only to Biomechanics graduate students.
Methods for analysis of biokinematic and biokinetic data.
QA: BIM 805

840*. Therapy of Connective Tissue Mechanics
Fall. 3(00-00)
P: BIM 810.
Mechanical properties, chemical content, and anatomical structure in connective tissues.
QP: BIM 812 QA: BIM 812

841*. Theory of Neuromuscular Mechanics
Fall. 3(03-00)
R: Open only to Biomechanics graduate students.
Neurological control of joint mechanics.
QA: BIM 810 BIM 805

858*. Theory of Joint Mechanics
Fall. 3(03-00)
P: BIM 813.
Motion and force transmission, and their relationship to anatomical structure and tissue function in joints.
QP: BIM 810 QA: BIM 810

860*. Occupational Biomechanics
Fall. 3(03-00)
P: BIM 815.
Applications of biomechanics in ergonomics with emphasis on the whole body.
QP: BIM 810 QA: BIM 810

861*. Clinical Biomechanics
Fall. 3(03-00)
R: Open only to Biomechanics graduate students.
Application of biomechanics to medicine.

880*. Independent Study
Fall, Spring, Summer. 1 to 3 credits.
R: Open only to graduate students in Biomechanics.
Approval of department.
Individual or group work related to biomechanics and/or neuromuscular system.
P: P

885*. Experimental Research Methods
Fall. 1(00-02)
R: Open only to Biomechanics graduate students.
Methods of experimental research in biomechanics.
QA: BIM 871 BIM 872 BIM 873

889*. Master's Thesis Research
Fall, Spring, Summer. 1 to 25 credits.
R: Open only to Biomechanics graduate students.
Approval of department.
QP: DEPT.APP QA: BIM 889

**BIOMEDICAL ENGINEERING**

311*. Introduction to Biomedical Engineering
Fall. 3(3-0)
Interdepartmental with the Department(s) of Metallurgy, Mechanics, and Materials Science, Chemical Engineering, Mechanical Engineering, Electrical Engineering, Metallurgy, Mechanics, and Materials Science.
P: MTI 132, PHY 184, BS 210
Physical and mechanical properties of soft and hard tissues, Biomechanics, Biocompatibility, Biochemical processes, biological transport and thermodynamics.
QP: MTI 310 PHY 285BS 210

405*. Biomedical Electronics
Fall of even-numbered years. 3(3-0)
Interdepartmental with the Department(s) of Electrical Engineering.
P: MTH 112 PHY 238 QA: BME 410
Electronic components and circuits. Physiological measurement, transmission of physiological events to electrical signals. Ultrasonic techniques, biomedical applications of lasers, x-ray and magnetic resonance imaging.
QP: MTH 112 PHY 238 QA: BME 410

424*. Biomatertals and Biocompatibility
Spring of even-numbered years. 3(3-0)
Interdepartmental with the Department(s) of Metallurgy, Mechanics, and Materials Science.
P: BME 311, PSL 245
Materials science of human implantable materials. Design requirements imposed by the body's milieu and the need to protect it.
QP: P: PS 240 OP 450 QA: BME 424

431*. Biological Transport Mechanisms
Fall of odd-numbered years. 3(3-0)
Interdepartmental with the Department(s) of Chemical Engineering, Mechanical Engineering.
P: BME 311 and MTH 355
Mechanisms which govern transport of momentum, heat and mass. Application to the mathematical description of transport processes in biological systems and to solution of biomedical problems.
QP: MTH 215 QA: BME 431

441*. Tissue Mechanics
Spring of odd-numbered years. 3(3-0)
Interdepartmental with the Department(s) of Metallurgy, Mechanics, and Materials Science,
Metallurgy, Mechanics, and Materials Science.
P: BME 311.
Application of solid mechanics to understanding mechanical responses of biological tissues. Microstructure and biological function for soft and hard connective tissues and muscle.
QP: ANT 318 QA: BME 481

493*. Special Topics (MTC)
Fall, Spring. 3 to 12 credits. May reenroll for a maximum of 12 credits.
P: BME 311.
Special topics in biomedical engineering or bioengineering such as biochemical design, occupational biomechanics, biological surface science, or low temperature biotechnology.
QP: APPROVAL QA: BME 499

491A*. Biomedical Design
3(3-0)
P: BME 311, MMM 311, MMM 306.
Special topics in biomedical engineering or bioengineering of current interest and importance.
QP: APPROVAL QA: BME 499

491B*. Occupational Biomechanics
3(3-0)
P: BME 311.
Special topics in biomedical engineering or bioengineering of current interest and importance.
QP: APPROVAL QA: BME 499

491C*. Biological Surface Science
3(3-0)
P: BME 311.
Special topics in biomedical engineering or bioengineering of current interest and importance.
QP: APPROVAL QA: BME 499
BOTANY AND PLANT PATHOLOGY/NATURAL SCIENCE

402. Biology of Fungi
Fall, Spring, P: BOT 110, BS 111 or BOT 105 or LBS 140 or MPH 302.

405. Introductory Plant Pathology
Fall, P: BS 110, BS 111 or BOT 105 or LBS 140.

406. Medical Mycology
Spring, P: BOT 301 and BOT 318 or FOR 204 or HRT 211 or HRT 212.

407. Diseases and Insects of Forest and Shade Trees
Spring, P: BOT 405 and LBS 140.

408. Plant Physiology: Metabolism
Spring, P: CEM 251 or BS 110, BS 111 or LBS 140.

410. Introductory Plant Physiology
Fall, Spring, P: CEM 141 or CEM 151; CEM 161, BOT 105 or BS 110 or LBS 141; organic chemistry.

415. Plant Physiology: Growth, Development and the Environment
Spring, P: CEM 251; BS 110, BS 111 or LBS 140.

416. Experiments in Plant Physiology and Molecular Biology
Fall, P: BOT 414 or BOT 415.

418. Plant Systematics
Spring, Summer, P: BOT 105 or BS 110, BS 111 or LBS 140.

420. Biology of Fungi
Fall, P: BOT 110, BS 111 or BOT 105 or LBS 140 or MPH 302.

423. Aquatic Plant Biology
Fall, Spring, P: BS 110, BS 111 or BOT 105, BOT 106.

424. Plant Structure and Function
Fall, P: BS 110, BS 111 or BOT 105, BOT 106 or BOT 202 or LBS 140.

441. Laboratory and/or field research in an area of botany and plant pathology.

442. Directed Studies
Fall, Spring, Summer, 1 to 4 credits.

448. Undergraduate Research
Fall, Spring, Summer, 1 to 4 credits.

490. Senior Seminar
Spring, 2 credits.

499. Seminar in Plant Biology
Fall, Spring, 1-3 credits.

500. Seminar in Plant Pathology
Fall, Spring, 1-3 credits.

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