BIOCHEMISTRY AND MOLECULAR BIOLOGY

Students may complete a major in Biochemistry & Molecular Biology. Required courses are drawn principally from the Biology and Chemistry Departments and those interested in the Biochemistry & Molecular Biology major should consult both Biology and Chemistry web pages. Students may double major in Biology and Chemistry, but are not permitted to double major in Biology and Biochemistry & Molecular Biology or Chemistry and Biochemistry & Molecular Biology. There is no minor in Biochemistry & Molecular Biology. Students majoring in Biochemistry & Molecular Biology are not permitted to minor in Biology or Chemistry. No more than two non-Tri-Co courses may be counted towards the major.

The Biochemistry & Molecular Biology major allows the student to progress through a series of courses that emphasize understanding life at the molecular level and utilize experimental approaches. Research can be a valuable experience for students considering graduate or professional studies or for those planning research or teaching careers. Any Biology or Chemistry professor may be selected as a research adviser and students are encouraged to consult departmental advisers for information on how to join research groups. Students may begin conducting research at any point in their undergraduate experience with the approval of a faculty member.

With careful advanced planning a student may enroll in Study Abroad. Typically a Biochemistry & Molecular Biology major will select a one-semester program in an English-speaking country such as England, Wales, Australia or New Zealand; other programs are possible.

Biochemistry & Molecular Biology Requirements and Opportunities

A student may qualify for an A. B. in Biochemistry & Molecular Biology (BCMB) by completing courses in Biology and Chemistry with the following distribution. Students should be mindful that some courses have pre-requisites. Students interested in the BCMB major should complete CHEM B103 General Chemistry I/CHEM B104 General Chemistry II in their freshman year. Students should see the BCMB major adviser if they believe they qualify for advanced placement.

Code	Title	Units
Fundamental Courses		
BIOL B110	Biological Exploration I	1
CHEM B103 & CHEM B104	General Chemistry I and General Chemistry II	2
CHEM B211 & CHEM B216	Organic Chemistry I and Organic Chemistry Laboratory I	1.5
CHEM B212 & CHEM B217	Organic Chemistry II: and Organic Chemistry Laboratory II	1.5
Major Writing Requirement [1]		
Select two of the following:		1
BIOL B375	Biochemistry	
BIOL B376	Molecular Biology	
CHEM B251	Research Methodology I	
CHEM B252	Research Methodology II	
Core Biochemistry Courses		
Select one of the following:		1
BIOL B375	Biochemistry	
CHEM B242 & CHEM B251	Biological Chemistry and Research Methodology I	
CHEM B377	Biochemistry II: Biochemical Pathways and Metabolism	1
Advanced Biology and Chemistry Courses		
BIOL B201	Genetics	1
BIOL B376	Molecular Biology	1
CHEM B221	Physical Chemistry I	1
or CHEM B222	Physical Chemistry II	
Advanced Electives on Biochemically Related Topics		
Select two of the following. Suggested courses include, but are not limited to: [2]		2
BIOL B215	Biostatistics with R	
BIOL B216	Genomics	
BIOL B255	Microbiology	
BIOL B271	Developmental Biology	
BIOL B317	Evolution and Medicine	
BIOL B352	Immunology	
CHEM B221	Physical Chemistry I (when not used as a Core course)	
or CHEM B222	Physical Chemistry II	
CHEM B231	Inorganic Chemistry	
CHEM B311	Advanced Organic Chemistry	
CHEM B332	Advanced Inorganic Chemistry	
CHEM B345	Advanced Biological Chemistry	
CHEM B515	Modern Medicinal Chemistry	
Total Units		**14**

[1] Students will complete two writing-attentive laboratory courses before the end of their junior year.

[2] Two courses that provide depth and breadth are required and at least one must be at the 300 or 500 level **or** have a laboratory component.

Students are encouraged to consider suitable course offerings at Haverford and Swarthmore. All advanced elective choices must be approved by the major adviser.

Senior Experience

Option 1 or Option 2 are required for Honors.

Option 1

2 semesters of BIOL B400 Senior Research or CHEM B398 Senior Seminar/CHEM B399 Senior Seminar, plus all requirements associated with the senior thesis.

Option 2

Independent Study or Praxis on a biochemical topic arranged by the student, plus all requirements associated with the senior thesis.

Option 3

An additional biochemically-related advanced elective at the 300-level or with a laboratory component.

Courses in Allied Fields

- MATH B101 Calculus I, MATH B102 Calculus II
- MATH B201 Multivariable Calculus

Timetable for Meeting Requirements

There are a variety of ways to meet the major requirements provided that 100 level courses in Chemistry are completed by the end of the freshman year. Fundamental courses in Biology and Chemistry must be completed before the junior year. Either BIOL B375 Biochemistry **or** CHEM B242 Biological Chemistry and CHEM B251 Research Methodology I must be completed before the senior year. Note that MATH B201 Multivariable Calculus is required as a pre-requisite for CHEM B221 Physical Chemistry I or CHEM B222 Physical Chemistry II. Two sample programs are shown here; other curricular configurations are possible.

Sample Major Workplan 1

Course	Title	Units
First Year		
CHEM B103	General Chemistry I	1
CHEM B104	General Chemistry II	1
MATH B101	Calculus I	1
MATH B102	Calculus II	1
	Units	**4**
Sophomore Year		
BIOL B110	Biological Exploration I	1
CHEM B211 & CHEM B216	Organic Chemistry I and Organic Chemistry Laboratory I	1.5
CHEM B212 & CHEM B217	Organic Chemistry II: and Organic Chemistry Laboratory II	1.5
MATH B201	Multivariable Calculus	1
	Units	**5**
Junior Year		
BIOL B201	Genetics	1
BIOL B255	Microbiology	1
CHEM B222	Physical Chemistry II	1
CHEM B242	Biological Chemistry	1
CHEM B251	Research Methodology I	1
	Units	**5**
Senior Year		
BIOL B352	Immunology	1
BIOL B376	Molecular Biology	1
CHEM B377	Biochemistry II: Biochemical Pathways and Metabolism	1
Senior Experience		
	Units	**3**
	Total Units	**17**

Sample Major Workplan 2

Course	Title	Units
First Year		
BIOL B110	Biological Exploration I	1
BIOL B111	Biological Exploration II	1
CHEM B103		
CHEM B104	General Chemistry II	1
MATH B101	Calculus I	1
MATH B102	Calculus II	1
	Units	**5**
Sophomore Year		
BIOL B201	Genetics	1
CHEM B213 & CHEM B216	Organic Chemistry I and Organic Chemistry Laboratory I	1.5
CHEM B212 & CHEM B217	Organic Chemistry II: and Organic Chemistry Laboratory II	1.5
MATH B201	Multivariable Calculus	1
	Units	**5**
Junior Year		
BIOL B216	Genomics	1
BIOL B375	Biochemistry	1
CHEM B222		
CHEM B377	Biochemistry II: Biochemical Pathways and Metabolism	1
	Units	**3**
Senior Year		
BIOL B317	Evolution and Medicine	1
BIOL B376	Molecular Biology	1
Senior Experience		
	Units	**2**
	Total Units	**15**

Honors

To be considered for honors, Biochemistry & Molecular Biology Majors must complete two semesters of research (Option 1) or an approved independent study or praxis (Option 2) and have a GPA of 3.7 in all courses taken for the major.

Advanced Placement

Students are instructed to follow the policies described by individual departments.

BIOL B110 Biological Exploration I (1 Unit)
BIOL B110 is an introductory-level course designed to encourage students to explore the field of biology at multiple levels of organization: molecular, cellular, organismal and population. Lecture three hours, laboratory three hours a week. BIOL B110 explores the ways the central dogma of molecular biology relates to the biochemical basis of human traits through the lens of biochemistry, cell biology, genetics, and molecular biology. The laboratory portion of the course will explore the fundamentals of molecular and cellular biology through scientific research, with an emphasis on scientific process and experimental design. Topics include genetically modified organisms, stem cell biology, and molecular biological techniques.

BIOL B111 Biological Exploration II (1 Unit)
BIOL B111 is an introductory-level course designed to encourage students to explore the field of biology at multiple levels of organization: molecular, cellular, organismal and ecological. Lecture three hours, laboratory three hours a week. Spring 2023: BIOL B111 will explore how organisms interact with and adapt to their environments, both abiotic and biotic. Topics to be investigated include development, physiology, photosynthesis, ecology (population, community and ecosystem), and evolution. The laboratory portion of the course will explore the fundamentals of organismal biology through scientific research, with an emphasis on the scientific process and experimental design.

BIOL B201 Genetics (1 Unit)
This course focuses on the principles of genetics, including classical genetics, population genetics and molecular genetics. Topics to be covered include the genetic and molecular nature of mutations and phenotypes, genetic mapping and gene identification, chromosome abnormalities, developmental genetics, genome editing and epigenetics. Examples of genetic analyses are drawn from a variety of organisms including Drosophila, C. elegans, mice and humans. Lecture three hours a week. Prerequisite: BIOL B110 and CHEM B104.

BIOL B215 Biostatistics with R (1 Unit)
An introductory course in statistical analysis focusing on biological data. This course is structured to develop students' understanding of statistics and probability and when to apply different quantitative methods. The lab component focuses on how to implement those methods using the R statistics environment. Topics include summary statistics, distributions, randomization, replication, and probability. The course is geared around problem sets, lab reports, and interactive learning. No prior experience with programming is required. Suggested Preparation: BIOL B110 or B111 is highly recommended. Students who have taken PSYC B205/H200 or SOCL B265 are not eligible to take this course.

BIOL B216 Genomics (1 Unit)
An introduction to the study of genomes and genomic data. This course will examine the history of this exciting field, the types of biological questions that can be answered using large biological data sets and complete genome sequences as well as the techniques and technologies that make such studies possible. Topics include genome organization and evolution, comparative genomics, and analysis of transcriptomes, with a focus on animal genomics and humans in particular. Prerequisite: One semester of BIOL 110. BIOL 201 highly recommended.

BIOL B236 Evolution (1 Unit)
A lecture/discussion course on evolutionary biology. This course will cover the history of evolutionary theory, population genetics, molecular and developmental evolution, paleontology, and phylogenetic analysis. Lecture three hours a week.

BIOL B255 Microbiology (1 Unit)
Invisible to the naked eye, microbes occupy every niche on the planet. This course will examine how microbes have become successful colonizers; review aspects of interactions between microbes, humans and the environment; and explore practical uses of microbes in industry, medicine and environmental management. The course will combine lecture, discussion of primary literature and student presentations. Three hours of lecture and three hours of laboratory per week. Prerequisites: BIOL 110 and CHEM B104.

BIOL B271 Developmental Biology (1 Unit)
An introduction to embryology and the concepts of developmental biology. Concepts are illustrated by analyzing the experimental observations that support them. Topics include gametogenesis and fertilization, morphogenesis, cell fate specification and differentiation, pattern formation, regulation of gene expression, neural development, and developmental plasticity. The laboratory focuses on observations and experiments on living embryos. Lecture three hours, laboratory three scheduled hours a week; some weeks require additional hours outside of the regularly scheduled lab. Prerequisite: one semester of BIOL 110-111 or permission of instructor.

BIOL B327 Evolutionary Genetics and Genomics (1 Unit)
This seminar course will discuss evolution primarily at the level of genes and genomes. Topics will include the roles of selection and drift in molecular evolution, evolution of gene expression, genomic approaches to the study of quantitative variation, evolutionary history of humans, and evolutionary perspectives on the study of human disease. Students will read papers from the primary literature, lead and participate in class discussions and debates, and write reviews of research articles. Quantitative proficiency required. Pre-requisites: One semester of BIOL 110-111 and BIOL 201, or BIOL 236, or permission of instructor.

BIOL B352 Immunology (1 Unit)
An introduction to immunology with a focus on the dynamic network of molecules and cells underlying the vertebrate immune response. This problem-based workshop course uses primary research articles and a curiosity-driven, open-ended laboratory research project to make sense of complicated biology and empower each student to build a big-picture view of this fast-moving, interdisciplinary field. Key themes include: immune cell specification and development; molecular recognition and immune cell signaling; generation of immunological memory; and cancer immunotherapies. Learning strategies include problem solving, small group discussion, and critical analysis of the primary literature. Three hours of class meetings and three hours of lab per week. Prerequisites: BIOL B110 and any 200-level course in Biology.

BIOL B375 Biochemistry (1 Unit)
This course will focus on the structure and function of proteins, carbohydrates and lipids, enzyme kinetics, and central metabolic pathways. Students will explore these topics via lecture, critical reading and discussion of primary literature and laboratory experimentation. Three hours of lecture, three hours of lab per week. Prerequisites: BIOL B110 and two semesters of Organic Chemistry (CHEM B211/B212).

CHEM B103 General Chemistry I (1 Unit)
This is an introductory course in chemistry, open to students with no previous chemistry experience. Topics include aqueous solutions and solubility; the electronic structure of atoms and molecules; chemical reactions and energy; intermolecular forces. Examples discussed in lecture and laboratory include applications of the material to environmental sciences, material science and biological chemistry. Lecture three hours, recitation one hour and laboratory three hours a week. Prerequisite: Quantitative Readiness Required.

CHEM B104 General Chemistry II (1 Unit)
For students who have completed General Chemistry I or have some previous work in chemistry. Topics include chemical kinetics; aqueous solutions and solubility; chemical equilibrium; electrochemistry; thermochemistry. Examples discussed in lecture and laboratory workshop include nuclear chemistry, geochemistry, environmental sciences, material sciences and biological chemistry. One section of the course is designed for students considering a major in the sciences and takes an interdisciplinary approach to the course topics. Lecture three hours, recitation one hour and laboratory three hours a week. Prerequisite: CHEM B103 with a grade of at least 2.0 or permission of the instructor.

CHEM B211 Organic Chemistry I (1 Unit)
An introduction to the basic concepts of organic chemistry, including acid-base principles; functional groups; alkane and cycloalkane structures; alkene reactions; alkynes; dienes and aromatic structures; substitution and elimination reactions; alcohol reactivity; and radical reactions. Lecture three hours, recitation one hour a week. There is no longer a laboratory portion of CHEM B211. Instead, students can enroll in CHEM B216 which is a half-credit laboratory course that introduces basic operations in the organic chemistry lab, spectroscopy, and reactions discussed CHEM B211. Students should consult with their deans/advisors about whether to enroll in CHEM B216. Students planning to major in STEM disciplines or intending to fulfill pre-health requirements will need to take CHEM B216 in addition to CHEM B211. Prerequisite: CHEM 104 with a grade of at least 2.0.

CHEM B212 Organic Chemistry II: (1 Unit)
The second semester of organic chemistry includes discussion of the reactivity of carbonyl carbons such as ketones, aldehydes, carboxylic acids and derivatives, saccharides and enolate chemistry. This course also emphasizes biologically relevant topics. There is no longer a laboratory portion of CHEM B212. Instead, students can enroll in CHEM B217 which is a half-credit laboratory course that covers reactions discussed in CHEM B212, more advanced NMR spectroscopy and an extended total-synthesis project. Students should consult with their deans/advisors about whether to enroll in CHEM B217. Students planning to major in STEM disciplines or intending to fulfill pre-health requirements will need to take CHEM B217 in addition to CHEM B212. Lecture three hours, recitation one hour a week. Prerequisite: CHEM 211 with a grade of at least 2.0.

CHEM B213 Organic Chemistry I (1 Unit)
An introduction to the basic concepts of organic chemistry, including acid-base principles; functional groups; alkane and cycloalkane structures; alkene reactions; alkynes; dienes and aromatic structures; substitution and elimination reactions; alcohol reactivity; and radical reactions. The laboratory course introduces basic operations in the organic chemistry lab, spectroscopy, and reactions discussed in lecture. Lecture three hours, recitation one hour and laboratory five hours a week. Prerequisite: CHEM 104 with a grade of at least 2.0. For students enrolled in the postbaccalaureate premedical program only

CHEM B214 Organic Chemistry II: Biochemistry (1 Unit)
The second semester (biological organic chemistry) is broken into two modules. In the first module, the reactivity of carbonyl carbon is discussed, including ketones, aldehydes, carboxylic acids and derivatives, saccharides and enolate chemistry. Traditional biochemistry coverage begins with the second module. Amino acids (pI, electrophoresis, side chain pKa), protein structure (1°, 2°, 3°, 4°), and enzymatic catalysis, kinetics and inhibition are introduced. The reactivity of the co-enzymes (vitamins) is also covered as individual case studies in bio-organic reactivity. Lecture three hours, recitation one hour and laboratory five hours a week. Prerequisite: CHEM 213 with a grade of at least 2.0. For students enrolled in the postbaccalaureate premedical program only.

CHEM B216 Organic Chemistry Laboratory I (0.5 Unit)
This is a half-credit laboratory course that introduces basic operations in the organic chemistry lab, spectroscopy, and reactions discussed CHEM B211. 1 hour of lecture and 4 hours of laboratory per week. Prerequisite: Either concurrent enrollment in CHEM B211 or prior completion of CHEM B211 with a grade of at least 2.0.

CHEM B217 Organic Chemistry Laboratory II (0.5 Unit)
This is a half-credit laboratory course that covers reactions discussed in CHEM B212, more advanced NMR spectroscopy and an extended total-synthesis project.. 1 hour of lecture and 4 hours of laboratory per week. Prerequisite: CHEM B216 with a grade of at least 2.0 and either concurrent enrollment in CHEM B212 or prior completion of CHEM B212 with a grade of at least 2.0.

CHEM B221 Physical Chemistry I (1 Unit)
Introduction to quantum theory and spectroscopy. Atomic and molecular structure; molecular modeling; rotational, vibrational, electronic and magnetic resonance spectroscopy. Lecture three hours. Prerequisites: CHEM B104 and MATH B201.

CHEM B222 Physical Chemistry II (1 Unit)
Modern thermodynamics, with application to phase equilibria, interfacial phenomena and chemical equilibria; statistical mechanics; chemical dynamics. Kinetic theory of gases; chemical kinetics. Lecture three hours. Prerequisite: CHEM B104 and MATH 201. May be taken concurrently with CHEM B212, with permission of instructor.

CHEM B231 Inorganic Chemistry (1 Unit)
Bonding theory; structures and properties of ionic solids; symmetry; crystal field theory; structures, spectroscopy, stereochemistry, reactions and reaction mechanisms of coordination compounds; acid-base concepts; descriptive chemistry of main group elements. Lecture three hours a week. Prerequisite: CHEM 212.

CHEM B242 Biological Chemistry (1 Unit)
The structure, chemistry and function of amino acids, proteins, lipids, polysaccharides and nucleic acids; enzyme kinetics; metabolic relationships of carbohydrates, lipids and amino acids, and the control of various pathways. Lecture three hours a week. Prerequisite: CHEM B212 or CHEM H222.

CHEM B251 Research Methodology I (1 Unit)
This is a laboratory topics course integrating advanced concepts in chemistry from biological, inorganic, organic and physical chemistry. Students gain experience in the use of departmental research instruments and in scientific literature searches, quantitative data analysis, record keeping and writing. Prerequisite CHEM B212. Co-requisite: CHEM B221 or B231 or B242. Attendance at departmental colloquia is expected of all students.

CHEM B252 Research Methodology II (1 Unit)
This laboratory course integrates advanced concepts in chemistry from biological, inorganic, organic and physical chemistry. Students will gain experience in the use of departmental research instruments and in scientific literature searches, quantitative data analysis, record-keeping, and writing. Attendance at departmental colloquia is expected of all students. Course Prerequisites: CHEM B212. Course Co-requisites: CHEM B222 or CHEM B231 or CHEM B242.

CHEM B345 Advanced Biological Chemistry (1 Unit)
This is a topics course. Topics vary. Prerequisite: CHEM B242 or BIOL B375.

CHEM B377 Biochemistry II: Biochemical Pathways and Metabolism (1 Unit)
This course is a continuation of CHEM B242 or BIOL B375. Biochemical pathways involved in cellular metabolism will be explored in molecular detail. Energy producing, degradation, and biosynthetic pathways involving sugars, fats, amino acids, and nucleotides will be discussed with an emphasis on structures and mechanisms, experimental methods, regulation, and integration. Additional topics, drawn from the primary research literature, may be covered. Readings will be drawn from textbooks and from the primary literature and assessments may include oral presentations, problem sets, written examinations, and writing assignments. This is a second course in Biochemistry and assumes a strong foundation in the fundamentals of Biochemistry. Prerequisite: BIO 375 or CHEM 242, or permission of instructor.

CHEM B515 Modern Medicinal Chemistry (1 Unit)
A survey of topics related to drug discovery including lead discovery, target interactions, structural optimization, drug metabolism and drug synthesis. The course will engage in an advanced treatment of these topics with particular attention to an understanding of drug design and development on the molecular level. Case studies will be used to illustrate the application of these principles. Discussions may include OxyContin and related opiate analgesics; aspirin and related NSAIDs; penicillin and other antibacterial agents; Tamiflu and related anti-virals; Alzheimer's disease drugs; and anti-depressants. Prerequisites: CHEM 212 or by permission of the instructor

CMSC B109 Introduction to Computing (1 Unit)
The course is an introduction to computing: how we can describe and solve problems using a computer. Students will learn how to write algorithms, manipulate data, and design programs to make computers useful tools as well as mediums of creativity. Contemporary, diverse examples of computing in a modern context will be used, with particular focus on graphics and visual media. The Processing/Java programming language will be used in lectures, class examples and weekly programming projects, where students will learn and master fundamental computer programming principles. Students are required to register for the weekly lab. Prerequisites: Must pass either the Quantitative Readiness Assessment or the Quantitative Seminar (QUAN B001).

CMSC B151 Introduction to Data Structures (1 Unit)
Introduction to the fundamental algorithms and data structures using Java. Topics include: Object-Oriented programming, program design, fundamental data structures and complexity analysis. In particular, searching, sorting, the design and implementation of linked lists, stacks, queues, trees and hash maps and all corresponding complexity analysis. In addition, students will also become familiar with Java's built-in data structures and how to use them, and acquire competency using a debugger. Students must also register for the weekly lab. Prerequisites: CMSC B109 or CMSC B113 or CMSC H105, or permission of instructor.

MATH B101 Calculus I (1 Unit)
This is the first in a sequence of two courses that covers single-variable calculus. Topics include functions, limits, continuity, derivatives, differentiation formulas, applications of derivatives, integrals, and the fundamental theorem of calculus. Prerequisite: proficiency in high-school mathematics (including algebra, geometry, and trigonometry).

MATH B102 Calculus II (1 Unit)
This is the second in a sequence of two courses that covers single-variable calculus. Topics include techniques of integration, applications of integration, infinite sequences and series, tests of convergence for series, and power series. Prerequisite: a merit grade in Math 101 (or an equivalent experience).

MATH B201 Multivariable Calculus (1 Unit)
This course extends calculus to functions of multiple variables. Topics include functions, limits, continuity, vectors, directional derivatives, optimization problems, multiple integrals, parametric curves, vector fields, line integrals, surface integrals, and the theorems of Gauss, Green and Stokes. Prerequisite: a merit grade in Math 102 (or an equivalent experience).

PHYS B101 Introductory Physics I (1 Unit)
PHYS B101/B102 is an algebra-based introductory sequence intended primarily for students on the pre-health professions track. Emphasis is on developing an understanding of how we study the universe, the ideas that have arisen from that study, and on problem solving. Topics are taken from among Newtonian kinematics and dynamics, relativity, gravitation, fluid mechanics, waves and sound, electricity and magnetism, electrical circuits, light and optics, quantum mechanics, and atomic and nuclear physics. An effective and usable understanding of algebra and trigonometry is assumed. First year students who will take or place out of MATH B101 should take PHYS B121. PHYS B101 and B102 are considered two sequential semesters in a full-year course and as such cannot be taken out of order. Corequisites: MATH B100 or H105. Lecture three hours, laboratory two hours.

PHYS B102 Introductory Physics II (1 Unit)
PHYS B101/B102 is an algebra-based introductory sequence intended primarily for students on the pre-health professions track. Emphasis is on developing an understanding of how we study the universe, the ideas that have arisen from that study, and on problem solving. Topics are taken from among Newtonian kinematics and dynamics, relativity, gravitation, fluid mechanics, waves and sound, electricity and magnetism, electrical circuits, light and optics, quantum mechanics, and atomic and nuclear physics. An effective and usable understanding of algebra and trigonometry is assumed. PHYS B101 and B102 are considered two sequential semesters in a full-year course and as such cannot be taken out of order. Prerequisites: PHYS B101. Lecture three hours, laboratory two hours.

PHYS B121 Modern Physics (1 Unit)
This course presents current conceptual understandings and mathematical formulations of fundamental ideas used in physics. Students will develop physical intuition and problem-solving skills by exploring key concepts in physics such as conservation laws, symmetries and relativistic space-time, as well as topics in modern physics including but not limited to: fundamental forces, quantum physics, quantum information science and engineering, nuclear physics, particle physics, cosmology, nanomaterials, and statistical mechanics. This course can serve as a stand-alone survey of physics or as the first of a four-semester sequence designed for those majoring in the physical sciences. Corequisite: MATH B101. Lecture three hours.

PHYS B122 Classical Mechanics (1 Unit)
This course covers Newtonian Mechanics of single particles, systems of particles, rigid bodies, and continuous media with applications, one-dimensional systems including forced oscillators, scattering and orbit problems. Prerequisites: PHYS B121 (or permission of the instructor) and MATH B101. Corequisite: MATH B102. Lecture three hours, laboratory two hours.