

Summary of Required Courses for 2019-2020 Application Cycle

Please note the specifications in each required or encouraged subject area below (e.g., laboratory work in biology, general/inorganic chemistry, and organic chemistry). Advanced-level courses may be used to satisfy basic course requirements. Detailed information regarding these prerequisites can be found below the following table.

REQUIRED COURSES*

Subject	Specifications**
Biology	<ul style="list-style-type: none"> • One year with lab experience • Should include cellular and molecular aspects • AP credits cannot be used
Chemistry/Biochemistry	<ul style="list-style-type: none"> • Two years of chemistry (four courses) including inorganic chemistry, organic chemistry, and biochemistry • Lab experience required • AP credits that enable you to take a higher-level course will satisfy one semester of inorganic chemistry
Math	<ul style="list-style-type: none"> • One year, including one semester each of calculus and statistics (preferably biostatistics) • An AP score of 4 or 5 on the AB or BC exam can be used to fulfill the one semester of calculus • AP credits cannot be used to meet the statistics requirement • HST candidates should take courses that include upper-level mathematics (through differential equations and linear algebra)*
Physics	<ul style="list-style-type: none"> • One year • Lab experience is desirable but not required • AP credits that enable you to take an upper-level course will meet one semester • HST candidates should complete additional coursework in calculus-based physics*
Writing	<ul style="list-style-type: none"> • One year • AP credits cannot be used • Writing intensive courses are preferred • Humanities or social science courses involving substantial expository writing will satisfy this requirement

* Please note that in addition to these requirements for all MD candidates, HST candidates are required to demonstrate competency in upper-level mathematics, biochemistry, molecular biology, and calculus-based physics. Read more below.

** Although courses that correspond to these discrete subject areas and specifications will satisfy admissions requirements, the Committee encourages and will consider other innovative approaches to mastering the competencies detailed below (i.e., interdisciplinary courses that complement required subject content).

Detailed Pre-Requisite Breakdown

Biology

All applicants must complete a full year of biology. We will accept advanced or higher-level biology courses toward this requirement.

Suggested biology courses: Courses devoted to genetics and cell biology and emphasizing human biology (signal transduction, basic pharmacologic principles, homeostasis and feedback, an introduction to hormone receptors, neuronal signaling, and immunology). Because biology is the most elegant expression of chemistry, physics, and mathematics, computational skills that tie these previously separate disciplines together should be emphasized.

The focus on genetics should include nucleic acid structure and function, genetic recombination, and mechanisms of gene expression in eukaryotic and prokaryotic cells (i.e., molecular biology/genetics); the study of cell biology should include subcellular organization, differentiation, cellular metabolic function, energy transfer, structure-function relationships, reproduction, and membrane properties. Preparation in biology should emphasize human biology and principles of systems biology.

Although a formal year-long course that covers these concepts will meet this requirement, other innovative approaches (including interdisciplinary courses taught together with biologically relevant physical sciences) that allow students to master these “competencies,” independent of discrete courses and semester time commitments, are encouraged and will be considered. Advanced placement credits cannot be used to satisfy this requirement; upper-level courses should be taken if students have been granted advanced placement credits.

Chemistry

All applicants must complete a two-year chemistry sequence that covers inorganic chemistry, organic chemistry, and biochemistry. Students should be exposed to general chemistry, organic chemistry, and biochemistry in a two-year sequence that provides the foundation for the study of biologically relevant chemistry.

General chemistry preparation should include foundational topics in physical and inorganic chemistry such as bonding, molecular structure, chemical reactivity, equilibrium, energetics, and thermodynamics. Organic chemistry preparation should be woven seamlessly with basic principles of biochemistry (especially protein structure and function) such that biologically relevant organic chemistry and biochemistry are covered concurrently across two semesters. Matriculants will be required to demonstrate mastery of biochemistry. Although many different course sequences may be used to satisfy this requirement, an integrated sequence that includes biologically relevant general, organic, and biochemistry is preferred.

Advanced placement credits that enable students to take an upper-level course may be used to meet one semester equivalent of this requirement as long as students demonstrate mastery of biologically relevant general and organic chemistry and biochemistry.

Laboratory Experience

Required laboratory components of biology and chemistry are no longer defined as discretely as they were in the past. Proper focus on hypothesis-driven exercises, problem solving, and hands-on demonstrations of important principles should take precedence over lengthy laboratory time commitments. Active, sustained participation in faculty-mentored laboratory research experiences is encouraged and can be used to meet requirements for the acquisition of laboratory skills.

Mathematics

All applicants must complete a one-year mathematics sequence that includes calculus and statistics. One semester of statistics is required. Biostatistics is preferred.

Computational skills are an integral component of contemporary scientific literacy. Familiarity with calculus will prepare students for the quantitative reasoning demands of the contemporary medical curriculum and certain medical specialties, provide them with analytic perspective, and help them appreciate the uncertainties in evaluating biological systems. Adequate grounding in statistics is essential for understanding the literature of science and medicine. Students should focus their mathematics preparation on developing skills that are relevant to biology and medicine. Students have flexibility in meeting these requirements.

Examples: A semester course in calculus that covers derivatives and integration and a semester course in statistics; a calculus-based physics course and another science course that includes a firm grounding in biostatistics; or preferably, a unified two-semester course that covers important, biologically relevant concepts in calculus and statistics.

Advanced placement calculus credits may satisfy the calculus component of this requirement (Calculus AB and/or Calculus BC). A course in statistics will not satisfy the calculus component of this requirement.

Physics

All applicants must complete a full year of physics. Students should be well prepared in biologically relevant areas of mechanics, kinetics, thermodynamics, the properties of matter (quantum theory) and wave theory, electricity and magnetism, and optics.

Advanced placement credits that enable students to take an upper-level course may be used to meet one semester equivalent of this requirement as long as students demonstrate mastery of the principles of biologically relevant physics.

Analytical and Writing Skills/Expository Writing

All applicants must complete one year of coursework that features expository writing. Generally, any course in the social sciences or humanities that involves substantial essay writing will count toward this requirement.

Creative, complex, and compelling discoveries in medicine involve grappling with good questions borne from close-reading analyses and careful observations. Courses used to fulfill this requirement, whether in science or other disciplines, should focus on analytical and writing skills. In addition, at a minimum, HMS matriculants should have one year of critical writing/thinking preparation, preferably in a course devoted specifically to the development of expository writing skills.

Students will need to be able to apply the following skills in their study of medicine and scientific inquiry:

- Writing logically and with clarity and style about important questions across disciplines
- Articulating persuasively, both on paper and in oral presentations, focused, sophisticated, and credible thesis arguments
- Appreciating the methodologies applied in certain disciplines for understanding and communicating results effectively
- Approaching evidence with probity and intellectual independence
- Using source material appropriately with scrupulous and rigorous attribution

Advanced placement credits cannot be used to satisfy this requirement.