

# Summary of Required and Encouraged Courses for 2020-2021 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 AND ENCOURAGED COURSES\*

Subject	Specifications**
<b>Behavioral Sciences</b>	<ul style="list-style-type: none"><li>Encouraged to complete coursework in Behavioral Sciences (e.g. psychology, sociology, etc).</li></ul>
<b>Biology</b>	<ul style="list-style-type: none"><li>One year with lab experience (one semester of lab experience should be with corresponding coursework; however, second semester lab may be fulfilled by independent laboratory based research) is required.</li><li>Should include cellular and molecular aspects</li><li>AP credits cannot be used; however, if students have earned college credit for biology through AP coursework, upper level courses in biology will satisfy this requirement.</li></ul>
<b>Chemistry/Biochemistry</b>	<ul style="list-style-type: none"><li>Two years of chemistry (four courses) including inorganic chemistry, organic chemistry, and biochemistry are required.</li><li>Lab experience required</li><li>AP credits that enable you to take a higher-level course will satisfy one semester of inorganic chemistry</li></ul>
<b>Math</b>	<ul style="list-style-type: none"><li><u>Pathways</u>- Encouraged to complete one year of coursework in mathematics, including one semester each of calculus and statistics (preferably biostatistics)</li><li><u>HST</u> –Coursework that includes upper-level mathematics (typically to include differential equations and/or linear algebra)* is strongly encouraged, although evidence of comparable engagement with analytic and computational tools through other activities will be considered. Statistics (preferably biostatistics) is also encouraged</li></ul>
<b>Physics</b>	<ul style="list-style-type: none"><li>One year is required.</li><li>Lab experience is desirable but not required</li><li><u>Pathways</u>- AP credits that enable you to take an upper-level course will meet one semester</li><li><u>HST</u>- One year of physics must be taken at the college level. Candidates are strongly encouraged to meet this prerequisite with at least one year in calculus-based physics*</li></ul>
<b>Writing</b>	<ul style="list-style-type: none"><li>One year is required.</li><li>AP credits cannot be used</li><li>Writing intensive courses are preferred</li><li>Humanities or social science courses involving substantial expository writing will satisfy this requirement</li></ul>

\* 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

### Behavioral Sciences

All applicants are encouraged to complete coursework in the behavioral sciences. Courses in the fields of psychology, sociology, as well as other disciplines, are suggested.

### 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).

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. 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

Pathways applicants are encouraged to complete a one-year mathematics sequence that includes calculus and statistics, preferably biostatistics.

The [HST curriculum track](#) requires that students be comfortable with upper-level mathematics and computational approaches (typically through differential equations and/or linear algebra) and molecular biology. This is usually demonstrated through upper-level course work, but other approaches may satisfy these guidelines.

Examples: A semester course in calculus that covers derivatives and integration and a semester course in statistics; for HST applicants 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.

## Physics

All applicants must complete a full year of physics. For applicants to the HST program, the required one year of physics should be taken in college, and calculus-based physics is strongly encouraged.

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.

For Pathways applicants, 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. Advanced placement credits cannot be used to satisfy this requirement.