

## PREMEDICAL COURSE REQUIREMENTS

By the time you apply to medical school, you must have completed, at minimum, the following courses:

### **Two years of CHEMISTRY, with lab.**

At Haverford, this can be fulfilled variously by:

**General Chemistry, with lab (Chem 100a/101b) and Organic Chemistry, with lab (Chem 220a/221b); OR, Advanced General Chemistry (Chem 105a), Organic Chemistry (Chem 220a/221b), and Biochemistry of Proteins and Nucleic Acids (Bio 300a/Chem 300a)**

### **One year of BIOLOGY, with lab.**

Can be fulfilled with **Cell Structure and Function (Bio 200a, 200b)**

### **One year of PHYSICS, with lab.**

Can be fulfilled with **Classical and Modern Physics I and II (Physics 101/102); OR Fundamental Physics (Physics 105/106)**

### **One year of English .**

Can usually\* be fulfilled with a **First Year Writing Seminar** and an additional course in the **English or another humanities department**, completed before matriculation into medical school.

\*Each medical school has its own English or Writing requirement. Most schools will accept writing intensive courses from humanities or social sciences departments, but an occasional school will insist on courses taken strictly in an English department. For information on specific schools go to: xxxx link; or check out 2008-9 Medical School Admissions Requirements (MSAR) available in the Pre-Health Office.

## ADDITIONAL SCIENCE AND MATH REQUIREMENTS

**SCIENCE:** Many medical schools require or strongly recommend additional upper level science courses beyond the basic requirements. Such classes are particularly helpful for non-science majors, enabling them to confirm their ability to master challenging coursework in science and solidifying their preparation for a medical school curriculum. Specifically, medical schools find students especially well prepared when they have taken **Biochemistry** (e.g. **Bio Superlab**, i.e. **Laboratory in Biochemistry and Molecular Biology - Biology 300a/Chem 300a**). Other undergraduate-level subjects that may strengthen applicants for medical school are **Genetics, Statistics** (e.g. at Haverford, **Statistical Methods & Their Applications, Math 203,**) and/or **Comparative Anatomy**.

If you are concerned about the requirements of individual medical schools, go to Bryn Mawr's up-to-date list of schools' science requirements at: <http://www.brynmawr.edu/healthpro/documents/MedSchoolList2008AdvSciReqs.pdf>.

Or, you may check out the Medical School Admissions Requirements (MSAR) Manual in the Pre-Health Office, or go to [www.aamc.org](http://www.aamc.org) which links to websites of individual schools. Information on requirements for osteopathic schools can be found at <http://www.aacom.org/data/cib/04-prereqs.html>.

Please note that, AP credits and semester abroad courses may **not** be used to satisfy science requirements. If you come to Haverford with several AP science credits, be sure to complete upper-level coursework in the following areas: **biology** (1 year), **chemistry** (2 years) or **physics** (1 year). An alternative is to relinquish the AP credit and retake the introductory courses. It may depend on your placement – please consult with the specific departments.

**MATH:** Medical and osteopathic schools' math requirements vary. In many cases you do not have to take a full year of calculus to enter medical school. A few schools do not require any math, others require up to one full year of calculus, some suggest or require a semester of statistics. And many schools will accept **AP credit** for one semester of the math requirement. ( For specific schools go to: <http://www.brynmawr.edu/healthpro/documents/MedSchoolList2008MathReqs.pdf> or check the Medical School Admissions Requirements (MSAR) Manual.)

At Haverford, a full year of calculus could be made up of **Calculus I (Math 113 = one credit)**, taught in a standard version in the **fall**, or as an intensive version for students requiring added support in the **spring**. The **second credit** could be made up of two half-credit sections: e.g. **Introduction to Integral Calculus (Math 114)**, and **Series and Complex Numbers (Math 115)**, or **Probability Distributions (Math 116)**. Math 116's focus on probability and statistics can prove useful for biomedical research and medicine. For those who want to take further coursework in statistics, **Statistical Methods and their Applications – Math 203** would be appropriate. (If you are planning on taking statistics in the Psychology or Economics department, it is important that you check with the websites of the medical schools to which you may apply. Some do and some do NOT accept statistics from a department other than mathematics).

It is important to note that calculus is required for some science majors (e.g., **Chemistry** majors must take at least one semester of mathematics, e.g. **Math 114/116** or higher; and are encouraged to take an additional semester, e.g. **Math 121**.) Calculus is certainly a foundation for understanding physics, required by all medical schools. (Medical schools will accept algebra-based physics, however.) At Haverford, in particular, physics is calculus-based. **Physics** majors are, of course, required to take math classes; specifically **Math 121** and **204b**; or **216b** and **215a**. Students interested in science careers and research may want to obtain the equivalent of a full year of calculus in their first year. It is important to discuss these issues with your science and math departments.

## FITTING REQUIREMENTS INTO A SCHEDULE

How quickly you complete premedical (dental, etc.) requirements depends on many factors, including high school science preparation, adjustment to college, major (s), research or extracurricular activities, post college plans, and vocational clarity. Keep in mind that your primary goal at Haverford should be to develop your intellectual and extracurricular interests. You may complete your pre-medical requirements at any time, but you will never have the opportunity to repeat your undergraduate experience. Don't think of your time at college solely as a means to an end and fail to enjoy your academic experience while you are here.

If you **do** wish to be positioned to enter medical school immediately upon graduation, however, your premedical requirements must be completed by the end of junior year. You would submit your application to medical schools during the summer before senior year. As always, there is more than one pathway to this goal.

#### SCENARIO ONE:

**Year One:** Math as placed; Gen Chem 100a/100b; First Yr Writing Seminar

**Year Two:** Bio 200a/200b. (Organic Chemistry can be taken sophomore OR junior year)

**Year Three:** Chem 220a/221b; Physics 101a/102b. MCAT taken late spring.

**Year Four:** Complete additional science class, e.g. Bio 300a, major & English requirement

SCENARIO TWO (This hypothetical student who took college-level science courses in high school and is a science major):

**Year One:** Math 114/116 or 121; Chem 105b; Physics 101/102 or 105/106; First Year Writing Seminar

**Year Two:** Bio 200a/200b; Chem 220a/221b

**Year Three:** Bio 300a (=Chem 300a); science major continued. MCAT taken late spring

**Year Four:** Major and English requirement completed.

### **SAMPLE SCHEDULES OF STUDENTS WHO COMPLETED PREMED REQUIREMENTS IN DIFFERENT WAYS**

Applicants come to medical school from a variety of backgrounds and therefore follow different timetables. Here are examples of what some students have done in the past:

**ENGLISH MAJOR with AP credit in Calculus:**

Year	Fall	Spring
First Year	<ul style="list-style-type: none"> <li>• <b>Chemistry 100a</b></li> <li>• 1st Year Writing Seminar</li> <li>• Anthropology</li> <li>• Spanish</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Chemistry 100b</b></li> <li>• English 150</li> <li>• Economics</li> <li>• Spanish</li> </ul>
Sophomore	<ul style="list-style-type: none"> <li>• <b>Bio 200a</b></li> <li>• <b>Chem 220a</b></li> <li>• English 2 --</li> <li>• Spanish</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Bio 200b</b></li> <li>• <b>Chem 221b</b></li> <li>• English 2 --</li> <li>• Spanish</li> </ul>
Junior	<ul style="list-style-type: none"> <li>• <b>Bio 300a (Superlab)</b></li> <li>• <b>Physics 101a</b></li> <li>• English --</li> <li>• Span 2</li> </ul>	Spring semester in Argentina
Senior	<ul style="list-style-type: none"> <li>• Engl 399b</li> <li>• Engl 2--</li> <li>• Anthro</li> <li>• Engl 3--/Rel 2</li> </ul>	<ul style="list-style-type: none"> <li>• Engl 3 --</li> <li>• <b>Phys 102b</b></li> <li>• Rel 2</li> </ul>

**MCAT** taken end of senior year. During year-long application process Haverford grad worked in inner city clinic gaining exposure to health issues of underserved populations. Applicant also took additional biology classes at a local college. Entered medical school one year after graduation.

**PSYCHOLOGY MAJOR:**

Year	Fall	Spring	Summer
First Year	<ul style="list-style-type: none"> <li>• <b>Chem 100</b></li> <li>• History</li> <li>• Psych</li> <li>• 1<sup>st</sup> Yr. Writing Seminar</li> <li>• <b>Psych/Math 114 &amp; 116</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Chem 101</b></li> <li>• Philosophy</li> <li>• Psych</li> <li>• Sociology</li> </ul>	<b>Organic Chem/Organic Chem at BMC</b>
Sophomore	<ul style="list-style-type: none"> <li>• <b>Bio 101</b></li> <li>• English</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Bio 102 (BMC)</b></li> </ul>	

	<ul style="list-style-type: none"> <li>• Art</li> <li>• Psych (HC)</li> </ul>	<ul style="list-style-type: none"> <li>• Psych (BMC)</li> <li>• French</li> <li>• <b>Bio 2 – (BMC)</b></li> </ul>	
Junior	<ul style="list-style-type: none"> <li>• <b>Bio --</b></li> <li>• Psych (BMC)</li> <li>• Psych; Psych</li> </ul>	Semester abroad in France in which took courses in French literature and history	<b>Phys 101/102 (BMC)</b>
Senior	<ul style="list-style-type: none"> <li>• <b>Bio 3 --(BMC)</b></li> <li>• Psych 3 -- (BMC)</li> <li>• Psych 395</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Bio 3 – (BMC)</b></li> <li>• Psych 3-- (BMC)</li> <li>• Psych 3 --</li> </ul>	

As an undergraduate, this student was heavily engaged in neuroscience research with faculty and at a lab in a local medical school. She also volunteered as a French-to-English translator at a nearby clinic serving a large immigrant population. Was accepted into an MD/PHD program.

**CHEMISTRY MAJOR who took time after college to decide between MD; MD/PHD and PHD**

Year	Fall	Spring
First Year	<ul style="list-style-type: none"> <li>• <b>Math 121</b></li> <li>• German</li> <li>• 1<sup>st</sup> Year Writing Seminar</li> <li>• <b>Physics 105</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Chem 105</b></li> <li>• German</li> <li>• Religion</li> <li>• <b>Physics 106</b></li> </ul>
Sophomore	<ul style="list-style-type: none"> <li>• <b>Chem 220</b></li> <li>• <b>Bio 200a</b></li> <li>• <b>Math 215</b></li> <li>• Religion</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Chem 221</b></li> <li>• <b>Bio 200b</b></li> <li>• English</li> <li>• Econ</li> </ul>
Junior	<ul style="list-style-type: none"> <li>• <b>Chem 301 (Superlab I)</b></li> <li>• <b>Chem 304</b></li> <li>• <b>Chem 320</b></li> <li>• Econ</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Chem 311 &amp; 312 (Superlab II)</b></li> <li>• Religion</li> <li>• <b>Chem 35x</b></li> <li>• Econ</li> </ul>
Senior	<ul style="list-style-type: none"> <li>• <b>Chem 305/Chem 357d+e</b></li> <li>• <b>Chem 36x (Year-</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Chem 357 d+e</b></li> </ul>

	<p><b>long research)</b></p> <ul style="list-style-type: none"> <li>• <b>Chem 391 (Year-long seminar)</b></li> </ul>	
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Student had received a Howard Hughes Medical Institute fellowship for summer research between his junior and senior years. He continued in the same lab throughout senior year, then assisted in another lab at a teaching hospital for one year before deciding to pursue an M.D., rather than a Ph.D. degree. He took his MCAT in the spring, one year after graduation. During his post-graduate years he was also active as a volunteer with the homeless, and in various clinical settings in the hospital where he worked. He applied to medical school in the summer, one year after graduation, and he entered medical school fall two years after leaving Haverford.

**HISTORY MAJOR who applied to medical school three years after graduation**

Year	Fall	Spring
First Year	<ul style="list-style-type: none"> <li>• <b>Chemistry 100a</b></li> <li>• <b>Calculus 113a</b></li> <li>• <b>Greek</b></li> <li>• History 1xx</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Chemistry 101b</b></li> <li>• First Year Writing Seminar</li> <li>• <b>Greek</b></li> <li>• History 1xx</li> </ul>
Sophomore	<ul style="list-style-type: none"> <li>• History</li> <li>• History 2xx (BMC)</li> <li>• Greek</li> <li>• English</li> </ul>	<ul style="list-style-type: none"> <li>• History (200 level)</li> <li>• Music</li> <li>• Greek</li> <li>• Archeology (BMC)</li> </ul>
Junior	Fall Semester in Athens	<ul style="list-style-type: none"> <li>• History 2xx/Archeology</li> <li>• Cities (BMC)</li> <li>• History 3xx</li> </ul>
Senior	<ul style="list-style-type: none"> <li>• History/History (400 a/b – senior thesis)</li> <li>• Political Science</li> <li>• Cities (BMC)</li> <li>• History 3xx (BMC)</li> </ul>	<ul style="list-style-type: none"> <li>• English</li> <li>• Music</li> <li>• History 3xx</li> </ul>

Candidate entered Haverford as premed, but early on developed a passion for ancient history and related course work in the Cities program at BMC. Not wanting to pass up the

opportunity to explore these disciplines and to write an honors thesis on early colonial American history, the candidate tabled his plans for fulfilling his premed requirements.

After graduation, he joined the Peace Corps for two years, then entered a post-baccalaureate program, completing its requirements in one year. He was highly successful with medical school admissions due to his maturity, two years of service, and record of intense intellectual curiosity. He entered medical school four years after graduation.

**Double major in BIOLOGY and SPANISH who applied to medical school two years after graduation.**

Year	Fall	Spring	Summer
First Year	<ul style="list-style-type: none"> <li>• <b>Chemistry 100a</b></li> <li>• <b>Math 114</b></li> <li>• 1<sup>st</sup> Year Writing Seminar</li> <li>• Spanish</li> <li>• Economics</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Chemistry 101b</b></li> <li>• <b>Math 116</b></li> <li>• Anthropology</li> <li>• Spanish (200 level)</li> </ul>	
Sophomore	<ul style="list-style-type: none"> <li>• <b>Biology 200a</b></li> <li>• <b>Chemistry 220a</b></li> <li>• English</li> <li>• Spanish 2xx</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Biology 200b</b></li> <li>• <b>Chemistry 221b</b></li> <li>• Anthropology</li> <li>• Spanish 3xx</li> </ul>	<b>Physics 1xx/1xx</b> at state university near home
Junior	<ul style="list-style-type: none"> <li>• <b>Biology a/b</b></li> <li>• <b>Four Bio 3xx (.5 credit) courses</b></li> <li>• Spanish/Spanish 3xx</li> <li>• Religion/Philosophy</li> </ul>	<ul style="list-style-type: none"> <li>• Spanish 3xx</li> <li>• Philosophy</li> </ul>	Student spent summer in Spain to improve Spanish fluency and cultural literacy
Senior	<ul style="list-style-type: none"> <li>• <b>Bio 4xx (Senior Research)</b></li> <li>• <b>Bio 499 (Senior Seminar)</b></li> <li>• <b>Bio 35x/Bio 35x</b></li> <li>• Spanish 490 (full year)</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Bio 35x</b></li> <li>• Spanish 490 (full year)</li> </ul>	

**MCAT** taken summer after graduation. After leaving Haverford, candidate served as an intern at a government agency contributing to research for a project on international science and technology exchanges. She subsequently worked in a laboratory at a university near her home town and concurrently volunteered as a medical translator at a clinic for immigrant Latinos. Also shadowed several doctors at the hospital where she

was employed. She was very successful with the application process because of her very strong background in science cultural sensitivity and maturity. Entered medical school two years after graduating.

**PHYSICS MAJOR completing premed requirements by end of junior year**

Year	Fall	Spring
First year	<ul style="list-style-type: none"> <li>• <b>Physics 105:</b> Mechanics</li> <li>• <b>Math 115/116:</b> Calculus Applications</li> <li>• Elective</li> <li>• First Year Writing Seminar</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Physics 106:</b> Electricity &amp; Magnetism</li> <li>• Math 121: Calculus III</li> <li>• <b>Chem 105: Advanced General Chemistry</b></li> <li>• Elective</li> </ul>
Sophomore	<ul style="list-style-type: none"> <li>• Physics 213: Waves &amp; Optics</li> <li>• <b>Chemistry 220a: Organic Chemistry I</b></li> <li>• <b>Bio 200a: Cellular and Molecular Biology</b></li> <li>• Elective</li> </ul>	<ul style="list-style-type: none"> <li>• Physics 214: Intro Quantum</li> <li>• <b>Chemistry 221b: Organic Chemistry I</b></li> <li>• <b>Bio 200b: Cellular and Molecular Biology</b></li> <li>• Elective</li> </ul>
Junior	<ul style="list-style-type: none"> <li>• Physics 3XX: upper level physics</li> <li>• Physics 211: Electronics &amp; Waves Lab (1/2 credit)</li> <li>• Math 204</li> <li>• Elective</li> <li>• English</li> </ul>	<ul style="list-style-type: none"> <li>• Physics 3XX:upper level physics</li> <li>• Physics 212: Modern Physics Lab (1/2 credit)</li> <li>• <b>Bio/Chem 300 (Bio Superlab--counts as an upper level physics course)</b></li> <li>• Elective</li> <li>• Elective</li> </ul>
Senior	At least three upper level physics courses, which may include a semester of research. Physics 399: Senior Seminar	

Premed coursework completed by the end of junior year. Applicant took MCAT in June after end of semester. Entered medical school fall after graduation.