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Medical Career Resources for Harvard Students
Dear Harvard Students,

*Premedical Information for Harvard Students: Timelines, Courses, \& Resources 2015-2016* provides an overview of the application timelines and courses required for admission to U.S. medical schools. We hope it will serve as a planning guide to help you integrate this coursework into your academic plan at Harvard. We have also included a list of Harvard resources that will help you as you consider a career in medicine.

As a first-year Harvard student, or someone who has recently decided to pursue premedical coursework, you will hear many opinions about what being premed means and what medical school admission committees expect to see in an applicant. Do not believe all that you hear (or that you read on the web). Misconceptions and misinformation can provoke unnecessary anxiety. This booklet is designed to help dispel some common premed and medical school admissions myths.

While this publication describes the process for students applying to MD programs (allopathic medicine), many Harvard students choose to pursue other health professions, such as public health, dentistry, veterinary medicine, nursing, and osteopathic medicine. Please feel free to contact us in regard to meeting the requirements for these and other health professions fields. We urge you to take advantage of the range of premedical and pre-health advising resources available at Harvard. Concentration advisers, House premedical tutors, OCS career advisers, and practitioners in the field will offer a range of perspectives on how to enhance your experience at Harvard as you explore your future careers.

Oona Ceder and Ellen Williams

Premedical and Health Careers Advisers
Office of Career Services
Faculty of Arts and Sciences
Harvard University
MEDICAL SCHOOL APPLICATION TIMELINE

Close to three-quarters of Harvard applicants to medical school in recent years have waited until their senior year and beyond to apply to medical school. This timeline allows students four years to fulfill their premedical requirements. Students can also take some or even all of their premedical requirements after they graduate from college. The national average age of entering medical school students is 24, and medical schools value the added experience and maturity brought by students who have taken one or more gap years.

**Alumni Applicants***

***Note: Timeline of alumni applicant who took one gap year.

It is also common to apply a few years after graduation.

*Note: We advise that you request a letter of recommendation from any recommender (i.e., professor, employer, supervisor, etc.) at the time when you have completed your association with them.

**Note: Recommended turnaround time for secondary applications is 10-14 days.

***Note: Timeline of alumni applicant who took one gap year.

It is also common to apply a few years after graduation.
MEDICAL SCHOOL REQUIREMENTS FOR ADMISSION
(AS OF JULY 2015)

I. Course Requirements

- One year of general or inorganic chemistry with lab
- One year of organic chemistry with lab
- One year of general physics with lab
- One year of biology with lab
- One year of English

It is recommended that you complete these courses before taking the MCAT and before applying to medical school.

ADDITIONAL REQUIREMENTS:

- Over 50 medical schools require one or two semesters of mathematics (college math, calculus, and/or statistics).
- Currently the following 40 medical schools require one semester of biochemistry. We expect this number to increase over the next several years. For more information about a specific school’s biochemistry requirement, check the school’s website.

  University of Arizona College of Medicine, Phoenix
  Baylor College of Medicine
  University of California, Irvine School of Medicine
  Case Western Reserve University School of Medicine
  University of Chicago, Division of the Biological Sciences, The Pritzker School of Medicine
  Creighton University School of Medicine
  Drexel University College of Medicine
  Duke University School of Medicine
  University of Florida College of Medicine
  Florida State University
  Geisel School of Medicine at Dartmouth
  Harvard Medical School (new requirements only)
  University of Hawaii at Manao, John A. Burns School of Medicine
  Indiana University School of Medicine (new requirements only)
  Johns Hopkins University School of Medicine
  Loma Linda University School of Medicine
  Louisiana State University Health Sciences Center, School of Medicine in Shreveport
  Louisiana State University School of Medicine in New Orleans
  Marshall University-Joan C. Edwards School of Medicine
  Mayo Medical School
  Medical College of Wisconsin
  University of Miami Miller School of Medicine
  University of Michigan Medical School
  University of Missouri-Kansas City School of Medicine
  University of Nebraska College of Medicine
  University of Nevada School of Medicine
  University of New Mexico School of Medicine
  New York Medical College
  Ohio State University College of Medicine and Public Health
  Oregon Health and Science University
  University of South Florida Morsani College of Medicine
  State University of New York-Upstate Medical University
  Stony Brook University School of Medicine
  Texas A&M Health Science Center, College of Medicine
  University of Texas Medical School at San Antonio
  University of Texas Southwestern Medical Center at Dallas Medical School
  Texas Tech University Health Sciences Center School of Medicine
  Wayne State University School of Medicine
  University of Wisconsin School of Medicine and Public Health
  Yale University School of Medicine
• 26 medical schools require more than one year of biology. These include many of the Texas and California state medical schools. See the OCS resource Information About Requirements, Admissions, and Financial Aid Policies for Medical School Matriculation Prepared by Harvard College HPA for more detail.

• A few medical schools have additional requirements such as psychology or sociology.

IMPORTANT: Check the current edition of the Medical School Admission Requirements (MSAR), the official guide of the Association of American Medical Colleges, for information on particular course requirements for the medical schools to which you may apply.

Be sure to check the premedical requirements for your state medical school. MSAR is updated annually and can be ordered online on the Association of American Medical Colleges (AAMC) website. Most medical schools list their specific requirements on their websites. For a list of all U.S. medical schools and links to their admissions policies pages, see the OCS resource Information About Requirements, Admissions, and Financial Aid Policies for Medical School Matriculation Prepared by Harvard College HPA.

II. Medical College Admissions Test (MCAT)

The Medical College Admissions Test (MCAT) currently assesses the medical school applicant’s understanding of basic concepts in general biology, biochemistry, general chemistry, organic chemistry, non-calculus based physics, statistics, psychology, and sociology. The test consists of four multiple-choice sections:

• Biological and Biochemical Foundations of Living Systems
• Chemical and Physical Foundations of Biological Systems
• Psychological, Social, and Biological Foundations of Behavior
• Critical Analysis and Reasoning Skills

For the most up-to-date information about the test, please visit the official Medical College Admission Test (MCAT) website. Some highlights include:

• What’s on the MCAT Exam?
• Online practice questions
• Khan Academy MCAT video collection
• Psychology and sociology textbook resources
• Test dates and registration

To prepare for the MCAT, we recommend that students take an introductory psychology course such as SLS 20, and Sociology 10 or any of the Sociology 20-series courses, in addition to the science requirements. As Harvard courses are not designed specifically to prepare students for the MCAT, there may be some topics that are included on the MCAT but not covered in your courses. Depending on your background, you may find it necessary to learn certain concepts on your own or through a review class.
For almost all medical schools, Advanced Placement (AP) tests in biology, chemistry, and physics do not fulfill the premedical requirement in these areas. Most medical schools require that biology, chemistry, and physics be taken in college. See the section on “Mathematics” below for more information about using AP Calculus to satisfy medical school math requirements. Please note that Harvard College does not make the decision about which courses meet premedical course requirements. Each medical school is the final arbiter of which courses they will accept. Therefore, if you have any doubt about whether a course can be substituted for the courses listed below, you should check with the admission offices of the medical schools to which you may apply.

GENERAL OR INORGANIC CHEMISTRY WITH LAB (ONE YEAR):

Two of the following courses. Preferably both should contain labs.

- Life Sciences 1a or Life and Physical Sciences A or Life Sciences 50a*
- Physical Sciences 1 or Physical Sciences 11
- Advanced inorganic or physical chemistry.
  For example, Physical Sciences 10, Chemistry 40, Chemistry 60, or Chemistry 160.

**Note:** *Life Sciences 50a will satisfy the requirement of one semester of general chemistry with lab and one semester of biology with lab at most medical schools.*

*Biomedical Engineering concentrators may take Engineering Sciences 181 for one semester of general chemistry with lab.*

If you plan to take only higher level inorganic or physical chemistry courses, most medical schools will accept these courses in lieu of general chemistry. If neither of these courses has lab, you may have to take an additional inorganic or physical chemistry lab course, or demonstrate your lab competency through lab research.
BIOLOGY WITH LAB (ONE YEAR):

Two of the following courses. Preferably both should contain labs. Most medical schools recommend that these courses cover the cellular and molecular aspects as well as the structure and function of living organisms. Narrowly focused biology courses should not be used to meet the basic premedical requirements.

- Life Sciences 1b
- Life Sciences 2
- Life Sciences 50a*
- Life Sciences 50b**
- Molecular & Cellular Biology 52 (no longer offered)
- Molecular & Cellular Biology 54 (no longer offered)
- Molecular & Cellular Biology 60
- Molecular & Cellular Biology 68
- SCRB 20
- Organismic & Evolutionary Biology 10
- Human Evolutionary Biology 1420
- Advanced courses

*Note: Life Sciences 50a will satisfy the requirement of one semester of general chemistry with lab and one semester of biology with lab. **Life Sciences 50b will satisfy the requirement of one semester of biology with lab and one semester of math at most medical schools.

Biomedical Engineering concentrators may substitute Engineering Sciences 53 for one semester of biology.

ORGANIC CHEMISTRY WITH LAB (ONE YEAR):

One of the following series:

- Chemistry 17 and Chemistry 27
- Chemistry 20 and Chemistry 30
- CHEM S-20ab (Harvard Summer School)

*Note: Most medical schools that require biochemistry will accept a combination of Chemistry 17 and Chemistry 27 as fully meeting both the organic and biochemistry requirements. Students who take CHEM S-20ab or Chemistry 20 or Chemistry 30 may subsequently take Chemistry 27 without the lab component, with permission from the course instructor/preceptor, to satisfy one semester of biochemistry. Students who wish to take a third semester of organic chemistry can take the combination of Chemistry 20, 30, and 27; or Chemistry 17, 27, and 30; or CHEM S-20ab and Chemistry 27.
BIOCHEMISTRY (ONE SEMESTER):

One of the following courses. Currently one semester of biochemistry is required by 40 medical schools, and we anticipate this number to continue to increase in the near future. MCAT 2015 also places a stronger emphasis on biochemistry than the previous MCAT.

- Most medical schools that require biochemistry will accept a combination of Chem 17 and Chem 27 as fully meeting both the organic and biochemistry requirements.
- SCRB 25
- Molecular & Cellular Biology 63
- Molecular & Cellular Biology 65 (formerly MCB 56)
- BCMP 234 (formerly MCB 234)
- BIOS S-10 (Harvard Summer School)
- Enroll in a biochemistry course the spring or summer before starting medical school.

PHYSICS WITH LAB (ONE YEAR):

One of the following series:

- Physical Sciences 2 and Physical Sciences 3
- Physical Sciences 12a and Physical Sciences 12b
- Physics 15a and Physics 15b
- Applied Physics 50a and Applied Physics 50b
- PHYS S-1a and PHYS S-1b (Harvard Summer School)
- Any two physics courses, one with a lab

MATHEMATICS:

One semester of calculus and one semester of statistics. However, depending on your background you may need to take more than one semester of calculus in order to be fully prepared for your concentration or for future coursework. Note that several physics courses, including Physical Sciences 2 and 3, require Math 1b or equivalent.

- Math Ma and Math Mb or
- Math 1a or Math 1b or
- Math 19a or
- Math 18 or
- Math 21a or 21b or
- Applied Math 21a or 21b or
- Life Sciences 50b** or
- Any more advanced Math or Applied Math course

PLUS

- Any statistics course (e.g., Statistics Department courses or Psychology 1900 or OEB 153 or Math 19b)

Note: **We expect that Life Sciences 50b will satisfy the requirement of one semester of biology with lab and one semester of math at most medical schools. If you have a 4 or 5 on the AP Calculus AB test, you have met the requirement for one of the two semesters of math required by many medical schools. If you have a 4 or 5 on the AP Calculus BC test, you have met the requirement for both of the two semesters of math required by many medical schools. Note, however, that some medical schools do not accept calculus (or statistics) APs toward satisfaction of their math (or statistics) requirement unless the AP score is recorded on the applicant’s official undergraduate transcript. Only Harvard students who have activated advanced standing will have AP tests and scores recorded on their official transcripts.
ENGLISH (ONE YEAR):

One semester of the English requirement is met with Expos. (Students who take two semesters of Expos have met the full requirement of two semesters of English.) The second semester can be met with English or Literature courses, some Arts and Humanities courses, or with many Aesthetic and Interpretive Understanding and Culture and Belief courses at many medical schools.

We cannot confirm that a specific Gen Ed course would be approved by every medical school, since schools make their own determination about what courses they will accept toward fulfillment of this requirement. Therefore, please use your best judgment when considering Gen Ed courses and whether they can be expected to meet the English requirement. To be accepted by most medical schools, Gen Ed courses should:

1) deal primarily with literature (English literature or literature originally written in another language but read in English translation). Courses that focus on music, painting, or architecture, for example, would not be acceptable for satisfaction of the English requirement at many medical schools. A course whose primary assignments are multimedia or group projects will not meet this requirement for most medical schools;

2) be writing intensive. As for the number of papers, many Gen Ed courses ordinarily assign enough papers to be considered writing intensive by medical schools;

3) be taught by a faculty member in the English or Comparative Literature departments, or a relevant foreign Literatures and Languages department (such as East Asian Languages and Civilizations, Germanic Languages and Literatures, Near Eastern Languages and Civilizations, the Classics, etc.).
considerations for planning your program of study

Course load, Pass/Fail, and GPA
There is no need to rush and overload with science courses freshman year. We recommend that freshmen take at most two science courses (including math) each semester. The first few years at Harvard involve getting used to a new setting, a new set of social and extra-curricular activities, and new ways of learning and studying. College-level science courses, especially those with lab, can be unexpectedly time-consuming and demanding, particularly for students who have not had strong science preparation in high school. Consult your Freshman Adviser, and the advising staffs in the Life and Physical Sciences, Engineering Sciences, and Math for course load and placement advice.

Just as it is important not to overload on courses and activities, premed students should also avoid dropping below the regular course rate of four courses per semester. To be competitive for medical school admission, applicants should demonstrate an ability to handle a science-intensive curriculum and a love of learning through in-depth study of a particular area or areas of interest. However, if you anticipate a challenging semester ahead, it is perfectly acceptable to take one of your elective courses pass/fail (Note: Premedical requirement courses must be taken for a grade to be accepted by medical schools).

While you do want to achieve an overall strong performance in sciences, there is no specific GPA (or MCAT score) that guarantees acceptance to medical school. Your grades are only one of the factors in the admissions process. Your personal qualities, experiences, and motivation are also critical factors. Medical school admissions committees look favorably on students who have tested their interest in medicine through community service, health-related internships, extracurricular activities, or significant research. Each medical school develops its own criteria and priorities for admission, reflecting the goals of the respective school. For some medical schools, potential for service to an underserved community is very important; for others, a determining factor may be leadership qualities. To assess these qualities, the admissions committees will carefully review the statements and essays in your application, letters of evaluation, your coursework (including trends in academic performance and level of course difficulty), and personal interviews.

Do not be disheartened or discouraged from pursuing medicine if your first science grades do not meet your expectations. Medical school admissions committees look with favor upon an upward trend in your record of academic performance. That being said, if you have received a C or lower grade in a science course, it is a good idea to make an appointment with an OCS premedical adviser, your academic adviser, and/or an adviser at the Bureau of Study Counsel to review your course load, your extracurricular activities, and study strategies as you continue your premedical studies.

For information on GPAs and admission to medical school, check the publication Medical School Admissions Data, which is available in the OCS Reading Room.

Chemistry, Biology, and Physics Placement
Please contact the placement advisers in the appropriate department.

Science General Education Courses
Science General Education Courses can not be used to satisfy the science premedical requirements. However, if the content of the General Education course is primarily biology, chemistry, math, or physics, this course will count towards your science GPA as calculated for your medical school application.
Research
Basic science research is not a requirement for medical school admission, and in fact, a number of Harvard students continue on to medical school without working in a lab. Successful medical school applicants have usually demonstrated the ability to pursue an area of study in depth. This could be basic science research, clinical research, or a thesis in English literature. The experience of formulating an original research question and critically analyzing data does not necessarily have to occur in a basic science research lab.

If you are excited about pursuing basic science research at Harvard, there are many wonderful resources available to you, both at the college campus in Cambridge and at the Harvard Medical School campus in Boston. For science concentrators in particular, the experience of working in a research lab can significantly enhance your college experience. Students who are seriously considering a combined MD-PhD or an academic medical career should take advantage of these opportunities to develop research skills.

Study Abroad
Premedical courses should not be taken during study abroad. Most medical schools will not accept premedical requirements taken at a foreign institution. However, students are encouraged to enroll in other courses abroad and to pursue international research and internship opportunities.

Summer School and taking premedical courses at a different institution
Harvard Summer School courses can be taken for credit toward your degree and toward your medical school requirements. However, you can also take a premedical course elsewhere during the summer at an academically competitive four-year U.S. college. (You do not need to get Harvard credit for a course to use it for medical school admissions.) Do not take more than the equivalent of one year of your premedical course requirements during the summer, as it may appear as if you are avoiding Harvard science courses. Additionally, it is usually not advisable to split sequential courses between institutions. Note that CHEM S-20ab: Organic Chemistry does not satisfy the requirement of one semester of biochemistry at many medical schools.

Post-Baccalaureate Options
Many Harvard students do not complete or even begin taking premedical courses while enrolled as undergraduates. Post-baccalaureate programs or independent coursework allow college graduates to take some or all of the required premedical courses. Harvard students who choose to complete their requirements after graduation can still take advantage of Harvard premedical advising and resources at OCS and in their House. Please visit the OCS website for more information on post-baccalaureate options and programs.
SAMPLE COURSE SEQUENCES THAT MEET MOST MEDICAL SCHOOL REQUIREMENTS

If you are planning on concentrating in a science, most premedical requirements will be included in your course of study. However, you can also choose any nonscience concentration and still have time to complete these required courses. Many Harvard students started premedical coursework later in college or even after graduation. We have created the following sample schedules to illustrate how you can assemble the needed courses for medical school—regardless of your concentration or when you embark on your premed path. Students considering concentrating in the life sciences should consult with the Head Tutor or the Director of Undergraduate Studies in the concentrations you are considering.

PLEASE NOTE THAT THESE ARE EXAMPLES ONLY. There are many possible course sequences and your individual circumstances will determine your plan of study.

Four-Year Plan (applying to medical school after senior year):

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Four-Year Plan (applying to medical school after senior year):

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Three-Year Plan (applying to medical school after junior year):

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Three-Year Plan (applying to medical school after junior year):

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Three-Year Plan (applying to medical school after junior year):

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### Three-Year Plan with Summer School and Study Abroad:

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Premed Beginning Junior Year:

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Premed Beginning after Graduation (Post-Baccalaureate):

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MEDICAL CAREER RESOURCES FOR HARVARD STUDENTS

Take the initiative to seek out the resources you need to get factual and realistic answers to your questions. Remember that fulfilling your premedical requirements should not completely dominate your college experience. Take the time to step off the “premed path” and take advantage of all Harvard has to offer you.

ACADEMIC AND PRE-PROFESSIONAL ADVISING

**Freshman and Sophomore Advising:** Resident proctors, freshman advisers, peer advising fellows, the Advising Programs Office, sophomore advisers, and the Freshman Dean’s Office are all here to help you to make your first two years a very positive experience.

**Premedical and Health Professions Advising:** The medical and health careers advisers at the Office of Career Services offer drop-in hours, group meetings, and individual advising. Workshops cover such topics as Considering a Career in Medicine, Creating Your Personal Statement, Selecting Medical Schools, Planning Your Gap Years, Financing Your Medical Education, and the Medical School Interview. If you would like more information, please check the Premed & Health Careers online calendar.

**Pre-Health Peer Liaisons (PPL):** The PPL are specialty PAFs who assist the OCS Premed and Pre-Health Advisers with workshops and pre-health programming. See the OCS Health and Medical Careers Website for a list of the PPL.

**House Premedical Tutors:** Premedical advising also takes place within upper-class Houses. Harvard’s House-based premedical advising system is unlike that at any other college. Each House has a committee of premedical tutors, who are generally Harvard Medical School students, residents, and/or alumni, or graduates of other U.S. medical schools currently in residency training in the Boston area. Students should become familiar with their committee. As medical practitioners, the premedical tutors are invaluable resources for learning about your potential career. The House premedical committee is also responsible for the Harvard College committee letter of evaluation sent to the medical schools when you apply. See the OCS Health and Medical Careers Website for a list of Premedical Tutors by House.

**Research:** For questions and advice about research in the life sciences, contact Margaret Lynch, Life Sciences Research Adviser: margaretlynch@fas.harvard.edu, or Greg Llacer, Director of the Office for Undergraduate Research Initiatives: gregory_llacer@harvard.edu. For more information see lifescience.fas.harvard.edu.
Life and Physical Sciences Advisers: For questions about life and physical sciences concentrations and courses, please contact one of the advisers listed below and be sure to check lifescience.fas.harvard.edu regularly for information, including updated FAQs.

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<th>CONCENTRATION</th>
<th>NAME</th>
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<tbody>
<tr>
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CAREER EXPLORATION AND OPPORTUNITIES

Crimson Careers: This job and internship database maintained by OCS contains listings of opportunities, updated daily: harvard-csm.symplicity.com/students. For other OCS job resources, please visit ocs.fas.harvard.edu/job-internship-search.

Health and Medical Careers Email Updates: Announcements, upcoming workshops, and discussion relevant to Harvard premedical and other pre-health career students are posted on a regular basis.

OCS Health and Medical Careers Website: You will find information on health-related internship opportunities, links, workshop schedules, past workshop PowerPoint slides, year-by-year timelines, links to relevant and annotated health-related sites on the Internet, and much more at ocs.fas.harvard.edu/medical-health.

The Office of Career Services Website: The general OCS website, www.ocs.fas.harvard.edu, has links to information on fellowships and funding, international opportunities, a calendar of events, and other career resources.

The Office of Career Services Resource Collection: The Health and Medicine shelves in the OCS Reading Room contain a range of relevant publications on careers in medicine and other health professions, including admissions information from the medical schools and graduate schools of public health, dentistry, nursing, and veterinary medicine.

HAA Alumni Database: This searchable database maintained by the Harvard Alumni Association contains an online listing of Harvard/Radcliffe College and other Harvard alumni/ae who have volunteered to serve as career advisers to students considering medicine or other health professions.

Association of American Medical Colleges (AAMC): The website www.aamc.org provides comprehensive information on medical careers and the medical school admissions process. This is a useful site for information on requirements, financial aid for medical school, and post-baccalaureate programs; you can also subscribe to Medical School Admission Requirements online.