

A Guide for STEM Activities at Yale for First-Year Students

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Sandy Chang, MD/PhD
Associate Dean
Science & QR Education and
Undergraduate Research

Rationale for writing this guide

Dear first-year students,

I do a lot of advising for Yale undergraduates majoring in a STEM field and I am surprised by how often Yale undergraduates (even upper-level students) do not know where STEM information vital to their academic success is located on the Yale's web space. This lack of knowledge is due in part to the sheer amount of information out there and to the multiple advising resources available at Yale. While these resources are important, first-years can easily get overwhelmed with so much information.

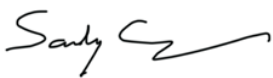
This guide highlights existing information and web links to help STEM majors navigate Yale resources more efficiently. While it is written with the first-year student in mind, more senior STEM students might also benefit from my career advice on medical and graduate schools.

There are three pieces of advice that I would like to offer to all first-year student, based on my own undergraduate experiences: (1) find a non-distracting place to study, away from your dorm, and go there every day to get your work done, (2) use course-based peer tutors for all your introductory STEM classes, if needed, and (3) go to your professors' office hours. I describe these points in greater detail below.

Note that the advice for pre-meds and pre-grads is just that - advice. It's not a plan set in stone for you to follow exactly, but a guide to get you started. It is essential for you to reach out to your first-year counselors (Frocos), residential college deans, heads of colleges, academic advisers, peer mentors and professors to get their take on what you want to accomplish at Yale. This is one reason why you chose Yale - the support here is incredible and we all want you to succeed in whatever you do.

Please help me make this guide better by giving me suggestions on additional information that I should include that could benefit you. I welcome any student to reach out to me. My e-mail is s.chang@yale.edu. I love eating breakfast or lunch with undergrads, so contact me to grab a meal.

Best,



Sandy Chang, MD/PhD
Associate Dean of Science and QR Education
Professor, Depts. of Laboratory Medicine, Pathology and MBB

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Things to consider before setting foot at Yale: STEM placement exams

Yale does not allow you to use AP STEM credits to automatically move into a higher level class. Even if you get a 5 on AP chemistry for example, you will still have to take the Yale chemistry placement exam to take advanced chemistry classes. You might want to use the summer to brush up on your AP chem or calculus to allow you to place into a more advanced class.

Chemistry: If you want to take organic or physical chemistry at Yale as a first year, you have to take a placement exam, no matter what you get on your AP chem exam. Info here:

<https://chem.yale.edu/academics/undergraduate-program/chemistry-major-yale>

As I state on p. 15, I highly recommend qualified premeds (those taking AP chem or the equivalent IB chem class) to place into first year orgo. This will get you credit for a year's worth of general chemistry plus lab that you don't have to take!

For chem majors, same thing. Some powerful students take p-chem as a first year.

If you have not taken any AP chemistry, just fill out the HS math and science form and you will be placed into a chem class according to the HS science classes you have taken. I highly recommend starting with chem 161 plus the lab if you have zero chem background.

Physics: There is no placement exam for physics. Just take whatever classes you best fit in. Here are my suggestions:

Physics majors: take physics 180 or 200 or 260, depending on your preparation. Intensive physics majors start with physics 260.

Most pre-meds take physics 170 or 180. Premeds also do not normally take physics in their first year-see p. 15 about my recommendations on courses for premeds.

Biology: There is a bio placement exam: you have to score a 5 on AP Bio or a 7 on IB bio to be eligible to take the Yale bio placement exam.

See <https://mcdb.yale.edu/placement-exam>

If you qualify, I recommend that you take this exam. There are 4 modules in Yale's intro bio sequence and you might be able to place out of a few. Only 2-3 students per year place out of all 4, so it's a hard exam, but it's easy to place out of 1 or 2.

Math: All first year students taking math at Yale must take a placement exam, to help the math dept better place you in the correct class. Those with AP calculus AB or BC backgrounds usually take either math 115 or 120. If you are not great in calculus, you might want to start at math 112. If you have zero calculus background, go for math 110. No matter how you score on your AP calculus exam, you still have to take the Yale math placement exam. See: <https://math.yale.edu/undergraduate/placement-exam>

Explore these links. Good luck on placing out of a few of these classes. This will allow you to take more advanced courses.

Finally, do not forget to look into the first year seminars (p. 9). You get only two chances to take them. The classes I teach are all first year seminars-I love the connection I make with students in a small class setting.

Proper E-mail Etiquette is Important to Make a Good First Impression

You won't believe how many undergrads address me with "Yo, Hey, Dude" in their e-mail messages. While these salutations are OK with your friends, do not use them to address your professors or deans! Proper e-mail etiquette is important to make a good first impression! The below was taken from an informative article written by Megan Roth, USA Today. Follow these rules when emailing your professor:

1. Be Formal

Always use a proper salutation when emailing a professor — even if you know the professor personally or professionally. Use "Dear" to begin the email and address him or her by the name you would use if speaking to the professor in person (Dear Dr. ____ or Dear Ms. ____). If your professor asks you to address him/her by first name, still use "Dear" to set up a respectful tone for the letter.

2. Specify

Specify who you are by first and last name and specify which class you are taking before diving into the specifics. Professors often teach anywhere from two to six classes per semester and usually have hundreds of students to serve. State your name, the class you are taking and the course section (the professor might teach three sections of your course and will need to know which one you attend).

3. Be thorough

Any time you send a message, you should have two things in mind: goal and audience. Your audience here is a professor, who is an authority figure. Your goal could be any number of things, from clarifying the reading assignment to asking for an extension. Whatever your goal may be, you'll want to anticipate any questions the professor may have and incorporate the information into your message. For example:

*Dear Professor Smith,
My name is John Green and I attend your ENC4214 section 9 course. I missed class on Tuesday and would like to find out the assignment for Thursday. The syllabus only lists a reading assignment, but I wanted to make sure nothing is due to hand in Thursday. Thank you for your help.
Sincerely,
John Green*

The example above shows that John indicated that he had already checked the syllabus. This saves time and allows the professor to simply respond, "Yes, there is a written assignment and it is ____" or "No, there is no written assignment," knowing that John has already gone to the syllabus.

4. Be kind

Professors are people, too. They have friends, families, hobbies and favorite foods. So, when you email a professor, remember that you are not writing to an entity, a building or a computer — you are communicating with a real person. Be kind, be thankful and never come across as demanding. This can be accomplished with the “You Attitude,” a concept that asks you to consider yourself as the reader. What words or sentences would be off-putting? For example:

“Get back to me as soon as possible.” This sentence is demanding, pushy and gives a direct command — something you want to avoid. After all, you are communicating with a higher-up.

“Please advise me at your convenience.” This conveys respect and awareness. The professor is not a public servant and doesn’t need to do anything as soon as possible for you.

Using the “You Attitude” establishes goodwill and respect and increases the chances you will receive the help you need. It also won’t hurt to thank the professor at the end of the email, which establishes good rapport (see the example above).

5. Proofread

Perhaps the most important and final step - proofreading ensures that you come across as professional and caring. An email full of errors and faulty sentence structure is sure to enflame a busy professor. After all, if your writing is unclear, the reader has to work to understand what you want. Do the work on your end and make the message clear and easy to read. For a short message, don’t get fancy. Use simple syntax (subject-verb-object) and proofread for run-on sentences, misspellings and other errors.

Together these tips will make emailing your professor a breeze.

Dr. Risa Sodi, Assistant Dean of Academic Affairs & Director of Advising and Special Programs, has a terrific website, <https://advising.yalecollege.yale.edu>, that contains numerous other resources that you will find useful.

How to Hit the Academic Ground Running

The first key to academic success at Yale is to know what your professor expects from you. The Academic Strategies Program, <https://poorvucenter.yale.edu/academic-strategies-program>, a part of the Center for Teaching and Learning (CTL), is a very valuable website that teaches you how to start smart in your classes. This link, <https://poorvucenter.yale.edu/undergraduates/academic-strategies-program/how-do-yale-some-advice> contains invaluable information. Read EVERYTHING in it, then read it again.

A second key to academic success is to use the tutoring service, if needed, for all your intro STEM classes. I can't stress this enough. USE THE COURSE-BASED PEER TUTORS! This is especially true for large STEM intro classes. Visit this link, <https://ctl.yale.edu/tutoring/quantitative-reasoning-science>, to find out more about this essential resource.

Each residential college also host science and quantitative reasoning (QR) peer tutors with unique specialties with drop-in hours, <https://ctl.yale.edu/tutoring/quantitative-reasoning-science/drop-residential-college-mathscience-tutors>.

You can also request individual peer tutors, if needed. For more information contact Dr. Purushothaman, kailas.purushothaman@yale.edu.

A third key to success is to go to your professors' office hours every week. They have this time set aside especially for you to ask questions about anything related to class work. Professors often use this time to review a difficult topic or p-set, or to review contents covered in an upcoming exam. If you don't go, you will miss out on these VALUABLE nuggets of wisdom. Going to office hours is also a great opportunity to interact with your professors.

Many STEM departments will be rolling out a new peer mentor program for their majors this year. Juniors and seniors chosen by the departmental Director of Undergraduate Studies (DUS) will function as ambassadors to teach first-year students more about their majors. Reach out to the DUS in a major you are interested in, get the e-mail address of a peer mentor and then grab a meal with one of them. Upper-level students are one of the best resources to get the low-down of a particular major.

Finally, those of you in the STARS I Program will have your own peer mentors assigned to you. Take advantage and meet with them often, they are an invaluable source of STEM information. If your STARS I mentor cannot answer a question, she/he will direct you to other STARS I mentors who can. You are also free to get in touch with other STARS peer mentors to ask them questions. <https://science.yalecollege.yale.edu/stars/stars-i-academic-year-program>

Recommended Small Enrollment Science Classes for First-Years

Our introductory biology, chemistry and physics courses are fabulous and well taught, and you need to take all of them if you are a MBB/MCDB/EEB/BME major and/or pre-med. But they are large classes, and some first-years might find it intimidating to get to know their professors. The solution is to take one large intro science class and a smaller science class on some science topic that interests you. Below are the small STEM classes that I recommend you shop. They come in two flavors; first-year seminars or Course-based Undergraduate Research Experience (CURE) classes.

First-year STEM Seminars

These classes delve into a specific topic in detail. They are capped at 18 students (classes are typically much smaller), so you really get to know your professor and classmates well. If you love to interact closely with a professor and to talk about science in a small group setting, this is your type of class. Many professors also take their seminar classes on cool field trips; I take mine to the Museum of Natural History in NYC pre-pandemic. Be aware that there is a lottery for these classes, so you might not get into the one you want. Remember, you only get to take these classes as first-years, so don't miss the opportunity! For up to date listings, check out <https://courses.yale.edu/>.

Course-based Undergraduate Research Experience (CURE) Classes

Through funding from the Howard Hughes Medical Institute, Yale has designed courses intended to increase hands-on research experiences for first-year students and sophomores via lab courses that have no prerequisites. These CURE classes mix lectures with hands-on research projects and are an excellent way for first-years and sophomores without previous research experiences to learn about research methodologies in a specific discipline. E-mail the course instructors for further information. Some class enrollments may be capped. For up to date listings, go to: <https://courses.yale.edu/>

Biology Laboratory Courses

If you are eager to do undergraduate research in biology but have no previous lab experience, you might want to consider taking one of the MCDB lab courses below. Dr. Moreno does a great job making Yale undergrads familiar with the latest techniques in biological research and prepares them to think like a scientist. After taking her lab course(s), you'll hit the ground running when you do research in a Yale bio lab over the summer. Her labs are great for preparing students who want to secure a Yale First-Year Summer Research Fellowship, <https://science.yalecollege.yale.edu/yale-college-first-year-summer-research-fellowship-sciences-engineering>, or a position in the STARS Summer Research Program, <https://science.yalecollege.yale.edu/stars/stars-i-summer-research-program>.

Also, if you are pre-med and are NOT doing any biology related research, you will need to take two semesters of biology lab. These labs below are very good choices. Even if you have extensive independent research experience, it's a good idea for pre-meds to take 1 semester of biology lab at Yale.

MCDB 221La, Model Organisms in Biological Research Maria Moreno

An introduction to research and common methodologies in the biological sciences, with emphasis on the utility of model organisms. Techniques and methods commonly used in biochemistry, cell biology, genetics, and molecular and developmental biology; experimental design; data analysis and display; scientific writing. With permission of instructor or concurrently with or after BIOL 101, 102 or 103. WR, SC ½ Course cr HTBA

MCDB 201Lb, Molecular Biology Laboratory Maria Moreno

Basic molecular biology training in a project-based laboratory setting. Experiments analyze gene function through techniques of PCR, plasmid and cDNA cloning, DNA sequence analysis, and protein expression and purification. Instruction in experimental design, data analysis, and interpretation. Concurrently with or after MCDB 200, or with permission from instructor. For freshmen and sophomores interested in research integrated laboratory experience. Special registration procedures apply. Interested students must contact the instructor and attend an organizational meeting during the first week of classes. WR, SC ½ Course cr HTBA

STEM classes without prerequisites

If you are looking to fulfill a SC or QR credit, and want to take a class without any prerequisites, look here for a list of Science Courses without prerequisites, <https://science.yalecollege.yale.edu/academics/faculty-resources/science-courses-without-prerequisite>, and here for Quantitative Reasoning courses without prerequisites, <https://science.yalecollege.yale.edu/academics/courses/qr-courses/qr-courses-without-prerequisite>.

The Importance of the Humanities in STEM

Contributed by Emme Magliato '23, Jaida Morgan '23 and Jeremy Otridge '22

The devastating COVID-19 pandemic illuminated how inequities on the basis of race, gender, class, disability, and citizenship deeply impact health and life outcomes. By becoming more well-rounded STEM majors, we can address this long-lasting and significant health and social inequality. Anyone pursuing a career in science or medicine must learn about the history behind the policies, technologies, and disparities that will influence your future patients' health care management.

Why the Humanities?

Historically, science, research, and medicine have built and perpetuated systems of oppression against Black, brown, and Indigenous communities through their sweeping generalizations and often malicious foundations. Courses in [Sociology](#), [Anthropology](#), [African American Studies](#), [History of Science, Medicine, and Public Health](#), and [Ethnicity, Race, and Migration](#) and other fields can provide context for present-day injustices and enable researchers to better understand the larger environment in which their research takes place. Part of being a responsible physician and researcher is being compassionate and understanding, thinking critically, and communicating efficiently and accessibly. The humanities foster such skills while also allowing students to engage with the human impacts of their scientific discoveries.

Courses of Interest: Note that not all of these courses are offered every semester/year. Courses about historical cultures of healing reveal the limits of medical knowledge, the vulnerability of disadvantaged populations, and the relativity of medical ethics. They allow students the opportunity to understand the past, present, and future impacts of the sciences that they are studying as part of their STEM curricula.

[History of Science Medicine and Public Health](#)

- HSHM 212: Historical Perspectives on Global Health
- HSHM 206: History of Reproductive Health and Medicine in the U.S.
- HSHM 321 - Cultures of Western Medicine
- HSHM 241: Sickness and Health
- HSHM 406: Healthcare for the Urban Poor
- HSHM 436: Health and Incarceration in U.S. History.

[Sociology](#)

- SOCY127: Health and Illness in Social Context
- SOCY 351: Race, Medicine, and Technology

[Anthropology](#)

- ANTH 011: Reproductive Technologies
- ANTH 018: Scientific Thinking and Reasoning
- ANTH 116: Introduction to Biological Anthropology
- ANTH 204: Molecular Anthropology
- ANTH 230: Evolutionary Biology of Women's Reproductive Lives

- ANTH 386: Humanitarian Interventions: Ethics, Politics, and Health
- ANTH 448: Medical Anthropology at the Intersections: Theory and Ethnography

Ethnicity, Race, and Migration

- ER&M 200: Introduction to Ethnicity, Race, and Migration
- ER&M 412: Native American Health

African American Studies

- AFAM 213: Medicine and Race in the Slave Trade
- AFAM 384: Slavery, Race, and Yale
- AFAM 752: Medicine and Empire

Women's, Gender, and Sexuality Studies

- WGSS 335: LGBTQ Life Spans

Other Courses

- HLTH 230: Global Health: Challenges and Responses
- Physics 170: Being Human in STEM

Undergraduate Research

Undergraduates in labs with caring mentors tell me that doing independent research is the most rewarding activity during their Yale career. I think all STEM majors should try doing some form of independent research for at least a summer. If you hate it, fine, you've tried it. If you love it, well, I don't have to tell you how thrilling making new discoveries can be. I love it so much I made it my career. You can too.

The Science and QR website, <https://science.yalecollege.yale.edu/>, should be your go-to place if you are interested in independent research with a lab at Yale. It contains information on why and when you should do research, how to find a mentor, and fellowships that support undergrad STEM research. Read every section, especially the sections titled, "*Entering Research*" and "*Choosing a Mentor*". Then read those sections again. Be sure to also check out the schedule for my monthly workshops on how to find a mentor, how to write a research proposal, etc. on the link above.

The Yale Center for International and Professional Experience also has a website, <https://funding.yale.edu/fellowships>, that contains information on fellowships and funding as well as other summer opportunities; although most of these are not STEM fellowships.

Another useful website is, <https://yura.yale.edu/>. The Yale Undergraduate Research Association created a database that allows you to type in key science words to look up Yale researchers working in those areas. Very cool and very helpful.

Are you a woman and/or a student from an underrepresented group? Then the STARS Programs might be for you. Check out these amazing programs, <https://science.yalecollege.yale.edu/stars>. They have been supporting STEM students since 1995!

Have you already found a great lab, but need funding? Here's what you should look at, <https://science.yalecollege.yale.edu/yale-science-engineering-research/fellowship-grants>. There is a fellowship specifically to support **first-year students**, <https://science.yalecollege.yale.edu/yale-college-first-year-summer-research-fellowship-sciences-engineering>, and a fellowship to support **sophomores and juniors**, <https://science.yalecollege.yale.edu/yale-undergraduate-research/fellowship-grants/yale-college-deans-research-fellowship>.

If you are on financial aid and want to do research in an institution back home over the summer, now you can! Check out this link for more information on the Summer Experience Award (SEA) that you can be used to fund a research position, <https://ocs.yale.edu/channels/summer-experience-award/>

Please note that there is no funding available for students doing research during the academic term except for the STARS II program which can provide financial support in your junior and senior years, <https://science.yalecollege.yale.edu/stars/stars-ii-program>.

Do you want to do STEM research in a foreign country? Find a professor who is willing to host you, formulate a research project and apply for the Tetelman and Bates Fellowships, <https://science.yalecollege.yale.edu/yale-undergraduate-research/fellowship-grants/tetelman-fellowship-international-research-sciences>.

Places to Study

Contributed by Grace Kim '20

It is essential for you to find a good, safe, quiet place to study, ideally away from your dorm room (too many distractions). I always studied in the Sterling library stacks, floor 3M. It's nice and quiet up there, and a bit spooky which made me work fast. I stayed there every night from 6PM onwards until I finished studying. Get your study routine down, and stick to it. Be smart, make sure where you study is safe, especially if you are studying by yourself. Below are some places to study in and around Yale.

Residential Colleges:

- Computer Labs
- Buttery (especially silent and empty in the mornings to mid-afternoon)
- Common Room (for collaborative study—go here if you want to talk)
- Library (for *quiet*, independent study)
- Dining hall (some dining halls are open for studying at night)
- Seminar Rooms
- Student Meeting Spaces

Science Hill

- KBT (Klein Biology Tower) Café
 - Located on top of science on the first floor of Klein Biology Tower
 - Great for grab & go use of your breakfast swipe (8:00-10:30am) and lunch swipe (11:00am-2:30pm)
- Kroon Hall School of Forestry & Environmental Studies
 - Go to the third floor for desks and windows
- CSSI (Center for Science and Social Science Information)
 - Located at the basement of KBT
 - Large computer lab and library (double screens, Matlab/Solidworks/R installed on most computers)
 - Open until 11pm (Monday through Thursday)
 - Study space with limited computers open 24/7
- Divinity School Library
 - Way up science hill—take the Blue (going up)/Red (coming down) line shuttle if needed
 - Beautiful, peaceful library with lots of light (Recommend: The Day Reading Room)
 - Your lunch swipe works in the Divinity School Refectory
- Rosencrantz Hall Political Science building
 - Across the street from the new colleges
 - Lots of light, couches, tables
 - Multiple floors to study at with a computer room in the basement
- CEID (Center for Engineering, Innovation, and Design)
 - Located between SSS and Watson Hall
 - Rooms with whiteboard walls available upstairs as well
 - A lot less popular in the mornings on weekends (can get really crowded during exam seasons)
 - group study, computers with technical programs installed
 - Get membership for 24/7 swipe access here: <http://ceid.yale.edu/member/#membership>
- Watson Hall
 - CS Department building across from Grove Cemetery
 - Has study space on 2nd floor

Hillhouse Ave

- Watson Center
 - Across the skating rink on Sachem Street
 - Classrooms and study spaces throughout
- 17 Hillhouse
 - 1st floor computer labs, printers, and whiteboard walls
 - Study spaces and whiteboards on upper levels as well
- Dunham Lab
 - Has computer lab on first floor with technical programs installed
 - Classrooms and whiteboards throughout

- Mason Lab
 - Common room (1st floor right inside entrance)

On Old Campus

- Phelps Hall
 - Located on the left as you walk through Phelps Gate into Old Campus
 - Classrooms with bright lighting and white boards
- LC (Linsly-Chittenden Hall)
 - Located across from Connecticut Hall on Old Campus
 - Classrooms and seminar rooms throughout
 - Top floors tend to be the most empty

Libraries

- Sterling Library Link to Study Spaces (Reservation Links included): <http://web.library.yale.edu/places/to-study>
- *Would highly recommend signing up for the Sterling Library Tours (emails sent out for sign-ups during the fall semester) which teaches you about library resources, such as your personal librarian, how to find books yourself with a call number, and how the Yale library system is organized*

Link has all the different available locations but some recommendations for locations more commonly used by undergraduate students:

- Bass Library
 - Located on Cross Campus underground
 - Can reserve rooms on the lower level for group study/meeting
- Sterling Library
 - Located on Cross Campus; big center building
 - Linonia and Brothers reading room (through main doors and take a right after you pass security; more comfortable atmosphere than the more popular Starr Reference Room)
 - Stacks (straight through the main doors and up the elevator to any floor; has individual desks along the walls)

Coffee Shops

- Jojo's
 - Located on the corner of Park and Chapel
 - Great coffee and food (and they give free food to the homeless, so supporting them is good!)
 - Relatively quiet
 - Limited tables and seating
- Koffee?
 - Located off Whitney on Audubon Street
 - Good coffee, hipster ambience, comfy seating
- Blue State Coffee
 - Has two locations: Wall Street and York Street
 - Wall St is closest Very standard coffee shop feel, lots of table
- Book Trader
 - Located at Chapel and York Street
 - Great coffee, lots of tables, outdoor seating
- Willoughby's
 - Has two locations: behind TD (Timothy Dwight College) on the corner of Church and Grove or across from JE (Jonathan Edwards College) on York Street
 - Good iced coffee and tea
 - Lots of tables
- Starbucks
 - Located on College Street across from Old Campus
 - The normal Starbucks atmosphere
 - Often crowded and busy
 - Good energy booster if you are having trouble staying awake; a bit distracting if you are trying to focus

Advice for Pre-Meds

Going to medical school to become a physician is a big decision to make, so make sure you know what you are in for. Besides four years at Yale, there are four years of medical school, four to seven years of medical residency in a speciality, one to two years of fellowship, and THEN you get to practice medicine. That's a long road. Make sure it's really what YOU want to do. I recommend that you volunteer for at least one year in a hospital to get hands-on experience taking care of patients, and make sure you like doing this before committing to a career in medicine.

Yale undergrads do very, very well when it comes to applying to and getting into medical schools, with almost 90% getting into a US medical school. Compare this with the ~45% national average. This high acceptance rate is unrelated to a student's major. For example, our English majors do as well as our MB&B majors in terms of medical school acceptances. I'm not saying that all of you will get into Yale Med or Harvard Med, but getting into any US medical school means that you will receive solid training in basic science/clinical medicine to become a good doctor. Remember, the secret is that for your future medical career success, **the quality of your residency program is more important than the medical school you attended**. So, don't stress out about getting into medical school! Do the best you can in your classes, volunteer in a hospital, and you'll have a very good chance of becoming a doctor after you graduate from Yale.

To get into medical school, you must take classes that satisfy the pre-med requirement. Yale does not have a "pre-med major". To help you think about when/what you should take, I've listed a typical pre-med curriculum below. Disclaimer: I sit on the MD/PhD committee at Yale Medical School so I am familiar with what Yale Medical School requires, but the specific class requirements sometimes vary from state to state. Below are **my recommendations only**, not the final word, but it applies to most med schools in the US.

You will need to decide by the end of sophomore year whether you want to go directly into med school after graduation from Yale, or whether you want to take a year or more off (a gap year). If you don't take a gap year, you must finish all your pre-med requirements by the end of junior year. Most undergrads now take a gap year after graduation before applying to medical school. It is much less stressful if you finish the medical school requirements over a 4-year period instead of 3. Post-baccalaureates (post-bacs) use their gap year(s) to finish a research project or to participate in clinical research. Medical school admission committees really like students with gap year experience. My suggestion is that you seriously consider taking one or two years off after graduating from Yale to do something interesting before applying to medical school.

The Office of Career Strategy, <https://ocs.yale.edu/>, is the place to get started if you are considering medical school. This link, <https://ocs.yale.edu/channels/health-professions/> will help you begin your medical school application process. Make an appointment to speak with the wonderful OCS health professionals during the beginning of your sophomore year, when you are sure medical school is for you. While OCS professionals

are terrific at giving great advice, they are busy working with current juniors so don't be surprised if they do not get back to you immediately. Look out for my career talks on, "*Things to consider for medical and graduate schools*", on the Science & QR website, if you need additional information.

My recommendations when to take specific pre-req classes for med school:

*This applies to any major at Yale.

If you do not want to take a gap year:

First-year:

General Chemistry (Chem 161+165 or 163+167)

Gen Chem Lab (Chem 134L+136L)

If you place into Freshmen Organic Chem: (Chem 174 and/or Chem 175); see notes A

Organic Chem Lab (Chem 222L and/or 223L); see notes A

Math 112, 115, 116 or 120 (depending on your preparation and major requirements)

English 114

First-year seminar, CURE class or take a bio lab course (see p. 10 for more info).

Summer: Do research at Yale and start volunteering at a hospital/patient care facility.

Notes A: If you are choosing between taking either general chem or the intro bio sequence during your first-year, my recommendation is to start general chemistry first. The chemistry sequence has to be taken in order (general chemistry, organic chemistry, biochemistry) and if you don't start taking it during your first-year, you will either have to take a chemistry class in the summer or during your senior year (which means you will have to take a gap year).

Math is tricky - you need a year of calculus for med school, but most (not all - check your favorite schools) med schools will consider that you've fulfilled your math requirement if you received a 5 in BC calculus in HS. If you didn't take BC in HS, or took AB instead, you might need to take at least one semester of calculus at Yale. Talk to Kristin McJunkins in Office of Career Strategy to make sure.

Most med schools now require only ONE semester of organic chemistry plus ONE semester of organic chem lab (although many medical schools in Texas still require 1 year of orgo plus one year orgo lab). Check the specific requirements of your favorite schools to make sure. If you love orgo, take the full year.

Sophomore year:

Organic Chemistry 220 (1 semester)

Organic Chemistry Lab 222L (1 semester)

[or 1 semester of Biochemistry MBB 300 or MCDB 300]

Bio 101, 102, 103, 104

Intro Psychology course (1 semester)

Intro Statistics course (1 semester)

A second English course or a course that will give you a WR credit

Summer: Do research at Yale or at another institution. Start volunteering in a hospital if you haven't started already. Or finish that language requirement in a foreign country.

Junior year:

Biochemistry MBB300 or MCDB 300 (1 semester)

Physics 170,180 or 200 + lab (2 semesters lecture and 2 semesters lab)

Independent Research for credit (if your major allows for this)

Study for MCATS (shoot for a score of 515 or better)

Summer: Apply to med schools: make sure you apply as early as possible

Notes B: If you didn't do any independent research in the biological sciences, you will need to take 2 semesters of biology lab courses - this requirement varies among med schools.

I DO NOT recommend most students doing research during their sophomore **academic** year. It's too much stress to do both research and academics well at this time, my office can't fund you, and you can't get course credit. Save independent research for the summer. You will be glad you did.

Senior year:

Plan accordingly for medical school interviews.

If you are planning to take a gap year:

Freshman year:

General Chemistry (Chem 161+165 or 163+167)

Gen Chem Lab (Chem 134L+136L)

If you place into Freshmen Organic Chem: (Chem 174 and/or Chem 175); see notes A

Organic Chem Lab (Chem 222L and/or 223L); see notes A

Math 112, 115, 116 or 120 (depending on your preparation and major requirements)

English 114

First-year seminar, CURE class or take a bio lab course (see p. 10 for more info).

Summer: Do research at Yale and start volunteering at a hospital/patient care facility.

See **Notes A** above.

Sophomore year:

Organic Chemistry 220 (1 semester)

Organic Chemistry Lab 222L (1 semester)

[or 1 semester of Biochemistry MBB 300 or MCDB 300]

Bio 101, 102, 103, 104

A second English course or a course that will give you a WR credit
Finish math requirement

Summer: Research at Yale or at another institution. Start volunteering if you haven't started already.

Junior year:

Biochemistry MBB300 or MCDB 300 (1 semester)
Intro Psychology course (1 semester)
Independent Research for credit (if your major allows for this)

Summer: Continue doing research and volunteering.

Senior year:

Physics 170,180 or 200 + labs (2 semesters each)
Intro Statistics course (1 semester)
Independent Research for credit course

Study for MCATS (shoot for a 515 or better) and apply to med schools.

See Notes B above

One year after graduating from Yale: Med school interviews

Additional things to consider

While good grades and a good MCATS score are important, medical schools are also looking for students with extensive clinical volunteering activities, demonstrated community service commitments and leadership qualities. Below are just a few of the programs that you might want to explore and possibly get involved in. Please note that these are only a sampling of the vast array of opportunities available at Yale and New Haven. While these programs have all received high marks from my students who participated in them, it is important for you to make sure they are right for you.

For physician shadowing:

<https://yalemedicalprofessionsoutreach.wordpress.com/home/>

Clinical volunteering opportunities:

Elder Horizons:

<https://www.ynhh.org/about/research-education/elder-horizons-program.aspx>

Haven Free Clinic:

<https://www.havenfreeclinic.com/>

Yale New Haven Hospital Volunteering:
<https://www.ynhh.org/about/community/volunteers.aspx>

Service work:

The Dwight Hall <https://dwithhall.org/> link is great site to explore the numerous service programs for you to get involved in.

Teach at Yale splash-sprout: <https://yale.learningu.org/>

Advice for Students Interested in Pursuing a PhD Degree

Getting a PhD means a career in science. You can go the academic route and climb that tenure ladder, or work as a scientist in industry. In any case, getting a graduate degree makes you much more marketable than working in a job right after you graduate from Yale. The last statement generally does not apply to engineering majors or computer science majors, where getting a Masters or a PhD is not usually as important as it is for those in the biological or physical sciences. The Office of Career Strategy, <https://ocs.yale.edu/>, is the place to get started if you are considering graduate school. For a typical PhD track, it's five years in a PhD program, followed by four years as a postgraduate doctorate (a postdoc) before you apply for an academic position. Doing a postdoc might not be as important if you are going into industry. STEM PhD programs are tuition-free and you get a stipend of ~\$30,000 a year to live on. Getting paid to do science is great, if you love doing it!

All Yale STEM departments do a great job preparing their majors academically to succeed in graduate school. In general, undergrads should do the BS track, and take the hardest classes offered by that major. Below are some of the things I look for when I look at applications for Yale's PhD graduate program in the biological sciences.

How good are the letters of recommendation from the research mentor(s)? This is the first thing I look at. An outstanding mentor's letter is essential to getting into a top grad school. Make sure you know your mentor well, both on a scientific and a personal level. Talk to your mentor about his/her career as a scientist, and why you want to go that route.

How much independent research did the candidate accomplish? Going into grad school means that you must love doing research for many years. It helps if you have done significant bench work as an undergraduate, demonstrate that you truly love science and are good at it. So, get into a lab the summer after your first-year and every summer after that, and do research for credit during your junior and senior academic years.

Did the candidate publish? It helps tremendously if you can get an authorship on a publication before you apply to grad school. It often pays to do a "postbac" in your lab after graduating from Yale to get that publication. Talk to your research mentor about this opportunity a year before you need the position.

Good grades do matter. A lot of students assume that grades don't matter as much for getting into grad school vs. med school. While there's some truth to that, good grades are still important to get into the very best graduate schools. Do the best you can, especially in your STEM classes. The same goes for the Graduate Record Examination (GRE), but Yale students shouldn't have any problems doing well on it.

Could the candidate describe his/her research in detail? Here's where the interview's important. I've faced plenty of applicants who look great on paper but can't talk about their research, or only have a superficial grasp of what it is that they tried to accomplish. Don't be that person. You need to know your research inside and out.

Advice for Students Interested in the MD/PhD Program

For those of you interested in combining basic science research interests with medicine, then the MD/PhD combined degree program that trains physician-scientists is for you. This is what I did after graduating from Yale. This is typically a seven-year program; two years of medical school followed by four years of PhD, with a final year of clerkships. Then you do a residency (four to seven years) followed by (or concurrently) with a postdoc (four years). This is a long journey; I was 36 before I landed my first real job as an Assistant Professor. But the MD/PhD program is extremely rewarding if you like doing medically relevant research and apply it to the bedside. In addition, it's free: medical school tuition is waived, and you get paid a ~\$30,000 stipend during your PhD years, just like any STEM graduate student. MD/PhD physician-scientists typically do 80% research and 20% clinical activities. Using myself as an example, I run a basic science cancer research lab and sign out clinical chemistry cases 1 week out of every month. You are expected to obtain independent grant funding to support your research, and mentor graduate and medical students.

Please visit this link to see the latest outcome survey for those enrolled in a MD/PhD program, <https://store.aamc.org/national-md-phd-program-outcomes-study.html>

The National Institute of Health (NIH) funds the Medical Scientists Training Program (MSTP), but almost all medical schools also have their own funding to support additional MD/PhD students. Examine this link for more information about the MSTP, <https://www.nigms.nih.gov/Training/InstPredoc/Pages/PredocOverview-MSTP.aspx>.

Note: If you are a student supported by the MSTP and after your MD/PhD training decide NOT to do academic research but to go into private practice, you will have to pay back to the federal government the tuition and stipend that supported your educational training. Remember, this program is to train future ACADEMIC physician-scientists, not private practice physicians.

To get into a MD/PhD program, you need to do everything I outlined in the pre-med and graduate school sections. Yale undergrads highly competitive for this program are usually STEM majors with intensive research experiences. Grades matter, and undergraduate publications are a definite plus. Come and talk to me if you are interested in this challenging yet rewarding program.

Advice for students interested in Computer Science

(contributed by Jeffrey Zhou '21, BS in CS and MBB)

Programming Courses (no CS background)

Don't be afraid to major in computer science, even if you have no programming experience! A lot of other students have been in the same boat and were just as successful as their peers. Yale offers two introductory programming courses: CPSC 100 (commonly known as CS50) <https://cs50.yale.edu/2021/fall/> in the fall, and [CPSC 112](#) in the spring. These courses also provide an introductory survey of broader computer science concepts, such as data structures and algorithms. If you're planning on majoring in computer science, CS50 may be better, as it not only gives you earlier exposure to programming, but also focuses primarily on C and Python as programming languages; C is used in the other core computer science courses, while Python is used frequently in industry.

If you do choose to take CS50 in the fall, you can take an additional core computer science class in the spring. The first core programming course is CPSC 201, which focuses heavily on fundamentals such as recursion. Some students who feel confident after taking CS50 choose to skip CPSC 201 and instead take CPSC 223, although this is not recommended; you will still need to take an additional course to replace CPSC 201 in the future.

Programming Courses (CS background)

Most students who come to Yale with prior programming experience choose to take CPSC 201, which will help solidify some fundamental programming concepts. Rarely, exceptionally well-prepared students will begin with CPSC 223 as their first programming course, or even more rarely with CPSC 323. If you have an extensive background in computer science, shop these courses and talk with the instructors to decide which is most appropriate for you.

Theoretical Courses

There are two tracks for fulfilling the theoretical computer science requirements. Each consists of a fall semester course mathematical tools relevant to computer science, and a spring semester course on the design and analysis of algorithms. CPSC 202/CPSC 365 is the easier of the two sequences, and the one that the majority of computer science majors take. CPSC 202 requires no calculus or programming experience (although it is definitely helpful to see how the math concepts can be applied), so it can be taken first year fall. However, it requires a different kind of thinking from typical math courses that most students have taken. CPSC 365 requires a more holistic understanding of computer science and has CPSC 223 as a prerequisite, so most students will wait until their sophomore or junior year to take this course.

MATH 244/CPSC 366 is a more advanced sequence, for students that are significantly more comfortable with or interested in the material. I would personally recommend this class if you have a fair of experience with contest math (particularly proof writing), as that is similar to what you'll be doing in either track.

Applying for tech internships

Start preparing early!

A lot of tech companies recruit very early; most will open applications for summer internships by the fall of the preceding year. Furthermore, a lot of internship positions are hired on a rolling basis, so it's in your best interest to apply as early as possible. The recruiting process for an individual company may also take quite a few weeks and depend on the company's schedule, so applying early can help ensure that your timeline is more flexible.

Utilize the Yale Office of Career Strategy ([OCS](#))

OCS has a lot of useful resources if you're planning on working in technology over the summer, such as resume workshops, career fairs, and networking events. Before applying to any company, it is important to have a focused and polished resume, and OCS offers both resume templates and one-on-one meetings in order to ensure that your resume is in good shape. [Career fairs](#) and networking events are extremely helpful for directly meeting recruiters from particular companies and getting your foot in the door.

Practice for coding interviews

Make sure you practice for coding interviews. Coding interviews usually come after an initial screening interview and consists of a couple of short questions in which you are asked to devise and implement an algorithm. Although this may be similar to what you've done in classes, it is important to practice in a timed environment, while talking through your thought process; that's what will be expected during the interview! It can be helpful to go through this process with a friend, with one person acting as the interviewer and one as the interviewee. A tried and true resource for preparing for coding interviews is [Cracking the Coding Interview](#), by Gayle Laakmann McDowell, which contains a plethora of practice problems as well as general strategies for how to approach these types of problems.

Strategies for Success

Talk to Upperclassmen

Many upperclassmen have been in the same position and felt the same way as you before, so don't hesitate to approach them for advice. This is a great way to learn more about anything and everything, including class recommendations, summer opportunities, and extracurricular activities. If you don't know any upperclassmen well enough, reach out to the Departmental Student Advisory Committee ([DSAC](#)); you can sign up for a coffee chat with one of their members, all of whom are extremely knowledgeable about the department. Students offer a different perspective on things compared to professors, so reach out and ask to grab a meal!

Go to Office Hours

Office hours are invaluable for computer science classes at Yale, whether you need to clarify an important concept, get help beginning with a problem set, or simply checking that you're on the right track. They are particularly helpful in introductory classes, many

of which have large teams of staff ready to assist you. Try your best to go as early as possible – you don't want to be part of the frantic mob that inevitably appears the night before each problem set is due, for both the staff's sake as well as your own.

Work with Friends

Try to work with friends when you're completing a problem set or studying for an exam. Computer science is all about teamwork – having someone to talk things through with will make things easier and more fun. However, be mindful of each course's collaboration policy. Many follow Professor Eisenstat's Gilligan's Island rule: "When discussing an assignment with anyone other than the teaching staff, you may write on a board or a piece of paper, but you may not take any written or electronic record away from the discussion. Moreover, you must engage in a mind-numbing activity (e.g., watching an episode of Gilligan's Island) before you work on the assignment again." Finding people you enjoy working with will not only make your journey through the program much more enjoyable, but also prepare you for the collaborative mentality present in both academia and industry.

STEM Major Roadmaps

The Yale College Deans Office, in consultation with the Directors of Undergraduate Studies, has undertaken a project designed to help students compare majors and navigate their ways through them. They have created a series of very useful “roadmaps”, <https://registrar.yale.edu/students/major-roadmaps>, or visual representations, guiding students through various majors. Many majors offer multiple paths, and the maps are designed to facilitate comparison. The roadmaps and typical course sequences are visually uniform so that students may easily compare one major with another at a glance. As a faculty advisor, I use them frequently.

Please use the link above for updated roadmaps for most of STEM majors at Yale.