**Advice and Guidelines for TU Pre-Medical Students** Revised 10-4-18

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These guidelines have been prepared for students as a supplement to regular faculty advising and information provided by the Pre-Medical/Pre-Dental Committee. Many additional questions can be answered by following the links at <https://www.towson.edu/fcsm/departments/preprofessional/medicaldental/>

A useful website for aspiring physicians is that of the Association of American Colleges (AAMC), <https://students-residents.aamc.org>. There one can find valuable information addressing every phase of planning and preparing for a career in medicine. The “**Choosing the Medical Career**” portion of the AAMC site, <https://students-residents.aamc.org/choosing-medical-career/medical-careers/aspiring-docs/>, is directed towards the premed student, and includes multiple “Aspiring Doc Fact Sheets.” Under the “Applying to Medical School” tab, there are more resources about the application process, choosing your prospective medical schools, how to prepare for the Medical School Admissions Test (MCAT), and how to become the strongest candidate that you can be. **“The Anatomy of an Applicant”** section of the AAMC site, <https://students-residents.aamc.org/applying-medical-school/preparing-med-school/anatomy-applicant/>, lays out the 15 core competencies that allopathic (see below) medical schools are looking for in a successful applicant. It also provides a downloadable guide encouraging students to assess their own readiness for medical school and establish a plan to become a more competitive candidate. There are also stories of real pre-med students and how they demonstrated these 15 core competencies. TU students should intermittently remind themselves of the attributes and experiences that medical schools are seeking while on the pre-med pathway.

**MEDICAL DEGREES AND EDUCATION PROGRAMS:**

Individuals wanting to become doctors pursue one of two degrees, a Doctor of Medicine (M.D.) from an **allopathic medical school** or a Doctor of Osteopathy (D.O.) from an **osteopathic medical school**. A comparison of the education required for each of these degrees can be found at <https://en.wikipedia.org/wiki/Comparison_of_MD_and_DO_in_the_United_States>

Osteopathic medicine has traditionally been associated with a more holistic approach to medicine, focusing on disease prevention and wellness, while minimizing use of prescription drugs. D.O.s have an additional, non-invasive, non-pharmacological, treatment and diagnosis tool called **osteopathic manipulative medicine (OMM).** For more information, see the articles and videos on this page <http://www.aacom.org/become-a-doctor/about-om#aboutom>, produced by the American Association of Colleges of Osteopathic Medicine. D.O.s can prescribe medications, and certainly will do so, but they try to avoid pharmacological interventions if either a change in lifestyle or a manual manipulation can provide the same relief.

Other than learning the osteopathic manipulative medicine tool, the medical training for an osteopathic degree is now virtually indistinguishable from allopathic training that leads to the M.D. degree. M.D.s and D.O.s can complete the same residencies in all specialties, are licensed in all states, and have rights and responsibilities that are identical in the United States. Osteopathic physicians often choose primary care and often choose to work in rural and underserved areas, but they can specialize and work in any environment or specialty.

**MEDICAL SCHOOL REFERENCE BOOKS/ONLINE RESOURCES**

The best source of information about individual medical schools can be found in the following:

* The **Medical School Admissions Requirements** **(MSAR)** book is updated every spring and should be purchased when deciding which allopathic schools to apply to. It costs $20 for either the print or e-book. The online version, which is searchable, costs $28 for a 1-year subscription. This book contains a plethora of information about each allopathic medical school in the U.S. and Canada, including typical metrics of accepted students (GPA and MCAT average and ranges), demographics, curriculum, mission statements, and required/recommended coursework. <https://students-residents.aamc.org/applying-medical-school/applying-medical-school-process/deciding-where-apply/medical-school-admission-requirements/>
* The **Osteopathic Medical College Information Book (CIB)** is a similar resource listing a great deal of information about osteopathic education in general and each school specifically. This book is updated yearly and available as hard copy for $15. You can buy it here: <http://www.aacom.org/news-and-events/publications/2018-cib>.

**TYPES OF PHYSICIAN (ALL CAN BE EITHER M.D. OR D.O.):**

* **Primary Care Physicians (General practitioners)** are broadly trained, treat the most common health problems, and refer patients to specialists when necessary. Following medical school, these physicians do residencies lasting about 3 years.
	+ **Family practitioner –** most broadly trained as they can treat children or adults; much of the focus is on outpatient experience
	+ **Internist –** focused on adults; spends more time in hospital environment while training
	+ **Pediatrician –** practice limited to children; deals with disease, growth, and development
	+ **Geriatrician –** focus on older adults and their medical/social needs
	+ **Obstetrician/gynecologist –** focus on female reproductive health, pregnancy, and childbirth; sometimes for primary care, too
* **Specialists/Subspecialists:** concentrate on specific types of disease or problems with specific tissues or organs. Examples include cardiology, oncology, neurology, and nephrology. Following medical school, these physicians do residencies that last from 3-7 years. For a more complete list of specialties, see [https://en.wikipedia.org/wiki/Specialty\_(medicine)](https://en.wikipedia.org/wiki/Specialty_%28medicine%29).

**WHAT ARE MEDICAL SCHOOLS LOOKING FOR IN AN APPLICANT?**

Medical schools are no longer just concerned with an applicant’s metrics (GPA/MCAT), but rather are evaluating students in a more **holistic manner**, considering other attributes that applicants bring to the table. They want the most qualified and competent individuals, while also making sure they have substantial diversity in each class. For more information, see: <https://students-residents.aamc.org/choosing-medical-career/article/holistic-review-medical-school-admissions/>

**AAMC’s Core Competencies** – The AAMC lists 15 traits/skills, grouped into 4 categories, that medical schools are looking for in students entering medical school (see below). Examples of how applicants can demonstrate these competencies in their medical school application can be found here: <https://students-residents.aamc.org/applying-medical-school/preparing-med-school/anatomy-applicant/>

* Interpersonal
	+ Service orientation
	+ Social skills
	+ Cultural competence
	+ Teamwork
	+ Oral communication
* Intrapersonal
	+ Ethical responsibility to self and others
	+ Reliability and dependability
	+ Resilience and adaptability
	+ Capacity for improvement
* Thinking and Reasoning
	+ Critical thinking
	+ Quantitative reasoning
	+ Scientific inquiry
	+ Written communication
* Scientific
	+ Understanding Living Systems
	+ Understanding Human Behavior

***Students should consider the factors that medical schools consider in the holistic review, including the core competencies, as they progress through their pre-med years to become the strongest applicant they can be.***

**TIMELINE FROM PRE-MEDICAL UNDERGRAD TO PRACTICING PHYSICIAN**

**Pre-medical Student: Complete a Bachelor’s degree, taking courses required by medical schools**

**Freshman year**

* + Tell your academic major advisor that you’re interested in medicine
	+ Attend a Pre-Med Orientation meeting, offered twice, early in each semester. Attendance is required before requesting any individual advising appointments with Dr. Martin.
	+ Sign up for the email/contact list by following the link below. If the link doesn’t work, just email premed.predent@towson.edu and ask to be sent the link. You need to be signed up for this list to be considered a participant in the Pre-med/Pre-dent Advising Program. Some critical information will be emailed, but to avoid overflowing your inboxes, most of the information of interest will be posted on the Blackboard Community Site (see below). <https://forms.office.com/Pages/ResponsePage.aspx?id=knP5y_ZJ3Umophn3EO_MNUJ58CsXE3VJmxPKgCS19hNUQzQ2OUpRUVJWVDZOSDAwVEdTTjJQTlRBMC4u>
	+ Sign up for the Blackboard community site to be aware of events and opportunities occurring on and off campus.

**Sign up for the Blackboard Community site by doing the following**:

1. Click on the Community tab on the upper right side of Blackboard home page.

2. In Organization Search box, enter “TU Pre-med” OR enter "TU predental". Pre-dents can sign up for both if they are interested in general volunteering at hospitals, post-baccalaureate (post-bacc) or graduate programs.

3. Click on drop-down arrow to right of the name

4. Click on Enroll.

* + Join the student-run organizations, the Pre-med club and/or MAPS (Minority Association of Pre-med Students). Meet other pre-meds, exchange ideas and suggestions for physicians to shadow, courses to take, etc.
	+ Attend all Pre-Medical/Pre-dental Advising Program-sponsored meetings and events. Every speaker at these meetings will impart critical advice and could be another important contact.
	+ Seek academic resources as needed: professor’s office hours, the Tutoring and Learning Center, offering tutoring and workshops <https://www.towson.edu/tutoring-learning/>, the 538 Smith Hall Science Chemistry Tutoring center, the Writing Center <https://www.towson.edu/cla/centers/writing/>, the career center <https://www.towson.edu/careercenter/> .
	+ Attend classes, sit in front of class, participate in class, get to know your professors (attend office hours when needed).
	+ Ask for help early on. You will ALMOST CERTAINLY need to establish new and better study habits to excel in college. Keep up with the assignments and don’t procrastinate studying until the night before the exam.
		- You **must** keep your GPA up. Do not overload your schedule. Try to avoid withdrawing from classes, but withdrawing is better than getting a D or F. Try not to have more than 1-2 withdraws during your ENTIRE college career.
	+ Be sure to have completed at least Biology 200/L and Chemistry 131/L class.
	+ Join other clubs that suit your interests, considering leadership opportunities.
	+ If you have time and you’re doing well in your classes, consider volunteering at GBMC or St. Joseph’s Medical Center (see below)
	+ During winter break and summer break, try to find physicians to shadow to begin getting exposure to the profession.
	+ **Keep a spreadsheet of volunteer and shadowing hours and the contact person(s) associated with each**.
	+ **Keep a journal of interesting experiences,** procedures you observed, patient-doctor conversations and interactions that seemed meaningful. (These notes will help with your eventual preparation of a personal statement)
* **Sophomore Year**
	+ **MORE OF THE SAME\* from freshman year**
		- Continue taking pre-med prerequisite classes, doing well and establishing relationships with your professors.
		- Continue to attend program meetings and events, as well as club meetings.
		- Gain shadowing experience when you can – keep notes and records.
		- Volunteer when possible.
	+ Hopefully by now you will have better study habits and time management skills. Be sure to add some clinical volunteering or community service into your schedule. (Note that clinical volunteering and shadowing help you learn about the profession, while community service demonstrates your desire to help others.)
	+ Most medical school applicants have some research experience, but no professor is eager to have a student in their lab who is just interested in checking off the research box. If you are interested in doing research, find faculty members that are doing research that interests you by reading over the descriptions of faculty research posted on the departmental websites.

If a project seems interesting, schedule an appointment to discuss the possibility of working with that faculty member. Often you will need to spend several semesters doing research to complete a project.

* + Over winter break, start to research and try to arrange for summer research internships or clinical experience programs, such as Summer Health Professions Education Program (SHPEP) (<http://www.shpep.org>) or the NIH Summer Internship Program in Biomedical Sciences (SIP) (<https://www.training.nih.gov/programs/sip>).
* **Junior Year**
	+ **MORE OF THE SAME\* from sophomore year** if you are planning on applying to medical school following your senior year.
	+ If you are trying to apply to med school between your junior and senior year (this is uncommon; see below), you need to have taken Biochemistry and other classes covered by the MCAT by Fall of your Junior Year (see sample plans of study below). If you have, then…
		- Start studying for the MCAT, so you can take it in late spring or early summer.
		- Request letters of recommendation; send to the Pre-Medical/Pre-Dental Committee
		- Go through committee interview process in Spring (see below).
		- Apply to medical school in June, July, or August (the earlier the better).
		- Complete secondary applications during the summer and fall.
		- Hopefully interview with schools during the fall and winter.

If you will wait to apply to med school until the summer after your senior year, which is most common, see next section.

* **Senior year**
	+ **MORE OF THE SAME\* from junior year**
	+ If you’ve been shadowing and volunteering for a while, you might have been offered a position as a medical scribe or assistant. This is great, because you can often continue at this sort of position through a gap year until you attend medical school.
	+ If you will apply to med school in the summer after your senior year (which is most common for TU students), by the end of the fall semester you need to have taken Biochemistry and other classes that will help you prepare for the MCAT (see sample plans of study below). Also…
		- Start studying for the MCAT so you can take it in late spring or early summer.
		- Go through committee interview process in Spring to get committee letter.
		- Apply to medical school in June, July, or August (the earlier the better).
		- Complete secondary applications during the summer and fall.
		- Hopefully interview with schools during the fall and winter.

**Note that \*MORE OF THE SAME\*** means that medical schools want see **continuity** in the pursuit of a goal, rather than simple “box-checking” where students only work to meet the minimum requirements. Students should be gaining clinical experiences, shadowing physicians, and volunteering (either clinically-related or non-clinically-related) as often as possible, throughout their college career (**because it demonstrates true passion for learning about the field and helping others**). The same is true for club participation and seeking out leadership opportunities. You need to keep your GPA high and need to keep nurturing relationships with your professors. The better they know you, the more they can write about your skills and motivations in their recommendation letters.

**Medical School - typically requires 4 years**

**Students will typically spend four years in medical school, being awarded an M.D. or D.O. degree upon successful completion.** As research about student learning styles, critical thinking skills, and patient-centric care has increased over the years, medical school curricula have adapted and changed to become less focused on memorizing enormous amounts of materials and more focused on honing problem-solving and communication skills. There is and will always be a huge amount of material for students to digest, but the delivery system for this material now varies in its presentation. **It is very important that you check the MSAR or Osteopathic CIB (see above) to read about the curriculum taught by each school to which you will apply; the delivery of material and clinical engagement will vary considerably from school to school.**

The “classic” curriculum, still presented at some allopathic schools, consists of spending the first two years of medical school studying the basic sciences, with most of the work focused in the classroom, with some clinical orientation. The last two years involve several different clinical rotations, gaining hands-on experience and exposure to clinical care in primary care fields, as well as in elective specialties. The level of responsibility increases with exposure to clinical care.

More schools, allopathic and osteopathic, are transitioning to teach a more integrated “organ system based” approach in which the basic science and the associated clinical applications/skills are taught in a unit. This allows students to apply their knowledge of the basic science to the clinic more directly, and gives students more hands-on patient contact earlier in their medical education. Some of these schools are also incorporating some small-group, case-based, problem solving, as described below.

The most striking curriculum change is the use of small-group, cased-based, problem-solving approach to learning each organ system. Some allopathic and osteopathic schools have cohorts of students that are using this approach almost exclusively, avoiding lecture-based learning of basic sciences. The group of students will be presented with a challenging patient, exhibiting certain symptoms and laboratory/scan results. The students will then research the basic science of that organ system to understand the meaning of the lab/scan results, consider the possible pathology causing abnormal values/images, and plan for the best treatment of this patient. When applying to medical schools, you should consider programs that best suit your learning style and interests.

You will earn an M.D. or D.O. upon successful completion, but you can’t practice until you’ve become “licensed” to practice in the U.S. and the state you live in. To become licensed, you must pass licensing exams, which begin during medical school and continue through residency, following medical school. You need at least one year of residency following medical school in order to become licensed to practice medicine.

* **Allopathic** medical schools use the United States Medical Licensing Exam (USMLE), sometimes called the “medical board exam.” This is a three-part test, taken at different points during your medical education.
	+ USMLE Step 1 – often taken after the second year of medical school, based on application of basic sciences to medicine.
	+ USMLE Step 2 – usually taken in your fourth year of medical school, tests your clinical abilities with both a written and practical exam.
	+ USMLE Step 3 – usually taken at the end of your first year of residency, tests your knowledge and ability to practice general medicine unsupervised.
* **Osteopathic** medical schools use a different licensure system, similar to the USMLE, but more specifically geared towards osteopathic approaches and techniques. The test is called the **Comprehensive Osteopathic Medical Licensure Exam (COMLEX)**. Similarly, there are 3 parts, taken around the same time frames as the USMLE for allopathic students. D.O. students are also eligible to take the USMLE. Many D.O. students will take both the USMLE and COMLEX to demonstrate their competitiveness with M.D. students, especially when they seek residencies in more competitive specialties.

**Residency**

Following completion of medical school, students are required to spend one, but usually at least 3 years in a residency before becoming licensed to practice. This is considered to be part of one’s **graduate medical education (GME).** The first year of residency is sometimes referred to as the internship year. Most primary care residencies last three years, while more specialized fields can have residencies lasting up to 7 years.

* **Match Day –** All senior medical students will select and rank their preferences from the available residency positions, considering both the specialty and the offering hospital itself. Residency programs then select students, hence, the “match.” The success of graduates to be chosen by the residency program of their choice is one way to look at the quality of specific medical school educations. Although this information isn’t always easy to find, the MSAR book does list the percentage of students in previous graduating classes pursuing each specialty. Beginning in 2020, there will be a single service that will “match” M.D. and D.O. students with residencies in their field of choice, so M.D. and D.O. students will be competing for the very same residency positions.
* **Board Certification** –Following a certaincourse of residency training (duration depending on specialty or subspecialty), physicians are eligible to become board certified. Board certification is required for physicians to work in some hospitals and programs, but not all.

**Fellowships**

Following residency, some students may elect advanced training in a particular specialty or subspecialty. These positions prepare the physician for either clinical medicine, teaching and practicing medicine, or clinical or basic science research, along with clinical practice.

**minimum COURSEwork RequireD BY MEDICAL SCHOOLS**

Most medical schools *require* applicants to have completed the following coursework within FIVE years of application:

* Two lab-based courses in **Biology**
	+ BIOL 200/200L (or BIOL 201): Intro to Cellular Biology and Genetics
	+ BIOL 202: Introduction to Ecology and Evolution (other options listed below)
		- many schools are now requiring Genetics (BIOL 309) and Cell Biology (BIOL 408)
* Two lab-based courses in **Physics** (may be calculus-based or non-calculus-based)
* PHYS 211: General Physics I AND PHYS 212: General Physics II (Algebra-Based)

OR

* PHYS 241: General Physics I AND PHYS 242: General Physics II (Calculus-Based)

 Algebra-based physics is perfectly acceptable. Phys 241 and 242 require completion of both Calc I and II.

Five (or sometimes four – see note below) courses in **Chemistry\*** (including two courses in general chemistry with lab, one or two courses in organic chemistry with lab, and a course in biochemistry)

* CHEM 131/131L: General Chemistry I lecture and lab
* CHEM 132/132L: General Chemistry II lecture and lab
* CHEM 331: Organic Chemistry I lecture and lab
* CHEM 332: Organic Chemistry II lecture and lab
* CHEM 351: Biochemistry (required by many schools; essential for MCAT preparation)

**Note**: Biochemistry is a critically important class to take before taking the MCAT. At TU, the prerequisites for Biochemistry (Chem 351) are either completion of Chem 331 (Organic Chemistry I) and Chem 332 (Organic Chemistry II) OR completion of Chem 330 (Essentials of Organic Chemistry). Some medical schools only require Organic Chemistry I and Biochemistry. We strongly recommend that students take the 3 semester sequence of classes (Chem 331, 332, 351) rather than the 2 semester sequence (Chem 330, 351), because we are concerned that medical schools will not view Chem 330 as rigorous as Chem 331/332, and it might not prepare you as well as Chem 331/332 does for Chem 351 or the MCAT.

Two courses in English composition

* + ENGL 102: Writing for a Liberal Education OR ENGL 190: Honors Writing Seminar AND
	+ Core 9/Advanced writing: Choose from:
		- ENGL 310: Writing Argument
		- ENGL 313: The Academic Essay
		- ENGL 316: Writing About Literature and
		- **ENGL 317: Writing for Business and Industry**
		- **ENGL 318: Technical and Scientific Writing**

 Although there are other Core 9 classes that you can choose from, we recommend that you take a class offered by the English department, i.e., an “ENGL” course. This makes it easy for medical schools to see that you’ve fulfilled the two composition classes requirement. If you take a Core 9 class offered in a different department (e.g., BIOL 381), you may be asked by the application service to provide evidence that this was a writing intensive course. We usually recommend **English 317 or 318** because these courses teach you practical writing skills that you are likely to use in your future career, whether it is in medicine or working in biotechnology.

* Two courses of “college math.” We recommend students take
	+ MATH 237 Elementary Biostatistics recommended; PSYC 212 Behavioral Statistics acceptable
	+ MATH 115 (College Algebra) or MATH 119 (Pre-Calculus)

But what about calculus? A statistics course along with MATH 115/119 will suffice for most med schools, some schools *do* require a calculus course (currently less than 10% of the >140 medical schools require it; about 25% of the other schools recommend it). Check the requirements of schools to which you think you might apply. If you need calculus, take MATH 211 (Calculus for Applications) OR MATH 273 (Calculus I). However, only take calculus, and especially MATH 273, if you are confident of getting a high grade.

 *Note: Even if your chosen schools do not require calculus, taking it shows that you are challenging yourself with added academic rigor.*

**Required Coursework: A Cautionary Note**

BE AWARE that medical schools vary in their admission requirements. You MUST investigate the requirements of each school to which you might apply. To find school-specific requirements for each U.S. and Canadian medical school use the **Medical School Admission Requirements** (**MSAR®**) for allopathic schools and the **Osteopathic Medical College Information Book (CIB)** forosteopathic medical schools.

When you look at the course requirement in the MSAR, you may notice that some schools do not list courses as required, but rather just recommended. This is because some medical schools are now transitioning to “competency-based” admissions, which means that while they may not require that students take specific undergraduate courses, they will expect that students demonstrate a “competency” in several different areas, including biology, chemistry, and physics. The evidence may be traditional coursework, online coursework, or even substituting laboratory work for a course. This is an initiative being added to the holistic review process, with the hope that it can help remove barriers and increase diversity in the medical profession. For more information about competency-based admissions, see any of the websites from 4 schools currently employing this process: Albert Einstein School of Medicine [**https://www.einstein.yu.edu/education/md-program/admissions/application-procedure/course-requirements.aspx**](https://www.einstein.yu.edu/education/md-program/admissions/application-procedure/course-requirements.aspx)**,** Pritzker School of Medicine at the University of Chicago [**https://pritzker.uchicago.edu/page/entrance-requirements**](https://pritzker.uchicago.edu/page/entrance-requirements)**,** Perelman School of Medicine at the University of Pennsylvania [**https://www.med.upenn.edu/admissions/admissions.html**](https://www.med.upenn.edu/admissions/admissions.html)**,** and David Geffen School of Medicine at the University of California Los Angeles [**https://medschool.ucla.edu/apply-competencies**](https://medschool.ucla.edu/apply-competencies)**.**

**CHOICE OF A MAJOR FOR PRE-MEDICAL STUDENTS**

Note that a Bachelor’s degree in one of the sciences is not necessary for entry into medical school. In fact, about 35% of medical school students have non-science undergraduate degrees. But that means that 65% major in the sciences, typically Biology or Chemistry. One major advantage to this is that there is greater overlap in the courses required as pre-med prerequisites and those required for the major. This limits the number of “extra” classes that you’ll need to take beyond those required for your major. Any “extra” classes a Biology or Chemistry major takes are usually those recommend for medical school or MCAT preparation. Also, a science curriculum demonstrates to the med schools that you can handle the level of rigor with a science-heavy course load, which students again face in medical school.

Choosing a different major, but still completing your premed prerequisites, may make your application “more interesting” to medical schools provided that you still do VERY well in your science classes. Your GPA will be calculated several different ways, but the science GPA (in the BCPM courses – Biology, Chemistry, Physics, Math) will be critical to your acceptance to medical school. If you major in History and have a 4.0 in all non-sciences classes, but a BCPM GPA of 3.0, you will not be considered a strong candidate for med school. SO, if you choose a non-science major, be sure to do so because you are fulfilling a passion (and possibly setting yourself up for an alternative career in case you don’t get into medical school). DO NOT choose another major to avoid taking hard science classes. Also, be sure to take science classes during the regular semester, as part of a full load of classes, instead of taking them one or two at a time, say in the summer. Medical schools need to know you can handle a challenging course load.

Because most pre-medical students major in Biology, below we discuss how a biology major can best plan their college career to complete their pre-med prerequisites and prepare for the MCAT.

**CHOICE OF A CONCENTRATION FOR PRE-MEDICAL BIOLOGY MAJORS**

TU Biology majors interested in medical school can complete this coursework by choosing **either** the *Functional Biology of Animals* or the *Cellular and Molecular Biology* concentration as detailed below. Both are equally good.

*When choosing a concentration, it is critical to consider what might happen if you do not get into medical school and must pursue an alternative career*. If you likely would pursue some other profession involving human health (e.g., radiology technician, pulmonary therapy assistant, etc.) then you should choose Functional Biology of Animals. Alternatively, if it is more likely that you would pursue a career that has you working in, say, clinical or research labs, the pharmaceutical industry, genetic counseling, or biotechnology, you should choose Cellular and Molecular Biology.

Another consideration is your interest and aptitude in anatomy and physiology. If you did not enjoy Anatomy and Physiology I and II and did not earn at least a B, then you should consider the Cellular and Molecular Biology concentration.

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| --- | --- |
| **Recommended coursework for students choosing*****Functional Biology of Animals*** | **Recommended coursework for students choosing*****Cellular and Molecular Biology*** |
| **For Foundation Courses must take**BIOL 200/200L or 201 Cellular Biology and Genetics (4)BIOL 202 Intro to Ecology and Evolution (4) BIOL 204 Educational and Career Planning for the Biologist (1) BIOL 309 Principles of Genetics (4) **For Breadth Courses should take**BIOL 208 Biodiversity (3)BIOL 221/221L **and** BIOL 222/222L Human Anat & Phys, II (4, 4)BIOL 408 Cell Biology (4)**For Elective Courses****Must take** BIOL 470 Advanced Physiology (4)**Should also take** CHEM 351 Biochemistry (3)**For free elective should take** BIOL 409 Molecular Biology (4)**For Ancillary courses should take**CHEM 131/131L **and** CHEM 132/132L Gen Chemistry I, II (4, 4)CHEM 331 **and** CHEM 332 Organic Chemistry I, II (5, 5)PHYS 211 **and** PHYS 212 General Physics I, II (4, 4) ***or*** PHYS 241+242 General Physics I, II Calculus-based (4, 4)MATH 237 Elem Biostats (4) ***or*** PSYC 212 Behavioral Stats (4)MATH 211 Calculus for Application (3) ***or*** MATH 273 Calculus I (4)\*\*If you are likely to do well in calculus**Also should take:**SOCI 101: Introduction to Sociology (3)PSYC 101: Introduction to Psychology (3)**If you are taking additional elective courses, options include:** BIOL 360: Histology (tissue biology)BIOL 367: Endocrinology (hormones) BIOL 411: Biology of CancerBIOL 420: Microbiology of Infectious DiseaseBIOL 421: ImmunologyBIOL 428: Virology | **For Foundation Courses must take**BIOL 200/200L or 201 Cellular Biology and Genetics (4)BIOL 202 Intro to Ecology and Evolution (4) BIOL 204 Educational and Career Planning for the Biologist (1) BIOL 309 Principles of Genetics (4) **For Breadth Courses should take**BIOL 208 Biodiversity (3)BIOL 221/221L **and** BIOL 222/222L Human Anat & Phys, II (4, 4)OR BIOL 325 Animal Physiology (4)**and must take** BIOL 408 Cell Biology (4) **and** BIOL 409 Molecular Biology (4) **For Elective Courses****Must take** **a lab course** (BIOL 410 Molec Bio, BIOL 483 Cell Bio, BIOL 312 Genetics or CHEM 356 Biochem)\* do not choose the Biochem lab if you did not do well in Biochem**Should take** CHEM 351 Biochemistry (3) **as one elective****Should take** BIOL 470 Adv Physiology (4) **as your free elective** **Must also take another elective course within concentration****Best options include:**

|  |  |
| --- | --- |
| BIOL 318 Microbiology BIOL 355 Parasitology BIOL 360 Histology BIOL 411 Cancer Biology  | BIOL 420 Infectious Disease BIOL 421 ImmunologyBIOL 428 Virology BIOL 463 Developmntl Bio |

**For Ancillary courses should take**CHEM 131/131L **and** CHEM 132/132L Gen Chemistry I, II (4, 4)CHEM 331 **and** CHEM 332 Organic Chemistry I, II (5, 5)PHYS 211 **and** PHYS 212 General Physics I, II (4, 4) ***or*** PHYS 241+242 Gen Physics I, II Calculus-based (4, 4)MATH 237 Elem Biostats (4) ***or*** PSYC 212 Behavioral Stats (4)MATH 211 Calculus for Application (3) ***or*** MATH 273 Calculus I (4) )\*\*If you are likely to do well in calculus **Also should take:**SOCI 101: Introduction to Sociology (3)PSYC 101: Introduction to Psychology (3) |

On the next pages, you will see two sample Academic Plans of Study, i.e., suggestions on when to take different courses. The first is for students who could potentially take the MCAT in their junior year. The second is for students who would take the MCAT in their senior year or later (the majority of students). *Below we discuss why students would want to take the MCAT in their Senior vs. Junior year.*

**SAMPLE PLAN OF STUDY FOR PRE-MEDICAL STUDENTS TAKING THE MCAT IN THEIR JUNIOR YEAR**

**AND ATTEMPTING TO ENTER MEDICAL SCHOOL IN THE FALL IMMEDIATELY AFTER GRADUATION**

|  |  |  |
| --- | --- | --- |
| **Fall 1**BIOL 200/200L or 201 CHEM 131/131LMATH 115 or MATH 119TSEM or ENGL 102 or ENGL 190 | **Spring 1**BIOL 202CHEM 132/132LMATH 211 or MATH 273 (Calculus)TSEM or ENGL 102 or ENGL 190 | **Summer 1**Possible coursework to stay on trackCaution: Science courses, including anatomy/physiology, microbiology, chemistry and physics should NOT be taken at a community college after students have enrolled at TU. |
| **Fall 2**CHEM 331BIOL 309BIOL 221/221L or BIOL 325*Plus one of the following:* Statistics course SOCI 101 PSYC 101 Honors course (if needed) | **Spring 2**CHEM 332BIOL 408 (suggested before BIOL 409)BIOL 222/222L (if took BIOL 221)*Plus one of the following:* Statistics course SOCI 101 PSYC 101 Honors course (if needed) | **Summer 2**Clinically related internship or research experiencePossibly study abroadStart preparing for MCAT |
| **Fall 3**PHYS 211 or 241BIOL 470 (Advanced Physiology)CHEM 351 (Biochemistry)*Plus one of the following:* SOCI 101 PSYC 101 ENGL 317 or 318 Core or Honors or other course**MINIMESTER** – start studying for the MCAT | **Spring 3**PHYS 212 or 242BIOL 409 (Molecular Biol)*Plus one or two of the following:* Statistics course SOCI 101 PSYC 101 Core or Honors or other course**Study for the MCAT!**\*\*MCAT in late semester or early summer\*\* \*\*Committee interview during finals week\*\* | **Summer 3**Clinically related internship or research experience\*\*Complete application to Medical School\*\* * submit application in June, July, or August, at the latest
* start completing secondary applications; try to submit secondary applications within 2 weeks of receiving them.
 |
| **Fall 4 and Spring 4:** Complete remaining Core coursework and remaining requirements for the major, any minor, and the Honors College (if an Honors student). Hopefully interview with med schools during fall and winter.  |

**Notes:** *This plan is just one of many possible plans. Students will have to develop their own plans, based on things like AP credit, the Math course with which they start, when they start their Chemistry courses, their need to repeat courses for better understanding, whether they take courses in the summer or minimester, whether they plan to study abroad during a fall or spring semester, etc.*

This plan does not show ALL of the courses required for one’s degree. Rather it shows primarily the critical courses for the MCAT and entry into medical school. **Honors students should notice that this plan does NOT show required Honors courses. These would need to be taken *in addition to* courses shown above, giving a student a heavy load of 5 courses per semester, usually including two lab sciences. If there is any danger of such a heavy course load lowering one’s GPA, students should consider the alternative plan of study that appears on the next page.**

Students also have the option to take one or more courses during minimesters. Typically core courses are taken but at least one BIOL elective course is offered most minimesters. Minimester would also be a good time for a student to study abroad, if he or she wants to do so.

**SAMPLE PLAN OF STUDY FOR PRE-MEDICAL STUDENTS TAKING THE MCAT IN THEIR SENIOR YEAR**

|  |  |  |
| --- | --- | --- |
| **Fall 1**BIOL 200/200L or 201 MATH 115 or 119TSEM or ENGL 102/190One other course | **Spring 1**BIOL 202CHEM 131/131LTSEM or ENGL 102/190MATH 211 or 273 (Calculus) or Honors Course (for Honors students) | **Summer 1**Possible coursework to stay on trackCaution: Science courses, including anatomy/physiology, microbiology, chemistry and physics should NOT be taken at a community college after students have enrolled at TU. |
| **Fall 2**BIOL 221/221L or BIOL 325CHEM 132/132L*Plus two other courses, which could include BIOL 208, Calculus (if not taken), a Core course, a BIOL elective course, or an Honors course (if needed)* | **Spring 2**BIOL 222/222L (if took BIOL 221)BIOL 309A third course - see Fall 2 options*Plus one of the following:* Statistics course SOCI 101 PSYC 101 | **Summer 2**Medically related internship or research experiencePossibly study abroad |
| **Fall 3**BIOL 309 (if not yet taken) or Honors course (if needed)CHEM 331PHYS 211 or 241*Plus one of the following:* Statistics course SOCI 101 PSYC 101 Honors course (if needed) | **Spring 3**BIOL 408 (suggested before BIOL 409)CHEM 332PHYS 212 or 242*Plus one of the following:* Statistics course SOCI 101 PSYC 101 Honors course (if needed) | **Summer 3**Medically related internship or research experiencePossibly study abroadStart preparing for MCAT |
| **Fall 4**BIOL 409 (Molecular Biol)BIOL 470 (Advanced Physiology)CHEM 351 (Biochemistry)*Plus other core, major, minor or honors requirements***MINIMESTER** – start studying for the MCAT | **Spring 4***Other core, major, minor, or honors requirements***Study for the MCAT!**\*\*MCAT in late semester/early summer\*\*\*\*Committee interview during finals week\*\* | **Summer 4**\*\*Complete application to Medical School\*\* * submit application in June, July, or August, at the latest
* start completing secondary applications; try to submit secondary applications within 2 weeks of receiving them.
 |

**Notes:**

*This plan is just one of many possible plans. Students will have to develop their own plans, based on things like AP credit, the Math course with which they start, when they start their Chemistry courses, whether they take courses in the summer or minimester, whether they plan to study abroad during a fall or spring semester, etc.*

Students also have the option to take one or more courses during minimesters. Typically, core courses are taken but at least one BIOL elective course is offered most minimesters. Minimester would also be a good time for a student to study abroad, if he or she wants to do so.

**THE MEDICAL COLLEGE ADMISSION TEST (MCAT)**

The MCAT is required for all students applying to either allopathic or osteopathic medical schools, and should be taken within three years of application.There are several links giving detailed information on the MCAT on the AAMC website. See especially <https://students-residents.aamc.org/applying-medical-school/taking-mcat-exam/>. There is an “MCAT Essentials” PDF available at <https://www.aamc.org/students/applying/mcat/about/>

The MCAT is a 6.25-hour exam (7.5 hours with breaks included). All questions are multiple-choice with four possible answers. The test is divided into four sections as shown below. In sections 1, 3, and 4, in which your knowledge of natural and social sciences is tested, you will find questions where you are required to read a passage of text and, in some cases, examine a graph (or table) containing data and answer a number of questions about this material. You will also find several stand-alone questions as well.

1. **Chemical and Physical Foundations of Biological Systems** – 59 questions, 95 minutes

(questions from biology, general and organic chemistry, biochemistry, and physics)

* 10 passages to read with 4-6 questions about each passage
* 15 other questions
1. **Critical Analysis and Reasoning Skills** - 53 questions, 90 minutes

(wide range of disciplines in humanities and social sciences)

* 9 passages to read with 5-7 questions/passage
1. **Biological and biochemical foundations of living systems** - 59 questions, 95 minutes

(questions from biology, general and organic chemistry, and biochemistry)

* 10 passages with 4-6 questions/passage
* 15 independent questions
1. **Psychological, social, and biological foundations of human behavior** - 59 questions, 95 minutes (questions from biology, psychology, and sociology)
* 10 passages with 4-6 questions/passage
* 15 independent questions

Each section tests a number of different **Foundational Concepts**. The questions are then categorized by the **skills** tested. Each section varies in the percentage of questions devoted to each skill. The skills tested are:

1. Knowledge of scientific principles
2. Reasoning and problem solving
3. Reasoning about the design and execution of research
4. Drawing conclusions from data and from statistical analyses of data

One other interesting aspect of this exam is that it integrates material across disciplines. See this link for a very detailed list of topics covered on the exam and a breakdown of disciplines tested per section, including the foundational concept and skills tested. [**https://aamc-orange.global.ssl.fastly.net/production/media/filer\_public/f7/e5/f7e57fb2-44fa-4c00-83dd-c17cee034c47/mcat2015-content.pdf**](https://aamc-orange.global.ssl.fastly.net/production/media/filer_public/f7/e5/f7e57fb2-44fa-4c00-83dd-c17cee034c47/mcat2015-content.pdf) **.**

**Biochemistry comprises 25% of both the Biology and Chemistry sections, which is why CHEM 351 (Biochemistry lecture) is now essentially considered a required course for TU pre-med students.**

As indicated above, in addition to a strong foundation in mathematics and the sciences that relate most to medicine, there are also questions from psychology and the social sciences. These questions relate to the interpersonal aspects of medicine. The ideal physician understands how society works and can communicate well with people from a diverse array of backgrounds. **This is why PSYC 101 and SOCI 101 now appear on the list of recommended courses below**.

**Recommended Coursework *Prior* to Taking the MCAT**

A list of courses we recommend for preparing for the MCAT appears below. As noted above, the MCAT requires you to read passages describing, in many cases, scientific information as well as interpret graphs and tables of data. This is why we suggest taking BIOL 309, 408, 409, and 470 prior to taking the MCAT. In these courses you will gain experience reading scientific papers and scrutinizing data. This is why we also recommend gaining research experience because that, too, involves reading scientific papers and working with data. To answer certain MCAT questions, you will be expected to understand basic statistical analysis of data so we suggest taking MATH 237 or PSYC 212 prior to taking the MCAT.

Students who excel in their science classes at TU seem to do better on the MCAT, perhaps because they don’t need as much “content” study and can focus more on test-taking strategies.

You should approach every class you take as important and necessary preparation for the MCAT and for medical school, so fully immerse yourself in your classes.

**Biology Courses**

* All of the courses in the “minimum coursework required” list above
* Biol 221/222: Human Anatomy and Physiology I and II
* Biol 309: Genetics
* Biol 408: Cell Biology
* Biol 409: Molecular Biology
* Biol 470: Advanced Physiology – ONLY recommended you obtain B or better in BIOL 221/222

**Chemistry Courses**

* all 5 of the courses in the “minimum coursework required” list above, including Chem 351-Biochem

**Math Courses**

* MATH 237 Elementary Biostatistics (or PSYC 212 Behavioral Statistics)

**Physics Courses**

* Physics I and II, as in the required list above

**Social and Behavioral Science Courses**

* SOCI 101: Introduction to Sociology
* PSYC 101: Introduction to Psychology

 We realize that you may only count one of these courses for Core 6, but we recommend taking both because it is an entire section of the MCAT and most students learn better in a classroom, rather than self-teaching. The AAMC provides a free study guide and recommended books if you choose to self-study for this section: <https://students-residents.aamc.org/applying-medical-school/article/study-mcat-exam/>

**Resources That Will Assist in Preparing for the MCAT**

Opinions vary widely concerning the “ideal” MCAT preparation materials. It is clear though that reviewing class notes isn’t the most effective way to prepare. You should go into the MCAT as fully prepared as possible the first time you take it. Yes, you can take the MCAT more than once, but multiple attempts and/or a very low score can be a “red flag” for medical school admission committees. It shows a lack of good judgment and maturity, so taking the exam unprepared just to see how well you do is *highly inadvisable*. In short: **Try to be super-prepared for the MCAT the first time you take it**! (How do you know if you’re ready: **make sure that you’re achieving target scores in SEVERAL FULL-LENGTH, TIMED PRACTICE TESTS.** Consider that actual test day jitters are likely to lower your score, perhaps by as much as 5-10 points, so you should aim to have your practice scores higher.

As far as preparation for the exam goes, the AAMC has a variety of preparation materials that are thought to accurately reflect the actual exam. See: <https://members.aamc.org/eweb/DynamicPage.aspx?webcode=AAMCStoreSearchResults&ListSearchFor=Student+Offerings>. There are also 1100 free videos and 3000 review questions offered by Khan Academy: <https://www.khanacademy.org/test-prep/mcat>. Regardless of what other preparation materials you use, you should ALWAYS get the AAMC practice tests, saving them to take right before taking the real exam. You should do your best to simulate actual test taking conditions, taking the full-length test, timed, in the library or at a computer surrounded by other people working quietly.

It is critical that you have a plan laid out to prepare for the MCAT. At minimum, one should prepare for the exam in terms of content preparation, test familiarity and testing skills. Most students devote at least 3 months to studying (more or less depending on how much content review is needed; the better you do in your classes, the less content review you will need). The **AAMC has a document to assist you in developing a study plan**: <http://offers.aamc.org/mcat-study>

Some students will purchase a set of books and plan to work through them at their own pace. To be successful with this plan, you need a great deal of self-discipline and a solid plan.

In many cases, an **MCAT preparatory course** is helpful and should be completed during the winter or spring of the year when you will take your MCAT. Many students find that the need the structure of a course, even an online course, for accountability. The major MCAT review companies are **Kaplan** [**https://www.kaptest.com/mcat**](https://www.kaptest.com/mcat)**, Princeton Review** [**https://www.princetonreview.com/medical/mcat-test-prep?ceid=nav**](https://www.princetonreview.com/medical/mcat-test-prep?ceid=nav)and **ExamKrackers** [**https://examkrackers.com**](https://examkrackers.com)**.** Some students have successfully used newer companies including **Next Step** [**https://nextsteptestprep.com/mcat-course/**](https://nextsteptestprep.com/mcat-course/)and **Altius** [**https://altiustestprep.com**](https://altiustestprep.com)**.** Sign up for their emails and watch for special deals for these in-person or online prep courses.

There are several websites offering a free “MCAT question of the day.”

<http://www.mcatquestion.com>; <https://kaplanquizzes.com/mcat/> ; <https://www.varsitytutors.com/mcat-questions-of-the-day> ; <https://www.jackwestin.com/mcat-question-of-the-day> ;

<https://nextsteptestprep.com/mcat-question-of-the-day/> ; <http://mcatquestionoftheday.com> ;

These could be very helpful, keeping your head in the game, but remember that most of the exam questions are based on passages, so READING is one of the most important skills you can possess. Working on reading speed and comprehension is critical. Reading science articles, focusing on scientific research, health or medicine will help you become more educated about the field that you would like to enter. <http://www.sciencemag.org>; <https://www.nature.com>; <https://www.nationalgeographic.com>; <https://www.nytimes.com>;

 <https://www.bbc.com/news/topics/c1038wnxy50t/medical-research>; <https://www.cnn.com/health>;

<https://www.sciencedaily.com/news/health_medicine/>;

**WHEN TO TAKE THE MCAT AND WHEN TO APPLY TO MEDICAL SCHOOL**

While medical schools individually determine their application deadlines, applications can be started at the beginning of May and a completed application can be submitted at the beginning of June. Considering that medical schools generally accept students on a rolling basis (first come, first served), it makes sense to apply relatively *early*. If you apply late, most or all of the “slots” may be taken and you are more likely to get “wait-listed” regardless of how strong a candidate you are. **PLAN ON APPLYING IN JUNE or JULY** for admission in the fall of the following year.

You need to take the MCAT far enough in advance so your scores will be ready for your application. The MCAT is only offered from January through September. However, it takes about a month to process your exam and report your scores. Thus, if you plan to submit your application by June or July (recommended), you should plan to take your test in April, May or early June.

**The *earliest* that a student could be ready to take the MCAT is spring of her/his junior year.** S/he could then apply to medical school between her/his junior and senior years, hear back from medical schools in her/his senior year, and then enter medical school the fall after graduation.

HOWEVER, as noted above, students are strongly advised to take a number (actually, a rather *large* number) of courses before attempting the MCAT. **In reality, most students will not complete the recommended coursework before spring of their *senior* year and hence will delay taking the MCAT until the spring of their senior year at the earliest**. There are a number of reasons for this, but one is that students will have difficulty getting into courses such as Cell Biology, Advanced Physiology, and Biochemistry before the fall of their senior year. Typically, only students who have early registration privileges - specifically, honors students and athletes and students who come to TU with substantial AP credit in the sciences - will get into such courses earlier, in time to complete the MCAT in their junior year.

Even if a student takes the MCAT between their junior and senior year, they are often still not ready to apply to medical school immediately because they lack enough extracurricular, clinical and volunteer experiences that medical schools want to see along with excellent grades and MCAT scores. Examples of such experiences are described below.

**The Gap Year**

If a student takes the MCAT in the spring of her/his senior year, s/he will have a year “off” after graduation before entering medical school. The year off is often called a “gap” year. Many students think that to take the MCAT “late” and then have a year off puts them at a disadvantage in competing for slots in medical school. In fact, the opposite is actually true. There are multiple potential benefits of this strategy, including:

- Medical schools tend to prefer students that are a little older, a little more mature, and a little more experienced; the average age of students entering medical school is typically ≥ 24 years.

- Students who apply to medical school at the end of their junior year would not report grades they get in courses during their senior year. Often, a student’s grades are highest in senior year because students are taking interesting courses and now have so much experience handling university courses. Thus, application to medical school in one’s senior year can mean application with a higher GPA.

- An extra year before application gives students more time to engage in critical extracurricular activities, such as clinically related internships, research, volunteer work, etc. (see below).

- An extra year before application gives students more time to study and prepare for the MCAT. This can result in higher scores, which would give students an extra advantage.

- A year “off” after graduation gives students time to enjoy themselves before they begin 7+ intense years of medical training. It can also give one time to make some much-needed spending money.

- Very often students find one or more paying, clinical positions, as medical scribes or assistants, allowing them to gain valuable exposure and experience, while making money.

**AAMC FEE ASSISTANCE PLAN**

If you have limited financial resources, you might consider applying for the AAMC Fee Assistance Plan. It will provide you with reduced registration price for the MCAT, free access to the MSAR, and copies of the AAMC Guide to the MCAT, 2 practice exams, a few section banks of questions, and waived application fees for AMCAS and application to 16 medical schools of your choice. See this link for more information:

<https://students-residents.aamc.org/applying-medical-school/applying-medical-school-process/fee-assistance-program/>

**RECOMMENDED EXTRA-CURRICULAR ACTIVITIES**

Medical schools pride themselves on having a **holistic review process**, taking the applicant’s unique experiences and attributes into consideration during the review process. Involvement in extracurricular activities is therefore an essential element to medical school application, helping to show the admission committees who you are as an individual. These activities should emphasize quality over quantity and should reflect your interests and values. Leadership roles are an important part of these experiences and generally only come with time and commitment to particular endeavors. It is not hard to tell on personal statements or during interviews when a student has engaged in certain extracurricular activities just to “check a box” and really have little personal interest in them.

**Applicants should have BOTH *clinical experience/exposure* and *community service*.** Medical schools are looking for students that have stepped out of their comfort zone and become involved in their community. They want students who HAVE helped people, not just students that SAY they want to help people. These experiences should be ON-GOING for as much of your college career as possible, because that continuous involvement demonstrates the applicant’s true altruistic (helpful) nature and suggests the student is not just box-checking. The community service experience can be clinical or non-clinical but should ideally demonstrate passion and commitment.

The list of possible activities includes, but is not limited to, the following:

**Clinical exposure** has several important elements and objectives. The student should seek experiences that will give them insight into the life of a patient (and their family), as well as the life of a physician. Working with patients and their families is challenging – it can be messy, sad, frustrating, and/or incredibly rewarding. It is recommended that students have enough contact with to be fairly certain that they will find it rewarding. They also need to see the true daily responsibilities of a physician by shadowing physicians.

**Patient Contact Experiences**: Applicants should consider volunteering at a local hospital or clinic to gain practical experience in the health professions. A big goal of clinical volunteering is to gain patient contact time, relating to patients and their families. We are so lucky to have several hospitals within walking distance of Towson University. These include; Greater Baltimore Medical Center: <https://www.gbmc.org/college-student-volunteers> ; University of Maryland St. Joseph’s Medical Center: <https://www.umms.org/sjmc/jobs/volunteer-services> ; and Sheppard Pratt Hospital: <https://www.sheppardpratt.org/careers-volunteers/volunteers>.

Students able to commute may also volunteer at University of Maryland Medical Center, including Shock Trauma: <https://www.umms.org/ummc/giving/volunteer>; and Johns Hopkins Medical Center: <https://www.hopkinsmedicine.org/volunteer_services/volunteer_benefits.html>

Other less traditional, yet equally valuable, experiences include working in an AIDS clinic or dialysis clinic, hospice volunteering or participation in a medical mission trip (see <http://www.medicalmissions.org> for examples, many of which accept volunteers with no medical training; also get involved in TU Global Brigades club, which goes to Nicaragua or Honduras every summer with both medical and dental volunteers). Students can get credit for these types of experiences by signing up for BIOL 493 - Internship. Students should see their advisor or the Biology Department’s Internship Coordinator for further information.

**Shadowing:** Pre-medical students are expected to spend time shadowing physicians to see exactly what the job entails over the course of an entire day(s). Ideally, students will spend many hours (50-100+ hours) doing this, seeing physicians in different fields or practices. If a student shadows a surgeon, they should be certain to shadow the surgeon on office visits, as well as in the operating room. Students should pay particular attention to the doctor-patient relationship and interactions. Students are expected to find their own shadowing opportunities, starting by asking their own physician or parent’s physician or other physician through a personal network. If that doesn’t work, the student can call or email larger, local practices and indicate your interest in shadowing a physician. Your level of professionalism will likely determine your success in this process, so always be certain to speak clearly, avoid slang, dress neatly and conservatively and show gratitude for the opportunity. If you shadow a physician and find yourself literally just following the physicians and not learning anything, finish out your day or whatever you committed to, thank them for their time, and then find a different physician and hope to find someone willing to impart some wisdom. If you connect with a physician and feel as if you can learn more, you might ask to spend more time shadowing them.

**Community Service:** Medical schools positively view non-clinical service to one’s community**.** Some schools even require their medical students to perform community service. Examples of service that will round out your application include: Habitat for Humanity, working in a soup kitchen, church-related work, and the like.

**Participation in pre-medical and academic societies (e.g., Beta Beta Beta Biological Honor Society, TU pre-med club, Minority Association of Premed Students (MAPS))**: Leadership roles within these groups are valued experiences. These groups also provide useful information and networking opportunities. You should be sure to sign up for the Pre-Medical/Pre-Dental Advising Program, getting on our mailing list (email premed.predent@towson.edu to be sent a link to a Microsoft Form), and gaining access to our Blackboard Pre-Med Community site (instructions for joining will be included in the same email). There are many informative articles and website here, and announcements about speakers, volunteer or work opportunities, MCAT deals, etc. are all posted here. ALSO, medical school want students to be involved in their school’s Pre-Med Program: it shows that the student is trying to learn more about the medical field and network/collaborate with other pre-med students and professionals.

**Research experience**: Although not required, involvement in research is considered a plus by some medical schools. Indeed, if you plan to apply to top-tier medical schools or to M.D.-Ph.D. programs, research experience will be *required*. The area of research is not nearly as important as your commitment to it and demonstration of intellectual involvement in the studies. Research in the social sciences is also accepted if your interests lie in psychology, sociology, public health or some other related field.

**Hobbies**: Medical schools often look for well-rounded individuals. Sustained involvement in interests outside your vocation is recommended and often valuable to the interview process.

**THE TOWSON UNIVERSITY COMMITTEE INTERVIEW/LETTER PROCESS**

One of the tasks of the Pre-Medical/Pre-Dental Advising Program is to work with the Pre-Medical/Pre-Dental Committee to interview medical and dental school applicants and prepare a “committee letter” of recommendation for students to submit with their application. This letter is a composite letter, including a letter written by someone on the committee, along with at least 3 Towson University faculty member letters of recommendation and possibly outside letters (from employers, physicians, etc.). Many medical schools, including the University of Maryland School of Medicine, will not admit a Towson University graduate that applies without a committee letter. This committee letter demonstrates that the student has taken the extra steps necessary to secure the support of TU and has met a minimum set of standards to qualify for the letter.

To qualify for a TU Committee Letter, students must have taken at least 24 credits at Towson University, with at least 16 credits in science classes, and they must have an overall and science TU GPA > 3.0. They must also be able to secure 3 letters of recommendation from Towson University faculty that can attest to the student’s academic ability and potential. At least two of these letters must come from science professors who taught the student in a traditional lecture-style class. The other letter can be from a non-science professor. Research mentors are also encouraged to submit an additional letter.

Students are also required to submit a detailed resume/CV and personal statement. Each student has a 30-minute interview with at least 4 members of the committee.

Ultimately, the committee’s letter will include a summary of the student’s qualifications, notes and quotes from the individual recommendation letters, impressions from the interview, and the committee’s level of confidence in the student’s ability to succeed in medical school.

**APPLYING TO MEDICAL SCHOOL**

Students applying to allopathic medical schools will apply to AMCAS application service, while students applying to osteopathic medical schools will apply to AACOMAS application service. Some students apply to both.

Both of these application services collect the student’s information, transcripts, MCAT scores, and letters of recommendation, and then transmit the entirety of the information to the medical schools that are selected by the student. Once AMCAS and/or AACOMAS receives the student’s application and transcript(s), the verification process begins, in which someone from the application service will categorize each class according to year taken and type of course (e.g. BCPM – Biology, Chemistry, Physics, and Math or AO – all other non-science classes). Verification is done to check for required courses and to calculate the student’s GPA in a number of different ways (by year, by science or non-science, etc.). This verification process takes 3-6 weeks. The committee letter is not needed until the verification process has been completed because only then is it ready to be sent to individual medical schools. More information about the process can be found at: <https://students-residents.aamc.org/applying-medical-school/applying-medical-school-process/applying-medical-school-amcas/> and <https://www.aacom.org/become-a-doctor/applying/aacomas-application-instructions>

Once your application has been sent to individual medical schools (and sometimes even before that), you will start receiving secondary applications. These **secondary applications** have an additional fee associated with them (~$50-150 each). Secondary applications are directed at learning WHY you picked their school and WHY you think that you are a good fit for their school, so it is imperative that you research each school.

**Deciding What Schools to Apply To**

As mentioned earlier, the MSAR is the ultimate source of information about each medical school. Here, information is all submitted in the same format, making it easier to compare schools than by searching individual school websites. Most students apply to 12-16 schools, stronger students may apply to fewer, while weaker students should apply to more schools. The MSAR will show the average **overall and science GPA**, as well as the **median MCAT** score for each school. You may wish to select a few “perhaps-out-of-reach” schools (based on your GPA and MCAT scores), but most schools you select should be those whose average GPA and MCAT scores are within range of yours. You should also check their **course prerequisite list** to make sure that you’ve taken every class they require. Even if you don’t qualify, they may send you a secondary application, collect the applications fees, and then discard your application, wasting your time and money.

You can apply to a **mixture of private and public schools**. You should understand the “**mission**” of the school and try to apply to schools that fit you best. In your personal statement, you can indicate what about the mission or nature of the school stimulated you to apply to that school.

You can apply to schools that are out of your home state, but check to see that each **out-of-state school** admits a reasonable number of out-of-state students. You should also consider the curriculum delivered at each school, as discussed above.

Some individuals pursue the M.D.-Ph.D. degree, a dual doctoral degree, designed for physician-scientists who wish to pursue research careers in the basic or clinical sciences. Some medical schools have Medical Scientist Training Programs (MSTP grants) for M.D.-Ph.D. candidates that pay for medical and graduate school tuition expenses, provide a stipend and pay for health insurance. M.D.-Ph.D. programs are exceptionally competitive and demand exemplary performance across the board including strong evidence that the candidate is capable of independent research.

**WILL YOU BE ACCEPTED TO Medical School?**

 **SOME INDICATORS AND THINGS TO CONSIDER**

***In a recent year, 21,388 students were admitted to allopathic U.S. medical schools while 51,680 applied. Thus, the application success rate was ~41%.***

***average GPA of MD applicants was 3.56, while that of accepted students was 3.71.***

***average science GPA of MD applicants was 3.45, while that of accepted students was 3.64.***

***average overall MCAT score of MD applicants was 505, while that of accepted students was 510.***

***In a recent year, 7,197 students were admitted to osteopathic U.S. medical schools while 20,836 applied. Thus, the application success rate was ~35%.***

***average GPA of DO applicants was 3.45, while that of accepted students was 3.53.***

***average overall MCAT score of DO applicants was 501, while that of accepted students was 503.***

As a way to measure your competitiveness with other applicants and the likeliness of getting into medical school, we have included some of the key indices of success below. While these are not the only determining factors, significant deviation from these values will dramatically decrease your probability of success.

* Most medical schools have a holistic admission policy, so they are considering many factors other than just GPA and MCAT (see Core Competencies discussion above). Some schools still have minimum GPA cutoffs to reduce the number of applications reviewed. If a student has a GPA below 3.3 (especially in science coursework), s/he will generally have to, at a minimum, do additional coursework after s/he obtains her/his B.S. degree to demonstrate competence in advanced science courses (see below). Please note that ALL grades must be reported on your medical school application and all grades are used when calculating your GPA. This includes grades in courses that were repeated for a better grade. For example, if you got a D in PHYS 211 the first time and a B the second time, both grades are reported and **both grades** are used to calculate your GPA for the medical school application. This means that your medical school application GPA may be **lower** than that shown on your Towson University transcripts if you repeated a course for a higher grade. It will also include all grades taken at other institutions, even if it was years ago.

Note also that withdrawals from courses (especially after your freshman first semester) and course repeats will definitely be noted by those reviewing your application and may raise concerns. Thus, you want to minimize withdrawals and repetition of courses. Valid excuses for withdrawal from courses such as medical leave or family emergencies are acceptable but may require documentation and an explanation in your personal statement. Again, the less you have to “explain,” the better.

* Note that the AAMC website posts a wealth of data on applicant and matriculated averages based upon race, ethnicity, sex, major, institution, age and state of legal residence (<https://www.aamc.org/data/facts/applicantmatriculant/>). In particular, the table shown here <https://www.aamc.org/download/321508/data/factstablea23.pdf> is particularly interesting as it shows applicant success with particular combinations of GPA and MCAT score. As we alluded to earlier, students that are committed to excellence in their grades are more likely to do well on the MCAT.
* These data may be helpful in determining your chances as well as being advisory in terms of choosing the right schools to which to apply. While there are a multitude of applicant credentials assessed at every school, a ranking of medical schools by MCAT scores of students admitted may help you to choose schools that best match your credentials (i.e., your own MCAT scores).

**WHAT IF YOUR GRADES/MCAT SCORES/EXPERIENCES ARE NOT GOOD ENOUGH**

**AND/OR YOU DON’T GET IN ON YOUR FIRST TRY?**

Failure to gain entrance to medical school on your first try is not uncommon – in a recent year, 59% of applicants were unsuccessful. Generally, rejected students have GPAs and/or MCAT scores that do not meet the standards required for admission. Some medical schools have cut-off values (GPA and MCAT) below which they will not review applications.

If you do not get into any school on your first try, you first need to consider whether you applied to an appropriate number of schools AND schools with standards that match your credentials (see above). Rarely is it advisable to apply to fewer than 10 schools and 15-20 is typical. If your credentials are borderline, closer to 20 is advisable to broaden your chances. Again, as discussed in the section above, you specifically want to focus on schools that regularly admit students with your MCAT scores, GPA, etc.

If your MCAT scores are lower than desired, it may make sense to **take a year off** to prepare better for the exam while simultaneously improving other elements of your application (clinical time, volunteering, research, etc.). It may be warranted to take an MCAT preparatory course or even to repeat a preparatory course. With or without a preparatory course, extensive focused preparation for several months is highly recommended prior to a second attempt at the MCAT.

If your GPA is lower than desired, you may choose to enter a **Master’s degree program** (thesis or non-thesis program) to do additional coursework at a higher level to prove your academic abilities. While graduate-level grades are not averaged into your undergraduate GPA, you will want to excel in graduate coursework to the point where the graduate GPA meets or exceeds the medical school standards. With that said, medical schools do focus on undergraduate course work considered most relevant to and predictive for success in medical school academic performance.

Expensive, but often effective, alternatives to graduate work are **post-baccalaureate programs** designed to provide students the tools to prepare them better for medical school application. Some of these programs are designed for students who have not taken the prerequisite science coursework (“career changer” programs). Other post-baccalaureate programs are designed to aid students from disadvantaged circumstances or those that just need to boost their credentials (“academic enhancer” programs).

One advantage of a post-bacc program over a graduate program is that the grades are factored into your undergraduate GPA, providing the potential to raise your undergraduate GPA. Keep in mind that even a stellar post-bacc GPA will likely only result in a modest undergraduate GPA improvement, but it is sometimes enough.

Another strategy is to attend post-bacc programs that are associated with medical schools. Occasionally these programs have linkage programs so that student excelling in the post-bacc program are either granted admission to the medical school in the following year or are at least guaranteed an interview. Even without these linkage programs, a medical school is likely to know what level of academic rigor a student is capable of based on their performance in the post-bacc program. Also, there is an opportunity to develop relationships with medical school faculty.

Please visit this AAMC website to determine if a post-baccalaureate program might be right for you: <http://services.aamc.org/postbac/>.

**WHAT IS YOUR “PLAN B”?**

Despite the fact that your *main* goal is to be accepted into medical school and eventually enter clinical practice, it's wise to consider alternate career paths as well. Medicine is an extremely competitive field. Many individuals who have begun undergraduate programs fully intending to become physicians end up changing their plans, either because their academic records don't meet the admission standards, because their MCAT scores are too low, or because they've simply found something more appealing to pursue. Please understand that to think about, even to plan, for the possibility of a "plan B" career is not a sign of weakness and does not mean you are not serious about going to medical school. Instead, it indicates that you are mature, forward-thinking, and adaptable. To be astute enough to consider secondary careers is not just smart - it could be extremely beneficial, save time and money, and almost certainly make a favorable impression on those evaluating that individual's application materials. In fact, you can expect a question about your ‘plan B’ in many medical school interviews for just these reasons.

Students interested in medicine are encouraged to research the wide variety of jobs available in the health professions very early in their collegiate education, including a discussion of the nature and demands of medicine with a pre-medical advisor and practicing health professionals. The Bureau of Labor Statistics lists many alternate health care professions, <https://www.bls.gov/ooh/healthcare/home.htm>.

There are also many health related careers discussed on this site: <https://explorehealthcareers.org> and there are many post-bac/graduate programs that will train you for a particular health care job. For example, see the programs at University of Maryland Graduate School <https://www.graduate.umaryland.edu/Program-Explorer/>. There are programs to be Pathology Assistants, Clinical Lab Scientists, and more. It is possible that you may find a very fulfilling career in the health field without the time and money it takes to get through medical school.