



**Pre-Med Guide for
IUP Chemistry and
Biochemistry
Majors**

2019

IUP Chemistry Department

PreMed Guide for IUP Chemistry and Biochemistry Majors

1. Overview and Resources

Overview

This guide is designed to provide you with the resources to build an undergraduate experience that will maximize your chance for admission to medical school. Sections of the guide explore these topics:

Section	Topic
1	Overview and resources
2	Key factors for successful application to medical schools
3	Choice of major for IUP premedical students
4	Academics
5	The MCAT
6	Extracurricular activities
7	Timeline
8	IUP PreMed interview and letter
9	Your personal statement

Resources

The Association of American Medical Colleges (**AAMC**, www.aamc.org) and the American Medical Student Association (**AMSA**, <http://www.amsa.org/>) provide a wealth of information regarding medical education. There is an **IUP chapter of AMSA** that is open to all interested IUP students (<https://iup.campuslabs.com/engage/organization/AmericanMedicalStudentsAssociation>).

Most **medical schools** list their admission requirements in detail on their websites. AAMC has a database (MSAR) of up-to-date admission requirements for individual medical schools. You must pay for complete access (you can access the list of medical schools with links to their websites for free here: <https://services.aamc.org/30/msar/home>).

Premedical information from other institutions can be very helpful and can be found by internet searches. Information from these sites have been incorporated in the PreMed Guide:

Columbia College (www.cc-seas.columbia.edu/sites/dsa/files/forms/Premedical%20Handbook%202015-2016.pdf)

University of Tennessee (artsci.utk.edu/wp-content/uploads/2016/01/Student-Handbook-for-Pre-Med-Students-2015.pdf)

You are ultimately responsible for building your undergraduate experience but many **people** are available to help. Key people in the College of Natural Sciences and Mathematics are the Premed Advisor (Dr. N. Bharathan) and the co-chairs of the Premed Interview Committee (Drs. N. Bharathan and J. Villemain). Seek out information, advice and feedback from your academic advisor, professors, peers, medical professionals, relatives and friends.

2. Key Factors for Successful Application to Medical Schools

Every medical school has its own requirements and criteria for selection of applicants. If you have particular schools in mind you should research these and tailor your activities to meet them (see PreMed Guide #1: Resources). This document addresses the factors that are common among most schools.

Medical schools rely heavily on numerical data (GPA and MCAT scores) to assess the knowledge and skills required for success in medical school. Applicants falling below specific values will be less likely to gain admission. The data described here is from the Association of American Medical Colleges (AAMC, www.aamc.org) for 2017-18.

The mean GPA for successful applicants are 3.70 overall and 3.64 for science courses. Acceptance rates for applicants with overall GPA under 3.0 are well below 50%. The mean MCAT score for successful applicants is 509. Acceptance rates for applicants with MCAT scores under 500 are well below 50%. This table shows the range of MCAT scores required to give an approximately 50% acceptance rate for GPAs from 3.00 to 4.00.

overall GPA range	MCAT score for approximate 50% acceptance rate
above 3.79	502-505 (51.4%)
3.60-3.79	506-509 (48.8%)
3.40-3.59	510-514 (50.0%)
3.20-3.39	514-517 (52.9%)
3.00-3.19	above 517 (52.6%)

*A perfect MCAT score = 528

In addition to the knowledge and skills as measured by GPA and MCAT scores, medical schools assess applicants for personal competencies. As defined by the AAMC these are:

- 1. Integrity and Ethics: Behaves in an honest and ethical manner; adheres to ethical principles and follows rules and procedures; resists peer pressure to engage in unethical behavior and encourages others to behave in honest and ethical ways.*
- 2. Reliability and Dependability: Consistently fulfills obligations in a timely and satisfactory manner; takes responsibility for personal actions and performance.*
- 3. Service Orientation: Demonstrates a desire to help others and a sensitivity to others' needs and feelings; demonstrates a desire to alleviate others' distress.*
- 4. Social, Interpersonal, and Teamwork Skills: Demonstrates an awareness of others' needs, goals, feelings, and the ways that social and behavioral cues affect peoples' interactions and behaviors; adjusts behaviors appropriately in response to these cues; treats others with respect and demonstrates a respect for diverse populations.*
- 5. Desire to Learn: Sets goals for continuous self-improvement and for learning new concepts and skills; assesses own strengths and weaknesses; solicits and responds appropriately to feedback.*
- 6. Resilience and Adaptability: Demonstrates tolerance of stressful or changing environments or situations and adapts effectively to them; is persistent, even under difficult situations; recovers from setbacks.*
- 7. Cultural Competence: Ability to relate to individuals from different cultural backgrounds. A willingness to seek exposure and interaction with diverse communities*
- 8. Oral Communication: Clear communication and ability to present yourself.*

An ongoing self-assessment of your level of competency in these areas is essential. You should seek to build these competencies both in your academic work and through extracurricular activities. The process should also help you ascertain with certainty whether or not medicine is the best profession for you.

3. Choice of major for IUP premedical students

No one major inherently produces a better candidate for medical school and a 'premedicine' designation on a degree is not required. Medical schools seek a range of interests in their students and accept applicants from a wide range of majors. In contrast, your choice of major is very important. The best major for you is the one that matches your intellectual interests and abilities. These qualities will maximize your ability to attain the level of academic achievement required for successful application to medical school.

For a variety of reasons, most students who start college with the goal of attending medical school and becoming physicians end up on other career paths. Among the fraction who do apply for admission to medical schools, less than 40% are successful. Given these facts, all premed students should have a 'plan B' for alternate career paths. A major matching your interests and abilities will serve you best for this.

Medical schools generally require one academic year of biology and physics and one academic year **each** of general and organic chemistry. These courses should be academically rigorous and acceptable for students majoring in those areas. All should include adequate laboratory experiences. Biochemistry is an important component of the MCAT and medical schools are increasingly requiring a semester of biochemistry. Many medical schools strongly recommend coursework in mathematics, statistics and/or computer science. Honors courses/programs, independent study, or research is encouraged. Opportunities for the development of effective writing and oral communication skills are strongly recommended.

At IUP most students seeking admission to medical school complete one of four degree programs:

- B.S. in Biology/Pre-medical track
- B.S. in Biochemistry
- B.S. in Chemistry/Pre-medical track
- B.S. in Natural Science

The following comparison of these programs is designed to aid students in selecting a major area of study based on the factors described above.

The liberal studies requirements of the programs (excluding designated science and math courses included on the next page) are similar. Specified courses are:

Biology/Pre-medical: PSYC 101 SOC 151 or 161

Biochemistry: none - students interested in medical school are advised to follow the Chemistry/Pre-medical specifications

Chemistry/Pre-medical: PSYC 101 SOC 151 or 161 or ANTH 110 or 211 PHIL 122 or 130

Natural Sciences: PSYC 101 BTED/COSC/IFMG 101

Biology/Pre-medical and Natural Science have a foreign language requirement; the others do not.

The course requirements of each degree program for science and mathematics courses (BIOL, BIOC, CHEM, MATH, and PHYS) are compared on the next page. This includes all required courses and controlled electives.

Comparison of required science and math courses

	Biology/Pre-medical	Biochemistry	Chemistry/Pre-medical	Natural Science
common BIOL courses 8 cr	202 Principles of Cell and Molecular Biology 203 Principles of Genetics and Development			
additional BIOL course	201 Princ Ecol & Evolution 240 Human Phys 250 Prin of Micro 331 Animal Dev Bio 402 Advanced Hum Anatomy 19 cr	250 Principles of Microbiology 4 cr	none required	201 Princ Ecology & Evolution 240 Human Physiology 241 Intro Medical Micro 150 Human Anatomy (250 and 402 may sub for 150 and 241) 16 Cr
common CHEM courses 16 cr	111 General Chemistry I <i>or</i> CHEM 113 Advanced General Chemistry I 112 General Chemistry II <i>or</i> CHEM 114 Advanced General Chemistry II 231 Organic Chemistry I 232 Organic Chemistry II			
additional CHEM courses	351 Biochemistry 4 cr	CHEM 325 Analytical Chemistry I CHEM 341 Physical Chemistry I 8 cr	290+390+490 (Chemistry Seminar series) 214 Intermed Inorg Chem 325 Analytical Chemistry I 341 Physical Chemistry I 14 cr	351 (may be used in place of CHEM 232)
BIOC courses	None required	301 Found of Biochemistry 302 Adv Biochemistry 311 Biochem Lab I 312 Biochem Lab II 401 Lab Meth Bio & Biotech BIOC 480 + 490 (Biochem Seminar) 13 cr	301 Found of Biochemistry 302 Adv Biochem 6 cr	None required
Research	none required	BIOC 482 Independent Research in Biochemistry 2 cr	CHEM 498 Problems in Chemistry 2 cr	None required
MATH courses	121 Calc I for Nat & Soc Sci 216* <i>or</i> 217 Prob & Statistics 7 cr	125* Calculus I 126* Calculus II (216* Prob & Statistics and 6-12 cr	125* Calculus I 126* Calculus II 216* Prob & Statistics 9 cr	121 Calc I for Nat & Soc Sci 216* <i>or</i> 217 Prob & Stats 7 cr
PHYS courses	111+121+112+122 (Non-calculus based lecture + lab series) 8 cr	131+141+132+142 (Calculus based lecture + lab series*) 8 cr	111+121+112+122 (Non-calculus based) <i>or</i> 131+141+132+142 (Calculus based) 8 cr	111+121+112+122 (Non-calculus based lecture + lab series) 8 cr
TOTAL required science + math cr	10 additional credits of controlled BIOL electives 72 cr	6 additional credits of controlled electives (CHEM/BIOL/MATH) 72 cr	11 additional credits of controlled electives (CHEM/BIOL/BIOC/MATH) 73 cr	- note, 29 credits of free electives are required, a majority of science courses are recommended 55 Cr

* Indicates courses required for majors in Mathematics and Physics

4. Academics

Every medical school has its own course requirements or recommendations. If you have particular schools in mind you should research these and tailor your academic program to meet them (see PreMed Guide #1: Resources). This document addresses the factors that are common among most schools.

Medical schools generally require one academic year of biology and physics and one academic year **each** of general and organic chemistry. These courses should be academically rigorous and acceptable for students majoring in those areas. All should include adequate laboratory experiences. Biochemistry is an important component of the MCAT and medical schools are increasing requiring a semester of biochemistry. Many medical schools strongly recommend coursework in mathematics, statistics and/or computer science. Honors courses/programs, independent study, or research is encouraged. Opportunities for the development of effective writing and oral communication skills are strongly recommended.

Your GPA is a critical factor for a successful application. Applicants falling below specific values will be less likely gain admission. The data described here is from the Association of American Medical Colleges (AAMC, www.aamc.org) for 2017-18.

The mean GPA for successful applicants are 3.70 overall and 3.64 for science courses. Acceptance rates for applicants with overall GPA under 3.0 are well below 50%. The mean MCAT score for successful applicants is 509. Acceptance rates for applicants with MCAT scores under 500 are well below 50%. This table shows the range of MCAT scores required to give approximately a 50% acceptance rate for GPA from 3.00 to 4.00.

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*A perfect MCAT score = 528

Beyond the GPA, some considerations for your academic program:

AP credit: Policies regarding the acceptance of AP credit vary at different medical schools. Most will require applicants to take at least one additional upper-level college course in the subject area should they receive AP credit for the course requirement.

Course loads: Medical education is intellectually demanding and medical schools want to see that applicants are able to handle multiple demanding courses simultaneously. Your program should contain some semesters with multiple demanding courses where you earn high grades in all courses.

Summer courses: Summer courses in required sciences should be avoided. While summer work may be necessary due to unusual circumstances, it should not be done to lighten your load during the regular academic year – medical schools want to see your ability to handle a science-heavy course load. Summers are good periods to pursue research or clinical opportunities.

Study abroad: While study or work abroad may have many benefits for premed students, required premedical courses should not be taken during study abroad programs. Many medical schools will not accept coursework taken outside of the United States in fulfillment of requirements

Advice: You are ultimately responsible for building your academic program but you don't have to do it alone. Seek out information, advice and feedback from your academic advisor, professors, peers, medical professionals and elsewhere.

5. The MCAT

MCAT scores are critical factors for successful applications. The data here is from the Association of American Medical Colleges (AAMC, www.aamc.org) for 2017-18. The mean MCAT score for successful applicants is 509 (528 is a perfect score). Acceptance rates for applicants with MCAT scores under 500 are well below 50%. This table shows the range of MCAT scores needed to give approximately a 50% acceptance rate for GPA from 3.00 to 4.00.

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The timing of your MCAT depends on your application timeline. If you plan to go straight on to medical school after graduation, it is recommended to take the MCAT no later than June after your junior year. Consider an earlier test date if you anticipate taking the test more than once. All scores will be provided to medical schools. Schools may consider all scores or may focus on the highest or the most recent score.

The MCAT is a test you can and should prepare for. Whether you do it by means of a commercial preparatory course, or on your own with one of the myriad preparation books, is a matter of personal taste. Whichever you decide, if you prepare as a full-time enrolled student, you should probably make some attempt to lighten your course or activities load during the semester/summer when you prepare.

The description of the MCAT below is from the AAMC (see <https://students-residents.aamc.org/applying-medical-school/article/whats-mcat-exam/> for further information).

The MCAT exam has four test sections:

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

The first three sections are organized around foundational concepts or “big ideas” in the sciences. They reflect current research about the most effective ways for students to learn and use science, emphasizing deep knowledge of the most important scientific concepts over knowledge simply of many discrete scientific facts. Questions in these sections will ask you to combine your scientific knowledge from multiple disciplines with your scientific inquiry and reasoning skills. You will be asked to demonstrate four different scientific inquiry and reasoning skills on the exam:

- Knowledge of scientific concepts and principles
- Scientific reasoning and problem solving
- Reasoning about the design and execution of research
- Data-based and statistical reasoning

The fourth section of the MCAT exam, Critical Analysis and Reasoning Skills, will be similar to many of the verbal reasoning tests you have taken in your academic career. It includes passages and questions that test your ability to comprehend and analyze what you read. The Critical Analysis and Reasoning Skills section asks you to read and think about passages from a wide range of disciplines in the social sciences and humanities, including those in population health, ethics and philosophy, and studies of diverse cultures. Passages are followed by a series of questions that lead you through the process of comprehending, analyzing, and reasoning about the material you have read. This section is unique because it has been developed specifically to measure the analytical and reasoning skills you will need to be successful in medical school.

6. Extracurricular Activities

Medical school admission committees are quite genuinely interested in what you have done in college besides take courses and prepare for the MCAT. It is important to focus on activities outside of school to help you develop and grow as a person. It is most important in choosing extracurricular activities is that you follow your interests and find things you enjoy. This makes excelling easy.

Relevant experiences can be very diverse; there is no "formula." There are, of course, certain types of activities that have been found to be valuable by those preceding you. These fall into four broad categories:

1. **Community Service:** Community service, student government, campus committees, honor societies and clubs are all excellent opportunities that can become part of an impressive resume. Community work, or other activities where you are giving your time freely to aid others, may help a medical school to assess your service orientation. Since medicine is a service-related profession, demonstrating that you have a history of serving others is certainly helpful. Community work also provides you with the opportunity to step outside of your comfort zone and interact with people of different background.
2. **Leadership Positions:** Medical school admission committees look favorably upon roles of leadership. Depth of involvement in an activity often leads to leadership opportunities, and this type of depth and commitment is something that is valued by professional schools. Much can be gained by experiencing the challenges of overseeing peers and taking on projects.
3. **Research:** Try to obtain a challenging summer research job involving the sciences. If you are interested in natural science MD/PhD programs and other heavily research oriented pathways you should have solid basic science research experience. A documented experience with a tangible outcome (such as a grade, written report, oral or poster presentation) is more valuable than undocumented, not-for-credit participation in a research project.
4. **Internship:** As a premed student, summers are a wonderful time to continue your explorations of the health professions and strengthen your overall application. Across the country, many institutions offer summer internship that incorporate clinical or research experiences. Try to gain internship experience. It does not have to be for credit but should be documented and involve significant time commitment. Other possibilities include EMT or medical scribe training and BIOL/CHEM 493 internship credits.

The only warning is to **avoid becoming over involved**. Remember to leave time for the academics. It is equally important to understand that impressive extracurricular involvement will not save you if your numbers are too low.

7. Timeline

Year 1			
	Fall	Spring	Summer
Course work	Develop study Skills in foundation courses. Things like Time Management are essential skills.	Foundation courses should be complete (CHEM 112, MATH 121(125) and Biol 202 - your grades should be mostly As with only a few Bs	
Personal development	Explore extra-curricular activities	Choose extracurricular activities, these should be related to science or medicine or developing interpersonal skills (Science Clubs, IUP ambassadors, Etc.)	Medical or science/research related internship.
Career development	Meet your advisor, and lay out a plan of study for Spring and beyond	Review your grades, prepare for year 2, discuss possible summer activities with your advisor.	Shadowing experience

Year 2			
	Fall	Spring	Summer
Course work	Complete foundation courses – this year is perhaps the most difficult in terms of classes	Should have completed CHEM 232, BIOL 203, PHYS 112/122.	
Personal development	Focus on leadership roles in organizations. etc.		Summer Research / Internship Study abroad
Career development	Plan for spring courses	Review your grades, prepare for year 2, discuss possible summer activities.	Review and organize resume focus on including all non-course related experiences.

Year 3			
	Fall	Spring	Summer
Course work	Begin work primarily on your major courses / electives	Ensure that you will have both the required courses, and number of credits for graduation.	
Personal development	Choose one extracurricular activity for a substantial leadership role – be president of a organization, Captain of a team, etc.	Interviews with Premed committee. Work on Personal statement for Application	
Career development	Prepare for MCATs	Identify schools of interest, begin applications MCATs	Medical internship. Complete Medical School applications

Year 4			
	Fall	Spring	Summer
Course work	Ensure Fall grades are added to applications. Make sure you will have completed all required courses for your chosen medical schools.	Courses completed / Graduation	
Personal development	Examine ways to improve your application.		Consider gap year – graduate school or Post baccalaureate work.
Career development	Med school applications, visits, interviews.	Make contingency plans in case you are not accepted.	Retake the MCAT exam if your scores are weak

8. IUP Pre-Med Interview and the Committee Letter

Purpose: The goal of the Pre-med interview committee is to conduct interviews of students applying to medical school and write a letter on their behalf assessing their suitability and preparedness for medical school in the context of the IUP environment. Following the interview and review of the student's portfolio of materials, the committee assigns a recommendation level of highly recommend, recommend or submit for consideration which accompanies the committee letter of recommendation. The value of the committee letter is that it offers an unbiased assessment of how the student performed in the IUP environment and encompasses a wider range of faculty viewpoints and information sources than an individual letter of recommendation. It will be maintained in the Dean's office for request by the student to be submitted on their behalf as one of their three letters of recommendation to accompany their medical school application.

The IUP interview conducted by the Pre-Med Interview committee is not intended to be a mock interview that duplicates the interview process at a medical school during the application process. However, you will be asked questions during the IUP interview process that helps prepare you for questions that you may encounter related to your academic or extracurricular record, your research, your knowledge about being a physician and the field of medicine in general and even your hobbies.

Committee composition: 9-10 faculty from across the departments in the College of Natural Sciences and Mathematics. Prior to the interview, each committee member has had the opportunity to review the student's materials.

Timing: Interviews are typically conducted in the spring semester of the junior year prior to submission of the application to medical school in the summer. Medical schools begin reviewing applications in the fall.

Interview criteria: A GPA of at least 3.2 is required although the average GPA of successful medical school candidates from IUP is 3.8.

It is recommended that students have accumulated significant experience in the medical field by doing one or more of the following:

- a. completed shadowing or internship experience in the healthcare field
- b. completed or be enrolled in Emergency Medical Technician training
- c. be employed as a medical scribe in a medical facility.

It is also recommended that the student has conducted research at IUP or other program on a significant project and be able to discuss its significance and the progress of their project.

Format: An interview time and place is arranged through the Dean's office to accommodate the student and 3-5 committee members. Interviews are typically one hour in length and consist of an interactive discussion between the student and committee members regarding the student's academic record, portfolio and personal statement.

Dress: Professional attire is recommended.

To request an interview for the spring semester, an application packet must be acquired from Ms. Angela Coulter in Dean's Office (Wey 305) and the required materials be submitted by Mar. 1. Once your folder is complete, Ms. Coulter will contact you to arrange interview time. Following the interview process, the committee letter will be available by early summer for inclusion with your application to medical school.

9. Your Personal Statement

The personal statement is a very important part of the medical school application. The purpose of this statement is to show the admissions committee the person behind the MCAT scores and GPA, and provide context to your application. Follow the following tips to help them better understand you as a candidate.

Write, re-write, let it sit, and write again! Allow yourself 6 months of writing and revision to get essay in submission-ready shape. Give time to take your first pass, set your draft aside (for a minimum of 24 hours), review, and re-work your draft.

Stay focused Your personal statement should highlight interesting aspects of your journey – not tell your entire life story. Choose a theme, stick to it, and support it with specific examples.

Back off the clichés Loving science and wanting to help people might be your sincere passions, but they are also what everyone else is writing about. Instead, be personal and specific.

Find your unique angle What can you say yourself that no one else can? Remember, everyone has trials, successes and failures. What's important and unique is how you reacted to those incidents. Bring your own voice and perspective to your personal statement to give it a truly memorable flavor.

Be interesting Start with a “catch” that will create intrigue before launching into the story of who you are. Make the admissions committee want to read on!

Show don't tell Instead of telling the admissions committee about your unique qualities (like compassion, empathy, and organization), show them through stories you tell about yourself. Don't just say it – actually prove it.

Embrace the 5-point essay format Here's a trusty format that you can make your own:

- 1st paragraph: These four or five sentences should “catch” the reader's attention.
- 3-4 body paragraphs: Use these paragraphs to reveal who you are. Ideally, one of these paragraphs will reflect clinical understanding and one will reflect service.
- Concluding paragraph: The strongest conclusion reflects the beginning of your essay, gives a brief summary of you are, and ends with a challenge for the future.

Good writing is simple writing Good medical students – and good doctors – use clear, direct language. Your essay should not be a struggle to comprehend.

Be thoughtful about transitions Be sure to vary your sentence structure. You don't want your essay to be boring! Pay attention to how your paragraphs connect to each other.

Stick to the rules Watch your word counts. That's 5,300 characters (including spaces) for AMCAS applications, 5,000 characters for TMDSAS, and 4,500 characters for AACOMAS.

Stay on topic Rambling not only uses up your precious character limit, but it also causes confusion! Think about the three to five “sound bytes” you want admissions committee to know and remember you by.

Don't overdo it Beware of being too self-congratulatory or too self-deprecating.

Seek multiple opinions Before you hit “submit”, ask several people you trust for feedback on your personal statement. The more time you have spent writing your statement, the less likely you are to spot any errors. A professor or friend whose judgment and writing skills you trust is invaluable.

Double-check the details Always check for grammar, spelling, and punctuation errors. This goes for the rest of your application too. A common oversight is referencing the wrong school in your statement! Give yourself (and your proofreaders) the time this task really requires.