

## Pre-Medical Studies

A Free-Standing Minor in the Natural Sciences Division  
And Concentrations in Biology, Chemistry, and Clinical Lab Science

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### Background & Justification

Students who want to pursue a career in a medicine must specially prepare themselves for admission to a graduate program in their area of interest. To pursue this goal they do not need to pursue a science oriented degree. However they must develop a strong background in science and math. The purpose of this minor is to provide the background that a non-science major must have to complete a successful application to medical school. It should be noted that this minor and concentrations not only provide the required background for admission to medical school but they also prepare students for graduate programs in pharmacy, veterinary, dental, and other health sciences.

This minor is for non-science majors only. Students majoring in Biology, Chemistry, and Clinical Lab Science who are interested in preparing for medical school are offered concentrations in their respective majors that serve the same general purpose. To earn those majors students are already required to take a significant portion of the coursework required for the free-standing minor. Three concentrations is a simpler approach than one division-wide minor for science majors. The single minor is not feasible because the major requirements for Biology, Chemistry, and Clinical Lab Science are so disparate that a free-standing minor would unnecessarily complicate advising and confuse students. Concentrations with a home in each department also create an atmosphere where the individual departments in the division have ownership and control over the coursework and advising of their own majors.

The American Association of Medical Colleges (AAMC) gives a list of suggested coursework that their members commonly expect applicants to have completed<sup>1</sup>. In 2009, The American Association of Medical Colleges (AAMC) along with the Howard Hughes Medical Institute (HHMI) engaged a panel of experts to write a report on the future of medical education, including the competencies that medical schools should expect of their applicants<sup>2</sup>. We have mapped the proposed curriculum for the minor and concentrations to the AAMC-HHMI

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<sup>1</sup> <http://www.aamc.org/medicalschoools.htm>

<sup>2</sup> [http://www.hhmi.org/grants/pdf/08-209\\_AAMC-HHMI\\_report.pdf](http://www.hhmi.org/grants/pdf/08-209_AAMC-HHMI_report.pdf)

competencies<sup>3</sup>. Our proposal is designed to satisfy all the suggested coursework and AAMC-HHMI competencies so that any student completing the minor or concentrations with a high GPA will be a good candidate for medical school.

Every course in this proposal is an existing course. Any student seriously preparing for medical school is already following this course of study. The purpose of the minor and the concentration are two fold:

1. To formalize the course work required for medical school so that it appears on a graduating student's transcript.
2. To simplify advising and offer students a clear path to prepare for a career in the professional health science.

### Division and Department Support

The bylaws of Natural Science Division include a standing committee on Pre-Professional Advising. The faculty on that committee are the responsible parties submitting this proposal. Operational responsibility for the free-standing minor (including advising and assessment) sits with this committee.

The Biology, Chemistry, and Clinical Lab Science departments will each be directly responsible for the concentrations in their major. The Pre-Professional Advising committee and the Natural Sciences Division director will work with the departments to ensure consistency of coursework and standards across the division for this minor.

In the past the college of Liberal Arts and Sciences has provided an NIA to one faculty member in the science division (most recently Rebecca Landsberg) for the purpose of Pre-Med advising. Budgetary constraints have caused the elimination of this NIA. We hope this is a temporary situation. Any future faculty NIA for Pre-Med advising in the Division will go to support the free-standing minor and concentrations within the majors.

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<sup>3</sup> See attached spreadsheet.

## Minor in Pre-Med for Non-Science Majors

### Requirements

The free-standing minor we are proposing for non-science majors is a total of 36 hours. We are aware that this is a large number of hours for a minor. We address this partially with our double dipping policy (see below). We are aware that this is a lot of additional course work for a non-science major. Yet if they wish to apply to medical school, at a minimum they must complete this course of study. It is important to understand that we have been highly selective in requiring just these courses. Not a single course could be dropped from the proposal without seriously compromising the purpose of preparing non-science majors for medical school. There are additional electives that we highly recommend but they are not included because they are not absolutely essential.

<b>Natural Science Division Pre-Med Minor</b>			
<b>**All Courses Required**</b>			
<b>(TOTAL 36 CREDIT HOURS)</b>			
BIO	141	Unity of Living Organisms	4
BIO	241	Biology of the Organisms in the Environment	4
CHE	141	Principles of Chemistry	4
CHE	241	Principles of Inorganic Chemistry	4
MAT	115	Calculus I	4
ASP	201	Physics I	4
ASP	202	Physics II	4
CHE	367	Organic Chemistry I	3
CHE	368	Organic Chemistry I Lab	1
CHE	369	Organic Chemistry II	3
CHE	371	Organic Chemistry II Lab	1

### *Double Dipping Policy for Pre-Med Minor*

Because there are so many hours required in this minor we will permit students to count any of the required courses in the minor simultaneously for any other graduation requirement. For example it would be permitted for a student to use BIO 141 and CHE 141 to satisfy their lower-division general education science requirement. Or MAT 115 could be used for a general education math requirement or toward a requirement in the student's major, in addition to counting toward the Pre-Med Minor.

## The Concentrations

### General Philosophy

The proposed freestanding minor represents the bare-bones minimum that students should take in course work to complete an application to medical school. Biology, Chemistry, and Clinical Lab Science majors are already taking many of these courses as part of their major. The concentrations we are proposing include, as required courses, any course in the minor that is not already required as part of the student's major.

The remaining hours for the concentrations are satisfied by electives that develop mastery of AAMC-HHMI competencies<sup>4</sup>. Students with broader experience are highly desirable to medical schools. For example, a Chemistry major who takes a number of advanced Biology classes is often a better candidate for admission than one who has not. We also feel it is important to the liberal arts mission of UIS that students broaden their perspective. The concentrations reflect this by requiring students to go outside their major to satisfy the electives requirements.

However this need to broaden perspectives must be tempered by the need to hone and develop skills and competencies to a higher level of expertise. The competencies in the AAMC-HHMI report should not just be acquired, but also mastered. To accomplish this, a student must be exposed to advanced work that builds on their previous exposure. All the electives included in these concentrations are upper-division (300 and 400 level) courses that serve to develop mastery of skills and competencies initially acquired at a lower level.

We acknowledge that there are other courses offered at UIS that are not included in these concentrations but still may be marketed as useful to Pre-meds. Those courses are excluded because they do not satisfy our requirements for electives. The AAMC-HHMI competencies are narrowly focused on skills associated with the process and practice of scientific inquiry. Courses that focus on policy or ethics do not address the focus of the AAMC-HHMI competencies even if they might be otherwise useful to a student considering a medical career. Using electives to develop mastery is also an issue. Any elective in this program must build on an existing skill to help develop mastery. This necessarily excludes most courses that are introductory and/or have no pre-requisites.

We encourage any faculty who has a course that they feel would fit as an elective in one of the pre-med concentrations to consult the AAMC-HHMI guidelines and propose that course to the Natural Sciences Pre-Professional Advising committee for inclusion in one or more of the concentrations. This should not preclude the acceptance of this proposal as it currently stands.

Each major covers the required courses to varying degrees. We want to ensure that students are challenged at the same level in each major by these

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<sup>4</sup> [http://www.hhmi.org/grants/pdf/08-209\\_AAMC-HHMI\\_report.pdf](http://www.hhmi.org/grants/pdf/08-209_AAMC-HHMI_report.pdf)

concentrations. We do not want the Pre-Med concentration to have the appearance of being any easier or less challenging in a particular major. As a result, majors that cover the required courses more extensively by default require more electives than those that do not.

*Double Dipping Policy for Concentrations*

As with the minor for non-science majors we realize that the number of hours required for each concentration makes these programs of study more difficult to complete in a standard four-year program. However, our goal is to provide students with the best preparation we can offer for medical school. That requires that we meet the AAMC-HHMI expectations and challenge our students on a level that they might expect later in medical school.

We have asked each individual department to set the double-dipping policy for the concentration that they are responsible for with the consideration that all the concentrations should meet their intended purpose and maintain high standards.

### Chemistry Pre-Med Concentration

The Pre-Med Concentration in Chemistry is 15 hours total. Eight hours are in required courses and seven are in electives split between Biology and Clinical Lab Science courses.

The Chemistry major already includes nearly all of the courses in the minor for non-science majors. BIO 241 is the exception so it is required for the concentration. Chemistry also elected to include CHE 416 in the required courses because it broadens and develops a skill set that med schools find desirable in their applicants.

<b>Required Courses (8 hours)</b>			
BIO	241	Biology of the Organism in the Environment	4
CHE	416	Biochemistry II	4

<b>Biology Electives (Choose minimum 4 hours)</b>			
BIO	311	Cell Biology	4
BIO	345	General Microbiology	3
and BIO	and 346	and General Microbiology Lab	1
BIO	381	Genetics	4

<b>Clinical Laboratory Science Electives (Choose at least 3 hours)</b>			
CLS	401	Introduction to Clinical Chemistry	2
CLS	402	Introduction to Hematology	2
CLS	403	Introduction to Immunohematology	2
CLS	411	ECCE: Health Care Management	3
CLS	448	Introduction to Immunology	4

### CHE Double Dipping Policy

The CHE major already requires at least 120 hours of course work for graduation. There is no foreseeable circumstance where double-counting a course for both the major and the concentration would weaken the degree earned by the student. Therefore, CHE majors will be allowed to apply any course simultaneously toward the requirements of both their major and the concentration.

### Biology Pre-Med Concentration

The Pre-Med Concentration in Biology is 20 hours total. Sixteen hours are in required courses and four are in electives. The required courses are exclusively courses in the non-science minor that are not normally required for Biology majors. Ideally students will be encouraged to take both Chemistry and a Clinical Lab Science elective. But in order to keep the number of hours in the concentration reasonable only four credit hours of electives are required.

<b>Required Courses (16 hours)</b>			
MAT	115	Calculus I	4
ASP	201	Physics I	4
ASP	202	Physics II	4
CHE	369	Organic Chemistry II	3
CHE	371	Organic Chemistry II Lab	1

<b>Electives (Choose minimum 4 hours)</b>			
CHE	415	Biochemistry I	4
CHE	433	Physiological Chemistry	4
CLS	401	Introduction to Clinical Chemistry	2
CLS	402	Introduction to Hematology	2
CLS	403	Introduction to Immunohematology	2
CLS	448	Introduction to Immunology	4

### BIO Double Dipping Policy

None of the above courses normally count toward a BIO major, therefore no elective used as part of this concentration may be used to satisfy another requirement for the biology major.

### Clinical Lab Science Pre-Med Concentration

The Pre-Med Concentration in Clinical Lab Science is 21 hours total. Seventeen hours are in required courses and four are in electives. The required courses are exclusively courses in the non-science minor that are not normally required for CLS majors. The electives offered to CLS students for this concentration are exclusively from Biology because of the number of Chemistry courses falling under the required courses.

<b>Required Courses (17 hours)</b>			
MAT	115	Calculus I	4
ASP	201	Physics I	4
ASP	202	Physics II	4
CHE	368	Organic Chemistry I Lab	1
CHE	369	Organic Chemistry II	3
CHE	371	Organic Chemistry II Lab	1

<b>Electives (Choose minimum 4 hours)</b>			
BIO	311	Cell Biology	4
BIO	381	Genetics	4
BIO	428	Human Diseases	4
BIO	429	Human Physiology	4

### **CLS Double Dipping Policy**

The CLS major already requires more than 120 hours of course work for graduation. There is no foreseeable circumstance where double-counting a course for both the major and the concentration would weaken the degree earned by the student. Therefore, CLS majors will be allowed to apply any course simultaneously toward the requirements of both their major and the concentration.