

The University Senate of Michigan Technological University

Proposal 22-22

(Voting Units: Academic)

Proposal to add a Pre-Pharmacy Concentration within the B.A. Chemistry degree program

Department of Chemistry

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1. Program description and characteristics:

The Department of Chemistry at Michigan Tech was recently approached by the Ferris State University School of Pharmacy to establish an articulation agreement for students coming out of a designated pre-pharmacy program at MTU who intend to pursue a Doctor of Pharmacy degree at FSU. Students possessing a chemistry degree from Michigan Tech have done well in their PharmD program historically, because of the broad-based theoretical background in chemistry, coupled with sharp critical thinking, analytical, and problem solving skills acquired in the curriculum here. This proposal sets forth to create such a designated pre-pharmacy program suitable to activate the articulation agreement, which will be a net benefit for both institutions and strengthen our strategic alliance.

This proposal is to add a pre-Pharm Concentration within the B.A. Chemistry degree program. A broader background in physiology and peripheral knowledge is needed to understand the biological effects of drugs on metabolic pathways and how this impacts the human condition to improve health. This is needed at the undergraduate level to provide chemistry students with a skill set that is valued by prospective employers and rapidly becoming an expected educational outcome.

Specifically, this program is to create opportunities for chemistry students in Pharmacy programs, which are demanding a greater understanding of chemistry. This proposal represents a co-mingling of the interests of this department and Pharmacy programs with the students being the greatest beneficiaries. The proposed concentration leverages existing faculty and resources in medicinal, biomolecular and synthetic chemistry to create a contemporary and robust concentration in pre-pharmacy that will provide chemistry majors with a competitive edge when entering pharmacy programs or in preparation for advanced studies at the graduate level.

The goal of this program is to tear down the walls that still exist between synthetic chemists, who synthesize the drugs; biochemists, who discern the function of the drug and biologists, who see physiological impacts of such drugs. This is the full spectrum of knowledge lacking in our pharmacists and those in related health fields. This proposal starts to resolve this deficit through a high-demand program.

2. Related programs:

No internal programs such as the one being proposed exists. External programs include:

Maranatha Baptist University:

https://www.mbu.edu/major/pre-pharmacy/?gclid=EAIAIQobChMIzrHXrO265wIVDJyzCh0v8QJAEAAAYASAAEgJEKfD_BwE

Clemson University (although the program is a non-major program):

<http://www.clemson.edu/degrees/prepharmacy>

3. **Rationale:**

There are two key rationales for implementing this new concentration. First and foremost, the reputation of MTU chemistry graduates have caught the attention of two Pharmacy Programs (Ferris State University and the University of Minnesota) based on the quality of the students. Each institution approached the Dept. of Chemistry to establish a pathway for our chemistry students who want to enter Pharmacy programs. In determining the reason for these requests, it became clear that on average pharmacy students, whose major work is in knowing the chemistry of pharmacologically relevant drugs, lack a solid chemistry foundation. This is a national problem that is being addressed to improve the safety and quality of our ever-expanding drug industry. This new concentration is a direct response to our national need.

Second, recent changes in faculty skill sets, expertise and composition have provided the fertile soil for such a program to blossom and grow. Medicinal chemistry with a strong knowledge in biochemical mechanisms impacted by such drugs within the physiological context provide students with coursework and research experiences at all levels with the full spectrum of knowledge relevant to Pharmaceutical sciences. Currently, our national research and education enterprise compartmentalizes such disciplines based on tradition and individual expertise. This is changing and MTU Chemistry is strategically positioned to be at the forefront. This program is also more appealing to students interested in the expanding opportunities within medicinal and pharmaceutical sciences. If a student decides not to enter into a Pharmacy program, their options are still wide open. And, unlike many programs the students in this program would have an intact degree rather than an ambiguous degree in pre-Pharmacy, or a non-degree set of courses with no degree. We currently offer a BS degree program in pharmaceutical chemistry.

4. **Projected student enrollment:**

As of Fall 2021, the undergraduate chemistry program had 81 majors. The number of students in each degree program is also shown below. We project that over time we will see growth in this new concentration as we become able to market to pre-pharmacy students. Although some of the students taking the concentration will simply add it to their existing degree plan, we expect a new group of students to enter this program. Based on the increase in new enrollments (enrollments in our B.S. in Chemistry was roughly constant over the same period) in the years following passage of our Pharmaceutical Chemistry and Biochemistry and Molecular Biology B.S. degrees roughly 10 years ago, the expected increase in student enrollment is 15-20 students over the first 3 years.

	2016	2017	2018	2019	2020	2021
Chemistry	38	42	35	37	39	45
Cheminformatics	3	4	2	2	3	5
Pharmaceutical Chemistry	14	12	12	15	14	10
Biochemistry & Molecular Biology	15	14	9	10	18	21
Totals	70	72	58	64	74	81

5. **Curriculum design:**

The Pre-Pharmacy concentration in the B.A. is comprised of the following categories of coursework:

- a. Required courses from original B.A. Chemistry degree program (48 credits).
- b. Concentration Requirements (26 credits). This allocates free-electives from the original BA degree program to courses demanded as prerequisites by FSU as well as the majority of other Doctor of Pharmacy programs in the midwest where Michigan Tech students venture.
- c. Major-Approved Electives (9 credits). These allow students to specialize in upper-level chemistry or biology topics.
- d. Free Electives (13 credits)
- e. Non-STEM General Education Courses (24 Credits). Consistent with university requirements.
- f. Co-Curricular Courses (3 Credits)

Total Credits Required = 120

Please find proposed degree audit in Appendix 1, listing all required courses and electives.

Learning Goals

Learning goals are knowledge and skills that a student will demonstrate upon completion and are not necessarily official University Student Learning Goals.

We expect that all chemistry majors will finish their program of study as well-rounded critical thinkers and lifelong learners. Graduates will be prepared to compete for and perform in graduate study or professional work in chemistry, education, and related professional fields. The Bachelor of Arts in chemistry degree is designed for students seeking a foundation in chemistry as a liberal arts degree, but who typically do not intend to become practicing chemists. The flexibility in this degree program allows students to gain significant educational breadth in other disciplines that they share an interest in. This degree may be well suited for students seeking to continue their education in medical, dental, business, or law school. In combination with another degree in engineering, mathematics, business, or technical communication (among other disciplines). Specific learning goals for graduates include:

- Students will demonstrate a foundational knowledge of the fundamental concepts and principles of the major areas of chemistry.
- Students will be able to carry out basic laboratory work in chemistry.
- Students will effectively communicate scientific work both orally and in writing

6. **New course descriptions:** No new courses are required or requested.

7. **Model schedule demonstrating completion time.** See Appendix 1

8. **Library and other learning resources:** No additional material required or requested.

9. **Description of available/needed equipment:** No additional equipment required or requested.

10. *Program costs:*

No additional costs to the program are anticipated. The programs required courses are already offered and take place in partially filled classrooms. Current faculty resources can support enrollment growth to 100 students.

11. **Accreditation requirements:** No additional accreditation requirements.

12. **Planned implementation:** Fall 2022

Approved by Dept. of Chemistry faculty:

Approved by CSA Dean:

Approved by Dean's Council:

Approved by the University Senate:

Approved by Provost:

Appendix 1: Proposed Degree Audit for Pre-Pharmacy Concentration within the
B.A. Chemistry



Major Requirements: 48 Credits

Course Number	Credits	Course Status Code M, R, P, WVD, SUB*
CH 1150 Univ. Chemistry 1 and CH 1151 Univ. Chemistry Lab 1 and CH 1153 Univ. Chem. Recitation 1 OR CH 1112 University Chemistry- Studio Laboratory I	5	
CH 1160 Univ. Chemistry 2 and CH 1161 Univ. Chemistry Lab 2 and CH 1163 Univ. Chem. Recitation 2 OR CH 1122 University Chemistry- Studio Laboratory II	5	
CH 1130 Professional Development for Chemists I: Orientation	1	
CH 2212 Quantitative Analysis	5	
CH 2130 Professional Development for Chemists 2: Career Planning	2	
CH 2411 Organic Chemistry Lab I	1	
CH 2421 Organic Chemistry Lab II	2	
CH 2430 Mechanistic Organic Chemistry	3	
CH 2440 Synthetic Organic Chemistry	3	
CH 3130 Professional Development for Chemists 3: Communication	1	
CH 3515 Principles of Physical Chemistry	3	
CH 4130 Professional Development for Chemists 4: Senior Seminar	2	
CH 4710 Biomolecular Chemistry 1	3	
PH 1110 College Physics 1	3	
PH 1111 College Physics 1 Lab	1	
PH 1210 College Physics II	3	
PH 1200 College Physics II lab	1	
MA 1160 Calculus 1 with Technology	4	
Credit Subtotal		

Concentration Requirements: 26 Credits

Course Number	Credits	Course Status Code MI, RI, P, WVD, SUS*
Concentration Requirements (continued)		
MA 3715 Biostatistics	3	

Credit Subtotal		

Major Approved Electives: 9 Credits		
BL2700 Bioinformatics OR CS 1121 Intro Programming	3	
BL 3300 Introduction to Genomics	3	
BL 4030 Molecular Biology	3	
CH 4110 Pharmaceutical Chemistry: Drug Action	3	
CH 4120 Pharmaceutical Chemistry: Drug Design	3	
CH 4140 Introduction to Pharmaceutical Analysis	3	
CH 4222 Bioanalytical Chemistry	5	
CH 4310 Inorganic Chemistry I	3	
CH 4311 Inorganic Chemistry Laboratory	2	
CH 4412 Spectroscopy of Organic Chemistry	3	
CH 4430 Intermediate Organic Chemistry	3	
CH 4610 Introduction to Polymer Science	3	
CH 4720 Biomolecular Chemistry 2	3	
Credit Subtotal		

Concentration Requirements: 26 Credits		
BL 2010 Anatomy & Physiology I	3	
BL 2011 Anatomy & Physiology I Lab	1	
BL 2020 Anatomy & Physiology II	3	
BL 2021 Anatomy & Physiology II Lab	1	
BL 3210 General Microbiology	4	
BL 2200 Genetics	3	
BL 1010 General Biology I: Intro to Organismal Bio, Ecology, Evolution	4	
BL 1020 General Biology II: Intro to Cellular and Molecular Biology	4	

Student Name and ID Number Estimated Graduation Date

*M-Passed with valid grade, transfer, or Advance Placement credit; Registered in course; Plan to take in future, WVD-Waived course or credit (does not reduce total degree credits required), SUB-Petitioned as substitute course.

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General Education Requirements: 24 Credits		
Course Number	Credits	Course Status Code

Free Electives: 13 Credits		
Course Number	Credits	Course Status Code M, R, P, WVD, SUB*
Credit Subtotal		

Courses used to complete General Education may not be used to complete other degree requirements.

Core: 12 Credits		
UN 1015 Composition	3	
UN 1025 Global Literacy or upper level modern language	3	
Critical and Creative Thinking	3	
Social Responsibility and Ethical Reasoning	3	EC 2001 recommended
HASS: 12 Credits		
Students must complete 12 credits of HASS course work Six of the 12 credits must be at the 3000- or 4000- level* At least three credits each in the following: Communication/Comp, Humanities and Fine Arts, and Social & Behavioral Sciences. No more than three credits may come from the Restricted List		
Communication/ Composition	minimum 3	HU 2830 (Public Speaking and Multimedia) recommended
Humanities and Fine Arts	minimum 3	HU3015 (Advanced Composition) Recommended
Social and Behavioral Sciences	minimum 3	PSY 2000 recommended

Course from any list above or Restricted List	0-3	
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•an upper division language course in place of UN1025 does not meet this requirement.

Co-Curricular Activities: 3 Credits		
Required for graduation, but not included in the GPA calculation or in the overall credits required for the degree.		

Advisor Use Only	
Total Credits Required	120
Total Credits Completed	
Total Credits Needed	

Student Signature

Date

Departmental Approval

Date

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