



**SOUTH DAKOTA BOARD OF REGENTS**  
**ACADEMIC AFFAIRS FORMS**  
**Intent to Plan for a New Program**

<b>UNIVERSITY:</b>	<b>USD</b>
<b>DEGREE(S) AND TITLE OF PROGRAM:</b>	<b>B.S. Biochemistry</b>
<b>INTENDED DATE OF IMPLEMENTATION:</b>	<b>Fall 2021</b>

**Please check this box to confirm that:**

- The individual preparing this request has read [AAC Guideline 2.4](#), which pertains to new intent to plan requests for new programs, and that this request meets the requirements outlined in the guidelines.
- This request will not be posted to the university website for review of the Academic Affairs Committee until it is approved by the Executive Director and Chief Academic Officer.

**University Approval**

*To the Board of Regents and the Executive Director: I certify that I have read this intent to plan, that I believe it to be accurate, and that it has been evaluated and approved as provided by university policy.*

\_\_\_\_\_  
President of the University

\_\_\_\_\_  
Date

Note: In the responses below, references to external sources, including data sources, should be documented with a footnote (including web addresses where applicable).

**1. What is the general nature/purpose of the proposed program? Please include a brief (1-2 sentence) description of the academic field in this program.**

The University of South Dakota (USD) seeks approval to plan a Bachelor of Science (BS) degree in Biochemistry, to be housed within the Department of Chemistry. This new major will provide students with current and practical knowledge related to the areas of biochemistry, chemistry and biology utilizing already existing course work and faculty from the Departments of Chemistry and Biology in the USD College of Arts & Sciences and the Division of Basic Biomedical Sciences (BBS) in the USD Medical School. The development of a biochemistry program already aligns with existing strengths within the chemistry department including:

Undergraduate research opportunities:

- 1) Dr. Rick Wang is currently collaborating with Dr. Lisa McFadden in BBS on the use of his nanomolecular cages to trap methamphetamines in the brain to prevent drug overdose.
- 2) Professor Grigoriy Sereda has developed new nanoparticle technology to help fight cancer through a second BBS collaboration with Dr. Khosrow Rezvani. They are in the final step of converting a provisional patent application to a utility patent application. With Dr. Victor Huber, also in BBS, Prof. Sereda's group has conducted different research work, which resulted in a patent application for a rapid method of evaluating vaccine efficiency.
- 3) Numerous chemistry majors have in the past conducted research with BBS faculty, either due to their interest in biochemistry or desired a closer working relationship with the

Medical School. Rachel Rucker, a USD Goldwater scholar and senior chemistry major, currently working in the lab of Prof. Brian Burrell, is a prime example. She intends to pursue her MD/PhD degree after graduation.

New biochemistry-related hire:

- 4) In 2020, USD Chemistry hired a new faculty member, Dr. Steven Wu, in the area of bioanalytical chemistry. His specialty is cellular imaging and cancer therapy using new types of nanoparticles.

External Research Support:

- 5) The Chemistry Department plays an important part in the recently renewed NSF EPSCoR Track 1 Biofilms award, primarily involving Prof. Sereda's research.
- 6) Through a recent NSF-MRI grant in 2020, the existing Transmission Electron Microscope (TEM) facility within the department will have upgrades that will achieve better resolution at the nano level and will be able to take movies of biosamples.
- 7) Future chemistry involvement is also envisioned in any large University/Hospital project involving PET and MRI imaging instrumentation.
- 8) Significant growth potential in external funding also exists with the National Institutes of Health (NIH).

Course/Program Development:

- 9) CHEM 330, Organic Chemistry of Biomolecules, was developed as a second semester course in Chemistry as part of the CHEM 310/330 organic chemistry sequence to better prepare students for health professions.
- 10) Recent program additions in Bioinformatics as part of the USD Computer Sciences and Biomedical Engineering (BME) programs provide opportunities for undergraduate involvement.

**2. What is the need for the proposed program (e.g., Regental system need, institutional need, workforce need, etc.)? What is the expected demand for graduates nationally and in South Dakota (provide data and examples; data sources may include but are not limited to the South Dakota Department of Labor, the US Bureau of Labor Statistics, Regental system dashboards, etc.)? Please cite any sources in a footnote.**

The USD Chemistry Department currently offers BS Coordinate and ACS-approved degrees in chemistry, a 3+2 accelerated BS/MS combination, an MS degree, and a PhD degree in Materials Chemistry. A new major in biochemistry would focus on our strength in materials chemistry as applied to biological systems, preparing students for post-graduate programs in medicine, dentistry, pharmacy, and veterinary practice and careers in the pharmaceutical industry and all bio-related fields.

**Statewide SD Occupational Employment Projections (2018-2028):** Website accessed 9/22/2020.

Life, physical and social science occupations	+10.1%
Life, physical and social science technicians	+8.1%
Life scientists	+12.8%
Chemists	+12.0%
Medical Scientists	+14.7%

**US Bureau of Labor Statistics - Job Outlook (2019-2029):** Website Accessed 9/22/2020

**3. How would the proposed program benefit students?**

The predominant benefit is providing a degree in Biochemistry where none currently exists. A biochemistry major will prepare students for a number of professional paths, including graduate study in biochemistry or biomedical sciences; professional study in medicine or dentistry; and careers in the life sciences, biochemistry, pharmaceutical or biomedical industries.

**4. How does the proposed program relate to the university's mission as provided in South Dakota Statute and Board of Regents Policy, and to the current Board of Regents Strategic Plan 2014-2020?**

*The statutory mission of the University of South Dakota is provided in SDCL 13-57-1:*

Designated as South Dakota's liberal arts university, the University of South Dakota, established and located at Vermillion, in Clay County, shall be under the control of the Board of Regents and shall provide undergraduate and graduate programs of instruction in the liberal arts and sciences and professional education in business, education, fine arts, law and medicine, and other courses or programs as the Board of Regents may determine.

*The mission provided in BOR Policy 1:10:1 for the University of South Dakota:*

The legislature established The University of South Dakota as the liberal arts university to meet the needs of the State and region by providing undergraduate and graduate programs in the liberal arts and sciences, and professional education in business, education, fine arts, law, and medicine, and other courses or programs as the Board of Regents may determine. (SDCL 13-57-1). The Board implemented SDCL 13-57-1 by authorizing undergraduate and graduate programs in the liberal arts and sciences and in professional education and by requiring the University to promote excellence in teaching and learning, to support research, scholarly and creative activities, and to provide service to the State of South Dakota, the region, and beyond.

Both the statutory mission and Board of Regents mission statement for the University of South Dakota designate the institution as the Liberal Arts University for the State of South Dakota and as the location of the state's only medical school. As such, USD is ideally suited to offer an interdisciplinary program in biochemistry, which draws upon the disciplinary strengths of existing academic expertise in Chemistry, Biology, and Basic Biomedical Sciences, as well as the research and laboratory opportunities afforded by the faculty in these programs, serving as a recruitment tool for increasing undergraduate enrollment.

**5. Do any related programs exist at other public universities in South Dakota? If a related program already exists, explain the key differences between the existing programs and the proposed program, as well as the perceived need for adding the proposed new program. Would approval of the proposed new program create opportunities to collaborate with other South Dakota public universities? A list of existing system programs are available through the university websites and the [RIS Reporting: Academic Reports Database](#). If there are no related programs within the Regental system, enter "None."**

South Dakota State University currently offers a Biochemistry degrees in the Department of Chemistry and Biochemistry. The major difference is USD Chemistry's proximity to the USD medical school and the ability to better train undergraduate students that interact between the two departments/divisions. As USD Chemistry is not proposing a new graduate program in Biochemistry, trained undergraduates at USD provide a potential pipeline for the SDSU

biochemistry graduate program and USD BBS and Biomedical Engineering (BME) graduate programs. Currently, no other programs exist in the SDBOR system

**6. Do related programs exist at public colleges and universities in Minnesota, North Dakota, Montana, and/or Wyoming?** *If a related program exists, enter the name of the institution and the title of the program; if no related program exists, enter “None” for that state. Add additional lines if there are more than two such programs in a state listed.*

*This question addresses opportunities available through Minnesota Reciprocity and WICHE programs such as the Western Undergraduate Exchange and Western Regional Graduate Program in adjacent states. List only programs at the same degree level as the proposed program. For example, if the proposed program is a baccalaureate major, then list only related baccalaureate majors in the other states and do not include associate or graduate programs.*

	<b>Institution</b>	<b>Program Title</b>
<b>Minnesota</b>	UM-Twin Cities	Department of Biochemistry: Biochemistry Major
<b>North Dakota</b>	NDSU	Department of Chemistry and Biochemistry: Biochemistry and Molecular Biology Major
<b>Montana</b>	MSU	Department of Chemistry and Biochemistry: Chemistry Major, Biochemistry Option
	UM	Department of Chemistry and Biochemistry: Biochemistry Major
<b>Wyoming</b>	Wyoming	None

In addition, Nebraska, Iowa and Iowa State all have biochemistry departments.

**7. Are students enrolling in this program expected to be new to the university or redirected from other existing programs at the university?**

Based on the list of programs above, USD Chemistry feels that not having a biochemistry major/option leaves an institution at a disadvantage in attracting new undergraduate students. The department has fielded calls/emails from students and recruiters who wanted to know about the biochemistry program, only to find out that we do not have one. Since 2012, an anonymous exit survey has been administered to our graduating senior chemistry majors. The survey asked the question, “*Would you have considered being a biochemistry major if available at USD?*” Sixty percent of the respondents said they would have considered biochemistry as a possible major. Whether they preferred this over a chemistry major or would have persisted in a biochemistry major is uncertain, since no biochemistry program details or personal programmatic experiences with biochemistry then existed. In a separate question that asked if our senior majors knew of other USD students that might be interested in a biochemistry major, almost all responded in the affirmative, believing that medical biology and biology students would also show an interest in biochemistry due to its tremendous career potential in medicine and science—“a perfect compromise between biology and chemistry majors,” as one student wrote. Recruitment of new students to the University will be a priority, predominantly from SD, IA, and NE. Students from both of these neighboring states pay in-state tuition.

8. What are the university's expectations/estimates for enrollment in the program through the first five years? What are the university's expectations/estimates for the annual number of graduates from the program after the first five years? Provide an explanation of the methodology the university used in developing these estimates.

Based on the possible conversion of majors from chemistry to biochemistry, attraction of students from other USD majors, and the potential recruitment of students outside of USD, the Department estimates an initial enrollment of 6-8 biochemistry majors per year, growing to 10-12 biochemistry majors/graduates per year after five years.

9. Complete the following charts to indicate if the university intends to seek authorization to deliver the entire program on campus, at any off campus location (e.g., UC Sioux Falls, Capital University Center, Black Hills State University-Rapid City, etc.) or deliver the entire program through distance technology (e.g., as an on-line program)?

Note: The accreditation requirements of the Higher Learning Commission (HLC) require Board approval for a university to offer programs off-campus and through distance delivery.

	Yes/No	Intended Start Date
On campus	Yes	Fall 2021

	Yes/No	If Yes, list location(s)	Intended Start Date
Off campus	No		

	Yes/No	If Yes, identify delivery methods <i>Delivery methods are defined in AAC Guideline 5.5.</i>	Intended Start Date
Distance Delivery (online/other distance delivery methods)	No		
Does another BOR institution already have authorization to offer the program online?	No	If yes, identify institutions:	

10. What are the university's plans for obtaining the resources needed to implement the program? Indicate "yes" or "no" in the columns below.

	Development/ Start-up	Long-term Operation
Reallocate existing resources	Yes	Yes
Apply for external resources <i>If checking this box, please provide examples of the external funding identified below.</i>	No	No
Ask Board to seek new State resources <i>Note that requesting the Board to seek new State resources may require additional planning and is dependent upon the Board taking action to make the funding request part of their budget priorities. Universities intending to ask the Board for new State resources for a program should contact the Board office prior to submitting the intent to plan.</i>	No	No
Ask Board to approve a new or increased student fee	No	No

**11. Curriculum Example: Provide (as Appendix A) the curriculum of a similar program at another college or university. The Appendix should include required and elective courses in the program. Catalog pages or web materials are acceptable for inclusion. Identify the college or university and explain why the selected program is a model for the program under development.**

Curriculum Example: BS Biochemistry, Creighton University, Omaha, NE  
 Similar existing course offerings in Chemistry, Biology and BBS Departments at USD.

## BIOCHEMISTRY (B.S.)

### Program Overview

The Bachelor of Science (B.S.) – Biochemistry major combines foundational courses in chemistry, biology and physics with advanced biochemistry and biology electives designed to expose students to important fields of study including metabolism, enzymology and structural biology, along with the study of biopolymers such as proteins and nucleic acids. This degree is especially suitable for students interested in medicine and offers an excellent preparation for a graduate education in biochemistry, and for careers in biochemistry and related disciplines.

### Prerequisite Courses:

(These courses are prerequisites to required upper-level chemistry courses)

Code	Title	Credits
MTH 245	Calculus I	4
MTH 246	Calculus II	4
or MTH 249	Modeling the Physical World I	
PHY 201	General Physics for the Life Sciences	3
or PHY 213	General Physics for the Physical Sciences I	
or PHY 221	Advanced General Physics I: Modeling the Physical World	
PHY 202	General Physics for the Life Sciences II	3
or PHY 214	General Physics for the Physical Sciences II	
or PHY 222	Advanced General Physics II: Modeling the Physical World	
BIO 201	General Biology: Organismal and Population	3
BIO 205	General Biology: Organismal and Population Laboratory	1
BIO 202	General Biology: Cellular and Molecular	3
BIO 206	General Biology: Cellular and Molecular Laboratory	1

### B.S., Biochemistry requirements (34 credits):

Code	Title	Credits
CHM 315	Quantitative and Statistical Analysis	4
CHM 321	Organic Chemistry I	3
CHM 322	Organic Chemistry I Laboratory	1
CHM 323	Organic Chemistry II	3
CHM 324	Organic Chemistry II Laboratory	1
CHM 331	Concepts of Physical Chemistry	3
CHM 382	Biochemistry Laboratory	2
CHM 383	Biochemistry I	3
CHM 384	Biochemistry II	3
CHM 456	Instrumental Analysis	3
CHM 466	Instrumental Analysis Laboratory	2
Select 2 additional courses, one from each list below:		6
Advanced Biochemistry		
CHM 392	Forensic Chemistry	
CHM 523	Bioorganic Chemistry	
CHM 575	Nucleic Acid Biochemistry	
CHM 576	Protein Biochemistry	
CHM 577	Biophysical Chemistry	

### Advanced Biology

BIO 317	Genetics
BIO 362	Cell Structure and Function
BIO 449	Physiology
BIO 451	Microbiology
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Total Credits	34