

**Regenerative Medicine Minnesota
Progress Report**

Due one month after your grant's end date or after payout of grant, whichever comes first.

Grant Title: Establishing an integrated undergraduate biomedical laboratory curriculum and research environment at BSU

Grant Number: RMM-2017-EP-04

Requester: Mark Wallert, PhD

Project Timeline: 5/30/2017 – 5/29/2018

Brief description of project:

Through this grant from RMM, the Biology Department in collaboration with the Chemistry Department restructured its undergraduate educational and research environment to better prepare students for career paths in biochemistry, cellular and molecular biology, and biomedical sciences. A new Biochemistry, Cellular and Molecular Biology (BCMB) B.S. Major was developed and approved by Bemidji State University and the Minnesota State University System. The program includes a two-semester integrated sophomore/junior year lab curriculum to introduce essential lab techniques and provide the skill sets required for advanced undergraduate research in cellular and molecular biology with a range of biomedical applications that is a requirement as a senior capstone in the new major. To support this new major, several new courses have been approved and implemented including: 1) BCMB 3070: Molecular Techniques, 2) BCMB 3071: Cellular Techniques, 3) BCMB 3072: Biochemical Techniques, 4) BIOL 4460/5460: Stem Cells and Regenerative Medicine, 5) BIOL 4470/5470: Introduction to Vaccinology, 6) CHEM 4614/5614: Medicinal Chemistry: Drug Design, and 7) CHEM 4615/5615: Medicinal Chemistry: Drug Action. Funding from RMM was used to purchase equipment that is used in the Molecular Techniques and Cellular Techniques course as well in teaching and research laboratories across the curriculum. A copy of the new major is attached to this document.

Where did this project take place? Bemidji State University, Sattgast Hall, Bemidji, Minnesota

People impacted by project and where they are from: The primary people impacted by the project are BSU BCMB, Biology, and Chemistry majors who will now have access to state-of-the-art facilities as a regular part of their training. BSU's student population comes predominantly from rural Minnesota.

What was the outcome of the project? (Did the project work the way you expected it to? What were the successes? What were the failures? How did it impact regenerative medicine in Minnesota?)

The project went exceptionally well. Drs. Mike Hamann and Mark Wallert used the summer duty days provided by the grant to purchase equipment and get it in place for the 2017-2018 academic year. During the academic year a group of faculty designed the new BCMB major and received all appropriate academic approval. The major officially began fall semester 2018. Molecular Techniques was taught for the first time spring semester 2018 and Cellular Techniques is being taught for the first time fall semester 2018. Additionally, research students from Dr. Hamann's and Dr. Wallert's laboratories regularly use the equipment purchased through this funding. In the first year, over 50 students have used equipment funded by this proposal. That number will grow substantially as the new major is in place and students progress through the program. We anticipate nearly 100 student using the facilities and equipment during the 2018-2019 academic year. There were no failures in the project. The primary challenge was that the new cell culture hoods did not get installed until the third week of class fall 2017. The primary impact on regenerative medicine in Minnesota to date is through enhancing BSU students' awareness of stem cell biology and regenerative medicine as biomedical career paths.

Please list any of the following that have resulted from your Regenerative Medicine Minnesota grant funding:

None to Date.

- Publications and/or manuscripts submitted for publication
- Disclosures/patents
- Other grant applications and/or awards

Responsible Spending:

Please let us know how you spent the money. Any unspent funds must be returned.

Funds were spent in two areas: 1) to purchase laboratory equipment and 2) to support course development and equipment installation. BSU provided financial support to renovate the cell culture laboratory facility and supplement equipment purchases.

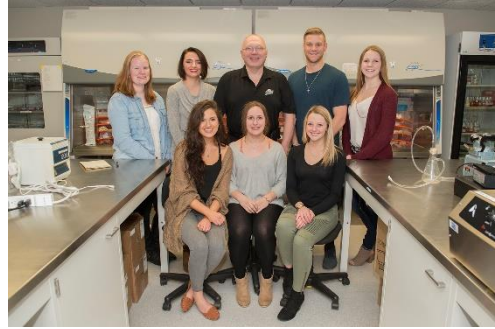


Figure 1. Cell Culture and Molecule Biology Equipment. A) New cell culture laboratory which includes two new culture hoods, a CO₂ incubator, and a chromatography refrigerator. B) The Wallert Cancer Research Team 2017 - 2018 photo in the new laboratory.

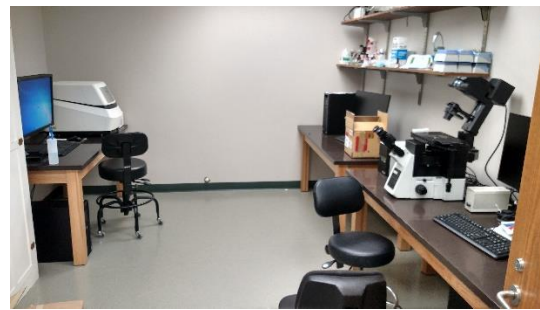
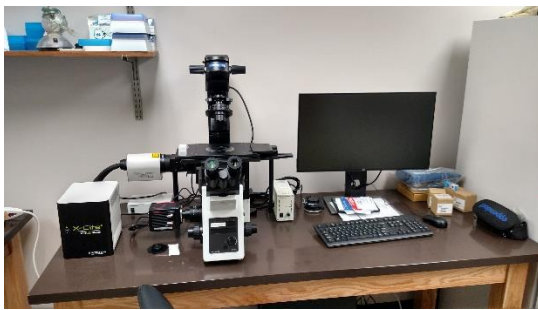


Figure 2. Imaging Laboratory. A) Funding from RMM contributed to the purchase of an Olympus IX73 inverted epifluorescence microscope. B) This purchase allowed us to expand our imaging laboratory. We purchased a Fluoview FV10i using funding from the George W. Neilson Foundation in Bemidji, MN.



Figure 3. Experimental Biology. Students that used this equipment for research presented at the national Experimental Biology Meeting in April 2018. BSU had 14 students and 2 faculty members attend this meeting in San Diego, CA.

Appendix 1: Biochemistry, Cellular and Molecular Biology Major. Cellular and Molecular Emphasis or Biochemistry Emphasis.

Biochemistry, Cellular and Molecular Biology, B.S. *major* Cellular and Molecular Emphasis

PROGRAM OFFERED PENDING MINNESOTA STATE APPROVAL

Required Credits: 76
Required GPA: 2.25

I REQUIRED COURSES

BIOLOGY CORE

COMPLETE THE FOLLOWING COURSES:

- BIOL 1211 Introductory Biology I (4 credits)
- BIOL 2360 Genetics (4 credits)
- BIOL 3380 Molecular Genetics (3 credits)
- BIOL 3590 Cell Biology (3 credits)
- BIOL 3710 Microbiology (4 credits)

CHEMISTRY CORE

COMPLETE THE FOLLOWING COURSES:

- CHEM 2211 Principles of Chemistry I (4 credits)
- CHEM 2212 Principles of Chemistry II (4 credits)
- CHEM 3311 Organic Chemistry I (3 credits)
- CHEM 3312 Organic Chemistry II (3 credits)
- CHEM 3371 Organic Chemistry Laboratory I (1 credit)
- CHEM 3372 Organic Chemistry Laboratory II (1 credit)
- CHEM 4411 Biochemistry I (3 credits)
- CHEM 4412 Biochemistry II (3 credits)
- CHEM 4471 Biochemistry Laboratory I (1 credit)

RELATED FIELD REQUIREMENTS

SELECT ONE OF THE FOLLOWING GROUPS:

GROUP 1:

- PHYS 1101 General Physics I (4 credits)
- PHYS 1102 General Physics II (4 credits)

GROUP 2:

- PHYS 2101 Physics I (5 credits)
- PHYS 2102 Physics II (5 credits)

SEMINARS

COMPLETE THE FOLLOWING COURSES:

- BCMB 1000 Biochemistry, Cell and Molecular Biology Careers (BCMB Careers) (1 credit)
- BCMB 3000 Biochemistry, Cell and Molecular Biology Research (BCMB Research) (1 credit)

TECHNIQUES CORE

SELECT ONE OF THE FOLLOWING:

- BCMB 3074 Molecular Techniques (2 credits)
or BIOL 3074 Molecular Techniques (2 credits)

SELECT ONE OF THE FOLLOWING:

- BCMB 3075 Cellular Techniques (2 credits)
- BIOL 3075 Cellular Techniques (2 credits)
- BCMB 3076 Biochemical Techniques (2 credits)
- CHEM 3076 Biochemical Techniques (2 credits)

RESEARCH

SELECT ONE OF THE FOLLOWING GROUPS:

GROUP 1:

- BIOL 4894 Advanced Research Project I (2 credits)
- BIOL 4895 Advanced Research Project II (2 credits)

GROUP 2:

- CHEM 4894 Research I (2 credits)
- CHEM 4895 Research II (2 credits)

II REQUIRED EMPHASIS - CELLULAR AND MOLECULAR BIOLOGY

BIOLOGY ELECTIVES

SELECT THREE COURSES:

- BIOL 3250 Human Anatomy (4 credits)
- BIOL 3260 Human Physiology (4 credits)
- BIOL 3300 Introduction to Hematology (4 credits)
- BIOL 3580 Immunology (3 credits)
- BIOL 4270 Histology (4 credits)
- BIOL 4360 Developmental and Tumor Biology (3 credits)
- BIOL 4447 Genomics (3 credits)
- BIOL 4460 Stem Cells and Regenerative Medicine (3 credits)
- BIOL 4470 Introduction to Vaccinology (4 credits)
- BIOL 4715 Clinical Microbiology (3 credits)

CHEMISTRY ELECTIVES

SELECT ONE OF THE FOLLOWING GROUPS:

GROUP 1:

- CHEM 3507 Analytical Chemistry (3 credits)
- CHEM 3570 Analytical Chemistry Laboratory (1 credit)

GROUP 2:

- CHEM 4614 Medicinal Chemistry: Drug Design (3 credits)
- CHEM 4615 Medicinal Chemistry: Drug Action (3 credits)

RELATED FIELD REQUIREMENTS

COMPLETE THE FOLLOWING COURSE:

- STAT 2610 Applied Statistics (4 credits)

SUGGESTED SEMESTER SCHEDULE FOR BIOCHEMISTRY, CELLULAR, AND MOLECULAR BIOLOGY, B.S. MAJOR

CELLULAR AND MOLECULAR BIOLOGY emphasis

Freshman:

- BIOL 1211 Introductory Biology I (4 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)
- BIOL 2360 Genetics (4 credits)

Biochemistry, Cellular and Molecular Biology, B.S.

major

Biochemistry Emphasis

PROGRAM OFFERED PENDING MINNESOTA STATE APPROVAL

Required Credits: 81

Required GPA: 2.25

I REQUIRED COURSES

BIOLOGY CORE

COMPLETE THE FOLLOWING COURSES:

- BIOL 1211 Introductory Biology I (4 credits)
- BIOL 2360 Genetics (4 credits)
- BIOL 3380 Molecular Genetics (3 credits)
- BIOL 3590 Cell Biology (3 credits)
- BIOL 3710 Microbiology (4 credits)

CHEMISTRY CORE

COMPLETE THE FOLLOWING COURSES:

- CHEM 2211 Principles of Chemistry I (4 credits)
- CHEM 2212 Principles of Chemistry II (4 credits)
- CHEM 3311 Organic Chemistry I (3 credits)
- CHEM 3312 Organic Chemistry II (3 credits)
- CHEM 3371 Organic Chemistry Laboratory I (1 credit)
- CHEM 3372 Organic Chemistry Laboratory II (1 credit)
- CHEM 4411 Biochemistry I (3 credits)
- CHEM 4412 Biochemistry II (3 credits)
- CHEM 4471 Biochemistry Laboratory I (1 credit)

RELATED FIELD REQUIREMENTS

SELECT ONE OF THE FOLLOWING GROUPS:

GROUP 1:

- PHYS 1101 General Physics I (4 credits)
- PHYS 1102 General Physics II (4 credits)

GROUP 2:

- PHYS 2101 Physics I (5 credits)
- PHYS 2102 Physics II (5 credits)

SEMINARS

COMPLETE THE FOLLOWING COURSES:

- BCMB 1000 Biochemistry, Cell and Molecular Biology Careers (BCMB Careers) (1 credit)
- BCMB 3000 Biochemistry, Cell and Molecular Biology Research (BCMB Research) (1 credit)

TECHNIQUES CORE

SELECT ONE OF THE FOLLOWING:

- BCMB 3074 Molecular Techniques (2 credits)
or BIOL 3074 Molecular Techniques (2 credits)

SELECT ONE OF THE FOLLOWING:

- BCMB 3075 Cellular Techniques (2 credits)
- BIOL 3075 Cellular Techniques (2 credits)
- BCMB 3076 Biochemical Techniques (2 credits)
- CHEM 3076 Biochemical Techniques (2 credits)

RESEARCH

SELECT ONE OF THE FOLLOWING GROUPS:

GROUP 1:

- BIOL 4894 Advanced Research Project I (2 credits)
- BIOL 4895 Advanced Research Project II (2 credits)

GROUP 2:

- CHEM 4894 Research I (2 credits)
- CHEM 4895 Research II (2 credits)

II REQUIRED EMPHASIS - BIOCHEMISTRY

CHEMISTRY

COMPLETE THE FOLLOWING COURSES:

- CHEM 3507 Analytical Chemistry (3 credits)
- CHEM 3570 Analytical Chemistry Laboratory (1 credit)
- CHEM 4614 Medicinal Chemistry: Drug Design (3 credits)
- CHEM 4615 Medicinal Chemistry: Drug Action (3 credits)

CHEMISTRY ELECTIVES

SELECT ONE OF THE FOLLOWING GROUPS:

GROUP 1:

- CHEM 4510 Instrumental Methods of Analysis (3 credits)
- CHEM 4571 Instrumental Analysis Laboratory I (1 credit)

GROUP 2:

- CHEM 4711 Physical Chemistry I (3 credits)
- CHEM 4771 Physical Chemistry Laboratory I (1 credit)

GROUP 3:

- CHEM 4811 Advanced Inorganic Chemistry I (3 credits)
- CHEM 4871 Inorganic Chemistry Laboratory I (1 credit)

BIOLOGY ELECTIVES

SELECT ONE OF THE FOLLOWING:

- BIOL 3250 Human Anatomy (4 credits)
- BIOL 3260 Human Physiology (4 credits)
- BIOL 3300 Introduction to Hematology (4 credits)
- BIOL 3580 Immunology (3 credits)
- BIOL 4270 Histology (4 credits)
- BIOL 4360 Developmental and Tumor Biology (3 credits)
- BIOL 4447 Genomics (3 credits)
- BIOL 4460 Stem Cells and Regenerative Medicine (3 credits)
- BIOL 4470 Introduction to Vaccinology (4 credits)
- BIOL 4715 Clinical Microbiology (3 credits)

RELATED FIELD REQUIREMENTS

COMPLETE THE FOLLOWING COURSE:

- MATH 2471 Calculus I (5 credits)