

**FULL PROPOSAL AND BUDGET
New Microbiology B.S. degree option in Microbial Ecology**

PROGRAM DESCRIPTION

1. Brief description of the proposed new program. Please indicate if it is an expansion of an existing program; a new program; a cooperative effort with another institution, business, or industry; or an on-campus or off-campus program.

The proposed new program is an expansion of an existing program. We propose to offer a B.S. in Microbiology with an option in Microbial Ecology, in addition to the currently offered general Microbiology B.S. degree. The new options will serve students interested in ecological, applied, and environmental aspects of microbiology. The current program structure does not accommodate students with these educational goals very well. This is not a cooperative effort with another institution, business, or industry. It is, like the general Microbiology B.S. degree, an on-campus program. This program combines faculty and existing or restructured curricula from the existing ecology and microbiology programs. While two new courses are being proposed, two existing courses (MICB 414/415 and MICB 416/417) are being cancelled. Central aspects of their content will be incorporated into the new Microbial Ecology course series. Therefore, no additional courses or faculty are requested.

2. Summary of a needs assessment conducted to justify the proposal.

Microbiology programs throughout the United States traditionally emphasize themes of medical microbiology and general microbiology (centered on structure and function). These areas are sometimes complemented with applied aspects such as Food Microbiology or Environmental Microbiology. An evident emerging microbiology theme across the U.S. and other countries (e.g. Sweden and Denmark) is the field of Microbial Ecology. As the eminent scientist and "Father" of conservation biology, E. O. Wilson, said three years ago when he delivered a Presidential Address at the University of Montana "If I had to do it all over again I would be a Microbial Ecologist". The world of microbes is essentially undiscovered (only 5,000 of the predicted 100,000 species are currently known). The microbial ecology field is emerging and gaining importance and prominence, we propose to carve a niche at the forefront. In doing so, we expand the repertoire of the Biochemistry/Microbiology Program and complement an already strong and internationally recognized Ecology Program housed in the Division of Biological Sciences and the School of Forestry.

Evidence of need in Microbial Ecology can be found in the form of the increasing number of jobs advertised in the Microbial Ecology area, increased funding at the national level, and an increase in student inquiries and interests. In the last year, 20-40% of the Microbiology related jobs advertised in the American Society for Microbiology Trade Journal were in the field of Microbial Ecology. Of the last 7 hires in the Microbiology/Biochemistry program (UM) three were in the field of Microbial Ecology. The new options will provide coherent and relevant coursework for students in career tracks related to Microbial ecology of disease, biogeochemistry/metabolism in applied and environmental microbiology, microbial diversity and evolution, microbial ecology, and a host of jobs in bioremediation, industrial microbiology, food microbiology, or regulatory agencies. . This will make University of Montana students more competitive for numerous Microbial Ecology-related positions.

Although several institutions offer courses or minors in microbial ecology, only one major university in the U.S. (Univ. Pennsylvania) offers a degree option in microbial ecology. The option at UP is in "Ecology with a Microbiology side". The program option proposed here is in

“Microbiology with an Ecology side”.

For the above reasons we believe that this program will attract new students. These students will graduate with timely skills necessary to address key regional and national environmental issues in coming years. In an effort to notify potential students of the program, we will: a) Develop a web page specific to program, b) Author and distribute a brochure to High Schools, 2 year schools, and Trade Schools in the region and elsewhere describing the strengths of program, and c) Promote the program at key regional and national meetings and events related to the discipline of microbiology.

3. Explain how the program relates to the Role and Scope of the institution as established by the Board of Regents.

The proposed program is fully consistent with and strongly supports institutional mission and purpose at the levels of the university system, The University of Montana, and The University of Montana-Missoula. The program will develop a more refined educational option for students, with focus on the application and relationship of microbiology to ecology and the environment. The proposed program enhances program diversity, and furthers professional opportunities for students while maintaining consistency with the liberal education spirit of undergraduate programs at the university. The program will incorporate a growing body of knowledge about microbial ecology, including at the molecular level, that relate closely to issues and problems of significance to Montana and the nation. Thus, the program supports university goals of addressing state and regional issues and problems. The program relates closely to growing research programs and initiatives in microbial ecology at the university, thus links closely to and supports university goals of expanding and disseminating new knowledge. The program will enhance and diversify opportunities for student research, enhancing university values for close professional interactions among students and faculty and providing students with key skills, perspectives, and abilities to address complex problems.

4. Effects of the proposed program on the administrative structure of the institution. Also indicate the potential involvement of other departments, divisions, colleges, or schools.

This program, along with the current option within the Microbiology major for the Bachelor of Science degree, will be administered within the Division of Biological Sciences in the College of Arts and Sciences. This program will not alter the administrative structure of the institution at any level. However, the program offers enhanced opportunity for collaboration with other units, especially the Geology Department within the College of Arts and Sciences, which we will pursue.

5. Extent to which similar programs are offered in Montana, the Pacific Northwest, and states bordering Montana.

To our knowledge, there are no established undergraduate programs that provide a degree option in microbial ecology in Montana, the Pacific Northwest, or states bordering Montana. Indeed, the only such established program in this area that we have identified is in Pennsylvania. This is in spite of the fact that there is increasing interest in this area from businesses, government agencies and universities and the number of microbial ecology positions available in all of these sectors continues to rise.

The program option that we propose for The University of Montana is in Microbiology provides students with the opportunity of an undergraduate education and degree that emphasizes microbial ecology rather than general microbiology or medical microbiology, but still meets The American Society for Microbiology recommended National Standards for undergraduate

degrees in Microbiology. Thus, we will be uniquely situated in. as one of the few providers of a formally acknowledged degree option in the area of microbial ecology. We expect our graduates to be more qualified and competitive for positions related to the emerging interests and opportunities in microbial ecology (mentioned above) than students who have come through general microbiology- or medical microbiology-oriented degrees at other institutions.

6. Accrediting agency(ies) or learned society(ies) that would be concerned with the particular program herein proposed. How has this program been developed in accordance with the criteria developed by said accrediting body(ies) or learned society(ies)?

There is no official national accreditation for Microbiology Degree Programs. The American Society for Microbiology, however, sets National Standards for degrees in Microbiology. These standards were used in the development of the curriculum proposed below.

7. Outline of the proposed curriculum showing course titles and credits

- There will be two emphases to pursue in this option, Molecular/Physiological and Ecological.
- In consideration of the different expertise required for success in these areas, two separate curricula have been designed.
- Note that Env. Micro (MICB 416/417) and Food and Ind. Micro (414/415) will be dropped and the course material covered in the new full-year Microbial Ecology sequence.

Molecular/Physiological Emphasis

Chem	161N College Chemistry (or 151)	5	
Chem	162N College Chemistry (or 152, 154)	5	
Chem	221 Organic Chemistry	3	
Chem	223 Organic Chemistry Lab	2	
Chem	222 Organic Chemistry	3	
Chem	224 Organic Chemistry Lab	2	
Phys	121 General Physics I	5	
Math	150 Applied Calculus (or 152)	4	
Math	241 Statistics	4	
	subtotal	33	
Biol	103N Diversity of Life	3	
Biol	104N Diversity of Life Lab	2	
Biol	340 Introductory Ecology	3	
Biol	221 Cell and Molecular Biology	4	
Biol	223 Genetics and Evolution	4	
Micb	300 General Microbiology	3	
Micb	301 General Microbiology Lab	2	
Micb	495a Microbial Ecology	3	
Micb	495b Microbial Ecology	3	
Micb	404 Microbial Genetics	3	
Micb	450 Microbial Physiology	3	
Micb.	495 Microbial Diversity	3	
Micb	418 Fungal Biology	3	note 27 cr >= 300 level
Bioc	380 or *481/482 Biochemistry	4	*note 481/482 = 6 credits
	subtotal	43	
3 of the following lab courses:			
Micb	495a lab Microbial Ecology Lab	1	
Micb	495b lab Microbial Ecology Lab	1	
Micb	451 Microbial Physiology Lab	1	
Biol	341 Introductory Ecology Lab	2	
	subtotal	3	note 3 or 4 credits
	Gen ed	24	
	TOTAL	103	*May be up to 106 depending on selections

ELECTIVES

Choose at least 12 credits from the following (includes at least 3cr MICB):

Biol	341 Ecology Laboratory	2	
Biol	366 Freshwater Ecology	5	
Biol	400 General Parasitology	2	
Biol	401 General Parasitology Lab	2	
Biol	413 Field Ecology	3	
Biol	440 Electron Microscopy	2	
Biol. (FHL)	453 Lake Ecology	3	
Biol. (FHL)	454 River Ecology	3	
Biol. (FHL)	455 Groundwater and Riparian ecol	3	
For	210 Introductory Soils	3	
Geol	382 Global Change	3	
Geol	431 Environmental Geology	3	
Math	153 Calculus II	4	
Math	251 Calculus III	4	
Math	444 Statistical methods	3	
Math	447 Computer data analysis	1	
Micb	312 Medical Bacteriology	3	
Micb	410 Immunology	3	
Micb	420 Virology	3	
Micb	451 Microbial Physiology Lab	1	
Micb	497 UG Research	6	
Chem	341 Instrumental Methods	3	
CS	131 Fundamental Computer Science I	3	
		68	total available

Ecological Emphasis					
Chem	151N	General & Inorganic Chemistry		3	
Chem	152N	Organic and Biological Chemistry		3	
Chem	154	Organic and Biological Chemistry lab		2	
Phys	121	General Physics I		5	
Math	150	Applied Calculus		4	
Math	241	Statistics		4	
Math	444	Statistical methods		3	
For	210	Introductory Soils		3	
			subtotal	27	
Biol	103N	Diversity of Life		3	
Biol	104N	Diversity of Life Lab		2	
Biol	121	Introductory Ecology		3	
Biol	221/222	Cell and Molecular Biology		5	
Biol	223	Genetics and Evolution		4	
Biol	340	Ecology		3	
Biol	366	Freshwater Ecology		5	
Micb	300	General Microbiology		3	
Micb	301	General Microbiology Lab		2	
Micb	404	Microbial Genetics		3	
Micb	495b	Microbial Ecology		3	
Micb.	495	Microbial Diversity		3	
Micb	418	Fungal Biology		3	
Micb	450	Microbial Physiology		3	note 32 cr >/= 300 level
Bioc	380 or *481/482	Biochemistry		4	*note 481/482 = 6 credits
			subtotal	49	
3 of the following lab courses:					
Micb	495a lab	Microbial Ecology Lab		1	
Micb	495b lab	Microbial Ecology Lab		1	
Micb	451	Microbial Physiology Lab		1	
Biol	341	Introductory Ecology Lab		2	
			subtotal	3	note 3 or 4 credits
			Gen ed	24	
			TOTAL	103	*May be up to 106 depending on selections
ELECTIVES		Choose at least 12 credits from the following (includes at least 3cr MICB):			
Biol	341	Ecology Laboratory		2	
Biol	400	General Parasitology		2	
Biol	401	General Parasitology Lab		2	
Biol	413	Field Ecology		3	
Biol	440	Electron Microscopy		2	
Biol. (FHL)	453	Lake Ecol		3	
Biol. (FHL)	454	River Ecol		3	
Biol. (FHL)	455	Groundwater and Riparian ecol		3	
Geol	382	Global Change		3	
Geol	431	Environmental Geology		3	
Math	447	Computer data analysis		1	
Math	153	Calculus II		4	
Math	251	Calculus III		4	
MIcb	312	Medical Bacteriology		3	
Micb	410	Immunology		3	
Micb	420	Virology		3	
Micb	451	Microbial Physiology Lab		1	
Micb	497	UG Research		6	
Chem	341	Instrumental Methods		3	
CS	131	Fundamental Computer Science I		3	
				57	
					total available

FACULTY AND STAFF REQUIREMENTS

1. Name and rank of current faculty who will be mainly involved with the program:

Dr. James E. Gannon, Professor
Dr. William E. Holben, Associate Professor
Dr. Matthias C. Rillig, Assistant Professor

2. Need for new faculty over the first five-year program. Include special qualifications or training. If present faculty are to conduct the new program, explanation how they will be relieved from present duties.

No new faculty will be needed in support of this new microbial ecology option. This is possible because the majority of the required curriculum combines existing courses in various programs into a different configuration that produces the appropriate knowledge base for success in the area of microbial ecology. Where courses are being restructured to meet the needs of the option, the above-named faculty will be responsible for those courses. This is being accomplished as follows: **Rillig's** position was created and filled in support of microbial ecology education and research. As such, his assigned duties are totally in line with the microbial ecology option. **Gannon** retains responsibility for the microbial physiology course, which is a key component for the general microbiology degree and the new option. His other assignments, environmental microbiology and food and industrial microbiology are being cancelled and the information restructured and combined into the new full-year microbial ecology course series which will serve both the general microbiology requirements and the microbial ecology option. **Holben** retains responsibility for his lower division undergraduate course, elementary microbiology. His graduate teaching assignment, molecular microbial ecology, is a required course in the new curriculum and he has been reassigned from teaching molecular genetics in to new assignments within the microbial ecology option.

3. Need and cost for support personnel or other required personnel expenditures:

None required for the proposed option.

CAPITAL OUTLAY, OPERATING EXPENDITURES, AND PHYSICAL FACILITIES

1. Summary of operating expenditure needs.

The proposed program will rely on existing courses, and other courses that are either 1) modifications of existing courses, 2) replacing others being eliminated (taught by current faculty), or, 3) being developed as part of the regular teaching assignment of a new faculty member hired to support the growth and development of this disciplinary focus within our programs. No courses required for the B.S. degree in Microbiology are being eliminated or significantly altered. We anticipate only modest increase in enrollment in particular courses. Increases in enrollment in lecture-only courses entail only slight increases in operating expenditures, mostly related to copying course syllabi, examinations, and other materials. Increases in operating costs for laboratory courses will be met through student laboratory fees that support direct costs in specific courses.

2. Evaluation of library resources. Are they adequate for operation of the proposed program? If not, how will the library need to be strengthened during the next three years?

The proposed program combines elements of two graduate programs (microbiology and ecology) that have been in existence for many years. As such, current library resources will be

as adequate as they are for the existing programs.

3. Special clinical, laboratory, and/or computer equipment that will be needed. List those pieces of equipment or computer hardware presently available in the department.

None required for the proposed option.

4. Facilities and space required for the proposed program. Are current facilities adequate for the program? If not, how does the institution propose to provide new facilities?

Current facilities are adequate for the proposed option; no additional facilities or space is required.

EVALUATION OF PROPOSED PROGRAM

1. Faculty committees or councils that have reviewed and approved the program herein proposed.

The proposal has been reviewed by the following committees: Microbiology Curriculum committee, DBS curriculum committee, DBS student advising staff, ASCRC Science Subcommittee (pending), ASCRC full committee, The University of Montana Graduate Council science subcommittee (pending), University of Montana Graduate Council (full committee, pending) and the University of Montana Faculty Senate (Pending).

2. If outside consultants have been employed, please list the names of these consultants, their current positions, and titles. Append copies of their written reports (this is required of new doctoral programs).

Not applicable to this proposal.

FISCAL IMPACT AND BUDGET INFORMATION

On this form, indicate the planned FTE enrollment, estimated expenditures, and projected revenues for the first three years of the program. Include both the reallocation of existing resources and anticipated or requested new resources. Second and third year estimates should be in constant dollars.

	FY 02 FIRST YEAR FTE HEADCOUNT	FY 03 SECOND YEAR FTE HEADCOUNT	FY 04 THIRD YEAR FTE HEADCOUNT
I. PLANNED STUDENT ENROLLMENT			
A. New Enrollment	10	15	15
B. Shifting Enrollment	15	20	20
GRAND TOTAL PLANNED STUDENT ENROLLMENT	25	35	35

II. EXPENDITURES	FIRST YEAR		SECOND YEAR		THIRD YEAR	
	FTE	COST	FTE	COST	FTE	COST
A. Personnel Cost	program is built on existing counts and faculty/staff resources					
1. Faculty						
2. Administrators						
3. Adjunct Faculty						
4. Graduate/Instruc/Assistants						
5. Research Personnel						
6. Support Personnel						
7. Fringe Benefits						
8. Other (_____)						
Total Personnel FTE/Cost	<u>0</u>		<u>0</u>		<u>0</u>	
B. Operating Expenditures						
1. Travel						
2. Professional Services						
3. Other Services						
4. Communications						
5. Utilities						
6. Materials & Supplies*						
						* costs will increase modestly with slight enrollment in some lab courses
7. Rentals						
8. Repairs & Maintenance						
9. Materials & Goods for Manufacturing & Resale						
10. Miscellaneous						
Total Operating Expenditures	<u>0</u>		<u>0</u>		<u>0</u>	
	FIRST YEAR		SECOND YEAR		THIRD YEAR	
	FTE	COST	FTE	COST	FTE	COST
C. Capital Outlay						
1. Library Resources						
2. Equipment						
Total Capital Outlay	<u>0</u>		<u>0</u>		<u>0</u>	
D. Physical Facilities Construction or Major Renovation						
E. Indirect Costs (Overhead)						
GRAND TOTAL EXPENDITURES	<u><u>0</u></u>		<u><u>0</u></u>		<u><u>0</u></u>	

III. REVENUES

A. Source of Funds

1. Appropriated Funds-Reallocation
2. Appropriated Funds-New
3. Federal Funds
4. Other Grants
5. Fees*
6. Other (_____)

* student course fees will defray the modest increases in costs of some lab courses, and such fees will be proposed for new lab courses

Total Source of Funds

<u>0</u>	<u>0</u>	<u>0</u>
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B. Nature of Funds

1. Recurring
2. Non-Recurring

GRAND TOTAL REVENUES

<u><u>0</u></u>	<u><u>0</u></u>	<u><u>0</u></u>
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