

# Department of Biology and Chemistry Self-Study: 2017

## Table of Contents

Department Overview.....	2
Faculty .....	10
Students .....	14
Curriculum .....	19
Strengths and Weaknesses.....	34
Plans for Change.....	36
Appendix A: Student Data.....	39
Appendix B: Faculty Data.....	43
Appendix C: Resources.....	170
Appendix D: Biology and Chemistry Department Procedures.....	190
Appendix E: Department Committees and Membership.....	199
Appendix F: Student Survey.....	205
Appendix G: Catalog Descriptions-Undergraduate Curriculum.....	262
Appendix H: Biology Programs in Graduate and Continuing Education.....	272
Appendix I: Four-Year Plans of Study.....	278
Appendix J: Rotation of BIOL and CHEM Courses.....	288
Appendix K: Student Handbook.....	290
Appendix L: Pre-Med Program, LECOM, and Northeastern Biotechnology MOU.....	307
Appendix M: Curriculum Mapping and Assessments.....	321
Appendix N: Special Studies 2013-2017.....	333

# Departmental Overview

## History of Department, Program, Mission of the Department

Fitchburg State University is committed to excellence in teaching and learning and blends liberal arts and sciences with professional programs within a small college environment. The Department of Biology and Chemistry is central to this mission because it contains the largest basic science major on campus, biology, a growing program in chemistry with two majors added in 2013, as well as minors in both biology and chemistry, and in collaboration with Psychological Sciences, a Neuroscience, Behavior and Cognition. As the school has evolved from a rich history of teacher preparation to a liberal arts and sciences university, the programs in the basic sciences have expanded, changed, and adapted to the needs of the university. The department is a core component of the traditional liberal arts and sciences education offered at the university and as such we have three main objectives. We prepare students interested in scientific or professional careers as well as provide foundational experiences for other majors on campus especially in nursing, exercise and sports science, and education. For non-majors, we offer courses to fulfill the scientific component of their liberal arts and science education.

The Biology Program includes both undergraduate and graduate degrees. The cornerstone of our degrees has been the Bachelor of Science degree, but in 2016 significant revisions were made to the Bachelor of Arts degree providing students with a much-improved alternative choice. Students may, but are not required to, select from among five possible concentrations: Biotechnology, Environmental Biology, Health Sciences, Neuroscience and Behavior, and Biology with Initial Teacher Licensure. Students interested in a career in education may also pursue the Post Baccalaureate Program in Biology 8-12. The Biology major currently (Fall 2017) has 240 majors enrolled in various programs compared to 208 majors in 2013. Within the major the majority of students are in concentrations: 15 in Biotechnology, 14 in Environmental Biology, 115 in Health Sciences, 10 in Neuroscience and Behavior, and 4 in Biology with Initial Teacher Licensure. Additionally, students from numerous other departments are enrolled as biology minors including 32 students in the Biology minor, 20 students in the Neuroscience, Behavior and Cognition minor as well as 17 students in the Chemistry minor.

Through the Division of Graduate and Continuing Education (GCE) we offer three degree and/or licensure programs: MA in Biology (thesis and non-thesis tracks), Post-Baccalaureate Biology Initial Licensure (8-12), and MEd. Science Education. There are currently 21 students enrolled in these programs.

The primary mission of the Biology Department is to provide students with a working knowledge of the life sciences that is part of a larger interdisciplinary, multicultural liberal arts and sciences education. We strive to:

- Produce students who are well prepared for careers and advanced study in the biological sciences and related fields.
- Maintain a high level of scholarly activity in a variety of fields associated with biology, chemistry and science education.
- Serve the needs of the entire college and specific academic departments through our curricular offerings and involvement in the college community.
- Provide state of the art pedagogical approaches as well as utilize appropriate equipment, technology, and resources for teaching, learning and research in the sciences and science education.

- Recruit and retain qualified students for our academic programs from diverse backgrounds.

Since 2001 the disciplines of biology and chemistry have been operating as one department when the two individual departments were merged. Since the two departments have joined, the chairs have been Dr. Meg Hoey, a biologist, and Dr. Meledath Govindan, a chemist, who was elected in 2014. Dr. Govindan is on sabbatical in the Spring semester 2018, and the position is being filled by Dr. Michael Nosek on an acting basis. Dr. Govindan's term as chair expires in June 2018. The Department recently voted to recommend him for a second 3-year term and the President has approved this recommendation.

Currently, the full-time faculty include 12 biologists and 7 chemists with one full-time, temporary faculty member. Dr. George Babich retired in December 2016 and a faculty search was conducted in the current academic year to replace him. The search was unsuccessful, and a new search is currently underway to hire a one-year, full-time faculty member. This person will start in September and serve while a new faculty search is conducted in AY18/19 or AY19/20. In addition to teaching undergraduate day students, faculty members may choose to teach courses in the evening and summers at the undergraduate and/or graduate level through the division of Graduate and Continuing Education (GCE). Several part-time faculty (adjuncts) teach introductory biology and chemistry courses for undergraduate, day courses as well as evening and summer courses. Department staffing also includes a full-time administrative assistant (shared with the Earth and Geographical Sciences (EGS) department), and 2 ½ full-time technicians. One of these technicians works full-time in biology, one is full-time in chemistry, and the half-time technician splits his time between our department, EGS, and works with the university's Environmental Health and Safety Officer. The roles of the technicians include setting up labs, ordering, stocking lab supplies, and most importantly, maintaining and enforcing health and safety regulations. The biology technician contributes significantly to the university by serving as a member of the university's Institutional Biosafety Committee (IBC). The Chemistry technician serves on the University's Safety Committee.

The department holds monthly meetings of the full-time faculty. Departmental committee procedures are detailed in a procedural manual ([Appendix D](#)) that describes committee formation, voting, and the job descriptions of committees. This document was developed previous to the last program review. A list of all departmental committees and their current membership can be found in [Appendix E](#). In addition, faculty also serve on many University-wide committees ([Appendix E](#)). All department documents such as meeting minutes or procedural manuals are stored on the campus server in a common file referred to as the "I-drive". All department members have access to this file. Department decisions are made by majority vote of faculty in attendance at the meetings after motions have been introduced, discussed, and recommended for a vote. The department and its committees informally follow the Robert's Rules of Order.

The Department holds biannual "retreats." During these sessions, held before the beginnings of each semester and lasting for most of a day, detailed and lengthy discussion take place concerning initiatives important to the Department. We use this time to establish key priorities for the department for the upcoming semester.

Departmental committees meet as needed to handle their respective responsibilities. These include the following. The Facilities Committee handles all proposals for the proper utilization of department space as well as the care and purchase of departmental equipment. Each academic year the university puts out a call for Strategic Funding Requests which provide departments with

funds to purchase materials that cannot be funded through the annual department operational budget. For our department, this often includes large pieces of equipment to enhance educational delivery. Each year these funds are focused on several of the goals outlined in the university's 5-year Strategic Plan. The Facilities Committee collects these requests and prioritizes them, forwarding them to the Chair for submission to the university as part of the annual budgeting process. The Student Affairs Committee is responsible for formal student/faculty interactions such as department sponsored social activities and student awards. The Peer Evaluation Committee in conjunction with the Chair oversees the evaluation of faculty in accordance with the guidelines set forth in the Massachusetts State College Association (MSCA) union contract. The Assessment Committee develops strategies to assess student achievement of learning outcomes. The Curriculum Committee and the Graduate Curriculum Committee are responsible for new course proposals or other changes to the curriculum or the majors. These committees make recommendations to the Department and Graduate Chairs. It should be noted that several of the departmental committees have student representatives who volunteer for the positions and serve as voting members.

The University has a governance structure that is composed of an All University Committee (AUC) and three subcommittees, the Academic Policies Committee (APC), the Student Affairs Committee (SAC), and the Curriculum Committee (CC). After review of proposals made by these committees, the AUC will make recommendations for approval or disapproval to the President who makes the final decisions on governance matters. These committees have administrators, faculty, and student representation. Our department encourages that we have at least one, if not several, members of our department on these crucial, University-wide committees.

The Department follows all established campus-wide policies and procedures as described in the university catalog, and the faculty contract. Additionally, the policies outlined in the Institutional Review Board (IRB) Policies and Procedures, the Institutional Animal Care and Use (IACUC) Policy, The Chemical Hygiene Plan, the Exposure Control Plan, and the Biosafety Policy. Training for compliance with these and other university policies is provided by the university via the Collaborative Institutional Training Initiative (CITI) program, and training provided via the Human Resources office.

**Identification of the Major Recommendations for Improvement Made by the Previous Reviewer and the Departmental Responses to These Recommendations**

The Department's previous self-study was conducted in the Spring of 2013. The major recommendations for improvement that were made by the reviewer and the Department's responses to those recommendations are provided below.

**Recommendation from Outside Reviewer                      Departmental Responses**

<p>1. The Condike Science Center was outdated, but the reviewer was cognizant that the new science facility was in the works.</p>	<p>New science building wing, renovations of the old building, along with much new equipment, was completed in 2014/15.</p>
<p>2. It was recommended that introductory biology and chemistry students be brought to the library for instruction on literature</p>	<p>Many of our professors do this in both introductory and advanced level courses.</p>

searching, quality of sources, and plagiarism.	
3. The University needs to dedicate resources to support IACUC including a veterinarian.	Our department has worked with administration and an IACUC has been formed and is operational. In addition, an Institutional Biosafety Committee (IBC) has been established and an institutional Biosafety Policy implemented (several faculty members were instrumental in the establishment of both of these committees and continue to serve on them). The services of a veterinarian have been retained by the University to provide necessary support to the IACUC.
4. The institution should establish parity for faculty course credit between non-majors and major laboratory courses.	The department chair works with faculty to establish satisfactory schedules that are equitable and balanced between non-majors and majors courses.
5. The department needs to maintain and enhance diversity/range of faculty teaching and research expertise across biology and chemistry disciplines.	We continue to do so with each new hire. Since our last review we have hired 6 full-time, tenure-track faculty in Biology and Chemistry and while our most current search to add a vertebrate biologist was unsuccessful, the University is supporting a one year, temporary position and will conduct a new search in 2018/19 or 19/20.
6. Develop a clear definition of a capstone course and develop new capstones particularly in organismal biology. Also, better define the criteria that would qualify independent/directed study for capstone status.	The department has continued to discuss this issue and efforts have been made difficult because of the increase in students in the major. Although we have made some progress in this area (detailed below), we have identified this as a weakness and propose new goals for the future.
7. Establish a Graduate School Advisor modeled after the Health Professions Advisor.	This has not been done as yet, although programs similar to the Health Professions programs are being developed for the Biotechnology concentration students. This would be facilitated by faculty getting release time to develop a program.
8. It was recommended that the department provide research opportunities to 1st and 2nd year students; suggestions included a seminar series (e.g. brown bag seminar), and/or social events for students to learn about faculty research (e.g. through a seminar series).	The department has introduced symposia in the fall and spring semesters for faculty and students to present their research activities. This has grown from early events that showcased the biology and chemistry research to include other departments and most recently we have extended invitations to the students of Mount Wachusett Community

	College. Additionally, an Introductory Research course (1-2 credits) for 1st and 2nd year students has been added to our curriculum, and General Biology I is being revised to increase the research focus within the lab. (Research projects listed in <a href="#">Appendix N.</a> )
9. Due to the heavy service load we have for other departments, it was recommended that there be more equitability among the faculty regarding amount of contact hours between introductory and upper divisional course offerings.	The department chair strives to balance the teaching loads for both introductory and upper-level elective courses, and include a consistent rotation of elective courses that allow each faculty member an opportunity to teach in their area of expertise.
<b>Graduate Program Recommendations</b>	
1. It was recommended that a tenured faculty member be appointed as chair or co-chair of the graduate program due to concerns about the program being managed by one untenured faculty member.	The current chair has the greatest expertise in Massachusetts licensure policy necessary to effectively lead our graduate program, and has received tenure in the current academic year.
2. The program chair should receive a load lift for the work that will be required to make important and necessary changes to the program.	A course release was provided during spring 2016 in order to revise curriculum and eliminate programs with low enrollments. Discussions are underway about further program revisions and the potential for additional release time to support these changes.
3. Define a set of learning objectives for each of the degree programs and use these objectives to guide the implementation of 2-year course schedules.	Clear learning objectives are outlined for our licensure programs (Post-Baccalaureate Biology 8-12 and M.Ed. Science Education) as required by our accrediting institution (NCATE/CAEP) and the Department of Elementary and Secondary Education. The Graduate Curriculum Committee is working on establishing clear objectives for our one non-licensure program, the MA in Biology.
4. Concern was expressed at having two different populations of graduate students (traditional biology students vs. teachers) in the same courses. It was recommended that the MA Biology program be tabled in order to focus on course development for our education programs.	The majority of students in our licensure programs and in our MA in Biology program are either teachers of record or are aspiring to become teachers. Therefore, our graduate student population tends to have similar science backgrounds and career goals.
5. Faculty interest and availability to teach graduate courses needs to be increased so	This is an area that we are working to improve. With the hiring of several faculty over

<p>that a consistent rotation of courses can be offered. It was recommended that graduate courses should be counted toward the day-load.</p>	<p>the last few years, the department is better staffed and is now able to allow some graduate courses to count toward faculty day-load. It is anticipated that this will increase faculty interest and improve the variety and consistency of our graduate course offerings.</p>
--	---

**Departmental Initiatives and Significant Changes During the Past Five Years**

**Personnel**

A number of significant personnel changes have occurred since the last self-study. These include the retirements of Drs. Howard Thomas and George Babich from Biology, as well as Drs. Da-hong Lu and Judith Ciottone from Chemistry. At the start of the review period Dr. Meg Hoey was the department chair. She temporarily moved to an administrative position as the Interim Dean of Health and Natural Sciences, and following the filling of that position with a permanent dean, she returned to the department faculty. Additionally, Dr. Christopher Cratsley had taken an administrative position as the Director of Assessment prior to the review period and returned in the Spring of 2017 as a department faculty member. We have hired two new tenure-track faculty in biology, Drs. Daniel Welsh (2013) and Eric Williams (2017), as well as four new faculty in Chemistry, Drs. Steven Fiedler (2014), Billy Samulak (2014), Emma Downs (2015), and most recently, Dr. Dennis Awasabisah (2016). This has led to an increase in biology faculty from 11 to 12 and in Chemistry from 5 to 7. Finally, we have had a non-tenure-track position for the past 3 years. This position has been varied from full-time to ¾ time. (Refer to [Appendix B](#) for all Faculty CVs.)

**Facilities**

As the last program review was being completed the department was preparing to move into the laboratory wing of the Antonucci Science Building (the Irving Wing) over the summer of 2013. Some of the new features in this wing include an herbarium, an animal facility, a walk in cold room, a microscope suite, a cell-culture facility, equipment and prep rooms, as well as faculty/student research labs for faculty research and student research projects. (See also the Resources section in [Appendix C](#)).

The completion of the science complex (renovation of the old Condike Science Building) was completed in the summer of 2014. This wing contains classrooms, faculty offices, several laboratories for the Earth and Geographic Science department, a computer lab, a mud room, a conference room and several small meeting rooms and study spaces, a faculty/staff lunchroom, and two supply rooms with printers and faculty mailboxes.

**Programs and Curriculum**

An extremely important change that occurred in the first year of the review period was the re-establishment of a chemistry major. Prior to the merging of our two departments the Chemistry Department had a chemistry major, but due to several years of very low enrollment it was phased out and eliminated around 2003. The new Chemistry major started in the fall of 2014 with 5 majors. Enrollment has increased to 9, 25, and 23 in the successive years of 2015, 2016 and 2017, respectively. The Department is working on plans to create a Biochemistry and Molecular Biology concentration, and provide a pathway to make it easier for students to have a dual major in chemistry and biology (3 students are currently dual biology and chemistry majors).

The Department has for many years offered a Bachelors of Arts (BA) degree in addition to the Bachelors of Science (BS) degree. The BA was an under-utilized option for students. So, in 2016, we proposed several changes to degree requirements including a reduction of the Chemistry requirement by eliminating the Organic Chemistry II requirement, and changing the Physics requirement to one of a variety of physical science/geography courses (see [Appendix G](#) for the current requirements of the B.A. degree).

One recommendation of the last program reviewer was to provide more research opportunities for freshmen and sophomores. Dr. Daniel Welsh took the initiative to create a new course entitled Introductory Research (BIOL 1600 and CHEM 1600) that can be taken for 1 or 2 credits. The response by students and faculty alike has been very positive. Since the course was started in the Fall of 2016 (4 semesters total) 18 students have taken BIOL 1600 and 3 students have taken CHEM 1600. A total of 9 different faculty members have mentored students in these courses. This may not sound like a lot, but these are students who may have dropped the major without these experiences, and these students are in addition to students taking Independent Studies and Internships.

Another significant change that is currently being developed is a new sequence of 2 courses entitled Human Anatomy and Physiology (I and II). This course sequence is offered at a 2000 level and is designed to provide biology majors and minors with more human biology electives to take. We want them to have an enhanced experience compared to that provided by the introductory Anatomy and Physiology I and II sequence. The new sequence will be composed of a 3-hour lecture and 3-hour lab format, more in line with our core courses and laboratory electives. This sequence will provide more elective choices for our majors and minors in an area that has been under-represented in our curriculum.

In the health science area of the department's program, we have established an Early Acceptance Program with the LECOM schools for students wishing to pursue doctoral degrees in the areas of Osteopathic Medicine, Dental Medicine, and Pharmacy. Additionally, a Memorandum of Understanding has been established between Fitchburg State University and Northeastern University to provide eligible students with a pathway to directly enter the Northeastern's Masters of Biotechnology Program. (See [Appendix L](#) for details of these agreements.)

The Fitchburg State Student-Faculty Collaborative Summer Research Experience offers a paid opportunity for students to engage in interdisciplinary projects focused on the environmental and public health of the Fitchburg community. The projects that make up this summer research experience will involve a collaboration between students, their peers, and faculty across a variety of settings (hands-on field and laboratory work and personal and professional development). Faculty in our department are involved in one part of this experience, focusing on environmental health. This project seeks to understand the health of the Nashua River and its relationship to Fitchburg communities by studying water quality indicators and connecting those to river and regional land use. Students and faculty from Biology, Chemistry, and Earth and Geographic Sciences will work together toward answering the following research questions: What is the health of the Nashua River from geological, biological, and chemical perspectives? How has the land-use/water-use in the watershed region changed in the past century? How are land and water use connected to water quality indicators? Students involved in this research may be involved in analyzing GIS data of historical and current land use, collecting and analyzing fish populations in the field, performing chemical analyses on water samples in the field and in the lab, and collecting and analyzing river sediments. This Collaborative incorporates high impact



practices to provide students with research opportunities and is geared toward students early in their degree to help increase retention.

### **Graduate Program**

Our graduate program has undergone significant changes since the previous program review in 2012 in response to reflections within our own department as well as feedback from the outside evaluator. The major focus of these efforts has been to make changes that will improve enrollment, matriculation and retention. In an effort to achieve these aims, we restructured our graduate program, making it more streamlined yet still capable of serving the needs of potential students in our surrounding communities. In 2012, the Department of Biology and Chemistry had five different graduate programs including the following: MA Biology (thesis and non-thesis track), MAT Biology Initial Licensure, MAT Biology Professional Licensure, MEd Science Education (teaching and non-teaching track). Average total enrollment was approximately 30 students. Having 30 students spread among five different programs, each with different course requirements, meant that we struggled with low course enrollments and with offering courses for all programs in a timely manner. Our main accomplishment was to remove three programs (MAT Biology Initial Licensure, MAT Biology Professional Licensure and MEd Science Education non-teaching track). These decisions were made based upon enrollment data. Beginning in spring 2013, applications for the MEd. Science Education program increased while applications for the MAT Biology Initial and Professional Licensure programs were decreasing. A decision was made to eliminate these two declining programs as well as the non-teaching track in the MEd Science Education program. It is important to note that even with the elimination of these programs, we are still able to offer prospective students the opportunity to achieve both an initial license (via Post-Baccalaureate program) and a professional license (via M.Ed. Science Education program) as well as an opportunity to obtain a master's degrees in either science education or biology. Therefore, these changes have eliminated low/declining enrollment programs without sacrificing the needs of our student population. By eliminating the MAT Biology Initial Licensure program (8-12) in favor of the Post-Baccalaureate Initial Licensure (8-12) program, we have retained the more efficient licensure program which may help us meet new DESE standards which require 6 program completers every three years. (The three programs in place in the Fall semester of 2017 are described in [Appendix H.](#))

### **Enrollments and Budget**

Despite the increase in student enrollment in our department and the increases experienced by the department regarding service courses, the department's operating budget has remained relatively constant (see [Appendix C](#)). The largest jump in student enrollments in our department occurred between 2013 and 2014. This was accompanied with a significant increase in the operating budget between 2014 and 2016. But since that time, despite continued steady growth in enrollment the department has either decreased or been level-funded. The University provides additional funding through Strategic Funding Requests (formerly referred to as Extraordinary Budget Requests - EBRQ) that may be applied for on an annual basis for large expenses (e.g. equipment). Justifications for these requests must be aligned with specific goals of the University's Strategic Plan. Each year the requests are prioritized and funds are provided for as many requests as funding allows. (See [Appendix C](#) section for more information.)

### **Administration**

A significant change that occurred since the last review period has been the establishment of a dean structure across the campus. The Biology and Chemistry Department has been housed in the Division of Health and Natural Sciences along with the departments of Earth and Geographic Sciences, Exercise and Sport Science, Mathematics, Nursing, and Psychological Science. When

the dean positions were first created, Dr. Meg Hoey of our department, was appointed as the Interim Dean of Health and Natural Sciences until Dr. John Schaumlöffel was appointed to the position in the summer of 2017.

## Faculty

### Faculty Information

The Biology and Chemistry faculty members at Fitchburg State are committed to their primary mission of providing students with a working knowledge of the life sciences that is part of a larger interdisciplinary, multicultural liberal arts and sciences education. In order to achieve this overarching goal, the faculty remain committed to a strong curriculum that will prepare students for careers and advanced study, remain active in their disciplines, provide curricular offerings appropriate for other majors on campus, and are active participants in not only the university community but the larger community as well. As a group, the faculty members remain committed to student learning and willingly integrate new pedagogical approaches and technology into their teaching. The size of our program allows for close relationships with students and advisees within our program, which generates a nurturing supportive environment.

Table of Biology and Chemistry Faculty Members at Fitchburg State

Faculty	Rank	Degree, Year of Appointment	Area of Specialty
<b>Biology</b>			
Christopher Cratsley	Professor	Ph.D. 2000	General Biology, Animal Behavior, Science Education
Lisa Grimm Graduate Program Chair	Assistant Professor	Ph.D. 2012	General Biology, Immunology, and Science Education
Margaret Hoey	Professor	Ph.D. 1993	General Biology, Evolution, Genetics
Elizabeth Kilpatrick	Assistant Professor (FT, Non- Tenure Track)	Ph.D. 2015	Anatomy and Physiology, Immunology
Ronald Krieser	Associate Professor	Ph.D. 2008	Genetics and Molecular Biology
John Ludlam	Associate Professor	Ph.D. 2011	Freshwater Ecology, Environmental Science, Invertebrate Biology, Marine Biology

Michael Nosek Acting Chair, Spring 2018	Professor	Ph.D. 2000	Cell Biology, Biochemistry
Christopher Picone	Professor	Ph.D. 2004	Ecology, Environmental Biology, General Biology
Erin Rehrig	Associate Professor	Ph.D. 2011	Plant Biology, General Biology
Sean Rollins	Associate Professor	Ph.D. 2012	Microbiology, Infectious Diseases
Thomas Schoenfeld	Associate Professor	Ph.D. 2007	Neuroscience, Anatomy and Physiology, and Animal Physiology
Daniel Welsh	Assistant Professor	Ph.D. 2013	Evolution, Behavior, Anatomy and Physiology
Eric Williams	Assistant Professor	Ph.D. 2017	Anatomy and Physiology, Developmental Biology
<b>Chemistry</b>			
Dennis Awasabisah	Assistant Professor	Ph.D. 2016	Organic Chemistry, General Chemistry, Organometalics
Emma Downs	Assistant Professor	Ph.D. 2015	General Chemistry, Inorganic Chemistry, and Environmental Chemistry
Steven Fiedler	Assistant Professor	Ph.D. 2014	Physical Chemistry, General Chemistry, Solvation Properties
Meledath Govindan Department Chair	Professor	Ph.D. 1996	Organic Chemistry, Natural Products Chemistry
Aisling O'Connor	Associate Professor	Ph.D. 2008	Analytical and Green Chemistry, Science Education
Mathangi Krishnamurthy	Assistant Professor	Ph.D. 2011	Organic and Medicinal Chemistry
Billy Samulak	Assistant Professor	Ph.D. 2014	Analytical Chemistry, Biochemistry, and Secondary Education.

The undergraduate and graduate programs are in separate divisions within the university. The graduate program in biology is overseen by The Division of Graduate and Continuing Education (GCE). All winter, evening, and summer session courses, both undergraduate and graduate, are offered through this division. Faculty members may teach in the graduate program as part of their day teaching load or may receive additional compensation. Participation in the program is voluntary as the two divisions are guided by two separate Massachusetts State College Association (<http://mscaunion.org/>) collective bargaining agreements.

The process of reappointment, tenure, and promotion is guided by the Massachusetts State College Association (<http://mscaunion.org/>) collective bargaining agreement. Faculty members are evaluated on their teaching, advising, scholarly activity, and service to the university and regional communities. In addition, if a faculty member holds an alternative assignment (e.g. chair) they are evaluated on this assignment as well. Faculty members submit a portfolio containing a narrative and supporting documentation. The nature of the evaluation process depends on the type of action being considered. Reappointment, tenure, and promotion are all first evaluated at the department level. Evaluations may be made by a peer evaluation committee (PEC) formed from tenured faculty members within the department. All candidates for a job action are evaluated by the chair. Subsequent to the departmental level evaluation the candidate is then evaluated by the Dean, Provost, and in the case of tenure and/or promotion a campus-wide committee. At each stage of the process, the candidate has the opportunity to write a rebuttal to any comments made in the formal evaluation documents. New faculty members are actively mentored within the department, which has resulted in well-rounded accomplished faculty members.

### **Involvement of Faculty in Teaching, Research, College Community, Community Outreach, etc.**

The Biology and Chemistry faculty are active members of the university community as documented by the extensive active service on committees, participation in both on-campus as well as outreach programs, and appointment to active leadership roles. Intradepartmental committees include Curriculum, Assessment, Student Affairs, Peer Evaluation, Equipment and Facilities, Graduate, and Faculty Search Committees. The participation and contributions of the faculty members to both the university and greater community are too numerous to review here but it should be noted that the faculty members are in general, engaged and active members of both communities. Several faculty members have had or currently hold active leadership roles on campus. Two faculty members, Drs. Cratsley and Hoey, have served the university in administrative roles. Dr. Cratsley served as the Director of Assessment and Dr. Hoey served as the founding dean for the Division of Health and Natural Sciences. Dr. Nosek served terms as chair of the All University Committee which is the main governing committee on campus. Currently, Dr. Erin Rehrig is serving as Director of the Undergraduate Research Conference and Dr. Hoey is the Director of the Center for Faculty Scholarship. Finally, the university has several important compliance committees, Safety, Institutional Review Board (IRB), Institutional Animal Care and Use (IACUC), and Institutional Biosafety (IBC). Departmental representation is present on the campus-wide Safety Committee and two of the committees, IACUC and IBC, are chaired by department members. Dr. Schoenfeld currently chairs the IACUC and Dr. Sean Rollins currently chairs the IBC. The IBC represents a new campus compliance committee as a new Biosafety policy was written and implemented during the evaluation period. (A list of current department committee memberships and a history of University committee participation can be found in [Appendix E.](#))

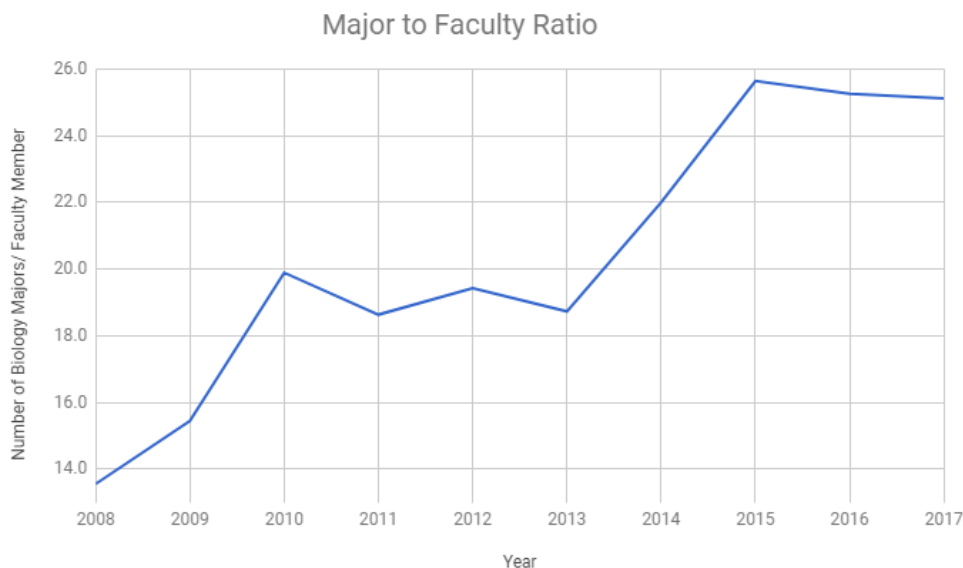
Dr. Govindan, Professor of Chemistry, has been serving informally as an advisor for health professions since 2006 and has developed the Pre-Medical Advising Program. He oversees the

Biology/Health Sciences concentration and helps to advise students in this concentration. The program has seen a significant growth in participation over the last ten years. Dr. Govindan has developed an advising handbook, brings in outside speakers, maintains an email listing of all pre-professional students, and has traveled extensively on behalf of the program. In addition, he was instrumental in the development and signing of early admission agreement for medical, pharmacy, and dental programs with the Lake Erie College of Osteopathic Medicine (LECOM).

Active research programs are ongoing as reflected in publications, papers presented, student research, and grant writing. All faculty members maintain membership in professional organizations. Several faculty members have attended national meetings where they have presented their scholarship and several have had publications during the review period. The major difficulty in pursuing biological or chemical research at Fitchburg State was the lack of appropriate facilities, equipment, research supplies, minimal start-up funding, and the heavy teaching load. The opening of the new science building in the summer of 2013 and the renovation of the current science building in 2014 greatly improved our facility and equipment resources. Faculty teaching load and research supply funding remains a hindrance to high levels of academic scholarship. Allowing teaching release time for scholarship activities would directly increase the faculty's scholarly activities. For instance, for faculty who are actively preparing (writing and/or generating preliminary data) a grant application with the Grants and Sponsored Programs office, it would promote expanded research funding. Additionally, allowing teaching release time for faculty with significant active grant's such as NSF, NIH, Gates Foundation or the equivalent; would provide faculty with the time needed to perform the research outlined in these applications. Student involvement would also be critical in performing research activities but attracting student interest is difficult without dedicated time and funding.

Because the first priority of faculty in the department is to help students acquire the knowledge and skill set necessary to prepare them for careers in biology and chemistry, student engagement is critical. However, the full teaching loads limit faculty involvement with students in these activities. While the number of faculty has grown in the last 10 years (9 in 2008 to 12.5 in 2017), it has not kept pace with the increasing number of biology majors. The number of biology majors per faculty has increased by 85% in the last 10 years and 34% in the last 5 years (13.6 in 2008, 18.7 in 2013, and 25.1 in 2017) (Figure 1). In 2018, the biology majors to faculty ratio is projected to fall to 22.3 due to a slightly smaller class and an increase in the number of faculty to 13.

\* <http://www.fitchburgstate.edu/about/facts/>



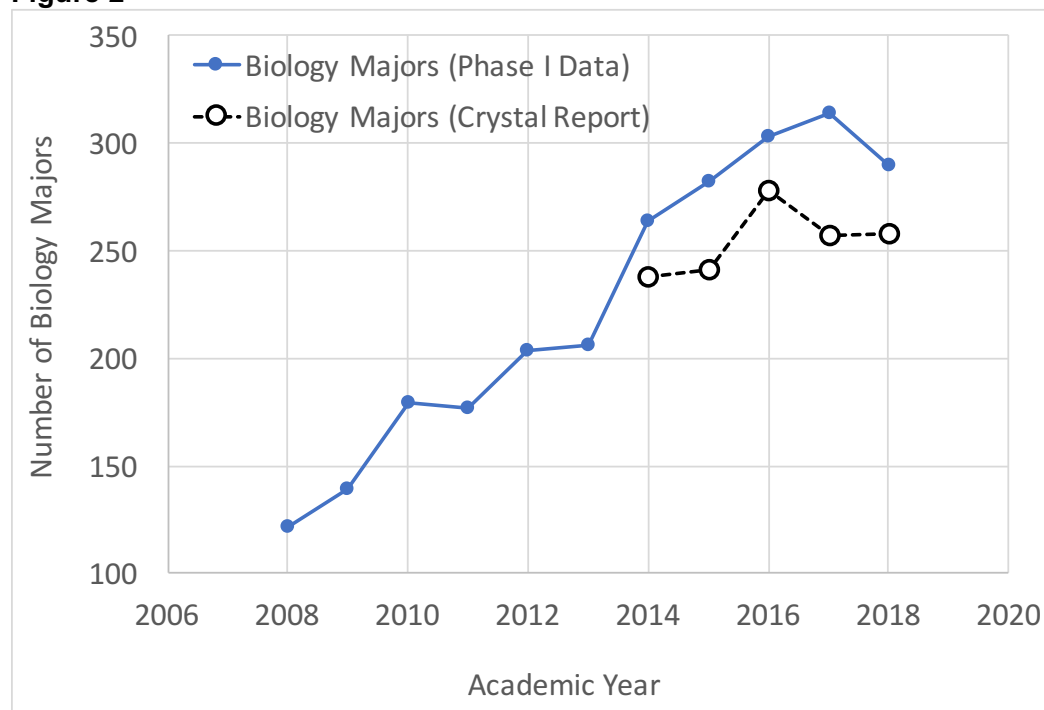
**Figure 1:** Graph showing ratio of the number of biology majors to number of biology faculty from 2008-2017. These data (referred to as Phase I data) were provided to the department by the office of Institutional Effectiveness and Research.

## Students

### **Student Population of Biology and Chemistry Department**

The Biology program has experienced steady growth over the last 10 years. The number of biology majors has increased by 52% over the last 5 years and 157% over the last 10 years (Figure 2). The undergraduate enrollment for the university has increased by less than 10% over the last 10 years. In 2017, there were 314 biology majors and 4,129 undergraduates enrolled in the university. The growth of the program appears to be the result of an increased rate of transfer students (45 in 2016) as well as an increased rate of new freshman (69 in 2016). The breakdown of our 2017 Biology Class is 34% freshman, 21% sophomores, 20% juniors, and 25% seniors. It does not appear that the number of biology majors will continue to increase in 2018 (290 currently enrolled).

**Figure 2**



**Figure 2** shows the number of biology majors over the time period beginning 2008 and ending with AY2018 (Sept 2017 data). The Department was provided Phase I data from Institutional Effectiveness and Research, and we also obtained data from Crystal Reports for September from each academic year from AY13/14 through the present AY17/18. Crystal Reports are generated through the University's Banner system and are a source of internal enrollment data. Despite some discrepancies in the enrollment numbers, the department has experienced a dramatic growth over the last 10 years, with a lesser increase in majors over the time of this review.

The majority of our biology majors choose the health sciences concentration (124 in 2017), a 2.5-fold increase in the last 5 years. The number of students choosing the Neuroscience and Behavior concentration has increased slightly in the last 5 years (10 in 2017), while the number of students choosing Biotechnology (16 in 2017) or Environmental Biology (17 in 2017) have declined. In 2017, we had 5 students in the Biology with Initial Teacher Licensure concentration (Table 1). (Additional information about our graduates related to employment and graduate school attendance is presented in [Appendix A.](#))

We have made some changes to our Bachelor of Arts Biology degree (see Department Initiatives and Significant Changes above) and expect more students to enroll in this program in the future. Historically, only an occasional student had chosen to pursue the Bachelor of Arts Biology degree program, but in the fall of 2017, 18 students had enrolled. The number of students choosing the Biology majors has also grown over the last 5 years (46%) with 32 students enrolled in 2017. The number of Neuroscience, Behavior and Cognition minors has increased from 13 in 2013 to 22 in 2017 (Table 1).

**Table 1**

<b>Majors</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
Biology Bachelor of Science	238	241	278	257	258
Biology Bachelor of Arts	0	1	6	16	18
<b>Minors</b>					
Biology	22	30	33	38	32
Neuroscience, Behavior and Cognition	13	16	13	21	22
<b>Concentrations</b>					
No concentration	89	71	84	92	86
Biology with Initial Teacher Licensure	11	7	4	2	5
Biotechnology	28	27	20	18	16
Environmental Biology	28	24	20	16	17
Health Sciences	48	104	140	120	124
Neuroscience and Behavior	2	10	14	11	10

Data for Table 1 were obtained from Crystal Reports from September of the academic year shown.

### **Student Support Through Service Courses**

One of our program goals is to serve the needs of the university through our curricular offerings. To this end, we offer a number of courses taken by students outside of our major. A substantial number of these service courses are taken by Exercise & Sport Science and the Pre-Nursing students. These courses include Anatomy and Physiology I & II, General Biology I, General Chemistry I, Medical Microbiology, and Chemistry for Health Sciences. While the number of Pre-Nursing majors has not changed over the last 10 years (80 in 2017), the Exercise & Sport Science program has experienced 39% growth in the last 10 years (237 majors in 2017). We also offer Life Science, a biology course for non-majors, Biological Issues and Inquiry, a biology course for



non-majors in the honors program, and the course Life Science for Educators which is taken by elementary and middle school teacher candidates to fulfill their science requirement and to help them prepare for their teacher licensure (MTEL) exams. (Additional information on faculty advising of students is provided in [Appendix A.](#))

### Transfer Student Population

We have a large number of transfer students, and many come in needing mostly their science requirements. In order to graduate in a timely fashion, these students need to work with their advisor to have a long-range plan for their courses to assure they will meet the graduation requirements. To facilitate advising and to help the department plan ahead, the department is working to create a two-year schedule for courses (see [Appendix J](#)). This begins by first determining the number of seats needed in the core courses, electives, and capstone courses each semester. The better planning allows students and advisors to have an idea of how their courses will be scheduled and help assure that they will be able to fit in their required biology and chemistry courses to complete their requirements in a timely fashion. Additionally, several faculty members from our department have worked very closely with the faculty and administration from MWCC to provide smooth transfer pathways for students wishing to make the move to a bachelors program at FSU.

### Diversity of Student Population

The breakdown in gender and ethnicity within the Department of Biology and Chemistry is shown in Table 2. In general, enrollment of female students increased from the 2012/2013 Academic Year (AY) to the 2016/2017 AY, while the enrollment of male students has remained fairly constant. It is worth noting that more female students than male students were enrolled each academic year over the last five years; a similar trend was observed in the last self-study. The percentage of female students enrolled in the biology program since the last self-study increased steadily from 60% in AY 12/13 to 70% in AY 16/17.

**Table 2.**

		AY12/13		AY13/14		AY14/15		AY15/16		AY16/17	
		N	%	N	%	N	%	N	%	N	%
<b>GENDER</b>	Female	144	60	185	68	187	66	202	67	200	70
	Male	97	40	87	33	95	34	100	33	86	30
	<b>Total Enrolled</b>	<b>241</b>	<b>100</b>	<b>272</b>	<b>100</b>	<b>282</b>	<b>100</b>	<b>302</b>	<b>100</b>	<b>286</b>	<b>100</b>
<b>RACE/ ETHNICITY</b>	Asian	10	4	8	3	11	4	14	5	12	4
	Black	30	12	40	15	48	17	51	17	61	21
	Hispanic	33	13	35	13	39	14	49	16	50	17
	More than One Race	3	1	6	2	7	3	5	2	7	2
	White	152	63	175	64	169	60	178	59	152	53
	Unknown	13	5	8	3	8	3	5	2	4	1
	<b>Total Enrolled</b>	<b>241</b>	<b>100</b>	<b>272</b>	<b>100</b>	<b>282</b>	<b>100</b>	<b>302</b>	<b>100</b>	<b>286</b>	<b>100</b>

## **Table 2: Diversity of Biology Majors 2012-2017\***

\*Data (Phase I data) were provided by Anthony Wilcox, Interim Director, Institutional Effectiveness and Research, Fitchburg State University.

The race/ ethnicity group representations of biology majors in the department reveals quite a diverse student population as indicated in Table 2. Overall, enrollment of minority students in the biology program has increased significantly since the last self-study. The percentage of minority students, which was 30% in AY 12/13, increased steadily in the five-year span, and currently stands at 43% in AY 16/17. Students who identify as Black represent the largest population of minority students, and is also the minority group showing the largest increase (percentage- and number-wise) over this five-year span. The number of Hispanic students represents the second largest minority groups in the biology program and their numbers similarly increased in the five-year span. Levels of minority enrollment in Biology now exceed the overall rates of minority enrollment in the institution as a whole. The improved student diversity since the last self-study parallels the diversity of faculty attained over the five-year span, with three of the six recent tenure track hires being from underrepresented groups in the field of science (women/minority).

With a large cohort of minority students being first generation college students, there are campus-wide and department efforts to help coach and encourage them to excel in their programs of choice. For example, the university offers free tutor services for all students through the Tutor Center as well as counseling services for students. In addition, many of our students are in an Expanding Horizons program – a program that targets low income, first generation college students and students with disabilities, and helps them succeed in college. Our faculty use the Student Success Collaborative (SSC) platform for monitoring student progress and for intrusive advising of students. Faculty member Dr. Meledath Govindan has collaborated with Dr. Deborah-Harmon Hines, a minority Professor Emeritus and Special Assistant to the Provost at UMass Medical School, who has periodically visited our department to challenge underrepresented student groups to excel academically and help them explore ways by which they can become more competitive for admissions to health professional schools, graduate school, etc. Through this collaboration, some of our minority students have attended conferences organized by the Student National Medical Association (SNMA), “an organization committed to supporting current and future underrepresented and minority medical students”. Many minority students have attended the Summer Enrichment Program at UMass almost every year in the five-year span. The goal is that all of these efforts will help retain minority students and promote their success within the department.

### **Biology and Chemistry Club**

The Biology and Chemistry Club is a student-run organization on campus (with one or two members of the faculty serving as faculty mentors). Although the club has a faculty mentor, the club is student-driven so each year, the goals of the club are dependent on the membership. Over the past five years, the major efforts of the club have been on promoting student-faculty relationships and providing academic support outside of the classroom. In some years the club focuses on science themed fun events like visiting the Museum of Science and the New England Aquarium, hiking and identifying local fauna and fungi. Other years, the club has had a more academic focus and brought in a variety of speakers: representatives from the career center to help students with their resumes, local business owners in scientific companies who speak on skills needed in the workplace, and alumni panels who have spoken on how they have succeeded with a science degree from FSU. Deborah Hines from the admissions office at UMass Medical School is one of our most popular speakers who comes every two years and discusses how to get into medical school. The club has attended and presented a poster at the Eastern New

England Biological Conference and sent representatives to the regional PKAL conference at Bridgewater State University. Consistently, the club has organized trivia nights with students and department faculty, the end of year holiday party, and kickball games in an effort to promote friendly student-faculty interactions. Those events have been mostly well-attended. In academic year 2014-2015, the club won an award for being the most improved club on campus.

In the future, the club has goals to increase its outreach to students academically and increase diversity in its membership. Future plans include holding a peer advising night during the advising period and a group homework/tutoring night beginning once per month. The club is working to advertise in classes and send out surveys of what biology students would like to see from the club in an effort to increase membership and diversity.

Another initiative for student-faculty interactions is the new STEM Living Learning Community. In fall of 2017, the University organized a floor on one residence hall with 10 first-year students in STEM majors, most of which are biology majors. One of our faculty has worked with the Dean and faculty from Exercise and Sports Science, Psychology, and Math to hold social and educational events. Our goal is to increase retention by helping STEM majors feel they are part of a whole community of learners. Next year the program will expand to 40 students and will include Nursing majors. As the Biology program continues to seek out new ways to engage with majors outside of the classroom, we are cognizant that we must be responsive to the changing demographics of our program, embracing the opportunity to promote the participation of underrepresented groups in the field of science.

### **Student Handbook**

During this review period, the Department completed a Student Handbook which is available on the Department webpage and is given to all incoming students at the start of the academic year by faculty when they meet with their advisees for the first time ([Appendix K](#)).

## **Curriculum**

### **Program Objectives**

The primary objective of the Department of Biology and Chemistry is to provide undergraduate and graduate students a combination of key concepts, scientific methodologies, and hands-on research, laboratory, and field study skills. The biology curriculum exposes students to a breadth of contemporary research and knowledge about the natural world. Scientific inquiry requires both a strong foundation of content knowledge and the critical thinking skills that comprise the scientific method. The biology program prepares students through a wide variety of courses that focus on both the content and process of science. In addition, we provide opportunities through internships, independent studies, and research.

### **Description of Curriculum**

The Department offers a BS/BA in Biology, as well as five concentrations within the biology major (Biotechnology, Environmental Biology, Health Sciences, Neurobiology and Behavior, Biology with Initial Teacher Licensure) (see [Appendix I](#) for the four-year Plans of Study for each concentration.) Each concentration has the same basic core of biology and chemistry classes (see [Appendix G](#)). This common core provides each major with the fundamental content and skills needed in many fields of study. The core also helps our majors develop a sense of

community despite their specializations. Beyond this core, each concentration is designed to meet the needs of a student population with a wide range of career interests. The upper level classes for each concentration are open to all majors and minors so that each major can take a diverse range of electives before they graduate.

In addition to our majors the Biology Department provides a variety of minors to other students. The department offers a Minor in Biology, in Chemistry, and in Neuroscience, Behavior and Cognition. These minors allow non-majors to specialize in an area of interest that might help them obtain a career or enter a graduate program. Furthermore, we have an even larger impact via service courses. The majority of classes taught by our department are service courses for majors in Exercise and Sport Science, Nursing, Education, as well as general lab sciences courses for the entire university community. Additionally, every student is required to take a lab science course as part of the liberal arts and sciences (LA&S) curriculum, and we provide several introductory biology and chemistry courses that meet this requirement.

As stated previously, the graduate program in the Department of Biology and Chemistry is comprised of three degree and/or licensure programs: MA in Biology (thesis and non-thesis tracks), Post-Baccalaureate Biology Initial Licensure (8-12) and MEd. Science Education (see [Appendix H](#)). With these three programs, we are able to offer students the opportunity to obtain an initial teaching license, a more advanced professional teaching license with a Master's degree in science education or a Master's degree in biology. Our graduate student population is composed mostly of high school teachers of record in biology, chemistry and earth science. Although they make up a small part of our program, we do have students who are not in the teaching field and are instead working in careers within basic research or clinical laboratories.

### **Impact of Growth on Curriculum**

During the period of the last program review our department saw a growth in the number of the total majors from 122 majors in 2008 to 204 majors in 2012. We have continued this trend during this review period growing from 206 majors in 2013 to 303 majors in 2016 (based on Institutional Effectiveness and Research data). Throughout this span, there has been a growth in full time biology faculty from 9 in 2008 to 12 in 2016. The growth of our majors has been reflected in the increased number of offerings of major core (particularly in Genetics and Ecology) and elective courses. For example, in AY 2013-2014 there were 10 sections of General Biology I, 11 sections of General Biology II, 4 sections each of Genetics and Ecology, and 203 seats listed (192 enrolled) in 9 majors, elective courses. Whereas in AY 2016-2017 there were 10 sections of General Biology I, 6 sections of General Biology II, 5 sections of Ecology and 6 sections of Genetics, and 341 seats listed (362 enrolled) in 16 majors, elective courses.

### **Capstone Experience**

Another requirement for biology majors is an elective course that provides a capstone experience. In the 2013 program review, the reviewer discussed the capstone course that we require our majors to take. At the time only two courses were available as capstone choices, Developmental Biology and Molecular Biology. The reviewer was impressed that we include a capstone experience where students worked on a research project as part of the course. However, the reviewer suggested that we develop a more clearly defined set of learning outcomes for the capstone course. At the time, Molecular Biology and Developmental biology were chosen because they both included a student research project as part of the course. The reviewer also suggested that we develop capstone courses in other fields such as environmental biology, physiology, animal behavior and evolution. In response to the reviewer's comments, the

curriculum committee adopted a set of expectations for capstone courses or experiences and in the fall of 2013 came up with the following descriptions:

A capstone course must be an upper level (3000 or 4000) course that has prerequisites above General Biology. In addition to course content, to qualify as a capstone course, students must work on an independent or guided research project and demonstrate the following:

- Ability to form and propose a testable hypothesis
- Ability to design an experimental process to address the hypothesis
- Ability to conduct experiments and collect data
- Ability to analyze and interpret data collected
- Ability to discuss results from these experiments
- Ability to access, analyze, and understand the scientific literature
- Students must show evidence (written and/or presented) of these skills

To accommodate the growth in the number of majors and the increasing need for seats in capstone courses as well as to address the recommendation of the reviewer that we broaden the subject areas that capstone courses cover, several changes have been made. The first was to redesign several courses, adding in new objectives to allow them to be taught as capstone courses. This has been done for Plant Biology, Invertebrate Biology, General Microbiology, and Animal Physiology. Two topics courses were also developed and taught as capstones: Aging, Disease and Nutrition and Applied Field Biology. (Note: Topics courses are experimental courses that may be taught two times without going through the formal approval processes of governance. After two offerings the course needs to be submitted as a "new course" through governance, or be eliminated from the course offerings.) During this process, several faculty found that offering their class as a capstone did not work well for their courses which were already content heavy. However, Plant Biology and Animal Physiology will continue to be offered as a capstone in the future.

In addition to adding courses, the number of seats in existing capstone courses (both Molecular Biology and Developmental Biology) was recently increased from 12 seats to 15 seats per laboratory section. Attention is also being paid to the frequency of course offerings. Molecular Biology is now offered more frequently than every other year (it was offered in Spring 2013, Spring 2014, Spring 2016, and Spring 2017 semesters) and Developmental Biology is offered every spring. Also, several students have conducted defined independent study research with faculty that were approved by the curriculum committee to be accepted as their capstone.

With increased capstone course offerings, students may complete projects in the fall which has the added benefit of giving the students an opportunity to present their research at the end of the fall semester during our end of semester departmental reception. The students conducting capstone projects in the fall or spring semester are also able to present at the Fitchburg State University Undergraduate Conference for Research and Creative Practices. This is a day near the end of the spring semester (held in late April) when classes are cancelled and students are allowed to present to the campus.

### **Special Studies (Student Research and Internships)**

Since our last self-study, the department has increased the options for student research and independent studies (Table 3). In the last five years, biology faculty offered 37 research projects that enrolled 44 students (sometimes multiple students enrolled in the same project). That biology research alone almost doubled the amount that we offered compared to our previous self-study (24 projects for 24 students), and yet that research does not include two important additions.

First, our chemistry faculty also offered 24 projects for 27 students, most of whom were Biology majors. Furthermore, in AY2016 the department created a 1-credit “Introductory Research” course in both biology and chemistry. In this new course students get practical research experience without the time commitment of a full (3-credit) independent study. In just three semesters, 7 Introduction to Research projects have enrolled 10 more students in biology. The full list of separate projects, students and faculty are presented in [Appendix N](#).

Table 3.

<b>Enrollment</b>		<b>2013 Self-Study</b>	<b>2018 Self-Study</b>
Independent Research Projects (≥3 cr)	Biology	24	44
	Chemistry	3	24
Introductory Research (1 cr)	Biology	–	10
	Chemistry	–	2
<b>TOTAL</b>		<b>27</b>	<b>80</b>
Internships		33	22

**Table 3.** Enrollment in special studies, comparing results from our 2013 and 2018 self-studies.

To help raise awareness of research opportunities, several STEM departments have presented research posters every fall semester since 2014. Faculty present posters of work in their labs, and students get a better sense of what options are available.

In 2017, several faculty from Biology, Chemistry, and Earth and Geographic Sciences received a \$240,000 grant from the Balfour Foundation to fund a Student-Faculty Collaborative Summer Research Experience. The project studies the health of the Nashua River from geological, biological, and chemical perspectives. The collaborative also pays students (30 hours/week), which has made a research experience much more accessible to our students. Those Nashua River projects are not included in Table 3 because the students did not receive academic credit for the research.

In addition to research, 21 Biology students enrolled in some kind of internship or work experience. Internships included conservation practice, student teaching, industry, and shadowing health care professionals. A full list of internships is listed in [Appendix N](#).

Table 3 shows a decline in the number of internships in the last five years compared to our previous self-study. One factor is probably the increase in research opportunities with new faculty and the new science building. With more options to engage with research, there may have been less incentive to find an internship off campus. Another factor is that an internship used to be required for our Environmental Biology concentration, but the internship became optional starting in AY2016.

Whether students complete independent research or internships, many present their work at the Fitchburg State Undergraduate Conference each April. From 2014-2017, poster presentations from biology projects were 32 of the all 155 posters at those conferences, or 21% of the total. Another 8% of posters were chemistry projects that included some biology majors. In the last 5 years, nine of our most promising students have also presented posters at regional undergraduate conferences. In contrast, only 3-4 students presented research or internship seminars at the FSU Undergraduate conference since 2013.

One difficulty faculty face in providing these high impact research opportunities involves compensation. In the natural sciences, student research requires a large time commitment by faculty for training and supervision. Safety concerns are an additional concern for most science projects, requiring more faculty supervision than in most fields of study. However, according to our contract faculty are compensated with only 0.25 credit hours for each student in an independent study, regardless of the number of credits. Therefore, a faculty member may need to accumulate 12 projects to earn one course release. We have not been successful in making lab science a separate type of independent study in our contracts to earn more compensation. Fortunately, each internship earns 0.33 credits of release time, which seems more appropriate given the amount of work required to supervise an off-campus internship. It should be noted that during this evaluation period the University has begun to increase the number of opportunities for course release for faculty through small faculty development grants. These are available to faculty of all departments.

### **Major Curricular Changes**

Since our last self-study in 2012-2013, we have instituted several significant changes to our curriculum that we hope will improve learning outcomes, retention and graduation rates. Most of these changes are fairly recent and it is difficult to quantify any impact at this point in time although anecdotal evidence suggests these changes have addressed issues concerning students who have struggled with the biology major and have remained in the major despite having little chance of graduating.

Retention and graduation rates in the biology major are relatively low at Fitchburg State, but more surprisingly, some of our students do not move on to other majors even when they find it difficult to succeed in the biology major. The data from the Student Success Collaborative show that an inordinate number of our “native” biology majors not only drop out of biology, but they drop out of Fitchburg State without completing a degree here. Our department has taken steps to improve student retention within our major, to create alternative pathways to graduate with a biology degree and to identify students who most likely would not graduate with a biology degree and direct them into majors where they would be more likely to succeed earlier in their academic career.

### **Minimum Grade Point Score Requirements and Limit on Repeating Some Core Courses**

One of the perennial problems in the biology major is the number of students who are not sufficiently prepared or motivated for a rigorous major in the sciences. Some students have unrealistic expectations that they will pursue careers as, say, doctors or environmental scientists, when they lack the quantitative skills and/or study skills to pursue those careers. Such students struggle in their courses with low grades for several semesters or even years before shifting to majors that are a better fit to their skills and interests. Two major changes that we have implemented deal with the minimum GPA required in core courses and the B.A. in Biology, both of which we discuss in more detail below.

In the spring of 2010 we instituted a policy, whereby students must maintain a 2.0 minimum GPA in the major required courses (*i.e.*, a 2.0 GPA across their science and math courses). If the student’s major GPA drops below 2.0, students go on probation and must meet with their advisor to plan strategies to raise the GPA. If the major GPA remains below 2.0 for two consecutive semesters after being put on probation, a student must leave the major.

This policy had only limited success. First, there is no automatic way to calculate a GPA in the major, so each advisor must calculate that GPA by hand for each advisee at risk. Second, catching the students with low GPA's depends on the attention of each academic advisor, which is imperfect. Third, even if the advisor is aware of a student at risk, some students have not been properly notified by a required letter. Finally, it is difficult to force students to come in for additional counseling. In sum, the 2.0 GPA in the major policy is time consuming and prone to human error, and therefore too many students were not being identified as at risk and remained in the major although they were unlikely to graduate. Moreover, even when the probation system works as planned, students were still able to enroll in subsequent courses for which they were not prepared, which has an impact on all students enrolled in a course.

Starting in the fall of 2014, we replaced this policy with something much simpler and more effective: a minimum grade requirement in core courses. Initially, the policy required students to achieve a 1.7 or higher in the required courses. Subsequently, the policy was modified in response to the Student Success Collaborative data. Many struggling students can often be seen in hindsight to have struggled with our introductory courses of General Biology I and II and General Chemistry I and II. Specifically, no student who scored below a 2.0 in General Biology I graduated with a biology degree from Fitchburg State (Figure 3a). For General Chemistry, students very rarely graduated with a biology degree from Fitchburg State University with a score below 2.0 (Figure 3b). Based on these data, in AY 2016 we changed the minimum grade that students are required to achieve in General Biology I and General Chemistry I from a 1.7 to a 2.0 before moving on to other courses.

Figure 3a.

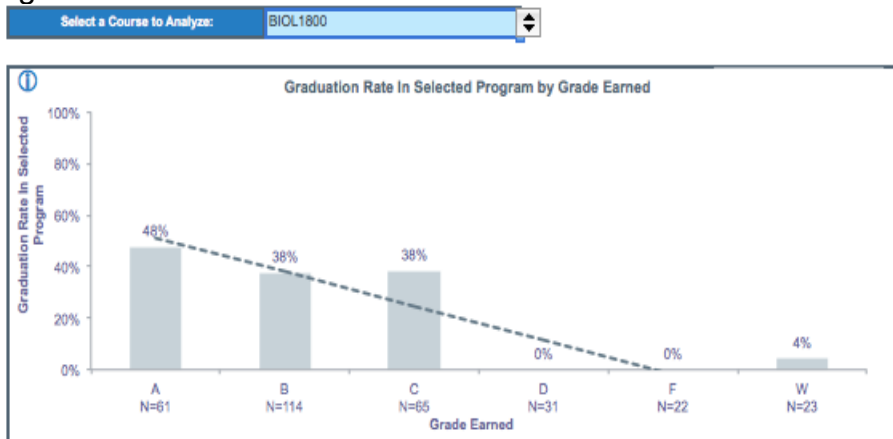
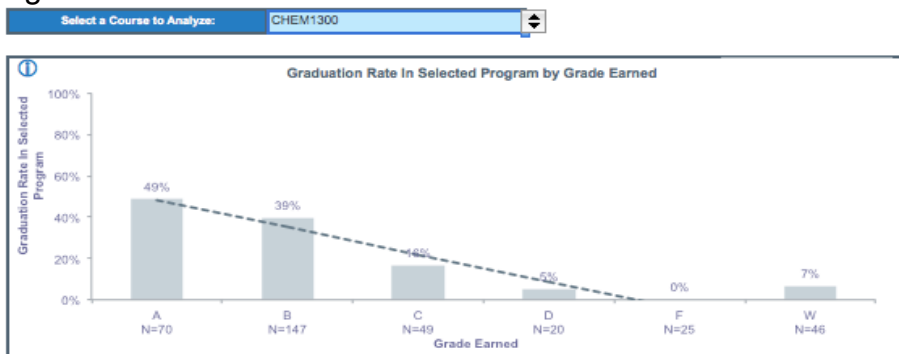


Figure 3b.





**Figure 3.** Graduation rates in biology majors (2002-2009 enrolling classes), compared to grades received in General Biology I (upper graph) and General Chemistry I (lower graph). Under the University's grading system, a 2.0 is a C (71-73%) and a 1.7 is a C- (69-70%).

Additionally, we have also limited the number of times a student may take General Biology I and General Chemistry I to two attempts. Failure to achieve a 2.0 in their second attempt (or withdrawing from the course) will result in the student being removed from the major and they will be advised on viable options for majors in other departments. (It should be noted that these changes do not apply to students in the biology minor.)

According to the data above, one quarter of incoming biology majors would be affected by this change. Between 13-17% earn a grade of D-F in these courses, and another 7-13% withdraw, for a total of 24-26% in each course. Since spring of 2013 that number has decreased to 19% in General Biology I but has increased to 29% in General Chemistry I.

With these changes, the registration system will automatically identify students during the registration process and is less prone to human error. Students at risk are identified early in their academic careers and, importantly, students who enroll in subsequent classes will be prepared for the challenges ahead, thus improving the learning environment for everyone. Additionally, the proposal allows faculty to intervene more quickly to help some students realize that the biology major is not a good choice for them or to direct them to academic support services when appropriate. Our hope is that early intervention will improve biology major retention and graduation rates or allow students to enter a more appropriate major early enough to complete their degree at Fitchburg State.

We are aware that these changes may reduce retention in biology majors in the short term. However, we are only likely to lose students who were not going to graduate in biology anyways (Figure 3). We hope that the changes in this proposal will encourage some students to “raise their game” in their introductory courses and build a better foundation to succeed in biology. Plans are being developed university-wide to invest more resources in the form of supplemental instruction to those students who encounter difficulties in these gateway courses. This change should also encourage some students to find other majors sooner so they can complete their new major at Fitchburg State.

It is too early to determine the effectiveness of these changes, but in August of 2017 we obtained limited data from fall 2016 and spring 2017 semesters. In fall 2016 one student each failed to get the 2.0 minimum in General Biology I and General Chemistry I, while in spring 2017 the numbers were three and five, respectively. These students have been advised about this and will be tracked to gather more data.

### Revisions to The Bachelor of Arts in Biology Program

A second major curricular change was a significant revision of the Bachelor of Arts in Biology Program (current program is described in [Appendix G](#)). This change was instituted to improve retention and graduation rates by providing students an alternative path to graduation with a biology degree. The previous B.A. in Biology program was nearly identical to the B.S. in Biology program. The only difference was that B.A. students were required to take 2 years of a foreign language on top of the same requirements of a B.S. student. Since the B.A. Program only placed an additional requirement on students, the program was seldom utilized.

A survey of Bachelor of Arts degree programs at institutions around the Commonwealth indicates that many of them have less science requirements to offset for additional liberal arts coursework. By removing some of the related science requirements, this degree is expected to become more desirable for students. We hope that this will help increase the graduation rate by providing a broader liberal arts degree that would also be appealing to some employers who are looking for broadly trained scientists.

The revised B.A. curriculum continues to have the same biology coursework as the B.S., which includes four core courses, a Capstone elective and five other BIOL electives. Students will continue to take two courses in mathematics and the two semester General Chemistry sequence (CHEM 1300-1400). The changes to the degree include dropping the requirement of Organic Chemistry II and changing the physics requirement. In the previous B.A. program, students were required to take Physics I and II. The revised program allows students to take a physics course and a geology/geography course. One additional requirement in the B.A. degree program when compared to the B.S. program is that B.A. will continue to require proficiency in a foreign language at the intermediate level. Additionally, students could replace a single biology elective (>2000-level) with the Anatomy & Physiology sequence (BIOL 1200 and 1300). This last change was instituted since a number of students from other majors (Nursing and Exercise and Sports Science) frequently change into the biology major and were not receiving any biology elective credit for these courses, which were requirements in their previous majors.

#### Summary of Changes B.A. Biology Program:

- One of the BIOL electives could be replaced with the two-semester sequence in Anatomy and Physiology (BIOL 1200-1300).
- Change the Organic Chemistry requirement from 2 semesters to just one semester.
- Change the current General Physics I and II requirements to “any PHYS course.”
- Add the requirement of a GEOG course, “any GEOG course.”

These changes are intended to make the major a broad-based biology degree that would be appropriate for students who wish to use biological knowledge in pursuit of a career that does not require a detailed knowledge of organic chemistry and physics. Examples of such careers are laboratory technician, teacher, science writer, scientific illustrator, technical sales representative, and editors or editorial assistants in the publishing industry. This degree would also help students fulfill the requirements for admission to certain health professions, such as Physician Assistant, Physical Therapy, Occupational Therapy, Public Health, Post-baccalaureate Nursing and Chiropractic – in some cases additional specific coursework may be required. Pre-medical and pre-dental students, and those who want to pursue graduate studies in biology would be advised to pursue the B.S. in Biology but they could also use this degree by tailoring their curriculum to meet the specific requirements of medical or graduate schools.

#### **Biology Student Learning Outcomes**

In our last self-study (2013), the department had created a list of learning outcomes, and had been collecting data from test questions that addressed those outcomes from various courses. However, the data were not useful because very different questions were being used in different courses, or by different instructors teaching the same course. Therefore, beginning in 2012 we began to use the same assessment questions among different instructors in General Biology I and II. While the outcomes data were a little more useful, they were still difficult to interpret. For example, 50-70% of students would score correctly on questions that tested deeper

understanding of concepts, while 70-90% would score correctly on easier questions testing memorization. We were not sure how to use such results to measure our success or to inform our curriculum, especially since we only collected data on content knowledge from General Biology I and II.

We also struggled to assess general skills in experimental design, data analysis, and information literacy. Our approach was to try to assess those skills in capstone courses (at the time, Developmental Biology and Molecular Biology). We used a generic rubric for those skills that was adapted from rubrics used by the AAC&U and our own Liberal Arts and Sciences Council. However, the assessment scores from these capstone projects were not very useful, either. The assessment committee members were not the instructors of those courses, so we could not distinguish how much of the demonstrated skills were really from student ability or from a professor's guidance. Furthermore, capstone projects were done in groups of four students, so we had small data sets. Finally, some projects were more oriented to applying techniques (e.g., molecular biology), while the generic rubrics were focused on testing hypotheses and analyzing quantitative data. So, enthusiasm for assessing capstone projects waned soon after our last program review.

### **Revised learning outcomes (BioCore) and Curriculum mapping**

To fix some of these problems, we began to revise our assessment program in AY 2015. We first revised the learning outcomes for disciplinary knowledge. By consensus, the department adopted content outcomes from the BioCore Guide of the AAAS, published in 2014.

<http://www.lifescied.org/content/13/2/200.full>

(Brownell, S. E., Freeman, S., Wenderoth, M. P., & Crowe, A. J. (2014). BioCore Guide: a tool for interpreting the core concepts of Vision and Change for biology majors. *CBE-Life Sciences Education*, 13(2), 200-211.)

The link above contains a PowerPoint table with the learning outcomes in the BioCore Guide. Those learning outcomes derive from the 2011 Vision and Change report from the AAAS, a national effort to revise biology teaching. The BioCore Guide lists five core areas of biology:

- Evolution
- Pathways and Transformations of Energy and Matter
- Information Flow, Exchange and Storage
- Structure and Function
- Systems

Each core area is addressed at different scales or sub-disciplines in biology:

- Molecular/Cellular/Developmental
- Physiological
- Ecological/Evolutionary

After some minor revisions and consolidation of the BioCore concepts, the Assessment Committee presented the department with a list of 37 learning outcomes for biology content (Table M-1, [Appendix M](#)).

In AY 2015 we then created a curriculum map to see if, where, and how often we teach those concepts in our four core courses. We surveyed faculty who teach the core courses to score

each concept on a scale of 1-5 (Table M-1, [Appendix M](#)). Approximately 89% (33/37) of the concepts are covered at least for “most of a lecture or a lab” (i.e., rated  $\geq 3$ ) at some point in the four core Biology courses. Learning outcomes that receive the weakest coverage in the core courses are in physiology and developmental biology.

This curriculum mapping highlighted weaker coverage of Physiology content and Molecular/Cell/Developmental content in the core courses. The department regularly offers a number of upper level biology electives in Molecular/Cell/Developmental though learning outcomes vary substantially across these electives. Upper level physiology courses are taught by a single faculty member and have limited seats. These physiology courses specifically address areas where introductory courses have limited coverage. Evolution topics are introduced in General Biology II and outside of Evolution there are few electives with substantial evolution coverage.

In AY 2017 the Assessment Committee highlighted the 19 learning goals that received less coverage in the four core courses (i.e., 25% and 50% quartiles for cumulative coverage). Physiology had 7 of 19 learning goals in the bottom two quartiles, Molecular/Cellular/Developmental Biology had 7, and Ecology/Evolutionary Biology had 5 of 19. In order to determine which upper-level Biology courses cover these topics, faculty rated coverage of BioCore learning goals in upper-level courses (only learning goals in the 25% and 50% quartiles were ranked).

Assessment and Curriculum Committees met together in March 2017 to discuss the results of the learning goals and skills surveys. Non-metric Multidimensional Scaling (NMDS) was conducted to group courses based on coverage rankings of learning goals (Figure 4). Developmental Biology and Bioethics were not included in the analysis because of a faculty retirement. Three general clusters of courses were apparent from survey rankings of learning goals.

**Cluster 1. Anatomy and Physiology** (tight grouping)

- Neuroscience, Animal Physiology, Comparative Anatomy, Anatomy and Physiology

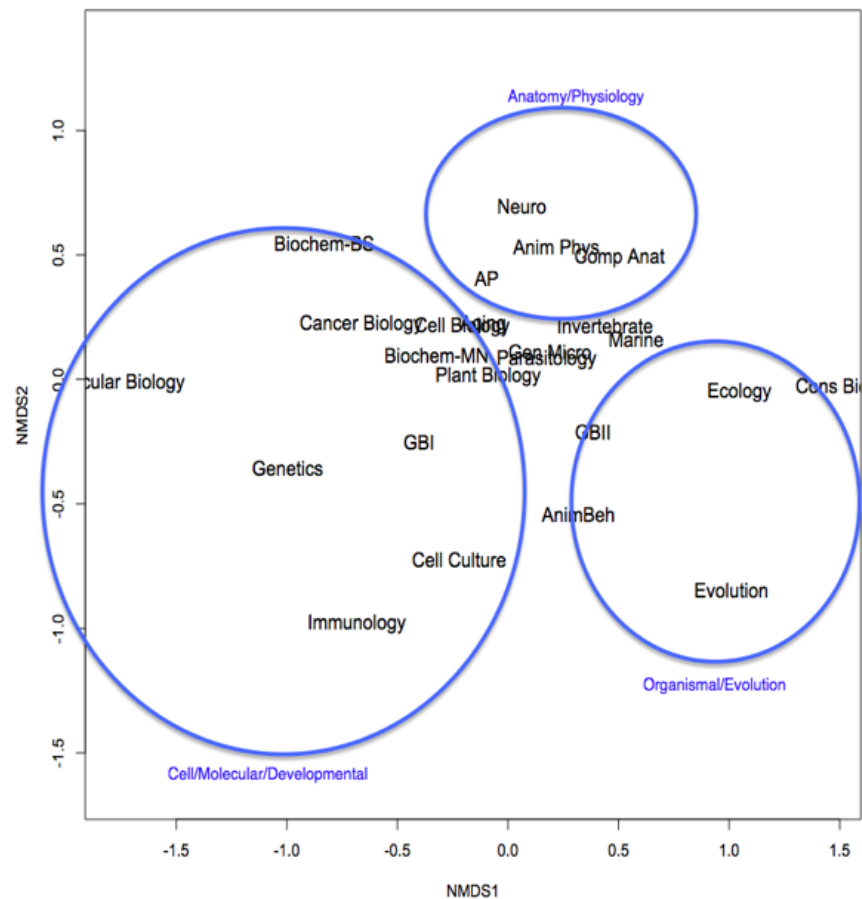
**Cluster 2. Organismal/Evolution** (loose grouping)

- Animal Behavior, Evolution, Conservation Biology

**Cluster 3. Molecular/Cellular/Developmental** (loose grouping)

- Molecular Biology, Biochemistry, Immunology, Cell Culture, etc.

As a result of this mapping, several curricular changes are being considered and/or implemented. (1) Currently some Biology majors take BIOL 1200 and BIOL 1300 (A&P I and II) but these courses do not count towards the Biology major and many majors have limited exposure to physiology beyond the freshman introductory coursework. To remedy this, we are considering adding a requirement that Biology majors take one course in Physiology or Anatomy (Neuroscience, Animal Physiology, or Comparative Anatomy). (2) In addition, we are developing a sophomore/junior sequence in Human Anatomy and Physiology that would count as Biology electives and be required for the Health Science concentration. (3) Additional sophomore biology electives without high level pre-requisites are being developed to provide students with additional elective options.



**Figure 4.** Non-metric Multidimensional Scaling (NMDS) plot grouping biology courses based on reported coverage rankings of BioCore learning goals. Courses that had high coverage of the same learning goals are grouped more closely together. Ovals drawn on top of results show grouping of courses into three general clusters. These groupings are only based on coverage of 19 of the 37 BioCore concepts that had lower coverage in our core courses.

### Assessing Disciplinary Knowledge of Revised Learning Outcomes

The assessment committee developed a new pre- and post-test to assess content knowledge of select topics from the AAAS BioCore, plus skills in experimental design (see more on skills below). The questions were developed by our faculty and edited by the Assessment Committee. Since spring of 2017, the same short pre-test has been given to students early in Introductory courses (General Biology I and II) and as a post-test in Capstone courses (Developmental Biology, Molecular Biology, Plant Biology, Animal Physiology). By using the same questions across different courses, we can better assess student progress and long-term retention. The pre- and post-test assessment results generally agreed with the findings of the curriculum mapping. (See [Appendix M](#) for the pre-post test questions, and discussion of the test results.)

### Revised Outcomes for Student Skills

In 2016 the Assessment Committee worked with the University Director of Assessment to develop student learning outcomes for skills that every biology major should possess. We used skills suggested from two published standards:

Committee on Professional Training. (2015). Undergraduate Professional Education in Chemistry: ACS Guidelines and Evaluation Procedures for Bachelor's Degree Programs.

Brownell, S. E., Freeman, S., Wenderoth, M. P., & Crowe, A. J. (2014). BioCore Guide: a tool for interpreting the core concepts of Vision and Change for biology majors. *CBE-Life Sciences Education*, 13(2), 200-211.

From these sources, the Assessment Committee has been working on the list of skills and competencies proposed here.

- *Problem Solving Skills*. Students should be able to define problems clearly, develop testable hypotheses, design and execute experiments, analyze data using appropriate statistical methods, understand the fundamental uncertainties in experimental measurements, and draw appropriate conclusions.
- *Disciplinary Knowledge and Skills*. Students should understand and be able to apply their understanding of all biology sub-disciplines and use appropriate research skills to solve problems in these areas. These areas of knowledge, based on the AAAS BioCore. Section deleted?
- *Biological Literature and Information Management Skills*. Students should be able to retrieve information efficiently and effectively by searching the biological literature, evaluate scientific articles critically, and manage many types of biological information.
- *Laboratory Safety Skills*. Students should be able to demonstrate and apply their understanding of the concepts of safe laboratory practices. They should be able to evaluate and assess safety risks associated with laboratory experiences. Students must be able to:
  - carry out responsible disposal techniques
  - comply with safety regulations
  - properly use personal protective equipment to minimize exposure to hazards
  - recognize chemical and physical hazards in laboratories, assess the risks from these hazards, know how to minimize the risks, and prepare for emergencies.
- *Communication Skills*. Students should be able to present information in a clear and organized manner, write well-organized and concise reports in a scientifically appropriate style, and use relevant technology in their communications.
- *Team Skills*. Students should be able to interact effectively in a group to solve scientific problems and work productively with a diverse group of peers.
- *Ethics*. Students should understand and demonstrate responsible treatment of data, proper citation of others' work, and the standards related to plagiarism and the publication of scientific results. Students should also be able to explain the role of biology in contemporary societal and global issues.

In January of 2017, the Assessment committee surveyed faculty to map where most of these skills and competencies are emphasized in different courses (Table M-2 in [Appendix M](#)). Results indicated that students were exposed to the five broad skills areas (Problem Solving, Biological Literature and Information Management, Laboratory Safety, Communication, and Team) by the core introductory courses required of all majors (General Biology I and II, Ecology, and Genetics). Upper level courses diverged in emphasis on particular skills as is to



be expected given the diverse nature of electives offered.

In the near future, the department should further discuss and define the skills and competencies we should expect in all biology majors, and which we will reinforce as faculty. For example, “ethics” is a common learning goal in published standards like those cited above, but it is dubious whether our curriculum addresses that goal. Refining our learning outcomes should also help us to better define what we want students to know and do in a “capstone” experience. We have struggled to decide whether every student really needs a lab research project, or whether other forms of independent scholarship might meet our learning outcomes. Finally, these discussions within our department should integrate with concurrent revisions of institutional learning outcomes of the LA&S program, including ethical reasoning, communication, information literacy, and integrative learning.

### **Graduate Program Learning Outcomes and Assessments**

Our graduate licensure programs are nationally recognized by the Council for the Accreditation of Educator Preparation (CAEP/NCATE) and our program outcomes and objectives have been reviewed and approved during the accreditation process. For our initial licensure program, Post-baccalaureate Biology Initial Licensure (8-12), all teacher candidates must be ready to teach biology and make an impact with students on day one in the science classroom. In order to achieve this outcome our courses are aligned with the Professional Standards for Teachers (PSTs) as well as the science content standards of the National Science Teachers Association (NSTA). Our initial licensure program is composed of five education courses as well as pre-practicum field experiences that help teacher candidates observe experienced teachers and apply teaching practices in a real classroom. The capstone experience in this program is the practicum where candidates teach in a high school classroom and are evaluated by the supervising practitioner (teacher of record) and a university supervisor. This program has several gates which allow the progress of individual candidates to be monitored closely. Candidates must pass a stage I review early in the program and a stage II review later in the program which requires the following: Successful completion of the MTEL exams, meeting GPA minimums (overall 2.75, major 3.0), positive assessments of disposition by instructors and practitioners and successful completion of pre-practicum hours.

For the professional licensure program (MEd. Science Education) which is designed for practicing teachers seeking the advanced license, the primary goal is to develop educators who are reflective, student-centered practitioners who can apply educational theory and research to positively impact student learning. Embedded within this goal are clearly established learning outcomes for this program (See [Appendix H](#)). In order to achieve these learning outcomes, this program is composed of a mix of science content and pedagogy courses. The pedagogical courses help students to strengthen their understanding of education theories and to design curriculum units consisting of multiple detailed lesson plans using *Understanding by Design*. Near the end of their program of study, students demonstrate their impact on student learning by investigating the effectiveness of a new pedagogical approach in a real classroom. While testing this pedagogical approach, they conduct a review of the literature, develop a hypothesis, develop a research design, gather and analyze data, and draw conclusions that will inform their own practice. Each student must write a short scientific paper and present their findings and are evaluated in these efforts by a faculty member from our department using an established rubric.

Our third program, the MA Biology, aims to help students increase content knowledge in a variety of biology disciplines and to engage students through independent study in the development of hypotheses, the development of a research design and the collection and analysis of data. There are two tracks within this program, thesis and non-thesis. In the non-thesis track, a paper is

written on a semester long research project and in the thesis track, a more substantial research project will be conducted and overseen by a thesis committee. One area within this program that requires further work is to establish learning objectives for our courses that clearly distinguish our graduate courses from our undergraduate courses. This work is underway and is a major goal of the graduate curriculum committee for the AY 2017/2018. (Graduate program information can be found in [Appendix H](#).)

## Retention

### Graduation Rate and Barriers to Graduation

The number of biology major graduates has increased 41% in the last 5 years (51 in 2017) (Figure 5) and is in line with the rate of growth of the biology major between 2009 and 2013 (Figure 2, Table 1). The average time it takes students to graduate within our program is approximately 4.5 years.

**Figure 5:**

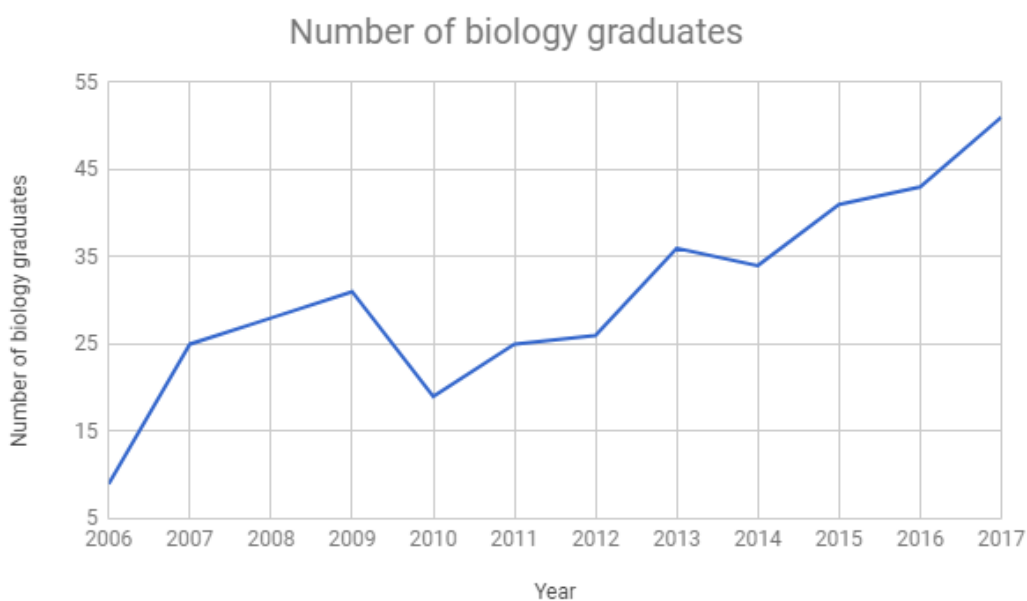


Figure 5 shows the number of Biology Graduates from 2006 to 2017. (Data were provided by Institutional Effectiveness and Research.)

In order to identify potential barriers to student success in the biology major, we surveyed students in the major in spring 2016 and 2017 using an online questionnaire (see [Appendix F](#)). The main findings were (1) students were frustrated with the number of seats available in upper level biology electives during registration and (2) students found required majors' coursework to be very demanding and time-consuming.

In part, in response to these concerns, the department revised the B.A. in Biology to make it a viable pathway for students desiring a more broad-based education with an emphasis on courses that better prepare them for particular careers. In order to make upper-division biology elective courses more accessible, the department has reduced the pre-requisites for three courses:



Biochemistry; Foundations of Biochemistry and Cell Biology. The chemistry faculty also revamped the Organic Chemistry sequence so that Organic Chemistry I would prepare students to take the biochemistry courses. These changes are expected to ease the students' concerns.

We have submitted an AUC proposal to change the current General Microbiology course from a 3000-level course to a 2000-level course with fewer pre-requisites. This will make the course more accessible to students and better prepare them for other upper division courses. In addition, other curricular revisions are being considered to address the concerns of students as well as to make the curriculum suitable for the needs of the increased number of majors.

### Retention Rates

Retention rates (Phase I data) were initially selected for assessment because The Department of Biology rates were below institutional averages for both Freshman retention rate and for Changed Major retention rate for the previous program review period. Recently obtained data for the same time range indicated that Freshman Biology Major (Freshman) retention was actually slightly higher than the University average (61.9% AY 2013 - 2016, University average 61.5%). The Changed Major retention rate averaged 9.5% from AY 2013 - 2016 which was lower than the University average of 14.9%.

**Table 3: Retention of Majors 2012-2016**

	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016
Majors retained	63.4	66.1	64.3	57.2	55.8
<i>Majors changed to other FSU programs</i>	6.5	3.6	12.5	15.3	18.6
Overall retention	69.9	69.7	76.8	69.5	74.4

\*Data (Phase I data) were provided by Anthony Wilcox, Director, Institutional Effectiveness and Research.

Over the review period, the Biology program generally retained a lower overall freshman retention rate to that of the broader institution, returning a five-year average of 72.0% vs. 76.7% respectively (Phase 1 data). To address this issue, in Fall 2014, the department began an assessment of early intervention approaches, which were subsequently implemented to identify and assist the weakest students.

As mentioned, the department implemented a 2.0 minimum/2 repeat policy for General Biology I and General Chemistry I that should affect retention rates. The new policy will encourage biology majors to master essential course content needed for success in future majors' courses. The 2-repeat policy was also intended to encourage students to switch to a more appropriate major earlier in their academic career. Thus, we hope to see improvements in both freshman biology retention and retention of students who transfer out of biology but stay at Fitchburg State.

An initial indication of the results of these measures can be highlighted by the five-fold increase over the four-year span from 2013-2016 in the percentage of students retained at the institution but not in the biology major, i.e., the “Majors changed to other FSU program” category, as italicized in Table 3. It must be noted, however, that due to a relatively small sample size of ca. 10 students that transfer annually from the program to other majors on campus, the trajectory of a small number of students may dramatically impact all aspects of the retention data. To account for potential variability, the departmental Assessment Committee will continue to monitor this category and retention as a whole in the phase 1 data. In addition, the department continues to explore increasing and clarifying the pathways for students who may be seeking to transfer out of the Biology major into related science majors. The department has proposed to the AUC a new BS/BA Interdisciplinary Studies (IDIS) concentration in General Science, and has been involved in conversations with Earth and Geographic Sciences about helping to support a proposal for a new major in Public Health.

## **Strengths and Weakness**

### **Areas of Strength**

The department’s faculty continue to be a key strength in our program. They represent highly qualified and motivated educators. Their backgrounds are diverse, permitting diverse course offerings and research opportunities for students.

Faculty are collaborative and willing to mentor new faculty. Classroom materials and reappointment/tenure portfolios are readily shared by veteran faculty to ensure the success of new members and to achieve our goals and missions. In general, our faculty work well as a unified, cohesive unit. As an example, several faculty who teach General Biology recently worked together to restructure the laboratory curriculum.

The new Science Building is a significant strength in our department. The new facility and equipment improves our ability to conduct research. This has enhanced student exposure to research opportunities which has helped develop laboratory and critical thinking skills among our students.

The primary focus of our faculty is on teaching but they also maintain a balance among teaching, research, and community service. This balanced approach allows our faculty to bring their experiences from outside the classroom into both their teaching and advising. Additionally, the majority of our faculty is involved in various campus-wide committees and participate in university activities beyond the department.

Systems have been put into place to identify struggling students early and direct them either to support services or to a different major.

Using the BioCore outcomes from AAA&S as a guide, we have identified gaps in our curriculum and have begun to make significant curriculum changes (e.g. the development of a Human Anatomy and Physiology sequence specific for our majors) to assure that we are providing a comprehensive biology education.

Our department is reflective and receptive to student feedback. For example, in response to student feedback from student evaluations, the curriculum of General Biology I is being restructured to include more high impact practices.

The department offers small class sizes for sophomore core courses and biology electives. Based on student surveys, this is one of the most important features of our department. Students often comment that the small class size allows for more interaction with faculty and for the development of strong student/faculty relationships ([Appendix F](#)).

Over the past five years a lot of effort has been focused on finding ways to increase enrollment, matriculation and retention in our graduate programs. In an effort to achieve these aims, we restructured our graduate program, making it more streamlined yet still capable of serving the needs of potential students in our surrounding communities.

### **Areas for Improvement**

Although we have made considerable progress in the area of capstone courses, we continue to struggle with our ability to offer consistent and diverse capstone experiences to our students. This is in part due to the large increase in the number of majors. Several courses were offered on an experimental basis and, although some were determined to be inappropriate for capstone designation, we have increased from just two capstone courses to four, and will be continuing to pilot new courses (e.g. Topics: Cancer Genomics will be offered in Fall 18). We need to establish clear capstone learning goals in a sufficient number and diversity of courses and other opportunities (e.g. independent studies) to provide our students with meaningful learning experiences and appropriately demonstrate our students' proficiency in the field.

We need to have a well-advertised, open, and easily accessible repository of all possible internship and/or graduate school opportunities for students. We have some databases currently, however, they are not combined or exhaustive. What work has been accomplished has been done by faculty, such as our Health Science Advisor, on top of their current responsibilities. Because this repository may require significant time to put together, one suggestion was to assign a faculty member to the position of internship/graduate school coordinator, which should come with a course release. Additionally, we should have funding to waive the tuition for students who want to do 3-credit summer internships. On a related note, release time for activities performed by the Health Science Advisor would also be beneficial.

Faculty teaching load and research supply funding remains a hindrance to high levels of academic scholarship. Allowing teaching release time for scholarship activities would directly increase the faculty's scholarly activities and increase research opportunities for students.

As indicated in our student surveys, we need more offering of low-prerequisite biology electives for students. This will help our traditional as well as our transfer students. Transfer students often enter our programs needing only biology courses to graduate and therefore need to take multiple biology courses each semester. When they first arrive, many biology electives with prerequisites are closed to them, hindering their progress through the major.

Students find it difficult to take all of the courses they need each semester due to courses conflicting with each other. A system should be put into place when course schedules are determined that would promote better communication within and between departments.

The graduate program needs to offer a consistent rotation of courses that will allow our students to map out their plans of study and to be able to graduate in a timely manner. This is hindered by our dependence on faculty being willing to teach in the graduate program on top of their day-load. If our department can consistently allow graduate courses to be part of a faculty's day-load, this will increase faculty involvement in the graduate program and allow us to offer more courses and to offer them in a predictable rotation.

We need to find strategies that will improve course enrollments in our graduate program. The size of our program is small (20-30 students) which can make it difficult to meet the 10-student minimum required to run a course. When the 10-student minimum is not met, courses are cancelled unless instructors agree to teach a directed study (not a popular option). Course cancellations hinder student progress and damage our reputation among the students we are trying to serve. Strategies under consideration include increasing hybrid and online course offerings and to offer graduate courses to qualified, upper level undergraduate students.

Although our graduate licensure programs have clear learning outcomes shaped by our own Education Unit, the Department of Secondary and Elementary Education and NCATE/CAEP, we still need to establish clear learning outcomes for our graduate science courses. If we begin to increase undergraduate enrollment in graduate courses, these learning outcomes will need to distinguish graduate and undergraduate coursework.

## Plans for Change

The Department has determined several significant items that it will address in the years ahead. The Department will use these items as well as the suggestions of the reviewer to develop an Academic Plan that will span the next review period. These items will be given as specific charges to the appropriate department committees for action. Each committee will rank the items in terms of their complexity and scope. An Action Plan will be developed and timelines for goals will be created where appropriate. Progress on each item will be reviewed during departmental retreats and periodically during departmental meetings.

### **Curriculum: The Capstone Experience**

Under the **Curriculum** section above, we have described the progress that has been made with regard to improving the capstone experience for our majors. In addition to piloting new courses as capstones, the Curriculum Committee developed a set of expectations that will be used going forward. Over the next five years the Department will charge the Curriculum Committee to assess the successes and failures with courses that have been tried and continue to improve the capstone experience.

The Curriculum Committee will use the set of expectations describe under **Curriculum** to establish a set of objectives and outcomes for courses that are approved as capstone courses, develop metrics for success in these experiences, and implement an assessment plan for capstone courses and experiences offered through independent studies. Additionally, the Department will continue to pilot capstone courses from existing courses or through the development of new courses.

### **Curriculum: Core Courses**

Several years ago (around 2012/2013) we revamped the core curriculum to reduce the number of core requirements. This was done in order to help student progress in the major while also balancing the subject matter that graduating students should be knowledgeable about. Now that enough time has passed, the department would like to look at our current core curriculum and determine if the new core curriculum has made significant improvements. The department plans to continue working on assessing the core requirements and explore if further changes need to be made. One component of this revision process will be an annual evaluation and potential revision of at least one of our course courses. The department has already conducted such a revision in 2017-18 of General Biology I labs, and will proceed to review General Biology II in 2018-19, as well as Ecology and Genetics in subsequent years of the review period. The emphases of these reviews will continue to be on integrating high impact practices into the curriculum such as student-faculty research, and writing and information literacy intensive coursework.

In addition, as a result of curriculum mapping of the core courses, the Curriculum and Assessment Committees have identified anatomy and physiology as an area in which our majors do not receive comparable exposure with the other areas, of cell/molecular/developmental biology and organismal/evolution. Therefore, in addition to the recently approved creation of the new Human Anatomy and Physiology I and II sequence, the department will expand the discussions centered around creating a physiology cluster of courses from which students will be required to select one course as a core requirement. The department will devote subsequent years to evaluating the course offerings in each of the other clusters (organismal/evolution) and cell/molecular/developmental, with a particular emphasis on insuring there are adequate intermediate level offerings in each of these clusters, and developing a system to insure that offerings do not conflict with each other within and across clusters and departments.

### **Graduate Program**

Several significant changes have been made to our graduate program. The Graduate Committee will monitor the existing programs to assess their effectiveness for serving our graduate student population. One critical element of this process will be the establishment of clear learning outcomes for our graduate science courses that distinguish between the expectations of graduate and undergraduate coursework.

Additionally, instead of offering courses based on what faculty "feel like offering," the Graduate Committee will work in the next academic year toward developing a consistent rotation of several diverse courses that are appropriate for our student needs. In order to overcome the limitation of not having a permanent graduate faculty, these courses will be developed such that several faculty can effectively teach from a single curriculum allowing for the rotation of faculty for each course.

Further the increased use of hybrid and online formats for courses will be explored, as well as the development of standardized delivery of differentiated instruction such that courses may be effectively targeted to both undergraduate and graduate students simultaneously. This will help resolve the ongoing problem of courses being cancelled due to low enrollments.

### **Student Support**

As noted above, the program has identified the need to better support students particularly as they pursue curricular and co-curricular internship opportunities and seek out and apply to programs of graduate study. The department will work with the administration to try to establish

two faculty positions with release time, one serving as Health Science Advisor, and a second as an Internship Coordinator. Each of these efforts will be supplemented by exploring the establishment of an external Biology advisory board of alumni and local employers to help identify research, internship, employment and graduate school opportunities.

### **Staffing and Faculty Support**

In AY17/18 the Department conducted a search for a full-time, tenure-track faculty to teach anatomy and physiology with expertise in vertebrate biology. This search failed. Therefore, the University has approved a one-year, full-time temporary position (renewable for a second year if needed) to start in the Fall18 semester. The individual hired will be primarily responsible for teaching Anatomy I and II. In September, the Department will establish a new Faculty Search Committee to start a new tenure-track faculty search. While funding for additional faculty positions may be limited, the department will continue to identify key areas of need and advocate for new positions to keep pace with our growing student body. To increase the availability of release time to support faculty scholarship, we will explore both maximally utilizing existing institutional funding for research and scholarship and Strategic Funding Request (SFR) funds, and pursuing external grant funding.

### **Equipment**

With the opening of the new science complex, the department acquired many new pieces of equipment and we have continued to purchase new instrumentation. As these items become older the department needs to develop a plan for maintenance and replacement of outdated and broken equipment. The Equipment Committee will be charged with working with the technicians to develop an inventory of key equipment, their ages and expected life-spans, and current maintenance schedules and service contracts. From this information, we will develop a plan for maintenance and replacement as well as to anticipate funding needs in the coming years. To increase the equipment and supply resources available for faculty scholarship, we will again explore both maximally utilizing existing institutional funding for research and scholarship and SFR funds, and pursuing external grant funding.

## Appendix A: Student Data

### Advising

Faculty perceptions of advising were anonymously surveyed December 2017 (n = 14). 57% of faculty strongly agreed and 21% agreed that “The experience of being an academic advisor is very rewarding”. 86% strongly agreed that “The Department provides up-to-date information concerning requirements for students in the Biology major”. 86% of faculty agreed or strongly agreed that “The University provides information necessary to successfully advise students”, and 71% strongly agreed that “I am very familiar with the LA&S requirements at FSU”. 64% agreed that “I am very familiar with the support services available for students at FSU” and 72% of faculty agreed or strongly agreed that “I would like to know more about the support services available for students at the university”. 57% of faculty reported that they have attended advisor training in the past 5 years.

<b>Table A1. Results from faculty survey of advising.</b>					
Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. The experience of being an academic advisor is very rewarding	57%	21%	14%	7%	0%
2. The Department provides up-to-date information concerning requirements for students in the Biology major	86%	14%	0%	0%	0%
3. The University provides information necessary to successfully advise students	36%	50%	14%	0%	0%
4. I am very familiar with the LA&S requirements at FSU	71%	21%	7%	0%	0%
5. I am very familiar with the support services available for students at FSU	21%	64%	14%	0%	0%
6. I would like to know more about the support services available for students at the university	29%	43%	21%	7%	0%
7. I have attended advisor training in the past 5 years	57% Yes	43% No			

### Employment/Graduate School after Graduation

We have utilized the Alumni Office’s records to track Biology graduates going back for the past five years in order to analyze the careers our students have been pursuing during the period of this self-study. Return rates of information to the Alumni Office are very low, so we have

supplemented this data with faculty reporting of student employment collected by the department's Student Affairs Committee. We were successful in obtaining data from 39.2% of our alumni who graduated between 2013 and May 2017. Both Alumni Office and faculty reported data is likely to over-represent successful employment in the biological sciences as these students are most willing to provide information about their employment. Despite the difficulty of obtaining a complete list of accurate data in this area, it is clear that many of our alumni have made careers in a wide variety of fields in the biological and life sciences over the past five years. This data provides information about the relative numbers of students going into graduate study and careers in biotechnology, biology teaching, environmental biology, and the health sciences.

**Table A2: Employment after Graduation of 2013 – 2017 Alumni**

<b>Professional Field</b>	<b># of Graduates</b>	<b>% of Graduates *</b>
Environmental / Conservation	3	3.75
Life Science Retail (Sales Rep, etc.)	2	2.5
Medical Office/Hospital non-research Support Staff	5	6.25
Medical Staff non-research	1	1.25
Pharma/Biotech Lab Technician/Research Staff	39	48.75
Teaching/Education Support Staff	4	5
<b>Total</b>	<b>54</b>	<b>67.5</b>

**Table A3: Graduate Programs Undertaken by 2013 – 2017 Alumni**

<b>Graduate or Professional Program</b>	<b># of Graduates</b>	<b>% of Graduates *</b>
Doctor of Osteopathic Medicine Program	1	1.25
Doctor of Pharmacy (Pharma D) Program	6	7.5
Doctor of Chiropractic (DC) Program	1	1.25
Physician Assistant (PA) Master's Program	5	6.25
Nursing Degree Programs (Post-Baccalaureate, Accelerated Nursing Degree, etc.)	4	5
Medical Sonogram Program	1	1.25
Veterinary Medicine Programs (DVM, Vet Tech, etc.)	2	2.5
Masters in Biotechnology	2	2.5



Doctor of Philosophy in Biology (PhD) Program	1	1.25
Masters in Biological Sciences	2	2.5
Masters in Education	1	1.25
Masters of Business Administration (MBA) Program	1	1.25
<b>Total</b>	<b>27</b>	<b>33.75%</b>

*\* % is based on the 80 alumni we have data on. It should be noted that this represents only 39.2% of all graduates during this time. Please note also that totals add up to more than 100% because one student is counted twice (because he/she is simultaneously working and pursuing an advanced degree).*

**Tables A2 and A3** above summarize the employment and graduate school data we have for 80 of our recent graduates (2013 – May 2017). The majority of our graduates (67.5%) found employment in various different sectors with the other 33.75% pursuing additional schooling after graduating from Fitchburg State University. Of those that found employment after graduation, the most common field was in pharmaceutical/ biotechnology (48.75%), typically as a laboratory technician or other research staff followed by, the medical field (7.5%, including medical support staff and those working as providers of health care) and education field (5%, including teachers and educational support staff). In comparing to the 2013 self-study, we see that the pharmaceutical/biotechnology field has remained the largest single source of employment for our graduates (although the absolute number approximately doubled- from 18 graduates in the previous self-study to 39 now). Two companies- PCI Synthesis and Charles River Labs- were the biggest employers of those graduates. There was no other category of employment that saw such noticeable changes in numbers or percentages between now and the previous self-study, although it must be kept in mind that only a relatively small number of our graduates worked in these other areas and, thus, the percentages and numbers are small overall.

Of our students who graduate and then continue on with additional schooling, the vast majority of graduates pursued schooling in some kind of certificate or advanced degree programs related to the health sciences field. This came in a variety of forms, although PA and Pharma D programs and Nursing-related programs were the three largest. The interest in advanced programs in the health field mirrors what we saw in the 2013 self-study; in both cases it was the largest area of interest for our graduates. One thing that has changed since the previous self-study is the small number of graduates entering graduate school programs not related to the health field, such as pursuing degrees in Biotechnology or Master's or PhD programs in Biology. In our previous self-study, we had one student (2% of the graduates we knew about) pursue a Master's in Biology program. Among our students who graduated between 2013-2017, this number has improved to five (6.25%). While this is clearly a small number, it may be the beginning of a trend, especially when coupled with the fact that three of the five students are from 2015 or later.

Whether we consider the data on jobs or advanced school options, it is clear that the largest driver is in the health and biotechnology fields (especially when many biotechnology jobs are research positions dealing with health research/medical device manufacturing). This suggests that we are preparing our students to the standards required for success in these areas and much of this success can be attributed to the efforts of Dr. Govindan's pre-health career advising. The department has also been working hard to establish pathways for our graduates interested in these two main areas (health fields and biotechnology) to continue their schooling. One of the

most important areas that Dr. Govindan has worked particularly hard on was to establish the Early Acceptance Program with the Lake Erie College of Osteopathic Medicine (LECOM). This program guarantees acceptance of up to 15 Fitchburg State students into LECOM's Doctor of Osteopathic Medicine, Doctor of Dental Medicine, and Doctor of Pharmacy programs, as long as students maintain the necessary academic standing while here at Fitchburg State. Similarly, in early 2017, Fitchburg State University signed an agreement with Northeastern University for their Master's in Biotechnology graduate program. This agreement reserves seats in this program for qualified Fitchburg State students and streamlines the process for their application and entry into the program. For both this agreement and the one with LECOM, these have only been in effect for a few years (LECOM in 2014, Northeastern in early 2017), and, so, the full effect of this offering probably has not been captured in this data yet. But these two opportunities exemplify how the department is trying to serve our students and ensure that they succeed after graduating.

## Appendix B: Faculty Data

### Curriculum Vitae

**DENNIS AWASABISAH, Ph.D.**

Fitchburg State University

Biology & Chemistry Department, 160 Pearl Street, Fitchburg, MA 01420

Office: 978-665-3248

Email: dawasabi@fitchburgstate.edu

---

### EDUCATION

**Aug. 2009 – May 2015**    **Ph.D. Chemistry (2015): University of Oklahoma (OU).**

- Advisor: Dr. George B. Richter-Addo.
- Dissertation: Synthesis and Redox Behavior of Group 8 Metalloporphyrins and Related Compounds.
  - I discovered new redox and reaction pathways of biologically relevant metalloporphyrin active sites.

**Jan. 2008 – Jul. 2009**    **M.S. Chemistry (2009): Southern Illinois University Edwardsville.**

- Advisor: Dr. Timothy B. Patrick.
- Thesis: Free Radical Reactions of 3-Fluorobutenone.
  - I discovered the synthesis of new fluorocarbon compounds that could potentially be used as building blocks for drugs, agrochemicals and polymers.

**Aug. 2002 – Jun. 2006**    **B.Sc. Chemistry (2006): University of Cape Coast, Ghana.**

- Advisor: Dr. Banyan A. Dadson.
- Thesis: Synthesis of Baclofen.
  - As part of my thesis, I performed a chemical synthesis of the drug baclofen, from readily available starting materials.

### TEACHING EXPERIENCE

**Sept. 1 2016 – Present**    **Assistant Professor, Biology and Chemistry Department, Fitchburg State University**

- I teach General Chemistry I and the Organic Chemistry course sequence
- I supervise laboratory research with students, advise students, and serve on department and university committees.

**Jun. 2015 – May. 2016**    **Lecturer, University of Oklahoma**

- Taught upper-level Organic Chemistry II lecture course.
- Taught General Chemistry I and II lecture course sequence
- Prepared course syllabus and assessed student performance (grading).

### POSTDOCTORAL EXPERIENCE

**Jun. - Dec 2015;**

**May. – Aug. 2016**    **Postdoctoral Research Associate, Department of Chemistry and Biochemistry, University of Oklahoma**

- Performed research on the interactions of heme models and other coordination compounds with NO<sub>x</sub> molecules.
- Investigated the role of nitric oxide as a vasodilator.
- Trained students on lab techniques, lab safety, etc.
- Performed laboratory administrative work in the lab of Prof. Richter-Addo

## OTHER TEACHING/ RESEARCH EXPERIENCE

### **Aug. 2009 – May 2015 Graduate Teaching/Research Assistant at University of Oklahoma**

- Taught junior-level Organic Chemistry Labs
- Taught General Chemistry I and II Lab and recitation sessions
- Taught senior-level Advanced Synthesis and Spectral Characterization lab
- Performed research in the Richter-Addo lab as graduate research assistant
- In charge of training undergraduates and new graduate students in the Richter-Addo lab.
- Ensured compliance of personnel to personal lab safety and training
- In charge of keeping and updating chemical inventory in the Richter-Addo lab.
- In charge of purchases of laboratory chemicals and equipment
- In charge of chemical waste disposal in the Richter-Addo lab
- Point of contact between the Richter-Addo lab and other lab groups as well as OU campus management for building and construction/ renovation activities.

### **Jan. 2008 – Jul. 2009 Graduate Teaching/Research Assistant at Southern Illinois University Edwardsville**

- Taught General Chemistry Labs
- Taught Sophomore Organic Chemistry Lab
- Taught Nursing Chemistry Lab
- Performed research in the Patrick Research Lab

### **Aug. 2006 – Jul. 2007 Teaching Assistant at University of Cape Coast, Ghana**

- Taught General Chemistry Lab and tutorial sessions
- Taught level 200 Organic Chemistry Lab and tutorial sessions

## SERVICE

### **2016/ 2017 year Service at Fitchburg State University**

- Committee Member – Department of Biology and Chemistry Assessment Committee
- Committee Member – Department of Biology and Chemistry Equipment Committee member
- Committee Member – University Technology Assessment Committee

**March 2017** Served as a judge for a poster session at the 62<sup>nd</sup> Oklahoma Pentasectional Meeting of the ACS

**2016** Reviewed two chapters of a General Chemistry book for W.H Freeman & Co. Publishers

**Aug 2015 – Date** Peer-reviewed journal articles for *Transition Metal Chemistry*.

## PUBLICATIONS

1. Xu, N.; Yan, B.; Awasabisah, D.; Powell, D. R.; Richter-Addo, G. B. "Preparation and infrared spectroelectrochemical studies of five-coordinate (por)Fe(OC(=O)R) compounds (por = TPP, OEP; R = CCl<sub>3</sub>, CH<sub>2</sub>Cl)". *Inorg. Chim. Acta.* **2017**. In Press.
2. Awasabisah, D.; Xu, N.; Sharmah Gautam, K. P.; Powell, D. R.; Shaw, M. J.; Richter-Addo, G. B. "Preparation, characterization, electrochemistry, and infrared spectroelectrochemistry of ruthenium nitrosyl porphyrins containing η<sup>1</sup>-O bonded axial carboxylates". *Eur. J. Inorg. Chem.* **2016**, 509-518.
3. Awasabisah, D.; Powell, D. R.; Richter-Addo, G. B. "Crystal structure of N-(2-([2,6-bis(2,2,2-trifluoroacetamido)phenyl]disulfanyl)-3-(2,2,2-trifluoroacetamido)phenyl)-2,2,2-trifluoroacetamide." *Acta Cryst.* **2015**, E71, o639-o640.  
*I am the corresponding author of this paper.*

4. Awasabisah, D.; Richter-Addo, G. B. BOOK CHAPTER: "Chapter One – NO<sub>x</sub> linkage isomerization in metal complexes: In *Advances in Inorganic Chemistry – NO<sub>x</sub> related Chemistry*" (2015). Eds. Van Eldik, R. & Olabe, J. A. Academic Press, Waltham, MA, USA. Vol. 67. pp. 1-86. *This work is the comprehensive review of linkage isomerization of NO<sub>x</sub>-coordinated porphyrin and non-porphyrin complexes.*
5. Awasabisah, D.; Powell, D. R.; Richter-Addo, G. B. "Crystal structure of chlorido{5,10,15,20-tetrakis[2-(2,2-dimethylpropanamido)phenyl]porphyrinato}iron(III). *Acta Cryst.* **2015**, E71, m42-m43.  
*I am the corresponding author of this paper.*
6. Abucayon, E. G.; Awasabisah, D.; Powell, D. R.; Richter-Addo, G. B. "(1-Methylimidazole)(*o*-nitrosotoluene)(5,10,15,20-tetraphenylporphyrinato)iron(II) dichloromethane solvate". *Acta Cryst.* **2014**, E70, m51–m52.  
*I mentored a student for 7 weeks leading to the publication of this paper.*
7. Awasabisah, D.; Xu, N.; Sharmah Gautam, K. P.; Powell, D. R.; Shaw, M. J.; Richter-Addo, G. B. "Stable ruthenium nitrosyl porphyrins with axial *O*-bonded ligands; preparation and redox behavior". *Dalton Trans.*, **2013**, 42, 8537-8540.  
*This paper was selected as Cover Art for the issue in which the paper was published.*
8. El-Attar, M.; Xu, N.; Awasabisah, D.; Powell, D. R.; Richter-Addo, G. B. "Cyclic voltammetric and fiber-optic infrared spectroelectrochemical studies of six-coordinate (por)Ru(NO)Cl compounds (por = porphyrinato dianion)." *Polyhedron*, **2012**, 40, 105-109.
9. Patrick, T. B.; Awasabisah, D. "Meerwein arylation with 3-fluorobutenone". *J. Fluorine Chem.*, **2010**, 131, 396-397.

#### SCHOLARSHIPS AND AWARDS

- 2016** "Most Inspiring Faculty Award" awarded to faculty members who have motivated and inspired student-athletes in the 2015-2016 Academic Year
- Received one of three awards. I received this award during my first year of teaching at the University of Oklahoma.  
[http://www.soonersports.com/ViewArticle.dbml?DB\\_OEM\\_ID=31000&ATCLID=210884497](http://www.soonersports.com/ViewArticle.dbml?DB_OEM_ID=31000&ATCLID=210884497)
- 2015** "Belle W. Goodman Scholarship Award" in recognition of outstanding achievement and superior service during the 2014 – 2015 academic year as a graduate student at the University of Oklahoma.
- One of 2 student awards (out of ~100 students).
  - Monetary amount of \$1,000
  - Received a certificate
- 2013** "Jerry J. Zuckerman Award" in recognition of outstanding performance in research during the 2012 – 2013 academic year at the University of Oklahoma. Provided annually to an outstanding graduate student pursuing a degree program in organometallic or inorganic chemistry at the University of Oklahoma
- One award was given (out of ~100 graduate students).
  - Monetary amount of \$300
  - Received a certificate
- 2012** "Lloyd E. Swearingen Award" in recognition of outstanding performance in research during the 2011 – 2012 academic year. Selected on the basis of outstanding performance in research as a graduate student at the University of Oklahoma
- One award (out of ~100 students).
  - Received a certificate

“Outstanding Graduate Teaching Award” for exemplary academic achievement in the Department of Chemistry at Southern Illinois University Edwardsville.

- One of 2 student awards (out of ~30 graduate students).
- Monetary amount of \$50

### PRESENTATIONS AND CONFERENCES

1. Awasabisah, D.; Powell, D. R.; Richter-Addo, G. B. Poster: "Reactions of nitric oxide with iridium phosphine complexes." 70th Southwest Regional Meeting of the American Chemical Society, Fort Worth, TX (2014)
2. Awasabisah, D.; Xu, N.; Gautham, K. P.; Powell, D. R.; Shaw, M. J.; Richter-Addo, G. B. Poster: "Six-coordinate ruthenium nitrosyl porphyrins with carboxylate and aryloxy ligands: Preparation and redox behavior". 245th ACS National Meeting & Exposition, New Orleans, LA (2013).
3. Awasabisah, D.; Xu, N.; Richter-Addo, G. B. Poster: Ruthenium porphyrins with O-bound ligands trans to nitric oxide. 241st National Meeting of the American Chemical Society, Anaheim, CA (2011).
4. Awasabisah, D.; Xu, N.; Gautham, K. P.; Powell, D. R.; Shaw, M. J.; Richter-Addo, G. B. Poster: "Stable ruthenium analogues of nitrosyl heme tyrosinates; preparation and redox behavior". 57th Annual Oklahoma Pentasectional Meeting of the American Chemical Society, Cameron University, Lawton, OK (2012).
5. Awasabisah, D.; Xu, N.; Richter-Addo, G. B. Poster: Ruthenium porphyrins with O-bound ligands trans to nitric oxide. 55th Annual Pentasectional Meeting of the American Chemical Society, Norman, OK (2010).
6. Patrick, T. B.; Awasabisah, D. Poster: "Free radical reaction of fluorovinyl ketone". Poster for Probst Lecture: Southern Illinois University Edwardsville, Edwardsville, IL (2009).

### SCIENTIFIC MEMBERSHIP AND PROFESSIONAL SOCIETIES

2011 – Present American Chemical Society

### TECHNICAL AND EXPERIMENTAL SKILLS

- Schlenk techniques and handling air-sensitive reactions
- Glovebox operation and maintenance
- Operation and handling of solvent purification system
- Synthesis of new target compounds
- Electrochemistry and spectroelectrochemistry
- NMR spectroscopy
- IR spectroscopy
- UV-vis spectroscopy
- X-ray data analysis
- Small molecule crystallization
- Mass Spectrometry data analysis
- Chemical purchasing and inventory
- Chemical waste and lab safety
- Microsoft Office
- Desire2Learn and Blackboard for teaching

## Christopher Kneeland Cratsley

### Curriculum Vitae

Department of Biology and Chemistry  
Fitchburg State University  
160 Pearl Street  
Fitchburg, MA 01420  
Phone (978) 665-3617  
[crratsley@fitchburgstate.edu](mailto:crratsley@fitchburgstate.edu)

### Education

Institute for Management and Leadership in Higher Education, June 2014  
Harvard Institute for Higher Education

Ph.D. in Biology, Tufts University, May 2000  
Thesis: Sexual selection on male courtship signals and nuptial gifts in *Photinus* fireflies.  
Advisor: Dr. Sara M. Lewis

Bachelor of Arts in Biology, Brown University, May 1991  
Certification in Biology and General Science through Brown Teacher Education Program.

### Professional Experience

Project Co-Director, Learning Assessment Research Consortium (LARC) August 2015 – present  
Co-managed Davis Foundation funded, 7 institution team (Fitchburg State University, Framingham State University, Manchester Community College, MGH Institutes of Health, Saint Michael's College, Simmons College, Suffolk University) that developed, tested and implemented on the NILOA website a 6-module online Learning Assessment Curriculum.

Director of Assessment, Fitchburg State University January 2012 – January 2017  
Interim Director of Assessment, Fitchburg State University January 2011 – December 2011  
Oversee University-wide and program-specific assessment activities  
Co-authored 2011 NEASC report on assessment activities and 2017 Interim Report on assessment activities

Institutional Lead for Complete College America STEM Guided Pathways to Success (GPS)  
Representing Massachusetts and Fitchburg State University October 2012 – 2015  
Developing student retention and success strategies with a focus on STEM fields, to be expanded into other disciplines and across the system, through early warning systems, meta-majors, and the use of improved technology and intrusive advising to guide students.

Project Co-Director American Association of Colleges and Universities Quality Collaboratives  
Dyad grant to Fitchburg State University and Mount Wachusett Community College February 2012 – 2015. Oversaw team of 32 faculty and staff from the two institutions engaged in the assessment of student learning and evaluation of transfer policies related to the Lumina Degree Qualifications Profile.

Campus Contact and Principal Investigator Partnership to Assess Readiness for College and Careers (PARCC) and Core to College grant awards to Fitchburg State University 2011 – 2015. Oversees campus forums and workshops for local teachers on the Common Core Standards and PARCC assessment efforts in Mathematics and English Language Arts.

Primary Contact, AMCOA Assessment Experiments Grant December 2011 – December 2012  
Central Mass. Partnership to Assess Written Communication. Collaborative grant with Worcester State University, Quinsigamond Community College and Mount Wachusett Community College.

## **Christopher Kneeland Cratsley**

Fitchburg State University organizer for Performance Incentive Funding September 2011-2014  
Organized the selection and training of Faculty Retention Specialists through Performance Incentive Grant funding from Worcester State University.

Co-Principal Investigator, NSF ATE Grant to Boston Museum of Science 2010 - 2013  
Co-organized workshops for Community College and State University educators on integrating Engineering, Science and Technology into undergraduate curricula for pre-service educators.

Interim Department Chair, Department of Biology and Chemistry Spring 2010  
BA/BS Biology: Tracks in Biology Teacher Licensure, Biotechnology, Environmental Biology and Exercise Science, and Minors in Biology and Chemistry  
Helped oversee Design and Development Phase of Science Facility Renovation

Project Director, Fitchburg State College March 2006-2009  
Improving Teacher Quality Grants (ITQ):  
EduTron - Intensive Immersion Institute for Grades 4-8 Teachers of Science.  
Science Content Institutes & Integrating Science Inquiry for Grade 5-12 Teachers

Principal Investigator, NSF C-RUI Grant in Biology and Computer Science, Fitchburg State College, 2003-2006  
Supervised staff and budget for interdisciplinary team of 3 faculty, 1 Postdoctoral Research Associate, 10 undergraduates.

Graduate Program Chair, Fitchburg State College 2001 - 2010.  
MAT Biology, State approved Initial and Professional Licensure tracks  
MEd Science Education, State approved Professional Licensure track  
MA Biology, Thesis and coursework tracks

### **Teaching Experience**

Professor, Department of Biology and Chemistry, Fitchburg State University 2009 – 2010, 2017 – present

Undergraduate coursework:

Lecture, laboratory instruction, and laboratory instructor supervision for General Biology II, Laboratory instruction for General Biology I

Developed new lecture and laboratory-based course in Animal Behavior.

Revised and taught existing courses in Ecology, Honors Biological Issues and Inquiry, Leadership in Biology, Mathematics and Technology, Life Science I & II, Life Science for Educators, Methods in Teaching Biology, and Biology Teaching Practicum

Visiting Professor, Graduate and Continuing Education, Fitchburg State University 2009- present

Graduate coursework:

Co-developed course for ITQ Grant, Unlocking Biological Diversity,

Co-developed course for ITQ Grant, The Physical Science of Life

Co-developed course for ITQ Grant, The Physics of Animal Adaptations

Revised and taught online course developed by WGBH, Teaching High School Biology

Revised and taught online course developed by WGBH, Science and the Living World

Revised and taught existing courses in Advanced Methods in Teaching Science, The

Modern Science Curriculum, Research in Science Education, Research in Science, Research in Biology, Independent Study, Internship and Teaching Practicum.

Associate Professor, Department of Biology and Chemistry, Fitchburg State College 2005-2009

Visiting Associate Professor, GCE, Fitchburg State College 2005-2009

Assistant Professor, Department of Biology and Chemistry, Fitchburg State College 2000-2005



## Christopher Kneeland Cratsley

Visiting Assistant Professor, GCE, Fitchburg State College, 2000-2005

Teaching Assistant, Department of Biology, Tufts University, 1994 – 2000

Animal Communication and Sexual Selection – Co-designed Graduate Seminar  
Experiments in Biology – Supervised experiments in Behavior, Neurobiology and Physiology  
Biostatistics – Assisted with course development and supervised computer lab activities  
Biology and the Social Contract – Led weekly discussion sections on Bioethics  
Introductory Biology – Laboratory Instructor and Undergraduate TA Coordinator  
Cell Biology – Guest lecturer and grader

Secondary Science Teacher, Pearl River School District, Pearl River, NY, 1991 – 1994  
Biology, Marine Biology and Physical Science

Team Teacher, St. Thomas Aquinas College, Marie Curie Math and Science Center, 1993  
Saturday Morning Search for Solutions Program on Cellular Investigations

Student Teacher, Brown University, Teacher Education Program, 1990

Team Teacher: Brown Summer High School 1990

### Research Experience

Co-Principal Investigator, Boston Museum of Science, Citizen Scientist Initiative – FireflyWatch 2008 – present.

Principal Investigator, NSF C-RUI Grant in Biology and Computer Science, Fitchburg State College, 2003-2006. Research developing and applying embedded computer systems to determine the ecology of firefly flash behavior.

Principal Investigator, Department of Biology and Chemistry, Fitchburg State College, 2000-2003. Research on mating behavior in *Pieris rapae* and Computer-based tools for Biological inquiry.

Research Assistant, Department of Biology, Tufts University, 1995-2000  
Supervisor: Dr. Sara M. Lewis, research on sexual selection in Lampyrid beetles.

Research Rotations, Department of Biology, Tufts University 1994-1995  
Supervisor: Dr. Barry Trimmer, research on proleg withdrawal reflex of the *Manduca Sexta*.  
Supervisor: Dr. Francie Chew, research on foraging behavior of *Pieris rapae* on *Alliaria petiolata*.

### Educational leadership and service experience

Co-leader, Fitchburg State University Liberal Arts and Sciences Council working group for AAC&U Institute for General Education and Assessment, Boston, MA June 2016  
Developed draft proposal for LA&S revision, shared it with the campus community Fall 2016, revised proposal based on feedback for further review and revision by the LA&S Council.

Team Member:

Fitchburg State University Reimagining the First Year AASC&U grant team 2016-2017  
Represented Fitchburg State University at AASC&U project meeting summer 2016.  
Developed Reimagining the First Year of College Definition of Scope and Success and full Action Plan with Metrics and budget implications through faculty and staff survey and focus groups with departments. Developed Campus Climate survey and revised Action Plan.

Team Member:

Fitchburg State University Campus Compact Civic Action Plan project 2016-2017  
Represented Fitchburg state University at Campus Compact regional meeting Princeton, NJ  
Developed and revised Fitchburg State University Campus Action Plan.

## Christopher Kneeland Cratsley

Primary Campus Contact, Commonwealth of Massachusetts Department of Higher Education Vision Project. 2012 – 2015. Organized and authored campus responses to the draft Vision Project Reports, and developed recommendations for campus participation in the Statewide Pilots for Assessing Student Learning.

Partnership for Assessing Readiness for College and Careers (PARCC). 2011 – 2015. Organized and co-authored with the PARCC Campus Engagement Team draft definitions of college readiness in English Language Arts/Literacy and Mathematics, organized campus responses to statewide PARCC requests and

### Representing Fitchburg State University

AMCOA Regional Planning Director 2016-2017

AMCOA II (Assessing Massachusetts Culture of Assessment) Task Force on Statewide Assessment 2012 - 2017

AMCOA II State Partner Team 2012 - 2015

AMCOA I and II Team 2011- 2017

COP (Council of Presidents) Assessment Leadership Team 2011-2017

### Presenter at Fitchburg State University:

Assessment and Development Days (January and May) 2011-2016

Center for Teaching and Learning Summer Institute 2012-2015

New Faculty Orientation 2012-2015

### Co-organizer:

Leominster Public Schools Southeast School Science Sleuths Night 2008-2013

Fitchburg State College and Mount Wachusett Community College middle school

STEM Career Awareness Days 2008 - 2010

### Team Member:

Boston Museum of Science BEST grant 2011 – 2013

Boston Museum of Science ATLAS grant 2009 – 2011

Developed science and engineering curriculum for pre-service elementary educators to be implemented in community colleges and state universities. Collaborated with faculty and staff from Massachusetts State Universities and Community Colleges to implement science and engineering curricula for pre-service elementary educators.

### Team Member:

DESE Professional Development Institutes through WGBH Teacher's Domain 2009-2010

Twin Cities Education Alliance 2006 – 2007

Leominster Public Schools Southeast School Partnership Curriculum Planning group 2006 – 2007

### Committee Chair:

All College Committee Teacher Education Council, 2003 – 2004.

NCATE Standard 1, 2 and TK20 Committee 2003 – 2005 and 2007- 2008

Biology Graduate Curriculum Committee, 2001 - 2010

Biology and Chemistry Peer Evaluation Committee, 2006-2008

Biology and Chemistry Search Committee, 2006-2007

### Additional Committee Memberships 2000-present:

All College Committee (AUC) Curriculum Committee

Dean of Liberal Arts and Sciences Search Committee

Director for Institutional Research Search Committee

Associate Vice President for Academic Affairs Search Committee

Liberal Arts & Sciences Council

Department Chairs Academic Planning Group

Biology Student Affairs Committee

## Christopher Kneeland Cratsley

Biology Self Study Committee  
Leadership Steering Committee  
Secondary Education Committee  
Masters of Arts in Teaching Council  
Acton Science Discovery Museum Science Advisory Board  
Animal Behavior Society Education Committee

Reviewer: Behavioral Ecology and Sociobiology,  
Coleopterist Bulletin  
Ethology  
Journal of Insect Physiology  
National Science Foundation Division of Biological Infrastructure Grants

Supervisor: Biology Department Graduate Assistant 2001-2006

Administrator: Biology Department Website. 2001-2006

Author: NCATE Program Reports Biology Secondary Education undergraduate and post-baccalaureate programs for initial licensure.

Co-author: Biology Department Self-Study.  
NCATE Program Report Middle School General Science and Middle School Math/Science programs for initial licensure and MEd in Science Education

Represented Fitchburg State University:  
NEASC Conferences December 2012-2016  
AAC&U Annual Meetings and General Education and Assessment Conferences 2012-2013  
PARCC Conferences October 2011 – 2015  
AMCOA Meetings and Conferences May 2011 - 2017  
NEEAN Fall Forums October 2010- present  
NEEAN Summer Institute June 2011, 2012, 2013, and 2017  
Vision Project Conferences October 2010 and 2013  
NCATE panel on assessment  
AACTE Annual Meeting, January 2006, San Diego, CA.  
NCATE program report workshop, NSTA National Convention, April 2004, Atlanta, GA  
AASCU Conference on Improving Teacher Licensure Test Performance, May 2001, Kennesaw State University, Kennesaw, GA.

Invited panel member: Tufts University 1999 Graduate Student TA Orientation.  
Tufts University 1998 "Excellence in Scholarship and Research"

### Awards and Honors

2017 FSU Faculty Award for Research and Scholarship  
2013 Department of Higher Education Core to College grant to Fitchburg State University for teacher workshops in Mathematics and English on the Common Core and PARCC.  
2012 AAC&U Quality Collaboratives Dyad grant to Fitchburg State University and Mount Wachusett Community College.  
2011 AMCOA Assessment Experiments Grant: Central Mass. Partnership to Assess Written Communication with Worcester State University, Quinsigimond Community College and Mount Wachusett Community College.  
2010 NSF ATE Grant Co-PI "Bridging Engineering, Science and Technology (BEST) for Elementary Educators"  
2009 Ruth Butler Grant for International Research and Education on Chemical Defenses in Fireflies

## Christopher Kneeland Cratsley

- 2008 DHE Improving Teacher Quality grant: Science Content Institutes & Integrating Science Inquiry for Grade 5-12 Teachers
- 2008 Marion and Jasper Whiting Foundation Scholarship
- 2008 Graduate Research Fellow Award
- 2007 FSC Faculty Award for Research and Scholarship
- 2007 Ruth Butler Grant for presenting research on white-footed mice as predators of fireflies
- 2006 FSC Harrod Lecture Award Recipient
- 2005 FSC Faculty Mentor Grant for Leadership Program Pilot Laptop Initiative
- 2005 Carnegie Award for a classroom-based research project on "Problem-based cooperative learning in a science course"
- 2003 NSF C-RUI Grant "Exploring the ecology of flash communication in *Photinus* fireflies through collaborative undergraduate research with computer-simulated signaling behavior."
- 2003 Ruth Butler Grant for research on "Conditional mating behavior in *Photinus ignitus* fireflies."
- 2002 CITI Grant "Exploring Biological Inquiry Through Computer Technology on the eLearning Network."
- 2002 FSC Mission Grant for "Improving Laboratory Instruction by Upgrading Technology and Improving Safety."
- 2002 Ruth Butler Grant for research on "Mating preference and melanization in *Pieris rapae*."
- 2001 Graduate Research Fellow Award
- 2001 Undergraduate Academic Scholarship Award
- 2001 IT Across the Curriculum CITI Grant "Biological Inquiry Through Computer Technology."
- 2001 FSC Mission Grant for "Teaching the Skills of Biological Inquiry in the 21<sup>st</sup> Century"
- 1999 Sigma Xi Grant-in-Aid of Research.
- 1998 SICB Division of Animal Behavior Best Student Paper Award, for poster presentation.
- 1996 Graduate Teaching Award, Tufts Biology Department.
- 1995 Honorable Mention, Department of Defense Fellowship Program.
- 1992 Finalist, Pearl River School District Outstanding New Teacher Award.
- 1991 Campbell Biology Prize for essay on high school science teaching.
- 1991 Sigma Xi, Scientific Research Society.

### Publications

- Cratsley, C.K., Slotnick, R.C. and Michelle Paranto. 2016. "Leveraging Campus Efforts that are Already Underway." In Dolinsky, R., Rhodes, T.L., and McCambly, H. *Action Steps for Advancing Transfer Student Success: Lessons Learned from Cross-Institutional Collaborations*, 14-15. Washington, DC: Association of American Colleges and Universities.
- Cratsley, C.K. and Slotnick, R.C. 2015. "Developing Shared Definitions of Student Proficiencies: A Case Study of the Collaboration between Fitchburg State University and Mount Wachusett Community College." In Maki, P. L. *Assessment that Works: A National Call, A Twenty First Century Response*, 37-38. Washington, DC: Association of American Colleges and Universities.
- Berg, J., Grimm, L. M., Wigmore, D., Cratsley, C.K., Slotnick, R.C. and Taylor, S. 2014. Quality Collaborative to Assess Quantitative Reasoning: Adapting the LEAP VALUE Rubric and the DQP. *Peer Review*. Summer 2014: 16(3): 17-21.  
<https://www.aacu.org/peerreview/2014/summer/berg>
- Slotnick, R., Cratsley, C.K., Consalvo, A.M. and Lerch, C. 2014. Outcomes-Based Assessment in Writing: Two Community Colleges and Two State Universities in a Local Four-Way Partnership. *The Journal of Assessment and Institutional Effectiveness*. 4(1): 52-84.
- Cratsley, C.K. and Slotnick, R.C. 2013. Working across institutions to define and assess civic learning. *Diversity & Democracy*. 16: 13-15.

## Christopher Kneeland Cratsley

- Cratsley, C.K., Prasertkul, T. and Thancharoen, A. 2012. Male aggregation behavior in the fireflies *Photinus ignitus* and *Pteroptyx malacca*. Proceedings of the Second International Firefly Symposium, Selangor, Malaysia. In Kirton, L.G., Lim, G.T. & Day, J.D. (eds). Lampyrid Vol 2.
- Sharkey, E.K., South, A., Moosman, P.R., Cratsley, C.K. and Lewis, S.M. 2010. Assessing condition-dependence of male flash signals in *Photinus* fireflies. *Journal of Insect Behavior*. 23: 215-225.
- Cratsley C.K. 2009. Patterns of flash signal preference in North American *Photinus* and *Photuris* fireflies and their implications for natural and sexual selection. Pp. 57-65 in Napompeth, B. (ed.). *Diversity and Conservation of Fireflies*. Proceedings of the International Symposium on Diversity and Conservation of Fireflies, Queen Sirikit Botanic Garden, Chiang Mai, Thailand, 26-30 August 2008. Queen Sirikit Botanic Garden, Chiang Mai, Thailand.
- Moosman, P.R., Lehto, S.D., Cratsley, C.K. and Thomas, H.T. 2009. Do courtship flashes of fireflies (Coleoptera: Lampyridae) serve as aposematic signals to insectivorous bats? *Animal Behaviour*. 78: 1019-1025.
- Cratsley, C.K. 2009. Evolution in Action: Bioluminescence Beetles and Bats. Invited review, Harrod Lecture Series, Fitchburg State College Press Fitchburg, MA.
- Lewis, S.M. and Cratsley, C.K. 2008. Flash signal evolution, mate choice, and Predation in fireflies. *Annual Review of Entomology*. 53: 293-321.
- Cratsley, C.K. and Lewis, S.M. 2005. Seasonal variation in mate choice of *Photinus ignitus* fireflies. *Ethology*. 111: 89-100.
- Austin, K.B., Dunlap J., Glover M., McKinnon J., Mohny D., Taft M., Vysocky M., and Cratsley, C.K. 2005. The virtual firefly: an interdisciplinary undergraduate research project. *Journal of Computing Sciences in Colleges*. 20 (5): 188-199.
- Lewis, S.M., Cratsley, C.K. and Demary, K. 2004. Mate recognition and choice in *Photinus* fireflies. *Annales Zoologici Fenici*. 41: 809-821.
- Cratsley, C.K. 2004. Flash signals, nuptial gifts and female preference in *Photinus* fireflies. *Integrative and Comparative Biology*. 44: 238-241.
- Lewis, S.M., Cratsley, C.K. and Rooney, J.A. 2004. Nuptial gifts and sexual selection in *Photinus* fireflies. *Integrative and Comparative Biology*. 44: 234-237.
- Cratsley, C.K. and Lewis, S.M. 2003. Female preference for male courtship flashes in *Photinus ignitus* fireflies. *Behavioral Ecology*. 14(1): 135-140.
- Cratsley, C.K., Rooney, J.A. and Lewis, S.M. 2003. Limits to nuptial gift production by male fireflies. *Journal of Insect Behavior*. 16(3): 361-370.
- Cratsley, C.K. 2000. Sexual selection on male courtship signals and nuptial gifts in *Photinus* fireflies. (Ph.D. Thesis) Tufts University.
- Cratsley, C.K. and Lewis, S.M. 1997. Variation in the nuptial gifts of *Photinus ignitus* males and the potential for female choice. *American Zoologist*. 37(5): 32A.
- Cratsley, Christopher. 1991. How problems can help. *The American Biology Teacher*. 53 (7): 390-392.

## Professional Talks and Posters

Intro to Assessment: Goals and Objectives. Plenary Presentation at the NEEAN Summer Institute 2017 with Linda Bruenjes and Jennifer Herman.

Demystifying Assessment. Traditional Summer Institute breakout session at the NEEAN Summer Institute 2017 with Linda Bruenjes and Jennifer Herman.

Assessment Modules: Previewing a New Online Professional Development Resource. Plenary session at the Advancing Massachusetts Culture of Assessment (AMCOA) Annual Conference 2017 with Jennifer Herman and Victoria Wallace.

Collaboratively Designed Learning Assessment Modules: An Interactive Professional Development Resource Available to Any Institution. Presentation at the NEEAN Fall Forum 2016 with Linda Bruenjes, Kimberly Hamilton-Bobrow, Jennifer Herman and Victoria Wallace.

Learning Assessment Modules for Everyone! An Interactive Professional Development Resource. POD Network Conference and Indianapolis Assessment Conference 2016 with Linda Bruenjes, Jennifer Herman and Victoria Wallace.

Course and Assignment Redesign: Integrating AAC&U ELOs, Rubrics, and the MSC. Breakout session at the Advancing Massachusetts Culture of Assessment (AMCOA) Annual Conference 2016.

What the DQP Looks Like on the Ground: National Trends and Campus Examples. AAC&U Annual Meeting 2014 with Sandra Fulton, Dr. Pat Hutchings, Dr. Natasha Jankowski, Dr. Scott Oates, and Dr. Ruth Slotnick.

Quality Collaboration for Successful Student Transfer. AAC&U Annual Meeting 2014 with Dr. Pat Crosson, Dr. Charlotte Mandell, Dr. Elise Martin, Dr. Ruth Slotnick and Dr. Terrel Rhodes.

Measuring Civic Engagement. NEASC Annual Meeting 2013 panel presentation with Dr. Peter Levine and Dr. Philip Sisson.

Calibrating Value Rubrics. NEASC Annual Meeting 2013 workshop with Dr. Ruth Slotnick and Dr. Terrel Rhodes.

The QC Dyad: Using assessment for collaborative professional development across institutions. NEEAN Fall Forum 2013 with Dr. Ruth Slotnick, Dr. Joseph Moser, Jennifer Fielding, Candace Shivers and Susan Taylor.

Measuring Student Success: New Approaches to Assessing Student Learning Outcomes. October 2013 AAC&U New England Educator-Employer Forum with Robert Awkward and Ruth Slotnick.

Towards a More Socially Just and Equitable System of Higher Education: Collaborative Faculty Partnerships for Outcomes-Based Assessment Between Two-year and Four-year Institutions AERA Conference 2013 with Drs. Ruth Slotnick, Carol Lerch and Anna Marie Consalvo.

Assessing Written Communication from Secondary to Higher Education AAC&U General Education and Assessment Conference 2013 with Kimberly Burns, Cathleen McCarron, Paula Haines, Darrin Berard, Ruth Slotnick and Carol Lerch.

Double-Loop Learning: A Multi-Institutional Effort to Assess Written Communication. NEEAN Fall Forum 2012 with Ruth Slotnick, Susan Taylor, Nancy Schoenfeld, Gaelan Benway, and Carol Lerch.

## Christopher Kneeland Cratsley

More than One Way to Assess QR? AMCOA Statewide Conference Worcester State University 2012 with Drs. Jennifer Berg and Elizabeth Gordon.

Liberal Arts and Sciences Outcomes Assessment: Closing the loop or spiraling in the right direction? November 2011. NEEAN Fall Forum. Worcester, MA and AMCOA Conference, Assessing Student Learning Outcomes Within and Across Disciplines. With Drs. Jennifer Berg, Elizabeth Gordon, Joseph Moser and Benjamin Railton.

Male aggregation behaviour in the fireflies *Photinus ignitus* and *Pteroptyx malaccae*. August 2010. Second International Firefly Symposium. Subang, Malaysia

Integrating EIE into non-majors Life Science courses. May 2010. Massachusetts Department of Higher Education Student Transfer Symposium. Boston, MA

Fireflies in your backyard and around the world. April 2010 Museum of Science Firefly Day, Boston, MA.

Envisioning Accountable and Sustainable Change: Educating Preservice Teachers in Engineering and Technology. February 2010. AACTE 62<sup>nd</sup> Annual Meeting. Atlanta, GA

Closing the Loop in Education. January 2010. FSC Winter 2010 Assessment Day. Fitchburg, MA

Teaching High School Biology. November 2009. Massachusetts Department of Elementary and Secondary Education Second Annual Summit on Curriculum, Instruction and Assessment. Marlborough, MA.

ATLAS Project: Enhancing the EiE Units to Raise the Science and Engineering Content to a College Level. April 2009. Massachusetts Department of Higher Education Student Transfer Symposium. Boston, MA

Why do fireflies flash? April 2009. Museum of Science Firefly Day. Boston, MA.

*Photinus ignitus* flash signal patterns and preferences: evidence for selection through mate choice and *Photuris* predation. January 2009. Society of Integrative and Comparative Biology Annual Meeting. Boston, MA.

Honesty, dishonesty and eavesdropping: using fireflies to explore the evolution of animal signals. November 2008. Kasetsart University Animal Behavior Seminar. Bangkok, Thailand.

Flash signal evolution in *Photinus* fireflies: exploring the roles of sexual selection and natural Selection. October 2008. Rivier College Biology Seminar Series. Nashua, New Hampshire

Patterns of flash signal preference in North American *Photinus* and *Photuris* fireflies and their implications for natural and sexual selection. August 2008. International Symposium on Diversity and Conservation of Fireflies. Chiang Mai, Thailand.

Male scramble competition, female responsiveness and predator avoidance in *Photinus ignitus* fireflies. June 2007. International Seminar on Lampyridae and Bioluminescence. Gaia, Portugal.

Sexual selection and predator avoidance in *Photinus* fireflies. April 2007. UMass Department of Plant Soil and Insect Sciences Entomology Seminar. Amherst, MA.

Effects of condition on flash behavior of male *Photinus ignitus* fireflies (Coleoptera: Lampyridae). January 2007. Society for Integrative and Comparative Biology Annual Meeting. Phoenix, AZ.

**Christopher Kneeland Cratsley**

- Effects of simulated firefly courtships on predatory *Photuris* fireflies and their prey. January 2007. Society for Integrative and Comparative Biology Annual Meeting. Phoenix, AZ.
- White-footed mice (*Peromyscus leucopus*) as potential predators of fireflies (Coleoptera: Lampyridae): the roles of lucibufagins and bioluminescence. January 2007. Society for Integrative and Comparative Biology Annual Meeting, Phoenix, AZ.
- Evolution in action: bioluminescence, beetles and bats. October 2006. Harrod Lecture Series. Fitchburg, MA.
- Male bioluminescent courtship competition, female preference and predation in *Photinus ignitus* fireflies. July 2006. International Society for Behavioral Ecology Congress. Tours, France.
- Candidate assessment: promising practices. January 2006. American Association of Colleges for Teacher Education Annual Meeting. San Diego, CA.
- Morphology and flash patterns as potential predictors of flash duration in *Photinus* fireflies (Coleoptera: Lampyridae). January 2006. Society for Integrative and Comparative Biology Annual Meeting. Orlando, FL.
- Photinus ignitus* male courtship behavior and *Photuris* predation in response to virtual fireflies. January 2006. Society for Integrative and Comparative Biology Annual Meeting. Orlando, FL.
- Information Technology in Biological Inquiry and Science Education. November 2005. Fitchburg State College Laptop Symposium. Fitchburg, MA.
- NCATE Accreditation: Views from the field. October 2005. Association of Science Teacher Educators, Northeast Region Meeting. Amherst, MA.
- Photinus pyralis* male flash signals as potential indicators of mate quality. August 2005. Animal Behavior Society Annual Meeting. Snowbird, UT.
- Variation in male flash characteristics of *Photinus* fireflies. November 2004. Entomological Society of America Annual Meeting. Salt Lake City, UT.
- Animal Behavior and Computer Science: Using extreme programming & virtual fireflies to train students in skills of inquiry. June 2004. Animal Behavior Society Annual Meeting. Oaxaca, Mexico.
- Female preference, male body size, spermatophore mass and the evolution of long flash duration in male *Photinus pyralis* fireflies. July 2003. Animal Behavior Society Annual Meeting. Boise State University, Boise, ID.
- Flash signals, nuptial gifts and precopulatory mate choice in *Photinus* fireflies. January 2003. Symposium: Communication: Fireflies at Fifty. Society for Integrative and Comparative Biology Annual Meeting. Toronto, Ontario.
- Flash signals and sexual selection in *Photinus* fireflies. November 2002. Colby College Department of Biological Sciences Seminar Series. Waterville, ME.
- Female preferences and male mate choice in *Photinus ignitus* fireflies. July 2002. International Behavioral Ecology Congress. Montreal, Quebec.
- Teaching about the tools of Information Technology for Biological Research. October 2001.



## Christopher Kneeland Cratsley

Invited poster, CITI Information Technology Across the Curriculum Conference.  
Framingham State College, Framingham, MA.

Male courtship signals as indicators of spermatophore mass in *Photinus ignitus* fireflies.  
July 2001. Animal Behavior Society Annual Meeting. Oregon State University, Corvallis,  
OR.

Female preference and precopulatory mate choice for large male lanterns in *Photinus ignitus*  
fireflies. August 2000. International Behavioral Ecology Congress. Zurich, Switzerland.

Female mating preference and resistance in *Photinus* fireflies. November 1999 Invited seminar,  
Department of Biology, Humbolt State University, Arcata, CA.

Mate choice and female condition in *Photinus ignitus* flash responsiveness. June 1999. Animal  
Behavior Society Annual Meeting. Bucknell University, Bucknell, PA.

Variation in the nuptial gifts of *Photinus ignitus* males and the potential for female choice.  
January 1998. Society for Integrative and Comparative Biology Annual Meeting. Boston,  
MA.

### Professional Affiliations

American Association of Colleges and Universities  
Animal Behavior Society, member serving on Education Committee  
Association of Science Teacher Educators, member  
International Society for Behavioral Ecology, member  
National Science Teachers Association, member  
Sigma Xi, Scientific Research Society, member  
Society for Integrative and Comparative Biology, affiliated member

### Professional References

Dr. Jennifer Berg  
Associate Professor of Mathematics  
Fitchburg State University  
160 Pearl Street, Fitchburg, MA 01420  
978-665-3787  
jberg5@fitchburgstate.edu

Dr. Elizabeth Gordon  
Associate Professor of Geo/Physical Science  
Fitchburg State University  
160 Pearl Street, Fitchburg, MA 01420  
978-665-3083  
egordon3@fitchburgstate.edu

Dr. Christopher Picone  
Associate Professor of Biology  
Fitchburg State University  
160 Pearl Street, Fitchburg, MA 01420  
978-665-3079  
cpicone@fitchburgstate.edu

**Christopher Kneeland Cratsley**

Dr. Paul Weizer  
Professor of Political Science  
Fitchburg State University  
160 Pearl Street, Fitchburg, MA 01420  
978-665-3167  
pweizer@fitchburgstate.edu

**Emma L. Downs, Ph.D.**

160 Pearl St.  
Fitchburg, MA 01420

edowns1@fitchburgstate.edu  
978-665-3621

---

**EDUCATION**

- University of Oregon (2009 -2014)* *Eugene, OR*  
Doctor of Philosophy: Chemistry 2014  
*Thesis: "An Exploration of Transition Metal Catalysts for Cyanohydrin Hydration: The Interface of Homogeneous and Heterogeneous Catalysis"*
- University of Massachusetts (2005 - 2009)* *Amherst, MA*  
Bachelor of Science: Chemistry, *magna cum laude* 2009  
*Thesis: "The Effect of Site-Specific Copper(II) Binding on Amyloid Formation in  $\beta$ -2-microglobulin Proteins"*
- Bachelor of Arts: English, *magna cum laude* 2009
- Phillips Academy Andover (2001 - 2005)* *Andover, MA*

**TEACHING EXPERIENCE**

*Department of Biology and Chemistry, Fitchburg State University* *Fitchburg, MA*  
**Assistant Professor of Chemistry**  
2015-present

- Teaching general chemistry I and II with associated lab sections.
- Teaching Inorganic chemistry as an upper level elective.

*Chemistry Program, Centre College* *Danville, KY*  
**Visiting Assistant Professor of Chemistry** 2014-2015

- Taught a course in chemistry for non-scientists containing 24 students, as well as multiple sections of general chemistry lab, each with around 24 students.

*Department of Chemistry and Biochemistry, University of Oregon* *Eugene, OR*  
**Head Teaching Assistant** 2012-2014

- Four terms as head TA supervising 10-15 lab instructors for organic chemistry lab courses. Tasks included training TAs, overseeing labs, proctoring and grading exams, and preparing and delivering 2-4 lectures per term to a class of 180-250 students.

**Discussion Leader** 2014

- Ran peer led discussion sections of the majors' organic chemistry lecture, overseeing workshops each week for three sections of 15-20 students.

**Teaching Assistant** 2009-2012

- Nine terms as a lab TA supervising two lab sections of 12-20 students per term for general and organic chemistry courses including both majors and non-majors.

**RESEARCH**

*Fitchburg State University* *Fitchburg, MA*  
2015-present

- Research on easily synthesized silver nanoparticles.
- Studying the effects on catalytic rates of different ligands and stabilizers for nanoparticles.
- Studying the leaching of silver nanoparticles in commercial products under various conditions.
- Examining the effects of silver nanoparticles on plants with Dr. Erin Rehrig
- Summer research collaborative – studying the effects of human activity on the Nashua River

University of Oregon

Eugene, OR  
2009-2014

- Worked under Professor David Tyler studying inorganic chemistry and catalysis.
- Focused on the synthesis and testing of new catalysts for the hydration of nitriles and cyanohydrins to amides towards a greener industrial synthesis of methyl methacrylate.
- Synthesized Ag, Ni, and Pt nanoparticles catalyst and characterized using TEM, XPS, UV-vis.
- Synthesized platinum phosphine complexes using air-free techniques and characterized using NMR and Mass Spec.
- Monitored catalyst kinetics using NMR techniques.
- Conducted mechanistic studies on homogeneous and heterogeneous catalysts.
- Mentored four undergraduate researchers. Three have gone on to graduate school.

University of Massachusetts

Amherst, MA  
2007-2009

- Worked under Professor Richard Vachet studying bioanalytical chemistry.
- Studied copper binding to protein ( $\beta$ -2-microglobulin) and the effects of the binding on protein unfolding and subsequent amyloid formation.
- Monitored with fluorescence spectroscopy and mass spectrometry.

## PUBLICATIONS

- Downs, E.L.; Tyler, D.R. "A Review of Nanoparticle Catalysts for Nitrile Hydration" *Coordination Chemistry Reviews*, **2014**, *280*, 28-37.
- Sherbow, T.J.; Downs, E.L.; Saylor, R.I.; Razink, J.J.; Juliette, J.J.; Tyler, D.R. "Synthesis and Characterization of PTA Stabilized Silver Nanoparticles and Use as Catalysts for Nitrile Hydration" *ACS Catalysis*, **2014**, *4*(9), 3096-3104
- Downs, E.L.; Tyler, D.R. "Nitrile and Cyanohydrin Hydration with a Nanoparticle Catalyst formed *In Situ* from a Platinum Dihydride Complex" *Journal of Inorganic and Organometallic Polymers and Materials*, **2014**, 1-8
- Downs, E.L.; Zakharov, L.N.; Tyler, D.R. "Crystal Structure of *trans*-dihydrido-bis-[tris(dimehtylamino)phosphane]-platinum(II)" *Acta Cryst*, **2015**, *E71*, m83-m84

## PRESENTATIONS

### **New England Association of Chemistry Teachers Annual Meeting**

Wellesley, MA  
April 30<sup>th</sup> 2016

Using Green Chemistry Principles to Improve Production of Plexiglas: Exploration of Catalysts for Cyanohydrin Hydration

### **2nd Annual International Materials Congress**

Zhenjiang, China  
May 18<sup>th</sup> 2013

Synthesis of Acrylate Monomers; Metal Nanoparticles as Hydration Catalysts for Nitrile and Cyanohydrin Hydration

## GRANTS

### **Special Project Grant**

Exploring the Catalytic Properties of Silver Nanoparticles - \$1500

Fitchburg State University

## PROFESSIONAL ACTIVITIES

Central Massachusetts Division of the American Chemical Society  
Attend local meetings

2015-present

University of Oregon Women in Graduate Sciences (uowgs.com)

Member 2009-Present

The Women in Graduate Science (UOWGS) organization at the University of Oregon is an organization which focuses on the professional development of women in all disciplines of science to enable them to become successful contributors to their fields. This mission is accomplished by informative workshops, inspirational speakers, and a community outreach program. The organization has around 50 members (women and men from various scientific disciplines) and continues to grow.

**Public Relations Chair**

2010-2011

- Responsible for the advertisement of WGS workshops, seminars, and activities.

**Treasurer**

2011-2012

- Managed the finances of the group and assisted in planning events such as a communication workshop and a Members' Banquet.

**Seminar Chair**

2012-2013

- Invited speakers and planned seminars and workshops on various topics in career choice and development.

**Outreach**

- Organized and participated in Girls' Science Adventure Days with local museum The Science Factory. Topics included chemistry in food, polymer chemistry, and chemistry of combustion.
- Helped organize a CSI day for Girl Scouts at the University of Oregon
- Participated in the Duck Village Science booth during the 2012 Olympic Track Trials
- Did demonstrations at several middle school science nights on campus.

**SCIENCE WRITING EXPERIENCE**

*New England Water Pollution Control Commission*

*Lowell, MA*

**Outreach Intern**

2007-2009

- Wrote and supplied research for several articles for NEIWPC's newsletter, *Interstate Water Report*, relating to current issues in chemistry and water pollution. These articles were intended to communicate scientific topics to an audience with little or no scientific training.

*University of Oregon*

*Eugene, OR*

**Science Journalism Course**

- Taught by John Palfrey, former editor for the PBS program Frontline

**AWARDS**

*Chemistry Department Travel Award*

*University of Oregon*

2013

*Undergraduate Award in Analytical Chemistry*

*American Chemical Society*

2008

# Steven L. Fiedler, Ph.D.

*Assistant Professor*

*Phone:* 978-400-3310    *Email:* sfiedle1@fitchburgstate.edu    *Web:* fiedlerchemistry.com  
*Address:* 160 Pearl Street, Fitchburg, MA 01420

## Professional Experience

- 9/2014 – present    Assistant Professor, Department of Biology and Chemistry,  
Fitchburg State University
- 2013 – 2014        Visiting Assistant Professor, Pomona College
- 2010 – 2013        Lecturer, Research Fellow, California State University, Northridge
- 2006 – 2010        Senior Research Fellow, University of Michigan, Ann Arbor
- 2003 – 2006        Research Fellow, University of Jyväskylä, Finland

## Education

- 2002    Ph.D. Chemistry, University of California, Irvine
- 1998    M.S. Chemistry, University of California, Irvine
- 1997    B.S. Chemistry, Michigan Technological University

## Peer-reviewed Publications

18. Interaction of Helium Rydberg State Molecules with Dense Helium, N. Bonifaci, Z. Li, J. Eloranta, S. L. Fiedler, *J. Phys. Chem. A*, 120, 9019-2027 (2016).
17. A Local Wave Tracking Strategy for Efficiently Solving Mid- and High-Frequency Helmholtz Problems, M. Amara, S. Chaudhry, R. Djellouli, J. Diaz, S. L. Fiedler, *Comput. Method Appl. Mech. Engrg.*, 276, 473-508 (2014)
16. Interaction of helium Rydberg state atoms with superfluid helium, S. Fiedler, J. Eloranta *J. Low Temp. Phys.* 174, 269-283 (2014)
15. Role of Water and Ions on the Dynamical Transition of RNA, H. Zhang, S. Khodadadi, S. L. Fiedler, J. E. Curtis *J. Phys. Chem. Lett.* 4, 3325 (2013).
14. Theoretical modeling of ion mobility in superfluid  $^4\text{He}$ , S. Fiedler, D. Mateo, T. Aleksanyan, J. Eloranta, *Phys. Rev. B* 86, 144522 (2012).
13. Experimental and theoretical characterization of the long-range interaction between  $\text{He}^*(3s)$  and  $\text{He}(1s)$ , N. Bonifaci, F. Aiken, V. M. Atrazhev, S. L. Fiedler, J. Eloranta. *Phys. Rev. A* 85, 042706 (2012).
12. Nonadiabatic dynamics by the mean-field and surface-hopping approaches: Energy conservation considerations, S. L. Fiedler (corresponding author), J. Eloranta. *Molec. Phys.* 108, 1471 (2010).
11. Simulation of Nanoparticle Permeation through a Lipid Membrane, S. L. Fiedler, A.

- Violi. *Biophys. J.* 99, 144 (2010).
10. Application of mean-field and surface-hopping approaches for interrogation of the  $\text{Xe}_3^+$  molecular ion photoexcitation dynamics, S. L. Fiedler, H. Kunttu, J. Eloranta *J. Chem. Phys.* 128, 164309 (2008).
  9. The effect of temperature on nanoparticle clustering, S. L. Fiedler, S. Izvekov, A. Violi, *Carbon* 45, 1786 (2007).
  8. Electronic spectroscopy of  $\text{C}_2$  in solid rare gas matrixes, S. L. Fiedler, J. M. Eloranta, K. J. Vaskonen, H. M. Kunttu, *J. Phys. Chem. A*, 109, 4512 (2005).
  7. Effects of static and dynamic perturbations on isotropic hyperfine coupling constants in some quinone radicals, S. L. Fiedler, J. Eloranta, *Magn. Reson. Chem.*, 43, 231 (2005).
  6. Charge transfer states of  $\text{C}_2$  in Kr clusters, S. Fiedler, H. Kunttu, J. Eloranta, *Chem. Phys.*, 307, 91 (2004).
  5. Host-guest charge transfer states: CN doped Kr and Xe, S. L. Fiedler, K. Vaskonen, J. Ahokas, H. Kunttu, J. Eloranta, V. A. Apkarian, *J. Chem. Phys.*, 117, 8867 (2002).
  4. Infrared study of five- and six-membered type cyclic imides, R. A. Nyquist, S. L. Fiedler, *Vib. Spec.* 8, 365 (1995).
  3. Infrared study of styrene oxide and phenylacetylene in various solutions, R. A. Nyquist, S. Fiedler, *Vib. Spec.*, 7, 149 (1994).
  2. Infrared study of vinyl acetate, methyl acrylate and methyl methacrylate in various solvents, R. A. Nyquist, S. Fiedler, R. Streck, *Vib. Spec.*, 6, 285 (1994).
  1. Infrared study of n-alkanes in  $\text{CCl}_4$ ,  $\text{CDCl}_3/\text{CCl}_4$ , and  $\text{CDCl}_3$  0.5% solutions, R. A. Nyquist, S. L. Fiedler, *Appl. Spec.*, 47, 1670 (1993).

## Proceedings and Other Publications

4. A Local Wave Tracking Strategy for Efficiently Solving Mid- and High-Frequency Helmholtz Problems, M. Amara, S. Chaudhry, R. Djellouli, J. Diaz, S. L. Fiedler, *Inria Research Report*, 8364, September 2013.
3. Local Basis Set Optimization to Efficiently Solve Helmholtz Problems, M. Amara, S. Chaudhry, R. Djellouli, J. Diaz, S. L. Fiedler (corresponding author), *Proc. 11th Int. Conf. Mathematical and Numerical Aspects of Waves*, Gammarth, Tunisia, 355 (2013)
2. Simulating Carbonaceous Pollutant Nanoparticles: An Aid to Discovery, *EM: Air & Waste Management Association, Magazine for Environmental Managers*, S. L. Fiedler, A. Violi, August 24, 2009.
1. Interactions of carbonaceous nanoparticles with a lipid bilayer membrane: A molecular study, S. L. Fiedler, A. Violi, *Proc. 6th U.S. Nat. Combust. Meeting*, Ann Arbor, MI, 22E4 (2009).

## Curriculum Vitae

### MELEDATH GOVINDAN

Chair, Department of Biology and Chemistry  
Fitchburg State University  
Fitchburg, MA 01420  
Tel: (978)-665-3628 (Office)  
e-mail: [mgovindan@fitchburgstate.edu](mailto:mgovindan@fitchburgstate.edu)

Home Address  
80 Settlers Path  
Lancaster, MA 01523  
(978)-660-8831(Mobile)  
e-mail: [govindan@verizon.net](mailto:govindan@verizon.net)

### EDUCATION

- 1981 Ph.D. Organic Chemistry, **University of Georgia**, Athens, GA  
Dissertation: "The Synthesis of Pyrrolizidines," directed by Dr. H. W. Pinnick.
- 1978 M.S. Organic Chemistry, **University of Kentucky**, Lexington, KY  
Thesis: "Ion Pairing of Carbanions in Polar Protic Solvents," directed by Dr. R. D. Guthrie.
- 1975 M.Sc. Chemistry, **University of Calicut**, Calicut, India  
Non-thesis degree in general chemistry
- 1973 B.Sc., **University of Calicut**, Calicut, India  
Major in chemistry and minors in physics and mathematics

### PRIMARY EMPLOYMENT

- 2014-present **Chair**, Department of Biology and Chemistry, Fitchburg State University.  
Duties include managing the department of 20 fulltime and 4-6 part-time faculty members and four fulltime staff. Duties include managing a budget over \$150,000 per year, course scheduling, curricular revisions, faculty hiring, and personnel evaluation of all non-tenured faculty and those seeking promotion. This involves classroom observations of their teaching as well as writing detailed evaluation letters to the Dean of Health and Natural Sciences. Accomplishment include revision of the B.A. Biology curriculum, leading the efforts to establish success markers for students to achieve to progress in the major, reconfiguration of biology and chemistry elective offerings to meet the increased demands, hiring and training four tenure-track faculty members and numerous adjunct faculty members in biology and chemistry over the past 3+ years.
- 1996-present **Professor of Chemistry and Advisor for Health Professions**, Fitchburg State University, Fitchburg, MA. Tenured in 1999 and promoted to full professor in 2001. Primary responsibility: teaching the sophomore organic chemistry sequence. I also developed and taught CHEM 1000, a course for non-science majors and Natural Products Chemistry, an elective course for majors. I have been serving as the Health Professions Advisor since 2004 and as the unofficial coordinator of the chemistry program since 2001. Major accomplishments include design and construction of the chemistry labs in the new Science Center, acquisition of instruments, such as NMR and FT-IR spectrometers, GC-MS, GC's, and HPLC, hiring of five new chemistry faculty members in the last 6 years, and revamping the organic chemistry curriculum to include new guided-inquiry laboratory experiments. I was also the primary author of the proposal to reestablish a chemistry degree program at FSU and led the multi-step application processes culminating in the approval by the



Mass Board of Higher Education in October 2013. As the health professions advisor, I have helped over 60 students to gain admission to health professional schools and I coordinated the establishment of an Early Admission Program with Lake Erie College of Osteopathic Medicine (LECOM) for FSU students to pursue D.O., D.M.D., and Pharm.D. degrees.

- 1985-96 **Professor of Chemistry and Coordinator for the Physical Sciences**, University of the Virgin Islands, St. Thomas, U.S.V.I. Promoted to full professor in 1989 and served as Coordinator for 1994-96. Major accomplishments include leading the establishment of a strong research program in the Division of Science and Math involving faculty in biology, chemistry, physics and mathematics using NIH grants from the MBRS, MARC and MSFD programs; acquisition of chemical instrumentation using NSF-ILI program; and revision of the chemistry B.S. curriculum. Supervised the research of over 30 undergraduates during my tenure.
- 1981-85 **Assistant/Associate Professor of Chemistry**, Wesleyan College, Macon, Georgia. Promoted to Associate Professor in 1983. Established a viable and thriving chemistry major and helped renovate the science laboratories.
- 1980-81 **Organic Chemistry Laboratory Coordinator**, Department of Chemistry, University of Georgia. Responsibilities included coordination of six undergraduate organic laboratory courses and supervision of teaching assistants.
- 1975-80 **Graduate Teaching Assistant**, Universities of Kentucky and Georgia. Taught organic and general chemistry labs for undergraduates.

#### **ADDITIONAL/OTHER APPOINTMENTS**

- 2004 - Present **Consultant**, Biomaterials Science and Engineering Lab, MIT. Elucidation of structures of natural products isolated from Malaysian plants.
- 2014 Summer **Adjunct Professor**, Boston College, Chestnut Hills, MA. I taught Organic Chemistry I and II.
- Fall 2011 **Visiting Professor**, Massachusetts Institute of Technology, Cambridge, MA. On sabbatical leave, I conducted collaborative research in natural products chemistry with Professor C-K. Rha at the Biomaterial Sciences and Engineering Laboratory.
- 2002-2008 **Adjunct Professor** (Summers), Brandeis University, Waltham, MA. I taught general chemistry for pre-medical students and chemistry majors.
- 2003, 2009 **Adjunct Professor**, Simmons College, Boston, MA. Taught introductory organic chemistry for allied health majors. At the request of the department chair, revamped the course to emphasize biological chemistry.
- 2004 **Adjunct Professor**, Assumption College, Worcester, MA. Taught general and organic chemistry labs and continued my research in natural products chemistry (during sabbatical leave from FSU).
- 2000-01 **Senior Consultant**, Tanical Therapeutics, Chelmsford, MA. Consulted with the firm's research on discovery of potential pharmaceutical leads from plants. This included establishing research collaborations with pharmacognosists in India.

- 1997 **Visiting Scientist**, Phytera, Inc., Worcester, MA. Carried out research on isolation and characterization of bioactive natural products from plants.
- 1993-94 **Visiting Professor**, Department of Chemistry, Virginia Tech, Blacksburg, VA. I was on leave from UVI to conduct research in marine natural products chemistry with Professor David Kingston. This was funded by a research grant from the National Cancer Institute.
- 1992-93 **Visiting Professor**, Department of Chemistry, University of Oklahoma, Norman, OK. I was on sabbatical leave from UVI to conduct research in marine natural products in the laboratory of Professor Francis J. Schmitz.
- 1986 (Summer) **Visiting Faculty Fellow**, Georgia Institute of Technology, Atlanta, GA. Research with Dr. Laren M. Tolbert in organic synthesis.
- 1985 (Summer) **Faculty Research Fellow**, Medical University of South Carolina, Charleston, SC. Research in medicinal chemistry with Dr. John B. Hynes.
- 1983 (Summer) **Faculty Research Fellow**, University of Kentucky, Lexington, KY. Research in organic photochemistry with Dr. Laren Tolbert.

### COURSES TAUGHT

**Organic Chemistry.** Sophomore organic chemistry for chemistry and biology majors. I have taught this course ~35 times. The textbook currently used is *Organic Chemistry* by J. Hornback, 2<sup>nd</sup> Edition. The laboratory uses microscale, guided inquiry experiments based on Lehman's problem-solving approach. Electronic resources, such as Blackboard, "Clickers", and *Sapling Learning* are used extensively for communicating with the students, keeping students engaged in class, and for graded homework assignments. I have also employed POGIL (Process Oriented Guided Inquiry Learning) and CPR (Calibrated Peer Review), active learning methodologies in this course.

**Chemistry for the Changing World** – a course in environmental chemistry for non-science majors using the ACS textbook *Chemistry in Context*. Electronic resources such as Blackboard and McGraw-Hill Connect are extensively employed in the course.

**Natural Products Chemistry** - An advanced junior/senior course. Text book: *An Introduction to Natural Products* by A. T. Sneden, manuscript form and extensive use of literature.

**General Chemistry.** I have taught this course here at FSU and for the many years at Brandeis University. Textbooks used include: *Essentials of General Chemistry*, Ebbing, Gammon and Ragsdale; *Chemistry – The Central Science*, Brown, LeMay and Bursten; and *Chemistry – A Molecular Approach* by N. Tro.

**Chemistry for the Health Sciences** - freshman-level courses for nursing and allied health majors. Textbooks used: *Chemistry for Today* by Seager and Slabaugh. I have used the POGIL (Process Oriented Guided Inquiry Learning) methodology in this course as well as OWL.

**Nutrition** - A course in general nutrition, primarily for nursing students. Textbook used: *Understanding Nutrition*, Whitney and Rolfe, 10<sup>th</sup> Ed.

**Instrumental Analysis.** One semester junior-level course for chemistry majors. Texts used: *Instrumental Analysis* by Willard, Gibbs and Merrit; Skoog and West.

**Biochemistry.** One-semester intensive lecture/lab course as well as a two-semester sequence for chemistry and biology majors. Textbook: *Principles of Biochemistry* by Lehninger.

### **PROFESSIONAL AFFILIATIONS**

American Chemical Society (ACS): Member (1980-present) and Alternate Councilor from Central MA Section (2011-present); **Chair of Central MA Local Section** (2015)

New England Association of Chemistry Teachers (NEACT): Member (2003-present), Central Division Chair (2011-13), President Elect (2013-15); **President** (2015-17)

American Society of Pharmacognosy, Member (1987–present).

National Association of Advisors of Health Professions (NAAHP): Member (2005–present).

Northeast Association of Advisors of Health Professions (NEAHP): Member (2005–present).

International Center for First Year Undergraduate Chemistry Education: Member (2005–present)

Council on Undergraduate Research: member 1998-2006, Institutional Liaison (2000- 2006)

### **AWARDS, HONORS, FELLOWSHIPS AND GRANTS**

**Vincent J. Mara Award for Excellence in Teaching, 2016, Fitchburg State University.** Award given to one faculty member from the University each year by the Alumni Association. I was nominated by former students and the selection was made by a committee appointed by the Alumni Association.

**Distinguished Service Award,** North South Foundation, Chicago, IL. An award given at the national finals in 2014 in recognition of my 13+ years of service to the organization.

**Marion and Jasper Whiting Foundation Fellowship, 2011.** Travel award to conduct lectures, workshops and collaborative research discussions with scientists at two universities and two research centers in Penang, Selangor and Kuala Lumpur, Malaysia.

**EBRQ Award** (Commonwealth of Massachusetts) for the purchase of an FT-IR spectrometer, \$14,500, 2011. I wrote the proposal for funds to purchase the instrument, which is used in organic and other chemistry courses.

**EBRQ Award** (Commonwealth of Massachusetts) for the purchase of an NMR spectrometer, \$65,000, 2008. I again wrote the proposal for funds to purchase the instrument, which is also used in organic and other chemistry courses.

**Teaching Innovation Grant,** Fitchburg State University, 2006-07. A faculty development grant for the amount of \$2000 to develop POGIL materials and implement POGIL methodology in the classroom. Most of the funds were used to attend workshops and conferences related to POGIL and other active learning methodologies.

**EBRQ Award** (Commonwealth of Massachusetts) for the purchase of a Gas Chromatograph – Mass Spectrometer (GC-MS), \$64,000. I wrote the proposal for funds to purchase the instrument. The instrument, purchased in 2006, is an integral part of the laboratory work in organic chemistry and analytical chemistry.

**Ruth Butler Research Award,** Fitchburg State University, 1997-99. For continued research on novel analytical

methods for analyzing active ingredients in herbal products and for continuing the research on the isolation and characterization of bioactive natural products from marine organisms.

**Principal Investigator**, Faculty Development Award, National Cancer Institute, NIH, 1993-96. Research grant for a project in natural products chemistry conducted in collaboration with Dr. David Kingston of Virginia Polytechnic Institute and State University, Blacksburg, VA. Total direct cost of the award was approximately \$360,000. As part of the project we also collaborated with Dr. Gabriella Santoro of the Council of National Research, Rome, Italy in the search for potential antiviral agents from marine soft corals.

**Program Director**, National Institutes of Health RIMI grant. I coordinated the preparation of this major grant proposal to improve the biomedical research infrastructure at the University of the Virgin Islands. Requested budget of this proposal was \$3.25 million.

**Program Director**, National Institutes of Health - MBRS Grant: "Biomedical Research in the Caribbean Environment". I directed this institutional grant to UVI for research by biology, chemistry, and psychology faculty members and students from 1988-92. My responsibilities included preparation of grant proposals and annual reports, management of the grant funds, recruitment and supervision of staff, and overall coordination of the research projects. The total amount of the grant was approximately \$2M for 1988-95. I also served as the P. I. for a sub-project: "Isolation and Characterization of Bioactive Marine Natural Products".

**Program Director**, PHS - Health Careers Opportunity Program (HCOP) Grant, 1990-93, \$269,533. I prepared the grant proposal and served as the Program Director coordinating various activities of the Program designed to increase the number of minority students entering health professions.

**Associate Investigator**, National Institutes of Health - Minority Biomedical Research Support Grant (Program Director: Dr. G. M. Moolenaar), awarded for 1995-1996, \$70,000.

**Principal Investigator** for an NIH-MBRS sub project (Program Director: Dr. LaVerne Ragster), "Synthetic Approaches to the Pyrrolizidine and Mitomycins", 1986-88, \$63,000.

**Project Director**, National Science Foundation - CSIP Program Grant: "NMR Spectrometer for Undergraduate Instructional Laboratory", 1986-88, \$46,000.

#### **SERVICE TO THE DEPARTMENT AND UNIVERSITY**

Member, Dean Search Committee, 2014.

University Committee on Promotions, 2012-13 and 2013-14.

Member, NEASC Accreditation Self Study Steering Committee, 2010-12.

All University Committee (FSU) **Chair**: 2001-02 and 2002-03; **Member**: 2000-03

Academic Policies Committee (FSU), **Chair**: 2005-06 and 2006-07, **Secretary**: 1997-98; **Member**: 1996-97, 2004-05, 2007-08, 2010-11.

All University Curriculum Committee (FSU), **Chairman**: 2000-01; **Member**: 1998-2001, 2008-09, 2012-13.

University-wide Tenure Committees (FSU). I have served on five tenure committees including once as the chair.

Departmental Search Committees – throughout my career I have served on search committees including many times as Chair, which resulted in the hiring of biologists, chemists and a physicist.

Departmental Peer Evaluation Committees (PEC), I served on several PEC's for the Departments of Biology and Chemistry, Exercise and Sports Science and Geo-Physical Sciences.

Biology/Chemistry Department Curriculum Committee (FSU), **Member:** 2002-03, 2004-05, 2005-06, 2006-07, 2007-08, 2014-present. In this capacity, I coordinated the preparation of the proposal for new B.S. degree programs in Chemistry and Chemistry Education in 2013 and shepherded it through the approval process involving many steps including departmental committee, university curriculum committee, All University Committee, University Board of Trustees, BHE Review Committee and finally the Board of Higher Education of the Commonwealth of Massachusetts.

Accreditation Self Study Steering Committee (FSU), **Member:** 2000-01, 2010-11.

Coordinator, Chemistry Program Review, Fitchburg State University, 1997-98. I served as the primary author of two departmental self-study reports submitted to the Massachusetts Board of Higher Education in 1997 and 1998.

Coordinator of Physical Sciences, University of the Virgin Islands, 1994-96. Responsibilities of a department chairman including annual evaluations of nine faculty members, course scheduling, teaching assignments, curriculum revision, faculty and staff recruitment, and overall coordination of the chemistry, physics, and pre-engineering programs at UVI.

Vice-Chairman of the Faculty Senate, UVI: 1988-89.

Curriculum Committee (UVI), Chairman: 1988-89; Member: 1987-90.

Chairman, Institutional Review Board for the Protection of Human Subjects in Research, UVI (1989-92). I coordinated the formulation of institutional policies for the protection of human subjects in research and for handling misconduct in science.

Member of other faculty committees at UVI including Accreditation Self-Study Committee, Business Reengineering Task Force, Strategic Planning Task Force, Student Recruitment Committee, Laboratory Safety Committee, Writing Proficiency Committee, and Faculty-Student Judicial Board.

## **PUBLICATIONS**

1. Guthrie, R. D. and Govindan, M. "Cation Effects on the Equilibrium Acidity of Carbon Acids in Methanol", *J. Am. Chem. Soc.*, *101*, 5769 (1979).
2. Pinnick, H. W., Chang, Y. -H., Foster, S. C., and Govindan, M. "Reaction of Ethyl Cyclopropanecarboxylate with Base", *J. Org. Chem.*, *45*, 4505 (1980).
3. Layton, W. J., Smith, S. L., Pinnick, H. W. and Govindan, M., "Reaction of Pyrrolidone with Phosphorus Pentachloride", *J. Org. Chem.*, *46*, 4076 (1981).
4. Govindan, M. and Pinnick, H. W. "Benzaldehyde Plus Potassium Hydride - Benzoyl Anion?", *J. Org. Chem.*, *46*, 5011 (1981).

5. Govindan, M. and L. Uncles. Laboratory Safety Manual, Univ. of the Virgin Islands, 1989.
6. Singh, S. K., M. Govindan, and J. B. Hynes. "Synthesis of 5-Trifluoromethyl-5,8-dideazafolic Acid and 5-Trifluoromethyl-5,8-dideazaisofolic Acid", *J. Heterocyclic Chem.*, **27**, 2101 (1990)
7. Govindan, M., A. McClean and K. A. Brown. "Constituents of the Marine Green Alga *Bryopsis plumosa*", *Microchemical Journal*, **47**, 193 (1993).
8. Govindan, M., J. S. Hodge, K. A. Brown, and M. Nunez-Smith. "Distribution of Cholesterol in Caribbean Marine Algae", *Steroids*, **58**, 178 (1993).
9. Govindan, M., S. A. Abbas, F. J. Schmitz, R. H. Lee, J. S. Papkoff, and D. L. Slate. "New Cycloartanol Sulfates from the Alga *Tydemania expeditionis*: Inhibitors of the Protein Tyrosine Kinase pp60<sup>V-SRC</sup>", *J. Nat. Prod.*, **57**, 74 (1994)
10. Govindan, M., G. Govindan, D. G. I. Kingston, "Mechanism-Based Antitumor Screening of Marine Invertebrates: Isolation and Structure Elucidation of Novel Diterpenoids from the Caribbean Gorgonian *Eunicea tourneforti*", *J. Nat. Prod.*, **58**, 1174 (1995).
11. Fu, X., F. J. Schmitz, M. Govindan, S. A. Abbas, K. M. Hanson, P. A. Horton, P. Crews, M. Laney, and R. C. Schatzman "Enzyme Inhibitors: New and Known Polybrominated Phenols and Diphenyl Ethers from Four Indo-Pacific *Dysidea* Sponges", *J. Nat. Prod.*, **58**, 1384-1391 (1995).
12. Govindan, M. and G. Govindan, **1999**. EVENING PRIMROSE OIL- A Scientific Summary, an article in MotherNature.com.
13. Govindan, M. and G. Govindan, **2000**. A Convenient Method for the Determination of Quality of Goldenseal, *Fitoterapia*, **71**, 232-235,.
14. Co-author: American Herbal Pharmacopoeia and Therapeutic Compendium: Goldenseal Root, R. Upton (Editor), **2001**.
15. Govindan, M., **2005**. Book Review: Eucalyptus: the Genus *Eucalyptus* Edited by John J. W. Coppen (Natural Resources Institute, University of Greenwich, UK). Taylor and Francis, London. 2002. xiii + 450 pp., *J. Nat. Prod.*, **68**(1) pp 151 – 152.
16. Govindan, G., T. G. Sambandan, M. Govindan, A. Sinskey, J. Vanessendelft, I. Adenan, C. K. Rha, **2007**. A Bioactive Polyacetylene Compound Isolated from *Centella asiatica*, *Planta Med.*, **73**: 597-599.

#### CONFERENCE PRESENTATIONS/ABSTRACTS

1. Guthrie, R. D. and M. Govindan, 1979. Cation Effects on the Equilibrium Acidity of Carbon Acids in Methanol. Paper Presented at the 178th National Meeting of the American Chemical Society, Washington, DC. Abstract 70.
2. Govindan, M. and H. W. Pinnick, 1979. Reaction of Ethylcyclopropanecarboxylate with Base. Paper Presented at the 31st Southeastern Regional Meeting of the ACS, Roanoke, VA. Abstract 241.
3. Govindan, M. and H. W. Pinnick, 1979. Generation and Trapping of Benzoyl Anions. Paper Presented at the 31st SE Regional Meeting of the ACS, Roanoke, VA. Abstract 244.

4. Govindan, M. and H. W. Pinnick, 1981. Benzaldehyde plus Potassium Hydride - Benzoyl Anion? Paper Presented at the 183rd National ACS Meeting, Atlanta, GA. Abstract 40.
5. Govindan, M. and H. W. Pinnick, 1981. Addition of Nucleophiles to Imino Ethers. Paper Presented at the 33rd Southeast Regional ACS Meeting, Lexington, KY. Abstract 196.
6. Tolbert, L. M. and M. Govindan, 1983. The Photoreaction of Thymidine with Alkylamines - A Mechanistic Revision. Paper Presented at the 35th Southeastern Regional Meeting of the ACS, Charlotte, NC. Abstract 477.
7. Govindan, M., 1984. Chemical Education in India - What Can We Learn from It? Paper Presented at the 36th Southeastern Regional ACS Meeting, Raleigh, NC. Abstract 204.
8. Cornelius, L. and M. Govindan, 1987. Synthetic Approaches to the Pyrrolizidines I. Paper Presented at the NIH Centennial MBRS-MARC Symp., Washington, D.C. Abstract 219.
9. Browne, C. A., R. E. Browne, and M. Govindan, 1988. Synthetic Approaches to the Pyrrolizidines II. Paper Presented at the 16th Annual NIH-MBRS Symposium, Los Angeles, CA. Abstract 154.
10. Smith, B. A., T. Turner, K. A. Brown, and M. Govindan, 1991. *In situ* Caribbean Fish Feeding Preferences - Not Entirely Chemical Deterrence. Paper presented at the Annual Meeting of the Association of the Caribbean Marine Labs, Bahamas.
11. Govindan, M., J. S. Hodge, K. A. Brown, and M. Nunez-Smith, 1991. Cholesterol Composition of Marine Algae of the Caribbean. Paper presented at the Joint Annual Meeting of the Puerto Rico EPSCoR and the AAAS Caribbean Division, San Juan, P.R.
12. Brewley, A. L., A. F. Browne, M. Govindan, K. A. Brown, and T. Turner, 1991. Natural products from Caribbean red algae. Paper presented at the NIGMS - Minority Programs Symposium, Washington, D.C. Abstract No. 518.
13. Fahie, L. V., A. F. Browne, H. W. Gjessing, K. A. Brown, M. Govindan, and T. Turner, 1991. Antimicrobial activity of Caribbean marine algae. Paper presented at the NIGMS-Minority Programs Symposium, Washington, D.C. Abstract No. 111.
14. Williams, E. C., T. Turner, C. A. Walters, K. A. Brown, A. E. McClean, and M. Govindan, 1991. Food Preferences, Chemistry, and Predation of Amphipods from the Green Alga *Bryopsis*. NIGMS-Minority Programs Symposium, Washington, D.C. Abstract No. 65.
15. McClean, A. E., M. Govindan, and K. A. Brown, 1992. Constituents of the Marine Green Alga *Bryopsis plumosa*. Paper presented at the Ninth Symposium on Advances in the Immunology and Biochemistry of Tropical Diseases, Meharry Medical University, Nashville.
16. Govindan, M., A. A. Abbas, F. J. Schmitz, R. H. Lee, J. S. Papkoff, and D. L. Slate, 1993. New Bioactive Cycloartanol Sulfates from the Marine Green Alga *Tydemania expeditionis*. Paper presented at the 34th Annual Meeting of the American Society of Pharmacognosy, San Diego, CA.
17. Govindan, M., G. Govindan, and D. G. I. Kingston, 1994. Antitumor Activity of Marine Invertebrates from the U. S. Virgin Islands. Paper presented at the International Congress on Natural Products Research, Halifax, Nova Scotia, Canada.

18. Govindan, M., G. Govindan, and D. G. I. Kingston, 1995. Mechanism-Based Antitumor Screening of Marine Organisms: Isolation and Structure Elucidation of Tournefortins A-E, Novel Diterpenoids from the Caribbean Gorgonian *Eunicea tourneforti*. Paper presented at the 209th National Meeting of the American Chemical Society, Anaheim.
19. Govindan, M., G. Govindan, W. Lennox, A. Gunatilaka, D. Kingston and B.Zhu. Further Chemical Investigations of the Caribbean Gorgonian *Eunicea succinea*. Paper presented at the 37th Annual Meeting of ASP, Santa Cruz, CA, **1996**
20. Lennox, W. J., D. Kingston, M. Govindan, and L. Gunatilake. The Use of Molecular Modeling In Conjunction with NMR for the Structure Elucidation of Natural Products Containing Medium Sized Rings. Paper presented at the 48th Southeast Regional Meeting of the ACS, Roanoke, VA, **1997**
21. Govindan, M. A Convenient Method for the Determination of Quality of Goldenseal Extracts. Paper presented at the 39th Annual Meeting of the American Society of Pharmacognosy, Orlando, FL. **1998**.
22. Govindan, M. Analytical Methods for the Detection and Quantitation of Active Ingredients in Evening Primrose Oil. Paper presented at the Interim Meeting of the American Society of Pharmacognosy, Tunica, MS, July **1999**.
23. Govindan, M., 2001. Analytical Methods for the Detection and Quantitation of Active Ingredients in Evening Primrose Oil. Paper presented at the Northeast Section Meeting of the American Chemical Society, June **2001**.
24. Michael Garoutte, Christina Mewhinney, and Meledath Govindan. Calibrated Peer Review (CPR) Collaboration Among Multiple Schools, Biennial Conference on Chemical Education, **2004**.
25. Govindan, M. Writing To Learn: Use of Calibrated Peer Review in Introductory Courses. Paper presented at the First Biennial First Year International Chemistry Conference, Urbana-Champaign, IL, **2005**.
26. Govindan, M. The Use of Process Oriented Guided Inquiry Learning (POGIL) in An Introductory Chemistry Course. Paper presented at the Second Biennial First Year International Chemistry Conference, Boulder, CO, **2007**.
27. Govindan, M., Engel, M. and Lana, L., Best Practices in Navigating Centralized Application Services. Panel presentation at the annual meeting of the Northeast Association of Advisors of Health Professions, Newport, RI, **2011**.
28. Govindan, M., Thurlow, D., Cichowicz, M., Weinreb, C. and Haines, P., Organic Chemistry, Biochemistry, MCAT<sup>2015</sup>, and Liberal Arts Education. Panel presentation at the annual meeting of the Northeast Association of Advisors of Health Professions, Atlantic City, NJ, **2013**.
29. Govindan, M. and Christian-Madden, M. Impact of NEACT, New England Association of Chemistry Teachers, on the Professional Development of Chemistry Teachers in Schools and Colleges in New England. Paper presentation at the 250<sup>th</sup> National Meeting of the American Chemical Society, San Diego, CA, **2016**.
30. Govindan, M. A History of NEACT – 118 Years of Involvement in Chemical Education. Paper presented at the 77<sup>th</sup> Annual Summer Conference of the New England Association of Chemistry Teachers, North Adams, MA, **2016**.



**INVITED LECTURES**

1. "Summer Research and Internship Opportunities for Science Majors", Virginia Union University, March 1987.
2. "Opportunities for Minority and Women Students for Careers in Sciences and Medicine", Virginia Union University, March 1987.
3. "Bioactive Marine Natural Products", Department of Experimental Medicine, National Council of Research, Rome, Italy, 1990.
4. "Synthetic Approaches to Pyrrolizidines", Catholic University of Puerto Rico, Ponce, P. R., April 1991.
5. "Bioactive Compounds from Marine Invertebrates", National Institute of General Medical Sciences, NIH, Bethesda, MD, July 1994.
6. "Antitumor Screening of Marine Invertebrates", 27th Scientific Meetings of the Association of Caribbean Marine Labs, St. Thomas, VI, June 1995.
7. "Bioactive Metabolites from the Gorgonian *Eunicea tournefortii*," Invited seminar at Phytera, Inc., Worcester, MA, 1998.
8. "U.S. Government Regulations on Dietary Supplements and PTI's Approaches to Developing Botanical Pharmaceuticals," Invited lecture at the 51<sup>st</sup> Indian Pharmaceutical Congress, Indore, India, 1999.
9. "Use of NMR in Structure Elucidation of Natural Products: A Novel Polyacetylene from *Centella asiatica*," Invited lecture at Science University of Malaysia (USM), Technological University of Malaysia (UiTM), Sime-Darby Research Center, and Malaysia Palm Oil Board (MPOB) Research Center, Malaysia, 2011.
10. "Dietary Supplements: U.S. Federal Regulations and Quality Control Issues," Invited lecture at USM and UiTM, Malaysia, 2011.
11. "Biodiesel from Non-Edible Oils – Challenges," Invited lecture at USM and Sime-Darby Research Center, Malaysia, 2011.
12. "Student-centered Teaching Methods in Organic Chemistry," Invited lecture at UiTM, Malaysia, 2011.
13. "Importance of Prayer in the Life of a Hindu," Invited lecture at the Episcopal Divinity School of Lesley University, Cambridge, MA, 2012.
14. "Structure Elucidation of Natural Products by NMR," Third Annual Professor K. P. Antony Memorial Lecture, St. Thomas College, Thrissur, Kerala, India, 2013.

**CONTINUING EDUCATION COURSES**

NSF-Sponsored Workshop on Guided Inquiry Laboratory Experiments in Organic Chemistry, University of Minnesota. One-week hands on short course taught by Jerry Mohrig and Jack Kampmeier, June 2010

NSF-Sponsored Advanced Workshop on NMR – New Developments and Biological NMR, One-week hands-on workshop taught by Professor James Prestegard and Dr. John Glushka, University of Georgia, May 2009.

Three-day Advanced Work on POGIL Facilitation and Authoring, University of St. Thomas, St. Paul, MN, June 2007. I used POGIL extensively in my classes as an active learning tool.

Two-day Consulting Visit to Bethel University, St. Paul, MN to observe the POGIL classes of Dr. Ashley Mahoney and consult with her on strategies for teaching introductory chemistry via POGIL, March 2007.

Three-day In-Depth Workshop on POGIL, College of Charleston, Charleston, SC, May 2006.

Three-day workshop on the use of Calibrated Peer Review, Miami University, Middletown, Ohio, February 2002. I subsequently implemented this active learning tool into my courses in general and organic chemistry.

NSF-MDL Project Dissemination Workshop, University of Massachusetts, Dartmouth, March 2001. Received introduction to various NSF-sponsored programs active learning including POGIL, CPR, Peer-Led Team Teaching, New Dimensions, and Chemical Connections.

Many ACS and NSF Chautauqua courses between 1981-2001 on topics, such as Atmospheric Chemistry – Acid Rain, Educational Computing, 2-Dimensional NMR Spectroscopy, Supercritical Fluid Extraction and Chromatography, Molecular Modeling.

### **PROFESSIONAL SERVICE**

**President New England Association of Chemistry Teachers**, July 2015 – present. President-elect 2013-15; member of the Executive Committee (2011-present); and Central Division Chair (2011-13). I served as a member of the conference committee that organized the 2010 Summer Conference at FSU. As Division Chair, organized the 2012 Central Division meeting at Clark University and 2013 Central Division meeting at FSU. Chaired the Conference Committee for the 2014, 2015 and 2016 summer conferences.

**Chair, Central Massachusetts Section of the American Chemical Society**, 2015; Elected Councilor to American Chemical Society 2016-19; Alternate Councilor from 2011-15. I was the main organizer of the highly successful sectional meetings at FSU in, March 2013, September 2013, April 2014 and March 2016.

**AP Chemistry Reader**, Educational Testing Service, 2012-present. Participated in scoring the free-response sections of AP Chemistry exam.

**External Expert Reviewer** for the promotion application of Associate Professor Patricia Kreke of Mount Saint Mary's University, Emmitsburg, MD, 2016.

**Reviewer** of Chapter: "Metabolic fingerprinting of the Lycopodiales species for chemotaxonomy and quality control" in *Instrumental Methods for the Analysis of Bioactive Molecules*. Manuscript ID: bk-2014-00060p. Author(s): Choo, Chee-Yan. Publisher: ACS, 2014.

**External Expert Reviewer** for the promotion application of Associate Professor Richard Gunatilake of the University of Houston, Victoria, 2010.

**External Reviewer**, Ph.D. Thesis of T. R. Soudararajan submitted to the Dr. M. G. R. University, Chennai, Tamil Nadu, India, 2009.

**Institutional Liaison**, Council on Undergraduate Research, 1999 -2006.

**Referee**, *Journal of Natural Products*, 1993 – 2000.

**Reviewer:** New York Sea Grant Program, August 1997.

Member: NIH-MBRS grant review panel, June 1997.

Member: NIH-RCMI grant site visit team to the University of Puerto Rico - Rio Piedras, 1995.

Member: NIH-MBRS grant site visit team to Texas Southern Univ., Houston, TX, 1994.

Member: NIH-MBRS grant review panel, 1993.

Member: NIH-MBRS grant site visit team to Hampton University, Hampton, VA, 1993.

Member: NIH-MBRS grant review panel, 1991.

Member: NIH-MBRS site visit team to Cayey University University, Cayey, PR, February 1988.

Member: NIH-MBRS site visit team to the University of Puerto Rico Medical Sciences Campus, San Juan, P. R., January 1988.

Review Panel Member: NSF Instrumentation and Laboratory Improvement Program, 1988 and 1990.

### **CONSULTING**

**Biomaterial Science and Engineering Laboratory**, Massachusetts Institute of Technology, Cambridge, MA. Structural elucidation of complex natural products using one- and 2-dimensional NMR and other spectroscopic analyses.

**Cengage Learning**, Classroom Testing of Online Web Learning (OWL) platform for the GOB course, 2009.

**American Herbal Pharmacopeia**, Santa Cruz, CA. Validation of analytical methods for Godenseal.

**Tanical Therapeutics**, Chelmsford, MA. Consulted with their research on discovery of potential pharmaceutical leads from plants, fungi and marine organisms.

**Phytochem Technologies, Inc.**, Chelmsford, MA. Evaluation of Indian medicinal plants as potential sources of pharmaceuticals.

**Phytera, Inc.**, Worcester, MA. Assisted with the isolation and characterization of bioactive natural products from plants.

**American Chemical Society**, Reviewer for Journal of Natural Products.

### **PUBLIC SERVICE/COMMUNITY OUTREACH**

**North South Foundation**, MA Regional Coordinator and Member of Coordinating Committee, 2001 – present. I have been involved with this organization that conducts educational contests for children in the U.S. and raises funds for scholarship program for economically disadvantaged students in India. Annual Massachusetts Chapter contests are held at Fitchburg State University and Tufts University in April that attracts over 800 children from New England area. In fall 2008, the MA Chapter hosted the national finals of the competition. Both for the

regionals and national final, I have been in-charge of the Technical Team - recruitment, assignment and training of over 100 judges, pronouncers and technical coordinators, and for the overall conduct of the contests.

**Member, Nashoba Regional School Committee** (Elected from Lancaster, MA), 2005 – 2011. I served two terms on the school board that supervises the education of the 3500+ students in seven schools in three towns (Bolton, Lancaster and Stow) that comprises the NRSD and oversees the budget of over \$45 million. I served the Vice Chair, Chair of the Facilities and Finance Sub-Committees. Prior to that I was member of Luther Burbank Middle School Council for two years.

**Member, Board of Directors, Nashoba FIRST**, a non-profit organization that raises funds and supports the robotics program at Nashoba Regional High School. I have been involved in fund-raising and also serve as a mentor for the children. During 2007-08 my efforts brought in \$7500 in corporate donations to the robotics program. This year (2008-09) we have raised over \$6000 for the program.

**Mathcounts Coach**, Lancaster Middle School, 2003 – 2008. I founded this program at LBMS and coached the team for five years. The highlight was the fourth-place finish in 2005 in the Central MA Regional Mathcounts competition.

**Secretary**, Kerala Association of New England, 2003-04.

**Lisa M. Grimm**

13 B Maple Street  
Maynard, Massachusetts 01754  
(978) 897-3340 (home)  
(978) 793-1751 (cell)  
lgrimm1@fitchburgstate.edu

---

**SUMMARY**

- Ph.D in Molecular and Cellular Biology from the University of Massachusetts, B.S. in Zoology from the University of Washington.
  - Postdoctoral fellow at Massachusetts General Hospital and Harvard University, recipient of a 3 year fellowship from the National Institutes of Health.
  - Research Accomplishments: Demonstrated a requirement for the ubiquitin-proteasome pathway during thymocyte apoptosis, providing the first definitive link between proteasomes and apoptosis in a mammalian system. Performed a structure-function analysis of the Notch receptor using *Drosophila melanogaster* as the model organism.
  - Science teacher at Westborough High School for 7 years. Teaching assignments included honors courses in biology, chemistry and physical science and college preparatory courses in biology and physical science.
  - Assistant Professor and Graduate Program Chair in the Department of Biology and Chemistry at Fitchburg State University. Teaching assignments include both lower and upper level biology courses and education courses. Responsible for supervising and mentoring teacher candidates in their initial licensure programs.
- 

**EXPERIENCE**

(2012-present) Assistant Professor and Graduate Program Chair in the Department of Biology and Chemistry, Fitchburg State University, Fitchburg, MA

- Developed curriculum and provided instruction for introductory and advanced biology courses required in the biology major. Courses taught include General Biology I, General Biology II, Immunology
- Developed curriculum and provided instruction for pedagogy courses required for biology undergraduate and graduate majors seeking teaching licensure. Courses taught include Methods in Teaching Science and Practicum Seminar.
- Developed an integrated science course for elementary school teacher candidates called Life Science for Educators.

- Mentored biology undergraduate and graduate students seeking initial licensure. Advised on course selection and supervised pre-practicum and practicum experiences.
- As graduate program chair, have worked on all aspects of the graduate program in the Department of Biology and Chemistry including advising, application review, course offerings and curriculum decisions.
- Collaborating member in a Massachusetts Mathematics and Science Partnership (MMSP) Grant awarded by the Department of Elementary and Secondary Education to the Lowell Public school system. Provided summer courses to middle school teachers designed to help teachers integrate math, science and engineering concepts into their life science curriculum.

(2005-2012) Science Teacher, Westborough High School, Westborough, MA

- Developed curriculum and provided instruction for honors courses in biology (grade 10), chemistry (grade 11) and physical science (grade 9).
- Developed curriculum and provided instruction for college preparatory courses in biology (grade 10) and physical science (grade 9).

(1999 - 2004) Postdoctoral Fellow / Dr. Spyros Artavanis-Tsakonas, Harvard University, Massachusetts General Hospital, Charlestown, MA

- Initiated project to identify sites of cleavage in the Notch receptor. Identified one cleavage site in the extracellular domain of Notch using site-directed mutagenesis. Demonstrated that loss of the extracellular cleavage event results in loss of receptor activity both *in vivo* (using *Drosophila melanogaster* as a model system) and *in vitro* (using *Drosophila* cell lines). Project utilized extensive cellular (cell culture, immunocytochemistry); molecular (cloning, PCR, site-directed mutagenesis, RNA interference); biochemical (Western blotting, immunoprecipitation, radioactive labeling of proteins, biotinylation); and genetic (creation and analysis of transgenic flies) approaches.
- In collaboration with Dr. Brian DeDecker and Dr. Timothy Mitchison at the Harvard Institute of Chemistry and Cell Biology, initiated a chemical screen to identify compounds that modify Notch signaling.
- Research duties were accompanied by the training and supervision of a research technician who was responsible for maintaining and screening the reporter cell lines.

(1993 - 1998) Graduate Student / Dr. Barbara Osborne, Univ. of Massachusetts, Amherst, MA

- Investigated a role for proteasome-mediated proteolysis in multiple apoptotic pathways in thymocytes. Utilized several peptide inhibitors and the specific inhibitor, lactacystin, to demonstrate a requirement for the proteasome after initiation of cell death. Initiated an analysis of potential proteasome targets using 2D electrophoresis. Proteasome project

required skills in cellular (thymocyte cell and organ culture, FACScan analysis, radioactive labeling of proteins, TCA precipitations) and biochemistry (Western blotting, 2D gel electrophoresis, cell fractionation, cell free assays) techniques.

- Utilized a cDNA library to isolate genes that are up regulated or down regulated during thymocyte apoptosis. Identified the down regulation of multiple regions of the mitochondrial genome. Created a Bcl-2 stable cell line to investigate the interaction between this anti-apoptotic protein and the mitochondrion. Project required skills in cellular (cell culture, construction of stable cell lines, FACScan analysis); molecular (differential hybridization screen, Northern blotting).
- Authored two comprehensive reviews on the subject of the role of proteasomes in apoptosis.

(1992 - 1993) Teaching Assistant / Univ. of Massachusetts and Amherst College, Amherst, MA

- Responsible for preparing weekly laboratory exercises for an Introductory Biology and Developmental Biology course. Practical duties included reagent preparation, setting up equipment, and administering quizzes. In addition to these duties, the assistantship required the teaching of fundamental biological principles and a readiness to answer or research student questions.

(1990 - 1992) Research Technician II / Dr. Stuart Bursten, Seattle V.A. Hospital and Cell Therapeutics Inc., Seattle, WA

- Investigated lipid signaling pathway in human mesangial cells. Developed protocols to isolate and assay the activity of acetyl CoA transferase. This project utilized several biochemical techniques: HPLC, protein purification using affinity chromatography and anion-exchange chromatography, SDS PAGE electrophoresis.

(1990 - 1992) Volunteer Night School Teacher / Seattle Education Center, Seattle, WA

- Responsible for tutoring students in subjects ranging from science to reading comprehension with the goal of preparing them to pass the General Equivalency Degree (GED).

(1989 - 1990) Lab Technician / Dr. Steve Moseley, University of Washington, Seattle, WA.

- Investigated mechanisms used by enteropathogenic Escherichia coli to adhere to human epithelial cells. A variety of molecular biology techniques were utilized and include: cloning, Southern blotting, Northern blotting, colony blot hybridization, sequencing.

## EDUCATION

1998 University of Massachusetts Amherst, Ph.D. in Molecular and Cellular Biology

Thesis Title – “The Role of Mitochondria and Proteasomes in T cell Apoptosis”

Graduate courses included: Biochemistry, Cell Biology, Molecular Biology, Introduction to Immunology, Cellular Immunity, Parasitism, Developmental Biology, Physical Chemistry

1990 University of Washington Seattle, B.S. in Zoology

## AWARDS

2017 Special Project grant awarded by Fitchburg State University

2014 Massachusetts Mathematics and Science Partnership Grant (3 year award)

2012 Received an initial license in biology (8-12) from the Massachusetts Department of Elementary and Secondary Education (DESE)

1999 Individual National Research Service Award from the National Institute of Neurological Disorders and Stroke (3 year award)

1993 Graduate Assistant Teaching Award, University of Massachusetts and Amherst College

1992 Outstanding Community Service Award from the City of Seattle for volunteer work at the Seattle Education Center

1990 Honors in Zoology, University of Washington

## PUBLICATIONS

Fowler, A., **Grimm, L.M.**, E.M. Rehrig (2016). The Use of Exemplars in Improving Students' Lab Report Writing Performance. Manuscript in Preparation.

Berg, Jennifer, **Lisa M. Grimm**, Danielle Wigmore, Christopher K. Cratsley, Ruth C. Slotnik and Susan Taylor (2014) Quality Collaborative to Assess Quantitative Reasoning: Adopting the LEAP Value Rubric and the DQP. Peer Review. Summer 2014: 16(3).

Lake, R.J., **Grimm, L.M.**, Veraksa, A., Banos, A., and S. Artavanis-Tsakonas (2009) In vivo analysis of the Notch receptor S1 cleavage. PLoS ONE 4(8): e 6728.



**Grimm, L.M.**, Osborne, B.A. (2001) The role of the proteasome in apoptosis. In: *Proteasomes: The World of Regulatory Proteolysis*. W. Hilt and H.W. Dieter, editors, LANDES Bioscience, Georgetown, Texas.

Rand, M.D., **Grimm, L.M.**, Artavanis-Tsakonas, S., Patriub, V., Blacklow, S.C., Sklar, J., and J.C. Aster (2000) Calcium depletion dissociates and activates heterodimeric notch receptors. *MCB* 20: 1825-1835.

**Grimm, L.M.**, Osborne, B.A. (1999) Apoptosis and the proteasome. In *Apoptosis: Biology and Mechanisms*. S. Kumar, editor, Springer-Verlag, Heidelberg, Germany.

**Grimm, L.M.**, Goldberg, A.L., Poirer, G.G., Schwartz, L.M., and B.A. Osborne (1996) Proteasomes play an essential role in thymocyte apoptosis. *EMBO Journal* 15: 3835-3844.

Osborne, B.A., Smith, S.W., McLaughlin, K.A., **Grimm, L.M.**, Morgan, G.M., and Goldsby, R.A. (1996) Genetic regulation of apoptosis in the mouse thymus. In *Advances in Experimental Medicine and Biology*. S. Gupta and J.J. Cohen, editors, pp. 199-207, Plenum Press, New York, NY.

Osborne, B.A., Smith, S.W., McLaughlin, K.A., **Grimm, L.M.**, Kallinch, T., Liu, Z-G., and L.M. Schwartz (1996) Genes that regulate apoptosis in mouse thymus. *Journal of Cellular Biochemistry* 60: 18-22.

Osborne, B.A., Smith, S.W., Liu, Z-G., McLaughlin, K.A., **Grimm, L.M.**, and Schwartz, L.M. (1994) Identification of genes induced during apoptosis in T lymphocytes. *Immunological Reviews* 141: 301-320.

## Margaret Hoey, Ph.D., Fitchburg State University

### Professional

Department of Biology and Chemistry  
160 Pearl Street  
Fitchburg, MA 01420  
(978) 665-3618  
mhoey@fitchburgstate.edu

### Academic Training

Doctor of Philosophy, The University of North Carolina at Chapel Hill, 1990.  
Dissertation: Patterns of genetic divergence in the vicariad genus *Liquidambar* L.  
(Hamamelidaceae)

Bachelor of Science, Emory University, Atlanta, Georgia, 1982  
Major: Biology

### Professional Experience

Director Center for Faculty Scholarship, Fitchburg State University, 2017 – 2018

Professor of Biology, Fitchburg State University, 2005–2014; 2017 - present

#### Interim Dean of Health and Natural Sciences, Fitchburg State University, 2014 – 2017

Acted as the chief academic and administrative officer of the division of Health and Natural Sciences consisting of the departments of Exercise and Sport Science, Nursing, Biology and Chemistry, Earth and Geographic Sciences, Psychological Science, and Mathematics. Oversaw the Institutional Review Board, Animal Care and Use Committee, Institutional Biosafety Committee, and Responsible Conduct of Research Policies and Procedures, and training for these programs.

- Served as founding dean for the division. Established and then coordinated operating structures including but not limited to the development and implementation of full year course schedules, budgets, and adjunct deployment. Was responsible for the resolution of student issues, review of degree and curriculum modifications, substitutions, policy waivers, independent and directed studies. Coordinated with various administrators and offices on campus to oversee graduate programs and schedules.
- ❖ Provided leadership for and oversaw the development, coordination, and supervision of instructional programs in the division and promoted interdisciplinary collaboration with programs in the other academic divisions of the University.
  - Aligned the divisional goals and programs with the campus strategic plan.
  - Oversaw the implementation of a Math Pilot that emphasized direct placement into college level mathematics courses. Assisted in the implementation of supplemental instruction in mathematics courses.

- Guided the new Psychological Science Department through the creation of an independent department and the implementation of a new curriculum.
- Oversaw a major revision of the on-line RN to BS Nursing Program.
- Oversaw the revision of the Earth Sciences Major to an environmentally based program.
- Began the process of developing a Public Health Program at the University.
- Led an interdisciplinary group developing an IDIS major for students who fail to complete a traditional science major or for students who prefer a broader education.
- ❖ Initiated and broadened the culture of research compliance on campus.
  - Developed and implemented a biosafety policy on campus. Oversaw the writing of the policy, the organization of the oversight committee, and the execution of the policy.
  - Organized a working group formed from the chairs of the compliance committees in order to provide consistency on campus compliance.
  - Implemented standardized practices that spanned all committees such as annual reports and training of all personnel.
  - Refined the CITI training and streamlined the work that was necessary for proper training. Developed training modules and guidelines for each area of compliance.
- ❖ Initiated and oversaw undergraduate and graduate program reviews and ensured that individual programs within the division achieve and maintain appropriate accreditation/certification.
  - The Nursing Department was reaccredited for 10 years at both the graduate and undergraduate level.
  - Mathematics successfully completed a self-study
  - Exercise and Sport Science, Psychological Science, and Earth and Geographic Sciences implemented 5-year plans.
- ❖ Led STEM focused initiatives on campus.
  - Hosted several Women in STEM events
  - Held annual forums that promoted the interdisciplinary nature of science and math, especially the mathematics deficits in students.
- ❖ Participated in faculty searches in collaboration with Human Resources, administered the division's Affirmative Action activities in a manner consistent with the policies of the university, and assisted in faculty retention.
  - Hired new faculty in Biology and Chemistry, Psychological Science, Nursing, Mathematics, Exercise and Sport Science, Earth and Geographic Sciences
- ❖ Consulted with the Provost concerning the reappointment, promotion or grant of tenure to any faculty member within the division.
  - Completed 24 personnel actions in AY2014, 37 in AY2015, and 42 in AY2016
- ❖ Maintained a strong presence with the professional community and government agencies and advisory boards as appropriate.
  - Facilitated transfer courses and transfer program articulation development and implementation.
  - Served on the Central Massachusetts STEM Network steering committee
  - Promoted engagement with the State University PKAL chapter. Oversaw the hosting of a PKAL meeting in June, 2017.

- ❖ Worked with Admissions and other appropriate university staff for recruitment and retention of students.
  - Served on the Student Success Collaborative implementation group
  - Served on Academic Partnerships Working groups.
  - Implemented and recruited faculty members to participate in AIMS

Chairperson, Department of Biology and Chemistry, 2006–2014, Fitchburg State University

- ❖ Expanded the number of tenure track faculty from 12 to 18
  - Participated in, or oversaw the hiring of 15 of the faculty present in the department
  - Wrote annual evaluations of faculty undergoing job actions
  - Mentored faculty through the tenure and promotion process
- ❖ Advanced several curricular initiatives, including:
  - Development of a new chemistry major
  - Expansion of the existing chemistry minor from 0-40 students
  - Oversaw the first comprehensive modification of the Biology major core curriculum in 20 years
  - Implementation of two new concentrations, Health Sciences, and Neuroscience and Behavior
  - Removed outdated biology concentrations
  - Development of a Neuroscience, Behavior and Cognition Minor
- ❖ Led the Department through two self-studies. The second study included the chemistry faculty and the graduate programs for the first time
- ❖ Developed and followed the first departmental Academic Plan. The plan enabled the department to set goals for change.
  - Instituted a practice of regular departmental retreats.
- ❖ Developed course schedules that included work with cognate departments. Instituted a shared drive planning document that increased transparency and equity in course assignments.
- ❖ Wrote a Department of Biology and Chemistry handbook that described among other items the responsibilities of each standing committee.
- ❖ Oversaw the implementation of program assessment.
- ❖ Oversaw the implementation of a campus-wide Chemical Safety Plan
- ❖ Oversaw the implementation of an Animal Care and Use Policy
- ❖ Supervised four staff members
- ❖ Implemented a budget process for the three separate budgets under my control that enabled my department to support very expensive and sophisticated supply needs even during periods of budgetary cutbacks
  - Conducted annual evaluations of spending in order to predict areas of increase spending and possible areas of reallocation
  - Developed an integrated system of purchasing that reduces wasteful spending
  - Implemented a 5 -7-year small equipment renewal within the confines of the existing budget
  - Increased the use of service and maintenance contracts which has prolonged equipment life

- Maintained a list of large one-time equipment purchases needed by the department
- ❖ Collaborate with the Associate Vice President of Academic Affairs as well as the Dean of Graduate and Continuing Education on undergraduate course schedules
- ❖ Completed routine administrative tasks
- ❖ Held regular departmental meetings and participated as a standing member of the curriculum committee
- ❖ Approved academic waivers, course substitutions, internship applications, independent study applications, policy waivers, Life Experience Credit Award Program (LECAP) requests
- ❖ Organized faculty attendance at student recruitment and alumni events
- ❖ Review and continuously update our course transfer agreements
- ❖ Worked with admissions to improve and update marketing materials

Interim Chair, Department of Biology/Chemistry, Spring Semester, 2002

Professor of Biology, Fitchburg State University, 2005–present

Biology Professor, Division of Graduate and Continuing Education, 1994–17, Fitchburg State University

Visiting Scholar Department of Biology, University of Massachusetts at Amherst, 2001

Associate Professor of Biology, 2000–2005, Fitchburg State College

Assistant Professor of Biology, Fitchburg State College, 1993-2000

Post-Doctoral Associate, School of Forest Resources and Department of Genetics, 1990-1993  
University of Georgia, Athens

Graduate Teaching Assistant, Department of Biology, 1983-89, The University of North Carolina at Chapel Hill

Research Assistant, Department of Biology 1985, 1988, 1989 The University of North Carolina at Chapel Hill

#### Undergraduate Courses Taught between 2008 and 2017

Genetics	BIOL2800
Evolution	BIOL4600
General Botany	BIOL1400
Human Genetics	BIOL1750
General Biology I & II Labs	BIOL1800/1900

#### Graduate and Summer Courses Taught between 2008 – 2017

Evolution	BIOL7300
General Biology I	BIOL1800

## University Service

### Campus-Wide

- Chaired Provost Search Committee 2015/2016
- Chaired Divisional Meetings 2014–2017
- Campus Safety Committee 2014 - 2017
- Chaired Compliance Committee Working Group 2014–2017
- Chaired Interdisciplinary Science Committee 2014-2017
- Chair's Committee and sub-committees 2006-14
- Chaired Academic Values Committee for Strategic Plan 2014/2015
- Member Strategic Planning Steering Committee 2014/2015
- New Science Building Committee 2008-14
  - Participated in the planning and design phases, led difficult discussions within the department as to how space would be used, and ultimately coordinated equipment purchase and actual move.
- AIMS Development Committee 2013/2014
- NEASC Steering Committee
- Bridges to Baccalaureate Working Group
- Academic Plan Development
- Chair's Planning Group
- Chair's Academic Plan Study Group
- Liberal Arts and Science Council
- Chairperson, Leadership Academy Policies Sub-Committee
- ACC, All College Committee
- All College Council Curriculum Committee
- ACC, Academic Policy Committee, Chair
- Fitchburg State College Advocacy Committee
- Leadership Academy Honors Program
- All College Council Long Range Planning Committee
- New England Association of Schools and Colleges Fifth-Year Report
- Admissions Assistance Committee

### Department

- Chairperson or member of Departmental Peer Evaluation Committee
- Chairperson or member of Departmental Faculty Search Committee
- Chairperson or member of Departmental Curriculum Committee
- Chairperson, Departmental Facilities and Equipment
- Chairperson, NEASC Departmental Committee
- MA in Biology Graduate Committee

- Graduate Curriculum Committee

### Professional Activities

- Science Seminar Advisor: Wachusett Regional High School 2009-17
- Central MA STEM Network Steering Committee member 2016-2017
- Member state-wide PKAL chapter 2014 - 2017
- Central Links, Academic Transfer Pathways, Massachusetts Department of Higher Education – multi-year initiative
- ACE Leadership Forum, May 2014
- Chemists Celebrate Earth Day, 2014
- Mt. Wachusett Community College Clinical Lab Science Advisory Board
- Mt. Wachusett Community College Biotechnology Advisory Board
- Instructor Advanced Placement Biology for Teachers 1997-99

### Selected Grants and Awards

MA State University STEM Retention and Completion Grant, 2015 – 2016

National Science Foundation Full Grant Proposal “The Evolution of Deoxyribonuclease II in Vertebrates”, Dr. Ronald Krieser, Principle Investigator, Drs. Margaret Hoey and Lisa Grimm, Co-PIs, submitted August, 2013. The Preliminary Proposal RUI “The Evolution of Deoxyribonuclease II in Vertebrates” submitted on 1/17/13 was one of the 30% of preliminary proposals invited to submit a full proposal.

Graduate Research Grant, “Molecular Phylogeny: Computer Analysis of DNA Data” Fitchburg State College, 2001

Ruth Butler Award, “The Evolution of Temperate Woody Plants” Fitchburg State College, 1993 – 1994, 1997 - 1998, 1999 - 2000.

National Science Foundation Instrumentation and Laboratory Improvement Grant, 1995 - 1997. "Development of an Undergraduate Program in Evolutionary Biology: A Molecular Approach to the Study of Genomic Variation."

United States Department of Agriculture Competitive Post-Doctoral Grant Award, “A Complete Genetic Map of *Liriodendron*” September, 1991-August, 1993.

Georgia Biotechnology Post-Doctoral Competitive Grant Award, March 1990-August 1991.

### **Graduate Theses Supervised at FSC**

“Evolution of *Platanus*: Evidence from Restriction Site Analysis of PCR-Amplified Fragments”. Xueyuan Liu, May, 1999.

“The Connecticut River as a Barrier to Gene Flow in the Short-Tailed Shrew, (*Blarina brevicauda*), As Determined Using Isozyme Electrophoresis”, Paula D. Packard, May, 1999.

## Selected Publications

- Birnbaum, Mark J., Jenna Picco, Meghan Clements, Hanna Witwicka, Meiheng Yang, Margaret T. Hoey, and Paul R. Odgren, 2010. Using Osteoclast Differentiation as a Model for Gene Discovery in an Undergraduate Cell Biology Laboratory. *Biochemistry and Molecular Biology Education*, 38: 385–392.
- Hier, Michelle and Meg Hoey, 2004. A Floristic Study of Flat Rock Reserve. Poster presented at the Eastern New England Biological Conference April, 2004.
- Barss, Sara and M.T. Hoey, 2003. Floristic Survey of Fitchburg State College Conservation Land. Poster presented at the Eastern New England Biological Conference April, 2003.
- Guinard, T.M. and M.T. Hoey, 2000. DNA Sequence Divergence Between *Platanus occidentalis* L. and *P. orientalis* L. Poster presented at the Eastern New England Biological Conference on April 29, 2000.
- Hoey, M. T. and C. R. Parks. 1994. Intercontinental patterns of isozyme divergence in *Liquidambar*. *Systematic Botany*. 19: 308-316
- Merkle, S.A., M. T. Hoey, B.A. Watson-Pauley and S. E. Schlarbaum. 1993. Propagation of *Liriodendron* hybrids via somatic embryogenesis. *Plant Cell, Tissue and Organ Culture* 34: 191-198.
- Hoey, M.T., S. A. Merkle and R. B. Meagher, 1992. Molecular markers in *Liriodendron* (Magnoliaceae). Poster presented at the Plant Genome I meeting in San Diego, CA, November, 1992.
- Hoey, M. T. and C. R. Parks, 1991. Isozyme divergence between eastern Asian, North American and Turkish species of *Liquidambar* (Hamamelidaceae). *American Journal of Botany*, 78: 938-947.
- Hoey, M. T. and C. R. Parks, 1990. The genetic control of isozymes in *Liquidambar* L. (Hamamelidaceae). *Journal of Heredity*, 81: 393- 397.
- Hoey, M. T. and C. R. Parks. 1989 Patterns of genetic variation with the genus *Liquidambar* L. (Hamamelidaceae). Abstract of a paper presented at the AIBS annual meeting. *American Journal of Botany* 76: 148.
- Hoey, M. T. and C. R. Parks. 1988. The genetic divergence between *Liquidambar styraciflua* and *L. formosana* (Hamamelidaceae). Abstract of a paper presented at the AIBS annual meeting. *American Journal of Botany* 75: 99.



**CURRICULUM VITA**  
**ELIZABETH D. KILPATRICK, PhD**

---

**EDUCATIONAL BACKGROUND:**

- 1997-2004** PhD in Immunology and Virology, University of Massachusetts Graduate School of Biomedical Sciences, Laboratory of Dr. Francis A. Ennis (Worcester, MA)
- 1992-1995** Bachelor of Arts *cum laude*, major in Biology with departmental honors, Macalester College (St. Paul, MN)
- 1991-1992** College of the Atlantic (Bar Harbor, ME)

**TEACHING POSITIONS AND EXPERIENCE:**

- 2015-Present** Assistant Professor of Biology, Fitchburg State University (Fitchburg, MA)  
*Courses: General Biology I and II (lecture and laboratory)*  
*Anatomy and Physiology I and II (lecture and laboratory)*  
*Human Physiology (lecture)*
- 2014-2016** Adjunct Faculty, Mount Wachusett Community College (Gardner, MA)  
*Courses: Anatomy and Physiology I and II (lecture and laboratory)*  
*Life Science for Allied Health (lecture and laboratory)*
- 2014-2015** Adjunct Faculty, Fitchburg State University (Fitchburg, MA)  
*Courses: General Biology I and II (laboratory)*  
*Anatomy and Physiology II (lecture and laboratory)*
- 2007-2014** Assistant Professor of Biology, Regis College (Weston, MA)  
*Courses: Anatomy and Physiology I and II (lecture and laboratory)*  
*Introduction to Microbiology (lecture and laboratory; Biology majors)*  
*General Microbiology (lecture and laboratory; Nursing majors)*  
*Virology (laboratory)*  
*Human Biology (lecture)*  
*Nutrition Along the Health Continuum*  
*Pathophysiology and Nutrition Therapy*  
*Natural Sciences: Biological Sciences*  
*First Year Seminar*  
*Tutorial in Immunology*
- 2006-2007** Adjunct Assistant Professor of Biology, Bridgewater State College (Bridgewater, MA)  
*Courses: Introduction to Zoology (lecture)*  
*Human Anatomy and Physiology II (laboratory)*  
*General Principles of Biology (laboratory)*

- 2006-2007** Adjunct Assistant Professor of Biology, Emmanuel College (Boston, MA)  
*Courses: Human Anatomy and Physiology I and II (lecture and laboratory)*
- 2003** Teaching Assistant, Assumption College (Worcester, MA), Introductory Immunology
- 2003** Teaching Assistant, Tufts School of Veterinary Medicine (Grafton, MA), Immunology

### **RESEARCH TRAINING:**

- 2004-2006** Postdoctoral Research Fellow, Harvard Medical School/Beth Israel Deaconess Medical Center, Laboratory of Drs. Xian C. Li and Terry B. Strom (Boston, MA)  
*Development of novel anti-rejection therapies for potential use following organ transplantation, focusing on the specific roles that T and NKT cells play in allograft acceptance vs. rejection.*
- 1999-2004** Doctoral Student, University of Massachusetts Graduate School of Biomedical Sciences, Laboratory of Dr. Francis A. Ennis (Worcester, MA)  
*Exploration of potential immunopathologic roles of virus-specific T cells in hantavirus pulmonary syndrome, a fulminant, emerging human viral hemorrhagic fever caused by Sin Nombre virus.*
- 1995-1997** Laboratory Technician, University of Minnesota Medical School, Laboratory of Dr. R. Paul Robertson, (Minneapolis, MN)  
*Mechanisms of insulin secretion by pancreatic beta cells.*

### **SERVICE:**

#### **Faculty Committee Service:**

- 2016-Present** Member, Biology & Chemistry Department Curriculum Committee (Fitchburg State University)
- 2015-2016** Member, Biology & Chemistry Department Assessment Committee (Fitchburg State University)
- 2013** Member, Life Science Advisory Board (Regis College)
- 2012-2013** Member, Pre-Medical Advisory Committee (Regis College)
- 2012-2013** Member, NEASC Self-Study Committee (Regis College)
- 2011-2013** Elected Member and Co-chair (2012-2013), Admission, Progression, and Retention Committee (Regis College)
- 2011-2013** Member, Judicial Board (Regis College)
- 2011** Chair, Women's Studies Program Summer Work Group (Regis College)
- 2010-2011** Member, President's Lecture Series Committee (Regis College)
- 2009-2011** Elected Member and Co-chair (2010-2011), Cultural and College-Wide Programs Committee (Regis College)
- 2008-2011** Member, First Year Seminar Summer Work Groups (Regis College)
- 2008-2009** Elected Member, Women's Studies Advisory Committee (Regis College)
- 2008** Member, Catholic Identity Summer Work Group (Regis College)
- 2008** Member, Student Profile Summer Work Group (Regis College)

### Community Service:

- 2010-2013** Judge, Massachusetts Region V Middle School Science and Engineering Fair (Weston, MA)  
*Review projects, discuss design and results with each student, score projects*
- 1997-2003** 1<sup>st</sup>/2<sup>nd</sup> Grade Teaching Assistant, Floral Street Elementary School (Shrewsbury, MA)  
*Volunteered weekly, assisted with math and science lessons*
- 1994-1996** 1<sup>st</sup> Grade Teaching Assistant, Central Park Elementary School (St. Paul, MN)  
*Volunteered weekly, assisted with math and science lessons*

### HONORS, AWARDS, AND GRANTS

- 2015** Women's HerStory Award (student nominated award; Mount Wachusett Community College)
- 2011** Faculty Development Grant (Regis College), Human Lymphocyte Responses to Influenza Virus
- 2010** Kaneb Faculty Scholar Grant (Regis College), Human T Lymphocyte Responses to Influenza Virus
- 1999** Placement on NIH Immunology Training Grant (University of Massachusetts Graduate School of Biomedical Sciences, Program in Immunology and Virology)
- 1995** Graduated from Macalester College *cum laude* and with departmental honors
- 1995** American Cyanamid Endowed Prize (Macalester College Biology Department)
- 1995** Letter of Academic Achievement (Macalester College)
- 1994** Ruth and Vernon Taylor Endowment Scholarship (Macalester College Biology Department)
- 1994** Letter of Academic Achievement (Macalester College)

### BIBLIOGRAPHY

#### Original Articles:

- Co, M.D., **E.D. Kilpatrick**, A.L. Rothman. 2009. Dynamics of the CD8 T-cell response following yellow fever virus 17D immunization. *Immunology* 128 (1 Suppl.): e718-27.
- Yu, G., X. Xu, M.D. Vu, **E.D. Kilpatrick**, X.C. Li. 2006. NK cells promote transplant tolerance by killing donor antigen-presenting cells. *J. Exp. Med.* 203(8): 1851-1858.
- Kilpatrick, E.D.**, M. Terajima, F.T. Koster, M.D. Catalina, J. Cruz, F.A. Ennis. 2004. Role of specific CD8+ T cells in the severity of a fulminant zoonotic viral hemorrhagic fever, hantavirus pulmonary syndrome. *J. Immunol.* 172(5):3297-3304.
- Terajima, M., J. Cruz, G. Raines, **E.D. Kilpatrick**, J.S. Kennedy, A.L. Rothman, F.A. Ennis. 2003. Quantitation of CD8+ T cell responses to newly identified HLA-A\*0201-restricted T cell epitopes conserved among vaccinia and variola (smallpox) viruses. *J. Exp. Med.* 197(7):927-932.

Cusson, N., S. Oikemus, **E.D. Kilpatrick**, L. Cunningham, M. Kelliher. 2002. The death domain kinase RIP protects thymocytes from tumor necrosis factor receptor type 2-induced cell death. *J.Exp.Med.* 196:15-26.

**Kilpatrick, E.D.**, and R.P. Robertson. 1998. Differentiation between glucose-induced desensitization of insulin secretion and beta-cell exhaustion in the HIT-T15 cell line. *Diabetes* 47(4):606-611.

#### **Proceedings of Meetings:**

**Kilpatrick, E.D.**, M. Terajima, F.T. Koster, M.D. Catalina, J. Cruz, F.A. Ennis. High levels of Sin Nombre virus-specific CD8<sup>+</sup> T Cells during acute hantavirus pulmonary syndrome may contribute to disease pathology. American Association of Immunologists 90<sup>th</sup> Anniversary Annual Meeting; 2003 May 6-10; Denver, Colorado. FASEB J. 17 (2003) C23.

**Kilpatrick, E.D.**, M. Terajima, M.D. Catalina, F.T. Koster, F.A. Ennis. Quantitation of Sin Nombre virus-specific CD8<sup>+</sup> T cells during acute and convalescent phases of hantavirus pulmonary syndrome. American Society for Virology 21<sup>st</sup> Annual Meeting; 2002 July 20-24; Lexington, Kentucky.

**Kilpatrick, E.D.**, D. Peterson, B.I. Frohnert, R.P. Robertson. Differentiation between glucose-induced desensitization of insulin secretion and  $\beta$ -cell exhaustion. American Diabetes Association's 57<sup>th</sup> Annual Meeting and Scientific Sessions; 1998 June 21-24; Boston, Massachusetts. *Diabetes* 46(Supplement 1): 212A.

**Kilpatrick, E.D.**, D. Peterson, B.I. Frohnert, R.P. Robertson. Differentiation between glucose-induced desensitization of insulin secretion and  $\beta$ -cell exhaustion. American Federation for Medical Research, Western section annual meetings; 1997 February; Carmel, California. *Journal of Investigative Medicine* 45(1): 165A.

#### **Dissertation:**

**Kilpatrick E.D.** Virus-specific CD8<sup>+</sup> T cells in hantavirus pulmonary syndrome [dissertation]. Worcester (MA): University of Massachusetts Medical School; 2004.

## RONALD J. KRIESER

Department of Biology and Chemistry  
Fitchburg State College  
160 Pearl Street  
Fitchburg, MA 01420  
(978)-665-3619  
[rkrieser@fitchburgstate.edu](mailto:rkrieser@fitchburgstate.edu)

### EDUCATION:

- Ph.D., Pharmacology and Toxicology**, Dartmouth College, Hanover, NH 1992-1999  
Thesis title: The study of an endonuclease and its potential role in apoptosis.  
Advisor: Dr. Alan Eastman
- B.A., Biochemistry and Molecular Biology**, Clark University, Worcester, MA 1985-1989

### TEACHING POSITIONS:

- Associate Professor, Fitchburg State College, Fitchburg, MA** 2014-present
- Assistant Professor, Fitchburg State College, Fitchburg, MA** 2008-2014
- General Biology I lecture & laboratories,  
Genetics lecture & laboratories,  
Life Sciences II lecture & laboratories  
Molecular Biology  
Biochemistry and Genetics of Disease  
Cancer Biology Biol  
Teaching High School Biology  
Summer Science Content Institute: The Science of CSI (Crime Scene Investigation)
- Instructor, Bennington College, Bennington, VT** 2005-2006
- Introduction to Cell Biology, Bio 2111.01  
Current Issues in Biology, Bio 2238.01  
Genetics, Bio 4207.01  
Advanced Cell and Molecular Biology, Bio 4411.01  
Microbiology Tutorial, Bio 4696.01

### RESEARCH EXPERIENCE:

- Harvard Medical School, Research Fellow**, Massachusetts General Hospital 6/06-6/08,  
Cutaneous Biology Research Center 12/01-8/05
- Dartmouth Medical School, Research Associate**, Department of 1/99-11/01  
Pharmacology and Toxicology
- Dartmouth Medical School, Graduate Student**, Department of Pharmacology 8/92-1/99  
And Toxicology
- New England Medical Center, Cytogenetic Technologist**, Boston, MA 8/91-7/92
- Tufts University School of Medicine, Senior Research Associate**, 7/89-8/91  
Molecular Pathology Research Laboratory, Boston, MA

### FELLOWSHIPS, GRANTS, AND AWARDS:

- CBRC-WCP Collaborative Research Grant "Natural Contrast Microscopy of Apoptosis *in vivo* During Embryonic Development" co-principal investigator with Dr. Ronit Yelin. 4/07-3/08
- NIH Individual National Research Service Award "The Phagocytosis of Apoptotic Cells". 5/03-4/05
- Hitchcock Foundation Grant "The Role of Deoxyribonuclease II in Development, Apoptosis, Genomic Instability, and Gene Transfer". 10/99-10/00
- NIH Cancer Biology Training Grant Fellowship. 7/93-6/97
- SmithKline Beecham Student Pharmacology Award. 1996

## PATENTS:

United States Patent # 6,184,034, *Deoxyribonuclease II proteins and cDNAs*  
United States Patent # 6,358,723, *Deoxyribonuclease II $\beta$  proteins and cDNAs*  
United States Patent # 6,767,997, *Antibodies that bind deoxyribonuclease II $\beta$  enzyme proteins*  
United States Patent # 6,943,014, *Deoxyribonuclease II proteins and cDNAs*  
United States Patent # 7,049,075, *Deoxyribonuclease II $\beta$  proteins and cDNAs*

## PUBLICATIONS:

Thomenius, M., Freil, C., Horn, S., **Krieser, R.**, Abdelwahid, E., Cannon, R., Balasundaram, S., White, K., Kornbluth, S. Mitochondrial fusion is regulated by Reaper to modulate *Drosophila* programmed cell death. *Cell Death and Differentiation*, 18: 1640-1650, 2011

**Krieser, R. J.**, and White, K. Inside and enigma: Do mitochondria contribute to cell death in *Drosophila*? *Apoptosis*, 14: 961-968 2009

Eltyeb Abdelwahid, Takakazu Yokokura, **Ronald J. Krieser**, Sujatha Balasundaram, William H. Fowle, and Kristin White. Mitochondrial disruption in *Drosophila* apoptosis. *Developmental Cell*, 12: 793-806, 2007

**Krieser, R. J.**, Moore, F. E., Dresnek, D., Pellock, B. J., Patel, R., Huang, A., Brachmann, C., White, K.. The *Drosophila* homolog of the putative phosphatidylserine receptor functions to inhibit apoptosis during development. *Development*, 134: 2407-2414, 2007

Pinto-González Howell, D., **Krieser, R. J.**, Eastman, A., Barry, M. A. Lysosomal DNase II as a barrier to transfection. *Molecular Therapy*, 8: 957-963, 2003

MacLea, K.S., **Krieser, R.J.**, Eastman, A. Structural requirements of human Deoxyribonuclease II $\alpha$  for formation of the active enzyme: the role of the signal peptide, N-glycosylation, and disulfide bridging. *Biochemical Journal*, 371: 867-76, 2003

MacLea, K.S., **Krieser, R.J.**, Eastman, A. A Family History of Deoxyribonuclease II: Surprises from *Trichinella spiralis* and *Burkholderia pseudomallei*. *Gene*, 305: 1-12, 2003

**Krieser, R.J.**, White, K. Engulfment Mechanisms of apoptotic cells. *Current Opinion in Cell Biology*, 14: 734-738, 2002

**Krieser, R.J.**, Maclea, K.S., Longnecker, D.S., Fields, J.L., Fiering, S., Eastman, A. Deoxyribonuclease II $\alpha$  is required for DNA digestion during the phagocytic phase of apoptosis and its loss is perinatal lethal. *Cell Death and Differentiation*, 9: 956-962, 2002

Maclea, K.S., **Krieser, R.J.**, Eastman, A. Revised structure of the active form of human deoxyribonuclease II alpha. *Biochemical and Biophysical Research Communication*, 292: 415-421, 2002

**Krieser, R.J.**, Maclea, K.S., Park, J.P., Eastman, A. The cloning, genomic structure, localization, and expression of human deoxyribonuclease II $\beta$ . *Gene*, 269: 205-216, 2001

**Krieser, R.J.**, Eastman, A. Deoxyribonuclease II: Structure and chromosomal localization of the murine gene, and comparison to the genomic structure of the human and three *C. elegans* homologs. *Gene*, 252: 155-162, 2000

**Krieser, R.J.**, Eastman, A. Cleavage and nuclear translocation of the caspase 3 substrate Rho-GDP dissociation inhibitor D4-GDI during apoptosis. *Cell Death and Differentiation*, 6: 412-419, 1999

- Krieser, R.J.**, Eastman, A. The cloning and expression of human deoxyribonuclease II: A possible role in apoptosis. *Journal of Biological Chemistry*, 273: 30909-30914, 1998
- Barchowsky, A., Roussel, R.R., **Krieser, R.J.**, Mossman, B.T., Treadwell, M.T., Expression of urokinase and its receptor in endothelial and pulmonary epithelial cells exposed to asbestos. *Toxicology and Applied Pharmacology* 152: 388-396, 1998
- Cherington, P.V., **Krieser, R.J.**, Chatterjee, R. Defined medium studies of regulated growth and differentiation. *Perspectives on Cellular Regulation: From Bacteria to Cancer*. Wiley-Liss, Inc., 165-174, 1991

**Mathangi Krishnamurthy**  
10 Edwinston Road, Tewksbury, MA 01876  
Phone: 707-480-2046  
mkrish1@fitchburgstate.edu

### Education

**Ph.D.** Pharmaceutical Sciences  
University of Tennessee Health Science Center, Memphis, December 2005

Dissertation title: **Probing the ligand binding pocket of cannabinoid receptors: Design, synthesis, structural analysis and biological evaluation of novel receptor agonists and antagonists.**

**B. Pharm.** The Tamil Nadu Dr. MGR Medical University, Chennai, India, June 1999

### Work Experience

09/2011 – Present

**Assistant Professor, Dept. of Biology/Chemistry, Fitchburg State University, Fitchburg, MA**  
Responsible for instruction of courses in Organic Chemistry to undergraduates

01/2011 – 05/2011

**Adjunct Faculty Member, Dept. of Chemistry, Stonehill College, Easton, MA**  
Responsible for instruction of lab courses in General Chemistry for undergraduates

02/01/2006 - 12/15/2009

**Research Fellow, Howard Hughes Medical Institute**  
**Joint Appointment in Department of Genetics, Harvard Medical School and**  
**Department of Molecular Biology, Massachusetts General Hospital**

Development of an efficient self replicating genetic system that would be used in assembly of a protocell

Synthesized 2'-amino and 3'-amino -5'-phosphorimidazole activated nucleosides for non-enzymatic primer extension of DNA. These compounds were able to penetrate fatty acid vesicles and effect rapid and efficient copying of DNA homopolymer templates encapsulated in these vesicles.

Bolaamphiphile-based vesicle systems

Synthesized a series of long chain monounsaturated dicarboxylic acids and evaluated the membrane forming properties of these double headed amphiphiles.

01/2005 - 12/2005

**Lecturer, Dept. of Chemistry, Sonoma State University, Rohnert Park, CA**  
Taught undergraduate General Chemistry and Organic Chemistry courses

08/1999 - 01/2005

**Graduate Research Assistant, University of Tennessee Health Science Center, Memphis, TN**

Design, synthesis, and biological evaluation of pyrazole class of cannabinoids

The effects of pyrazole substitution on ligand conformation and binding affinities were studied by using high field NMR spectroscopy and systematic molecular mechanics geometry searches.

Design, synthesis, and biological evaluation of novel phenyl-substituted side-chain analogues of  $\Delta^8$ -THC

The side-chain geometries of these analogues were determined using high field NMR spectroscopy and molecular mechanics searches to understand substituent effects on binding



affinity and gain insights into the side-chain binding pocket of the cannabinoid receptors. Some of these analogues displayed potent cytotoxic effects on human glioma cell lines.

### **Research skills**

#### ***Chemistry:***

- Multi-step synthesis of modified nucleotides for non-enzymatic DNA synthesis and scale-up thereof for synthesis of oligonucleotides.
- Multi-step synthesis of drug-like organic molecules of varied chemical classes such as pyrazoles, benzopyrans, coumarins, and pentamidines.
- Synthetic methodologies such as aromatic functional group interconversions, orthogonal protection/deprotection strategies, palladium-mediated coupling reactions, Grignard chemistry, and utilization of terpene precursors for preparing chiral intermediates with sound understanding of underlying reaction mechanisms.
- Purification techniques including column chromatography, ion-exchange chromatography, thin layer chromatography, recrystallization, vacuum distillation, and sublimation.

***Analytical:*** Proficient in spectroscopic techniques including mass spectrometry, IR, UV, and NMR spectroscopy, with expertise in interpretation of both 1D and 2D NMR (Homocuclear and Heterocuclear) spectra.

***Biology:*** Expertise in cell culture techniques, in vitro cytotoxicity assay techniques and ligand-receptor binding assay techniques involving radioisotopes.

### **Publications**

1. Schrum JP, Ricardo A, Krishnamurthy M, Blain C, and Szostak, JW, "Efficient and Rapid Template-Directed Nucleic Acid Copying using 2'-amino-2', 3'-dideoxyribonucleoside-5'-phosphorimidazolid Monomers," *Journal of the American Chemical Society*, 131, 40, 14560-70 (2009)
2. Ferreira AM, Krishnamurthy M, Moore BM II, Finkelstein D, and Bashford D, "Quantitative structure-activity relationship (QSAR) for a series of novel cannabinoid derivatives using descriptors derived from semi-empirical quantum-chemical calculations," *Bioorganic & Medicinal Chemistry*, 17, 2598-2606 (2009)
3. Mansy SS, Schrum JP, Krishnamurthy M, Tobé S, Treco DA, and Szostak JW, "Template-directed synthesis of a genetic polymer in a model protocell," *Nature*, 454, 122-125 (2008)
4. Krishnamurthy M, Gurley S, and Moore BM II, "Exploring the substituent effects on a novel series of C1'-dimethyl-aryl  $\Delta^8$ -tetrahydrocannabinol analogs," *Bioorganic & Medicinal Chemistry*, 16, 6489-6500 (2008)
5. Duntsch C, Divi MK, Jones T, Zhou Q, Krishnamurthy M, Boehm P, Wood G, Sills A, and Moore BM II, "Safety and efficacy of a novel cannabinoid chemotherapeutic, KM-233, for the treatment of high-grade glioma," *Journal of Neuro-Oncology*, 77, 2, 143-152 (2006)
6. Ferreira AM, Moore BM II, and Krishnamurthy M, "Theoretical analysis of the NMR and electronic structure of novel  $\Delta^8$ -THC derivatives," *Journal of Molecular Structure- THEOCHEM*, 674, 131-138 (2004)
7. Krishnamurthy M, Li W, and Moore BM II, "Synthesis, biological evaluation, and structural studies on N1 and C5 substituted cycloalkyl analogues of the pyrazole class of CB1 and CB2 ligands," *Bioorganic & Medicinal Chemistry*, 12, 393-404 (2004)
8. Krishnamurthy M, Ferreira AM, and Moore BM II, "Synthesis and Testing of Novel Phenyl Substituted Side-Chain Analogues of Classical Cannabinoids," *Bioorganic & Medicinal Chemistry Letters*, 13, 3487-3490 (2003)
9. Nadipuram AK, Krishnamurthy M, Ferreira AM, Li W, and Moore BM II, "Synthesis and Testing of Novel Classical Cannabinoids: Exploring the Side Chain Ligand Binding

Pocket of the CB1 and CB2 Receptors," *Bioorganic & Medicinal Chemistry*, 11, 3121-3132 (2003)

### **Presentations**

1. Krishnamurthy M, Ferreira AM, and Moore BM II, "Probing the Ligand-Binding Pocket of the Cannabinoid Receptors: Synthesis and Testing of Novel Phenyl Substituted Side-Chain Analogs of  $\Delta^8$ -THC," 228th ACS National Meeting, Philadelphia, Pennsylvania, 2004
2. Divi MK, Nallamothu R, Krishnamurthy M, Nazarova MA, Wood GC, Thoma LA, Moore BM II, and Duntsch C, "Development and Evaluation of Parenteral Formulations for a New Chemical Entity," Pharm Forum, University of Tennessee Health Science Center, Memphis, Tennessee, 2004
3. Krishnamurthy M, and Moore BM II, "Novel Pyrazole Cannabinoid Antagonists," 29th Annual MALTO Medicinal Chemistry-Pharmacognosy Meeting, Monroe, Louisiana, 2002
4. Krishnamurthy M, "From pot to pill", American Chemical Society Central MA section meeting, Fitchburg, MA, 2013
5. Krishnamurthy M, Moore BM II, "Finding new cures for cancer- design, synthesis and biological testing of D8-THC analogs, FSU Science Colloquium, Fitchburg, MA, 2014
6. Krishnamurthy M, "What's in your spice- GC-MS analysis of essential oils", 75<sup>th</sup> NEACT Summer Conference, Fitchburg, MA, 2014
7. Krishnamurthy M, "Colorful chemistry with glucose oxidation", 76<sup>th</sup> NEACT Summer Conference, Clark University, Worcester, MA, 2015
8. Krishnamurthy M "Improving student retention through active learning", 24<sup>th</sup> Biennial Conference on Chemical Education, University of Northern Colorado, Greeley, CO, 2016
9. Krishnamurthy M " Marijuana: The Wonder Drug" 77<sup>th</sup> NEACT Summer Conference, Massachusetts College of Liberal Arts, North Adams, MA, 2016

### **Patents**

1. Moore BM II, Ferreira AM, and Krishnamurthy M, "Cannabinoid Derivatives, Methods of Making and Use thereof", U.S. Patent No. 7169942, Issue date: Jan 30, 2007

### **Professional affiliations**

1. Member, American Chemical Society
2. Member, Rho Chi Pharmacy Honor Society, Alpha Nu Chapter
3. Coordinator for the Central MA section, Chemists Celebrate Earth Day
4. Coordinator for the Central MA section, National Chemistry Week

### **Grants and Fellowships**

1. The Discovery Museum / National Science Foundation Science Communication Fellowship (2013)
2. Special Project grant in the area of faculty scholarship from Fitchburg State University (July 2013-June 2014)
3. Innovation in Teaching grant from the Center for Teaching and Learning at Fitchburg State University (2013-2014)
4. ACS Science Coach program in partnership with McKay Arts Academy (Oct 2014-June 2015)
5. ACS Science Coach program in partnership with McKay Arts Academy (Oct 2015-June 2016)
6. ACS Science Coach program in partnership with McKay Arts Academy (Oct 2017-June 2018)

**Awards**

1. ACS Outreach Volunteer of the Year 2015

# John P. Ludlam

Department of Biology and Chemistry, SCI 226  
Fitchburg State University, Fitchburg, MA 01420  
Phone: (978) 665-3981 • [jludlam@fitchburgstate.edu](mailto:jludlam@fitchburgstate.edu)

## Education

---

### **Doctor of Philosophy, Biology**

*University of Arkansas, Fayetteville AR.* August 2009; GPA 4.0

Dissertation title: *Effects of fish and crayfish on ecosystem structure and function during stream drying*

Advisor: Dr. D. Magoulick

### **Bachelor of Science, Biology**

*Gordon College, Wenham MA.* May 2004; GPA 3.84

## Professional Experience

---

### **Associate Professor of Biology**

August 2011-present

*Fitchburg State University*

Instructor for lecture and laboratory classes, including majors and non-majors biology and environmental science courses. Supervising undergraduate research. Developing lecture and laboratory curriculum.

### **Assistant Professor of Biology**

August 2009-May 2011

*Francis Marion University*

Instructor for lecture and laboratory classes, including majors and non-majors introductory biology courses. Conducting collaborative research and working with undergraduate students on research projects. Developing lecture and laboratory curriculum. 3-year term position.

### **NSF GK-12 Graduate Fellow**

June 2008-May 2009

*University of Arkansas*

Participant in National Science Foundation funded project placing graduate students in local middle schools. Facilitated weekly inquiry-based lessons in math and science classrooms, and implemented “learning through doing” approach to involve students in the scientific process.

### **HERMES Program Mentor**

May 2008-December 2008

*Collaboration between Environmental Dynamics Program and Honors College, University of Arkansas*

Mentored undergraduate research assistant over a nine month period, including full-time collaboration over eight weeks in the summer.

### **Graduate Teaching Assistant**

August 2004-June 2008, May-June 2009

*Department of Biological Sciences, University of Arkansas*

Taught both undergraduates and graduate students, and assisted in developing lab course curriculum, including an extensive revision of the introductory biology laboratory manual. Conducted occasional lectures and assisted students with the design and implementation of class research projects.

## Research Experience

---

### Graduate Research Fellow

August 2004-May 2009

*Arkansas Cooperative Fish and Wildlife Research Unit, Department of Biological Sciences, University of Arkansas*

Used a combination of field-based experimental manipulations and laboratory mesocosms to investigate the role of fish, crayfish, and drying in influencing the structure and function of an Ozark stream. Used electric exclusions to manipulate consumer density in stream pools and measured effects on biofilm and algal biomass, invertebrate abundance, detrital decomposition, and primary productivity. Supervised an independent undergraduate project using nutrient diffusing substrata to examine interactions between nutrient limitation and consumer exclusion effects on benthic communities.

### Research Technician

June-August 2004

*Highland Biological Laboratory, Highland, N.C.*

Field technician for Ph.D. graduate student (Ben Strauss, Princeton University) in streams of western North Carolina. Studied the distribution and dispersal of the aquatic snail *Elimmia proxima* along stream gradients.

### Undergraduate Student Researcher

June-August 2002

*Research Experience for Undergraduates, Ecosystem Center, Woods Hole, M.A.*

Investigated the effects of vegetation removal on epibenthic salt marsh invertebrates. Conducted field surveys of vegetation and invertebrate distributions and abundance and identified plant and animal samples. Directly supervised a high school student in field and laboratory work.

## Publications

---

**Ludlam, J. P.**, B. T. Banks, and D. D. Magoulick 2015. Density-dependent effects of omnivorous stream crayfish on benthic trophic dynamics. *Freshwater Crayfish* 21(1): 165 – 170

King, P, and **J. P. Ludlam** 2014. Status of diamondback terrapins (*Malaclemys terrapin*) in North Inlet, Winyah Bay, SC. *Chelonian Conservation and Biology* 13(1): 119 – 124

**Ludlam, J. P.** 2013. R by example: Numerical solutions to differential equations (Soetaert, K., et al; 2012)[Book Review]. *Computing in Science and Engineering* 15(2): 6 – 7

Taylor, H., and **J. P. Ludlam** 2013. The role of size preference in prey selection of *Amphiuma means*. *BIOS* 84(1): 8 – 13

**Ludlam, J. P.**, and D. D. Magoulick 2010. Effects of consumer identity and disturbance on stream ecosystem function. *Fundamental and Applied Limnology* 177:143 – 149

**Ludlam, J. P.**, and D. D. Magoulick 2010. Environmental conditions and biotic interactions influence ecosystem structure and function in a drying stream. *Hydrobiologia* 644:127 – 137

**Ludlam, J. P.**, and D. D. Magoulick. 2009. Spatial and temporal variation in the effects of fish and crayfish on benthic communities during stream drying. *Journal of the North American Benthological Society* 28(2): 371 – 382

R. N. Buchsbaum, L. A. Deegan, J. H., R. H. Garritt, A. E. Giblin, **J. P. Ludlam**, and D. H. Shull. 2008 Effects of regular salt marsh haying on marsh plants, algae, invertebrates and birds at Plum Island Sound, Massachusetts. *Wetlands Ecology and Management* 17(5): 469 – 487 DOI 10.1007/s11273-008-9125-3.

**Ludlam, J. P.**, D. H. Shull, and R. Buchsbaum. 2002 Effects of haying on salt-marsh surface invertebrates. *Biological Bulletin* 203(2): 250 – 251

## Presentations

**Ludlam, J.P.** *Changes in stream productivity in response to upstream reservoirs, nutrients, and light.* Oral Presentation, Ecological Society of America Annual Meeting, August 11<sup>th</sup>, 2016, Fort Lauderdale, FL.

**Ludlam, J.P.** *Effects of upstream reservoirs, nutrients, and light on stream metabolism and benthic algal biomass.* Oral Presentation, Northeast Natural History Conference, April 23<sup>rd</sup>, 2016, Springfield, MA.

**Ludlam, J.**, J. Steinmetz, A. Stoeckmann, D. Turner and D. Truncellito. *Population dynamics of invasive *Daphnia lumholtzi* and native zooplankton in Lake Wateree, SC.* Poster Presentation, Joint Aquatic Sciences Meeting, May 20<sup>th</sup>, 2014, Portland, OR.

King, P, and **J.P. Ludlam**. *Status of Diamondback Terrapins in North Inlet-Winyah Bay NERR, South Carolina.* Oral presentation, 5th Symposium on the Ecology, Status, and Conservation of the Diamondback Terrapin, November 12-14, 2010, Chauvin, LA.

**Ludlam, J.P.**, and D. D. Magoulick. *Disturbance and predation mediate trophic interactions in an aquatic food web.* Poster presentation, Ecological Society of America's 93<sup>rd</sup> Annual Meeting, August 3<sup>rd</sup>, 2008, Milwaukee, WI.

**Ludlam, J.P.**, and D. D. Magoulick. *Effects of crayfish and grazing fish on benthic communities during stream drying: Spatial and temporal variation.* Oral presentation, North American Benthological Society's 56<sup>th</sup> Annual Meeting, May 29, 2008, Salt Lake City, UT. Invited Presentation in Special Session – Patterns in Stream Ecosystem Functioning Across Bioclimatic Regions II

**Ludlam, J.P.**, and D. D. Magoulick. *Spatial and temporal variation in the effects of grazing fish and crayfish on benthic communities during stream drying.* Oral presentation, North American Benthological Society's 55<sup>th</sup> Annual Meeting, June 5, 2007, Columbia, SC. Invited Presentation in Special Session - Benthic vertebrates: Ecology and conservation of substrate-oriented fishes

**Ludlam, J.P.**, D. H. Shull, and R. Buchsbaum. *Effects of haying on salt-marsh surface invertebrates.* Oral presentation at MBL General Meeting, August 2002, Woods Hole, MA, and at Gordon College Board of Trustees Meeting, 2002, Gordon College, MA.

## Supervised Student Projects

Wiita, K. and **J. Ludlam**. Distribution of *Palaemon macrodactylus* and *Palaemon elegans* along the Massachusetts coastline. Oral presentation on April 21<sup>st</sup>, 2016 for the Fitchburg State University Undergraduate Conference on Research and Creative Practice.

Maloughney, B., S. Mauro, E. McCown, E. Purington, and **J. Ludlam**. Changes in stream metabolism in response to upstream reservoirs, nutrients, and light. Poster presentation on April 21<sup>st</sup>, 2016 for the Fitchburg State University Undergraduate Conference on Research and Creative Practice.

Alvarez, C., **J. Ludlam**, and D. Welsh. A diet analysis between river and pond dwelling bluegill sunfish (*Lepomis macrochirus*). Fall 2013 Independent Study Project.

Henderson, A., **J. Ludlam**, and F. Grenham. Effects of a dam on stream habitat integrity at Wekepeke Brook. Poster presentation on April 23<sup>rd</sup>, 2013 for the Fitchburg State University Undergraduate Conference on Research and Creative Practice.

Skaza, J. and **J. Ludlam**. Larval odonate assemblage patterns in relation to physical and biological microhabitat variation in Western Massachusetts. Poster presentation on April 26<sup>th</sup>, 2012 for the Fitchburg State University Undergraduate Conference on Research and Creative Practice.

Banks, B.T., **J.P. Ludlam**, and D.D. Magoulick. Effects of crayfish density on benthic periphyton. Poster presentation, 93rd Annual Meeting of the Arkansas Academy of Science, April 3-4, 2009, Clarksville, AR.

## Grants, Awards and Honors

**Measuring metabolic rates in recirculating stream chambers.** Ludlam, J.P. Fitchburg State University Special Projects Grant. \$1500. Spring 2016

**Changes in stream productivity in response to reservoirs.** Ludlam, J.P. Fitchburg State University Ruth Butler Grant. \$450. Spring 2015

**Changes in stream productivity in response to reservoirs and urbanization.** Ludlam, J.P. Fitchburg State University Special Projects Grant. \$1314. Spring 2015

**Changes in stream productivity and leaf litter breakdown in response to reservoirs and urbanization.** Ludlam, J.P. Fitchburg State University Special Projects Grant. \$1500. Spring 2014

**Smartphone applications for spatial analysis of roadkilled animals.** Ludlam, J.P. Fitchburg State University Innovation Grant Proposal (Center for Teaching and Learning). \$1000. Spring 2013

**Distribution and ecological consequences of introduced *Daphnia lumholtzi*.** Ludlam, J.P. Francis Marion University internal grant. \$2099.

**Factors affecting the distribution and effects of stream crayfish.** Ludlam, J.P. Francis Marion University internal grants. \$1997, \$2295.

**Sigma Xi Grant-in-Aid of Research.** Ludlam, J.P. 2008. Effects of disturbance and grazer identity on stream ecosystem function. \$400.

**Professor Delbert Swartz Endowed Graduate Fellowship for Outstanding Graduate Student.** University of Arkansas, Fayetteville, AR. 2008

**Causey Grant in Aid.** Ludlam, J.P. 2006. The effects of stream drying on grazer-mediated processes in Boston Mountain streams and the importance of grazer identity. \$300.

**Distinguished Doctoral Fellowship.** University of Arkansas, Fayetteville, AR. August 2004-2008.

**Best Poster Award** (*Effects of haying on salt-marsh surface invertebrates*) at Benthic Ecology Meeting, Mystic, CT. 2003

## Professional Affiliations and Service

Ecological Society of America

Scientific advisor for Black Creek Land Trust, Darlington, SC 2009-2011  
Provide scientific advice and analysis of water quantity and quality for community organization interested in habitat conservation

Biology Graduate Student Association 2004-2009  
Served as president and treasurer at the University of Arkansas. Chaired monthly meetings of graduate students and organized graduate student participation in multiple faculty hiring interviews. Served as student representative during faculty meetings.

Past Reviewer for Transactions of the American Fisheries Society and Freshwater Science.

## Courses taught

*Fitchburg State University*

Marine Biology (1 lecture and lab section, Graduate/undergraduate co-listed summer course, Summer 2012 and 2013, day program Fall 2015, Spring 2017)

Ecology (lecture and lab, Spring 2012 – 2017, Fall 2017)

General Biology II (1 lab section)

Introduction to Environmental Science (Numerous lecture and lab sections)

Invertebrate Biology (1 lecture and lab section, Fall 2012, 2014, 2016)

Honors Biological Issues and Inquiry (lecture and lab, Spring 2013 – 2017)

*Francis Marion University*

Organismal Biology 106 (lecture) 1 semester

Human Biology 104 (lecture and laboratory) 2 semesters

Environmental Biology 103 (lecture and laboratory) 1 semester



Introduction to Life Science 105 (majors laboratory) 3 semesters  
Ecology 411 (co-lecturer) 1 semester

*University of Arkansas*

Principles of Biology (freshman biology laboratory) 7 semesters  
Zoology (laboratory) 1 semester  
Biometry (laboratory and guest lecturer) 2 semesters  
Fish Biology (laboratory, guest lecturer)  
Community Ecology (laboratory)  
Marine Biology (guest lecturer)

## ***Michael T. Nosek***

---

Phone: (978) 665-3430  
mnosek@fitchburgstate.edu

455 Harvard Road  
Lancaster, MA 01523

### **Education:**

---

PhD.	Department of Biology Tufts University, Medford, MA	May 1991
B.S.	Department of Biological Sciences (cum laude with a minor in Chemistry) University of Lowell, Lowell, MA	May 1981

### **Professional History:**

---

Professor		2015-pres.
Associate Professor		2006-2015
Assistant Professor		2000-2006
	Department of Biology and Chemistry Fitchburg State University, Fitchburg, MA	
Adjunct Lecturer		1998–2001, 2004
	Tufts University, Medford, MA Summer School Division and the Department of Biology	
Laboratory Instructor / Adjunct Lecturer		Jan. 1996-Mar. 2000
	Department of Biology Merrimack College, No. Andover, MA	
Research Associate		Apr.-Aug. 1996
	Department of Biology Tufts University, Medford, MA	
Postdoctoral Research Fellow		Feb. 1993-Mar. 1996
	Anesthesiology Shriners Burns Institute, Cambridge, MA	

Postdoctoral Research Fellow Cell Biology Unit	Dec. 1990-Jan. 1993
Research Technician Biology Department Tufts University, Medford, MA	1981-1985
Weekend Supervisor	Aug. 1980-Mar. 1982
Animal Technician II	Mar. 1981-Dec. 1982
Animal Technician I (6/79 - 3/81)	Jun. 1979-Mar. 1981
New England Regional Primate Research Center Southborough, MA	

## **Research Interests:**

---

Mitochondrial function and pathophysiology

Current Projects:

- Determination of relationships between closely related *Tamias* species using mitochondrial DNA analysis
- Progression of mitochondrial DNA deletion mutation present in Kearns-Sayre Syndrome
- Mitochondrial dysfunction in Friedreich's ataxia

## **Memberships:**

---

Mitochondrial Research Society  
American Society of Cell Biology  
American Association for the Advancement of Science

## **Teaching Experiences:**

---

- |  |                                      |
|--|--------------------------------------|
| - Biochemistry                                     | - Introduction to Life Sciences I/II |
| - Life Science for Educators                       | - General Biology I (Lecture/Lab)    |
| - Genetics   | - Cell Biology                       |
| - Cell Culture Techniques                          | - Immunology                         |
| - Human Biology                                    | - Clinical Microbiology              |
| - Survey of Microorganisms                         | - Nutrition                          |
| - General Chemistry II Laboratory                  | - Cell and Organelles (DGCE)         |
| - Independent Studies and<br>Internship Supervisor |                                      |

- Seminar in Modern Biology  
(topics in Virology, Cancer Biology, and Biotechnology)
- Cellular and Molecular Biology (Seminar course in DGCE)

## **Awards and Grants:**

---

Mission Proposal Grant - Biology Department Fitchburg State College	May 2001
Alumni Tangible Items Proposal Fitchburg State College	May 2001
Ruth Butler Grant (Development of a Gel Electrophoresis Method for Analyzing Normal and Mutant Mitochondrial DNA in Cultured Cells) Fitchburg State College	Jan. 2002
Special Projects Grant Investigating Mitochondrial Dysfunction in Friedreich's Ataxia Fibroblasts Fitchburg State University	June 2014

## **Committee Activities:** (at Fitchburg State University)

---

### University Committees

- Animal Care Committee (1 year)
- Safety Committee (Chair for 2 ½ years)
- Acting Chemical Hygiene Officer  
(shared responsibilities with 2 other Safety Committee  
members for ½ year)
- Human Subjects Committee (2 years)
- Strategic Planning Committee (2014)  
(Finance and Operations Group)
- Technology Advisory Committee – (secretary, AY04)  
Learning management systems subcommittee
- Campus NEASC committee
- All College Committee  
(Chair, AY13, AY14)
- Curriculum Committee  
(Chair for AY08, AY09, AY10)

- Tenure Committee (5<sup>th</sup> Committee member for one faculty member)
- University Promotions Committee
- Institutional Biosafety Committee  
(Chair for 1.5 years)

*Biology/Chemistry Department committees*

- Graduate Curriculum Committee
  - Faculty Search Committee \*
  - Curriculum Committee \*
  - Facilities and Equipment Committee \*
  - Biology/Chemistry Internship Coordinator
  - Biology Club Advisor
  - Pre-Med Advisor
  - Biology Department Self-Study
  - Student Affairs Committee
  - Peer Evaluation Committee (for faculty in Biology and Chemistry,  
Physics, and Exercise and Sport Science)
- (\* = served as Chair in one or more academic year)

## **Other Activities:**

---

- |   |                       |
|---|-----------------------|
| Participant, <i>Designing Scientific Teaching<br/>Tools for BMB Education Workshop,</i><br>(held at Simmons College and Sponsored by the ASBMB) | 2014                  |
| Consultant, BEST and ATLAS Grants<br>Boston Museum of Science, Boston, MA   | 2009-2012             |
| Member, Biotechnology Advisory Board<br>Mount Wachusett Community College, Devens, MA   | 2007-2009             |
| Judge, Massachusetts State Science Fair<br>Massachusetts Institute of Technology, Cambridge, MA   | 1992-99,01, 03-05     |
| Subcommittee of Research Animal Care<br>Protocol Review Group<br>Massachusetts General Hospital, Boston, MA                                     | Aug. 1992 – Nov. 1993 |

## Publications:

---

1. Ibebunjo, C., Nosek, M.T., Itani, M.S., and Martyn, J.A.J. (1997) Mechanisms for the paradoxical resistance to d-tubocurarine during immobilization-induced muscle atrophy. *J. Pharmacol. Exp. Therap.* 283(2):443-451.
2. Nosek, M.T., and Martyn, J.A.J. (1997) Na<sup>+</sup> Channel and acetylcholine receptor changes in muscle at sites distant from burns do not simulate denervation. *J. Appl. Physiol.* 82(4):1333-1339.
3. Ouellette, A.J., Hsieh, M.M., Nosek, M.T., Cano-Gauci, D.F., Huttner, K.M., Buick, R.N., and Selsted, M.E. (1994) Mouse Paneth cell defensins: Primary structures and antibacterial activities of numerous cryptdin isoforms expressed in a single intestinal crypt. *Infect. Immun.* 62(11):5040-5047.
4. Nosek, M.T. and Aprille, J.R. (1992) Characteristics of ATP-Mg/P<sub>i</sub> carrier activity in rat liver mitochondria. *Arch. Biochem. Biophys.* 296(2):698-703.
5. Nosek, M.T., Dransfield, D.T., and Aprille, J.R. (1990) Calcium stimulates ATP-Mg/P<sub>i</sub> carrier activity in rat liver mitochondria. *J. Biol. Chem.* 265(15): 8444-8450.
6. Aprille, J.R., Rohweder-Dunn, G., Brennan, W.A., Jr., Kelley, R.T., and Nosek, M.T. (1987) Mitochondrial function after acute alteration of the endogenous insulin-to-glucagon ratio. *Biochem. Biophys. Res. Commun.* 142(2):315-321.
7. Aprille, J.R. and Nosek, M.T. (1987) Neonatal hypoxia or maternal diabetes delays postnatal development of liver mitochondria. *Pediatr. Res.* 21(3):266-269.
8. Aprille, J.R., Nosek, M.T., Brennan, W.A., Jr. (1982) Adenine nucleotide content of liver mitochondria increases after glucagon treatment of rats or isolated hepatocytes. *Biochem. Biophys. Res. Commun.* 108(2):834-839.

## Published Abstracts:

---

1. Brennan, W.A., Jr., Aprille, J.R., Nosek, M.T., and Amoah, H. (2000) 303: The differential effects of typical versus atypical antipsychotics on mitochondrial function in vitro: possible mechanisms for tardive dyskinesia. (Presented at Keystone Symposium on Mitochondrial Dysfunction in Pathogenesis. January 2000, Sante Fe, NM.)
2. Martyn, J.A.J., and Nosek, M.T. (1996) Increased expression of transcripts of  $\alpha$ -subunit of acetylcholine receptor (AChR) in area immediately burn injury. *Anesthesiology* 85(3A), A700. (Presented at the annual meeting of the American Society of Anesthesiologists, New Orleans, LA, October, 1996.)
3. Nosek, M.T. and Martyn, J.A.J. (1995) P192: Expression of the  $\alpha$ -subunit of the acetylcholine receptor (AChR) and of myogenin following burn injury confirms a denervation phenomenon in skeletal muscle. (presented at the annual meeting of the American Burn Association. Nashville, TN.)
4. Nosek, M.T. and Martyn, J.A.J. (1995) #1032: Burn injury-induced upregulation of the rat skeletal muscle acetylcholine receptor includes increased gamma subunit expression. (Presented at the 35th annual meeting of ASCB,

- Washington, D.C. December, 1995.)
5. Nosek, M.T. and Martyn, J.A.J. (1995) 244p: Burn injury does not induce any alterations in sodium channels in rat skeletal muscle. (Presented at the 27th annual meeting of the American Burn Association. Albuquerque, NM.)
  6. Nosek, M.T., Wang, S.J., Yang, G., Snow, R., and Ouellette, A.J. (1991) P52: Cryptdin-related mRNA sequences in the mouse small intestine and myeloid cells. (Presented at Molecular Cross-Talk Between Epithelial Cells and Pathogenic Microorganisms, an ASCB and EMBO joint conference, Arolla, Switzerland.)
  7. Nosek, M.T. and Aprille, J.R. (1988) Stimulation by calcium of ATP-Mg influx and efflux over the ATP-Mg/P<sub>i</sub> carrier in rat liver mitochondria. FASEB Journal 2:A775.
  8. Nosek, M.T. and Aprille, J.R. (1986) Divalent phosphate is a counterion for carboxyatractyloside-insensitive adenine nucleotide transport in rat liver mitochondria. Fed. Proc. 45:1924.
  9. Aprille, J.R., Brennan, W.A., Jr., Brown, C.A., Kelley, R.T., Modica-Napolitano, J.S., Nosek, M.T. (1984) Stimulated mitochondrial function in relation to increased matrix adenine nucleotide content after glucagon injection. Fed. Proc. 43:2002.
  10. Nosek, M.T. and Aprille, J.R. (1984) Mg<sup>2+</sup> requirements for carboxyatractyloside-insensitive adenine nucleotide fluxes in rat liver mitochondria. Fed. Proc. 43:2003.

## **Poster Presentations:** (unpublished)

---

1. Gordon, E. and Nosek, M.T. (2012) Integrating EIE into Undergraduate Coursework. (Presented at the Engineering is Elementary Workshop at the Boston Museum of Science.)
2. Beardmore, R. and Nosek, M.T. (2012) Differentiating Instruction for the Adult Learner. (Presented at the FSU Graduate and Continuing Education Faculty Meeting and Professional Development Workshop.)

updated: 10/17

**Aisling M. O'Connor,  
31 Misty Lane,  
Westford,  
MA 01886.  
Tel. (978) 902 4471  
Email: aisling\_oconnor@hotmail.com**

## **1. EDUCATION**

---

### **2005-2007 Postgraduate Studies - University of Massachusetts, Lowell, MA**

Graduate Certificate in Foundations of Business (2007).

### **1994-1998 Postgraduate Studies - University of Limerick, Ireland**

Ph.D. Degree (1998), by research and thesis. Title of research project: Carbon Dioxide Reforming of Methane over Pt/ZrO<sub>2</sub> Catalysts.

### **1990-1994 Undergraduate Studies - University of Limerick, Ireland**

Bachelor of Science in Industrial Chemistry (1994). Awarded a second class honors, grade one degree.

## **2. PROFESSIONAL EXPERIENCE**

---

### **September 2008-Present Assistant Professor – Fitchburg State College, Fitchburg, MA**

I am currently a tenured associate professor of chemistry. I teach lecture and lab courses in General Analytical Chemistry, General Chemistry I and General Chemistry II. I also teach a Forensic Chemistry course which does not have a lab component. In addition to teaching, duties include student advising, service to my department (Biology and Chemistry) and the wider college community and continuing scholarship. Currently, I am actively involved in promoting and growing the Chemistry minor program at the university and various projects involving science / chemistry at the K – 12 level and chemistry education.

### **February 2008-July 2008 Technical Support Manager – Lowell Centre for Sustainable Production, University of Massachusetts, Lowell, MA**

In this position, I worked with industry, academics and NGOs promoting sustainable practices including using safer alternatives in products and green chemistry. During my short term in this position, I contributed to projects with industry partners, Interface Fabrics and United Technologies and organized the 3<sup>rd</sup> Green Chemistry and Commerce Council Roundtable held at the Nike Campus, Beaverton, OR in July 2008.



**July 2006-December 2007 Sr. Applications Chemist – Waters Corporation, Milford, MA**

I was a member of a team of applications chemists providing support to the environmental, food safety, food and beverage industries. Duties include the research, identification and development of applications on Waters HPLC, UPLC, single and tandem quad MS instrumentation, collaboration with customers (industry & government) support of customers, sales staff, and field service/applications staff. Other responsibilities include sample analysis and presentation of applications, methods and Waters technologies at seminars and conferences.

**March 2002-June 2006 Sr. Development Engineer – Waters Corporation**

I was employed in the Development Evaluation Laboratory at Waters Corporation. My job involved the evaluation of Waters instruments and software during development and prior to customer release. I have worked on the development of the following products: HPLC autosamplers and pumps, UV detectors, evaporative light scattering detector, electrochemical detector, UPLC system, single quad mass detector and triple quad mass detector. I served as evaluation project manager for various products including UPLC control software, an electrochemical detector and single quad mass spectrometer.

**March 2000-March 2002 Evaluation Scientist – Waters Technologies Ireland, Wexford, Ireland**

I worked in the Development Evaluation Laboratory at Waters (Ireland). Projects worked on include the evaluation of instrument control software products and the development of qualification workbooks for LC/MS systems. In addition, I was involved in new instrument testing at the New Product Introduction Department (Waters, Milford, MA) and LC Grants (Scotland), installing and qualifying LC/MS equipment, instrument troubleshooting and maintenance.

**March–Oct. 1999 Technical Officer - Environmental Protection Authority, NSW, Australia**

I was employed in the Organic Chemistry Section of the NSW EPA's Analytical Chemistry Laboratory. The position involved the extraction and analysis of organic compounds such as pesticides, herbicides, phenols, PAHs, VOCs and chlorophylls in various sample matrices (soil, water, biota and air) as well as oil fingerprinting. Analysis was performed by GC, GC-MS and HPLC. Other responsibilities included liaison and support of EPA Environmental Inspectors, method development, instrument maintenance, troubleshooting and calibration, LIMS and database operation, internal auditing of standard methods and writing/updating of standard method manuals.

**June–Dec. 1998 Laboratory Analyst/Project Administrator - BHP Laboratories, Limerick, Ireland**

In this position, I had the dual role of Laboratory Analyst and Project Administrator for a large project involving the sampling and analysis of soil, water and air samples from contaminated sites. Laboratory Analyst duties included method development and analysis of samples by HPLC, GC, GC-MS, ICP and AAS for compounds such as PAHs, phenols, VOCs, sulphur and metals. Project Administrator duties involved LIMS management, staff training, writing SOPs, audit preparation, quality control, customer liaison, subcontracting and report issuing.

**Oct. 1994–June 1998 Laboratory Demonstrator/Ph.D. Candidate - University of Limerick, Limerick, Ireland**

Laboratory demonstrator duties included the supervision and demonstration of undergraduate laboratory sessions. The position involved teaching 3 laboratory sessions (9 contact hours) each week during the academic year. I supervised general, organic, physical, and analytical chemistry and chemical engineering laboratories.

Demonstrations included the use of instrumentation such as GC, HPLC, XRD, FTIR and UV. I was also responsible for the supervision of three final year project students during the academic years 95/96, 96/97 and 97/98.

The primary task of my research was the investigation of Pt/ZrO<sub>2</sub> catalysts for the conversion of natural gas to synthesis gas using CO<sub>2</sub> as an oxidant. Various supported catalysts were made and tested for activity and stability using a test rig with on line GC analysis. Characterization of these catalysts was carried out by XRD, AAS, H<sub>2</sub> chemisorption, BET surface area and pore size distribution measurements. In-situ Diffuse Reflectance Infrared Fourier Transform Spectroscopy (DRIFTS) experiments and Temporal Analysis of Products (TAP) investigations were carried out to elucidate the reaction mechanism over the Pt/ZrO<sub>2</sub> catalyst.

This project was funded by Kinetic Technology International (KTI), Zoetermeer, The Netherlands and the European Commission under the JOULE II Programme (*Conversion of Natural Gas to Synthesis Gas and C<sub>2+</sub> Hydrocarbons*). The project involved collaboration with KTI on an ongoing basis, with a view to industrializing the process. There were also six monthly reports and meetings with the other EU partners. During the course of my research I attended three meetings with project partners in Norway, France and Greece, carried out experimental work at University of Patras, Greece and Institut de Recherches sur la Catalyse, Villeurbanne, France and participated in four international conferences on catalysis giving both oral and poster presentations.

**March – Nov. 1992 Intern - Asahi Chemical Co., Nobeoka, Japan**

This position, based in the Rayon Plant, involved the establishment of an automatic titration system for the total alkali and sulfur contents in viscose mixtures. The automatic titration system consisted of a sequenced controlled robotic arm and an automatic titration unit.

### 3. AWARDS

---

- Granted a Special Projects Grant (\$700) from Fitchburg State University (2013) to fund travel to the ChemEd 2013 Conference at University of Waterloo, Canada.
- Selected to receive a 2012 AAUW (American Association of University Women) Community Action Grant (\$10,000). This grant was awarded to fund the expansion of Science Club for Girls in the Fitchburg / Leominster area.
- Awarded two Special Projects Grants from Fitchburg State University (2012). The first grant (\$1,000) was in support of a project which involved compiling, documenting and photographing a collection of instrument components to be used for teaching analytical chemistry. The other grant (\$700) was awarded to fund travel to the Biennial Conference on Chemical Education 2012, State College, PA to present the work funded by the first project.
- Received a Special Projects Grant from Fitchburg State University (2011) which helped to support an elementary school outreach project and two after school Science Clubs for Girls sites (\$1,000).
- Received a Ruth Butler Grant from Fitchburg State University (2010) which allowed me to present and get feedback on my work in service learning at Biennial Conference on Chemical Education 2010, Denton, TX (\$825).
- Received a Crocker Center for Civic Engagement Faculty Award from Fitchburg State University (2009) in support of an elementary school chemistry outreach project (\$500).
- Obtained five awards for extraordinary effort from Waters Corporation (2001, 2002 and 2004).
- Received a Basic Research Award from Forbairt, The Irish Research Council (1994-1997) and a University of Limerick Scholarship (1994-1998) to pursue postgraduate studies.
- Named on the UL president's list for academic excellence during the first (1993) and second (1994) terms in the fourth year of my degree programme.
- Awarded a place on the Asahi Scholarship and Study Programme (1992), which enabled me to spend 9 months working in a Japanese company.

### 4. PUBLICATIONS AND PRESENTATIONS

---

- Oral presentation given at **ChemEd 2013, Waterloo, Ontario, Canada**, July 28 – Aug. 1, 2013. “Lab activities for high school chemistry using the Vernier SpectroVis Plus Spectrophotometer”.
- Oral presentations given at the **Biennial Conference on Chemical Education 2012 (BCCE), State College, PA**, July 29 – August 2, 2012. “How Surfactants Work” and “Trash to Treasure: Using Instrument Components to Teach Instrumental Analysis”
- Oral presentation given at **ChemEd 2011, Kalamazoo, MI**, July 24 – 28, 2011. “A Green Chemistry Curriculum for Science Club for Girls”.

- Oral presentation given at the **Biennial Conference on Chemical Education 2010 (BCCE), Denton, TX**, August 1 – 5, 2010. “Service Learning in Chemistry for Non Majors”.
- Oral presentation given at **The National Environmental Monitoring Conference (NEMC), Cambridge, MA**, August 19 -25, 2007. “Analysis of Perfluorinated Compounds by UPLC/MS/MS: Contamination Reduction Strategies”.
- Poster presentation given at **The Florida Pesticide Residue Workshop, St. Pete Beach, FL**, July 22 - 25, 2007. “Analysis of Nerve Agent Degradation Products by UPLC/MS/MS”.
- Oral presentation given at **The Pittsburg Conference on Analytical Chemistry and Applied Spectroscopy (Pittcon) Chicago, IL**, February 25 – March 2, 2007. “Sample Screening Using LC/MS and LC/MS/MS Libraries”.
- Oral presentation given at **The National Environmental Monitoring Conference (NEMC), Arlington, VA**, August 28 -31, 2006. “Enhancement of EPA Method 535: Resolving Alachlor and Acetochlor ESA Metabolites”.
- A.M. O'Connor, Y. Schuurman, J.R.H. Ross, and C Mirodatos, Transient Studies of Carbon Dioxide Reforming of Methane over Pt/ZrO<sub>2</sub> and Pt/Al<sub>2</sub>O<sub>3</sub> Catalysts, **Catalysis Today**, 115 (1), p.191-198, Jun 2006
- Poster presentation given at **The Society of Forensic Toxicology (SOFT) Annual Meeting** in New Orleans, 2001. “Determination of Gamma-Hydroxybutrate (GHB) and Related Compounds in Forensic Samples by LC/MS”.
- J.R.H. Ross, A.H.J.van Keulen, A.M. O'Connor, et al., Effect of the method preparation and pretreatment on the dispersion and catalytic behavior of finely divided Pt or Ni particles supported on zirconia for the dry reforming of methane, **Abstracts of Papers of the American Chemical Society** 219: 68-Petr Part 2, Mar 26, 2000.
- A.M. O'Connor and J.R.H. Ross, The Effect of O<sub>2</sub> Addition on the Carbon Dioxide Reforming of Methane over Pt/ZrO<sub>2</sub> Catalysts, **Catalysis Today** 46 2-3 (1998) 203-210.
- M.E.S. Hegarty, A.M. O'Connor and J.R.H. Ross, Syngas Production from Natural Gas using Zirconia supported Metals, **Catalysis Today** 42 3 (1998) 225-232.
- A.M. O'Connor, F.C. Meunier , and J.H.R. Ross, An in-situ DRIFTS study of the mechanism of the CO<sub>2</sub> reforming of CH<sub>4</sub> over a Pt/ZrO<sub>2</sub> catalyst, **Studies in Surface Science and Catalysis** 119 (1998) 819-824.
- J.R.H. Ross , A.M. O'Connor, Hegarty MES, Syngas production from natural gas using CO<sub>2</sub>-reforming or CO<sub>2</sub> reforming combined with steam reforming or partial oxidation over a Pt/ZrO<sub>2</sub> catalyst, **Abstracts of Papers of the American Chemical Society** 215: 216-Coll. Part 1 April 2 1998.
- Oral presentation given at **The 3rd Workshop, C<sub>1</sub>-C<sub>3</sub> Hydrocarbon Conversion, Krasnoyarsk, Russia**, July 14 -17, 1997. “Syngas Production from Natural Gas using Zirconia supported Metals”.
- Poster presentation given at **The RSC 3rd International Symposium on Supported Reagents and Catalysis in Chemistry, University of Limerick, Ireland** July 8 - 11,

1997. “The Conversion of Natural Gas by Oxygen and / or Carbon Dioxide over Pt based Catalysts”.

- Oral presentation given at **The 5th European Workshop on Methane Activation, University of Limerick, Ireland**, 8 - 10 June, 1997. “The Effect of O<sub>2</sub> Addition on the Carbon Dioxide Reforming of Methane over Pt/ZrO<sub>2</sub> Catalysts”.
- Poster presentation given at **The 1st H.S. Taylor Conference, Nottingham Trent University, UK**, 1 - 4 September, 1996. “The Conversion of Natural Gas by Oxygen and / or Carbon Dioxide over Pt based Catalysts”.
- Oral presentation given at **The 5th Meeting on the Conversion of Natural Gas to Synthesis Gas, C<sub>2</sub>+ Hydrocarbons and Alternative Fuels (EU JOULE 2 Programme), Villeurbanne, France**, 21 - 23 October, 1995. “The Effect of Al<sub>2</sub>O<sub>3</sub> Addition on Pt/ZrO<sub>2</sub> Catalysts for Methane Reforming by CO<sub>2</sub>”.

## CHRISTOPHER M. PICONE

Department of Biology & Chemistry  
Fitchburg State University  
Fitchburg, MA 01420

(978) 665-3079 (w)  
(978) 827-6727 (h)  
cpicone@fitchburgstate.edu

### EDUCATION:

- University of Michigan (Ann Arbor, MI). Ph.D. Ecology. .... 1992-1999
  - Ph.D. Thesis: Comparative ecology of arbuscular mycorrhizal fungi in tropical rainforest and degraded pastures
- College of the Holy Cross (Worcester, MA). B.A., Biology *summa cum laude*... 1986-1990

### TEACHING EXPERIENCE:

#### Associate Professor, Fitchburg State University

- Ecology (undergraduate and graduate, with lab)..... 2004-present
- Environmental Science (with lab) ..... 2004-present
- General Biology II (with lab) ..... 2005-present
- Conservation Biology..... 2006-present
- Raising STEM in Your Learning Garden (w/ Lowell science teachers)..... 2015
- Applied Field Biology (capstone course with independent projects) ..... 2014
- Evidence Behind Controversial Subjects in the Next Generation Science Standards (grad course, hybrid/online)..... 2014
- Physical Science of Environmental change (grad course, teacher training) ..... 2008-2011
- Population, Hunger and Agriculture (ALFA, non-credit course) ..... 2006
- Global Warming (ALFA, non-credit course)..... 2005-2006
  
- Independent research advisor for 6 independent studies ..... 2007-2012
- Internship advisor for 22 students ..... 2007-present

#### Visiting Assistant Professor, Mount Holyoke College (MA)

- Advanced Ecology (with lab) ..... 2003
- Ecology and Evolution (with lab) ..... 2004
- Independent research advisor for two projects..... 2004

#### Visiting Faculty, Warren Wilson College (NC)

- Ecology (with lab) ..... 2002-2003
- Plant Morphology and Anatomy (with lab)..... 2003
- General Biology (with lab) ..... 2003
- Field Natural History (with lab) ..... 2002

#### Instructor, The Land Institute (Salina, KS).

- Natural Systems Agriculture courses (non-credit) for undergraduate and graduate students;
- Director of the graduate fellowship program..... 2000-2002

#### Adjunct faculty, Kansas State University-Salina

- Principles of Biology (with lab)..... 2000

#### Adjunct faculty, University of Michigan

- Ecology, Conservation, and Development of the New World Tropics ..... 1998

**Instructor, Universidad Nacional Autónoma de Nicaragua (Leon, Nicaragua) ..... 1995**  
Short course on the ecology and methods of mycorrhizal studies in the tropics; in Spanish.

**RESEARCH EXPERIENCE:**

- Projects at Fitchburg State** .....2004-present
- Bumblebee conservation in farms and residential gardens (new in 2017)
  - Impacts of aquatic herbicides on frog communities
  - Assessing and changing ecological misconceptions in the classroom
  - Strategies to assess and teach analytical skills in undergraduate courses
  - Effects of plowing on the ability of beneficial soil fungi (mycorrhizal fungi) to improve soil structure
- Mount Holyoke College (MA)** .....2003-2004
- Impacts of soil disturbance and fertilizers on the effectiveness of mycorrhizal communities in western Massachusetts
- The Land Institute (Salina, KS)** ..... 1999-2002
- Mycorrhizal ecology in farms and native grasslands. This was part of an interdisciplinary research on perennial grain agriculture.
- University of Michigan** (Ph.D. research). Advisor: John Vandermeer..... 1992-1999
- How mycorrhizal fungi are affected when tropical forest is converted to pasture.
- Research Assistant** with John Vandermeer, University of Michigan ..... 1993-1997
- Tropical forest dynamics and diversity following hurricane damage in Nicaragua
- Research Assistant** with Tom Martin, University of Arkansas ..... 1992
- Life-history traits, nest requirements, and predation rates of nesting birds in Arkansas and Arizona
- Intern** with the Manomet Bird Observatory (Manomet, MA)..... 1991-1992
- Data analysis of field counts and migration routes of American shorebirds
- Research Fellow** with the Thomas J. Watson Foundation ..... 1990-1991
- Connections between poverty and environmental destruction in Latin America (Mexico, Peru, Ecuador, and Brazil)
- Research Assistant** with Margaret Davis, University of Minnesota ..... 1989
- Mapping old-growth forest in northern Michigan
- Research Assistant** with Greg Murray and Kathy Winnet-Murray, Hope College (MI)..... 1988
- Forest dynamics and seed dispersal by birds in the Monteverde Cloud Forest Reserve, Costa Rica

## PUBLICATIONS

### Peer-Reviewed Articles & Book Chapters

- Picone, C.** 2015. Effects of aquatic herbicides and housing density on abundance of pond-breeding frogs. *Northeastern Naturalist* 22: 26-39.
- Picone, C.,** J. Rhode, L. Hyatt, and T. Parshall. 2007. Assessing gains in undergraduate students' abilities to analyze graphical data. *Teaching Issues and Experiments in Ecology*, Vol. 5. <http://tiee.ecoed.net/vol/v5/research/picone/abstract.html>
- Cox, T.S., **C. Picone**, and W. Jackson. 2004. Research priorities in natural systems agriculture. *Journal of Crop Improvement* 12 (1/2): 511- 532.
- Picone, C.** 2003. Managing mycorrhizas for a sustainable agriculture in the tropics. Pp. 93-130 in *Advances in Agroecology – Tropical agroecosystems*. John Vandermeer, Ed. CRC Press.
- Picone, C.,** D.Vantassel. 2002. Agriculture and biodiversity loss: industrial agriculture. Pp. 99-105 in *Life on Earth: An Encyclopedia of Biodiversity, Ecology, and Evolution*. Niles Eldredge, Ed. ABC-CLIO publishers.
- Cox, T. S., M. Bender, **C. Picone**, D. L. Van Tassel, J. B. Holland, C. E. Brummer, B. E. Zoeller, A. H. Paterson and W. Jackson. 2002. Breeding perennial grain crops. *Critical Reviews in Plant Sciences* 21:59-91.
- Picone, C.** 2000. Diversity and abundance of arbuscular mycorrhizal fungus spores in tropical forest and pasture. *Biotropica* 32: 734-750.
- Picone, C.** 1996. Abundance, diversity, and spatial heterogeneity of AM fungal spores in degraded pasture and lowland forest of Nicaragua. Pp. 134-136 in *Mycorrhizas in Integrated Systems: from Genes to Plant Development*. C. Azcón-Aguilar and J.M.Barea, Eds. European Commission, Brussels, Belgium.
- Murray, K. G., S. Russell, **C. Picone**, W. Sherwood, M. Kuhlman, and K. Winnet-Murray. 1994. Seed passage rates in fruit-eating birds: chemical control by plants and consequences for dispersal distance and germination success. *Ecology* 75: (4) 989-994.
- Harrington, B. H., **C. Picone**, S. L. Resende, and F. Leeuwenberg. 1993. Hudsonian Godwit (*Limosa haemastica*) migration in southern Argentina. *Wader Study Group Bulletin*, January.

### Reports & Popular Media

- Picone, C.** and M.C. Picone. 2011. Parents and educators concerned about impacts of iPads in classrooms. Op-Ed for the Community Journal (06/17/2011)
- Picone, C.** 2004. Evaluation of the Land Institute's Graduate Fellows Workshop in Natural Systems Agriculture, June 6-12, 2004. Evaluation on file with the G.E. Dodge Foundation, and with The Land Institute, Salina, KS.
- Picone, C.** 2002. Natural systems of soil fertility: the webs beneath our feet. *The Land Report* 73: 3-7.
- Picone, C.** 2000. Wheat as part of a soil community: a history of cooperation with fungi. *The Land Report* 67: 6-7.
- Picone, C.** Voting for Nader would help farmers. Op-Ed piece for *The Salina Journal*, 9/18/2000
- Picone, C.,** W. Jackson, S. Cox, and D. Van Tassel. Give consumers choice on genetically altered food. Op-Ed piece for the *Kansas City Star*, 9/11/2000.
- Picone, C.** The goal is fair trade, not just free trade. Op-Ed piece for the *Salina Journal*, 12/15/1999.
- Picone, C.,** D. Andresen, G. Thomas, and D. Griffith. 1999. Say no to GMOs: A rational, scientific assessment of the risks from genetically modified crops to health, the environment and small farmers. *Agenda* magazine, Ann Arbor, Michigan. May-June. pp. 6-8.
- Picone, C.** 1992. Searching for the austral shorebirds. *Manomet Bird Observatory Quarterly*. Spring/summer: 10-13.



## CONFERENCE PRESENTATIONS & ABSTRACTS

- Massachusetts PKAL Network Summer Meeting**, Fitchburg State University ..... 2017
- **Picone, C.** Using hornworm caterpillars to help students understand biological transformations of matter and energy. (*Oral presentation.*)
- Ecological Society of America meeting**, Baltimore, MD ..... 2015
- **Picone, C.** Effects of Aquatic Herbicides on Abundance of Breeding Frogs (*Poster*)
- Massachusetts Association of Conservation Commissions, Fall Conference**  
Framingham State University, MA..... 2014
- **Picone, C.** Challenges in managing nuisance aquatic plants in lakes and ponds (*Invited seminar*)
- Northeast Natural History Conference**, Springfield, MA..... 2014
- **Picone, C.** Effects of Aquatic Herbicides on Abundance of Breeding Frogs (*Poster*)
- Ecological Society of America meeting**, Portland, OR ..... 2012
- **Picone, C.** Trophic efficiency in caterpillars as a model ecosystem. (*Workshop presented as part of the Resources for Ecology Education: Fair and Share, or REEFS.*)
- Ecological Society of America meeting**, Pittsburg, PA ..... 2010
- **Picone, C.** Diagnostic question clusters (DQC's) improve teaching about decomposition and transformations of nutrients and energy. (*Poster*)
- Ecological Society of America meeting**, Albuquerque, NM ..... 2009
- **C. Picone.** Effects of agricultural tillage on the ability of mycorrhizal fungi to restore soil structure (*Poster*)
  - AB Griffith, BJ Abraham, **C Picone**, C D'Avanzo, CW Anderson, NJ Pelaez, KS Williams, and NE Stamp. Diagnostic question clusters and student active learning: Their role in faculty development of scientific teaching. (*Poster*)
  - Hartley, LM, CW Anderson, BJ Abraham, C D'Avanzo, A Arnett, A Dickman, H Griscom, A Maskiewicz, **C Picone**, JW Schramm, and B Wilke. Student reasoning related to matter and energy flow through ecosystems: Lessons from diagnostic question clusters. (*Poster*)
- Ecological Society of America meeting**, Milwaukee, WI. .... 2008
- **Picone, C.** Confronting, changing and assessing ecological misperceptions in the classroom. (*Invited seminar*)
- Ecological Society of America meeting**, Memphis, TN..... 2006
- **Picone, C.** Using TIEE to improve analytical skills in undergraduates (*Poster*)
- Ecological Society of America meeting**, Montreal, Quebec..... 2005
- **Picone, C.** Specificity among plant functional groups and mycorrhizal fungi in grasslands and agriculture (*Poster*)
- 4th International Conference on Mycorrhizas**, Montreal, Quebec..... 2003
- **Picone, C.** Effects of tillage and plant diversity on mycorrhizal fungus communities (*Poster*)
- Kansas Academy of Sciences** ..... 2000
- **Picone, C.** Effects of tillage and plant diversity on mycorrhizal fungus communities. (*Invited seminar*)
- Ecological Society of America meeting**, Spokane, WA. .... 1999
- **Picone, C.** Diversity of arbuscular mycorrhizal fungi in tropical forest and pasture. (*Seminar*)
- Ecological Society of America meeting**, Baltimore, MD. .... 1998
- **Picone, C.** Host-dependent sporulation of tropical mycorrhizas. (*Seminar*)

**CONFERENCE PRESENTATIONS/ABSTRACTS (cont.)**

- 3rd National Meeting of the Cuban Association of Organic Agriculture**, Villa Clara, Cuba. .... 1997
- **Picone, C.** Mycorrhizal ecology of tropical forest and pasture (*Poster*)
- 1st International Conference on Mycorrhizas**, Berkeley, CA. .... 1996
- **Picone, C.** Soil infection in tropical forest and pasture. (*Poster*)
- 4th European Symposium on Mycorrhizas**, Grenada, Spain. .... 1994
- **Picone, C.** Abundance, diversity, and spatial heterogeneity of AM fungal spores in tropical forest and pasture. (*Invited seminar*)

**OTHER INVITED SCIENCE PRESENTATIONS**

- UMass (Worcester) Medical School, Doctoral Roundtable. (On climate change/health).... 2018
- Ashburnham Public Library (seminar on climate change) ..... 2017
- Growing Places Garden Project, Leominster, MA (Soil panelist at the annual Food Gardeners' Gathering; and workshops on composting).....2015-present
- Lancaster Garden Club (on soil sustainability and mycorrhizas) ..... 2012
- Fitchburg State Center for Professional Studies (on climate change and gardens) ..... 2010
- Fitchburg State and Framingham State Alumni Association (on climate change) ..... 2008
- Prescott College, Fitchburg State, and University of the Wild Conference at the Doyle Conservation Center, MA (on climate change) ..... 2008
- Plymouth State University (NH) on perennial agriculture and mycorrhizas ..... 2007
- Harvard Forest (MA) on perennial agriculture and mycorrhizas ..... 2006
- Nashua River Watershed Association on perennial agriculture ..... 2006
- College of the Holy Cross (MA) on sustainable agriculture and mycorrhizas ..... 2006
- Vassar College (NY) on perennial agriculture and mycorrhizas ..... 2004
- Mansfield University (PA) on perennial agriculture and mycorrhizas..... 2003
- Mount Holyoke College (MA) on perennial agriculture and mycorrhizas ..... 2003
- Lynchburg College (VA) on perennial agriculture and mycorrhizas ..... 2003
- University of Minnesota on perennial agriculture ..... 2002
- Fitchburg State College (MA) on perennial agriculture and mycorrhizas..... 2002
- Siena College (NY) on perennial agriculture and mycorrhizas ..... 2002
- Hampshire College (MA) on perennial agriculture and mycorrhizas..... 2002
- University of Vermont (Series on Ecological Design) on perennial agriculture ..... 2001
- Green Mountain College (VT) on perennial agriculture ..... 2001
- St. Michael's College (VT) on perennial agriculture ..... 2001
- Wichita State University (KS) on perennial agriculture and mycorrhizas..... 2001
- USDA-ARS, Eastern Regional Research Center (PA) on mycorrhizas ..... 2000
- The Land Institute, Salina, KS on tropical mycorrhizas and Cuban agriculture ..... 1999
- Calvin College (MI) on tropical mycorrhizas ..... 1998
- Hood College (MD) on Cuban Agriculture ..... 1998

**GRANTS & HONORS:**

- **Massachusetts Mathematics and Science Partnership Program (MMSP)**, awarded by the Department of Elementary and Secondary Education (DESE). A collaboration between Lowell School District and STEM departments at FSU (\$400,000). ..... 2015-2017
- **Fitchburg State Special Studies** grant to eliminate course textbooks in favor of open sources online (\$500) ..... 2015
- **Fitchburg State Center for Teaching and Learning** Innovation Grant to use iButtons in science labs (\$1000)..... 2011
- **Ecological Society of America** grant (via National Science Foundation). Diagnostic Question Cluster (DQC) research fellow, studying student misconceptions and strategies to correct them. (\$2500).....2008-10
- **BiosciEdNet Scholar**. BEN is a program of the American Association for the Advancement of Science to improve teaching (\$500 stipend)..... 2008
- **Fitchburg State President's Initiative** for starting the McKay School Garden (\$1700) ... 2008
- **Fitchburg State Student Government Association's Faculty Member of the Year**..... 2008
- **Fitchburg State Ruth Butler Award** for soil research with 2 students (\$1000) ..... 2007
- **Fitchburg State Undergraduate Research Associate Award** (\$800) ..... 2007
- **Knapp Foundation Grant** to purchase books for the Environmental Biology concentration at Fitchburg State (\$15,000) ..... 2006
- **Ecological Society of America** education grant to research ways to improve graphing skills in ecology students. (\$500)..... 2005-2006
- **Lindbergh Foundation** research fellowship (\$10,580)..... 2001-2002
- **Univ. of Michigan** Rackham Graduate School writing grant (\$4000) ..... 1999
- **Univ. of Michigan** Rackham Discretionary Funds for field assistants (\$500)..... 1995
- **Univ. of Michigan** Matthai Botanical Gardens research grant (\$470) ..... 1994
- **National Science Foundation (NSF)** graduate student fellowship (\$49,200)..... 1993-1997
- **Univ. of Michigan** Regents fellowship (\$37,500)..... 1992-1998
- **Thomas J. Watson Fellowship** to study connections between the environmental movement and Liberation Theology in Latin America (\$12,000) ..... 1990-1991

**PROFESSIONAL MEMBERSHIPS**

- \* Ecological Society of America (sections on soil microbial ecology, agro-ecology, ecological education, and ecological justice)
- \* New World Agriculture and Ecology Group

**SERVICE: FITCHBURG STATE**

- **Liberal Arts and Sciences Council.** I have been an active member of this council since the deployment of the new LA&S curriculum, and helped develop ways to assess essential learning outcomes. In recent years I have also facilitated many workshops at Development Days. I was **LA&S Chair** in AY2014. In that role I compiled documents to help prepare for the Program Review, and I coordinated the LA&S assessment of student work...2006-present
- **Sustainability Advisory Committee.** I helped initiate campus recycling (2008) and energy-savings contests (2008-2013). In 2013 we initiated a food waste campaign that temporarily reduced food waste by 15%. I have also presented at 11 campus panels and forums, and showed 10 films on sustainability, agriculture, or climate change. ....2007-present
- **Volunteer garden manager, McKay Academy**  
I created and continue to manage this large school garden used by K-8 classes, Upward Bound high school students, and a few FSU undergraduates ..... 2008-present
- **MSCA Executive Council** ..... 2015-present
- **Strategic Planning, Academic Planning Subcommittee.** I recorded and compiled meeting minutes for eight meetings and helped write a white paper..... 2014
- **NEASC sub-committee on Academic Programs and Faculty**.....2010-2011
- **Academic Policies Committee** ..... 2005-2008
- **Faculty Center for Teaching, Learning, and Writing** ..... 2004-2005

**SERVICE: BIOLOGY & CHEMISTRY DEPARTMENT**

- **Biology & Chemistry Curriculum Committee** .....2005-2013; 2016-present  
As chair from 2007-11 and again in 2012-2013, I led revisions of the core Biology curriculum, wrote nine ACC proposals, and directed a review of BIO and CHEM transfer equivalencies for all of our sister schools in MA.
- **Biology Assessment Committee.** I developed assessment tools for two of the four core courses for biology majors. In fall 2014 I began to revamp our strategy for program assessment. .... 2009-2016
- **Peer Evaluation Committee** for 26 evaluations  
and chair for 11 of those evaluations .....2009-present
- **Faculty Search Committees** .....2004-present  
Seven searches in Biology (one as Chair), and two in GeoPhysical Sciences (one as Chair)
- **Science Building Committee** .....2005-2006
- **Biology-Chemistry Facilities Committee** .....2004-2005

**SERVICE: PROFESSIONAL**

- Reviewer of primary research articles in *Biotropica*, *Oecologia*, *Plant Ecology*, *Tropical Ecology*, *Teaching Issues and Experiments in Ecology* (TIEE), and the *EcoEd Digital Library* .....2007-present
- Braun Judge for graduate student posters at the annual meetings of the Ecological Society of America..... 2006-2010
- Reviewed a SARE grant and served as a soil science advisor for Seeds of Solidarity, a nonprofit in Orange MA ..... 2010
- Reviewed of a book proposal for Pluto Press, London: *A Parasite on Earth: Thriving capitalism means a sick planet* by Stan Cox..... 2006
- Reviewer for *Biotropica*, *Soil and Tillage Research* ..... 1999-2002

**SERVICE: RECENT COMMUNITY OUTREACH**

- **Ashburnham Conservation Commission (MA)** ..... 2006-present (Chair 2007-2009)  
This town commission evaluates permits to uphold the MA Wetland Protection Act. I have also developed criteria for permits addressing aquatic weed management, and I wrote a grant proposal in 2016 for restoring a grassland. In 2014 I facilitated a town forum on the Open Space and Recreation Plan.
- **Growing Places Garden Project (Leominster, MA)**.....2014-present  
Growing Places is a nonprofit organization that establishes community gardens in low-income communities, and teaches how to use them. I teach 2 workshops/year on composting and improving soil.
- **Mt. Watatic Management Committee** .....2013-present  
I represent the Town of Ashburnham among the six owners of this property.
- **Ashburnham Rail Trail Committee** .....2015-present  
This became an official Town Committee in 2017, a subset of the Ashburnham Economic Development Council. I serve on the board as Secretary (since 2017).
- **Ashburnham Conservation Trust (a non-profit)** .....2012-present.  
I write annual monitoring reports for two Conservation Restriction properties, and in 2012 I wrote a brief Management Plan for Broadhurst Point recreation area.
- **Ashburnham Elementary School Wildflower Garden**..... 2014  
I started a teaching garden with another volunteer and two teachers.
- **Nashua River Watershed Association** ..... 2011-2013  
Volunteer for monthly water quality sampling
- **Natural History Field Trips** .....2005-present  
I have led at least one field trip/year for the Ashburnham Conservation Trust, Freedom's Way Natural Heritage Area, Mt. Grace Conservation Trust, and Friends of the Willard Brook
- **School presentations** on aquatic invertebrates, frogs, soils, plants, or climate change for JR Briggs Elementary School (2007-2014), Oakmont Regional High School (2010), Wachusett Regional High School (2009), Southeast Elementary School (2008), Fall Brook Elementary (2008), Littleton Middle School (2007) and Ashburnham Girl Scouts/Boy Scouts (2009-2013)
- Science Fair Judge, Leominster High School ..... 2011
- Ashburnham Agricultural Commission ..... 2009-2012

# ERIN MACNEAL REHRIG

814.880.3173 (c) || 978.665.3982 (w) || erin@rehrig.net || erehrig@fitchburgstate.edu

## Education

### **Ph.D. in Plant, Insect, and Microbial Science, 2010**

UNIVERSITY OF MISSOURI, Columbia, MO

### **M.Ed. in Science Education, 2000**

THE PENNSYLVANIA STATE UNIVERSITY, University Park, PA

### **M.S. in Horticulture, 1997**

THE PENNSYLVANIA STATE UNIVERSITY, University Park, PA

### **B.S. in Biology, Minor in Chemistry, 1994**

BLOOMSBURG UNIVERSITY, Bloomsburg, PA

## Professional Experience

### *Associate Professor*

Department of Biology and Chemistry, Fitchburg State University, Fitchburg, MA, Dr. Mel Govindan Fall 2011-Present

- Prepared syllabi and lectures and taught Biology, Chemistry and Science Education Courses for both day and GCE programs (General Biology I & II, Biology Laboratory, Teaching Methods, Plant Biology, Plant Molecular Ecology, Seminar in Biology, Food Chemistry, Crop Science, Life Science for non-majors)
- Used a variety of pedagogical techniques including powerpoint lectures, chalk-talks, laboratories, jig-saws, readings, discussions, minds-on problems, clicker quizzes, real-time graphing, videos, and outdoor field trips.
- Advised students on course registration, major selection, study habits, course loads, and success strategies
- Served on and chaired various departmental, college-wide and community-related committees such as Biology Curriculum, Faculty Hiring Searches, Academic Policies, Ruth Butler Grant (chair), Internships, Education Unit, Secondary Education, Undergraduate Research Conference (chair), Biology Grad Committee and Wekepeke Brook Committee
- Collaborated with students and researchers to conduct experiments, analyze biological data, and prepare manuscripts for publication and posters for presentation
- Supervised student internships, independent studies, and pre-practicum student teaching experiences
- Prepared reports and conducted data analysis for the Education Dept.'s accreditation by NCATE (now CAEP)
- Analyzed data, updated syllabi, and wrote reports for the final approval of the new chemistry major as requested by the Massachusetts's Department of Secondary and Elementary Education (DESE)
- Provided workshops for incoming freshmen on student success and adopting a growth mind-set
- Volunteered at local elementary, middle, and high school science-related events
- Peer-reviewed and edited manuscripts and textbooks for publication

### *Adjunct Faculty in Biology*

Department of Natural Sciences, Assumption College, Worcester, MA, Dr. Ed Dix

Fall 2010

- Designed syllabus, lecture materials, and exams for freshmen-level core introductory Biology course
- Taught laboratory sections of Biology and coordinated student experiments

### *Project Assistant/ Post Doctoral Scholar*

Agricultural and Biological Engineering, Penn State University, Dr. Jeff Catchmark

2009- 2010

- Used techniques such as FE-SEM, TEM, SDS-PAGE, Western Blotting, and *in vitro* assays to purify and characterize membrane-bound bacterial protein complexes, measure enzyme activity, and visualize samples
- Optimized cellulose nanofiber production by manipulating enzyme thermostability in fermentation reactions
- Managed equipment, enforced safety procedures, and designed standard protocols for the laboratory

- Graduate Research Assistant* 2007-2010  
 Bond Life Sciences Center, University of Missouri, Dr. Jack Schultz (continuation of work from Penn State)  
 Thesis Title: The role of *Arabidopsis* Ethylene Response Factor (ERF) Transcription Factors in differential defense responses against the generalist insect herbivore, *Spodoptera exigua*, and the specialist, *Pieris rapae*
- Designed and conducted experiments to identify plant gene function after insect herbivory using RT-PCR, chromatography (GC, HPLC, HPLC-MS), whole-plant physiology, bioinformatics, various molecular biology techniques, and insect bioassays
  - Performed DNA/RNA/protein extraction, genetic transformation, in-situ hybridization of *Arabidopsis* plants
  - Trained all new lab members in biochemical and molecular methods and statistical analyses
  - Skilled in plant care, mutant screening (plant phenotyping), and insect rearing
- Graduate Research Fellow* 2004-2007  
 Huck Institute for the Life Sciences, Penn State University, Dr. Jack Schultz
- Analyzed *cis*-regulatory elements, enriched motifs, and gene expression patterns in *Arabidopsis* after insect herbivory using a whole-genome cDNA microarray and computational biology tools
  - Taught portions of Biochemistry I and II and conducted review sessions for classes with over 200 students
  - Conducted bioinformatics research, performed sequence alignments, and completed phylogenetic analyses of large families of human G-Protein Coupled Receptors
- Teaching Assistant* 1995-2009  
 Colleges of Science and Agriculture, Penn State University & Bond Life Sciences Center, University of Missouri
- Served as teaching assistant or guest lecturer for the following college-level courses:
 

Biochemistry I & II	Specialized Plant Biochemistry	Plant Systematics
Plant Tissue Culture	Plant Growth and Development	Horticulture
Dendrology	Molecular Ecology of Plant-Insect Interactions	
- Instructional Specialist/ Supplemental Instruction Supervisor* 2000-2004  
 University Learning Centers (ULC), Penn State University, Supervisor: Mrs. Ann McLaren
- Coordinated and served as supervisor for the ULC's technology, math, and science tutoring programs
  - Responsible for hiring, training, and supervising tutors, work-study students, and waged employees
  - Collaborated with faculty, staff, and students to implement innovative educational technologies
  - Assisted with retention-based programs such as Trio, SSS, and Leading-Edge Academic Programs (LEAP)
  - Served on education-related committees for the Office of the Vice Provost for Undergraduate Education, including Teaching with Technology, Disability Services, Strategic Planning, and Living/Learning Communities
- Student Teacher* Spring 2000  
 State College Area High School, State College, PA, Mentor Teacher: Ms. Michelle Manson
- Taught sophomore level Biology using active learning models and technology
  - Designed inquiry-based curricula, including lesson plans, lesson objectives, and assessments
  - Conducted in-class educational research using action research methods
- Senior Microcomputer Systems Consultant*, Supervisor: Mr. Paul Perworchik 1997-2000  
 Office of the Vice Provost for Information Technology, Penn State University
- Designed, maintained, and performed troubleshooting on computer/network systems for executive offices
  - Researched new technologies, developed technology plans, and purchased equipment to improve efficiency of division processes
  - Participated in strategic planning, managed educational technology projects and budgets, and designed software training programs
- Graduate Research Assistant* 1995-1997  
 Department of Plant Science, Penn State University, Advisor: Dr. Rob Berghage
- Maintained germ line and mutant strain plant tissue cultures for research and coursework
  - Conducted field research assessing vegetable and flower quality for PSU's trial gardens
  - Analyzed pesticide levels in irrigation water, biofilters, and plant tissue using HPLC and AA spectroscopy
  - Managed laboratory and computer equipment and provided training to new lab members

## Grants, Awards, and Scholarships

- *FSU Innovation Grant (\$1500), and Ruth Butler Grants (\$950 total), AYs 2011-2012, 2012-2013, 2016-2017*
- *Key Collaborator (non-author) on NSF Grant #1416825, Comparative Genomics of a Species Radiation: Sequencing the Apple Tribe, Sarah Mathews, Harvard University, Principle Investigator (\$300,000), Prepared 2012, Accepted 2014.*
- *Collaborator (non-author/editor) on Trout Unlimited Grant (Chapter 148), Wekepeke Brook Reconnection Project, Joe Rodgers, Rushing Rivers, Lead Project Manager (\$10,000 w/ Nestle Waters match) 2013*
- *Recipient of FSU Special Projects Grant (\$1500-AY 2012-2013, \$700 AY2015-2016)*
- *Excellent Poster Award Winner & Student Judge, University of Missouri Research Competition, 2008, 2009*
- *Nominated for the Nina V. Federoff TA Award for Excellence in Teaching, Spring 2006*
- *Penn State Huck Institutes for Integrative Biosciences Fellowship Recipient, 2004-2006*
- *Most Outstanding Publication Award Winner, American Society for Horticultural Science, 2000*
- *Penn State University Library Archives, Malloy Graduate Assistantship Recipient, 1999-2000*
- *Bloomsburg University Student Athlete Award (Indoor/Outdoor Track & Cross-Country) 1991-1994*

## Current Memberships

- *Member of the American Society of Plant Biologists*
- *Member of the National Science Teachers Association*
- *Member of the American Society for Horticultural Science*
- *Member of the Massachusetts Teacher Association*
- *Standing Member of Beta Beta Beta National Biological Honor Society*
- *Lifetime Member of Alpha Phi Omega National Service Fraternity*

## Volunteer Work and Community Service

- *Volunteer for STEM afterschool programs, Fitchburg, MA public elementary schools 2014-present*
- *Official member of Sterling, MA Open Space Committee, Spring 2014-Present*
- *Judge for N.E. Chapter of the American Chemical Society poetry contest, Spring 2014*
- *Volunteered as judge for Leominster High School and Southeast Middle School Science Fairs, Spring 2012-2016*
- *Nominated as a "Champion of Sustainability", University of Missouri for starting a Tips-Box recycling program, 2009*
- *Member for Central Missouri Humane Society's Friends of CMHS Development Board, 2008-2009*
- *Volunteer for 2008 Presidential Campaign*
- *Volunteer for PREP Program teaching hands-on science to rural Missouri High School students, 2007, 2008*
- *State College High School DNA Science Fair Volunteer, 2006, 2007*
- *Volunteer for BIODAYS at Penn State, 2004, 2006*
- *Patton Township Pennsylvania, Planning Committee Alternate member, 2004-2005*
- *Counselor for New Leadership PA Program, Women in Politics in PA, Chatham Univ., Pittsburgh, PA 2002, 2003*
- *Penn State University Undergraduate Strategic Planning Committee member 2002*
- *Penn State University Commission for Women, 2002-2004*
- *Alpha Phi Omega National Service Fraternity volunteer events, 1993-ongoing*



## Publications & Professional Presentations

### Publications

Fowler, A., Grimm, L. and **Rehrig, E.M.**, (2016) Using exemplars to improve students' performance on writing lab reports. Original research article for the Journal of Evaluation and Assessment. Submitted to the Journal of Evaluation and Assessment (May 2016).

Appel, H.M., Fescemyer, H., Ehtling, J., Weston, D., **Rehrig, E. M.**, Joshi, T., Xu, D., Bohlmann, J., and Schultz, J.C. (2014). Transcriptional responses of *Arabidopsis thaliana* to chewing and sucking insect herbivores. *Frontiers in Plant Science* 5:565. doi: 10.3389/fpls.2014.00565

**Rehrig, E.M.**, Appel, H.M., Jones, A.D., and Schultz, J.C., (2014) Roles for jasmonate- and ethylene- induced transcription factors in the ability of *Arabidopsis* to respond differentially to damage caused by two insect herbivores. *Frontiers in Plant Science* 5:407. doi: 10.3389/fpls.2014.00407

Green, J. M., Harnsomburana, J., Chang, J-F., Balienc-Kurti, P., **Rehrig, E.M.**, Appel, H., & Shyui, C-R., (2012) PhenoPhyte: a flexible affordable method to quantify 2D Plant phenotypes from imagery. *Plant Methods*, 8 (45) 1-12.

**Rehrig, E.M.**, Appel, H.M., & Schultz, J.C., (2011) Measuring normalcy after insect attack in *Arabidopsis thaliana*. *Molecular Ecology Resources*, 11(2) 294-304.

Havens, T.C., Keller, J.M., **Rehrig, E.M.**, Appel, H.M., Popescu, M., Schultz, J.C., & J.C. Bezdek, Fuzzy cluster analysis of bioinformatics data composed of microarray expression data and Gene Ontology annotations. In *Proc. NAFIPS 2008*, New York, NY, May 2008

Berghage, R.D., **MacNeal, E.P.**, Wheeler, E.F., & Zacharitz, W., (1999) Green water treatment for the green industries: Opportunities for biofiltration of greenhouse and nursery irrigation water and run-off with constructed wetlands, *HortScience*, 34(1): 50-54.

### Newspaper Articles

**Rehrig, E.M.**, Allergy prompts reassessment of beauty and cleaning products, Special to the Worcester Telegram and Gazette, Worcester, MA. April 2, 2014

**Rehrig, E.M.**, A head's up about lice: It's manageable. Special to the Worcester Telegram and Gazette, Worcester, MA. November 10, 2013.

**Rehrig, E.M.**, Cleanliness is next to Unhealthiness, Special to the Worcester Telegram and Gazette, Worcester, MA. *In prep. To be submitted Sept. 2016*

### Posters and Presentations

**Rehrig, E.M** and Glaze-Corcoran, Samantha., (2016) Wasabi? The role of glucosinolates in plant resistance to insects, Oral Presentation and Workshop for the New England Chemistry Teachers Association Annual Conference, Scheduled for August 10, 2016, Massachusetts College of the Liberal Arts, North Adams, MA.

**Rehrig, E.M** and Grimm, L., (2016) The use of exemplars to improve students' lab report writing skills, Oral Presentation for the New England Regional STEM Conference of the American Association of Colleges and Universities. Scheduled for June 10, 2016, Westfield State University, Westfield, MA.

**Rehrig, E.M.**, Appel, H.M., Jones, A.D., and Schultz, J.C., (2015) The role of stress-related transcription factors in the response of *Arabidopsis thaliana* to different insect herbivores, poster presentation given at the American Society for Plant Biologist's annual conference, July 27-30, Minneapolis, MN.

- Martorana, S., Beaulieu, J., and **Rehrig, E.M.**, (2015) The effect of insect herbivory on plant photosynthesis, poster presentation given at the Annual Undergraduate Conference on Research and Creative Practice, Fitchburg State University, April 23, 2015, Fitchburg, MA.
- Glaze-Corcoran, S.G. and **Rehrig, E.M.**, (2014) Season extension and sugar accumulation in low tunnel-grown spinach, poster presentation given at the American Society for Horticultural Science Annual Conference, July 28-31, Orlando, FL.
- Cormier, Kyle, Largey, M., **Rehrig, E.M.**, Brush, D., (2014) The use of DNA barcoding in conducting a plant survey, poster presentation given at the New England Natural History Conference, April 7, 2014, Springfield, MA.
- Glaze-Corcoran, S.G. and **Rehrig, E.M.**, (2013) Season extension and production: A comprehensive analysis of spinach, poster presentation given at the Annual Undergraduate Conference on Research and Creative Practice, Fitchburg State University, April 25, 2013, Fitchburg, MA.
- Largey, M., **Rehrig, E.M.**, Brush, D., (2013) *Thesis Report*: The use of DNA barcoding in conducting a plant survey, poster presentation given at the Regional Undergraduate Research Conference, University of Massachusetts-Amherst, April 26, 2013, Amherst, MA.
- Largey, M., **Rehrig, E.M.**, Brush, D., (2012, 2013) *Thesis Proposal & Report*: The use of DNA barcoding in conducting a plant survey, poster presentation given at the Annual Undergraduate Conference on Research and Creative Practice, Fitchburg State University, April 26, 2012, and April 25, 2013, Fitchburg, MA.
- Rehrig, E.M.**, & Rehrig, P.W. (2011) It's Electric! How and why to build an electric car, Presentation given in the Science Seminar Series, Wachusett Regional High School, Dec. 13, 2012, Holden, MA.
- Rehrig, E.M.**, & Catchmark, J. (2010) Extraction and characterization of the Cellulose Synthase enzyme complex from *Acetobacter xylinum*. Poster presentation for the Center for Lignocellulose Structure and Formation Annual Meeting, an Energy Frontiers Research Center, May 17-18, 2010, State College, PA.
- Rehrig, E.M.**, Appel, H.M., Zhang, S., Green, J., Cheng, J-F, Shyu, C-R., & Schultz, J.C., (2009) Insect performance on *erf* mutant plants is independent of glucosinolate profiles. Poster presentation for Plant Biology Symposium, April 11-13, 2009, Columbia, MO.
- Rehrig, E.M.**, Appel, H.M., Zhang, S., & Schultz, J.C., (2008) Ethylene signaling in defense against specialist vs. generalist herbivores in *Arabidopsis thaliana*. Poster presentation for University of Missouri Life Sciences Week. April 11-15, Columbia, MO.
- Rehrig, E.M.**, Ehltling, J., Appel, H.M., Bohlmann, J., & Schultz, J.C., (2006) Transcription factor profiles and *cis*-regulatory motif distributions in *Arabidopsis* genes regulated by herbivory. Poster and presentation for the 4th Annual Ecological Genomics Symposium. November 3 – 5, Overland Park, KS.
- Bacon-Woodard, A.M., & **Rehrig, E.M.**, (2004) An ANGEL in Disguise: Use of web-based tools to enhance the delivery and effectiveness of Supplemental Instruction (SI) at Penn State. Presentation for the 3rd International Conference on Supplemental Instruction. June 2-4, Boston, MA.
- Brungard, R., Bacon-Woodard, A.M., & **Rehrig, E.M.**, (2003) Slurpies, snacks, & study skills: A 24/7 convenience store for academic success, Presentation for the 4<sup>th</sup> Regional Conference of the College Reading and Learning Association. March 30-31, Philadelphia, PA.
- Rehrig, E.M.**, Carubia, J., & Busis, C., (2003) Co-curricular civic leadership education: A model for liberal learning. Proceedings of the National Conference for American Association of Colleges and Universities, January 12-15, Seattle, WA.
- Rehrig, E.M.**, (2002). Developing programs to teach technology as the new basic skill. Presentation for the 3<sup>rd</sup> Regional Conference of the College Reading and Learning Association, April 11-12, Rutgers, NJ.
- Rehrig, E.M.**, (2002) Technology: Why we need to get with IT! Presentation for Perspectives Women's Leadership Conference, April 3-4, State College, PA.

- Crawford, B. A. & **Rehrig, E.M.**, (2001). A prospective teacher's insights into learning to teach inquiry. A paper presented at the annual meeting of the National Association of Research in Science Teaching, March 25-28, St. Louis, MO.
- Friedrichsen, P., Crawford, B., Zembal-Saul, C., **Rehrig, E.M.**, Munford, D., &. (1999) Integrating technology into pre-service science teacher preparation. Presentation for The National Association for the Education of Teachers of Science, October 14-15, Syracuse, NY.
- MacNeal, E. P.**, & Berghage, R. D., (1998) Biofiltration of metalaxyl residue in recirculating irrigation systems using constructed wetlands, HortScience, 31(1): 655. Poster abstract.
- MacNeal, E. P.**, (1996) Bioremediation of environmental toxins by plants. Presentation to the Northeastern PA Chapter of the Sierra Club. March 1. Scranton, PA.

**Billy Samulak**  
**Assistant Professor**  
**Department of Biology and Chemistry**  
**Fitchburg State University**

**160 Pearl Street**  
**Fitchburg, MA 01420**  
**978-665-3625**  
**bsamulak@fitchburgstate.edu**

---

**EDUCATION:**

Ph.D., Chemistry, University of Michigan, May 2013  
Mentors: Philip C. Andrews, Janine R. Maddock, Hollis Showalter

M.S., Secondary Science Education, University of Michigan, December 2012

Preparing Future Faculty Seminar Participant: 2011

M.S., Chemistry, University of Michigan, 2009

B.S., Chemistry, University of Michigan – Flint, 2007

**EXPERIENCE:**

***Fitchburg State University, Department of Biology and Chemistry***  
***Assistant Professor, September 2014-Present***

Lectured, wrote exams and quizzes, designed laboratory activities, graded assignments for both small classes and large lectures (<80 students), designed independent, internally-funded research projects, mentored student research assistants, participated in university wide and departmental committees, advised students on careers and classes

***University of Michigan, Chemistry***  
***Post-doctoral Research Fellow, 2013-August 2014***

Performed externally funded research activities, mentored graduate and undergraduates students, wrote papers for peer-reviewed journals, attended national conferences

***University of Michigan, Center for Research on Learning and Teaching***  
***Practice Teaching Facilitator, 2011-Present***

Gave seminars in teaching techniques for new graduate student instructors, facilitated practice teaching sessions, offered suggestions for teaching improvement, provided instruction in incorporating active learning technologies into the classroom

***University of Michigan***  
***Graduate Student Instructor, 2007-2010***

Designed lesson plans, brief lectures, assignments, and quizzes; demonstrated laboratory techniques; edited, proctored, and graded exams; graded laboratory reports and assignments.

***University of Michigan***  
***Tutor, 2004, 2007-present***

Taught multiple students math and chemistry both for classes and pre-professional exams, including students with minor learning disabilities

**University of Michigan – Flint  
Supplemental Instructor, 2006-2007**

Prepared lesson plans, taught chemistry for nursing students, and graded assignments and papers

**University of Michigan - Flint  
Laboratory Assistant, 2004 - 2007**

Assisted and supervised students with laboratory work, graded laboratory notebooks, and mentored independent study students

**INTERNSHIPS:**

***National Institutes of Health, Bethesda, Maryland  
May 1, 2006 – August 25, 2006***

Advisor: Dr. Sonja Hess of The Proteomics and Mass Spectrometry Laboratory at The National Institute of Diabetes, Digestive and Kidney Diseases

Project: Analysis of glycated hemoglobin chains using HPLC and mass spectrometry

Result: Presented a poster at the Undergraduate Poster Session at NIH on August 3, 2006

***National Institutes of Health, Bethesda, Maryland  
May 15, 2005 – August 25, 2005***

Advisor: Dr. Sonja Hess of The Proteomics and Mass Spectrometry Laboratory at The National Institute of Diabetes, Digestive and Kidney Diseases

Project: Analysis of the human proteome using free flow electrophoresis and mass spectrometry

Result: Presented a poster at the Undergraduate Poster Session at NIH on August 4, 2005

**PATENTS:**

- B. Clifford-Nunn, H.D.H. Showalter, P.C. Andrews. Novel Class of Chemical Crosslinkers for High-Throughput Protein Complex Analysis

**PEER-REVIEWED PUBLICATIONS:**

- B.M. Samulak, S. Niu, P.C. Andrews, B.T. Ruotolo. Ion Mobility-Mass Spectrometry Analysis of Cross-Linked Intact Multiprotein Complexes: Enhanced Gas-phase Stabilities and Altered Dissociation Pathways. *Anal. Chem.* 2016, 88, 5290-5298.
- B. Clifford-Nunn, H.D.H. Showalter, P.C. Andrews. Quaternary Diamines as Mass Spectrometry Cleavable Crosslinkers for Protein Interactions. *JASMS* 2012, 23, 201-212.

**PRESENTATIONS & ABSTRACTS:**

- B. Samulak, P.C. Andrews, B.T. Ruotolo. Structural Analysis of Protein Complexes Using Integrated Crosslinking and Ion Mobility-Mass Spectrometry. In American Society for Mass Spectrometry, June 2014, Baltimore, MD.
- B. Clifford-Nunn, L. Han, Y. Zhong, P. Andrews, B. Ruotolo. Combined Crosslinking and Ion Mobility-Mass Spectrometry for Structural Analysis of Protein Complexes. In American Society for Mass Spectrometry, June 2013, St. Paul, MN.
- B. Clifford-Nunn, J. Maddock, P. Andrews. Crosslinking RNA and DNA with DC4: Reactivity of NHS Esters. In American Society for Mass Spectrometry, May 20-24, 2012, Vancouver, BC, Canada.
- B. Clifford-Nunn, J. Maddock, P. Andrews. Interaction Analysis of Ribosomal Particles Using the Mass Spectrometry Cleavable Crosslinker DC4. In Vaughan Symposium, July 28, 2011, University of Michigan, Ann Arbor, MI.

- B. Clifford-Nunn, J. Maddock, P. Andrews. Interaction Analysis of Ribosomal Particles Using the Mass Spectrometry Cleavable Crosslinker DC4. In American Society for Mass Spectrometry, June 5-9, 2011, Denver, CO.
- B. Clifford-Nunn, H. K. Kweon, P. C. Andrews. Crosslinking Reagents and Tags with Intrinsic Positive Charges for Protein Interactions. In Michigan Mass Spectrometry Discussion Group, 11 December 2010, Ann Arbor, MI
- B. Clifford-Nunn, J.R. Maddock, H.D.H Showalter, P. C. Andrews. A New Category of Protein Crosslinkers for Protein Complexes. In American Society for Mass Spectrometry, May 23-27, 2010, Protein Conformations and Chemical Crosslinking - 077, May 2009, Salt Lake City, UT.
- B. Clifford-Nunn, E. Simon, P. C. Andrews. MS Cleavable Crosslinker for Protein Interactions. In American Society for Mass Spectrometry, 2009, Protein Conformations II, 431, May 31- June 4, 2009, Philadelphia, PA.

#### **FACULTY LED STUDENT PROJECTS:**

- Summer 2015, Alex Serino and Barry Bouchard. SDS-PAGE Analysis and Determination of Kinetic Parameters for Crosslinked Aldolase.
- Fall 2016, Tim Brinkman and Duluc Huynh. Functional Enzymatic Analysis of crosslinked Aldolase. Presented at a department poster session with biology and chemistry students.
- Spring 2017. Tim Brinkman. Analysis of Crosslinked Proteins by SDS-PAGE. Presented at the Fitchburg State University Undergraduate Conference for Research and Creative Practice, April 2017.
- Spring 2017. Blake Phinney. Analysis of Crosslinked Proteins by Mass Spectrometry. Presented at the Fitchburg State University Undergraduate Conference for Research and Creative Practice, April 2017.
- Spring 2017. Mike McGrath. Functional Enzymatic Analysis of Crosslinked Aldolase and Alkaline Phosphatase.
- Spring 2017. Melanie Bauer. Designing Experiments for McKay Arts Academy Students.

#### **INTERNAL FUNDING:**

- 2017, Fitchburg State University Special Projects Grant, \$2163
- 2017, Fitchburg State University Continuing Scholarship funds - \$821
- 2016, Fitchburg State University Continuing Scholarship funds - \$800
- 2015, Fitchburg State University Continuing Scholarship funds - \$773

#### **AWARDS:**

- Fitchburg State University Advisor of the Year, 2016-2017
- Fitchburg State University Biology and Chemistry Club Co-Advisor of the Year 2014-2015
- Vaughan Symposium Poster Session Travel Award – 2011
- Rackham Travel Grants – 2009, 2010, 2011, 2012
- Maize & Blue Award – 2007
- Outstanding Graduating Chemistry Senior Award – 2007
- Freeman Chemistry Scholarship – 2006
- Freeman Honors Scholarship – 2006
- Honors Service Award
- McKinnon Scholarship – 2004, 2005, 2006
- Cyrus Farrahi Scholarship – 2004
- Outstanding Freshman Chemistry Student Award – 2004
- Michigan Scholar Award – 2003  
-Full Tuition and Fees to the University of Michigan – Flint
- Honors Program Scholarship

**INSTRUMENTATION:**

- Mass Spectrometry: ABI 4800 TOF-TOF, Thermo Scientific LTQ Orbitrap
- HPLC: Agilent with capillary pump
- Nuclear Magnetic Resonance Spectroscopy: Varian, Bruker
- Cary UV-Vis spectrophotometer
- FT-IR spectrophotometry
- Fluorometry

**AFFILIATIONS:**

- New England Association of Chemistry Teachers, 2016-Present
- American Chemical Society, 2004, 2007, 2014-Present
- American Society for Mass Spectrometry, 2008-2014
- University of Michigan – Flint Chemistry Club, 2003 – 2007
- Honors Student Council, 2003 – 2007

## THOMAS ALAN SCHOENFELD

### Current Appointments

December 1, 2017

Associate Professor of Biology, Fitchburg State University, Fitchburg, MA

### Contact information

Department of Biology and Chemistry, Fitchburg State University, Fitchburg, MA 01420  
978-665-4024; [tschoenf@fitchburgstate.edu](mailto:tschoenf@fitchburgstate.edu)

### Education

Lawrence University	B.A. conferred 1971 (Psychology, Premed)	1967-1971
Rutgers University	M.S. conferred 1973 (Psychobiology)	1971-1973
Rutgers University	Ph.D. conferred 1978 (Psychobiology)	1973-1978
U. Florida Coll. Medicine	Postdoctoral Research Fellow (Neuroscience)	1978-1980

### Professional Experience: Teaching (selected)

#### *A. Teaching positions*

Rutgers University	Adjunct Instructor in Psychobiology	1975
University of Florida	Adjunct Assist. Prof. of Psychobiology	1979-1980
U. Florida Coll. Medicine	Instructor/Lecturer in Neuroscience	1979-1982
UMass Medical School	Instructor in Medical Neuroanatomy lab	1986-2003
	Lecturer in Graduate Neuroscience	1999-2003
	Lecturer in Medical Neuroanatomy	2005
Clark University	Visiting Lecturer in Biology	1987-1988
	Assistant Professor of Psychology	1988-1995
	Adjunct Assistant Professor of Biology	1989-1995
	Director, Neuroscience Program	1992-1994
	Research Associate Professor of Psychology	1995-1998
Quinsigamond C. C.	Adjunct Instructor in Biology	1995-1997
		2006
Assumption College	Lecturer in Biology	1995-1997
		2005-2006
	Visiting Assistant Professor of Biology	1997-1998
		2006-2007
Fitchburg State University	Assistant Professor of Biology	2007-2011
	Associate Professor of Biology	2011-

#### *B. Courses taught (selected undergraduate and graduate; all include both lecture and lab)*

General Biology	General Physiology
Human Biology	Animal Physiology
A&P of Speech & Hearing	Neuroscience (UG/grad/med/vet)
Anatomy and Physiology I & II	Advanced Neuroscience
A&P I online	Psychobiology
Mammalian/Vertebrate Anatomy	Neuroanatomy (UG/grad/med/vet)



**Professional Experience: Research****A. Research positions**

U. Florida Coll. Medicine	Assistant Research Scientist in Neuroscience	1980-1982
Worcester Foundation for Biomedical Research	Research Associate in Neurobiology Senior Research Associate in Neurobiology	1982-1986 1986-1988
	Foundation Scholar	1995-1998
UMass Medical School	Research Associate Professor of Physiology	1998-2008

**B. Current scholarly interests**

- The terrestrial vertebrate nose as a gas chromatograph: How smelling is like seeing
- Persistent birth and long-term survival of new olfactory receptor neurons from stem cells in the adult nose: When rodents are like lobsters
- Dissecting public science: Science journalism for the non-scientist
- Inverting the Anatomy and Physiology classroom

**Honors and Awards**

Edwin E. Aldrin Research Fellowship, New Jersey Dept. Higher Education. Research conducted at Rutgers University.	1974
Predocutorial Fellowship (National Research Service Award), National Institute of Mental Health no. 05403: "Limbic System, Ingestion, Nutrition, Development." Research conducted at Rutgers University.	1974-1977
Sigma Xi (scientific honor society)	1976
Postdoctoral Fellowship (National Research Service Award), National Institute of Mental Health no. 05403: "Functional Maturation of Neural Connections." Research conducted at University of Florida College of Medicine.	1978-1980

**Professional Associations**

Association for Chemoreception Sciences  
New York Academy of Sciences

**Grants (extramural)**

Research grant, National Science Foundation no. BNS-7924680: "Postnatal Development of the Olfactory System" (U. Florida Coll. Medicine; T.A. Schoenfeld and C.M. Leonard, Co-Principal Investigators). \$78,765 total costs for 2 years.	1980-1982
Site grant, Research Experiences for Undergraduates (REU) program, National Science Foundation no. BBS-9100475: "Bio-Psycho-Sociocultural Aspects of Behavior" (Clark University; S. Wapner, P.I., T.A. Schoenfeld and J.V. Wertsch, co-P.I.'s, 13 faculty associates). \$38,816 total costs for 1 year to support the summer 1991 research of 10 undergraduate students.	1991
Research grant, Academic Research Enhancement Award, National Institutes of Health no. 1 R15 DC02661-01: "Rhinotomy as an Organizational Principle in Olfaction." (Clark University, T.A. Schoenfeld, P.I.). \$99,847 total costs for 3 years.	1995-1998
Research grant, National Institutes of Health no. 1 R01 DC03835-05: "Spatial Organization of the Olfactory System." (UMass Medical School, T.A. Schoenfeld, P.I.). \$1,003,683 total costs for 5 years.	1998-2003

**Selected Publications (of more than 25)**

- Schoenfeld, T.A. & Hamilton, L.W. (1976). Multiple factors in the short-term behavioral control of protein intake in rats. Journal of Comparative and Physiological Psychology, 90, 1092-1104.
- Corwin, J.V., Leonard, C.M., Schoenfeld, T.A., & Crandall, J.E. (1983). Anatomical evidence for differential rates of maturation of the medial dorsal nucleus projections to prefrontal cortex in rats. Developmental Brain Research, 8, 89-100.
- Schoenfeld, T.A., & Macrides, F. (1984). Topographic organization of connections between the main olfactory bulb and pars externa of the anterior olfactory nucleus in the hamster. Journal of Comparative Neurology, 227, 121-135.
- Schoenfeld, T.A., Marchand, J.E., & Macrides, F. (1985). Topographic organization of tufted cell axonal projections in the hamster main olfactory bulb: An intrabulbar associational system. Journal of Comparative Neurology, 235, 503-518.
- Schoenfeld, T.A. & Corwin, J.V. (1985). Maturation of olfactory exploration in golden hamsters. Developmental Psychobiology, 18, 515-528.
- Schoenfeld, T.A. & Leonard, C.M. (1985). Behavioral development in the Syrian golden hamster. In H.I. Siegel (Ed.), The Hamster: Reproduction and Behavior. New York: Plenum Press.
- Macrides, F., Schoenfeld, T.A., Clancy, A.N., Kumar, M.S.A., & Kream, R.M. (1987). Hormones and neurotransmitters in the mammalian olfactory system. Annals of the New York Academy of Sciences, 519, 150-164.
- Schoenfeld, T.A., McKerracher, L., Obar, R., & Vallee, R.B. (1989). MAP 1A and MAP 1B are structurally related microtubule associated proteins with distinct developmental patterns in the CNS. Journal of Neuroscience, 9, 1712-1730.
- Schoenfeld, T. A. (1991). Biology and homosexuality. Science, 254, 630.
- Schoenfeld, T. A., Clancy, A., Forbes, W., & Macrides, F. (1994). The spatial organization of the peripheral olfactory system of the hamster: Part I: Receptor neuron projections to the main olfactory bulb. Brain Research Bulletin, 34, 183-210.
- Clancy, A., Schoenfeld, T. A., Forbes, W., & Macrides, F. (1994). The spatial organization of the peripheral olfactory system of the hamster: Part II: Receptor surfaces and odorant passageways within the nasal cavity. Brain Research Bulletin, 34, 211-241.
- Schoenfeld, T. A., & Obar, R. A. (1994). Diverse distribution and function of fibrous microtubule-associated proteins in the nervous system. International Review of Cytology, 151, 67-137.
- Schoenfeld, T. A., & Knott, T. K. (2002). NADPH diaphorase activity in olfactory receptor neurons and their axons conforms to a rhinotopically-distinct dorsal zone of the hamster nasal cavity and main olfactory bulb. Journal of Chemical Neuroanatomy, 24, 269-285.
- Schoenfeld, T. A., & Knott, T. K. (2004) Evidence for the disproportionate mapping of olfactory airspace onto the main olfactory bulb of the hamster. Journal of Comparative Neurology, 476, 186-201.
- Schoenfeld, T. A., & Cleland, T. (2005). The anatomical logic of smell. Trends in Neurosciences, 28, 620-627.
- Schoenfeld, T.A., guest editor (2006). Introduction. Special Issue: What's in a Sniff? The Contributions of Odorant Sampling to Olfaction. Chemical Senses, 31, 91-92.
- Schoenfeld, T. A., & Cleland, T.A. (2006). Anatomical contributions to odorant sampling and representation in rodents: Zoning in on sniffing behavior. Chemical Senses, 31, 131-144.

**Talks Given (recent, selected)**

- “What the Nose Knows, How the Nose Survives.” Winter Respite Meeting of ALFA (Adult Learning in the Fitchburg Area), Fall 2008. Invited by Assoc. VPAA Shirley Wagner.
- “Three Years in the Classroom with Clickers: In Search of Best Practices.” 71<sup>st</sup> annual conference of New England Association of Chemistry Teachers (NEACT), Fitchburg State College, Summer 2010. Invited by Prof. Mel Govindan and NEACT organizers.
- “Classroom Response Systems, aka Clickers.” Summer Institute VII, Center for Teaching and Learning, Fitchburg State University, Summer 2011.
- “The Well-Wired Professor.” Summer Institute VII, Center for Teaching and Learning, Fitchburg State University, Summer 2011.
- “Inverting the A&P Classroom: A Progress Report.” 6<sup>th</sup> Annual Meeting of New England Biology Association of Two-Year Colleges, Massasoit CC, Summer 2012.
- “Inverting the A&P Classroom: What Not to Do.” 2013 Academic Affairs Summer Meeting, Baltimore, MD, American Association of State Colleges and Universities (AASCU), invited by Provost Robin Bowen.
- “Inverting the A&P Classroom: What Not to Do.” FSU Speakers Series, Fall 2013.

**Professional Service (selected)**

Served on Departmental and University-wide committees at Fitchburg State University:

*Equipment & Facilities Committee, Molecular Biology Search Committee, several Anatomy & Physiology Search Committees, Assessment Committee, Curriculum Committee, several Personnel Evaluation Committees (Dept. of Biology & Chemistry); Technology Advisory Committee, Animal Care Committee/IACUC (University-wide)*

Served as grant proposal peer reviewer for:

*National Science Foundation* (programs in Sensory Physiology and Perception, Integrative Neural Systems, Frontiers in Integrative Biological Research, etc.)  
*National Institutes of Health* (Integrative, Functional, and Cognitive Neuroscience IRG; NIMH Special Emphasis Panel for Behavioral and Neurosciences)

*Israel Science Foundation*

*Agence Nationale de la Recherche (France)*

Served as journal manuscript peer reviewer for:

*Physiology and Behavior, Experimental Neurology, Neuroscience, Brain Research Bulletin, Chemical Senses, Journal of Neuroscience, Developmental Brain Research, Behavioural Processes, Journal of Comparative Neurology, Journal of Neurobiology*

Served as book manuscript peer reviewer for:

*Brooks-Cole, MIT Press, Basil Blackwell*

Organized a professional meeting symposium:

*"Spatial Coding in Olfaction: Molecules to Behavior," (co-chair with L. Buck, 2004 Nobel laureate), at the annual Spring 1994 meeting of the Association for Chemoreception Sciences (AChemS) in Sarasota, FL.*

Organized and guest-edited a journal issue devoted to a special topic:

*"What's in a Sniff? ", with 8 contributing authors covering the fluid dynamics, physiology and behavior of odor sampling in both invertebrate and vertebrate models, in Chemical Senses, 2006, 31.*

Organized a one-day on-campus conference for MA state colleges and universities:

*titled "ClickerFest 2008," with participants invited to share their experiences with Classroom Response Systems (aka "clickers") at their institutions. Took place May 21, 2008, with ~75 attendees. Supported with funds from my Innovation Grant and the Technology Advisory Committee.*

**Daniel P. Welsh**  
Fitchburg State University  
Department of Biology & Chemistry  
Antonucci Science Complex, Room 233  
Fitchburg, MA 01420  
(845) 480-2159  
dwelsh3@fitchburgstate.edu  
[danielwelsh.weebly.com](http://danielwelsh.weebly.com)

---

## ***EDUCATION***

**Ph. D in Biology**, August 2013

University of Illinois at Urbana-Champaign, Champaign, IL

*Dissertation Title:* Local Adaptation in the Blackstripe Topminnow, *Fundulus notatus*

*Adviser:* Rebecca C. Fuller

GPA: 4.00/4.00

**M.S. in Biology**, December 2007

Bowling Green State University, Bowling Green, OH

*Thesis title:* Examination of a Life History Characteristic: Initiation of Spawning in Smallmouth Bass

*Co-advisers:* Jeffrey G. Miner and Daniel D. Wiegmann

GPA: 4.00/4.00

**B.S. in Biology, Minor in Chemistry**, May 2004

St. Thomas Aquinas College, Sparkill, NY

- Graduated Magna Cum Laude
- Honors Program
- Dean's List for academic achievement for 7 semesters

GPA: 3.79/4.00

## ***TEACHING EXPERIENCE***

**Assistant Professor**, Fitchburg State University, September 2013- Present

- Enhanced student learning through the development of assignments and assessment tools
- Utilized active learning to engage students in topics
- Evaluated students through lab reports, quizzes, projects, and in-class activities
- Instructed 510 college students during 8 semesters of classroom teaching

**Introductory & Non-majors Courses:** Anatomy and Physiology I (lecture and lab), Anatomy and Physiology II (lecture and lab), General Biology II (lab)

**Advanced/Majors Courses:** Animal Behavior (lecture and lab), Evolution (lecture), Ichthyology (lecture)

**Teaching Assistant**, University of Illinois at Urbana-Champaign, August 2007- May 2013

- Enhanced student learning through the development of assignments and assessment tools
- Utilized active learning to engage students in topics
- Evaluated students through lab reports, quizzes, projects, and in-class activities
- Gained classroom experience teaching course sections in laboratory, discussion, and field settings
- Received excellent student evaluations
- Instructed 230 college students during 12 semesters of classroom teaching

**Introductory Course:** Organismal and Evolutionary Biology

**Advanced Courses:** Structure and Function of Plants and Animals, Ichthyology, Limnology

**Special Sections Taught:**

Merit Program for Emerging Scholars: Structure and Function (3 semesters), Organismal and Evolutionary Biology (1 semester)

-This program encourages the retention of students in the sciences from typically underrepresented backgrounds, including ethnic minorities, women, and individuals from small high schools

Access and Achievement Program: Organismal and Evolutionary Biology (1 semester)

-This program provides a supportive learning environment and academic support to encourage participation in sciences for students from small high schools and underrepresented backgrounds

**Guest Lectures**

“Muscles and Movement”, University of Illinois at Urbana-Champaign, 2013

-Designed and presented a 50 minute lecture to a 150 students, lower-level Anatomy and Physiology majors course

“Circulatory System”, University of Illinois at Urbana-Champaign, 2011

-Designed and presented a 50 minute lecture to a 160 student, lower-level Anatomy and Physiology majors course

“Sex Hormones”, University of Illinois at Urbana-Champaign, 2010

-Designed and presented a 50 minute lecture to a 120 student, lower-level Anatomy and Physiology majors course

“Hearing and Equilibrium”, University of Illinois at Urbana-Champaign, 2008

-Designed and presented a 50 minute lecture to a 150 student, lower-level Anatomy and Physiology majors course

**Course Development**

- Devised and implemented 4 new procedures for the laboratory portion of the Structure and Function course by creating procedures, producing data tables, amending introductory material, and trouble-shooting methodological problems
- Revised 5 procedures for the laboratory portion of the Structure and Function course by constructing questions, clarifying procedures, and editing introductory material

- Created new laboratory manual for Ichthyology course that reflected recent taxonomic organization and ecological research of freshwater fish

**Teaching Assistant**, Bowling Green State University, September 2006- December 2006,  
September 2004- May 2005

- Enhanced student learning through the development of assignments and assessment tools
- Evaluated students through hands-on lab practicals
- Instructed 160 college students during 3 semesters of classroom teaching

**Advanced Course:** Human Anatomy and Physiology

## ***TEACHING AWARDS AND HONORS***

**Heiligenstein Outstanding Teaching Assistant Award**, University of Illinois at Urbana-Champaign, 2009-2010

**“List of Teachers Rated Excellent by their Students”**, University of Illinois at Urbana-Champaign

Spring 2013, Fall 2012, Spring 2012, Fall 2011, Spring 2010, Fall 2009, Spring 2009, Fall 2008, Spring 2008

**Teacher Scholar Certificate & Graduate Teaching Certificate**, University of Illinois at Urbana-Champaign, 2009, 2013

- Completed a voluntary teaching enrichment program through the Center for Teaching Excellence
- Explored pedagogy in a structured, discipline-based process
- Developed a deeper understanding of the scholarly duties required in an academic position
- Learned to develop teaching skills and reflective practices through workshops and one-on-one interactions with a teaching consultant

## ***RESEARCH EXPERIENCE***

**Undergraduate Student Research Mentor**, Fitchburg State University, 2013-Present

- Advised 8 undergraduate students and 2 graduate students throughout all steps of an Independent Study (independent, field-based research projects) related to ecology, evolution, behavior and/or natural history of freshwater fish
- Engaged 3 additional undergraduate students (not pursuing Independent Studies) in research by involving them in smaller aspects of larger research projects (such as experimental design, data collection, and/or analysis)

**Doctoral Researcher**, University of Illinois at Urbana Champaign, 2007-2013

- Utilized field-based methods to study morphological and survival differences between lake and stream populations

- Designed a laboratory-based breeding experiment to explore the genetic and environmental components of body shape variation in response to water velocity

**Environmental Assessment Research Assistant**, Bowling Green State University, January 2007- July 2007, May 2005- August 2006

- Assigned species identification to larval and adult fish specimens
- Collected samples and environmental data from field sites

**Undergraduate Student Research Mentor**, University of Illinois at Urbana-Champaign, 2012

- Guided 1 undergraduate student throughout all steps of an independent, field-based research project to explore over-winter survival in a freshwater fish

**Undergraduate Student Research Assistant Adviser**, University of Illinois at Urbana-Champaign, 2008-2013

- Engaged 17 undergraduate students in the scientific research process through involvement in experiment design, sample collection, and data analysis

## **GRANTS**

- 2016: (\$240,000): Student-Faculty Collaborative Summer Research Experience Program (co-PI with 7 faculty), **Balfour Foundation**
- 2016: (\$800): Special Projects Grant, **Fitchburg State University**
- 2015: (\$700): Special Projects Travel Grant, **Fitchburg State University.**
- 2014: (\$700): Ruth Butler Grant, **Fitchburg State University.**
- 2014: (\$490): Special Projects Grant, **Fitchburg State University.**
- 2014: (\$877): Faculty Continuing Scholarship Funds, **Fitchburg State University.**
- 2012: (\$14,726): Doctoral Dissertation Improvement Grant, **National Science Foundation.**  
Local adaptation to lakes and streams in the blackstripe topminnow, *Fundulus notatus*.
- 2011 (\$750): Frances and Harlie Clark Research Support Grant, **University of Illinois at Urbana-Champaign.** Influence of genetics and environment on body size/shape.
- 2010 (\$1000): Odum-Kendeigh Research Award, **University of Illinois at Urbana-Champaign.** What Influences Body Shape in the Fundulidae Family?
- 2010 (\$500): Francis and Harlie Clark Research Support Grant, **University of Illinois at Urbana-Champaign.** What Influences Body Shape in the Fundulidae Family?
- 2010 (\$250): Conference Travel Grant, **University of Illinois at Urbana-Champaign.** What Influences Body Shape in the Fundulidae Family?
- 2008 (\$1000): Odum-Kendeigh Research Award, **University of Illinois at Urbana-Champaign.** Examination of Multimodality in Mating Cues of the Bluefin Killifish, *Lucania goodei*.

## **PUBLICATIONS**

- D. P. Welsh**, D. D. Wiegmann, L. M. Angeloni, S. P. Newman, J. G. Miner, and J. R. Baylis.  
2017. Condition-dependent reproductive tactics in male smallmouth bass: evidence of an inconsistent birthdate effect on early growth and age at first reproduction. *Journal of Zoology* 302: 244-251. DOI: 10.1111/jzo.12454

**D. P. Welsh** and R. C. Fuller. 2015. Size and shape of anal and dorsal fins in the blackstripe topminnow, *Fundulus notatus*. *Journal of Fish Biology* 86: 217–227.  
DOI: 10.1111/jfb.12564

**Daniel P. Welsh**, Muchu Zhou, Steven M. Mussmann, Lauren G. Fields, Claire L. Thomas, Simon P. Pearish, Stephanie L. Kilburn, Jerrod L. Parker, Laura R. Stein, Jennifer A. Bartlett, Christopher R. Bertram, Thomas J. Bland, Kate L. Laskowski, Brett C. Mommer, Xuan Zhuang, and Rebecca C. Fuller. 2013. The effects of age, sex, and habitat on body size and shape of the blackstripe topminnow, *Fundulus notatus*. *Biological Journal of the Linnean Society* 108:784-789.

**Welsh, D. P.** and R. C. Fuller. 2011. Where to place your eggs: the effects of conspecific eggs and water depth on oviposition decisions in bluefin killifish. *Journal of Zoology* 284:192-197. DOI: 10.1111/j.1469-7998.2011.00793.x

### **PRESENTATIONS** (student author underlined)

“Residual Anal Sheath Length Differences Related to Current and Spawning Habitat”. Poster Presentation. Fitchburg State Undergraduate Research Conference. Presented with Erica Boucher

“Effects of Leaf Litter on Eastern Red-backed Salamander Movement”. Poster Presentation. Twenty-Second Annual Massachusetts Statewide Undergraduate Research Conference. Presented with Ayla Sheridan.

“Effects of Leaf Litter on Eastern Red-backed Salamander Movement”. Poster Presentation. Fitchburg State Undergraduate Research Conference. Presented with Ayla Sheridan.

“Size and shape of anal and dorsal fins in the blackstripe topminnow, *Fundulus notatus*”. Poster Presentation. Ecological Society of America. 2015.

“Influence of Salinity on Growth Rate of Blacknose Dace (*Rhinichthys atratulus*)”. Poster Presentation. Fitchburg State Undergraduate Research Conference. 2015. Presented with Michael Leva

“Size and shape of anal and dorsal fins in the blackstripe topminnow, *Fundulus notatus*”. Poster Presentation. Evolution. 2014.

“A Diet Analysis Between River and Pond Dwelling Bluegill Sunfish (*Lepomis macrochirus*)”. Poster Presentation. Fitchburg State Undergraduate Research Conference. 2014. Presented with Charly Alvarez and Dr. John Ludlam.

“Is there evidence for local adaptation to lakes and streams? A study using the blackstripe topminnow, *Fundulus notatus*”. Oral Presentation. Ecological Society of America. 2012.

“Where to Place Your Eggs: the Effects of Conspecific Eggs and Water Depth on Oviposition Decisions in Bluefin Killifish”. Poster Presentation. American Fisheries Society Student Colloquium, 2012.

“Where to Place Your Eggs: the Effects of Conspecific Eggs and Water Depth on Oviposition Decisions in Bluefin Killifish”. Poster Presentation. Animal Behavior Society Conference, 2011.

“What Determines Body Shape? Influence of Sex, Habitat, and Phylogeny in a Family of Fish”.



- Oral Presentation. Midwest Ecology and Evolution Conference, Southern Illinois University Carbondale, 2011.
- “What Determines Body Shape? Influence of Sex, Habitat, and Phylogeny in a Family of Fish”. Oral Presentation. 13<sup>th</sup> Annual Graduate Student Symposium, University of Illinois at Urbana-Champaign, 2011.
- “What Determines Body Shape? Insights from a Family of Fish”. Oral Presentation. Ecological Society of America, 2010.
- “What Determines Body Shape? Influence of Environment in the Fundulidae Family of Fish”. Oral Presentation. Midwest Ecology and Evolution Conference, Iowa State University, 2010.
- “What Determines Body Shape? Influence of Environment in the Fundulidae Family of Fish”. Oral Presentation. 12<sup>th</sup> Annual Graduate Student Symposium, University of Illinois at Urbana-Champaign, 2010.
- “Genetic Component of a Life History Characteristic: Initiation of Spawning in Smallmouth Bass”. Poster Presentation. Midwest Ecology and Evolution Conference, Kent, OH, 2007.
- “Genetic Component of a Life History Characteristic: Initiation of Spawning in Smallmouth Bass”. Poster Presentation. Bowling Green State University Biology Department Research Retreat, Bowling Green, OH, 2007.
- “Genetic Component of a Life History Characteristic: Initiation of Spawning in Smallmouth Bass”. Poster Presentation. Midwest Ecology and Evolution Conference, St. Louis, MO, 2006.
- “Genetic Component of a Life History Characteristic: Initiation of Spawning in Smallmouth Bass”. Poster Presentation. Bowling Green State University Biology Department Research Retreat, Bowling Green, OH, 2005

## ***SERVICE***

**Reviewer**, *Behavioral Ecology and Sociobiology*, *Biological Journal of the Linnean Society*, *Journal of Environmental Informatics*, *Journal of Zoology*, *Ecology and Evolution*.

**Hamilton Award Judge**, *Evolution* 2014, Raleigh, NC, 2014

- Judged presentations for the prestigious Hamilton Award at the Society for the Study of Evolution’s annual conference

**Mentor**, Merit Program, University of Illinois at Urbana-Champaign, 2012

- Provided advice, suggestions, and feedback on teaching methods and ideas to a new Merit teaching assistant

**Treasurer/Vice President**, Graduate Students in Ecology and Evolutionary Biology, University of Illinois at Urbana-Champaign, 2010-2011

- Maintained the financial records of the organization
- Assisted President in organizing and coordinating organization’s activities

**Award/Grant Coordinator**, Department of Animal Biology, University of Illinois at Urbana-Champaign, 2010-2011

- Provided details and deadlines about grant opportunities for graduate students

- Updated and maintained master file of grant opportunities

**Collaborator (#2013)**, FishBase, [www.fishbase.org](http://www.fishbase.org), 2009-Present

- Provided digital images and data for 6 species entries

**Poster Judge**, Midwest Ecology and Evolution Conference, Carbondale, IL, 2005

- Assessed poster presentation on scientific content and aesthetic value

## ***COMMITTEES***

**Institutional Animal Care and Use Committee (IACUC)**, Fitchburg State University, 2014-Present (Vice Chair, 2015-Present)

- Reviewed policies related to the ethical treatment of vertebrate animals in research

**Assessment Committee**, Department of Biology and Chemistry, Fitchburg State University, 2013-2017 (Co-chair 2016-Present)

- Assessed educational performance of majors throughout the department

**Student Affairs Committee**, Department of Biology and Chemistry, Fitchburg State University, 2016-Present (Chair 2016-Present)

- Developed student handbook for Biology and Chemistry majors
- Responsible for choosing awardees for student awards

**Academic Policies Committee**, Fitchburg State University, 2013-Present

- deliberates on and makes recommendations to the university concerning matters such as the academic calendar, academic standards, admissions standards, policies governing selective retention, and library services

**Sustainability Advisory Committee**, Fitchburg State University, 2013-2014

- Deliberated on policy recommendations regarding campus-wide sustainability efforts

**Technology Advisory Committee**, Fitchburg State University, 2013-Present

- Reviewed and recommended advancements in technology on campus

**Curriculum Committee**, Department of Biology and Chemistry, Fitchburg State University, 2013-2016

- Provided feedback and input on department-wise course implementation

**Publicity Coordinator**, Annual Graduate Student Symposium, University of Illinois at Urbana-Champaign, 2008-2010

- Delivered information about symposium to students and faculty in various departments
- Created and distributed paper fliers and e-mail announcements
- Coordinated submission of presentation Abstracts

**Evolution/Ecology Reading Group Organizer**, University of Illinois at Urbana-Champaign, 2008-Present

- Voluntarily created and directed 5 semester-long graduate student scientific book/paper discussions

**Graduate Student Handbook Committee**, Biology Graduate Student Association, Bowling Green State University, Bowling Green, OH, 2004

- Assisted in creation of graduate student handbook for incoming graduate students

**Candidate Search Committee** St. Thomas Aquinas College, Sparkill, NY, 2002

- Evaluated undergraduate Chemistry professor job candidates

### ***OUTREACH***

**Judge**, Education Contest, **North South Foundation**, 2014-Present

- Judged the essays of over 150 middle and high school students

**Judge**, Earth Day Contest, **American Chemical Society**, 2014

- Judged poems of over 100 elementary and middle school students

**Science Mentor**, Plantingscience.org, Spring 2014, Fall 2011

- Assisted four science classes (2 high school, 2 middle school) in conducting inquiry-based science projects studying plant germination and growth through online mentoring

**Fishes of Boneyard Creek**, Boneyard Creek Community, 2013

- Designed and implemented an educational booth with the purposes of introducing participants to the native fishes found in Boneyard Creek

**Native Fishes of Illinois**, Champaign County Forest Preserve District, 2012

- Designed and implemented an outreach “booth” with the purpose of teaching guests about the native fishes of Illinois
- Created information sheets and brochures

**“Take Me Fishing”**, Champaign County Forest Preserve, 2010-2011, 2013

- Aided adult and child participants with information on fish species
- Assisted participants with fishing technique

**Science Night**, Hall Elementary School, 2012

- Assisted in the implementation of an outreach activity designed to introduce elementary students to the structure and function of cells

**Orpheum Children Science Museum**, 2012

- Developed a learning station to teach elementary school children about native fishes

**AgDiscovery Program**, U. S. Department of Agriculture, 2012

- Led an activity to educate high school students about the native fishes of Illinois

**Farmer's Market Outreach Booth**, Graduate Students in Ecology and Evolutionary Biology, 2010-2011.

- Introduced general public to some of the local Illinois natural history
- Informed general public about roles of insects in agriculture

**“Migration Fest”**, Champaign County Forest Preserve, 2009-2012

- Aided adult and child participants with information on educational activities
- Assisted hiking tour leaders with organization and equipment
- Provided adult and child participants with educational information about birds

### ***PROFESSIONAL MEMBERSHIPS***

<b>Society for the Study of Evolution</b>	<i>2008- Present</i>
<b>Ecological Society of America</b>	<i>2010- Present</i>
<b>American Society of Ichthyologists and Herpetologists</b>	<i>2011-Present</i>
<b>Sigma Xi</b>	<i>2010- Present</i>
<b>Society for Comparative and Integrative Biology</b>	<i>2010- Present</i>
<b>North American Native Fishes Association</b>	<i>2012- Present</i>
<b>Phi Kappa Phi Honor Society</b>	<i>2005- Present</i>
<b>Alpha Chi Honor Society</b>	<i>2003- Present</i>

### ***ADDITIONAL RELEVANT WORK EXPERIENCE***

**Chemistry Laboratory Assistant**, Saint Thomas Aquinas College, July 2001- May 2003

- Prepared chemical solutions for laboratory classes
- Maintained order and cleanliness of laboratory
- Assisted college students with laboratory activities

**Veterinary Assistant**, County Animal Hospital, September 1999- January 2001

- Aided veterinarian in the treatment of animals
- Sustained diet and cleanliness of stay-over patients

**Animal Caretaker**, Outragehiss Pets Inc., June 1997- October 1997

- Handled variety of exotic animals
- Maintained animal health and living areas

### ***SKILLS***

#### Research Related:

- Genetic Procedures: DNA Extraction, Polymerase Chain Reaction (PCR)
- Fish Aging using scales
- Fish Otolith Removal
- Scuba Schools International **Open Water SCUBA** certified
- The Ohio State University **Larval Fish Identification Workshop**

#### Safety:

- Red Cross **CPR** Certification

Red Cross **First Aid** Certification  
Ohio Department of Natural Resources **Boating Education** Course

Computer:

MS Word, Excel, and PowerPoint  
SAS and MINITAB Statistical Software  
ImageJ Imaging Software  
Geometric Morphometric Software

# Eric Williams

## Curriculum Vitae

179 Mill Street  
Groton, Ma 01450

☎ (607) 351 2831

✉ ewilli28@fitchburgstate.edu

### Education

2003–2009 **Doctor of Philosophy**, *Neurobiology & Behavior*, Cornell University.  
Minor in Pharmacology

1995–1999 **Bachelor of Arts**, *Genetics & Developmental Biology*, Cornell University.

### Teaching Experience

Fall 2017–Present **Assistant Professor**, *Fitchburg State University*.

Fall 2015 & **Instructor**, *Cancer Biology*, Bio360, *Suffolk University*.

Fall 2016 Designed this new course offering.

Spring 2015 **Instructor**, *Writing for Research*, Bio302, *Suffolk University*.

Summer 2014 **Teaching Certificate Program**, *Massachusetts Institute of Technology*.

Spring 2013 & **Instructor**, *Epigenetic Regulation of Stem Cells*, Course 7.344, *Massachusetts Institute of Technology*.

Created the curriculum for this class

2013–2017 **Curriculum Development**, *Massachusetts Biotechnology Education Foundation*.

Designed laboratory experiments to be performed by high school students

Fall 2006 **Teaching Assistant**, *Introduction to Computational Neuroscience*, Cornell University.

Spring 2006 **Teaching Assistant**, *Introduction to Molecular & Cellular Neuroscience*, Cornell University.

### Fellowships & Awards

2011–2014 **American Cancer Society Postdoctoral Fellowship Award**, *The role of Sirt1 in Oncogenesis and Tumor Suppression in Skin Cancer*, Grant # PF-11-258-1-TBG.

March 2013 **Koch Institute Image Awards**, *On the Scent*.

<http://video.mit.edu/watch/on-the-scent-2013-image-award-winner-13987>

July 2011 **Ruth L. Kirschstein National Service Award for Postdoctoral Fellows (F32 NRSA)**, *The role of Sirtuin1 in Skin Cancer*, Grant # 1F32 CA162606-01, Score:21.  
*Awarded but not accepted*

2007–2008 **Cellular and Molecular Mechanisms of Behavior Training Grant**

2005–2006 **NIMH Integrative Training Grant**

### Research Mentoring

#### Suffolk University

Fall 2016 Sierra Anderson

Summer 2015 Gabriel Ochonski

## Massachusetts Institute of Technology

2012–2014 Amy Taylor

2011–2012 Rachelle Lim

## Cornell University

2009–2010 Adam Bisogni

2006–2008 Leslie Lee

2006–2009 Mitsu Yoshida

2005–2008 Katherine Hinchcliff

## High School Students

Summer 2015 Daniel Kim

Summer 2006 Berrak Kocaoglu

---

## Research Experience

2015–2017 **Research Scientist**, *Biology*, Massachusetts Institute of Technology, Cambridge, MA, *A. C. elegans* drug discovery platform for dysferlin-based Muscular Dystrophies.

2010–2015 **Postdoctoral Fellow**, *Biology*, Massachusetts Institute of Technology, Cambridge, MA, *Sirtuins in Cancer, Stem Cells & Aging*.

2003–2009 **Doctoral Thesis**, *Neurobiology and Behavior*, Cornell University, Ithaca, NY, *Axon guidance in the olfactory system*.

2001–2003 **Research Technician**, *PI: Davide Trotti*, Massachusetts General Hospital, Charlestown, MA, *Excitotoxicity and Amyotrophic Lateral Sclerosis*.

1999–2001 **Research Technician**, *PI: Jing Zhou*, Brigham & Women's Hospital, Boston, MA, *Polycystins and Polycystic Kidney Disease*.

1999 **Technician Assistant**, *Transcription Division*, Cereon Genomics, Cambridge, MA.

---

## Community Outreach

### Educational

January 2015 **Lab Instructor at Diman Regional Vocational Technical High School**

February 2014 **Lexington Massachusetts High School Science Fair Judge**

September 2013 **Teaching Assistant for Massachusetts Biotech and Beyond Workshop**

February 2014 & **Teaching Assistant for Massachusetts Biotech Teacher Professional**  
March 2014 **Development Workshop Series**

### Cancer

2011–2014 **Cancer Action Network New England Annual Breakfast**

January 2013 **Cancer Action Network Fund the Next Discovery**

March 2012 **American Cancer Society Hope on the Slopes**

### Social Justice

2013–Present **Community Group for Social Justice**

June 2014 **Metro Boston Race Amity Festival Volunteer**

Summer 2013 **White People Challenging Racism Class**, Cambridge Center for Adult Education

---

## Publications

- Stem Cells Williams EO, Taylor AK, Bell EL, Lim R, Guarente LP. Sirtuin 1 Promotes Deacetylation of Oct4 and Maintenance of Naive Pluripotency **Cell Reports** 2016 Oct;17(3): 809-820. PMID: 27732856
- Vascular Aging Das A, Huang GX, Longchamp A, Kim L, Li C, Osborne B, Joshi S, Kang M, Huang T, Lee B, Williams EO, Igarashi M, Mitchell J, Wu LE, Turner N, Arany Z, Guarente LP, Sinclair DA. Impairment of an endothelial NAD<sup>+</sup>-H<sub>2</sub>S signaling network is a reversible cause of vascular aging **Cell -In Review**
- Stem Cells Bell EL, Nagamori I, Williams EO, Rosario AD, Bryson BD, Watson N, White FM, Sassone-Corsi P, Guarente L. SirT1 is required in the male germ cell for differentiation and fecundity. **Development** 2014 Sep;141(18):3495-504. PMID: 25142464
- Cancer Simic P, Williams EO, Bell EL, Gong JJ, Bonkowski M, Guarente L. SIRT1 Suppresses the Epithelial-to- Mesenchymal Transition in Cancer Metastasis and Organ Fibrosis. **Cell Reports** 2013 Apr 25;3(4): 1175-86. PMID: 23583181
- Axon Guidance Williams EO, Sickles HM, Dooley AL, Palumbos S, Bisogni AJ, Lin DM. Delta Protocadherin 10 is regulated by activity in the mouse main olfactory system. **Front Neural Circuits** 2011;5:9 Aug 23. PMID: 21897809
- Neuromuscular Disease Boston-Howes W\*, Williams EO\*, Bogush A, Scolere M, Pasinelli P, Trotti D. Nordihydroguaiaretic acid increases glutamate uptake in vitro and in vivo: therapeutic implications for amyotrophic lateral sclerosis. **Experimental Neurology** 2008 Sep; 213(1):229-37 PMID: 18625223 \*co-first authors
- Axon Guidance Williams EO, Xia Y, Sickles HM, Shafer P, Yona G, Yang JY, Lin DM. Novel subdomains of the mouse olfactory bulb defined by molecular heterogeneity in the nascent external plexiform and glomerular layers. **BMC Developmental Biology** 2007 May 16;7:48. PMID: 17506891
- Microarray Technology Moran-Mirabel JM, Tan CP, Orth RN, Williams EO, Craighead HG, Lin DM. Controlling microarray spot morphology with polymer liftoff arrays. **Analytical Chemistry** 2007 Feb 1;79(3) 1109-14 PMID: 17263343
- Neuromuscular Disease Boston-Howes W, Gibb SL, Williams EO, Pasinelli P, Brown RH Jr, Trotti D. Caspase-3 cleaves and inactivates the glutamate transporter EAAT2. **Journal of Biological Chemistry** 2006 May 19;281(20):14076-84. PMID: 16567804
- Polycystic Kidney Disease Nauli SM, Alenghat FJ, Luo Y, Williams E, Vassilev P, Li X, Elia AE, Lu W, Brown EM, Quinn SJ, Ingber DE, Zhou J. Polycystins 1 and 2 mediate mechanosensation in the primary cilium of kidney cells. **Nature Genetics** 2003 Feb;33(2): 129-37. PMID: 12514735

---

## Meetings & Invited Talks

- 2016 **Second Annual NE Glenn Aging Meeting.**
- 2014 **Rhode Island College Colloquium, Sirtuin-1 & Pluripotency Networks, Invited Speaker.**
- 2010–2016 **Annual Paul Glenn Symposium on Aging**
- 2012 **Koch Institute 11th Annual Oncology Symposium on Epigenetics, Plasticity, and Cancer**
- 2011 **Cold Spring Harbor Meeting on the Molecular Genetics of Aging**



- 2009 **Keystone Symposia, Williams EO & Lin DM.** *Identifying Axon Guidance Molecules during the Development and Regeneration of the Mouse Olfactory System, Invited Short Talk.*
- 2008 **International Symposium on Olfaction and Taste, Williams EO & Lin DM.** *Novel Subdomains within the External Plexiform Layer of the Developing Mouse Olfactory Bulb.*
- 2007 **Society for Neuroscience, Williams EO Sickles H, Lin DM.** *Novel Subdomains of the Mouse Olfactory Bulb defined by Molecular Heterogeneity in the Nascent External Plexiform and Glomerular Layers..*

# Deanne Moosman

*Fitchburg State University*  
*Adjunct Instructor, Biology & Chemistry Dept.*  
[dmoosman@fitchburgstate.edu](mailto:dmoosman@fitchburgstate.edu)

## EDUCATION

- 2004 **Eastern Kentucky University**  
M.S. in Biology
- 2000 **University of Rhode Island**  
B.S. in Biology, Minor in Psychology

## TEACHING EXPERIENCE

- 2014-present **Faculty Member, Dept. of Physical Education, Virginia Military Institute, Lexington, VA**  
Prepared and taught lectures for Nutrition, Wellness Concepts, Nutrition & Cardiovascular Health, Drug & Alcohol Abuse Awareness. Designed lectures, quizzes, exams, and activities for this course. Taught skills courses, including Swim Fitness, Basic Swimming Survival, Dynamic Stretching & Speedwork for Running, and Boxing. Created two new courses, Nutrition & Cardiovascular Health and Dynamic Stretching & Speedwork for Running. Oversaw and managed the House Mountain/Chessie Trail and High-water Entry/Pole of Doom stations for Rat Challenge, a program required by all VMI freshmen that builds leadership and confidence.
- 2005-present **Adjunct Faculty Member (current position: Online Instructor for Nutrition), Dept. of Biology & Chemistry, Fitchburg State University, Fitchburg, MA**  
Taught undergraduate Nutrition lectures and graduate level Herpetology and Marine Biology lectures. Also taught laboratories, including Life Science II, and Biology, Mathematics, and Technology. Developed and taught an online Nutrition class for undergraduates. Designed class notes, PowerPoint presentations, exams, class activities, and online materials. Lectures built an appreciation of the subject area by encouraging discussions from readings of current issues, participating in classroom activities, and completing projects and assignments. Laboratories enhanced learning of biological systems through hands-on experience, mathematic models, and computer technology.
- 2013-2014 **Adjunct Faculty Member, Dept. of Physical Education, Virginia Military Institute, Lexington, VA**  
Prepared and taught lectures for Wellness Concepts. Designed lectures, quizzes, exams, and activities for this course. Taught skills courses, including Fitness Swimming, Basic Swimming Survival, and co-taught Boxing.
- 2008-2014 **Adjunct Faculty Member, Dept. of Biology, Virginia Military Institute, Lexington, VA**  
Prepared and taught labs and lectures of Human Biology, Nutrition, General Biology, and Environmental Science to non-majors as well as biology majors. Designed laboratories, course lectures, and quizzes. Lectures built an appreciation in the area of biology. Labs, as well as lectures, encouraged students to use critical thinking skills and the scientific method.
- 2012-2014 **Group Study Session (GSS) Coordinator for Biology, Virginia Military Institute, Lexington, VA**  
Selected and worked with cadet facilitators to lead group study sessions for cadets taking General Biology I and II. Assisted facilitators in creating activities and worksheets for evening group study sessions. Observed cadet facilitators as they led the study sessions and provided feedback.

- 2008 **Adjunct Faculty Member (Online Instructor), Western Wyoming Community College, Rock Springs, WY**  
Developed an online General Biology course for science majors. Designed lecture and laboratory material, lecture notes, quizzes, exams, and activities to reinforce reading material and lecture notes.
- 2006-2008 **Adjunct Faculty Member (Online Instructor), ITT-Technical Institute, Carmel, IN**  
Taught Environmental Issues, an online non-majors course. Used an online educational system (Questa) to communicate to students and to grade submitted assignments. Acted as an advisor to students, graded typed assignments and discussion forums, and created course announcements.
- 2005-2008 **Adjunct Faculty Member, Quinsigamond Community College, Worcester, MA**  
Taught Nutrition and Introductory Biology classes and laboratories to non-science and science majors. Designed class notes, PowerPoint presentations, exams, and quizzes. Classes encouraged students to develop logical and critical thinking skills, which are necessary in exploring the natural world. Students were also encouraged to read and discuss biological issues observed in their daily lives and participate in classroom activities.
- 2002 **Teaching Assistant, Eastern Kentucky University, Richmond, KY**  
Prepared and taught labs for Human Physiology and Zoology. Designed and graded exams and quizzes.
- 2001-2002 **Teaching Assistant, Eastern Kentucky University, Richmond, KY**  
Taught (sole instructor) Human Physiology labs. Prepared and taught labs for Natural Science. Designed and graded exams and quizzes.
- 2000-2001 **Research Assistant, Eastern Kentucky University, Richmond, KY**  
Taught introductory chemistry labs, including Chemistry 101 and Chemistry 111.

#### **INTERNSHIPS**

- 2003 **Intern, Belize Marine TREC (Tropical Research and Education Center), Ambergris Caye, Belize, Central America**  
Guided classes on snorkeling trips along coral reefs and mangroves. Identified species and behaviors of organisms on snorkeling trips. Directed night seines with classes and identified captured species. Collected data on salinity and water temperature at various locations along the barrier reef of Belize for a long-term monitoring project. Assisted in boating responsibilities and maintenance.

#### **PROFESSIONAL EXPERIENCE**

- 2003-2005 **Research Associate, Alabama Cooperative Fish and Wildlife Research Unit, Auburn University, Auburn, AL**  
Compiled and organized data (primary data manager) for research projects, including the Aquatic GAP project. Assisted in analyzing data, writing, and editing reports for government agencies and edited masters theses. Conducted field data collection using pre-positioned area electrofishers (PAE's) and radio-tracked fish. Identified freshwater fish in laboratory for research projects.
- 2003 **Product Release Auditor, Johnson & Johnson/Merck Consumer Products via Kelly Scientific Resources, Lancaster, PA**  
Responsible for tactical activities related to product (intermediate and finished goods) release, assured their conformance to established standards, and provided electronic approval of those products.

## TECHNICAL REPORTS AND PUBLICATIONS

- 2017 **Moosman, D.** 2017. Goal-setting reduces the impact of stress on eating habits in college students. *Journal of Nutrition Education and Behavior* 49(7):S81.
- 2016 **Moosman, D.** 2016. "Creating a colorful plate" to increase fruit and vegetable consumption: Does it work with college students? *Journal of Nutrition Education and Behavior* 48(7):S97-S98.
- 2015 **Moosman, D.** 2015. Student perspectives of nutrition and health at a military college. *Journal of Nutrition Education and Behavior* 47(4):S50.
- 2006 **Moosman, D. L.** and Moosman, P. R., Jr. 2006. Subcutaneous movements of Visible Implant Elastomers (VIE) in wood frogs (*Rana sylvatica*). *Herpetological Review* 37:300-301.
- 2005 **Moosman, D. L.** and Moosman, P. R., Jr. 2005. *Bufo americanus*, *Rana catesbeiana*, Microhabitat. Natural history note. *Herpetological Review* 36(3):298.
- 2005 Moosman, P. R., Jr., **D. L. Moosman**, and J. C. Pillow. 2005. *Ambystoma talpoideum* (mole salamander). Geographic distribution note. *Herpetological Review* 36(2): 198.
- 2004 Turner, G., E. Irwin, J. Peterson, B. Freeman, M. Freeman, E. Kramer, C. Straight, A. Wimberly, **D. Moosman**, C. Hayer, J. Ruiz. 2004. Aquatic GAP: A GIS and modeling approach for analysis of biodiversity in the Tallapoosa River Basin, Alabama and Georgia. Proceedings of the First Annual GIS Symposium at Troy State University, Troy, AL. <http://spectrum.troyst.edu/~kroblee/First%20Annual%20GIS%20Symposium/>
- 2004 Irwin, E., P. Sakaris, and **D. Moosman**. 2004. Hydrologic variation in the lower Tallapoosa River: Effects on recruitment and growth of striped bass and catfishes. Final Report. Alabama Department of Conservation and Natural Resources, Montgomery, AL. 55 pp.

## PRESENTATIONS

- 2016 **Moosman, D.** 2016. "Creating a Colorful Plate" to Increase Fruit and Vegetable Consumption: Does it Work with College Students? Society for Nutrition Education & Behavior 2016 Annual Conference. San Diego, CA.
- 2015 **Moosman, D.** 2015. Student Perspectives of Nutrition and Health at a Military College. Society for Nutrition Education & Behavior 2015 Annual Conference. Pittsburgh, PA.
- 2008 deHart, P., P. Moosman, **D. Moosman**. 2008. Bridging Building & Biology: Anthropogenic Impacts on Marine Intertidal Community Composition and Biodiversity. Poster presented at the 9<sup>th</sup> National Conference for Biodiversity in a Rapidly Changing World. Washington D.C.
- 2004 Turner, G., E. Irwin, J. Peterson, B. Freeman, M. Freeman, E. Kramer, C. Straight, A. Wimberly, **D. Moosman**, C. Hayer, and J. Ruiz. 2004. Aquatic GAP: A GIS and modeling approach for analysis of biodiversity in the Tallapoosa River Basin, Alabama and Georgia. Oral presentation at the Georgia URISA GIS/IT Conference. Peachtree City, GA.
- 2004 Turner, G., E. Irwin, J. Peterson, B. Freeman, M. Freeman, E. Kramer, C. Straight, A. Wimberly, **D. Moosman**, C. Hayer, J. Ruiz. 2004. Aquatic GAP: A GIS and modeling approach for analysis of biodiversity in the Tallapoosa River Basin, Alabama and Georgia. Oral presentation at the First Annual GIS Symposium at Troy State University, Troy, AL.
- 2003 Turner, G., E. Irwin, C. Hayer, and **D. Moosman**. 2003. Aquatic GAP: Regional Analysis of Biodiversity in the Tallapoosa River Basin. Poster presented at the 2003 Auburn University GIS Day, Auburn, AL.

- 2002                    **Swartley, D. L.** 2002. Status of and pond selection by *Rana pipiens* and *Rana palustris* in the Kentucky Bluegrass. Guest speaker at the Kentucky Society of Natural History Fall 2002 Meeting, Pine Mountain, KY.
- 2002                    **Swartley, D. L.** 2002. Status of and pond selection by *Rana pipiens* and *Rana palustris* in the Kentucky Bluegrass. Oral presentation at the 2002 Joint Meeting of Ichthyologists and Herpetologists, Kansas City, MO.
- 2001                    **Swartley, D.L.** 2001. Retention and movement of Visible Implant Elastomers in wood frogs, *Rana sylvatica*. Poster presented at the First Annual Eastern Kentucky University Poster Competition, Richmond, KY.
- 2001                    **Swartley, D.L.** 2001. Retention and movement of Visible Implant Elastomers in wood frogs, *Rana sylvatica*. Poster presented at the 2001 Joint Annual Meetings: Herpetologists' League and the Society for the Study of Amphibians and Reptiles, Indianapolis, IN.

#### **CURRENT SOCIETY MEMBERSHIPS**

- 2014-present            Society for Nutrition Education & Behavior (SNEB)  
 2009-present            Center for Science in the Public Interest (CSPI)

#### **CERTIFICATIONS**

- Nutrition & Wellness Consultant (American Fitness Professionals & Associates)
- USA Triathlon Level I certified coach (certification includes training in swimming, biking, running, nutrition, and strength training)
- Safe Sport (United States Olympic Committee)
- Red Cross CPR, First-aid, Lifeguarding
- Advanced SCUBA (certified through the National Association of Underwater Instructors - NAUI), NITROX (Certified to SCUBA dive with mixed gases), Dry-suit (Specialty Diver through NAUI)
- MOCC (U.S. Department of Interior's Motorboat Operator Certification Course) boating certification

#### **ACTIVITIES/INTERESTS**

- 2015-present            Member of the VMI Jiu Jitsu Club, Lexington, VA  
 2015-2016                Member of Valley Brazilian Jiu Jitsu, Staunton, VA  
 2008-2009                Member of the AIM Triathlon Team, North Central/Eastern MA  
 2006-present            Member of USA Triathlon (USAT)  
 2004-2005                Member of the Auburn Masters Swim Team, Auburn, AL  
 2004-present            Member of United States Masters Swimming (USMS)  
 2004                        Member of the Auburn Crew (Rowing) Club, Auburn, AL  
 1996-2000                Scholarship athlete (1996-2000) and co-captain (1999-2000) of the women's varsity swim team at the University of Rhode Island, Kingston, RI

# Mary Lou Soczek, M.S.

15 Rocky Hill Drive, Nashua NH 03062

Phone: 603-305-9086 · Email: mlsoczek@myfairpoint.net

---

## Summary

Conservation biologist with 12 years of teaching and advising experience in biology and environmental science at the university level. Over 10 years additional experience in academic and technical writing.

## Education

**M.S., Environmental Studies, with a concentration in Conservation Biology** 2006

Department of Environmental Studies, Antioch University New England, Keene, NH

Specialties: Ecology, Evolutionary Biology, Research Design and Statistics, Ornithology, Botany

Thesis: An Analysis of Seabird Bycatch in New England Commercial Fisheries

**A.B., Sociology, *cum laude*** 1980

Department of Sociology, Bryn Mawr College, Bryn Mawr, PA

## Teaching Experience

**Fitchburg State University, Fitchburg, MA** Fall 2005 -present

Senior Adjunct Instructor, Dept. of Biology and Chemistry

- Develop and teach undergraduate courses in Life Science and Environmental Science, Oceanography and Earth System Science, and graduate courses in Ornithology and Field Botany. All courses include lab or field components.
- Developed, maintain, and teach online Life Science course using the Blackboard LMS.
- Mentor new Life Science instructors. Selected textbooks and wrote labs for all Life Science sections.
- Advise students on course selection, studying habits, and writing skills. Counsel at-risk students.

**Quinsigamond Community College, Worcester, MA** Spring 2009

Adjunct Instructor, Dept. of Biology

- Developed and taught undergraduate course in Life Science. Course included a lab component.

**Antioch University New England, Keene, NH** Summers 2006-2008

Adjunct Instructor, Dept. of Environmental Studies

- Developed and taught graduate course in Coastal and Marine Ornithology. Course included a 5-day field trip to coastal Cape Cod, MA.

## Writing/Editing Experience

**W.W. Norton & Company, New York, NY** 2010

Reviewer for Discover Biology, 5<sup>th</sup> Edition; a leading non-majors biology textbook.

**Environmental and Technical Software Companies in MA and NH** 1982-2003

Technical/academic writer. Prepared articles and reports for publication or submission to government agencies. Developed guides for users of scientific and technical software systems.

## Research Experience

**Tufts University Center for Conservation Medicine, Grafton, MA** Fall 2004

Intern, Seabird Ecological Assessment Network

- Compiled seabird demographic data and evaluated data available for assessment of threats to seabirds in New England, especially from commercial fisheries.

**Massachusetts Audubon Society, Lincoln, MA** Summer 2004  
 Intern, Joppa Flats Education Center, Newburyport, MA

- Designed and completed vegetation survey for bird banding station on Parker River National Wildlife Refuge. Analyzed survey using multivariate ordination statistical procedures.

**Massachusetts Audubon Society, Lincoln, MA** Summer 2000  
 Volunteer, Salt Marsh Bird Program, Newburyport, MA

- Conducted breeding bird surveys (point count method) on Parker River National Wildlife Refuge.

## Continuing Education (selected recent, representative programs)

**New England Wildflower Society, Framingham, MA** 2015-present  
 Advanced Field Botany Certificate program. New England plant identification and conservation courses with research botanists Arthur Haines, Elizabeth Farnsworth, and other staff biologists.

**Mount Washington Weather Observatory, Mount Washington, NH** Mar 2015  
 Global change: A View from the Rockpile. Two-day workshop with Dr. Mark van Baalen (Harvard University) and Weather Observatory staff.

**Nashua River Watershed Association, Groton, MA** Jul 2015  
 Aquatic Plant Identification Workshop with Tom Flannery, aquatic ecologist with the Massachusetts Department of Conservation and Recreation's Lakes and Ponds Program along the Nashua River in Groton, MA.

**Audubon Society of New Hampshire, Concord, NH** May 2014  
 Bog Plants and Adaptations Workshop with sanctuary staff at Ponemah Bog, Amherst, NH.

**Harris Center for Conservation Education, Hancock, NH** Feb 2012  
 Mammal tracking workshop with ecologist David Anderson of the Society for Protection of New Hampshire Forests at Monadnock State Park.

## Volunteer Work

**Nashua River Watershed Association, Groton, MA** 2014-present  
 Water monitor, Nashua River summer monitoring program.

**Kitty Angels, Tyngsboro, MA** 2014-present  
 Feral cat colony monitor, Nashua, MA.

**Merrimack Valley Women Outdoors Meetup Group, Nashua, NH** 2012-present  
 Co-founder and naturalist for bird-watching, plant identification, and general nature appreciation field trips and programs.

## Affiliations

New England Wildflower Society  
 Massachusetts Audubon Society  
 New Hampshire Audubon Society  
 Nashua River Watershed Association  
 Cornell Lab of Ornithology

## Skills

Course development, teaching, academic and technical writing and editing  
 Developmental and pro-active (intrusive) student advising  
 Biology laboratory management and safety, microscopy, water testing/analysis  
 Mac and PC computers, MS Office programs, data analysis, Banner, LMS systems, social media

# CURRICULUM VITAE

HOWARD H. THOMAS

## HOME ADDRESS:

103 Boulder Drive, Dublin, NH 03444; Telephone: 603 831-1111;  
Email: hthomas@sdnhm.org

## MILITARY SERVICE:

LCpl, U. S. Marine Corps, 1966-1969, Honorable Discharge.

## EDUCATION:

Ph.D., Biology, Northeastern University, Boston, MA, 1982. Dissertation:  
“Systematics and zoogeography of *Blarina brevicauda*, *Peromyscus maniculatus*,  
*Clethrionomys gapperi*, and *Microtus pennsylvanicus* on the islands and adjacent  
mainland areas of the Canadian Maritimes.”

M. S., Biology-Marine Biology, Adelphi University, Garden City, NY, 1974.  
Thesis: “An Investigation of the attachment and early development of a natural  
population of *Codium fragile tomentosoides*”.

B.S., Biology and Secondary Education, State University of New York at  
Geneseo, NY, 1972.

## AREAS OF CONCENTRATION:

- Vertebrate Biology, Comparative Vertebrate Anatomy, and Mammalogy.
- Foreign Language: reading French and Spanish, and conversational Spanish.

## GRANTS, CONTRACTS, and AWARDS

- Recipient of the 2011 Dr. Vincent J. Mara for Excellence in Teaching, FSU.
- Recipient of the 2000 Outstanding Research and Scholarship Award, FSU.
- Professional Development Grants, 1982, 1984-88, FSU.
- Distinguished Service Award, 1985 and 1988, FSU.
- Ruth Butler Grants, 1986, 1995, and 1998, FSU.
- Summer Research Fellowship, 1989, FSU.
- New England Telephone Undergraduate Research Award (ca. \$25,000), 1990-91, FSU.
- Natural Heritage and Endangered Species Grant, 1992, Comm. of MA, PI.



- Undergraduate Research Associate, 1992, FSU.
- U. S. Department of Defense Environmental Training Grant, 1994, CoPI.
- National Science Foundation Grants, 1995 (\$50,000), 2003 C-RUI (\$663,000), and 2008 Interdiscip. Research Exper. (ca. \$500,000), CoPI.
- National Geographic Grant, 2010 (\$20,000) awarded to San Diego Natural History Museum, participant as a research associate.
- Graduate Research Associate, 1996, FSU.
- Graduate School Research Grant, 1996, 2001, and 2003, FSU.

#### PROFESSIONAL MEMBERSHIP:

- American Society of Mammalogists, 1974, Life Member.
- Northeastern Naturalist, 1994.

#### PROFESSIONAL EXPERIENCE:

- Emeritus Professor of Biology, 2013, FSU.
- Interim Registrar, 2001-2002, FSU.
- Chairman, Department of Biology, 1988-1998, FSU.
- Coordinator, Environmental Science Concentration, 1982-2005, FSU.
- Professor of Biology, both undergraduate and graduate, 1981-present, FSU.
- Thesis advisor for 5 masters theses, 1996-present, FSU.
- Curriculum Coordinator, Industrial Wastewater Treatment Program, 1986, FSU.
- Instructor of Biology, Northeastern University, 1975-1981.
- Administrative Coordinator and Supervisor, large multi-section biology course, Northeastern University, 1975-1979.
- Marine Biologist, SCUBA diver, and Senior Field Technician, Grumman Ecosystems Corporation, Bethpage, NY, 1973-1974.
- Limnology Research Assistant, SUNY at Geneseo, NY 1972.
- Environmental Consultant, Wetlands Wildlife Habitat Analysis in Massachusetts, 1989-2003 (18 projects).
- Field Experience: Field work: San Jacinto Mountains, California, 2009-present; Kenya, 2004, 2007, and 2012; Nicaragua, 1995-1997, and 2001; People's Republic of China, 1998; Labrador, Ontario, Quebec, Canada, and Nicaragua, 1993; Baja California, Mexico and British Columbia, Canada, 1989; New Mexico, 1987; Mexico, 1986, 1998; California, 1984, 2009-present; Canadian Maritime Provinces, 1977-1978.
- Local Committee, 75<sup>th</sup> Annual Meeting, American Society of Mammalogists, University of Vermont, 1995.
- Grants-in-Aid Committee, American Society of Mammalogists, 2006-2013.

- Committee on Education and Graduate Students, American Society of Mammalogists, 1991-1996, 2001-2011.
- Bibliography Committee, American Society of Mammalogists, 1976-1987.
- Editorial Review—refereed articles for Canadian Journal of Zoology, Southwestern Naturalist, Journal of Mammalogy, and Northeastern Naturalist.
- Curatorial Experience: Associate of Research, Mammal Department, Museum of Comparative Zoology, Harvard University, Cambridge, MA, 1996-1998; Research Associate, Department of Birds and Mammals, San Diego Natural History Museum, 2010-present.

#### SEMINARS AND PRESENTATIONS:

- School groups, general public; Honor's Program and Harrod Lecture, 1985, FSU; Worcester State University; Pepperell, MA Conservation Committee, 1988; guest speaker on a veteran's perspective on the Vietnam war to undergraduate and graduate sections of HIST 3740.

#### ACADEMIC COMMITTEES:

##### **Departmental—**

- Departmental Self-Study, 2012;
- Assessment, 2009-2011;
- Facilities, 1984-1988; 2000, 2005-2007;
- Curriculum, 1982-1984;
- Graduate Curriculum, 1999-2011;
- Peer Evaluation (elected), 2002-2009, 2012;
- Faculty Search, 2002-2008, 2010-2012;
- Office Renovation, 1983-1984;
- Safety, 1983.

##### **University—**

- Institutional Animal Care and Use Committee, 2005-2010, 2012-2013;
- Department Chair's Committee, 1988-1998;
- Academic Policies, 1982-1983;
- Liberal Arts and Science, 1989-1993;
- Long Range Planning, 1984-1987;
- Harrod Lecture Selection, 1986-1988;
- Institutional Representative to New England-Nova Scotia Student Exchange Program, 1989-1995;
- Institutional Representative for the Morris K. Udall Foundation, 1992-present;
- Institutional Representative for the Goldwater Scholarship, 1995-present;
- Humans as Research Subjects IRB, 1989-2001;

- Ad Hoc Peer Review Committee—6 contractually mandated and grieved instances (Chair for 3);
- Advisory Committee for the university's Grant Center, 1997-2000;
- Faculty Research Subcommittee, Institutional Evaluation, 1992;
- Massachusetts State College's Graduate Research Symposium, Selection Committee, 1998.

#### COURSES TAUGHT:

- **Graduate:** Seminar, Biology of Mammals, Parasitology, Evolution, Biology of Arid Lands, Freshwater Biology, and Topics: Vertebrate Biology;
- **Undergraduate:** Parasitology, Mammalogy, Vertebrate Biology, Evolution, Ecology, Comparative Vertebrate Anatomy, Environmental Field Techniques I and II, General Biology I and II, General Zoology, Seminar in Modern Biology, Life Science I and II, Anatomy and Physiology I and II, Life Science I and II, Human Anatomy, Vertebrate Physiology, and Human Physiology.

#### PUBLICATIONS:

- Jones, G. S. & **H. H. Thomas** (eds.). 1979. Laboratory manual for basic animal biology (18.132/142), Department of Biology, Northeastern University, Boston, MA. Burgess Publ., Co., Minneapolis.
- **Thomas, H. H.**, G. S. Jones, & R. L. Dibblee. 1980. *Sorex palustris* on Prince Edward Island. Canadian Field-Naturalist, 94:329-331.
- Jones, G. S. & **H. H. Thomas**. 1980. Ticks from mammals from Prince Edward Island, New Brunswick, northern Nova Scotia, and Gaspé Peninsula, Quebec. Canadian Journal of Zoology, 58:1394-1397.
- Best, T. L., B. Hoditschek, & **H. H. Thomas**. 1981. Foods of coyotes (*Canis latrans*) in Oklahoma. Southwestern Naturalist, 26:67-71.
- Jones, G. S. & **H. H. Thomas**. 1982. Mites, ticks, and fleas of the mice *Zapus hudsonius* and *Napaeozapus insignis* from Prince Edward Island, New Brunswick, northern Nova Scotia, and Gaspé Peninsula, Quebec. Canadian Entomologist, 114:1031-1035.
- Jones, G. S. & **H. H. Thomas**. 1983. Distribution and ectoparasites of Little Brown Bats, *Myotis lucifugus*, on Prince Edward Island. Canadian Field-Naturalist, 97: 320-321.
- **Thomas, H. H.** & R. L. Dibblee. 1986. *Canis latrans* on Prince Edward Island. Canadian Field-Naturalist, 100: 565-567.

- Fain, A., J. O. Whitaker, Jr., & **H. H. Thomas**. 1988. Two new species of *Geomylichus* Fain, 1970 (Acari, Listrophoridae) from California, U. S. A. *International Journal of Acarology*, 14:121-125.
- **Thomas, H. H.**, J. O. Whitaker, Jr., & T. L. Best. 1990. Ectoparasites of *Dipodomys elator* from north-central Texas with some data from sympatric *Chaetodipus hispidus* and *Perognathus flavus*. *Southwestern Naturalist*, 35:11-114.
- Best, T. L. & **H. H. Thomas**. 1991. *Dipodomys insularis*. *Mammalian Species*, No. 374:1-3.
- Best, T. L. & **H. H. Thomas**. 1991. *Spermophilus madrensis*. *Mammalian Species*, No. 378:1-2.
- **Thomas, H. H.**, T. L. Best, & C. Lydeard. 1991. Parasitic and phoretic arthropods of the elephant-eared (*Dipodomys elephantinus*) and Santa Cruz Kangaroo Rats (*D. venustus*) in California. *Journal of Wildlife Diseases*, 27:358-360.
- Fain, A., J. O. Whitaker, Jr., & **H. H. Thomas**. 1991. Two new fur mites of the genus *Geomylichus* Fain, 1970 (Acari, Listrophoridae) from kangaroo rats *Dipodomys* spp. from the U. S. A. *International Journal of Acarology*, 17:175-180.
- **Thomas, H. H.** & T. L. Best. 1994. *Sylvilagus mansuetus*. *Mammalian Species* No. 464:1-3.
- **Thomas, H. H.** & T. L. Best. 1994. *Lepus insularis*. *Mammalian Species* No. 465:1-3.
- Sheffield, S. & **H. H. Thomas**. 1997. *Mustela frenata*. *Mammalian Species* No. 570:1-9.
- Perla, R. J. & **H. H. Thomas**. 2001. Ixodid ticks recovered from vegetation in north-central Massachusetts. *Wildlife Society Bulletin*, 29:387-389.
- Moosman, P. R., Jr., **H. H. Thomas** & J. P. Veilleux. 2007. Foods eaten by the small-footed myotis (*Myotis leibii*) in Cheshire County, New Hampshire. *American Midland Naturalist*, 158:354-360.
- Bjorklund, B. M., **H. H. Thomas**, P. A. Palmiotto, J. P. Algeo, D. Slate, R.

- B. Chipman, M. D. Chandler, & D. J. Wilda. 2008. Potential food item distractions during raccoon ORV baiting campaigns on Cape Cod, Massachusetts: would you like fries with that? Proceedings of the 23<sup>rd</sup> Vertebrate Pest Conference, 23:270-274.
- Veilleux, J. P., **H. H. Thomas**, & P. R. Moosman, Jr. 2008. Bats of Pisgah State Park, New Hampshire. *Northeastern Naturalist*, 15:25-34.
  - Moosman, P. R., Jr., C. Cratsley, S. D. Lehto, & **H. H. Thomas**. 2009. Do courtship flashes of fireflies (Coleoptera: Lampyridae) serve as aposematic signals against insectivorous bats? *Animal Behavior* 78(2009):1019-1025.
  - Austin, K. B., P. R. Moosman, Jr., & **H. H. Thomas**. 2011. Eavesdropping on echolocation: recording the bat's auditory experience. Engineering in Medicine & Biology Society, EMBC, 2011. Proceedings Ann. Internat. Confer. IEEE:7682-7686.
  - Moosman, P. R., Jr., **H. H. Thomas**, & J. P. Veilleux. 2012. Diet of the widespread insectivorous bats *Eptesicus fuscus* and *Myotis lucifugus* relative to climate and richness of bat communities. *Journal of Mammalogy*, 93:491-496.
  - **Thomas, H. H.**, P. R. Moosman, Jr., J. P. Veilleux, & J. Holt. 2012. Foods of bats (Family Vespertilionidae) at five locations in New Hampshire and Massachusetts. *Canadian Field Naturalist*, 126:117-124.
  - Moosman, P. R., Jr., J. P. Veilleux, G. W. Pelton, & **H. H. Thomas**. 2013. Changes in capture rates in a community of bats in New Hampshire during the progression of white-nose syndrome. *Northeastern Naturalist*. 20(4):552-558.
  - **Thomas, H. H.**, T. L. Best & B. Agwanda. 2017 (in press). *Heliosciurus rufobrachium*. *Mammalian Species*, 2016-20.
  - Tremor, S., D. Stokes, W. Spencer, J. Diffendorfer, **H. Thomas**, S. Chivers, & P. Unitt (eds.). 2017 (in press). **San Diego County Mammal Atlas**. Proceedings of the San Diego Society of Natural History, 46:1-434.
  - Mellink, E. S. Tremor, **H. Thomas**, N. Siordia, J. Luevano, & S. E. Vanderplank. 2017 (in press). Status of the isolated, threatened Valle de la Trinidad round-tailed ground squirrel, Baja California, Mexico. *Bulletin of the Southern California Academy of Sciences*, manuscript no. 3323.
  - Whitaker, J. O., Jr., A. Hicks, **H. H. Thomas**, J. Bopp, & R. Kenney. In manuscript. **The Mammals of New York State**. Comstock Press, Ithaca, NY

- **Thomas, H. H.**, J. P. Veilleux, & P. R. Moosman, Jr. In manuscript. Bats of Surry Mountain Dam, New Hampshire. *Northeastern Naturalist*.
- **Thomas, H. H.**, & T. L. Best. In manuscript. Morphological variation in populations of the meadow vole (*Microtus pennsylvanicus* Ord) in the Maritime Provinces of Canada. *Canadian Field Naturalist*.
- **Thomas, H. H.** In manuscript. Small mammal zoogeographic relationships in the Maritime Provinces of Canada. *Canadian Field Naturalist*.
- Tremor, S.B., M. Patton, P. Unitt, E. Mellink, & **H. H. Thomas**. In manuscript. Taxonomic status of the Round-tailed Ground Squirrel (*Spermophilus tereticaudus*) in California including a new subspecies. *Transactions of the San Diego Natural History Society*.
- **Thomas, H. H.**, M. Nosek, J. Pespisa & S. B. Tremor. In progress. Identification of two species of southern California chipmunks using morphological analysis and mitochondrial DNA sequencing.
- **Thomas, H. H.** & S. B. Tremor. In progress. Distributional status of the lodgepole chipmunk (*Tamias speciosus*) in southern California.
- **Thomas, H. H.**, T. L. Best, C. W. Kilpatrick, & P. R. Moosman, Jr. In progress. Taxonomic status of Nicaraguan mice of the genus *Peromyscus*.
- Moosman, Jr., P. R., & **H. H. Thomas**. In progress. Pelage and morphological variation in the red bat genus *Lasiurus* with special attention to the Seminole bat (*Lasiurus seminolus*).
- **Thomas, H. H.** In progress. **The Mammals of Northern New England.**
- Musila, S. and **H. H. Thomas**. In progress. **An Atlas of Kenyan Mammals.**

#### ABSTRACTS AND TECHNICAL PAPERS

- **Thomas, H. H.** 1985. The North American Coyote: Its origins, evolution, past and present status. Harrod Lecture, Fitchburg State College.
- **Thomas, H. H.** 1987. Recent zoogeography of Canadian Maritimes small mammals. Abstract No. 173, 67<sup>th</sup> Annual Meeting, American Society of Mammalogists, Albuquerque.

- Gardiner, E., P. Hogan, **H. Thomas**, & S. Wagner. 1990. Recommendations for implementing a program of faculty development. Presented to the faculty and administration of Fitchburg State College. Report prepared for the Lilly Endowment Workshop on the Liberal Arts, Colorado Springs, CO, 20 pp.
- **Thomas, H. H.** & P. C. Frost. 1993. Taxonomic status of Northeastern North American wild *Canis*. Abstract 30, 73<sup>rd</sup> Annual Meeting of the American Society of Mammalogists.
- **Thomas, H. H.** 1996. Insectivorous bats roosting in lava tubes within the Volcan de Masaya Parque Nacional, Nicaragua. Technical Report to MARENA, Republic of Nicaragua, 3 pp.
- **Thomas, H. H.** 1996. The bat genus *Pteronotus* in Nicaragua. Technical Report to MARENA, Republic of Nicaragua, 1 pp.
- Kollath, L. R. & **H. H. Thomas**. 1998. Taxonomy of Nicaraguan forms of mice of the genus *Peromyscus* (Rodentia, Muridae) using discriminant function analysis. Massachusetts State College Graduate Deans' Symposium, 1:155-167.
- St. Jean, K. R. & **H. H. Thomas**. 1998. Identification of Nicaraguan *Peromyscus* using mitochondrial DNA sequences. Massachusetts State College Graduate Deans' Symposium, 1:213-217.
- Moosman, P. R., Jr., **H. H. Thomas**, J. T. Paula, & A. Page. 2005. Bats (*Eptesicus fuscus* and *Myotis lucifugus*) as potential predators of *Photinus* fireflies (Coleoptera: Lampyridae): Importance of chemical defenses and luminescence. Abstract, 35<sup>th</sup> Annual North American Symposium on Bat Research, Sacramento, CA
- Austin, K. A., **H. H. Thomas**, P. R. Moosman, Jr., K. Veasna, B. Crepeau, R. Farnsworth, B. Huff, P. Lustig, & M. Tatro. 2009. Capturing the auditory experience of behaving bats: a preliminary study. Abstract. Computing, Engineering, and Information, International Conference, pp. 123-126.
- Moosman, P. R., Jr., K. B. Austin, **H. H. Thomas**, B. J. Crepeau, R. K. Farnsworth, B. A. Huff, P. L. Lustig, M. F. Tatro, & K. Veasna. 2010. Gaining a bat's perspective on echolocation: recording ultrasound calls and their resulting echoes in-situ from flying bats. 39th Annual NASBR meetings, Portland, OR.
- Huff, B., **H. H. Thomas**, K. Austin, P. R. Moosman, Jr., K. Veasna, P.

Lustig, & R. Farnsworth. 2010. The effects of experimental tethering on echolocation calls of the Big Brown Bat, *Eptesicus fuscus*. N. U. R. D. S. Conference, University of S. Maine, 10 pp.

- Moosman, P. R., Jr., J. P. Veilleux, & **H. H. Thomas**. 2011. Ecology of *Myotis leibii* and trends in capture success associated with white-nose syndrome in New Hampshire. 41st Annual NASBR meetings, Toronto, ON.
- Moosman, P. R., Jr., M. J. Hosler, P. A. P. deHart, & **H. H. Thomas**. 2013. Dietary niche of *Myotis leibii* and its associates inferred from fecal contents and stable isotope analysis. Southeastern Bat Diversity Network Annual Meeting, Chatanooga, TN.
- **Thomas, H. H.** 2017. Bat Facts. The Dublin Advocate, 18(6): 14; Dublin, NH.

#### GRADUATE THESES SUPERVISED:

- Bushey, M. 1996. An investigation of the cause and effects of interstitial cystitis. M.A., Biology, FSU, 56 pp. (thesis advisor)
- Grogan, M. 1996. Feeding strategies of the coyote (*Canis latrans*) in Western Tennessee. M. S. Biology, University of Memphis. 112 pp. (committee member).
- Packard, P. 1999. Isozyme variation within and between *Blarina brevicauda* populations west and east of the Connecticut River. M. A., Biology, FSU. 23 pp. (thesis advisor)
- Liu, X. 1999. Evolution of *Plantanus*: Evidence from restriction site analysis of PCR-amplified fragments. M. A. Biology, FSU. 25 pp. (committee member).
- Springfield, A. J. 2005. Amphibian and reptile diversity survey of a beaver impoundment in Princeton, Massachusetts. M. A. Biology, FSU. 26 pp. (thesis advisor).
- Muigai, L. N. 2005. Comparison of small mammal communities of grass-land habitats along the rim and in the valley of the Great Rift Valley, Kenya. M. A. Biology, FSU. 24 pp. (thesis advisor).
- Langford, R. A. 2006. Bait preference of southern (*Glaucomys volans*) and northern (*G. sabrinus*) flying squirrels of the Wachusett Reservoir of Worcester County, Massachusetts. M. A., Biology, FSU. 35 pp. (thesis advisor).



- Bjorklund, B.M. 2009. Food habits of the raccoon (*Procyon lotor*) on Cape Cod, Massachusetts and its relation to ORV baiting. M. S. Biology, Antioch University New England. (committee member).

#### NOTABLE STUDENT ACHIEVEMENTS

- Lydeard, C., FSU, 1984 –completed Ph.D., Auburn University, chair of the Department of Biology, Western Illinois University;
- Lizotte, R., FSU, 1988 – completed Ph. D., University of Mississippi, employed by USDA;
- Veilleux, J., FSU, 1996 – completed Ph.D., Indiana State University, employed by Franklin Pierce University as chair of the Department of Natural Sciences;
- Holznagel, W., FSU, 1993 – completed Ph.D., University of Alabama (dissertation advisor C. Lydeard), employed by U. of Alabama; (deceased)
- Bjorklund, B. M., FSU, 2004—completed MS, Antioch University, employed by USDA;
- Muigai, L. M., FSU, 1997—completed a thesis master’s degree (MA), 2005, working as a testing monitor of pharmaceuticals;
- Bevilaqua, R., FSU, 2008—employed by USDA (B. M. Bjorklund is his supervisor);
- Huff, B. A., FSU, 2010—completed MSc degree program at the University of Wyoming now works for USGS assessing population states of megachiropteran bats on Guam.

## Appendix C: Resources

### Budget

The Biology and Chemistry Department receives funding through 5 sources, 3 operating budgets, Extra-Budgetary Requests (EBRQs), which are now called Strategic Fund requests, and travel. The base-operating budgets, Biology, Chemistry, and Condike Science, support the purchase of laboratory and classroom and laboratory supplies, equipment and equipment repair, and hazardous waste removal on a routine basis. The table below contains the base budgets for biology and chemistry for each of the last five years. The operating budgets are administered through the Department Chair. In addition to the operating budgets, the University supports the administrative costs of the Department. These items include administrative support, departmental technicians, office supplies, postage, phone usage, faculty computers and technical support, duplicating costs, and faculty salaries. We are fortunate that, overall, our budgets, have increased or remained steady, over the last five years. The Department received additional equipment funding from the University through extraordinary budget request (EBRQ) funds. These University-wide funds are allocated for purchases that often represent a large one-time purchase of equipment. The Department's Equipment and Facilities Committee solicits input from the faculty and compiles a list of equipment needs based upon curricular needs that are driven by the Department's mission. The request is submitted to the University during the normal budget process. Since our last self-study, the university has been very generous in providing EBRQ monies to our department. These have been used to purchase items such as a UV-Vis Spectrophotometer, and a Potentiostat, which were both used for a new Physical Chemistry lab and a new swivel rotor for our large centrifuge.

Faculty travel funds are allocated per faculty member from the University and have remained around \$400 per year per full-time member. The Department has always maintained a policy of assigning funds according to need thereby covering the majority of costs when faculty travel. If travel requests exceed available funding, priority is given to junior faculty or to those faculty who are presenting at meetings. Faculty also have an annual professional development stipend that may be used for travel.

**Table1: Approved Budget for Biology**

Biology Department	FY-18	FY-17	FY-16	FY-15	FY-14
Travel Budget	\$5,200.00	\$5,300.00	\$6,514.00	\$6,045.00	\$4,900.00
Operating Budget	\$103,610.00	\$107,910.00	\$117,042.00	\$108,815.00	\$90,074.00
Strategic Funds	\$5,834.00	\$4,046.00			

**Table 2: Approved Budget for Chemistry**

Chemistry Department	FY-18	FY-17	FY-16	FY-15	FY-14
Travel Budget	\$2,800.00	\$4,700.00	\$4,398.00	\$4,247.00	\$3,750.00
Operating Budget	\$42,175.00	\$42,275.00	\$56,015.00	\$54,953.00	\$40,562.00
Strategic Funds	\$1,500.00	\$7,938.00	\$6590.00		

Purchasing of supplies and equipment for the Department is coordinated by the support staff. General supplies and materials such as gloves, microscope slides, glassware, pipets, etc. are monitored and purchased by the technicians on an as needed basis. Each semester, specific course needs are submitted to the lab technicians by individual faculty members. Because the supply needs for each course varies, there is not specific allotment of funds on a per course basis. Rather there is a single pool for all courses within each discipline. Additionally, all chemical purchases are reviewed and approved by the campus Environmental Safety officer in accordance with the University's Chemical Hygiene Plan.

The purchase of equipment, equipment repair, and animal and hazardous waste removal are centralized under the supervision of the technical support staff. The system is effective and fairly efficient. In recent years the Department Chair has worked with support staff to set up regular equipment maintenance schedules (e.g. microscopes, pipet aids), and we now have a rotating schedule for the replacement of some of the standard equipment items (e.g. microscopes, balances, vortexes, pH meter, etc.). This has been a very effective innovation and makes the budget request process much more efficient and predictable.

## **Space**

In the last five self-studies, the most significant issue hindering our ability to fulfill our mission was the facility. This has been remedy since the most recent self-study with the creation of a new science center and renovation of the previous space (the Condike Science Building). The Antonnuci Science Complex houses a new wing, the Irving Wing, that was opened in 2013, and a renovation of the Condike Wing, which opened in 2014. Taken together, this Science Complex houses all of the Biology and Chemistry laboratories, preparation rooms, research labs, vivarium, and greenhouse as well as lecture classrooms, faculty offices, conference rooms, student lounges, and common areas. Also occupying this complex is the Earth and Geographic Sciences Department, facilitating interactions across our closely related disciplines.

The Science Complex is LEED Silver certified and also meets all laboratory and classroom standards for OSHA and ADA. The Irving Wing has 8 Biology teaching labs, 3 Chemistry teaching

labs, 6 faculty research labs, various research facilities (tissue culture room, vivarium, green house, cold room, microscope room, herbarium, chemistry instrumentation room, NMR) and preparation rooms on each floor to support the new facilities. The newly updated Condike Wing has 28 offices (including chairs, faculty, and technician offices), 3 Physics labs, 2 Geoscience labs, Geo/Physical Science research areas, 4 classrooms, a large lecture hall, a computer lab, numerous meeting rooms, and student lounges.

The impact of the Science Complex on the ability of the Department to carry out its mission is incalculable. Its effects are far-reaching, impacting faculty and students alike. The modern facility has no doubt contributed to the increased growth of the Biology major (see the section on student data for full details). Increased technology in the lecture and lab classrooms has enhanced teaching and learning opportunities. In addition, the new equipment has provided increased opportunities for students to conduct research with faculty members. Lastly, students can frequently be seen utilizing the lounge spaces as study areas and to interact with their peers and several faculty offices have small “common areas” outside of their office. All of this creates a more collaborative and welcoming atmosphere for all the occupants of the building.

### **Environment and Safety**

Since the opening of our new Building in the Summer 2013, many of our safety issues that were addressed in the previous self-study have been rectified. The new building meets all OSHA guidelines and fulfills the requirements of the American with Disabilities Act, therefore all labs and research spaces are accessible to all students.

Due to the sophistication of the research that can now be done in the new building, members of our faculty, including former Interim Dean of Health and Natural Sciences, Dr. Meg Hoey in consultation with an outside consulting firm, have written a University-wide Biosafety Policy and an Exposure Control Plan. This certifies us to use materials and equipment with biosafety levels 1 or 2. To ensure that this policy enforced, it is overseen by a University-wide Biosafety committee. Additionally, we have an animal care facility which is under the guidance of our IACUC committee, staffed by both faculty and a licensed veterinarian. Established safety procedures are now routinely followed and faculty receive yearly training on topics such as chemical safety and blood-borne pathogens. We also have a fully effective Chemical Hygiene Plan, an online chemical inventory system, and a full-time Environmental Safety Officer.

One concern that was addressed in the last self-study was the training and safety of students while they conduct independent research work. We have been able to solve this problem by allowing certain students into research spaces using swipe cards which open lab doors and can be carefully monitored and managed administratively. Furthermore, faculty have been effectively communicating via email regarding student projects and allowing students into research spaces while at least one or several responsible faculty are present in the building.

### **Technology and Equipment**

The Department possesses a diverse and very extensive array of equipment for all of the courses. Since the previous self-study (2013), we have moved into the new Science Center and have upgraded and purchased a lot of new equipment. In addition, many of the new pieces of equipment have service contracts. In addition to equipment needed in the teaching laboratories, we have an extensive range of research grade equipment which will be summarized in the paragraphs below.

We have a dedicated greenhouse facility with a growth chamber, a range of growth lamps and automated irrigation systems. Our plant laboratory has a range of equipment including a Real Time PCR, Photosynthetic Meter, Ethylene Analyzer, Quantum Light Meter and Leaf Area Meter.

The cell culture, genetics and molecular biology labs have a vast array of equipment including the following: high speed centrifuge, acrylamide gel boxes, western blotting apparatuses, spectrophotometers (Vis and UV/Vis), polarographs (oxygen electrodes), fraction collectors, platform rocker, automated cell counters (2 different types), bioreactor (3-14 liter), three research grade fluorescent microscopes, (inverted, upright, and dissecting), PCR machine, plate reader, plate washer and motorized cryostat. Also housed with this equipment is a motorized cryostat for histology.

The microscope suite houses three research-grade microscopes - inverted, upright, and dissecting. Each has fluorescence capabilities, with dedicated digital cameras and computer-based software for data collection and image analysis.

The vivarium has three holding rooms for vertebrate animals, including an aquatics room and a rodent room with ventilated caging, plus a cage washing room with automated cage washer and a procedure room with ventilated biosafety cabinet, isoflurane anesthesia system, and physiology monitoring equipment for use during rodent surgery. Modified biosafety cabinets are available in the facility for protecting animal caretakers when handling animals and collecting waste bedding.

The anatomy and physiology labs are equipped with a ventilated storage cabinet for storing preserved specimen for dissection and numerous models and skeletons for displaying both human and infrahuman vertebrate anatomy. Also, six physiology recording workstations are available for use in teaching and research in A&P, animal physiology, and neuroscience, with specialized amplifiers for neurophysiology and a gas analyzer for small organism respirometry.

The department is well appointed in terms of field equipment such as a backpack fish electroshocker and a wide-range of research-grade meters for accessing water quality e.g. Salinity Meter, pH Probe, Turbidity Meter and Dissolved Oxygen Meter.

Access to computers for students and faculty has improved since the last self-study. Information Technology has continued to be aggressive in introducing and supporting new technologies such as Zoom Web Conferencing, Hoonuit Learning (on-line technology training) and SelectSurvey. In addition, the IT department has employed an Instructional Technologist, Sheryl Wolnik who provides regular training sessions for faculty on various technologies. She is also available for consultation and one-on-one training.

All faculty members are provided with a new laptop or tablet every 3 years. Students in the department now have increased access to laptops for class use as the department has 4 carts containing 8 – 10 laptops each. Since the last self-study, support for emergency-type problems that occur in the classroom has improved. Faculty can call the IT helpdesk if they have a classroom emergency and a member of the IT staff will immediately come to the classroom to provide assistance.

## **Biology**

### **AY17/18 Library Program Review**

The biology program at Fitchburg State University offers a B.A. and B.S. degrees in straight biology and biology (secondary) education, and it offers biotechnology, environmental biology, health sciences, and neurosciences and behavior concentrations in the B.S. track. Similarly, it offers a traditional biology minor, as well as a neuroscience, behavior, and cognition minor. The program also offers a post-baccalaureate certificate for licensure in biological secondary education. Moreover, the department offers a traditional Masters of Arts in biology, as well as a M.Ed. in Science; a Master of Arts in Teaching (MAT) was offered for years, but the program is being rethought, and current students are being “taught out.”

In addition, the biologists play one of the largest service roles in the undergraduate general education curriculum. All students must take one lab science course, and students often satisfy their open “science, math, or technology” elective with a biology course. Similarly, the biologists regularly offer courses that facilitate other majors, most especially nursing and allied sciences (with BIOL 1200 and 1300, “Anatomy and Physiology” I and II, and BIOL 1650, “Nutrition”).

The last full library analysis came in the academic year 12/13, and there have been no partial analyses or addendums to the original review. The previous review was in the AY07/08.

### **Monograph Collection Description and Analysis**

Fitchburg State University is, by Carnegie classification, a Master’s granting institution. As stated above, the biology program has an M.A. on the books, and therefore the University must currently uphold the standard of 3c, “advanced instructional support” for its collections; the monograph collection has consistently not met this threshold, and in this review it continues that tradition.

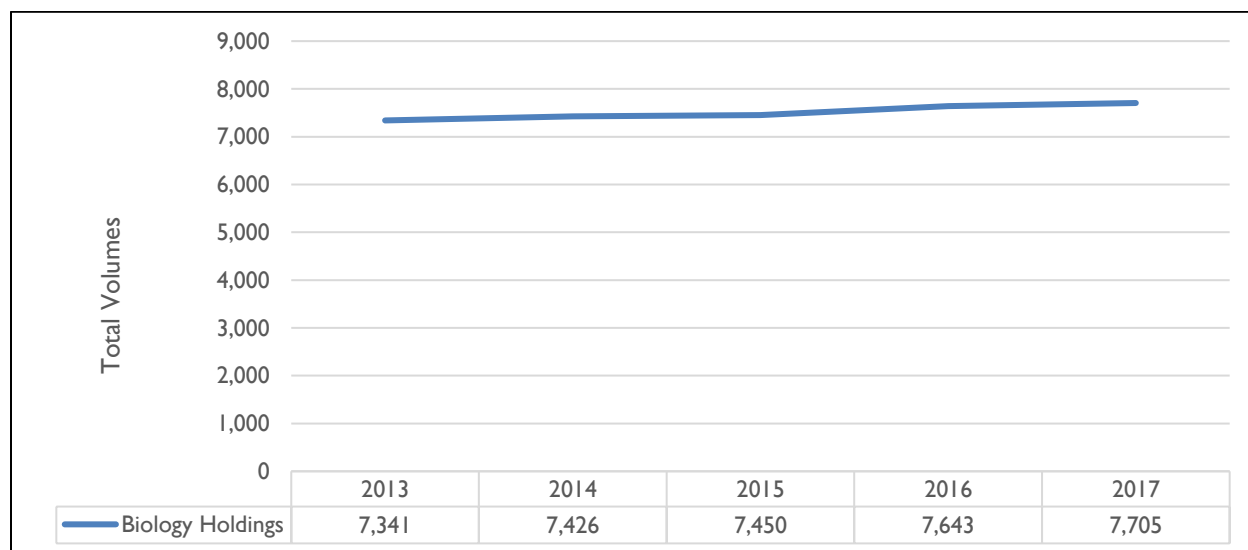
#### *General Guidelines for Monograph Collection Depth*

- 1 Minimal – A level that consists mostly of basic works.
- 2 Basic Information.
- 2a A level that introduces and defines the subject and that indicates the varieties of information available elsewhere.
- 2b Basic Instructional Support – A level that introduces course work and research for undergraduate courses, including a wide range of basic monographs and reference tools pertaining to the subject and targeted to undergraduate students.
- 3 Study or Instructional Support.
- 3a Basic Study – A level that supports undergraduate courses.
- 3b Intermediate Study – A level that supports upper division undergraduate courses.
- 3c Advanced instructional Support – A level that supports course work and research for graduate and undergraduate courses, including a wide range of basic monographs and reference tools pertaining to the subject.
- 4 Research – A level that supports independent research and preparation of doctoral dissertations
- 5 Comprehensive Inclusion – Comprised of all significant works for a defined topic.

### *Specific Definitions for Monograph Holdings*

- 1b (or less) Minimal level = less than 2,500.
- 2a Basic introductory level = 2,500 - 5,000 titles.
- 2b Basic advanced level (Community College) = 5,000 - 8,000 titles.
- 3a Instructional support (lower level undergraduate) = 8,000-12,000 titles representing a range of monographs.
- 3b Intermediate support level (advanced undergraduate) = more than 12,000 titles representing a wider range than 3a.
- 3c Advanced support level (Master's degree level).

In the period under review, the monograph collection in biology and biology education experienced steady growth. Unlike other disciplines, the collection has not undergone extensive weeding, which means that it has not experienced the significant contraction others have. It is now 5.0% larger than it was in the AY12/13. Again, although it did not happen here, weeding of collections is both necessary and healthy. The culling of the general collection in other disciplines was carried out to prepare for a newly-renovated facility that saw a 4,000 linear foot reduction in the overall shelf space allotted for physical holdings, but the larger rationale for periodic weeding is to bring up the currency of the collection. The trends in total disciplinary holdings (by volume) during the period under review are reflected below:

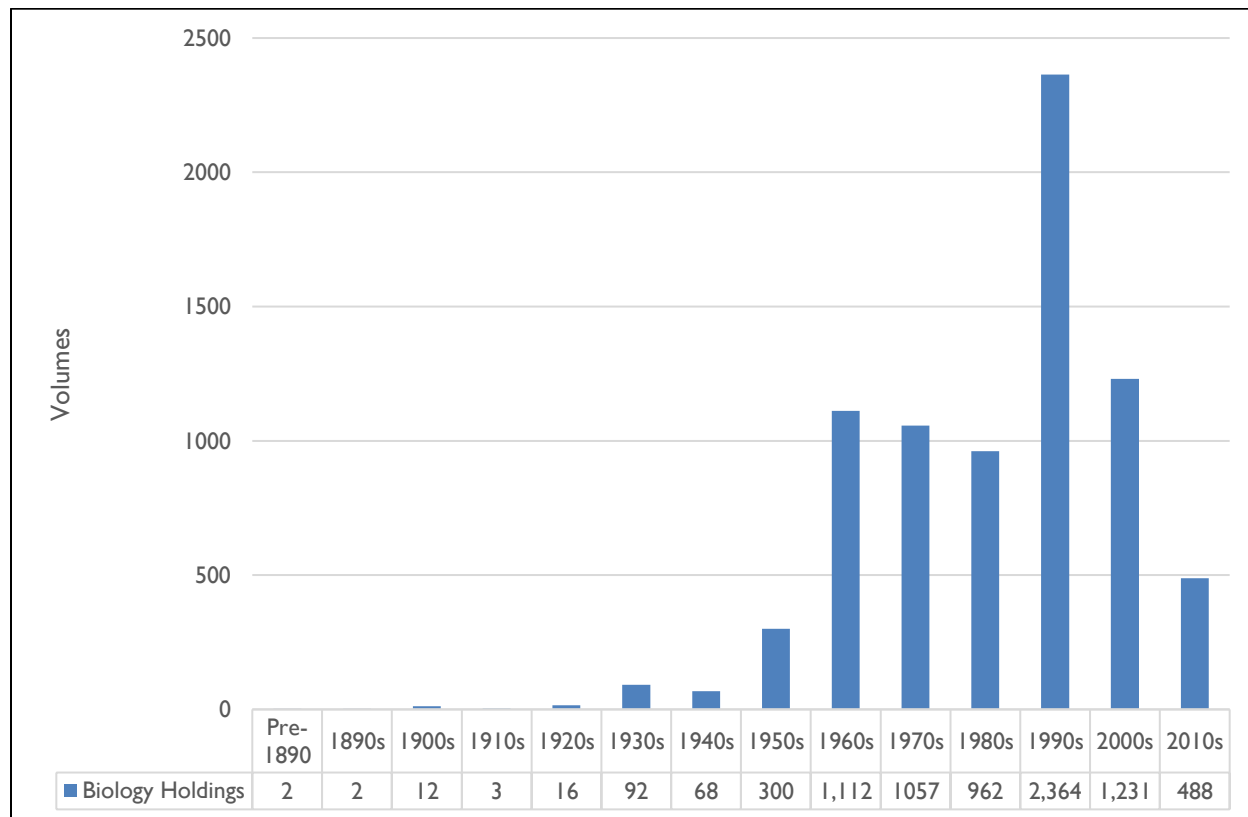


As the various disciplinary holdings grew in number, and then even as we weeded the entirety of the general collection, the biology and biology education volumes nevertheless shrank as a percentage of the Library's overall holdings. At the conclusion of the AY16/17, titles in biology comprised 4.0% of the overall holdings, or 7,705 out of 190,921 volumes; they were 4.2% of our holdings (173,237) in the AY12/13, which is roughly when we began collecting consistent data. Thus, throughout the last five years our physical holdings in monographs have met the criteria for category 2b, "basic advanced" or that which is sufficient for community colleges. Despite the University having offered multiple flavors of Master's programs in the discipline, the numbers reveal the inadequacy of the library's collections for graduate-level education in biology. Serious consideration would need to be given to continuing the program given this deficit.

Holdings in each of the Library of Congress call letter categories over the last five years appear below:

LC Subject Area	LC Call Number	2013	2014	2015	2016	2017
Environmental Science	GE	381	388	399	402	405
Natural History	QH	2,154	2,172	2,178	2,232	2,256
Botany	QK	632	636	637	642	647
Zoology	QL	2,108	2,131	2,138	2,153	2,169
Human Anatomy	QM	125	126	126	126	126
Physiology	QP	1,324	1,350	1,352	1,377	1,395
Microbiology	QR	340	345	346	353	356
Environmental Tech	TD	277	278	281	285	289

Many of the collections in the Amelia V. Gallucci-Cirio Library are “crowded” around acquisitions in the 1990s, and here the biology and biology education disciplines are no exception. Fully one-third (30.7%) of all biology holdings were published in this decade. However, more than half of the volumes (53.0%) were published since 1990. In recent years, this buying trend has slowed. It is for this reason that the mean holding for many of the discrete elements of the collection is from the 1980s, while the median and mode are almost always from the 1990s. The Washington Library Network’s *Collection Assessment Manual* recommends having 5% of a discipline’s holdings published within the last 5 years and 10% within the last 10 years. In biology and biology education, 3.1% of our holdings have a copyright date within the last 5 years, and 8.3% of the holdings are from within the last 10 years. The distribution of our holdings by decade is below:

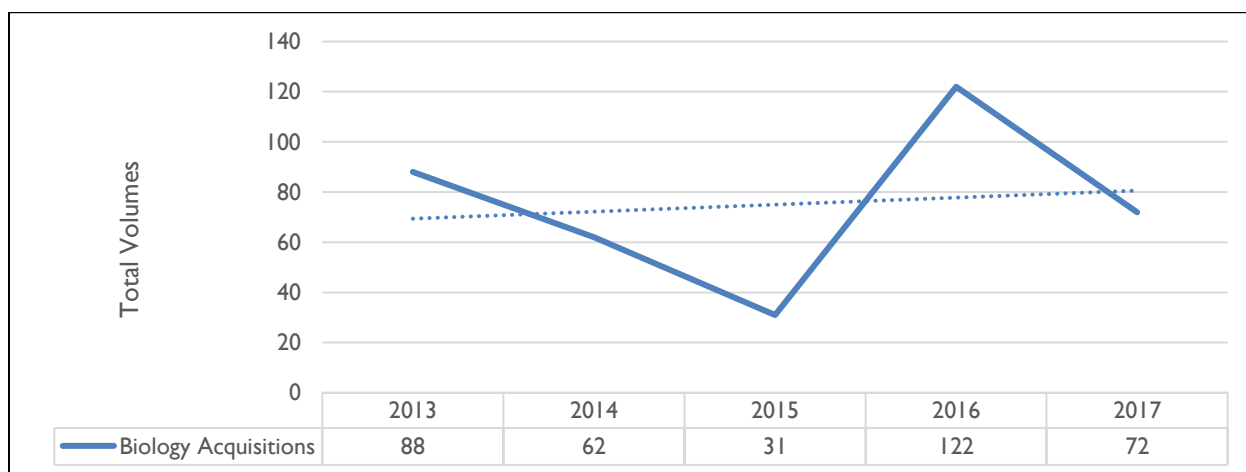




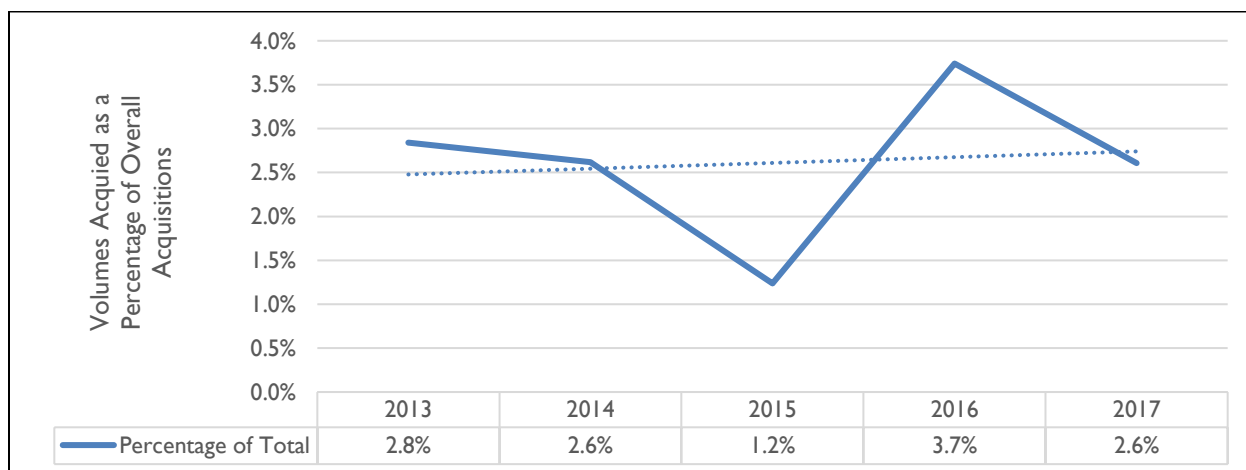
A disaggregated view of the mean, median, and mode for the biology and biology education collection is below:

LC Subject Area	LC Call Number	Mean	Median	Mode
Environmental Science	GE	1999	1999	1999
Natural History	QH	1985	1992	2000
Botany	QK	1986	1992	1993
Zoology	QL	1986	1992	1993
Human Anatomy	QM	1988	1993	1993
Physiology	QP	1988	1992	1993
Microbiology	QR	1985	1992	2000
Environmental Technology	TD	1994	1995	1993

In the last five years, acquisitions in biology and biology education have fluctuated, but they have generally trended upward. The per annum breakdown in acquisitions appears as follows:



The acquisitions in the discipline when viewed as a percentage of overall purchases by the library roughly track with the data above:



The breakdown of acquisitions in each of the LC call letter areas in the period is as follows:

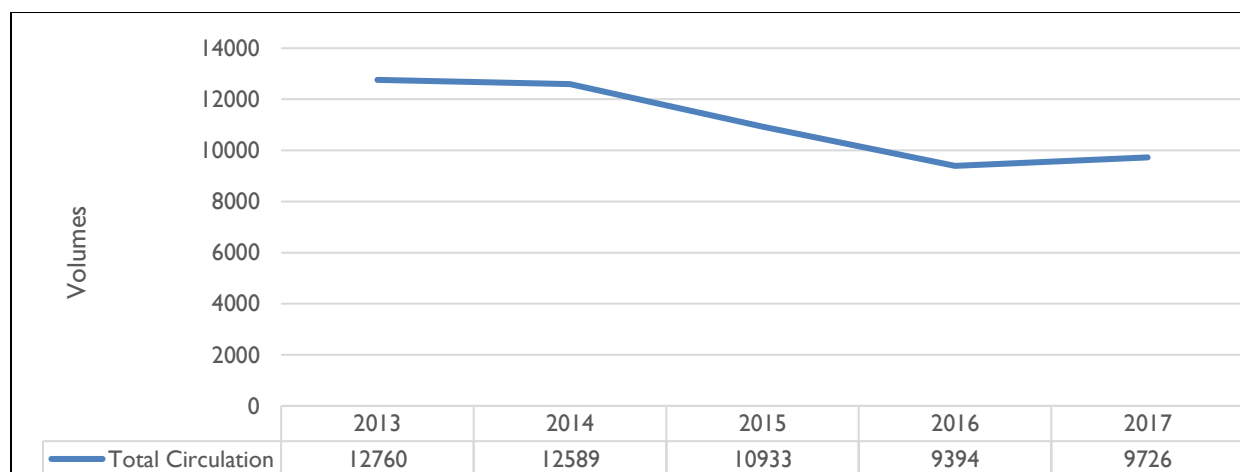
LC Subject Area	LC Call Number	2013	2014	2015	2016	2017
Environmental Science	GE	2	5	7	5	4
Natural history	QH	0	13	7	58	24
Botany	QK	2	3	1	6	4
Zoology	QL	26	12	9	15	13
Human anatomy	QM	2	1	0	0	2
Physiology	QP	20	23	3	26	19
Microbiology	QR	5	4	1	7	4
Environmental Technology	TD	4	1	3	5	2

### eBook Collection

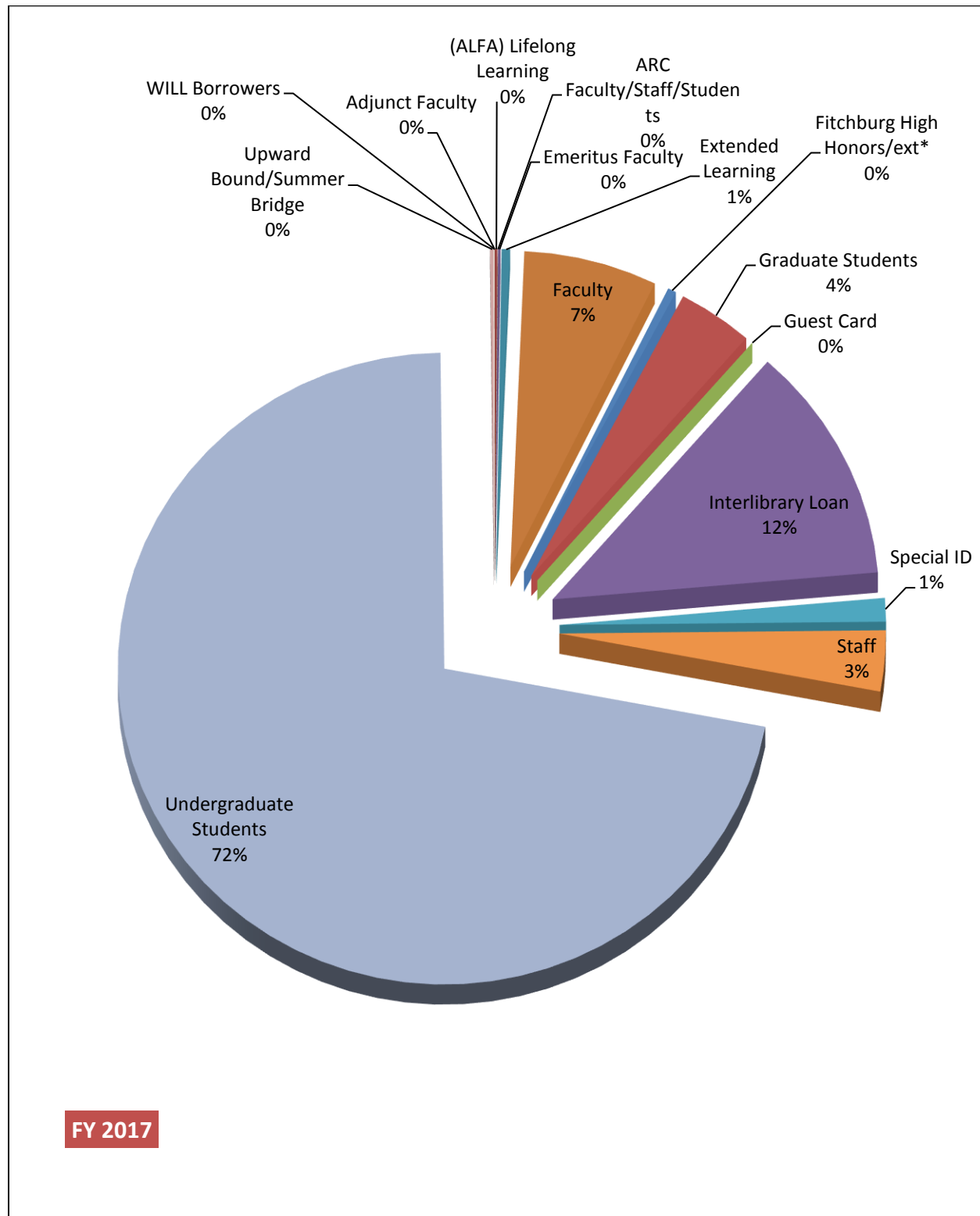
The University's eBook collection is quite small, and the library has acquired only a handful of volumes in biology and biology education. No benchmarking for such acquisitions exists, as the medium is so young. Recently, subject liaisons have explored the option of joining such consortia as the Massachusetts Library System's "Commonwealth eBook Collections" (found here: <http://guides.masslibsystem.org/ebooks>).

### Circulation

In the last few decades, a downward trend in circulation has emerged both nationally and locally. In 2012, the Association of College and Research Libraries openly speculated about the possibility that "by 2020 university libraries will no longer have circulation desks" (<http://acrl.ala.org/techconnect/?p=233>). While the ACRL is right to cite the rise of eBooks and the disruptive effects of the internet, the latter of which coincided with the first sustained drops in circulation in the aughts, such dire predictions have been made in many industries, and we have expected a levelling off in circulation declines to occur. Unsurprisingly, therefore, this has been the trend at FSU; it is also worth pointing out that during the AY14/15 (FY15) and AY15/16 (FY16), the library was undergoing major renovations. Discipline-specific circulation data has not been tracked for the review period, a lacuna we will rectify, but the institution-wide circulation rates are below:



Lastly, the bulk of the circulation has been with undergraduate students, but we also play a large role as a regional provider of interlibrary loan services. A snapshot of institution-wide usage for the AY16/17 is below:



## Serials Collection Description

### *Definitions for Serials Holdings*

1 & 2a = some general periodicals and some major indexes.

2b = 30% or more of the titles indexed in *Magazines for Libraries* and access to indexes.

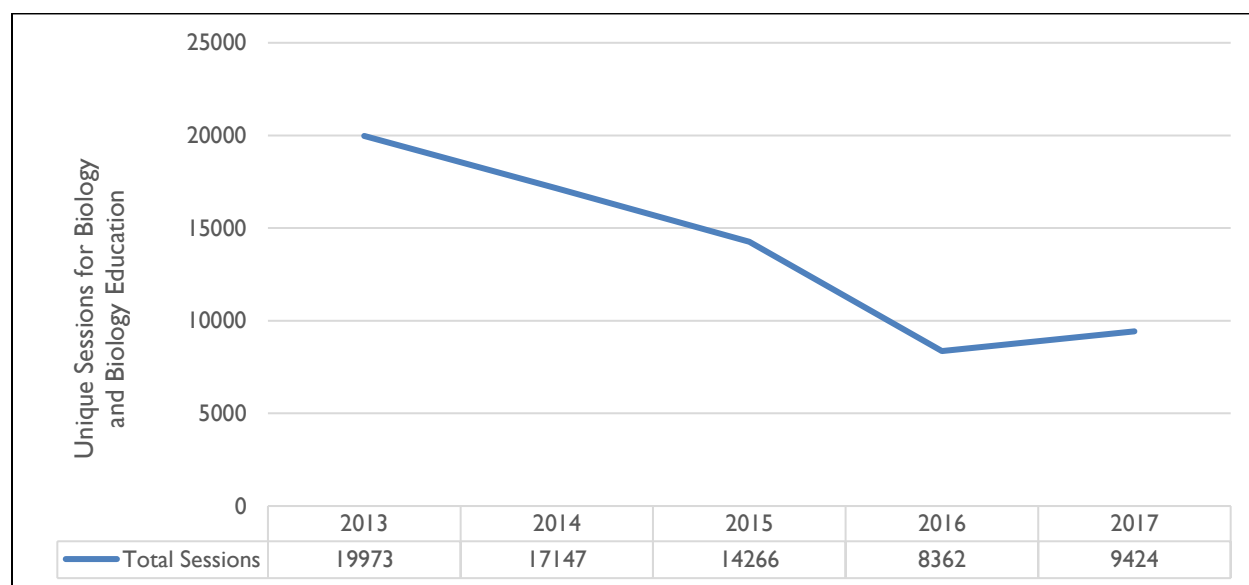
3a = 50% of the titles indexed in *Magazines for Libraries* and access to indexes.

3b = 75% of the titles indexed in *Magazines for Libraries* and access to indexes and access to non-bibliographic databases.

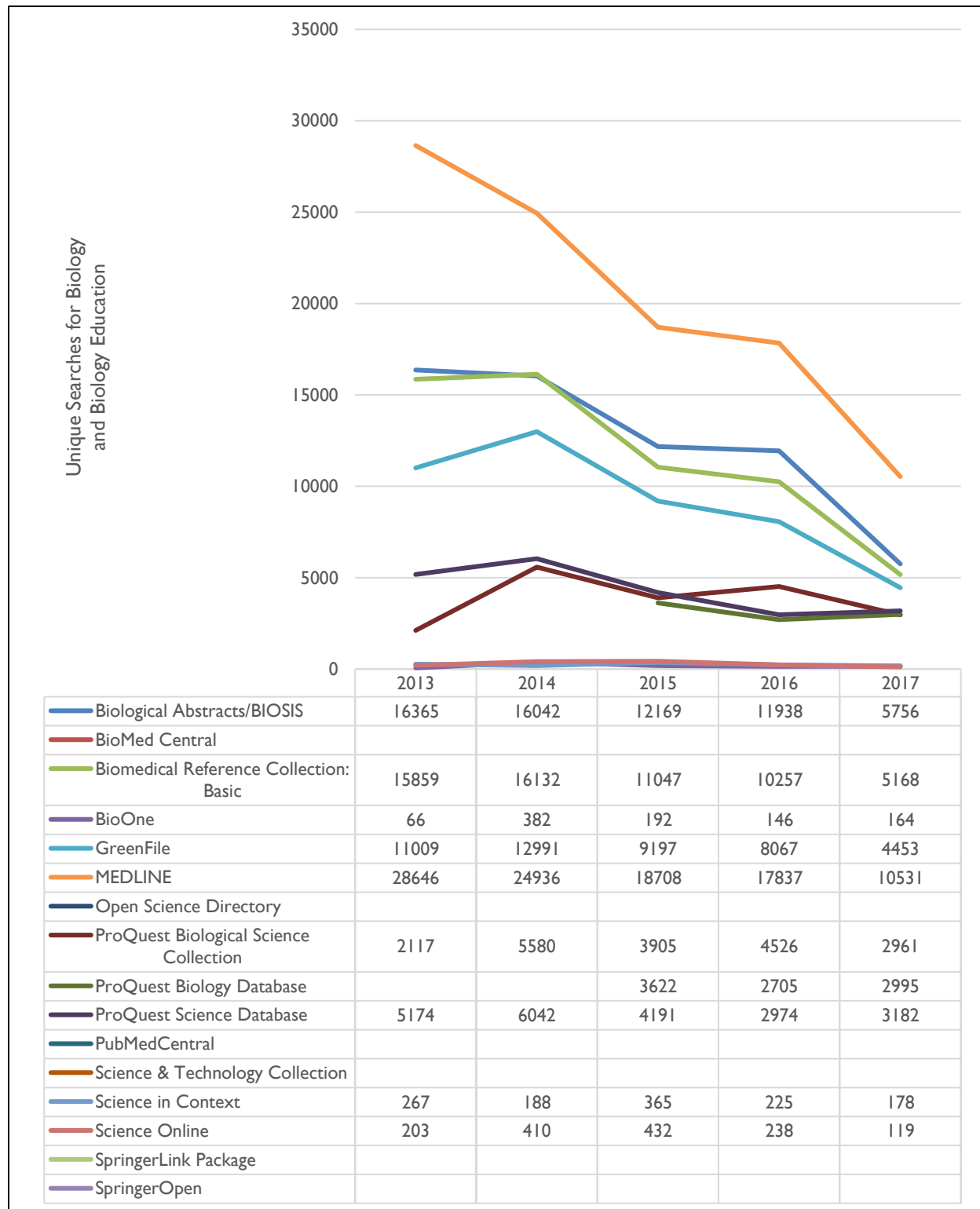
3c = 90% of the titles indexed in *Magazines for Libraries* and access to the major indexing and abstracting services in the field.

The full complement of databases treating the biology and biology education disciplines can be found on the FSU library website (<http://library.fitchburgstate.edu/research/databases/biology/>). Whereas there are 16 directly applicable databases, another 14 databases supplement this core collection, and individual titles that stretch across the sciences and that are embedded within databases or that we subscribe to separately (and which are accessible through Serials Solutions) number in the thousands.

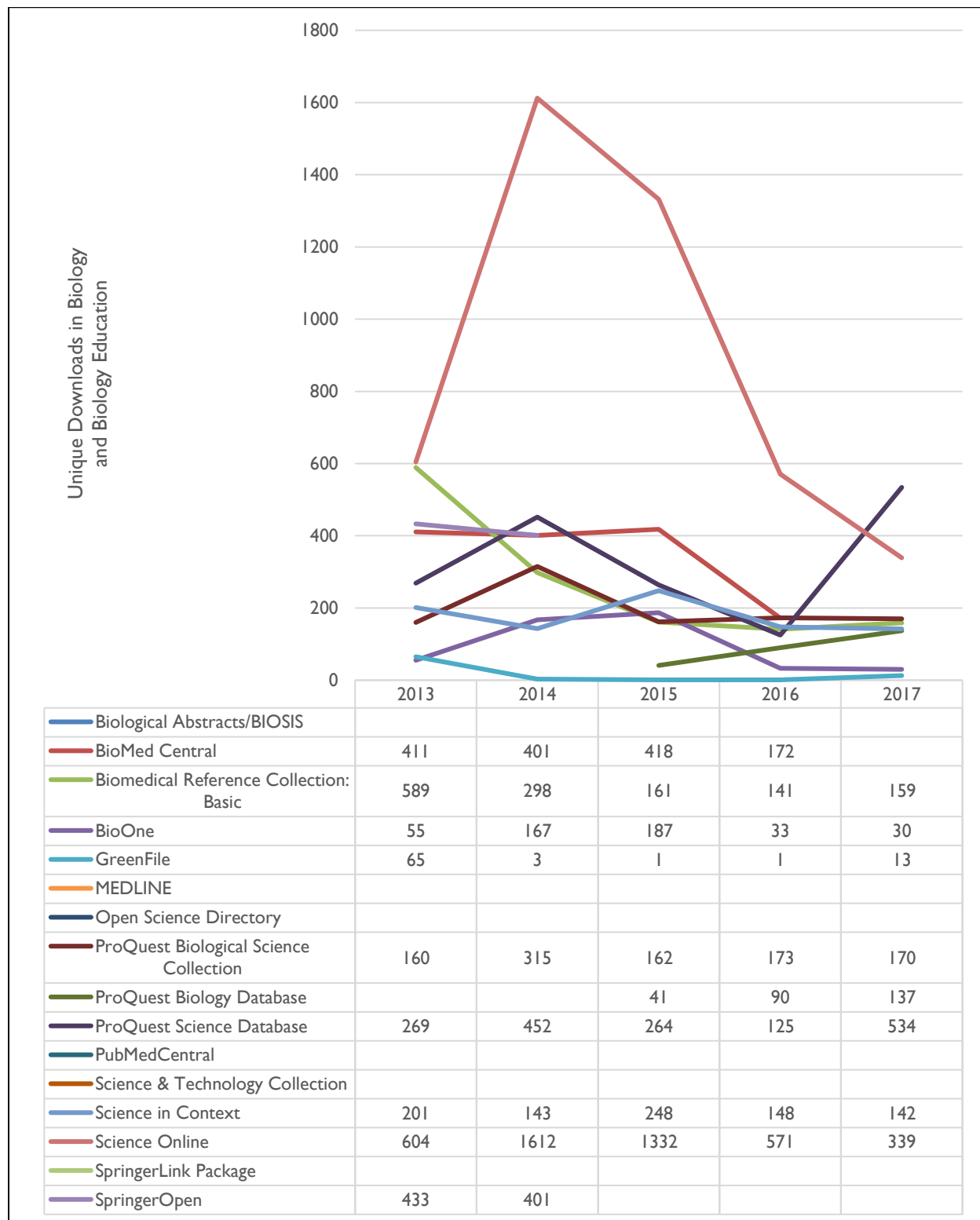
Database usage data disaggregated by discipline does not exist. Aggregate usage on the 16 core databases associated with biology and biology education has fallen 52.8% (as reflected in sessions) during the period under review. This, of course, means that we are taking into account sessions in databases that offer more general coverage and appeal to a larger audience (e.g., Science Online and the Springerlink Package). The number of institution-wide unique sessions for these core resources are below (see graphs on the following four pages for their enumeration):



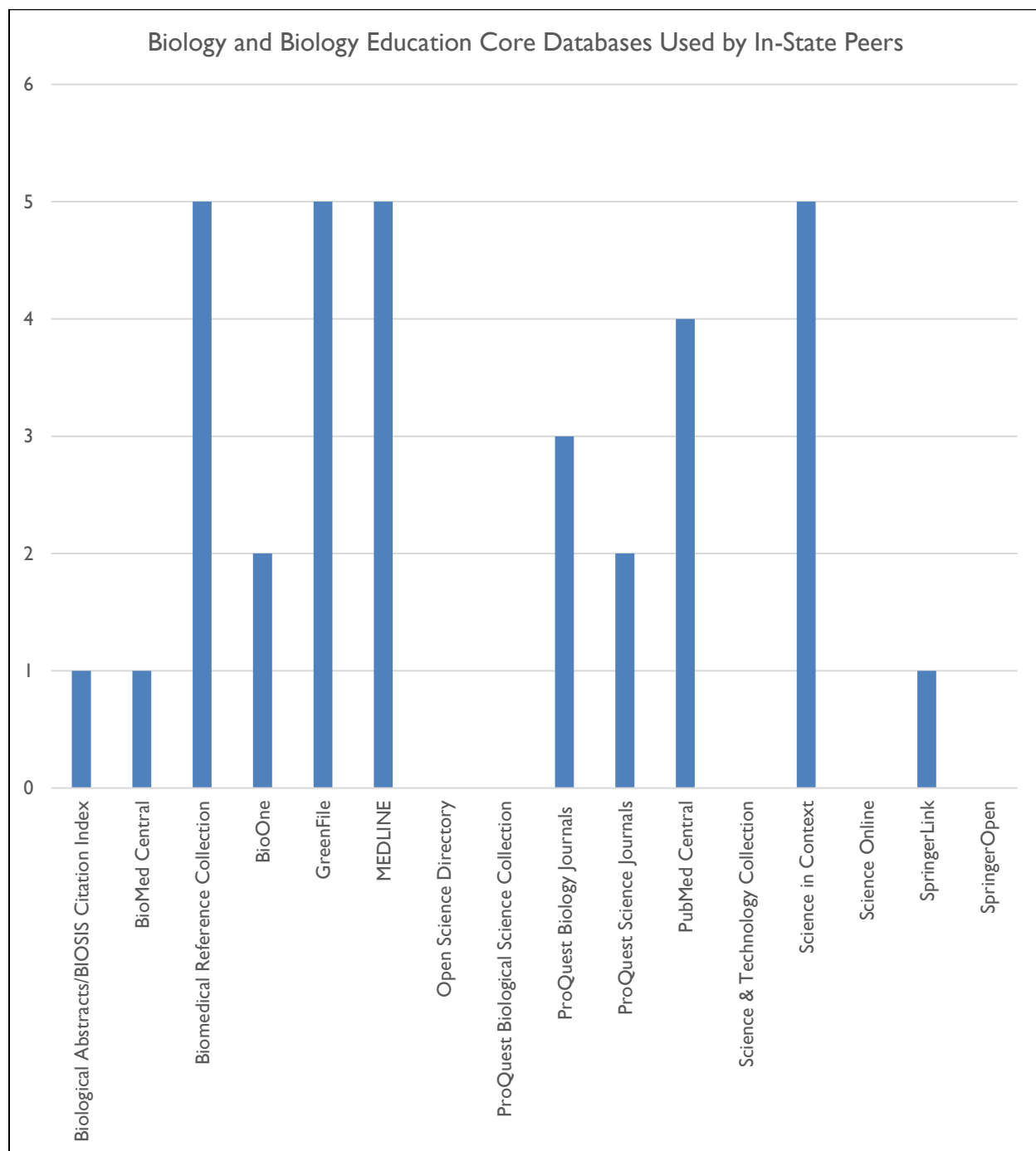
The disaggregated institution-wide trends for searches in core biology and biology education resources are below. N.B.: In general, usage declined across the board; however, the precipitous decline in usage of Medline distorts the picture by “flattening” the usage elsewhere. Moreover, blanks indicate either that there was no data for a given database or year, or that the database was newly acquired



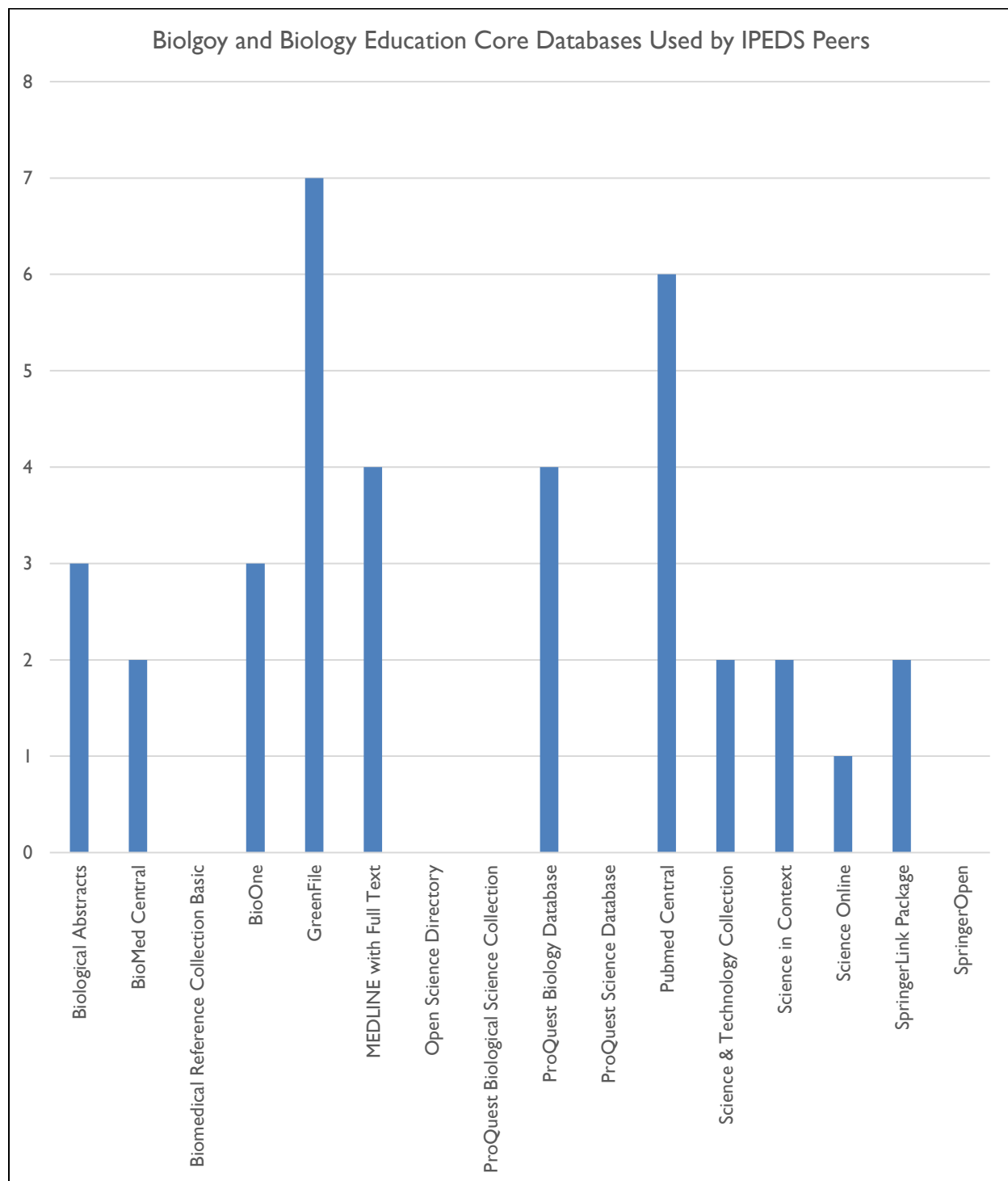
The disaggregated institution-wide trends for downloads in biology and biology education are below. N.B.: again, blanks indicate either that there was no data for a given database or year, or that the database was newly acquired; moreover, note the distortion of the various downward trends by Science Online data.



The majority of our core resources are not generally utilized by our in-state peers, which for the purposes of this program review are five of the eight sister state universities (i.e., Bridgewater State University, Framingham State University, Salem State University, Westfield State University, and Worcester State University). Of the several resources that are shared amongst our peers, 6 are “generally” held (in this report, this means by 3 or more institutions). In short, as the graph below suggests, we are somewhat different from most of our state peers, even as our sister institutions have additional databases that serve the discipline of biology and biology education. (The full list of the databases used by in-state peers appears below in Addendum A.)



A slightly smaller number of our national peers, as measured by IPEDS and Carnegie classification (i.e., Albany State; Auburn University, Montgomery; Chicago State; Fort Hays State; Georgia College and State University; Saginaw Valley State; University of Tennessee, Chattanooga; University of Michigan, Flint; Western Carolina University), subscribe to the same services as we and our in-state peers do. (The full list of databases utilized by our IPEDS peers appears in Addendum B.) The number of IPEDS peers using our core databases is below:

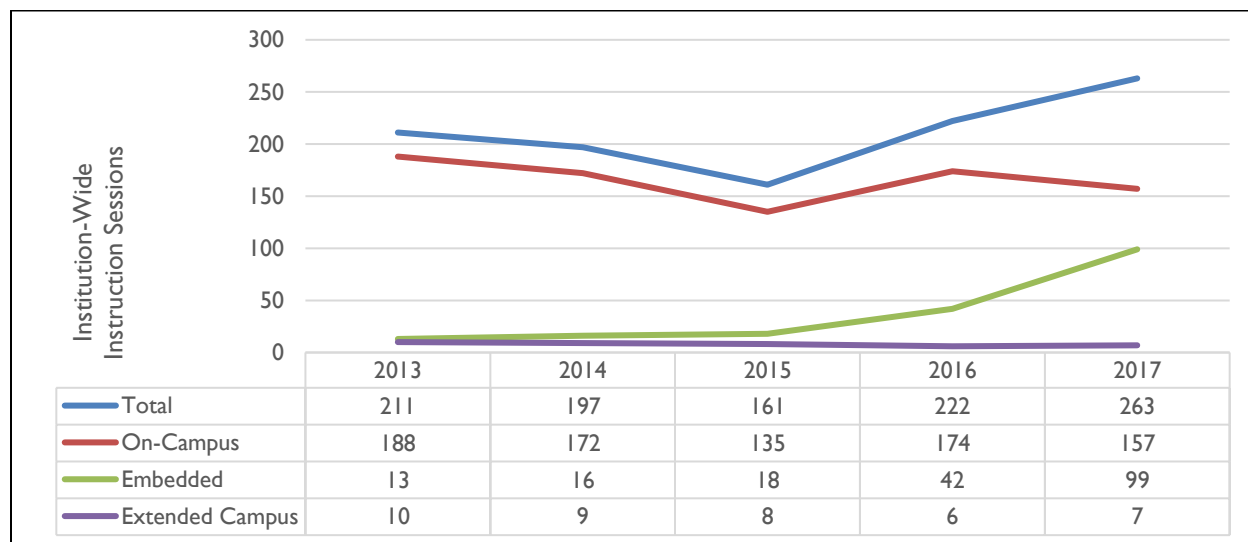




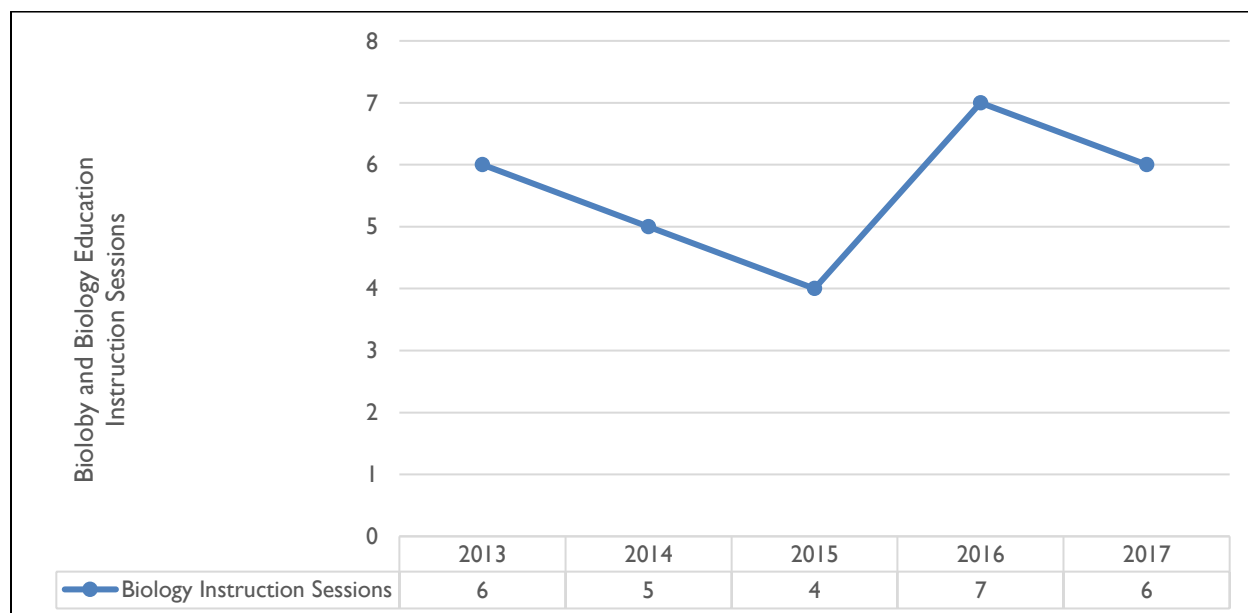
A comparative analysis of our individual journal holdings (by title) against national benchmarks shows that we are at the level of 3b, which means that we offer resources for advanced undergraduate study; the collection is nevertheless insufficient for graduate students. We have 86% or 61 of 71 core biology and biology education titles indexed in *Magazines for Libraries* (2016 ed.).

### Library Instruction

The library offers discipline-specific and general information literacy instruction sessions. During the renovations, we experienced considerable disruption of these services. This perhaps explains the drop off in instruction requests and the subsequent rebound. The trends in institution-wide instruction sessions are represented in the graph below:

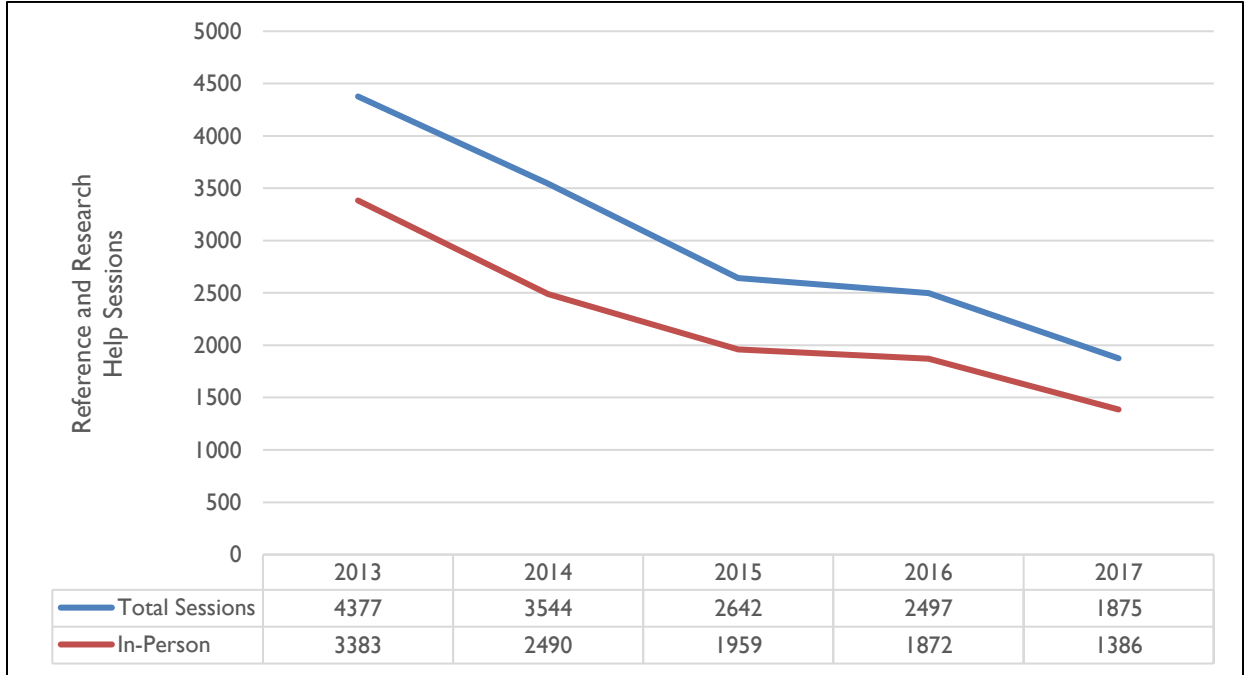


The trends in biology and biology education instruction sessions are represented in the graph below:

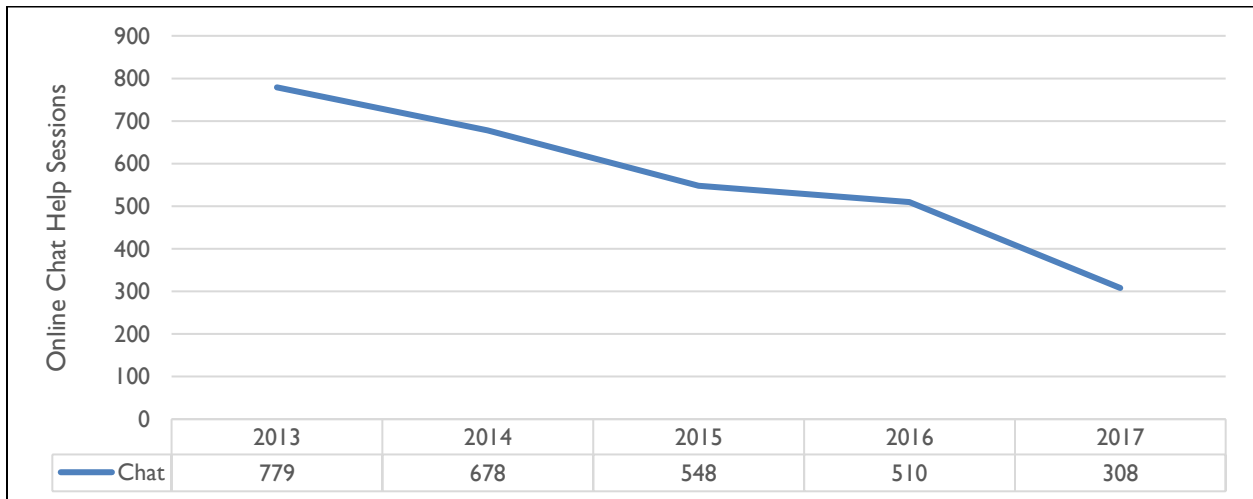


## Reference Instruction

The library offers reference services in a variety of modes. The overwhelming majority of such services are offered in-person at the research help desk, although this number has declined significantly over time. The aggregate trends in reference and research help appear below:



One piece of this decline in reference and research help is the rapid reduction in the number of online “chat” help sessions. We have traced this, in part, to our web re-design, which buried the chat functionality in the new website; a fix for this is in the offing, and we should see a resulting return of web-based reference and research help sessions. The trend is identified below:



## Addendum A: Databases Used by In-State Peers

Academic OneFile	GreenFile
Academic Search Premier	Hazardous Substances Data Bank
AccessScience	Health and Wellness Resource Center
AgeLine	Health Reference Center Academic
Agricola	Health Source: Nursing/Academic Edition
Agriculture Collection	HighWire Press Journals
Annual Reviews	JSTOR
	Mammalian Species Index
Applied Science & Technology Abstract	MasterFILE Premier
Biography in Context	MEDLINE
Biography Index Past & Present	Nature.com Complete
Biography Reference Center	OMIM : Online Mendelian Inheritance in Mac
Biological Science Database	Open Science Directory
BioMed Central	OVID
Biomedical Reference Collection: Basic Edition	PrimateLit Database
BioOne	Proceedings of the National Academy of Sciences of the United States of America (PNAS)
Biological Abstracts/BIOSIS Citation Index	PLOS (Public Library of Science)
Birds of North America Online	ProQuest Biological Science Collection
Book Review Digest Plus	ProQuest Biology Journals
Books in Print with Book Reviews	ProQuest Central
Britannica Academic	ProQuest Science Journals
Cochrane Collection Plus	PsychINFO
Credo Reference	Pubget
Current Biography Illustrated	PubMed
DOAB - Directory of Open Access Books	Science & Technology Collection
DOAJ - Directory of Open Access Journals	Science Direct
Ebook Central (ProQuest)	Science in Context
eBook Collection (EBSCO)	Science Online
EBSCOhost Web	ScienceResearch.com
Ecology	SciFinder
Environmental Studies and Policy	SpringerLink
EurekaAlert!	SpringerOpen
Expanded Academic ASAP	Web of Science
Films on Demand	Wiley Online Library
Gale Virtual Reference Library	Zoological Abstracts
Gardening, Landscape, and Horticulture	
General OneFile	
General Science Collection	
Google Scholar	

## Addendum B: Databases Used by IPEDS Peers

Academic OneFile	Botanicus (Missouri Botanical Garden Botanicus Collection)
Academic Search Complete	CINAHL Plus with Full Text
AccessScience	Cochrane Collection Plus
Agricola Index	COS Conference Papers Index
Agricultural & Environmental Science	Credo Reference
Agriculture Collection	Dictionary of Substances & Their Effect (Dose, 3rd Electronic Edition)
American Chemical Society Publications	Earth, Atmospheric & Aquatic Science
Applied Science & Technology Abstracts	Ebook Central (ProQuest)
Applied Science & Technology Full Text	Ebook Collection (EBSCOhost)
Applied Science & Technology Retrospective	Encyclopedia of Life
ASFA: Aquatic Sciences & Fisheries	Encyclopedia of Life Sciences
Biography & Genealogy Master Index	Environment Complete
Biological Abstracts	Environmental Science Collection
Biological & Agricultural Index Plus	Environmental Sciences & Pollution Management
Biological Sciences	Environmental Studies and Policy Collection
Biological Science Full Text Journals	Expanded Academic ASAP
Biology & Agriculture Index Plus	Films on Demand
Biology Database (ProQuest)	Forest History Society Databases
BioMed Central	Gardening, Landscape and Horticulture Collection
Biomedical Reference Collection Basic	General Science Collection (Gale)
BioOne	General Science Full Text (EBSCO)
BioOne Abstracts & Indexing	GenETHX
Biosis Citation Index	Genetics Abstracts
Biosis Previews	GreenFile
Biotechnology and BioEngineering Abstracts	GREENR (Global Resource on the Environment, Energy, and Natural Resources)
Birds of North America Online	Health and Wellness Resource Center

Health Reference Center  
Academic  
Health Source: Consumer  
Edition  
Health Source:  
Nursing/Academic Edition

Infotrac Agriculture Collection  
JOVE  
JSTOR  
MEDLINE Complete  
MEDLINE with Full Text  
Merck Index  
Methods in Enzymology  
National Science Digital  
Library  
Nature Journals Online  
Nature Publishing Group  
Journals  
NCBI National Center for  
Biotechnology Information  
Open Science Directory  
PLOS Biology  
PLOS Computational Biology  
PLOS Genetics  
PLOS Pathogens  
Primal Pictures Anatomy &  
Physiology  
Primal Pictures 3D Human  
Anatomy and Physiology  
Public Library of Science  
PubMed

Pubmed Central  
PubSpace (NASA funded  
research)  
Sage Premier  
Science & Technology  
Collection  
Science Citation Index  
Science in Context  
Science Databases  
Science Magazine  
Science Online  
ScienceDirect  
Science.gov  
SciTech Connect  
SciTech Premium Collection  
SpringerLink Package  
SpringerOpen  
SpringerProtocols  
Today's Science  
TOXLINE  
TOXLINE & Toxicology  
Abstracts  
Web of Science  
Web of Science & EndNote  
Web  
Web of Science Core  
Collection  
Wildlife & Ecology Studies  
Worldwide  
Wiley Interscience  
World Wide Science  
Zoological Record

## Appendix D: Biology and Chemistry Department Procedures

### Department Meetings

1. The Department Chair is the presiding officer. If the chair is unavailable and the meeting must be held, the members present should elect a chair *pro tem*. It is the responsibility of the presiding officer to maintain order at the meeting, including adherence to the agenda, use of proper motions and establishment of a speaker's order for all discussions.

2. A schedule of departmental meetings for the semester should be established by the chair at the beginning of each semester and distributed to all department members. Meetings should take place between the hours of 8:00 a.m. and 4:30 p.m., Monday through Friday. Meetings should be scheduled to maximize participation (*i.e.*, avoid days and times when a large number of members have a scheduled class). If there is insufficient business or the chair knows a quorum cannot be attained, the meeting may be canceled at the discretion of the chair.

3. At the Chair's discretion, special meetings of the department may be called in order to make decisions that cannot be postponed until a regularly scheduled department meeting. The specific agenda and the reason for the special meeting must be given to all members of the department. Notification must be given at least two (2) working days in advance of the special meeting. Department members should be contacted via their home telephone number; additional notification via e-mail, office telephone numbers and written memoranda may also occur.

4. A written agenda, with all items and proposals to be considered, shall be distributed to all members of department at least three (3) working days in advance of the meeting. The members present at the meeting may vote to change the order of agenda items. Members of the department may submit items for the agenda to the chair at least five (5) working days prior to the meeting or from the floor at the meeting.

5. A quorum is a majority of the eligible voting members of the department. Part-time faculty and faculty on any leave of absence on a full-time basis are not eligible to attend department meetings. If a quorum is not present, discussion may occur but no votes may be taken.

6. Everyone has the opportunity to be heard on a subject under discussion. The Chair is not required to allow participants to repeat the same points or address themselves to extraneous matters.

7. Voting is by a show of hands or a voice vote. Secret ballots shall be used when individuals are being elected to a position (chair, committee appointments, *etc.*). Votes by mail or email may be allowed when proposals have been submitted to all department members ahead of time. Proxy voting is not permitted under any circumstances.

8. In accordance with Robert's Rules, a majority vote is a majority of the votes cast when a quorum is present; abstentions are not votes.

**Summary of Departmental Meeting Attendance, Committee Service and Voting Rights**

Type of Appointment	May Attend Meetings?	May Serve on Committees?	May Vote in Elections?	May Vote on Non-Election Matters?
Tenure Track	Yes	Yes	Yes	Yes
Full-Time Temporary	Yes	Yes	No	Yes
Other Part-Time Faculty	At Dept's Discretion	No	No	No

9. Minutes shall be taken by a secretary *pro tem* appointed by the chair for the term of the meeting and such appointments should rotate among department members. Minutes will include the names of members present, motions adopted or not adopted, reports announcements. Unless points are made in discussion that clarify the motion or actions to be taken, discussion of motions are not summarized in the minutes. Minutes shall be signed by the secretary *pro tem* and distributed to all department members within ten (10) working days after the meeting. Minutes must be approved at subsequent department meeting.

10. If the chair deems it necessary, and no member of the department objects, voting on a specific issue that would otherwise need to be handled via a special department meeting may be conducted via email or telephone so long as the issue is not one in respect of which confidentiality is a concern.

11. The chair is authorized to make decisions on an emergency basis. The chair should notify the department members of any such emergency decisions as soon as practicable. Such notice might appropriately be given via home telephone.

12. Non-voting guests (including part-time and full-time faculty and faculty on a leave of absence on a full-time basis, such as a sabbatical leave) may attend meetings at the invitation of the chair or by majority vote of the members present at any meeting.

**Recruitment of Full-Time Faculty**

**I. General Provisions**

1. The procedures for the recruitment of all faculty in the department shall conform to applicable Affirmative Action/Equal Employment Opportunity guidelines of the university, state and federal law and the BHE/MTA collective bargaining agreement.
2. These procedures shall only apply to the recruitment of full-time faculty, whether tenure-track or temporary, when either the Vice President for

Academic Affairs or the department chair has requested that the department assist in the recruitment for the position.

3. The hiring of part-time faculty is conducted under the auspices of the department chair. The chair may request assistance in the hiring of part-time faculty.

## II. **Job Descriptions**

1. The department chair shall call a meeting of the department to discuss the job description. The department chair shall then submit a written proposed job description for the approval of the department members at least ten (10) working days prior to the deadline for submission to the administration.

2. If the department fails to approve a job description at the end of the meeting, the chair may call further meetings for the purpose of discussing the job description or submit his/her own job description to the administration. Copies of any such submission shall be provided to the members of the department.

## III. **Search Committees**

1. Once the job description has been approved for advertisement by the administration, a search committee shall be formed, the size of which shall be determined by standard university policy. Members of the department may submit their names for nomination to search committees. If more members are nominated than are required on the committee, then an election shall take place. Members of the department shall vote by secret ballot and the department chair shall tally the votes.

**Note:** While the contract requires a secret ballot in this instance it is agreed that if a verbal resolution may be reached we will not require a secret ballot.

2. Once constituted, the search committee shall elect its' own chair. The search committee chair shall be responsible for communication with the members of the department, the department chair and the administration. The search committee chair shall ensure that the committee adheres to all university procedures.

3. In compliance with appropriate university and collective bargaining requirements, the search committee shall devise its own method of reviewing job applicants, identifying those applicants to be interviewed, and gathering feedback regarding interviewed candidates from members of the department.

## IV. **Interviewing Candidates**

All members of the department, including the department chair, shall be invited to participate in on-campus interviews with all candidates to be interviewed. Copies of applicant materials shall be made available to members of the department prior to

## V. **The Role of the Department Chair**



1. The search committee shall recommend, simultaneously and in writing, the names of finalists to the department chair and the Affirmative Action/Equal Employment Opportunity Officer, in accordance with college procedures. The department chair shall then meet with the search committee to discuss the relative strengths and weaknesses of each finalist.
2. When the department chair has prepared his/her recommendation regarding which candidate(s) should be offered the position, the department chair shall communicate that recommendation, in writing, to all members of the search committee at least five (5) working days prior to submitting the chair's and committee's recommendation(s) to the administration.
3. At the request of either the search committee or the department chair, another meeting shall be held to discuss the Chair's and/or committee's recommendation(s).

#### VI. Notification Procedures

1. After the administration has informed the department chair that an applicant has accepted an offer of employment, then, within ten (10) working days thereafter, he/she shall inform the members of the department in writing of the name of the successful candidate.
2. Upon the conclusion of the search, the search committee chair or designee shall notify all other candidates that the search has concluded. If for any reason a search fails, then the department chair shall notify the members of the department in writing as soon as practicable.

### **Departmental Committees General Provisions**

#### I. Eligibility

Unless precluded from serving by contractual or statutory provisions, all full-time members of the department who are not on a leave of absence on a full-time basis are eligible to serve on departmental committees. All full-time faculty members are expected to serve on at least one committee within the Department.

#### II. Nominations and Membership

1. Unless otherwise specified by contractual or statutory provisions, the department chair shall determine the number of members to serve on a committee and, if applicable, the number of student members.
2. The department chair shall request faculty nominations for all committees in writing at least five (5) working days before nominations are to close. Members may nominate themselves; members shall not nominate others without the express consent of the other person.
3. Proposed committee composition will be presented at a departmental meeting for review by all faculty. Once agreement has been reached committee membership, each committee then meets to nominate a chair and to select student members.

4. Whenever appropriate or required contractually, students shall be appointed to serve on departmental committees. Unless otherwise specified, student nominees shall be full-time, matriculated students majoring in a major offered by the department. In all cases, student members must be in good academic standing.
5. The chair shall solicit from members of the department the names of student nominees. Members may submit names of student nominees after obtaining permission from the student to be nominated; such nominations shall be in writing. The chair shall then appoint the requisite number of students to the appropriate committee and inform all members of the department of these appointments in writing.

### **Composition, Duties, and Responsibilities of Department Committees**

- I. A. Departmental Undergraduate Curriculum Committee
  1. The membership of the committee is composed of full-time faculty, the Department Chair, and two eligible students. The committee is composed of at least three but not more than five faculty (excluding the Chair in the faculty count).
  2. Faculty and student members are selected according to the General Provisions outlined above and serve for one academic year. The committee is reconstituted in the fall of each academic year.
  3. Once constituted, the committee shall elect its' own chair.
- B. Duties and Responsibilities
  1. The committee shall review and make recommendations concerning the undergraduate curriculum of the department.
  2. The committee shall from time to time review the long-range educational objectives of the department as those may relate to its academic curriculum and to the goals and objectives of the University.
  3. The committee shall also make recommendations concerning the quality of student academic advising in the department and the manner of its most effective delivery to students, interdisciplinary cooperation, innovative instructional techniques, career opportunities for students, or such other related matters as the committee shall deem appropriate.
  4. In respect of all of the foregoing matters, the committee shall consider such recommendations and proposals as the Vice President may from time to time submit to the committee. The Vice President may also meet with the committee from time to time to discuss matters of mutual concern.
  5. The committee shall transmit its recommendations to the Department Chair who shall transmit the committee's recommendation to the Vice President.
  6. In considering and making its recommendations on the quality of academic advising in the department and its most effective delivery to

students, the committee shall solicit recommendations and comments from those students who are advisees assigned to members of the department, and shall do so using Appendix H.

II. A. Departmental Graduate Committee

Membership consists of graduate faculty (as determined by the College President) within the department is selected by the same process as for other committees; the chair of the committee is selected by majority vote of the committee members. The number of committee members is at least 3 but no more than 5 graduate faculty. The Graduate Program Chair is automatically on this committee.

B. Duties and Responsibilities

1. The Departmental Graduate Committee shall review and make Recommendations concerning graduate curriculum, admissions, the criteria for appointment to membership on the graduate faculty and other related matters.
2. From time to time, the committee shall also review the long-range Educational objectives of the department in relation to the department 's graduate curriculum and make recommendations concerning interdisciplinary cooperation, career opportunities for students or such other matters as the committee shall deem appropriate.
3. The committee shall transmit its recommendations to the Department Chair, who shall transmit the committee's recommendation to the Graduate Dean.

III. A. Peer Evaluation Committee

1. The Department shall constitute a Peer Evaluation Committee as necessary. If the department has twelve or more full-time members and the Peer Evaluation Committee must conduct eight or more evaluations, then the department may, at its discretion, establish a second Peer Evaluation Committee.
2. The Department Chair is responsible for ensuring that the Peer Evaluation Committee is annually established no later than September 30<sup>th</sup>.
3. Two tenured members are be elected by the department from within the department; a third member may be selected in each case by the candidate from the department or from a cognate department (the selected member can serve on more than one Peer Evaluation Committee).
4. Elected members may be drawn from cognate department(s) when needed. Cognate departments are designated as such by the Vice President.

B. Duties and Responsibilities

Members conduct the duties and shall meet contractual calendar deadlines as outlined in the MSCA Contract.

IV. A. Student Affairs

1. The membership of the committee is composed of full-time faculty. The committee is composed of at least 3 but not more than 5 faculty.
  2. Faculty members are selected according to the General Provisions outlined above and serve for one academic year. The committee is reconstituted in the fall of each academic year.
  3. Once constituted, the committee shall elect its' own chair.
- B. Duties and Responsibilities
1. Ensure that students are integrated into departmental committees, advise the Biology and Chemistry Club, and help coordinate social activities between students and faculty.
  2. Work to improve student/faculty communication by writing and maintaining a student handbook.
  3. Determine which students will be awarded the Outstanding Senior Awards annually.
  4. Review and update departmental publications or marketing materials on a regular basis; PowerPoint, Open House board, web pages. Interface with Admissions so that they may better recruit students.
  5. Update enrollment data annually including retention and diversity which should be broken down by majors, tracks, non-majors, and by courses. Develop a system to identify those students that will need particular courses in any given year to help in course scheduling.
  6. Update post-graduate student records, develop a method of surveying former students as to their post-graduate employment. Make recommendations on how to improve career advising.
  7. Compile an annual summary of Independent Study/Internships completed by students.
  8. Any student appeals concerning the student's removal from the major for a science GPA below 2.0 will be directed to and decided by this committee.

V. A. Assessment

1. The membership of the committee is composed of full-time faculty. The committee is composed of at least 3 but not more than 5 faculty.
  2. Faculty members are selected according to the General Provisions outlined above and serve for one academic year. The committee is reconstituted in the fall of each academic year.
  3. Once constituted, the committee shall elect its' own chair.
- B. Duties and Responsibilities
1. Compile assessment data, review assessment action items on an annual basis.
  2. Evaluate course content, work to increase and maintain coordination and integration among courses, especially core courses.
  3. Develop and implement an exit survey for majors as well as a post-

graduate survey in order to assess the effectiveness of our program.

4. Interface with campus on the incorporation of our assessment and survey documents into the campus-wide system.

VI. A. Equipment and Facilities

1. The membership of the committee is composed of full-time faculty. The committee is composed of at least 3 but not more than 5 faculty.

2. Faculty members are selected according to the General Provisions outlined above and serve for 1 academic year. The committee is reconstituted in the fall of each academic year.

3. Once constituted, the committee shall elect its' own chair.

B. Duties and Responsibilities

1. Develop and annually update a comprehensive plan on facility use. Propose space reallocations.

2. Identify and develop justifications for capital expenditures (must be ready to submit in December on budget as EBRQ (extraordinary budget requests) as relating to vision statement action items.

3. Compile an annual summary of equipment, technology, and facility changes, purchases or improvements.

4. Coordinate with staff support and campus community on safety procedures. Interface with other campus departments about new building.

VII. A. Departmental Ad Hoc Committees

1. The membership of the committee is composed of full-time faculty. The committee is composed of at least 3 but not more than 5 faculty.

2. Faculty members are selected according to the General Provisions outlined above and serve for 1 academic year. The committee is reconstituted in the fall of each academic year.

3. Once constituted, the committee shall elect its' own chair.

VIII. A. Search Committees

See Recruitment of Full Time Faculty

### **Selection Process for a Department Chair Nominee**

The appointment of a Chair follows those procedures stated in the MSCA Contract. The single nominee put forth by the department for consideration of the President is selected according to the following procedure:

1. Candidates are selected by nomination. A candidate is nominated by a tenure-track faculty member or may self-nominate for the position.

2. All candidates will express their willingness to serve at an open departmental meeting. If more than one faculty member wishes to serve, the

faculty are given a chance to consider the merits of all candidates.

3. If necessary, a vote is taken to decide on the nominee that will be put forth to the President. Voting is by secret ballot and will take place within a defined time period.

4. The name of the nominee is put forward to the President according to the time frame outlined in the MSCA Contract.

**Appendix E:  
Department and University Committees and Memberships**

**A. Current Committees in the Department of Biology and  
Chemistry  
2017/2018**

**Curriculum**

Sean Rollins, Chair  
Ronald Krieser  
Elizabeth Kilpatrick  
Mathangi Krishnamurthy  
Christopher Picone  
Eric Williams  
Michael McGrath (Student member)  
Meghan Umbrello (Student member)  
Meledath Govindan (Department Chair, Fall)  
Michael Nosek  
(Acting Department Chair, Spring)

**Assessment**

John Ludlum (fall semester only, Chair)  
Dennis Awasabisah  
Christopher Cratsley  
Steven Fiedler  
Christopher Picone  
Eric Williams

**Biology Search**

Margaret Hoey, Co-chair  
Ronald Krieser, Co-chair  
Aisling O'Connor  
Daniel Welsh

**Equipment and Facilities**

Erin Rehrig, Chair  
Aisling O'Connor  
Daniel Welsh

**Earth and Geographic Sciences Search**

Emma Downs  
Chris Picone  
(With Jane Huang of EGS as Chair)

**Grad Committee**

Lisa Grimm, Chair  
Emma Downs  
Meg Hoey  
Christopher Cratsley

**Biology/Chemistry Club**

**Co-Advisors**

Emma Downs  
Billy Samulak

**Peer Evaluation Committee (PEC)**

Erin Rehrig  
Tom Schoenfeld

**Student Affairs**

Daniel Welsh, Chair  
Dennis Awasabisah  
Lisa Grimm

## B. University Committee History

Name	University Committee	Past (5) Years	Title
Erin Rehrig	Undergraduate Research Conference	2014-2018	Chair (2016-2018) Member (2014-2016)
	Education Unit	2011-2018	Member
	Secondary Education	2011-2018	Member
	Academic Transitions Task Force	2015-2017	Member
	Ruth Butler	2013-2014	Chair
Daniel Welsh	Technology Committee	2013-2014	Member
	Sustainability Committee	2013-2014	Member
	AUC Policy	2014-2017	Member
	IACUC	2014-2018	Member (2014-2015) Vice chair (2015-2018)
	Interdisciplinary Working Group (Ad Hoc committee)	2015-2016	Member
	University Data Advisory committee (Ad Hoc committee)	2015-2016	Member
	Interdisciplinary Science Major Working Group (Ad Hoc committee)	2016-2017	Member
Billy Samulak	AUC Policy	2014-Present	Member & Secretary (2 years as secretary)
	STEM Working Group	2016-2017	Member
	PreMajor Advising Committee - it really didn't have a name	2015-2017	Member



Lisa Grimm	Graduate Council	2014-2018	Member
	AUC Policy	2014-2015	Member
	AUC Curriculum	2013-2014	Member
	Education Unit	2012-2018	Member
	Secondary Education	2012-2018	Member
Aisling O'Connor	AUC	2017-2018	Member
	AUC Curriculum	2015 - 2016	Member
	International Advisory	2014 - 2015	Member
	Undergraduate Conference	2013 - 2014	Member
Emma Downs	LA&S Council	2016-present	Member
	FYE Committee	2016-present	Member
	Sustainability	2015-2016	Member
	Stem Working Group	2016-2017	Member
Sean Rollins	Safety Committee	2012-13; 2014-17	Member
	IRB	2014-16	Member
	Biosafety	2015-present	2016-17 Chair Designate; 2017-2018 Chair
	IACUC	2014-2015	Emergency Replacement Member
Mathangi Krishnamurthy	Student Affairs	2011-2012, 2012-2013	Member

	AUC Policy	2013-2014, 2014-2015 and 2015-2016	Member
	AUC Curriculum	2016-2017 and 2017-2018	Member and secretary
Ron Krieser	Safety	2016-2017	Member
	Harrod Lecture	2015-2017	Chair, member
	AUC Policies	2013-2014	
Chris Picone	MSCA Executive Committee	2015-2018	Member
	STEM Living-Learning Community	2017-2018	Department Rep.
	Liberal Arts and Sciences Council	2012-2017	Chair 2013-14; Member
	Sustainability Advisory Committee	2012-2017	Member; Gadfly
	STEM Working Group	2012-17 (Sporadic)	
	Strategic Plan, Academic Planning Subcommittee	2013-2014	Secretary
Steven Fiedler	AUC Curriculum	2017-2018	Member
	UARC	2016-2018	Member
	Technology Advisory	2014-2017	Chair, member
	LA&S Council	2014-2015	Member
	Parking	2014-2015	Member
	Interdisciplinary Learning Working Group	Summer 2015	Member
	STEM Working Group	2015-2016	Member
Dennis Awasabisah	Parking	2017-2018	Member
	Technology Advisory	2016-2017	Member

Eric Williams	Parking Committee	2017-2018	Member
	Emeritus Committee	2017-2018	Member
Meledath Govindan	Member, Vincent J. Mara Award Committee	2016-present	Member
	Environmental Public Health degree program group	2016-present	Member
	Harrold Lecture Committee	2016-2017	Member
	Emeritus Faculty Selection Committee	2016-2017	Member
	Faculty Scholarship Forum	2016-2017	Member
	International Advisory Committee	2016-2017	Member
	Dean Search Committee	2014	Member
	University Committee on Promotions	2012-2014	Member
	CITI Training Campus Administrator for IRB, IACUC and IBC compliance training	2014-2018	Participant
	Development Day Planning Working Group 2014 - 2018	2014-2018	Member
	Tenure Committee Member for 3 Biology Faculty	2017-2018	Member
	Provost Search Committee	2015-2016	Chair
	Divisional Meetings	2014-2017	Chair
	Campus Safety Committee	2014-2017	Member
	Compliance Committee Working Group	2014-2017	Chair

Meg Hoey	Interdisciplinary Science Committee	2014-2017	Chair
	Chair's Committee and sub-committees	2006-2014	Member
	Academic Values Committee for Strategic Plan	2014-2015	Chair
	Strategic Planning Steering Committee	2014-2015	Member
	New Science Building Committee	2008-2014	Member
	AIMS Development Committee	2013-2014	Member
	Undergraduate Research Conference Committee	2016-2017	Member
John Ludlam	Assessment	2015-Fall 2017	Member, Chair 2016-Fall 2017.
	University Curriculum Committee	2014-2017	Member
Michael Nosek	All University Committee	2012-2015, 2016-2017	Member, Chair in AY14 and AY15
	Institutional Biosafety Committee	Sp. 2016 (committee formed) and 2016-2017	Member and chair

# Appendix F: Student Survey

## 2016 Student Survey Results Report

### Department of Biology/Chemistry

*(Compiled by Daniel Welsh)*

**Student Survey:** During the spring 2016 semester, a student survey was created by the department's Student Affairs Committee and Assessment Committee. The purpose of this survey was to help the department address some of the issues noticed in the Student Success Collaborative (SSC) report. The main problem is that retention and graduation rates are low at FSU, and even lower for students who start as Biology majors. To address this problem, one of the goals set forth by the department is to study how we might improve retention and completion of the students in our majors.

To that end, a student survey was created electronically and shared with all Biology and Chemistry majors. The goal of the survey was to elicit feedback from the students, themselves, with the hope that their input would provide insights into both the positives and negatives of the university and department (i.e. what students liked/disliked, difficulties they face, etc.). The end of this report provides the raw results of the student survey (including the questions asked) as well as a link to the survey results online.

#### **Survey Results:**

**Responses:** The survey was available for students to complete for a few weeks, from about April 7, 2016 – April 22, 2016. In that time frame, we received a total of about 80 respondents (although not every student answered every question). Demographic data of respondents can be found in #4 below and at the end of this report (as part of the Raw Results), but it seemed like a fairly good representation of the students in the department (in terms of sex, ethnicity, grade level, etc.).

**Results of Survey:** On May 17, 2016, the two committees (Student Affairs Committee and Assessment Committee) met together to discuss the responses from the survey with the goal of identifying the main issues and concerns of the students and discussing potential solutions to help improve student retention and completion.

1. Based on the response from the students, there seemed to be TWO key **issues/complaints** that came up repeatedly:

**A. The electives issue.** Many student respondents voiced their displeasure and concern over the lack of electives. These centered around two main aspects: (i) a lack of variety of electives and (ii) an insufficient number of seats in the electives being offered.

**Several ideas discussed by the committees:** This issue likely came up at least partly because the survey occurred during advising and registration time of the semester. However, that alone isn't the full explanation- the number of students in our major has grown but the number of electives has not kept up with that increased enrollment. There was an acknowledgement by members of the committees that this is an area where we need to find more solutions.

Several members of the committee mentioned that we had already begun to address some of these issues already this year. Michael Nosek has reduced and/or removed the Organic Chemistry pre-requisite for a couple of courses (Cell Biology and Biochemistry). This, alone, should help offer more options to students.

However, several other ideas were discussed by the committee. One idea was to allow the two-semester sequence of Anatomy and Physiology to count as one BIOL elective. That was already suggested for the revised B.A. in Biology and may be something to consider for the B.S. as well. Another idea is to make sure advisors are encouraging students to contact professors to get on a Wait List if a class is full. Many professors create Wait Lists and will Red Card students in, but the students need to be encouraged to contact those professors more. A third idea suggested was to see if GCE would be willing to work more with our students to allow undergraduates to take GCE courses without the additional cost typically associated with GCE courses. One final idea was to consider developing/implementing some new electives that would work well with large class sizes. This may not be the best option because many students in the survey noted how they liked small class sizes and considered the small class sizes a strong “plus” when considering the positive aspects of the department.

**B. Chemistry issue/concern.** The second main issue/complaint from many student respondents was related to Chemistry. Many students commented on how they felt there was too much Chemistry in the curriculum, Chemistry was too difficult, and other similar ideas. (Interestingly, almost no students voiced concern/displeasure about Physics or Genetics, two other courses that several committee members were expecting students to have mentioned)

**Several ideas discussed by the committees:** Many members of the committee felt that this is more of a perception issue and not a content issue. The Chemistry sequence here is very common to many schools in the state and across the country. The committee discussed the need for advisors to inform students about the need for Chemistry and the importance of Chemistry, to help students to understand that the department isn't requiring an “excessive” amount of Chemistry. One similar idea was to also have the Chemistry professors try to emphasize this as well and perhaps even try to make more connections to Biology through the use of more Biology-based examples and problems. This is likely hard to do given the already tight schedule of topics in the Chemistry courses.

One last option discussed by the committees is that for students where this is more of a content issue than a perception issue, the department has already worked on addressing this issue. The newly revised B.A. in Biology now requires less Chemistry. Students really struggling in Chemistry should be made aware of this option and advisors should discuss this option with students as they see fit. The committee felt that the B.A. may help immensely and the department now just needs to “advertise” and make students aware of this new option/path for them.

2. Based on the response from the students, there seemed to be a few key **positives** that came up repeatedly that is worth noting briefly:

**A. Student-faculty interactions:** Many students commented that they thought their professors were nice, welcoming, approachable, and helpful. (It should be noted that a fair amount said the opposite, but eyeballing the results suggests more thought positively of the faculty than negatively).

**B. Small class sizes:** As mentioned, many students liked having small class sizes.

**C. The facilities:** A small (but noticeable) number of students commented on how they appreciated and liked the new Science Center, including the new equipment and the potential opportunities for doing interesting research that come with it.

3. The committees also briefly discussed other ways to help students outside of the key concerns mentioned above in #1. The discussion centered around what other support services (outside of the classroom) could be pursued/offered. One idea was to try to bring to campus more presenters from outside the university, especially from more of a variety of backgrounds. The committees acknowledged Mel's great work in bringing in speakers related to the health sciences field and thought more presenters from other areas may also be helpful. The second main idea discussed was to develop more centralized locations for students to find information about opportunities like internships, research opportunities, graduate school, etc. Again, Mel has done a wonderful job with this for the Health Science concentration through a Blackboard site and establishing and maintaining sites for the other concentrations would be tremendously valuable to the students.

4. Demographics- myths and truths: When looking over the demographic data of the respondents, some interesting information was noted by the committees. First, there was a balance of both commuters and residents, suggesting that we may not be as commuter-dominated as is often thought (especially keeping in mind that many "commuters" live close to campus in off-campus housing). Second, it seems that fewer students than initially thought are working long hours. Roughly 1/3<sup>rd</sup> of respondents didn't work, about 1/3<sup>rd</sup> worked less than 20 hours per week, and the remaining 1/3<sup>rd</sup> worked more than 20 hours. Clearly we have many students who work a lot in addition to their coursework, but the common belief that "all"/most of our students working a lot may not be completely correct.

There were some commonly-held beliefs that did seem upheld by the demographics, however. It was clear that the vast majority of students were coming to the university because of the cost and/or close to home, supporting the idea that our students are mainly from the local region and find the affordability of the campus to be hugely appealing. Also, students in our major are, probably not surprising, mainly white/Caucasian and mostly female.

**Raw Results from Student Survey** (can also be accessed electronically here: <https://survey.fitchburgstate.edu/CustomReport.aspx?CReportID=n4315n>)

(Note: These results are presented unedited and unformatted)

Thank you for taking our survey! The Department of Biology/Chemistry at Fitchburg State University is seeking your thoughts and opinions about the department and the university. Your insights will be used to help us improve upon our mission of providing a quality educational experience for all of our students. Your answers will be kept anonymous. Please provide your honest feedback. All students completing the survey BY FRIDAY, April 22nd will be entered into a drawing to win ONE \$15 Amazon gift card (you will be asked to provide an e-mail address at the end of the survey so that we may contact the winner). You may only complete this survey ONCE and it must be completed in one sitting (there is no way to save it and come back to it). Thank you, again, for your time and thoughtful input.

## 2. Gender

		Response Total	Response Percent
Male		24	30%
Female		55	70%
	Total Respondents	79	100%

## 3. What is your current Year/Grade?








		Response Total	Response Percent
Freshman (0-1 year here)		17	21%
Sophomore (1-2 years here)		19	24%
Junior (2-3 years here)		18	22%
Senior (3-4 years here)		21	26%
"Super Senior" (>4 years here)		5	6%
	Total Respondents	80	100%

## 4. Describe your student status








		Response Total	Response Percent
Commuter		36	45%
On-campus resident		44	55%
Total Respondents		80	100%










#### 5. Major/concentration

		Response Total	Response Percent
Biology		30	38%
Biology/Biotechnology		7	9%
Biology/Environmental Biology		6	8%
Biology/Health Sciences		29	36%
Biology/Neuroscience and Behavior		3	4%
Biology/Secondary Education		1	1%
Chemistry		4	5%
Chemistry/Secondary Education		0	0%
Total Respondents		80	100%





#### 6. Which category best describes you?

		Response Total	Response Percent
Caucasian/Non- hispanic		52	65%
Hispanic/Latin		8	10%
African American		8	10%
Asian		6	8%
Native American		0	0%
Native Hawaiian or Pacific Islander		0	0%
Other		6	8%
Total Respondents		80	100%

7. In an AVERAGE week, approximately how many hours do you work at job(s) outside of being a student (regardless of whether that job is on campus or off campus)?

		Response Total	Response Percent
0-5		27	34%
6-10		10	12%
11-15		9	11%
16-20		8	10%
21-25		9	11%
26-30		7	9%
31-35		2	2%
36-40		6	8%
41+		2	2%
Total Respondents		80	100%


8. Which of the following best describes how you started your college career?

		Response Total	Response Percent
I started as a Biology/Chemistry major HERE at Fitchburg State University		47	59%
I started as a different major HERE at Fitchburg State University and changed majors		14	18%
I started as a Biology/Chemistry (or similar) major at a DIFFERENT college and transferred to Fitchburg State University		8	10%
I started as a different major (outside of Biology/Chemistry) at a		11	14%



DIFFERENT college,  
and then transferred to  
Fitchburg State  
University and changed  
majors, too.

Total Respondents 80 100%

9. The reputation of the university was an important factor in my attending Fitchburg State University

		Response Total	Response Percent
Strongly Agree		12	15%
Agree		30	38%
Neutral		27	35%
Disagree		7	9%
Strongly Disagree		2	3%
Total Respondents		78	100%

10. Closeness to work and home was an important factor in my attending Fitchburg State University

		Response Total	Response Percent
Strongly Agree		30	38%
Agree		18	23%
Neutral		15	19%
Disagree		11	14%
Strongly Disagree		4	5%
Total Respondents		78	100%

11. Cost of attending the University was an important factor in my attending Fitchburg State University

		Response Total	Response Percent
Strongly Agree		55	71%
Agree		16	21%
Neutral		5	6%
Disagree		2	3%
Strongly Disagree		0	0%

Total Respondents 78 100%

12. The reputation of the Biology/Chemistry department was an important factor in my choosing this major

		Response Total	Response Percent
Strongly Agree		17	22%
Agree		26	34%
Neutral		25	32%
Disagree		8	10%
Strongly Disagree		1	1%
Total Respondents		77	100%

13. The approachability of the faculty in the Biology/Chemistry department was an important factor in my choosing this major

		Response Total	Response Percent
Strongly Agree		22	29%
Agree		28	36%
Neutral		20	26%
Disagree		5	6%
Strongly Disagree		2	3%
Total Respondents		77	100%

14. The science equipment and building were an important factor in my choosing this major

		Response Total	Response Percent
Strongly Agree		25	32%
Agree		30	39%
Neutral		18	23%
Disagree		3	4%
Strongly Disagree		1	1%
Total Respondents		77	100%

15. What do you like about the Biology/Chemistry department?
  1. Dr. Picone
  2. The teachers are people who I can talk to.
  3. I like the new facilities and the faculty. The new building and equipment have been great and my professors have all been very knowledgeable and helpful.
  4. The biology professors
  5. I love the professors in the biology/chemistry department. They genuinely care about their students and are always willing to help.
  6. It's really helpful that faculty are very accessible for students in most cases, whether for advising, extra help, or anything else. Small class size was also an important factor for me as well.
  7. There are some very good professors that really care about their student's education and their future. These professors are very passionate about their job and enjoy teaching.
  8. I love the staff, they're all so knowledgeable and approachable, even if they aren't your adviser you can still go to them with questions and/or advice. And the equipment that has been added to the new building is a positive as well.
  9. The professors are very approachable and the new building is really nice.
  10. They are extremely helpful.
  11. The new science build and the ability of the faculty to explain and convey knowledge in an understandable way.
  12. I like the ability to work with professors on their research and the availability of new equipment for student use.
  13. I like the updated facilities and equipment, and the biology teachers are very down to earth and intelligent.
  14. I like the fact that there are more new biology electives for Biology majors, I remember when I was a freshman I used to hear the seniors saying that there wasn't enough biology electives for them to choose.
  15. The professors are the best thing about the department.
  16. Many opportunities for students to be involved.
  17. Approachable/helpful/caring faculty members  
Nice building and state of the art equipment
  18. I like that most professors are here to help me as much as they can and are almost always approachable.
  19. The department head is really great. The professors are very approachable and accessible.
  20. I like all the professors in the biology/chemistry department. They will do anything in their power to help and watch you succeed along the way.

21. Although the department it seems is still up an coming, the department works with all students to get them the things they need
22. Availability of the professors and willingness to help.
23. Availability of extra help if needed
24. The teachers, and how they help you try to understand the course materials.
25. The level of education.
26. All of the biology and chemistry professors that I've had in my three years at Fitchburg State have been wonderful. All very approachable and happy to offer extra help where it's needed. Through personal experience, I've learned that the professor makes a huge difference in whether someone will succeed in a class.
27. I enjoy the different labs and interactions to understand the material of each subject.  
My professors genuinely care about my education and will always take the time to help me with their classes. They want me to succeed in their classes and after college.
28. My classes are rigorous but my professors are understanding about students lives and will try to accommodate us as much as possible. The science building is beautiful and we are offered a variety of tools to work with during labs, etc. size of classes is ideal.
29. The classes; they're really interesting and the professors engage the students.
30. Helpful professors/ staff and beautiful new building!  
I love how the building is brand new and all of the equipment and labs are
31. clean/organized. The faculty are all very knowledgeable and willing to help students who need assistance.
32. I like all the open space for students to take advantage of to study and do homework. All the professors I've had are very approachable and understanding.
33. Availability of professors, clarity of most lectures and labs.
34. the new building, equipment and the teachers
35. I like how willing the staff are to help out students. I also like how there are so many opportunities of research for students to do.
36. I like that the professor are really helpful, and the classes are interesting.
37. The science building and the hands on experience.  
Since Freshman year I have liked how the department keeps the biology community together and has not left a student behind. Some but not all professor understand the struggles that we as students are going through because they went through the same experience.
38. It is overall a good program. Most professors are very approachable and helpful
39. Many of the teachers are very engaging and passionate about their fields of study and their jobs.
40. Great teachers that give the help you need.
- 41.

42. Interesting classes some faculty have a passion for what they do
43. What I like the most is the faculty are willing to help us students.
44. I like the science building itself and the technology and equipment we use in lab is up to date.
45. They are very helpful.
46. Yes
47. The new building
48. The challenges each course has.  
I love the class sizes, because they were small (especially my junior and senior level courses) I believe I got more out of the classes for this reason. I think all of my professor were great and pushed me to learn and understand the material not just memorize it. Most of my professors were passionate about their research and were enthusiastic about teaching. I was challenged but at the same time had great feed back. Most answered all of my questions and I had many!!
49. Great facilities
50. Approachable faculty  
Camaraderie between faculty promotes a positive learning experience
51. Lab equipment is updated and lab room is updated compared to the school I transferred from.  
I like that the Professors and advisors are so open and nice to the students. The equipment is up to date as well as easy to work with. The other bio majors have been nice with no problems and the curriculum is enjoyable.
52. I love how all the professors are very understanding and helpful especially Dr.Grimm
53. availability of staff and professors, facility(building)
54. I like how approachable all the professors are and how nice the science complex is.
55. The faculty contain a great deal of information that can only help me on my journey as a bio major.
56. My advisor is extremely helpful and approachable. I also think that the new science building and technology that we are exposed to helps us in classes and benefits us.
57. All the professors are very approachable and down to earth, they make an active effort to help if you don't understand, and they all know their material very thoroughly.
58. I like all science professors who i have taken classes from the past. They are all nice and very understanding. I also love my advisor.
59. The small classes/good teacher:student ratio, the opportunity for research
60. I really appreciate the staff in the Biology and Chemistry departments.
61. In my previous major (Criminal Justice) I found it very difficult to communicate and meet with the professors outside of class and only met with my advisor twice over the
- 62.

two years I spent in the major. It is much easier to meet with the instructors here when I need to.

Total Respondents 62

16. What do you dislike about the Biology/Chemistry department?
1. Not enough classes offered
  2. The equipment is nice and new, and classes are engaging.
  3. I dislike that the department is so focused on the health sciences concentration.  
The inconsistency of chemistry professors.  
Professors that tell you they feel you should switch your major.
  4. lack of class options.  
Lack of tutors.  
Sapling learning and pearsons  
Textbook prices  
I dislike having to take four different chemistry classes as an environment biology major. I would like to take more classes that I am interested in and will help prepare me more for the environmental aspect of biology.
  5. The chemistry classes are extremely difficult in my opinion, and the resources for extra help are somewhat lacking. Tutoring is available, but group tutoring for a difficult class didn't work for me as it just felt like sitting in lecture again.
  6. The teaching style of some professors and how they handle some of our concerns.  
Being an environmental biology major I do NOT feel that taking 2 years of chemistry classes (and that's providing that you pass every single one first time around, which doesn't seem common) is necessary. I would rather focus on other biology classes that are just as important. Considering I'm graduating in May and applying to jobs, they require certain biology classes that I have not had the opportunity to take here at Fitchburg State because of conflicts with the chemistry classes that are required.
  8. I'm not sure if it is a registrar or staffing problem, but you need to offer a wider variety of biology electives THROUGHOUT the year, not just every other year or every other semester.  
There was a shorter list of biology electives this ENTIRE year and next year, after I have graduated and left, there are a bunch of specialized subject related classes that I will never be able to experience.
  9. Not too much help obtaining internships and not a lot of advertised information about projects on campus.
  10. Not enough class variability.
  11. Lack of variety of classes & professors that teach those courses. Availability of classes(eg spring/fall only courses)
  12. It's lack of electives offered.



- I dislike how I can never get into classes that I need due to high demand. I dislike
13. how few electives are offered every semester and how if you miss a class that's only offered every other year you will not be able to graduate on time.  
I dislike the chemistry teachers they are not very good with communicating with there
  14. students they give unreasonable tests and are determined to make people fail there classes.  
They should hire teachers more teacher in the CHEMISTRY department that can actually teach. Chemistry is a hard subject and it would be helpful if there are more
  15. teachers that can actually teach it , cause there are some chem professor that honestly make it hard for the students to understand. I myself have had pretty good chemistry professors here at Fitchburg state but most of my peers disagree on that.
  16. I dislike the availability of classes. Beyond the general biology and chemistry classes it seems like at least half of a class had to be red-carded in.
  17. The struggle of trying to get into classes you need to graduate
  18. Not enough biology electives  
Not enough opportunities for independent research or internships
  19. I dislike that there are a lack of organic Chem professors available. Dr K is a good teacher, but Dr Govindan leaves a LOT to be desired. This is a crucial course as a bio major and I would like a better opportunity to thrive.
  20. N/A
  21. N/A
  22. Hard to speak to some faculty
  23. Not enough options for class times. Certain classes are only offered MWF but not T TH
  24. Not enough group socializing events
  25. No dislikes
  26. Cost.  
Scheduling is always a nightmare. Whether it's one class not being offered a certain semester, or sections filling up extraordinarily quickly and messing up the entire
  27. schedule I had planned out, forcing me to change it, I've had a problem with scheduling something almost every single semester I've been here. The electives in particular always filled up way too quickly.
  28. There is not enough course sections within the biology/chemistry department.
  29. Availability in classes is so limited when picking classes.
  30. Not enough classes
  31. Too few elective choices and lots of scheduling conflicts
  32. Many classes require so much material to be learned in the amount of time we are given for a semester, making it hard to balance it with all the other classes we are

taking as well.

33. Nothing comes to mind. I think it's a wonderful building.
34. Lab classes interfere with each other while trying to schedule. Its nearly impossible to schedule two lab courses with out over lapping the other.  
the required length of labratory times, and the amount of pre-recs for classes pushes
35. many important classes until the end and then I find I can not fit them properly into a schedule
36. I dislike how there are no chairs in the lab on the third floor.
37. I dislike that The labs are very long, and they don't offer many biol electives.
38. None  
The abundance of students that are in the Biology Major is amazing but there is never enough space for classes. We shouldn't wait a whole year in order to take a class we are interested or have to complete. Professors went to school for a degree of "teaching" in college level which means being challenged with a large amount of
39. students in their classes but some limit the availability of sits in their course. I thought that the limit of sits in a course was not supposed to be decided by the professor but by the chair of the department. Many students complain that their advisors need to be taught more about "how you speak to a student"and "what does advising mean" . But I will stop here for now  
More options for General physics. Should have more than one professor teaching the
40. course, preferable one with better teaching skills than the present. The subject is tough as it is and this school needs a professor who can present it effectively.  
Signing up for classes needed is nearly impossible. Had to drop my concentration in
41. order to graduate in a timely manner. There are just not enough class seats for specific electives, esp those who are only given every other year, have prerequisites, ect.
42. It is tough to get into the classes you need.
43. The classes that are offered. There was never enough space or a lot of the interesting classes weren't offered.
44. What I dislike is the lack of class seats.
45. that there are not a lot if biology electives to choose from
46. Nothing really.
47. Nothing  
I dislike that a lot of the class lectures are set in stone and a different day/ time is not offered for some courses.... It makes scheduling very hard, especially with other science courses scheduled at the same time that all require labs as well. Also many
48. science sections fill up very fast, so you have to get red carded in, or you have to wait until the next semester or school year, and then you fall behind.

Also as a Biology Major concentrating in health sciences , we are required to take a

lot of chemistry classes, that may not be beneficial in our career path, instead I feel like we should be taking more biology based courses earlier on.... Maybe switch some of the chemistry courses with some classes the nursing students have to take

49. Not enough classes offered

There are many things that are wrong with the Biology/Chemistry Department such as professor not communicating well through emails, Not having enough seats in courses required for major, Also having only two professor that teach Organic chemistry IS A JOKE we need more than two professors!

I believe that physics 1 and 2 were unnecessary classes. I would have benefited more from the choice of more electives. There was very little electives to chose from and time schedules were not ideal.

52. Difficulty of getting into required courses

There is a some what steep learning curve when I first entered the university and chose the biology major that took me a few months to get aquatinted.

54. nothing.

55. I do not like how fast the classes fill up when registering for them.

56. Some faculty members seem to have trouble explaining concepts to students.

Some of the staff is a little unapproachable. The course offerings are never in sync with the others, and makes it very difficult to choose classes and have a variety of different interests.

I wish there were more electives available for greater diversity in the curriculum. I understand this is due to the size of the department, which is more a dislike of the school than the department itself.

59. The scarcity of electives such as parasitology can be frustrating

The availability of some courses can be somewhat limited, but I have never had a problem with it.

It has been difficult for me to get into the classes that I need in order to graduate. I will already be spending a 5th year here because I changed my major, but I feel continuously set back each time I find a class section that is 'no longer available'.

Total Respondents 61

17. What could you suggest to improve the Biology/Chemistry department?

1. More classes to be taught

2. more lab days on lecture days

I would suggest that there be more opportunities for concentrations other than health sciences. Opportunities such as internships, guest talks, classes, class trips, etc.

Get rid of online homework. It doesn't help. It's a lot harder to focus on a bunch of websites. You spend more time squinting and developing a headache from the screen

then actually learning. Also fighting for Internet is frustrating. Ideally I would love paper, however to be ecofriendly, it would be nice for a program that doesn't need constant internet connection maybe an app on an iPad or tablet that can be used offline.

Tablets also help reduce the prices of books and paper consumption. Now that the apple products have the orange screen( night shift) i feel that will help students not develop headaches before exams from studying sapling the night before exams so quality of work will go up. And then students will understand the materials better.

5. Provide more opportunities as far as studying abroad (that relate to biology), providing more internships and research opportunities.
6. Work with the tutor center to help make resources available for chemistry classes.
7. Better professors.

If you want the environmental bio. students to take chemistry, combine classes so even a year (1 semester of the general chemistry and 1 semester of the organic chemistry) is better than the two. In regards to the biology elective selection, may be send out a survey and have students select which classes they would like to see be offered for the year (2 semesters) so the students can get a better lay out for their own graduation criteria. Offer a bigger selection of classes that are BIOLOGY related and cut down some of the chemistry requirements or have it not take up such a big chunk of the four years of attendance. Have it be more focused on the environmental biology aspect and not chemistry.

8. Offered for the year (2 semesters) so the students can get a better lay out for their own graduation criteria. Offer a bigger selection of classes that are BIOLOGY related and cut down some of the chemistry requirements or have it not take up such a big chunk of the four years of attendance. Have it be more focused on the environmental biology aspect and not chemistry.
9. More available seats in courses, especially ones not offered that often.
10. Maybe have more health sciences based classes such as medical terminology or pharacology.  
An Intro to Lab class would be nice. A lot of students come in with little to no lab experience. Gen bio& gen Chem do not provide enough lab work to prepare some people for other labs like genetics.
11. Open more seats or add more electives for students to take.
12. Offering more biology electives and offering classes more frequently to allow to students who may have transferred into the program to still graduate on time.
13. I think they need better chemistry teachers who care about there students and there students success here at fitchburg state.
14. For upcoming seniors like me maybe a job fair would be nice for like those laboratory in Boston . The goal is to get a job in the field once we graduate to get experience and start paying the loans
15. I think adding more sections of classes (limiting classes to 25 to 30 students), especially in classes like genetics where material starts to become much more confusing, would allow students to ask more questions and allow professors more time to explain material.
16. Open more biology electives
17. Open more biology electives

18. More opportunities for independent research. More access to internships  
 MORE CLASSES! There aren't enough bio electives OR spots available in those
19. electives. There are so many classes I wanted to take before I graduated, but I couldn't due to my lack of options.
20. Offer intro courses like chemistry 2 in both semesters rather than one semester.
21. N/A
22. More available access to faculty potentially more internet communications to improve espouse time
23. Larger availability for key classes
24. More group socializing events.
25. Nothing
26. More clubs
27. Add more seats or sections for some of the major classes! And electives too! If an elective appears to be highly in demand, why only offer 16 seats for the entire biology major population to fight over?
28. Provide more study groups with professors before exams to benefit with the courses because science courses within biology/ chemistry are sometimes difficult to learn in one sitting.
29. Higher quality tools for labs, all science classes should be in the science building
30. There could be more classes in the genetics field.  
 I think that the required classes for students should be more specific to what their concentration is (given they chose a concentration). Also, I think a lot more classes should be offered that would benefit upperclassmen who need additional credits in BIOL2000 or above courses. There were very few classes offered for this fall (2016) that upperclassmen who have already completed genetics, ecology, gen bio, etc, could take to progress in their degree evaluation.
31. The professors are bad at responding to emails but it's understandable. There's not alot of research opportunities for students as well.
32. Having a pre-med committee.  
 open up more biology electives to more students, or even put them in the lecture hall
34. so that there can be more students per class - everyone needs them and not many are getting the ones they want
35. I suggest getting rid of the prerequisite in some courses & allowing students to take some biol elective earlier on.
36. More chemistry teachers
37. Include a student in your biology committe ! Hear the student out, because sometimes we have forgotten that student are first in FSU or any other school

38. Change Physics professor so students do not leave program or go elsewhere for the course.
39. Working on class schedules a bit more.
40. Slightly bigger class sizes, and keep the students informed.  
Added more interesting electives. There are multiple rooms available for teachers to teach in within the science building so they should use them and satisfy more students
41. with more options for classes that interest them more on what they want to do for a career
42. I would suggest more faculty, so they can open up more bio/chem classes.
43. to offer more biology electives in the fall
44. There should be more events related to Biology/Chemistry. Have more guest speakers.
45. Nothing
46. More electives  
There are many things that are wrong with the Biology/Chemistry Department such as professor not communicating well through emails, Not having enough seats in courses required for major, Also having only two professor that teach Organic chemistry IS A JOKE we need more than two professors! ( SOLVE ALL THESE PROBLEMS ! ) ALSO THERE IS NO NEED TO TELL STUDENTS TO BUY A BOOK THEY BARELY USE !
47. I would suggest offering more electives with more subjects of interest such as cancer biology, proteins, and also offering cell culture techniques more often.  
More electives
48. Internship opportunities
49. Emphasis on building relationships with faculty  
Courses or seminars on ways to use your degree
50. Offering classes every semester instead of certain ones just in spring or fall
51. easier path to professors for help as well as communication.
52. At this time nothing comes to mind. I will think on it.
53. Have more classes to choose from.
54. Nothing comes to mind.
55. To have a diverse amount of class offering and different times if possible.
56. More opportunities for research and participation in conferences is an achievable goal I think that would greatly deepen the experience for bio/chem majors.
57. We need more teachers teaching Chemistry classes, especially Organic Chemistry.
58. More sections/ professors for organic chemistry.

59. More elective options/more frequently occurring electives  
Year-round general biology I and II. Switching to a biology major in the spring semester, I appreciated that I had the opportunity to take General Biology I in the spring semester, whereas before I may have had to wait until the next fall.
60. Offer more class sections and/or course options.
61. Offer more class sections and/or course options.

Total Respondents 61

18. Do you consider there to be anything unique about the Biology/Chemistry major at Fitchburg State University?

1. How wonderful all the professors are
2. I couldn't tell, this is the first college I've attended
3. How approachable all the professors are and the proximity of the department to lots of new england natural settings
4. The ecology class trips to bogs and mountains. There should be more classes that do trips off campus.
5. No  
Small class size!! The largest class I've taken here was maybe 65 students for Ecology, and still Dr. Ludlam did an excellent job teaching the class in the lecture hall. All the rest of my classes have been 30 or less students, which is really helpful in the more difficult classes like chemistry or genetics.
6. No  
Some of your biology courses offered are very unique to the school, and of course only certain professors can teach those subjects and not every school can offer those courses so it makes you stand out among the crowd when applying for graduate school or jobs. Some of the professors hired here are incredibly supportive which is also unique to the school that you should never change. Hiring professors based on their background and desire to work with students and have them be successful and have a different way of teaching their classes is crucial in this kind of department.
7. It's a very small community which is really nice, and makes everyone far more approachable.
8. We have a great staff that gears you toward your goals.
9. The number of professors actively working on research projects.
10. The professors themselves are very unique and amazing.
11. No not really
12. Our professor do interesting research to me thats unique from other departments
13. I think the diversity of upper level courses sets the major apart, for example you may not find plant biology, invertebrate biology, or cancer biology at an undergraduate
- 14.
- 15.

level at other universities.

16. The amazing professors and the many opportunities to work along side those professors.
17. Not really
18. The really great science building!
19. The topics at hand overlap a lot
20. Up to date equipment
21. It presents the students with unique opportunities both in and out of school
22. Every individual student who's trying to accomplish something different with just biology or chemistry.
23. Peers
24. No.
25. If you want to dual major there are only a few more classes you are required to take because the course requirements overlap
26. How most professors will do their best to help you succeed if you show you're putting in effort
27. Compared to the other school I attended for one semester, the faculty here are a lot more concerned about student progression and are very open to assistance.
28. I think the curriculum is the same as any private school. I have a friend that goes to the University of New Haven and we take the same classes. I feel that the upper level courses may be a different story.
29. N/A
30. no not really. there is a lot of really nice equipment i guess
31. I think that the mostly everything is located in the science is unique.
32. We are a strong community because the engagement in laboratories creates long living friendships and network!
33. I am not familiar with other programs to indicate uniqueness. I do like the program overall
34. The teachers, lots are very dedicated to their students, and show a general interest in them succeeding, both in the classroom and beyond. There are lots of very passionate educators that I feel really benefits the student.
35. The science building
36. Nothing.
37. I consider the science building we have to be unique and I'm grateful for it.
38. the independent studies and research the students get to do.



39. I'm not sure.
40. Maybe
41. No
42. ....
43. Yes my Professor's I had a great experience with most of my Professor's they gave me the extra encouragement and positive feed back to want to further my education.
44. I have not experienced any other specific majors at any other universities.
45. For me the small campus is the best part of the school. Also no assistants instructing courses. Compared to Umass Amherst.
46. One way is that it is very hands on, unlike some of the other majors at the University.
47. I believe that a science major is unique at any specific university. As for specifics of the degree itself, not particularly.
48. I can think of anything at the moment.
49. Not particularly. Only things I said in the previous questions.
50. everyone helps each other and wants you to stay strong in your major.
51. I believe the opportunity to do research early in a student's career sets FSU's Biology/Chemistry major apart from other schools' programs.
52. The new building really stands out on campus.
53. Not in particular.

Total Respondents 53

19. Can you describe the common obstacles you or your peers encounter when trying to complete a Biology/Chemistry degree?

1. Not enough time to finish work, while having a demanding job
2. not having the study guide a few days in advance
3. The most complaints I hear are regarding not having enough time to complete all the required courses since some courses are only offered once in awhile. Other complaints are regarding the harder courses such as organic chemistry.  
Sapling learning and online homework  
Organic chemistry professors.
4. Not having enough seats for classes. Which makes graduating on time difficult.  
Lack of understanding.  
Money
5. Getting through general chemistry 1 & 2, and organic chemistry 1 & 2, while maintaing a GPA of 3.0 or higher.
6. -Course rotations: some classes are only offered every other year, or during certain

semesters, which can make getting all your degree requirements completed a difficult task

-Chemistry classes for bio majors: these seem like the major roadblock for a lot of the bio majors, and usually the defining moment when they decide to transfer or change majors, typically to EXSS

-Interdepartmental requirements (biology vs. chemistry vs. physics, etc) are often conflicting classes and can make it difficult to complete requirements on time

-LA&S requirements also can conflict with biology electives, which means we often have to choose between one requirement or the other, and can miss a one-time offered bio elective if we have to choose the LA&S course

7. Being unhappy with the teaching in the department, the curriculum can sometimes be ridiculous, and lack of support in the department.

a common obstacle for students to stay in the biology degree is the chemistry required. Biology students are here to take classes in BIOLOGY, not chemistry. Now I am very much aware that chemistry is used quite often in this field, but it is too much to teach and too in depth for an environmental biology major that is more focused on conservation and preservation of species and how global warming works. I know several students that have left the biology department and switched to some other major like the health sciences or a complete 180 and went to some random degree because the level of chemistry required for this department is too much. For myself, I'm getting to the point where I hate chemistry because I'm sick of dealing with it and hating the fact that it is the determining factor of whether or not I receive my degree. The only reason I've stuck with it so long is because I am graduating in May and I'm finishing up organic chemistry 2 this semester. But the chemistry requirement is something that definitely weighs down on students.

8. Registering for courses and just juggling work and school. Typically most bio/Chem courses have tests on the same week which can be difficult.
9. The class times and availability.
10. Falling behind because some classes aren't offered as often. Also there aren't enough class sections.
11. Not enough electives to take. I need two more to graduate but was unable to get into any for the fall semester.
12. Courses not being offered every year, and not enough to electives offered or too few seats in the electives.
13. Keeping up with the professors content they were teaching in lecture was over whelming along with the homework and preparing for tests was challenging.
14. Trying to pass chemistry with a decent grade lol
15. The most common obstacle is trying to get into required classes without needing to red card in to them.
16. Upon registration it is very stressful to get into certain classes.
17. Having to take free electives. Having to take bio electives but not enough are offered every semester. Struggle through difficult classes like organic chem and physics.
- 18.

Some teachers expect us to attend lab more than our scheduled time and we frankly just do not have time for that

19. Having to red card into most classes due to lack of availability. Teachers with heavy accents teaching really difficult courses. Lack of electives!
20. The fact that some classes are offered once a semester.
21. No.
22. Getting classes they need in the semester they need
23. Class availability  
The interrelation of course makes it hard to build your graduation plan.
24. Example: if you don't get into gen chem 1 your first semester, and only gen chem 2 is offered the next semester, you are behind a year
25. The work that you do independently. It's hard when you don't have peers to study with. So, it's tough when you don't have spey around.
26. Homework and blackboard  
Some of the more difficult courses like Organic Chemistry often feel rushed and pressed for time. Trying to master a chapter in a day at some points. This makes it all
27. the make stressful when a class is difficult to begin with. Scheduling is also a huge obstacle, trying to get all of the necessary classes on your schedule within your four years is not easy when classes fill up or aren't offered.
28. Exams do not mathc up to material taught in class especially the study guides.  
The difficulty of the understanding of material and the fact there are no extra credit
29. opportunities in most classes because sciences are harder so I think there should be more availability to achieve a good understanding and a good grade in those classes.  
Having a lot of homework while also having a job and trying to balance both can be hard. Finding time to ask questions on homework (especially online homework) can
30. be a struggle because finding a time where both you and the professor are free is difficult, and asking a question via email can be tedious and the explanation is sometimes still hard to understand.
31. Time management skills and getting the required classes when you need them in a semester.
32. The amount of material covered in required upper level courses given how advanced the material is.  
Chemistry is usually a difficult subject. My roommate dropped out of his bio major so
33. he wouldn't have to take chemistry again. Usually the bio courses have people in your grade but chemistry courses have everyone in them. This major also requires alot of studying which my roommate did not do.
34. Difficulty of courses, some people believe the lectures are unclear and must be self taught majority of material.
35. getting into the biology electives that we want to. there are not enough seats in the most sought after classes, so it is forcing students to take classes they have no interest

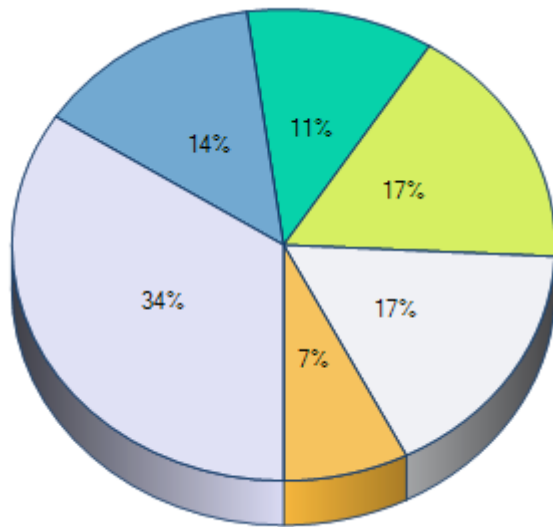
in, get a terrible schedule, or push the classes off to further years. also I do not believe that organic 2 is a necessary class for a biology degree. I agree with organic 1 as a requirement however orgo 2 teaches about aspects students will literally never use again unless they are going into the field of chemistry, which I, and many other students do not think is appropriate, not to mention it is a very difficult class and brings the GPA of many students down for a BIOLOGY major.

36. Not Getting into courses b/c of prerequisite  
NOT ENOUGH COURSE OFFER!!!! Professor do not understand that we are not
37. taking only their class and the workload given to us is completed but What have we learn If all the material in our head is mix with other knowledge
38. scheduling conflicts and availability of classes on a rotation
39. Competition for classes/ electives/ specific teachers for a class
40. A lot of tough work, and hours of studying
41. Finding classes and registering for them. A schedules are the worst.
42. One obstacle would be not able to get into a class because it was filled up or it conflicted with other classes you were taking.
43. the Chemistry aspect is difficult about obtaining my bio degree because its not a field i'm interested in.
44. I'm a Freshman and haven't really encountered these obstacles yet but getting a biology/chemistry ask for a lot of work.
45. Class sizes  
Many of my peers that are also health science concentrations struggle with the
46. Chemistry courses (gen Chem II, Orgo I and II, etc.) and we wish we were required to take more classes that we biology based instead, or even take some of the nursing courses.
47. Language barriers  
Not enough electives each semester with very little spots available
48. CHEMISTRY, GENETICS, PHYSICS  
It takes a lot of work and dedication. Many people want things the easy way. I do
49. believe how ever some of the details some Professor's asked for on exams was a little much for an undergraduate level courses. You are expected to take multiple difficult classes, which makes it hard to gain the knowledge and experience you need.  
Availability of required classes
50. Workload being difficult to manage while holding a job  
Deciding/ knowing what to do with the degree  
As a transfer student with multiple transferred credits it is difficult to set a schedule
51. for up coming semesters that would allow me to graduate on time due to certain courses being offered only in specific semesters (spring/fall)
52. The work load can be somewhat difficult when faced with other obstacles in life and then students fall behind.

53. The material is not easy and taking bio 1 in spring there isn't enough time for everything it feels rushed
54. My most common obstacle is getting up to speed with computers and math.  
Some of the classes and can very difficult so they need more time devoted to them.
55. Some people may not be able to deal with that or the subject can be too hard for them. They may also lose interest in the major or decide that it is not really for them anymore.
56. Only thing that comes to mind would be the overall workload and how much needs to be done.  
Time management between all of the classes, especially when having multiple lab classes.
57. I've heard that physics and organic chemistry are hard, so I am fearing taking those, but soon have to. Lots of classes I want and need to take overlap and so I end up not being able to take one, which could be a problem for my year of graduation.
58. Finding opportunities for research and internships is the biggest obstacle for me.
59. The amount of 4 credit classes required is overwhelming to complete in 4 years without taking summer courses at an extra cost.  
The most common obstacle I see in my peers is difficulty overcoming the gap in expectation between freshman level classes (general biology, general chemistry, etc.) and sophomore level classes (organic chemistry, genetics, ecology, etc.)
60. Being able to get into certain classes that fit best into our schedules. Labs that only permit 16 students can make it difficult to complete a degree on time.
61. The material often seems rushed in lectures and needs more class time to be taught.  
I think just the difficulty of the curriculum makes it a bit of a challenge. For example, Organic Chemistry makes sense to require for the major, but I personally do not see the need for Physics to complete a degree in biology. That's just my opinion however.
62. Also, I know several student who have dropped out of school due to motivation/monetary issues that they felt made college an inappropriate choice for them.

Total Respondents 63

20. Based on your experiences and/or what you know from your peers, which of the following are important factors that explain why students leave the Biology/Chemistry major? (Check off ALL that apply)



	Response Total	Response Percent
<input type="checkbox"/> The CURRICULUM makes it difficult to finish a degree in four years	55	72%
<input type="checkbox"/> Students are UNHAPPY with the teaching in the department	22	29%
<input type="checkbox"/> FAMILY/PERSONAL ISSUES interfere with completing a degree	18	24%
<input type="checkbox"/> A lack of MONEY for college prevents students from completing a degree	27	36%
<input type="checkbox"/> Students realize that a science degree is no longer their career goal	27	36%
<input type="checkbox"/> Other, please specify	12	16%
Total Respondents	76	
(skipped this question)	34	

Responses from “Other”:

They fail out/ more work than they expected it to be

Difficulty of the courses

A Professor will state that they aren't good enough for the major.

The difficulty to stay in a program where you generally get wait listed for your classes and never have confidence in getting into them unless you are a super senior.

in addition some people i know who leave this major to pursue another is Its just not as interesting or fun as they thought it would be

The availability of seats in classes does not meet the needs of the number of students trying to get into the class.

The availability of classes in different semesters

It's just genuinely a difficult major

No communication in the department

commuting can often prevent  
challenges for students to maintain  
professors expectations and  
requirements during a semester

There's way too much material

Chemistry



21. If you have any other comments that you would like to share to help us better understand what motivates students to pursue a Biology/Chemistry degree, the challenges that students face while pursuing their degree, or ways that the department and university can better assist students, please enter them here. (OPTIONAL)

1. Online homework is the hardest part. The programs that are used are not effective. And require constant internet.
2. N/A
3. Offer more elective courses based on personal interests while also having more seats available.  
I love our biology department and I would love to finish my degree in 4 years. I wish that more classes were offered so students could not have to be chosen on a wait list for the classes they need to be in.
4. I think in order to better assist students attempting to get this degree you need to first have professors who make learning fun and are passionate about what they teach and fire the ones who are just teaching for a pay check and don't care if there students fail.
5. In addition they should also lessen the amount of material covered in lecture and make the tests reasonable and only on the material seen or done in class. They should also provide more professional tutors for chemistry and biology classes for students struggling with certain topics. Last but not least they should offer more extra credit for students who struggle with tests but are hard workers  
I would really like to see more options for internships and independent studies
6. available to students through the school. I believe that hands on experience is crucial before going into the real world.
7. N/A
8. Na
9. I've noticed students who excell in mathematics tend to enjoy chemistry more, where students who fall slightly shorter with math, tend to enjoy biology more.  
Please, give students a little break sometimes because we have a whole other classes
10. that we might have some struggles with and so we can focus on our struggles more. But also challenge us to do or best.  
The professors make the biggest difference. Emma Downs inspired me to want to major or at least minor in chemistry along with my biology major. Dr. Picone and Dr. Rehrig solidified my decision to continue my biology major. I definitely wouldn't change anything about my experience so far.
11. Students need to take advantage of the tutor center. I know it's not the professors job to do this but when they provide review material, I find it very helpful.
12. Students need to take advantage of the tutor center. I know it's not the professors job to do this but when they provide review material, I find it very helpful.
13. N/a
14. No

15. IMPROVE!!!! we pay the school enough money in DUES to improve the department!
16. Prof. Schoenfeld records screencasts of all of his lectures which are extremely helpful in courses with a lot of complex material. Being able to rewatch, pause and rewind lectures to ensure understanding of concepts makes studying much easier and it would be nice to see other professors offer similar options.
17. I love the natural environment. I believe understanding what makes it tick will help me work to be part of preserving and protecting it.
18. All of the science teachers are very helpful and be there for their students with extra office hours but some of them have too many works outside of teaching so students don't have chance to asking for questions. We should have teachers who can sit down with the students and help them out with their classes more.
19. Like I said before, the only issue I really have is the lack of available options for courses each semester. Either offering more courses and/or more slots for each available course would greatly help most of us out. Just look at the course registration lists. How many of the upper level Bio classes this coming fall are full and already have more students than the limit?

Total Respondents 19

Responses from "Other"

(cont'd):

The difficulty to stay in a program where you generally get wait listed for your classes and never have confidence in getting into them unless you are a super senior.

in addition some people i know who leave this major to pursue another is Its just not as interesting or fun as they thought it would be

The availability of seats in classes does not meet the needs of the number of students trying to get into the class.

he availability of classes in different semesters

It's just genuinely a difficult major

No communication in the department

commuting can often prevent challanges for students to maintain professors expectations and requirements during a semester

21. If you have any other comments that you would like to share to help us better understand what motivates students to pursue a Biology/Chemistry degree, the challenges that students face while pursuing their degree, or ways that the department and university can better assist students, please enter them here. (OPTIONAL)

1. Online homework is the hardest part. The programs that are used are not effective. And require constant internet.

2. N/A

3. Offer more elective courses based on personal interests while also having more seats available.

4. I love our biology department and I would love to finish my degree in 4 years. I wish that more classes were offered so students could not have to be chosen on a wait list for the classes they need to be in.

5. I think in order to better assist students attempting to get this degree you need to first have professors who make learning fun and are passionate about what they teach and fire the ones who are just teaching for a pay check and don't care if there students fail. In addition they should also lessen the amount of material covered in lecture and make the tests reasonable and only on the material seen or done in class. They should also provide more professional tutors for chemistry and biology classes for students struggling with certain topics. Last but not least they should offer more extra credit for students who struggle with tests but are hard workers

6. I would really like to see more options for internships and independent studies available to students through the school. I believe that hands on experience is crucial before going into the real world.

7. N/A

8. Na

9. I've noticed students who excell in mathematics tend to enjoy chemistry more, where students who fall slightly shorter with math, tend to enjoy biology more.

10. Please, give students a little break sometimes because we have a whole other classes that we might have some struggles with and so we can focus on our struggles more. But also challenge us to do or best.

11. The professors make the biggest difference. Emma Downs inspired me to want to major or at least minor in chemistry along with my biology major. Dr. Picone and Dr. Rehrig solidified my decision to continue my biology major. I definitely wouldn't change anything about my experience so far.

12. Students need to take advantage of the tutor center. I know it's not the professors job to do this but when they provide review material, I find it very helpful.

13. N/a

14. No

15. IMPROVE!!!! we pay the school enough money in DUES to improve the department!

16. Prof. Schoenfeld records screencasts of all of his lectures which are extremely helpful in

courses with a lot of complex material. Being able to rewatch, pause and rewind lectures to ensure understanding of concepts makes studying much easier and it would be nice to see other professors offer similar options.

17. I love the natural environment. I believe understanding what makes it tick will help me work to be part of preserving and protecting it.  
All of the science teachers are very helpful and be there for their students with extra office hours but some of them have too many works outside of teaching so students don't
18. have chance to asking for questions. We should have teachers who can sit down with the students and help them out with their classes more.  
Like I said before, the only issue I really have is the lack of available options for courses each semester. Either offering more courses and/or more slots for each available course
19. would greatly help most of us out. Just look at the course registration lists. How many of the upper level Bio classes this coming fall are full and already have more students than the limit?

## 2017 Student Survey Results Report

### Department of Biology/Chemistry

**Raw Results from Student Survey** (can also be accessed electronically here:

<http://survey.fitchburgstate.edu/CustomReport.aspx?CReportID=944Lmo>

(Note: These results are presented unedited and unformatted)

#### Survey Properties:

Total Respondents:	107
Survey Status:	Closed
Launched Date:	02/21/2017
Closed Date:	03/10/2017

#### Responses By Question Analysis:

Last year the Department of Biology/Chemistry at Fitchburg State University sent out a survey to students seeking your thoughts and opinions about the department and the university. It was very helpful and we made several changes based on your feedback. We would like to get further feedback. This survey will allow you to give us your thoughts and input on the department and the university and will be used to help us improve upon our mission of providing a quality educational experience for all of our students. ALL Biology

and Chemistry majors are welcome to complete this survey (you do not need to have completed the survey last year to complete this one!) Your answers will be kept anonymous. Please provide your honest feedback. All students completing the survey BY FRIDAY, March 3rd will be entered into a drawing to win ONE \$15 Amazon gift card (you will be asked to provide an e-mail address at the end of the survey so that we may contact the winner). You may only complete this survey ONCE and it must be completed in one sitting (there is no way to save it and come back to it). Thank you, again, for your time and thoughtful input.

## 2. Gender

		Response Total	Response Percent
Male		25	30%
Female		57	70%
Total Respondents		82	100%

## 3. What is your current Year/Grade?








		Response Total	Response Percent
Freshman (0-1 year here)		17	21%
Sophomore (1-2 years here)		15	18%
Junior (2-3 years here)		24	29%
Senior (3-4 years here)		23	28%
"Super Senior" (>4 years here)		3	4%
Total Respondents		82	100%

## 4. Describe your student status







		Response Total	Response Percent
Commuter		44	54%
On-campus resident		37	46%

Total Respondents 81 100%

5. Major/concentration










		Response Total	Response Percent
Biology		31	39%
Biology/Biotechnology		6	8%
Biology/Environmental Biology		5	6%
Biology/Health Sciences		29	37%
Biology/Neuroscience and Behavior		4	5%
Biology/Secondary Education		1	1%
Chemistry		3	4%
Chemistry/Secondary Education		0	0%
Total Respondents		79	100%

6. Which category best describes you?





		Response Total	Response Percent
Caucasian/Non- hispanic		45	55%
Hispanic/Latin		13	16%
African American		14	17%
Asian		4	5%
Native American		0	0%
Native Hawaiian or Pacific Islander		1	1%
Other		5	6%
Total Respondents		82	100%

7. In an AVERAGE week, approximately how many hours do you work at job(s) outside of being a student (regardless of whether that job is on campus or off campus)?

Response Response

		Total	Percent
0-5		20	24%
6-10		10	12%
11-15		5	6%
16-20		14	17%
21-25		14	17%
26-30		7	9%
31-35		5	6%
36-40		6	7%
41+		1	1%
Total Respondents		82	100%






8. Which of the following best describes how you started your college career?

		Response Total	Response Percent
I started as a Biology/Chemistry major HERE at Fitchburg State University		42	51%
I started as a different major HERE at Fitchburg State University and changed majors		19	23%
I started as a Biology/Chemistry (or similar) major at a DIFFERENT college and transferred to Fitchburg State University		14	17%
I started as a different major (outside of Biology/Chemistry) at a DIFFERENT college, and then transferred to Fitchburg State University and changed majors, too.		7	9%








Total Respondents 82 100%






9. The reputation of the university was an important factor in my attending Fitchburg State University

		Response Total	Response Percent
Strongly Agree		14	18%
Agree		30	38%
Neutral		24	30%
Disagree		5	6%
Strongly Disagree		6	8%
Total Respondents		79	100%

10. Closeness to work and home was an important factor in my attending Fitchburg State University

		Response Total	Response Percent
Strongly Agree		39	48%
Agree		17	21%
Neutral		16	20%
Disagree		4	5%
Strongly Disagree		5	6%
Total Respondents		81	100%

11. Cost of attending the University was an important factor in my attending Fitchburg State University

		Response Total	Response Percent
Strongly Agree		55	68%
Agree		21	26%
Neutral		2	2%
Disagree		2	2%
Strongly Disagree		1	1%
Total Respondents		81	100%



12. The reputation of the Biology/Chemistry department was an important factor in my choosing this major

		Response Total	Response Percent
Strongly Agree		23	30%
Agree		25	32%
Neutral		19	25%
Disagree		5	6%
Strongly Disagree		5	6%
Total Respondents		77	100%

13. The approachability of the faculty in the Biology/Chemistry department was an important factor in my choosing this major

		Response Total	Response Percent
Strongly Agree		25	32%
Agree		25	32%
Neutral		19	24%
Disagree		6	8%
Strongly Disagree		3	4%
Total Respondents		78	100%

14. The science equipment and building were an important factor in my choosing this major

		Response Total	Response Percent
Strongly Agree		25	32%
Agree		26	33%
Neutral		22	28%
Disagree		3	4%
Strongly Disagree		2	3%
Total Respondents		78	100%

15. What do you like about the Biology/Chemistry department?

1. I like the command of subject matter and expertise the professors in this department have.

2. I like how willing everyone else to help you. The department is very kind and very helpful. They definitely want you to succeed
3. The professors are by far the best thing about the department. I have come across professors in other subjects and their have been ones I had a hard time learning from. But in the science subjects I have had nothing besides great professors who I learn great from.
4. The faculty is so friendly and helpful. Everyone is very approachable and do their best with the resources at their disposal.
5. I enjoy the close interaction between the Biology/Chemistry faculty and the students, I also like how the
6. The faculty are extremely approachable and willing to work with students as long as the effort is reciprocated.
7. That most of the teachers care about your success in the class.
8. Approachable and understanding faculty
9. I like how there's always people there to help.
10. It seemed new and useful. Appropriate and effective for following the career I want
11. I like science building and lab and classroom set ups a lot. I like the concentrations available
12. I like how the professors all want to what is best for the student and are willing to go out of their way to help students progress towards our goals.
13. How easy it is to go and talk to your professor one on one if there are any questions or issues throughout the semester! I also like the open office hours because it gives us more professors to get help from if I don't understand what my professor is trying to explain to me!
14. I like that all the staff is very approachable and very easy to talk to to even if I don't have a class with them.
15. All of the faculty I have encountered have been kind and have made themselves available if students need further help.
16. I like that it's very tightly knit
17. I like how the faculty members are always willing to help.
18. I am taking biology because is a one of the items in my check list to become who i want to be. But this department is terrible!!! I can name those that make it great Dr. O'connor , Dr.Ludlam , Dr.Krieser , Dr. Babich , Dr. Grimm, Dr. Picone, Dr. Rehrig. These listed are the best professors because they simply care and know that society have change and so has education. Every student learns differently !!!!!
19. I just liked the prospect of all the options I could pursue in my career choices
20. Don't use expensive books or no book/online website at all
21. The professors, who I've met so far, are amazing.

22. I like how challenging it makes me want to keep learning hard and become a better student overall
23. Most teachers are willing to offer time to help or explain ideas and concepts
24. The science building
25. How organized the study rooms are and how nice the professors are.  
I like being able to get to know my professor and be more than just a number. I've established close knit relationships with my professors in both labs and lectures. I
26. find it really beneficial especially in my area of study. It's a great relationship to have and I value that I have that opportunity.
27. They are all very willing to help and i love how enthusiastic they are about their subject.
28. What I like about is how the lab are set up and classes are small
29. The science building is very advanced so it's useful to be able to work with the equipment daily.  
Those within the department are very much approachable, they make it easy to
30. discuss different options. This is especially true when undergoing the process of changing my major.
31. I like how intelligent the professors are. I look up to many of them ( Grim, Schoenfeld )
32. The teachers
33. The professors! Every professor I have had as been extremely helpful and great at teaching the complex material
34. Cleanliness and experience from faculty.  
I like that the teachers seem to enjoy what they are teaching. Coming from a
35. different school I had several professors who didn't seem interested in the content which made it difficult for students to become interested
36. Availability of resources. The professors make extra effort to assist students. Very good sense of humor. Genuine and enthusiastic professors.
37. Some advisors are helpful, and the class sizes
38. Teachers are very approachable and willing to help whenever needed.
39. I love how friendly the faculty are to students.
40. I do like that some professor are willing to help you and want you to succeed in their class and overall in the major.  
All of the core professors are very passionate about their subjects and eager to help
41. students through the course work. Additionally the professors actively try to engage the students in independent research to provide real world practical experiences, which students can take into the world beyond college.
42. how the professors know and love what they are teaching.

43. The buildings are nice, but I can't really comment on this extensively as I'm not enrolled in the biology major here and I'm only taking one class here.
44. I like the technology that we have here. The science building being brand new in my first year was awesome.
45. I love how all professors are so approachable and willing to help when asked.
46. I like most of the professors because they really helpful. Always willing to help .  
What I really like about the department is how interactive the classes are. You are
47. able to have one on one time with professors rather than 300 students cramped in one room.  
The fact that one student can go to any of the different professors for help, and not
48. necessarily one specific one that they are assigned to, especially when it comes to advising for classes.
49. I like how I can find my professors and my advisor in the same building. Also everyone is there to help you succeed.
50. Every biology professor I've ever had has been incredibly approachable and helpful. Chemistry, not so much.
51. The professionalism and qualification of the department professors, and advisors
52. The professors are all very helpful and willing to help students who need it
53. The hands on experience that the technology present on campus can offer is a great advantage.
54. The openness and people in general. Everyone is approachable.
55. So far most of the professors I have had have really made me like the course. They make sure everyone understand should the material and are always ready to help
56. I like how the faculty are approachable and knowledgeable about their courses and about the field.  
The building , the resources some teachers give us for extra help . Some teachers
57. genuinely try there best to get students to pass. My favorites are Fiedler and Kilpatrick . Best teachers I've had so far.  
All of the professors are awesome, different in so many ways, but all awesome! I
58. like how we all mainly stay in the same building and everyone really gets to know one another.
59. The instructors are very knowledgeable and willing to help.
60. i like the capstone courses that allow to go deeper into depth about a specific topic
61. It has a brand new lab facility
62. Most of the professors are very good teachers and care about their student.
63. The staff is always willing to help and its location being so close to almost everything else.
64. I thoroughly enjoy the state of the art science complex as well as the size of the

classes

65. Some of the teachers in this department are approachable. They go out of their way to ensure that the students are progressing in their classroom and outside of it. They also make it their aim to ensure that there are a lot of opportunities for students to be exposed to upon graduation.

Total Respondents 65

16. What do you dislike about the Biology/Chemistry department?

1. Many of the electives require either too many prereq's or a higher level of a prereq, so it makes it hard for people switching into the major or sophomores to really start working on their electives.

2. I dislike that there are not as many options for electives. I wish there were more environmental-based classes beyond ecology, because I feel like the main focus is the molecular side of biology at her school. I also wish advisors help more with finding internships

3. There is not many things I dislike about the department, the only thing that I don't like is the fact that the chemistry labs don't have chairs. I have a minor heart condition and standing in the same spot for a long period of time aggravates it so that's the only downfall.

4. I don't like the lack of environmental biology/ecology classes as compared to medicine related classes

5. I wish there were more electives for students to take, a Hunger Games vibe occurs during registration, especially for classes without an Organic Chemistry requirement like Marine Biology.

6. For \$40-45 a student, I think Sapling is a rip off. The software is very poorly-made and the amount of times it will create false positive and label my correct answer wrong caused me a lot of anguish in my chemistry courses.

7. Sapling is the absolute worst, along with the use of clickers. They are both expensive and irritating.

8. Not enough options for classes for people who are health science concentration

9. Little research opportunities

10. There's not a lot of events that occur there.

11. Nothing in particular comes to mind

- I do not like the classes I have to take to be a pre health concentration such as ecology, physics 2, orgo 2. I do not like that the internships that are advertised are always in out of state when we have great facilities in Massachusetts. I do not like how the small spaces in biology electives make it so I can not always take the classes I need to and fall behind. I do not like how biology electives are mostly only available for one semester and given priority to seniors

12. I wish the screens in the lecture hall worked better.
13. I wish lab times were offered earlier in the day.
14. Nothing the only thing I find strange is that it's combined but it does make sense.
15. Not very clear about what requirements are needed for many grad school
16. I don't really have something.
  - Professors
  - lack of opportunities
  - miscommunication
  - Rudeness
17. - improper ways of tell students to switch majors
  - Jokes in class of students intelligence
  - accumulative test
  - open responds test
  - finals back to back
18. N/A
19. A lot of the professors, labs, not a lot of classes with flexibility.
 

The lab equipment seems a little outdated. MWCC had single eye piece
20. microscopes which almost eliminated my migraines. I am aware that my microscope may not be adjusted correctly but my anxiety often interferes when asking for help.
21. None
22. Lack of equipment
23. Nothing
24. N/A
25. Nothing
26. I don't have an answer
27. Some of the major classes are at similar times/das so making a schedule can be difficult some semesters.
28. N/A
29. I dislike the fact that there is barely any elective with low prerequisites!  
We need more !
30. Not enough electives
31. The labs, their very long and professor taking the entire 3 hours is boring and makes me zone out
32. Nothing to mind.

- One thing I dislike about the program is the fact that some of the lab assistants
33. don't always seem to know what they're supposed to be teaching or what is happenibf in lab
  34. Not very good with setting up internships for final year students. Needs to build more connections with the internship programs.
  35. Few class sections available which prolong graduation
  36. More offerings of core classes. They seem to fill up quickly and never habe enough times available.
  37. There are not a lot of research opportunities for many of the students.  
Some chemistry classes make it impossible to even understand what's going. Also last semester I did encounter a major obstacle with my Cancer Biology class. I worked really hard and was always in her office hours and library. In class she
  38. wouldn't teach much, just spoke about herself and when the exam came by it would throw a lot of people off guard. When I did speak to her explaining my methods of studying for the class all I was told that everyone had a different background which were smarter and for others it was just difficult because of their background.  
There is not sufficient funding and resources to conduct research projects and the biology program is set up in a way to disadvantage students who seek to do
  39. multise­mester independent work. There should be a higher focus on getting students into research internships for credit as part of the degree even if it supplants a bio elective. Company's want both education and experience and the program is not supportive enough from an a­cedemic point of view.
  40. Some classes are not in rotation when i want to take them
  41. N/a
  42. Some of the professors aren't as accommodating as others.
  43. N/A
  44. nothing
  45. I dislike that there are not many professors teaching each class which leads to having inflexible class times and difficulty making a schedule.
  46. i dislike how some professors won't update their old ways of teaching
  47. N/A
  48. Nothing, I feel Biology/Chemistry department is great!
  49. Most of the chemistry professors. I've had a couple of rude/arrogant professors over my four years and many were from the chemistry department.
  50. Nothing much.
  51. I personally dont dislike anything
  52. The timing/variety of choices for elective courses. It never seems that there are



enough seats in the offered courses or enough elective courses offered in general each semester.

53. Nothing really.

54. Some professor are too harsh.

55. The lack of courses being taught each semester compaired to the amount of srudents.

56. There are not enough options of classes to take and it's always so difficult to get teachers to red card you in. Oh and 3 hour labs that take up so much time in my schedule

57. I feel like they should offer more classes.

58. some of the teachers do not seem to care about teaching the students here. I understand that we should learn some things out of class but some teachers just seem to not care if the students understand the information.

59. The labs should involve more techniques and tools that will be used in actual labs

60. The way Some professors teachers their class. They expect you to already know stuff they haven't tought in class, and some just read the information right off their slides, and just don't know how to teach.

61. Nothing.

62. There really is not too much i dislike about the department other than some professors, however much of that is subjective

63. I dislike that some teachers expect you to know the information about the course before it even started.

Total Respondents 63

17. What could you suggest to improve the Biology/Chemistry department?

1. More lower level options for required electives, as well as better separation of days and times for classes. Some semesters classes that are important to take overlap, making putting together a schedule difficult.

2. I know it is difficult because that department is very small but trying to register for classes is very difficult due to the low selection of electives. There are too many bio majors and not enough classes for us to take as electives.

Would love to see a zoology course added!

3. I don't really have any suggestions. The department in my opinion is great. Minus the chair situation in the chem labs.

4. I would suggest a larger variety of classes and more sections of them so that people who actually want to take a class aren't kicked out by people who just need the bio credit

5. While I understand more electives requires more faculty, the major seems to have grown a lot and I think it's in the Department and University's best interest to take

on more faculty to do lower level biology and chemistry courses to offer more advanced courses.

A software other than Sapling would be greatly appreciated.

6. More electives!!!! It has been very difficult to get into electives the past few semesters. Also more capstone options would be great.
7. Offer more classes
8. More electives and stronger concentrations
9. I think more activities should be held there
10. A coffee machine
11. I would suggest more sections to all the classes, more biology electives, more priority given to juniors in picking classes
12. The sound systems in the classrooms all need improvement when watching videos in class.
13. Put pencil sharpeners in all classrooms. Allow vending machines the ability to take debit cards. Commuters don't typically put money on Falcon cards.
14. Advisors are more informed about graduate schools and what you should take.
15. Create more opportunities/events for Biology/chemistry students to be more connected to each other.
  - Take the 10 year plan out for professors to fear the system and do their job
16. -Make sure that courses like ORGANIC CHEM are the same curriculum rather than one being more difficult than the other
17. Coffee machine
18. Newer professors.
19. Offer more sections of classes. I live an hour away and it was difficult to schedule classes around my son's daycare.
20. None
21. More events or groups that influence studying outside of what we are learning in class
22. Nothing
23. More educational resources provided to students.
24. N/A
25. Just the way some professor teach classes
26. It would be useful if our finals weren't the day after our final class for that test.
27. N/A
28. As a biology major student who's surrounded by such intelligent professors, sometimes it feels like they look down on you. I feel like some have forgotten what

it was to be a student and it's sad to see that there's barely any humbleness in the department.

29. Provide more electives, or more sections of classes, hire more professors
30. Don't know. Think it's a great department with fantastic teachers
31. Not sure.

One suggestion I could make to improve the department is to have social events to allow students to get to know each other. As a commuter transfer student I don't know anyone in my classes and it's hard to get together to study with people

Another computer lab that doesn't hold classes. Add more electives. Advisors should practice being more aware of when/what their students need to take to graduate in 4 years. Stop making students pay for clickers. Sapling is easy for the professors to grade but in-book problems for homework would be much more efficient to learn from. Help students be more comfortable with lab practicals.

33. Add more sections of classes to help fit more schedules, and include more variety of classes
34. Add more sections of classes to help fit more schedules, and include more variety of classes
35. More class times would be great.

36. I would like to see more environmental biology electives.

37. Better explanation in some courses and more assignments other than the exams.

38. There should be a broader array of electives offered. The catalog is too limited from semester to semester.

39. Not much its very well

40. N/a

41. [No Answer Entered]

I highly appreciate the review sessions that some professors hold the day before an exam; it would be helpful if most of the professors offered this if they have the time to do so.

43. I would prefer more lab works than lectures. Most jobs require more hands on experience.

44. To improve I recommend holding more teacher meeting to see how each professor is with their students and work off of the feedback

45. Make it easier for classes that aren't offered often (every semester/once a year) to be known in advance, so students can plan their schedules ahead of time.

46. Everything seems fine. I don't think there should be much improvement.

47. More bio electives!!!! Or more seats!

48. Nothing that i can think of

49. Offer more biology elective courses more often for students who need to fulfill the requirements.

50. Nothing really.
51. Please have more electives each semester and don't overfill classes.  
Add more classes or teachers . Get teachers to make their own exams instead of
52. giving up the school exams with no study guide or knowledge of what to study for some teachers
53. Offer more classes please!
54. more 3 and 4 cred bio electives offered in evenings and summers.
55. more exaples for problem base classes. Give time for students to do the work then go over the steps
56. Adding classes that target specific fields under biology/chemistry
57. Get more professor for the same subject, so it give students more options on who taking a class.
58. They are doing a satisfying job so far.
59. The flow of the classes and to really make sure the tests match up with the course material taught and the exams match the level of info taught
60. I think that there should be a day dedicated to learning about different kinds of internships and Internships must be compulsory.

Total Respondents 60

18. Do you consider there to be anything unique about the Biology/Chemistry major at Fitchburg State University?

1. There are a lot of internship opportunities through the department as well as approachable staff.  
Yeas, that apartment here is unique because it is one of the only schools where their biology and chemistry department is combined. Most schools have a large
2. biology department that is separate from a large chemistry department. I think the small size allows for a more intimate setting in terms of learning  
I think the most unique component of a biology/chemistry major is the variety you
3. receive. I think there is so much to learn in these two subjects that receiving a degree in either gives you a wide range of job opportunities.  
Having a smaller school probably makes for a different experience in taking the
4. general bio courses. The fact that we have an urban campus but have natural settings still accessible
5. I think the opportunity for interaction with the faculty at Fitchburg State was the main factor that kept me from transferring.
6. I love the class sizes and faculty
7. No
8. The staff is very willing to help and go the extra mile

9. It's the only building that stands out
10. I haven't seen other science majors in other colleges to make a real comment
11. No it seems like a lot of the other ones I hear about
12. I'm not sure about the other majors and departments, but I like the interactive outdoor labs in ecology and geology.
13. Biology isn't a hard major to find but the Neuroscience concentration was a huge draw. It's hard to find as part of a bachelors program.
14. No not really anything
15. Not sure since I don't really know how it is elsewhere.
16. YES!!!! You are the only department that enjoys failing student because you consider your self smart ??????????
17. When I first switch my major to chemistry I meet 14 people that are in the same field as me and this year the number expand
18. N/A I have nothing to compare to
19. Green room.
20. Quality education close to home.
21. The availability of professors and advisors in helping students
22. Always office hours for one teacher or another
23. No  
I feel as if being a Biology/Chemistry Major at Fitchburg State is unique in a way that it allows for a prospective student in this major to have diversity in this area of
24. study, particularly here. Also, there is a lot of encouragement and support from Professors, Faculty, and Staff that you meet when being a Bio/Chem Major here at FSU.
25. I havent been to another university but i think they bio/chem major at FSU is great. I am so excited to learn because of the professors.
26. Biology/chemistry department is diverse.
27. The professors are very approachable here, always willing to lend a hand
28. We have very up to date resources
29. Yes we have a great student body! We have so many nationalities ! It's amazing
30. Wonderful professors  
Transferring from another school I think this department really sticks out because I
31. really struggled in biology/Chen classes at my other school. Fitchburg has professors that are invested in their students and how well they do.
32. Think it helps to build a strong knowledgeable understanding of the field.

- One thing I find unique about the program is that some of the professors also teach
33. the lab sections. I like this because it allows the student and professors to get better acquainted and make the professors seem more approachable
  34. Small class sizes. Available help/ study groups set up by professors.
  35. Nothing unique that stands out about the major. I do like the second major added that allows for one semester of organic
  36. I think the faculty here are unique, every professor brings something different to the department.
  37. I would maybe say I like that a lot of student have the opportunity to do research with the professors on campus.
  38. The professors are excellent. That is the defining attribute. The only caveat is that some of the adjuncts demean the program.
  39. Just having a building dedicated for the Science major
  40. I attended a much larger university for majority of my coursework, but also attended MWCC for some science courses. I feel the buildings and Equipment are much newer and nicer at FSU then at MWCC, and it is much more intimate then UMass.
  41. N/A
  42. They are very hands on majors which is a great way to learn, especially if the career one wishes to obtain after college is hands on as well.
  43. IS FINE .
  44. What I consider unique is how we are able to learn the information in a non stress related enviroment
  45. For Chemistry, the fact that Inorganic Chemistry is required, while Physical Chemistry II is not, as a way to try to not scare off any potential students.
  46. You don't have to go to your professor about a question you have on you biology/chemistry homework, you can ask any other biology or chemistry professor around and they would be will to help. Everyone is super friendly. The labs are very unique and very fun to do.
  47. The preparedness and intelligence of the professors in their respective fields
  48. I think they keep students up to date with opportunities whether its internship or jobs
  49. The faculty within the department is extremely well trained and educated, and know exactly how to help students when they need it.
  50. I don't know any other to compare it to.
  51. I don't know because I haven't gotten the chance to be in other departments
  52. How approachable the faculty is and how they teach the classes not student teachers. They also have students help with research.

- I'm not really sure. One thing I do know, is we have much smaller class sizes than
53. other schools, which i have heard makes a huge difference to those that have been in much larger classes before.
  54. more lab time then other schools
  55. The teachers have less students than a regular college so they know who you are and can help you on a regular basis
  56. none that I can think about right now.
  57. The investment put into the subject area in terms of technology, the environment, and the professors
  58. Small hands on labs are a unique feature
  59. Teacher and Student Research Project

Total Respondents 59

19. Can you describe the common obstacles you or your peers encounter when trying to complete a Biology/Chemistry degree?

- Usually, all the exams for bio/chem classes happen within the same seven days, making studying stressful and more difficult than it would be otherwise. That's been my experience as well as many people I know for the past few semesters. Some
1. people with disabilities have a hard time with the lab component to class, because missing even one lab can really negatively impact your grade. Better preparation or availability for make up lab sessions is something a lot of people I know want.
  2. Lack of electives. Too many bio majors and not enough courses. Organic chemistry
  3. The most common obstacle I have faced is family issues and personal problems that have caused me to be absent. So since I think the curriculum is taught at such a fast pace, that if you miss one day it throws you off drastically.
  4. Organic chemistry has definitely been a topic of frustration among me and my peers. It's a difficult class and the information is often not applicable to our career paths.
  5. In my experience tutoring biology courses, I think the educational background of students really is a major factor in the student's success. Some students come from very poorly-rated high schools and the effort they have to put into the lower level courses can really overwhelm them.
  6. Sapling, class registration, capstone options, chemistry
  7. Having all these science classes at once is overwhelming.
  8. Commuting and working interfere with studying time
  9. The tests are some what challenging
  10. Using sapling or websites that force you to pay for them

- I have had difficulties with professors in the department and find a lot of the time I
11. end up teaching myself the material because they are unclear and don't seem able to convey the information in a way we can understand  
 Along with all science majors, there is a lot of hours that need to be put in and a lot of tough content to memorize. Science is its own language and it takes focus and
  12. dedication. The toughest part about being a science student is trying to fit in all the homework and studying along with working out of school to earn money to pay off the education.  
 Having enough time to take the classes needed to graduate. With a part time job it is
  13. difficult to do all the work that is asked however being someone who has taken summer and winter courses, I believe its still difficult to finish on time with a switch in the major.
  14. Massive amount of information given at once. Hard to absorb it all. Lack of sleep.  
 Many classes are taken very soon and are hard to fit into your schedule. Also many
  15. classes are offered every other year which makes it difficult to take if you can't get in initially.
  16. The obligation to take very challenging classes.
  17. PROFESSORSSSSSSSSSSSSSS and PROFESSSSSSSORSSSSSS ! People other than the department head should sit in these classes and see whats happening
  18. There have been issues with clickers, paying for online homework websites,
  19. Classes aren't as flexible and professors are harsh and boring.
  20. Being a single mother trying to maintain good grades while working.
  21. The level of difficulty and trying to stay on track
  22. Struggle to find readings on material other than text book assigned
  23. Lab report
  24. The workload can be overwhelming at times.
  25. Stress of assignments being piled on, struggle to understand/learn course material.
  26. Chemistry is usually what i hear people struggle with.
  27. That way some professor teach is far for me to understand that subject.
  28. I work upwards of 20 hours a week so it can be more difficult to find time to study for tests and quizzes
  29. n/a
  30. CHEMISTRY
  31. Many students have a tough time passing organic chemistry, and the physics requirements deter many students
  32. Study groups would be helpful or more tutor options



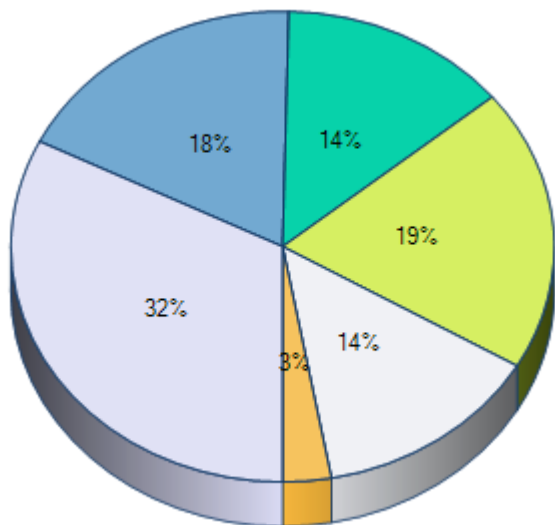
33. Difficulty of courses.
34. As a transfer student some of the credits didn't transfer as I would have intended, so I am left retaking classes and wasting money learning things I already know.  
Studying a study guide then having it be irrelevant to the actual exam. Parking.
35. Group projects are pretty much useless with how many commuters there are and all the work usually falls on single individuals due to lack of availability to meet up outside of class. Finding internships.
36. Organic chemistry with Dr. Govindan is very difficult
37. Courses available  
Organic Chemistry and Physics are usually the classes people struggle with the
38. most most. People give up too early, that is why they leave the major. The major also requires you to put a lot of your free time into studying.
39. The teaching styles of the professors. Most of my peers have said "Don't take that class because he or she is too hard doesn't know how to explain, you will fail".
40. Availability of course work. Challenging time in physics, additional help would be greatly appreciated, order of course work.
41. The amount of classes one has to take to graduate.  
Not enough support academically if struggling, ie tutoring. At UMass professors
42. would hold a kind of study session prior to the test to answer questions/points of confusion that could not be clarified in class. Also there were SI ( supplemental instructors)
43. Nothing in particular stands out.  
Balancing classes that all have a lot of information to learn before an exam, when
44. the exams are during the same week is difficult because I tend to study more for the class I deem more important or the one a struggle in the most.
45. FINANCE.
46. Graduation on time because many classes are only offered in the same block of time/days as other courses necessary during the semester.  
This degree requires lots of attention and sometimes working with this major can be
47. extremely difficult. To fit in all these requirements within 4 years is frustrating but worth it in the end.  
For most students, especially Freshman, it's the fact that they don't understand how
48. difficult a Biology/Chemistry major is. A lot of the students in Gen Chem/Bio I do very poorly because they don't understand how much time is needed to be put into studying, or doing homework or lab reports, due to the fact that lab science courses in Highschool are nothing like college.
49. It's only my freshman year of college and it took along time for me to get use to the transitioning from high school to college, but I believe I'm get the gist of it. I met a lot of Biology majors in upper classes and they told me it does get any easier and I have to agree so far. I've been challenged to a different degree and I'm happy about

that. I'm excited for the journey of becoming an Bio major so I can go off and follow my dream of becoming a Dentist or a Pharmacist.

50. I'm graduating a year late because certain classes filled and I couldn't get what I needed when I needed it.
51. Any of the chemistry classes are obstacles
52. trying to keep up with the workload, whether its studying for tests or completing lab and other assignments
53. Difficulty with Organic Chemistry immediately comes to mind. And again, not having enough course offerings each semester.
54. Office hours not being a time when I am available. Low grades despite studying.
55. Too much work and some professors are not really helpful
56. The amount of seats for each course
57. Scheduling classes  
I feel like there are not enough classes offered, mostly upper level courses. It's hard to make everything fit into your schedule if you only have a few options to choose from, not to mention the classes fill up insanely quick and I feel like more often than not you have to pray the professor will red card you in.
58. organic chemistry
59. I haven't noticed any avoidable problem that would cause people to leave the major
60. Professor that can't teach. they are very smart and know the information but are unable to teach what they know to their students.
61. Basically, just academic because all majors have classes that is not what you view yourself needing in the future and often, they are the hardest ones to the students.
62. not enough class seats available to effectively graduate on time  
The lack of tutors  
Social Problems
63. Family issues  
Debt  
Time management

Total Respondents 64

20. Based on your experiences and/or what you know from your peers, which of the following are important factors that explain why students leave the Biology/Chemistry major? (Check off ALL that apply)



	Response Total	Response Percent
<input type="checkbox"/> The CURRICULUM makes it difficult to finish a degree in four years	45	62%
<input type="checkbox"/> Students are UNHAPPY with the teaching in the department	25	35%
<input type="checkbox"/> FAMILY/PERSONAL ISSUES interfere with completing a degree	19	26%
<input type="checkbox"/> A lack of MONEY for college prevents students from completing a degree	27	38%
<input type="checkbox"/> Students realize that a science degree is no longer their career goal	19	26%
<input type="checkbox"/> Other, please specify	4	6%
Total Respondents	72	
(skipped this question)	35	

Responses from "Other":

Some students with poor backgrounds in science have a hard time catching up.

PROFFESSORSSSSSSSS

How hard it is to successfully major in biology

They can't seem to pass all of the chemistry classes

21. If you have any other comments that you would like to share to help us better understand what motivates students to pursue a Biology/Chemistry degree, the challenges that students face while pursuing their degree, or ways that the department and university can better assist students, please enter them here. (OPTIONAL)

1. N/A

We desperately need tutors for organic chemistry. The one woman I think her name is Shelia is horrible. She confuses you more than teaches you. If organic chemistry two is to remain a constant or a mandatory class for the biology degree there needs to be better sources for help

2.

The biggest challenges I face when pursuing my degree is having to take courses that have nothing to do with what I want to do as a career. That is the hardest part for me because it takes a lot of motivation to spend my time on courses I don't necessarily like.

3.

YES this is Jonathan Guzman !!! Let me know if you want more feedback on this horrible department run by unprofessional people

4.

I understand completing a biology degree is hard but I cannot attend tutoring after 4 as I do not have child care. Before 4 I either have class or I have work. I saw an email of online tutoring which I did not know was available. Both are great resources but varies from student to student.

5.

6. N/A

I can only speak for myself, that reason I become a Biology major was because I love how things work and reproduce. That only reason I struggle with my classes because the way questions are written or I didn't understand the subject.

7.

8. n/a

9. I just want to thank professor Rehrig for believing in me since freshman year !

When professors make suggestions of how material can be applied to a real world job is encouraging and useful to know and help plan my future. Professors offering student positions to help them during research is great. Add more

10.

electives that don't cross mandatory lab times. I find most upper level students still don't understand acids/bases so those should be taught better in gen Chem. Group projects need to have designated class time due to amount of working commuters, availability to meet outside of class is very difficult and stressful.

11. I just want more environmental classes. I'm talking you Dr. Ludlam, Dr. Picone, and Dr. Welsh. Give the people what they want!!!  
The program is rigid and not willing to be flexible where students are. While providing a well rounded education is important, if someone is interested in
12. molecular biology in animal systems they shouldn't be forced to take plant biology courses for the sake of taking them. Let students focus on their passions.  
I think in class tutors or SIs would be great. Someone who attends the class but is
13. not student in the course and holds study sessions are clarifies points of confusion that the professor is unavailable for.
14. [No Answer Entered]  
The biology/chemistry department at FSU is a thousand times better than that of
15. my previous university; class sizes are much smaller, and professors are easily reachable and available for extra help outside of class.
16. i am happy with my experience here but I was given the luxury of not having to work my first two years allowing me to focus solely on my studies.
17. N/A
18. N/A
19. n/a  
One thing that is often an obstacle in completing our four years here is the low
20. frequency in which some classes are offered. By making them more available and accept a greater number of students, we can have more freedom to experience as many different subjects within the Biology/Chemistry area.
21. Aside from office hours, Professors should have review sessions to review subjects or topics before the exams.

Total Respondents 21

## Appendix G: Catalog Descriptions – Undergraduate Curriculum

### B.S. Degree in Biology

#### Objectives of the B.S. Degree in Biology

Fitchburg State University offers a biology program that emphasizes basic scientific principles while challenging students. The Department of Biology and Chemistry has a rich history of producing successful graduates in secondary education, biotechnology, environmental biology and health sciences. Our faculty foster a supportive teaching and learning environment, offer individual attention to students, and provide numerous undergraduate and graduate research opportunities. The Biology and Chemistry Club sponsors social events to encourage interaction between students and faculty. The department also offers courses in laboratory science for other majors.

#### Requirements for the B.S. Degree in Biology

All Biology majors are required to take four core courses and six advanced BIOL electives ( $\geq 2000$ ) including a Capstone course, for a total of 36 credits. The core biology courses include student laboratory work so that students develop the skills of scientific inquiry. Students develop scientific literacy through reading, writing, testing hypotheses, and quantitative analysis. Core courses also integrate computer literacy through lab activities.

#### Core courses required in the Biology major

---

- BIOL 1800 – General Biology I **4 cr.**
- BIOL 1900 – General Biology II **4 cr.**
- BIOL 2300 – Ecology **4 cr.**
- BIOL 2800 – Genetics **4cr.**

#### Additional Requirements

Biology majors also take six advanced electives at or above BIOL 2000. Independent study, directed study or internship may each count as one advanced BIOL elective in a student's program of study. Courses with a separate lecture and lab registration count as a single elective: the lab portion of a course does not constitute a distinct biology elective.

One of the six electives must be a designated Capstone course. Students in the Capstone course conduct a research project to demonstrate their skills in research design and analysis. The Capstone course also meets the University's Listening and Speaking and Junior/Senior Writing requirement.

Biology majors must earn a minimum grade of 2.0 in General Biology I and General Chemistry I. If a grade below 2.0 is earned in either course, that course must be repeated before enrolling in any subsequent BIOL or CHEM classes. Biology majors are

also limited to two attempts for each of General Biology I and General Chemistry I. If Biology majors earn <2.0 or a W in a second attempt, they must find another major that more closely matches their skills and interests.

### **Capstone course options**

Capstone courses must be taken at Fitchburg State: courses that transfer as the equivalent course will not fulfill this requirement. Independent studies (BIOL 4903) require approval by the departmental curriculum committee in order to fulfill the Capstone requirement.

- BIOL 3550 – Developmental Biology **4 cr.**
- BIOL 3650 – Plant Biology **4 cr.**
- BIOL 4500 – Molecular Biology **4 cr.**
- BIOL 4700 – Animal Physiology **4 cr.**

BIOL 4903 – Independent Study **3 cr.** (*requires departmental approval*)

### **Required courses in related sciences**

In addition to BIOL courses, Bachelor of Science (BS) students are required to take courses in related sciences and two courses in mathematics at or above MATH 1300.

- CHEM 1300 – General Chemistry I **4 cr.**
  - CHEM 1400 – General Chemistry II **4 cr.**
  - CHEM 2000 – Organic Chemistry I **4 cr.**
  - CHEM 2100 – Organic Chemistry II **4 cr.**
  - PHYS 2300 – General Physics I **4 cr.**
  - PHYS 2400 – General Physics II **4 cr.**
- 2 MATH courses at or above the 1300 level

### **Career Options**

The general Biology B.S. degree prepares students for a wide range of careers. Some of the graduates have gone to work in the biotech and pharmaceutical industries; some have gone on to graduate schools and health-professional schools in medicine, dentistry, pharmacy, physician assistant, chiropractic, nursing and clinical laboratory sciences.

## **B.A. Degree in Biology**

### **Objectives of the B.A. Degree in Biology**

The Bachelor of Arts (B.A.) in Biology is a broad-based biology degree that would be appropriate for students who wish to use biological knowledge in pursuit of a career that does not require a detailed knowledge of organic chemistry and physics. Examples of such careers are: laboratory technician, teacher, science writer, scientific illustrator, technical sales representative, and editors or editorial assistants in the publishing industry. This degree would also help students fulfill the requirements for admission to certain health professions, such as Physician Assistant, Physical Therapy, Occupational Therapy, Public Health, Post-baccalaureate Nursing and Chiropractic - additional

specific coursework may be required in some cases. Pre-medical and pre-dental students, and those who want to pursue graduate studies in biology would be advised to pursue the B.S. in Biology, but they could also use this degree by tailoring their curriculum to meet the specific requirements of medical or graduate schools.

### **Requirements for the B.A. Degree in Biology**

The Biology requirement includes four core courses and six biology electives at the 2000 level or above including a capstone elective. The core biology courses include hands-on laboratory work that provides opportunity for students to develop the skills of scientific inquiry. Students develop scientific literacy through reading, writing, testing hypotheses, and quantitative analysis. Core courses also integrate computer literacy through lab activities.

### **Core Courses Required by the Major**

- BIOL 1800 – General Biology I **4 cr.**
  - BIOL 1900 – General Biology II **4 cr.**
  - BIOL 2300 – Ecology **4 cr.**
  - BIOL 2800 – Genetics **4cr.**
- \* General Biology requires the completion of the Math Placement test prior to enrollment. Students who are able to co-enroll in Basic Math II will be accepted into the general biology courses.

### **Additional Requirements**

Biology B.A. majors also take six electives at or above BIOL 2000 including a capstone course. One of the BIOL electives could be replaced with the two-semester sequence in Anatomy and Physiology (BIOL 1200, BIOL 1300). Independent study, directed study or internship may count as one advanced BIOL elective in a student's program of study. Courses with a separate lecture and lab registration count as a single elective: the lab portion of a course does not constitute a distinct biology elective.

Biology majors must earn a minimum grade of 2.0 in General Biology I and General Chemistry I. If a grade below 2.0 is earned in either course, that course must be repeated before enrolling in any subsequent BIOL or CHEM classes. Biology majors are also limited to two attempts for each of General Biology I and General Chemistry I. If Biology majors earn <2.0 or a W in a second attempt, they must find another major that more closely matches their skills and interests.

### **Capstone Course**

One of the six electives must be a designated capstone course. Students in the capstone course conduct a research project to demonstrate their skills in research design and analysis. The capstone course also meets the University's Listening and Speaking and Junior/Senior writing requirement.



The capstone course must be taken at Fitchburg State. A course that transfers as an equivalent course will not fulfill this requirement. Currently, the following courses are designated as capstone courses:

- BIOL 3010 – Invertebrate Biology **4 cr.**
- BIOL 3550 – Developmental Biology **4 cr.**
- BIOL 3650 – Plant Biology **4 cr.**
- BIOL 3900 – General Microbiology **4 cr.**
- BIOL 4500 – Molecular Biology **4 cr.**
- Independent Studies (BIOL 4901-4903) require approval by the departmental curriculum committee in order to fulfill the capstone requirement.

### **Required Courses in Related Sciences**

---

In addition to BIOL courses, Bachelor of Arts students are required to take courses in related sciences and two courses in mathematics at or above MATH 1300

- CHEM 1300 – General Chemistry I **4 cr.**
- CHEM 1400 – General Chemistry II **4 cr.**
- CHEM 2000 – Organic Chemistry I **4 cr.**
- MATH 1300 – Precalculus **4 cr.**
- MATH Elective 3 or 4 cr.\*\*
- One PHYS course 3 or 4 cr.
- One GEOG course 3 cr.
- \* General Chemistry I requires the completion of the Math Placement test prior to enrollment. Students who are able to co-enroll in Basic Math II will be accepted into General Chemistry I.
- \*\* Either Applied Statistics or Calculus I is recommended as the second math course.
- Note: Many of the biology and chemistry courses have specific minimum grade requirements for prerequisite courses.

### **LA&S Requirements**

- 
- ENGL 1100 – Writing I **3 cr.**
  - ENGL 1200 – Writing II **3 cr.**
  - Foreign language proficiency at the intermediate level. This is typically met by successfully taking four courses (12 cr.) of a single foreign language.
  - LA&S electives 21 cr.
  - Up to 18 cr. free electives to meet the 120-credit minimum University requirement for a Bachelor's degree.

## **Biology Minor**

A Minor in Biology enables students to demonstrate a substantial and coordinated subsidiary expertise in biological sciences. The curriculum provides a theoretical foundation balanced with practical applications. Students gain an understanding of the process of science, as well as its universal applicability to society.

## Required courses

- BIOL 1800 – General Biology I **4 cr. and**
- BIOL 1900 – General Biology II **4 cr.**

BIOL minors will complete an additional ten semester hours of any BIOL electives  $\geq$  2000 level. These electives must be selected after consultation with a minors' advisor in the Biology and Chemistry Department.

## Chemistry Minor

The Chemistry minor is a popular choice among Biology majors at Fitchburg State University. It is also an option for students from other majors. The Chemistry minor provides an additional qualification to students and enhances their graduate school applications and job prospects, particularly in the pharmaceutical and biotechnology industries in the local area (Bristol-Myers Squibb, AstraZenica, Athena Diagnostics, Charles River Labs, etc.).

### Required Courses:

- CHEM 1300 – General Chemistry I **4 cr.**
- CHEM 1400 – General Chemistry II **4 cr.**
- CHEM 2000 – Organic Chemistry I **4 cr.**
- CHEM 2100 – Organic Chemistry II **4 cr.**
- CHEM 2400 – General Analytical Chemistry **4 cr.**  
Chemistry elective (CHEM 2000+, 3-credit)

*Note: CHEM 1300, CHEM 1400, CHEM 2000 and CHEM 2100 are all required courses for the Biology major.*

General Analytical Chemistry is offered every year in the Spring semester. A Chemistry elective is usually offered in the Fall semester. Recent offerings include Forensic Chemistry, Natural Products and Medicinal Chemistry. Biochemistry courses can be used to satisfy the chemistry elective requirement. They cannot be used to satisfy both the major and minor requirements.

## Concentration Descriptions

### Biotechnology Concentration

The pharmaceutical and biotech industries continue to be strong in Massachusetts. In addition, many other disciplines in Biology are also using the tools of biotechnology in one manner or another. Thus, an understanding of these tools and experience using techniques of biotechnology

can help prepare you for your career in science. Indeed, these tools are commonly used or referenced by the many pharmaceutical and biotechnology companies in Massachusetts, by government and academic research laboratories, and even by some environmental research and consulting groups. Several courses that can be taken as part of the Biotechnology Concentration at Fitchburg State can help you achieve an understanding of the principles underlying different aspects of biotechnology. In addition, many of these courses are laboratory-based where students gain hands-on experience using several cutting-edge molecular techniques and equipment.

### **Biotechnology Concentration**

The Bachelor of Science in Biology/Biotechnology concentration includes all of the requirements for the Biology major. When choosing their six advanced electives including a Capstone course, students in this concentration must take BIOL 3250 Cell Biology and at least three courses from the following: BIOL 3450 Biochemistry, BIOL 3900 General Microbiology, BIOL 4500 Molecular Biology, BIOL 3350 Cell Culture Techniques, or BIOL 4810 Immunology.

### **Environmental Biology Concentration**

The bachelor of science in Biology/Environmental Biology is an appropriate concentration for students interested in environmental careers, including ecology research, environmental protection, or state agencies. This concentration includes the requirements of the bachelor of science in Biology with the following exceptions:

1. One of the six Biology electives is Conservation Biology (BIOL 3100).
2. In addition to General Physics I and II, students will take one course from each of the two clusters with a GEOG designation. At least one course will come from the cluster consisting of Geology (GEOG 2100), Oceanography (GEOG 2500), or Environmental Hydrogeology (GEOG 4600), and at least one course will come from the cluster consisting of Remote Sensing of the Environment (GEOG 4500), Computer Cartography (GEOG 3120), Geographic Information Systems (GEOG 4000), Urban Geography (GEOG 4400), and Computer Applications in Geoscience (GEOG 2400).
3. Qualified students are encouraged to replace one of the six Biology electives with an internship of 3-6 credits in an environmental area (BIOL 4950).
4. While the MATH requirements are the same as for any Biology major, Applied Statistics (MATH 1700) is encouraged.
5. Students are strongly encouraged to pursue a minor in Earth Systems Science or in Geographic Science and Technology, or in Chemistry to complement the Environmental Biology concentration.

## **Biology/Health Sciences Concentration**

The Health Sciences concentration addresses the increased interest in health professions and is designed to prepare students for pursuing post-graduate studies. In addition to the core requirements for the bachelor of science in Biology the curriculum for the Health Sciences concentration is based on the student's intended career path.

Core biology courses involve student laboratory work to develop the skills of scientific inquiry. Student training includes a strong foundation in bioethics which is fostered within in the curriculum. The University's pre-health advisor is available as a resource to students in this concentration.

Students are prepared to continue their education in health professional programs, such as allopathic medicine, osteopathic medicine, dentistry, veterinary medicine, optometry, podiatric medicine, chiropractic medicine, naturopathic medicine, nutrition, physician's assistant, pharmacy, and physical therapy.

The concentration includes all of the requirements of the Biology major. Among the six BIOL electives, students must take BIOL 3450 Biochemistry. Students should choose the remaining electives based on their intended career path and are strongly encouraged to consult the prerequisites for the particular professional degree program. The University's pre-health advisor is available as a resource to students in this concentration.

In addition to the six advanced BIOL electives and Capstone, students with the concentration in Health Sciences must also take:

- BIOL 1200 Anatomy and Physiology I and
- BIOL 1300 Anatomy and Physiology II

The 2015 MCAT revision and the proposed medical school admission requirements also suggest that medical school applicants need to have additional competencies in cellular and molecular biology, microbiology, statistics, psychology and sociology. To

fulfill these requirements, the following courses are strongly recommended as electives for those who are interested in applying to M.D. or D. O. programs:

- Microbiology (BIOL 2700 or BIOL 3900)
- Applied Statistics (MATH 1700)
- Introduction to Psychological Science (PSY 1100)
- Introduction to Sociology (SOC 1100)

### **Biology/Neuroscience and Behavior Concentration**

The Neuroscience and Behavior concentration examines the interrelationships between the nervous system and behavior. Students interested in bridging the traditional disciplines of biology and psychology focus on nervous system function and how it relates to behavior. The interdisciplinary training received prepares students for careers broadly related to the neural, behavioral and cognitive sciences.

Core biology courses involve student laboratory work to develop the skills of scientific inquiry. Student training includes a strong foundation in bioethics which is fostered within in the curriculum. Students become aware of career potentials by close association with their academic advisors.

Students are prepared for a variety of career paths in academic, industrial, or clinical settings broadly related to the neural and behavioral sciences, including basic research in the neural and behavioral sciences, applied research, marketing and sales in the pharmaceutical, biotechnology and biomedical industries, occupational therapy, neuropsychology, and pharmacy.

The Bachelor of Science in Biology/Neuroscience and Behavior is an appropriate concentration for biology students pursuing future employment and careers in academic, industrial, or clinical settings broadly related to the neural and behavioral sciences. The concentration includes all of the requirements for the BS in Biology. Among the six BIOL electives required for the BS in Biology, including the Capstone, students must take BIOL 2650 (Neuroscience) and at least two courses providing additional perspectives to the study of neuroscience and behavior, chosen from among the following:

- BIOL 2600 - Animal Behavior **4 cr. 6 hr.**
- BIOL 3250 - Cell Biology **4 cr. 6 hr.**
- BIOL 3550 - Developmental Biology, or **4 cr. 6 hr.**
- BIOL 4700 - Animal Physiology. **4 cr. 6 hr.**

In addition, students with the concentration in Neuroscience and Behavior must also take:

- PSY 1100 - General Psychology and **3 cr.**
- PSY 3500 - Psychology of Learning or **3 cr.**
- PSY 3550 - Cognition **3 cr.**

## **Biology with Initial Teacher Licensure Concentration**

Students within our Biology major can pursue initial licensure as high school Biology teachers. This program provides students with both a broad introduction to high school teaching and specific instruction in the theory, research and practice of secondary science teaching.

The Secondary Education Teaching Licensure in Biology program seeks to prepare outstanding educators with a strong foundation in Biological content. Students engage in field-based experiences in the school setting supervised by our faculty through on-site pre-practicum experiences coupled with each teaching course and a formal teaching practicum as the capstone experience.

Students interested in pursuing Initial Teacher Licensure must apply for formal admission to the program. For information about undergraduate requirements in teacher preparation, see the section titled: Teacher Preparation Programs

### **(Undergraduate) The Bachelor of Science in Biology with Initial Teacher**

**Licensure** includes all of the requirements for the Biology major. Among the 6 Biology electives, teacher candidates must take BIOL 3450 Cell Biology, One of the 6 Biology electives must also satisfy the Capstone requirement. MATH 1700, Applied Statistics must be taken as one of the two math courses at or above the level of MATH 1300.

In addition, Biology teacher candidates must also take the following courses, two of which count towards the 6 Biology electives:

- GEOG 1000 Earth Systems Science 3 cr.

- BIOL 2860 Introduction to Secondary School Teaching\* 3 cr.
- SPED 3800 Secondary Programs for Adolescents with Disabilities\* 3 cr.
- ENGL 4700 Teaching Reading and Writing Across the Content Area\* 3 cr.
- BIOL 4012 Practicum Seminar 3 cr.
- BIOL 4850 Methods in Teaching Science\*\* (counts as one of 6 Biology electives) 3 cr.
- BIOL 4860 Biology Practicum in a Secondary School I (counts as one of 6 Biology electives) 3 cr.
- BIOL 4870 Biology Practicum in a Secondary School II (taken concurrently with BIOL 4860 for a total of 300 hrs. of Practicum experience) 3 cr.
- EDUC 3122 Sheltered English Immersion

\* Students must have an overall GPA of 2.5 to take any of these courses.

\*\* Students must have an overall GPA of 2.75, 3.0 in the major courses and passing score on the MTEL Communication and Literacy and Subject Area Exam.

## Appendix H: Biology Programs in Graduate and Continuing Education

(NOTE: These programs are from current catalog and do not reflect recently made changes to the programs.)

### Master of Arts in Biology

---

#### Graduate Program Chair

*Lisa Grimm, PhD*

#### Graduate Committee

*Erin Rehrig, PhD*

*Christopher M. Picone, PhD*

*Emma L. Downs, PhD*

#### Program Objectives

The Master of Arts (MA) in Biology Program is designed to prepare the student for a career in biology, environmental science, or for advanced study in these fields.

#### Program Description

The MA in biology program offers a flexible program of study with both a thesis and non-thesis concentration. As students progress through the program, they will develop a strong scientific philosophy, apply sound scientific thinking to analyze biological issues in society, develop skills needed for employment within the field of biology, and expand the breadth and depth of scientific knowledge.

#### Admissions Standards and Criteria

Applicants to the MA in Biology Program must submit documents as outlined in the graduate admissions section as well as:

- An official transcript of a bachelor's degree from an accredited institution, preferably with (but not limited to) a major or minor in biology or an allied discipline and at least two semesters each of chemistry, physics and mathematics

*Notes: Applicants with inadequate preparation will be required to take prerequisite courses prior to admission. The students interested in the thesis option should contact a potential graduate advisor as part of the application process.*

#### Program Requirements

The Masters of Arts in Biology Program has a thesis and non-thesis concentration. Each concentration provides the student with a solid investigative core balanced by content course



work. During the first year each student completes a biology seminar during which the student's writing and communication skills are evaluated. The thesis committee (comprised of the thesis advisor and at least two other graduate faculty) helps the student design a series of courses (electives) which aid them in successfully completing the thesis.

## MA Program of Study

---

Required courses for MA in Biology

- BIOL 7400 - Bioethics
- BIOL 9004 - Research in Biology
- BIOL 9011 - Seminar in Biology
- BIOL 9010 - Thesis in Biology (Thesis track only) 6-9 cr. required
- \*Electives 18-27 cr.

**Total for Degree: 36 cr.**

---

### Note:

*\*27 hours reflects a non-thesis option.*

# Post Baccalaureate Certificate Program, Biology Concentration, Initial Licensure, (8-12)

Students who hold a bachelor's degree and wish to become a secondary level (grades 8-12) teacher of Biology, may complete a post baccalaureate program that consists of the equivalent of a degree in biology and 21 credit hours of pedagogical coursework in education.

Students who are interested in the program must meet the following criteria:

- Evidence of a bachelor's degree
- A GPA of 2.8 or better
- Successful completion of the Massachusetts Test for Educator Licensure: Communication and Literacy Skills Sub-test
- Personal Statement

Students must complete an essay of no more than one page in response to one of the following questions/ statement:

1. Tell about a positive situation in which you helped a person and made a significant difference in that person's life.
2. What are the most important factors in establishing a long-term working relationship with students, friends, etc.?
3. Tell us about a significant event that involved you in a teaching or helping role.
  - Describe the situation as it occurred at the time.
  - What did you do in that particular situation?
  - How did you feel about the situation at the time you were experiencing it?
  - How do you feel about the situation now?
  - What would you change, if anything?

Once accepted, students will undergo a transcript review by the graduate program chair or undergraduate advisor, as designated by the department and a plan of study will be developed that addresses:

- Courses missing (if applicable) in the subject that are equivalent to the requirements for the major will be determined through a transcript review. Students will complete all requirements of the major and license as identified in the undergraduate program.
- Courses as identified below in the teacher preparation program (pedagogy courses):

When courses are in a student's plan of study, they will complete the plan of study at the undergraduate level, or at the graduate level if the equivalent is offered.

Once the licensure program is completed, students can request admission to the graduate program after completing additional admissions requirements as designated by the department.

## Required Education Courses

---

SEED 7015 - Introduction to Strategies for Effective Teaching in the Academic Discipline

or BIOL 2860 - Introduction to Secondary School Teaching 3 cr. (25-hour pre-practicum)

SPED 7709 - The High School Environment—Challenges In Educating Students with Disabilities

or SPED 3800 - Secondary Programs for Adolescents with Disabilities 3 cr. (10-hour pre-practicum)

ENGL 8076 - Creating Literacy Experience: Building Reading and Writing into the Content Areas

or ENGL 4700 - Teaching Reading and Writing Across the Content Area 3 cr. (25-hour pre-practicum)

SCED 9000 - Advanced Methods in Teaching Science

or BIOL 4850 - Methods in Teaching Science 3 cr. (25-hour pre-practicum)

EDUC 7096 - Sheltered English Immersion (SEI) (25-hour pre-practicum)

BIOL 8005 - Practicum in **Biology I**

BIOL 8006 - Practicum in **Biology II**

or BIOL 4860 - Biology Practicum in a Secondary School I (150 hours), 4.5 cr. and

BIOL 4870 - Biology Practicum in a Secondary School II (150 hours) 4.5 cr.

**Please Note:** BIOL 4860 and BIOL 4870 are taken concurrently for a total of 300 hours of practicum experience.

### Note:

Once a student has completed all requirements for professional and content specific courses, they will be eligible for endorsement in their selected field through Fitchburg State University.

# MEd—Science Education

---

## Graduate Program Chair

*Lisa Grimm, PhD*

## Graduate Committee

*Emma L. Downs, PhD*

*Christopher Picone, PhD*

*Erin Rehrig, PhD*

## Program Objectives

The graduate program in science education is for students who want to expand their study of biology, chemistry, earth science and environmental science. This program enhances teaching methods, curricula, research and content in science education. In addition, students can pursue professional licensure in general science (5-8).

## Program Description

The science education program is flexible enough to accommodate students interested in elementary, middle school, secondary or non-traditional science education. Students work closely with an advisor to select the appropriate balance of content and teaching courses to meet their objectives. Students pursuing professional licensure in general science must complete a science teaching internship and 18 credits of coursework in science content chosen from at least two of the sciences including biology, earth science and appropriate courses in physics and chemistry offered through the science education program.

## Admissions Standards and Criteria

To apply for enrollment in the Master of Education in Science Education Program, the student must submit documents as outlined in the graduate admission section as well as:

- An official transcript of a bachelor's degree from a regionally accredited institution with a major or minor in biology, earth science, physics, chemistry or related field
- Documentation of initial teaching license (for students pursuing professional licensure)
- Applicants to the M.Ed. in Science Education must complete an essay of no more than one page in response to one of the following statements or questions:
  1. Tell us about a positive situation in which you helped a person and made a significant difference in that person's life.

2. What are the most important factors in establishing a long-term working relationship with students, friends, etc.?
3. Tell us about a significant event that involved you in a teaching or helping role.
  - Describe the situation as it occurred at the time.
  - What did you do in that particular situation?
  - How did you feel about the situation at the time you were experiencing it?
  - How do you feel about the situation now?
  - What would you change, if anything?

## **Required Courses**

---

- SCED 9000 - Advanced Methods in Teaching Science
- SCED 9001 - The Modern Science Curriculum
- EDUC 8300 - Research in Education

**Subtotal Required Credits 9 cr.**

---

## **Electives Required for Professional License**

---

- SCED 8002 - Internship
- Science Content Courses 18-24 cr.

## **Additional elective options**

---

- SCED 8001 - Independent Study
- SCED 8003 - Practicum in Science
- Workshops
- Science Teaching Courses
- Related Education Courses
- Approved Transfer Courses

**Subtotal Required Electives 27 cr.**

---

**Total for Degree 36 cr.**

---

# Appendix I - Four-Year Plans of Study Biology and Chemistry Department 2017-2018

## Suggested Four-Year Plan of Study BIOLOGY/CHEMISTRY



### Biology B.A. (Bachelor of Arts)

#### FRESHMAN YEAR

Fall Semester	15 Credits	
ENGL 1100		Writing I.....(3)
CHEM 1300		General Chemistry I*..... (4)
BIOL 1800		General Biology I*..... (4)
MATH 1300		Precalculus.....(3)

\* General Biology and General Chemistry require the completion of the Math Placement test prior to enrollment. Students that are able to co-enroll with Basic Math II will be accepted into Biology and Chemistry courses.

Spring Semester	14-15 Credits	
ENGL 1200		Writing II.....(3)
CHEM 1400		General Chemistry II..... (4)
BIOL 1900		General Biology II..... (4)
MATH ≥ 1300		Math Elective**..... (3-4)

\*\*Either Applied Statistics or Calculus I is recommended as the second math course.

#### JUNIOR YEAR

Fall Semester	15-17 Credits	
BIOL ≥2000		Biology Elective..... (3-4)
		PHYS Elective..... (3-4)
		Foreign Language.....(3)
		LA&S Elective.....(3)
		Free Elective.....(3)

Spring Semester	15-17 Credits	
BIOL ≥2000		Biology Elective..... (3-4)
BIOL ≥2000		Biology Elective..... (3-4)
		Foreign Language.....(3)
		LA&S Elective.....(3)
		Free Elective.....(3)

#### LA&S Elective List

- 1 AOM attribute (Art or Music)
- 1 ART attribute (the Arts)
- 1 CTW attribute (Citizenship & The World)
- 3 credits HAF attribute (Health/Fitness)
- 1 HIST subject (History)
- 1 HMN attribute (Human Behavior)
- 1 LIT attribute (Literature)

#### Advanced LA&S Options Area

Must be developed in consultation with the student's academic advisor and transmitted to the Registrar.

Foreign language proficiency at the intermediate level required for Bachelor of Arts candidates.

An Independent Study or Internship may count as 1 elective but is not required.

#### Global Diversity Area

Two courses taken must meet the Global Diversity requirement: GDAN course + (GDC or GDCN course) OR GDCN course + (GDA or GDAN course). These courses are allowed to satisfy this requirement and another requirement at the same time.

#### SOPHOMORE YEAR

Fall Semester	17 Credits	
BIOL 2300		Ecology..... (4)
CHEM 2000		Organic Chemistry I..... (4)
		Foreign Language Elective.....(3)
		LA&S Elective.....(3)
		LA&S Elective.....(3)

Spring Semester	16 Credits	
BIOL 2800		Genetics..... (4)
		GEOG Elective.....(3)
		Foreign Language Elective.....(3)
		LA&S Elective.....(3)
		LA&S Elective.....(3)

#### SENIOR YEAR

Fall Semester	16-17 Credits	
BIOL ≥2000		Biology Elective..... (4)
BIOL ≥2000		Biology Elective..... (3-4)
		LA&S Elective.....(3)
		Free Elective.....(3)
		Free Elective.....(3)

Spring Semester	13 Credits	
BIOL ≥2000		Biology Elective (Capstone)..... (4)
		Free Elective.....(3)
		Free Elective.....(3)
		Free Elective.....(3)

#### NOTES:

1. One of the BIOL electives could be replaced with the two-semester sequence in Anatomy and Physiology (BIOL 1200-1300)
2. The total number of credits comes to 120-124. Student must choose one of the >2000-level BIOL electives with lab in order to meet the minimum requirement of 36 credit hours in BIOL courses. The number of free electives are needed to meet the 120-credit minimum for graduation requirement.
3. For the LA&S Advanced option, students are encouraged to choose option A: 6 credits in a single foreign language, and 6 credits from a single discipline outside of the student's first major, at the 2000 level or above of LA&S courses (either from a recognized LA&S discipline or LA&S designated courses from a discipline that is not recognized as LA&S).

Completion of 120 credits required for graduation.

Rev. 7-2017

## Biology B.S. (Bachelor of Science)

### FRESHMAN YEAR

<b>Fall Semester</b>	<b>15 Credits</b>
ENGL 1100	Writing I .....(3)
CHEM 1300	General Chemistry I* ..... (4)
BIOL 1800	General Biology I* ..... (4)
MATH 1300	Precalculus ..... (4)

\* General Biology and General Chemistry require the completion of the Math Placement test prior to enrollment. Students that are able to co-enroll with Basic Math II will be accepted into Biology and Chemistry courses.

<b>Spring Semester</b>	<b>14 Credits</b>
ENGL 1200	Writing II .....(3)
CHEM 1400	General Chemistry II ..... (4)
BIOL 1900	General Biology II ..... (4)
	LA&S Elective .....(3)

### JUNIOR YEAR

<b>Fall Semester</b>	<b>16-17 Credits</b>
BIOL ≥2000	Biology Elective ..... (3-4)
PHYS 2300	General Physics I ..... (4)
	LA&S Elective .....(3)
	LA&S Elective .....(3)
	Free Elective .....(3)

<b>Spring Semester</b>	<b>13-14 Credits</b>
BIOL ≥2000	Biology Elective ..... (3-4)
PHYS 2400	General Physics II ..... (4)
	LA&S Elective .....(3)
	Free Elective .....(3)

### SOPHOMORE YEAR

<b>Fall Semester</b>	<b>17 Credits</b>
BIOL 2300 <b>OR</b> 2800	Ecology ( <b>OR</b> Genetics) ..... (4)
CHEM 2000	Organic Chemistry I ..... (4)
MATH ≥ 1300	Math Elective .....(3)
	LA&S Elective .....(3)
	Free Elective .....(3)

<b>Spring Semester</b>	<b>17 Credits</b>
BIOL 2800	Genetics ..... (4)
CHEM 2100	Organic Chemistry II ..... (4)
	LA&S Elective .....(3)
	LA&S Elective .....(3)
	Free Elective .....(3)

### SENIOR YEAR

<b>Fall Semester</b>	<b>15-17 Credits</b>
BIOL ≥2000	Biology Elective ..... (3-4)
BIOL ≥2000	Biology Elective ..... (3-4)
	Free Elective .....(3)
	Free Elective .....(3)
	Free Elective .....(3)

<b>Spring Semester</b>	<b>13-16 Credits</b>
BIOL ≥3000	Biology Elective (Capstone) ..... (4)
BIOL ≥2000	Biology Elective <b>OR</b>
	Independent Study <b>OR</b> Internship ..... (3-6)
	Free Elective .....(3)
	Free Elective .....(3)

#### LA&S Elective List

- 1 AOM attribute (Art or Music)
- 1 ART attribute (the Arts)
- 1 CTW attribute (Citizenship & The World)
- 3 credits HAF attribute (Health/Fitness)
- 1 HIST subject (History)
- 1 HMN attribute (Human Behavior)
- 1 LIT attribute (Literature)

#### Advanced LA&S Options Area

The four required courses in Chemistry fulfill the 12-credit Option B of the LA&S Advanced Curriculum Requirement.

An Independent Study or Internship may count as 1 elective but is not required.

#### Global Diversity Area

Two courses taken must meet the Global Diversity requirement: GDAN course + (GDC or GDCN course) **OR** GDCN course + (GDA or GDAN course). These courses are allowed to satisfy this requirement and another requirement at the same time.

Completion of 120 credits required for graduation.

Rev. 9-2017

## Biotechnology B.S. (Bachelor of Science)

### FRESHMAN YEAR

<b>Fall Semester</b>		<b>15 Credits</b>
ENGL 1100	Writing I.....	(3)
CHEM 1300	General Chemistry I*.....	(4)
BIOL 1800	General Biology I*.....	(4)
MATH 1300	Precalculus.....	(4)

\*General Biology and General Chemistry require the completion of the Math Placement test prior to enrollment. Students that are able to co-enroll with Basic Math II will be accepted into Biology and Chemistry courses.

<b>Spring Semester</b>		<b>14 Credits</b>
ENGL 1200	Writing II.....	(3)
CHEM 1400	General Chemistry II.....	(4)
BIOL 1900	General Biology II.....	(4)
	LA&S Elective.....	(3)

### JUNIOR YEAR

<b>Fall Semester</b>		<b>17 Credits</b>
BIOL 3250	Cell Biology.....	(4)
PHYS 2300	General Physics I.....	(4)
	LA&S Elective.....	(3)
	Free Elective.....	(3)
	Free Elective.....	(3)

<b>Spring Semester</b>		<b>13-14 Credits</b>
BIOL ≥2000	Biology Elective.....	(3-4)
PHYS 2400	General Physics II.....	(4)
	Free Elective.....	(3)
	Free Elective.....	(3)

#### LA&S Elective List

- 1 AOM attribute (Art or Music)
- 1 ART attribute (the Arts)
- 1 CTW attribute (Citizenship & The World)
- 3 credits HAF attribute (Health/Fitness)
- 1 HIST subject (History)
- 1 HMN attribute (Human Behavior)
- 1 LAB attribute (Lab Science)

#### Advanced LA&S Options Area

The four required courses in Chemistry fulfill the 12-credit Option B of the LA&S Advanced Curriculum Requirement.

An Independent Study or Internship may count as 1 elective but is not required.

#### Global Diversity Area

Two courses taken must meet the Global Diversity requirement: GDAN course + (GDC or GDCN course) **OR** GDCN course + (GDA or GDAN course). These courses are allowed to satisfy this requirement and another requirement at the same time.

### SOPHOMORE YEAR

<b>Fall Semester</b>		<b>17 Credits</b>
BIOL 2300 <b>OR</b> 2800	Ecology ( <b>OR</b> Genetics).....	(4)
CHEM 2000	Organic Chemistry I.....	(4)
MATH ≥ 1300	Math Elective.....	(3)
	LA&S Elective.....	(3)
	LA&S Elective.....	(3)

<b>Spring Semester</b>		<b>17 Credits</b>
BIOL 2800	Genetics.....	(4)
CHEM 2100	Organic Chemistry II.....	(4)
	LA&S Elective.....	(3)
	LA&S Elective.....	(3)
	LA&S Elective.....	(3)

### SENIOR YEAR

<b>Fall Semester</b>		<b>15-17 Credits</b>
BIOL ≥2000	Biology Elective.....	(3-4)
BIOL ≥2000	Biology Elective.....	(3-4)
	Free Elective.....	(3)
	Free Elective.....	(3)
	Free Elective.....	(3)

<b>Spring Semester</b>		<b>13-16 Credits</b>
BIOL ≥3000	Biology Elective (Capstone).....	(4)
BIOL ≥2000	Biology Elective <b>OR</b>	
	Independent Study <b>OR</b> Internship.....	(3-6)
	Free Elective.....	(3)
	Free Elective.....	(3)

Three of the five Biology electives must be selected from the following courses: BIOL 3450 Biochemistry, BIOL 2150 General Microbiology, BIOL 4500 Molecular Biology, BIOL 3350 Cell Culture Techniques, or BIOL 4810 Immunology.

Completion of 120 credits required for graduation.

Rev. 9-2017



## Environmental Biology B.S. (Bachelor of Science)

### FRESHMAN YEAR

<b>Fall Semester</b>	<b>15 Credits</b>
BIOL 1800	General Biology I* ..... (4)
CHEM 1300	General Chemistry I* ..... (4)
ENGL 1100	Writing I ..... (3)
MATH 1300	Precalculus ..... (4)

\*General Biology and General Chemistry require the completion of the Math Placement test prior to enrollment. Students that are able to co-enroll with Basic Math II will be accepted into Biology and Chemistry courses.

<b>Spring Semester</b>	<b>14 Credits</b>
BIOL 1900	General Biology II ..... (4)
CHEM 1400	General Chemistry II ..... (4)
ENGL 1200	Writing II ..... (3)
MATH ≥ 1300	Math Elective** ..... (3)

\*\*Applied Statistics is recommended as the second math course.

### JUNIOR YEAR

<b>Fall Semester</b>	<b>16-17 Credits</b>
BIOL ≥ 2000	Biology Elective ..... (3-4)
PHYS 2300	General Physics ..... (4)
	LA&S Elective ..... (3)
	LA&S Elective ..... (3)
	Free Elective ..... (3)

<b>Spring Semester</b>	<b>16 Credits</b>
BIOL 3100	Conservation Biology ..... (3)
PHYS 2400	General Physics II ..... (4)
	LA&S Elective ..... (3)
	LA&S Elective ..... (3)
	Free Elective ..... (3)

#### LA&S Elective List

- 1 AOM attribute (Art or Music)
- 1 ART attribute (the Arts)
- 1 CTW attribute (Citizenship & The World)
- 3 credits HAF attribute (Health/Fitness)
- 1 HIST subject (History)
- 1 HMN attribute (Human Behavior)
- 1 LIT attribute (Literature)

#### Advanced LA&S Options Area

The four required courses in Chemistry fulfill the 12-credit Option B of the LA&S Advanced Curriculum Requirement.

An Independent Study or Internship may count as 1 elective but is not required.

### SOPHOMORE YEAR

<b>Fall Semester</b>	<b>14 Credits</b>
BIOL 2300 OR 2800	Ecology (OR Genetics) ..... (4)
CHEM 2000	Organic Chemistry I ..... (4)
GEOG ≥ 2000	From Cluster 1*** ..... (3)
	LA&S Elective ..... (3)

<b>Spring Semester</b>	<b>17 Credits</b>
BIOL 2800	Genetics ..... (4)
CHEM 2100	Organic Chemistry II ..... (4)
GEOG ≥ 2000	From Cluster 2*** ..... (3)
	LA&S Elective ..... (3)
	LA&S Elective ..... (3)

\*\*\* At least one course must come from Cluster 1 consisting of GEOG 2100, GEOG 2500, GEOG 3110, or GEOG 4600. Another course must come from Cluster 2 consisting of GEOG 4500, GEOG 3120, GEOG 4000, GEOG 4400, or GEOG 2400.

### SENIOR YEAR

<b>Fall Semester</b>	<b>16-17 Credits</b>
BIOL ≥ 2000	Biology Elective ..... (3-4)
BIOL XXXX	Biology Elective (Capstone Course) ..... (4)
	Free Elective ..... (3)
	Free Elective ..... (3)
	Free Elective ..... (3)

<b>Spring Semester</b>	<b>12-18 Credits</b>
BIOL ≥ 2000	Biology Elective OR Independent Study / Internship ..... (3-6)
BIOL ≥ 2000	Biology Elective ..... (3-4)
	Free Elective ..... (3)
	Free Elective ..... (3)

#### Global Diversity Area

Two courses taken must meet the Global Diversity requirement: GDAN course + (GDC or GDCN course) OR GDCN course + (GDA or GDAN course). These courses are allowed to satisfy this requirement and another requirement at the same time.

## Health Sciences B.S. (Bachelor of Science)

### FRESHMAN YEAR

#### Fall Semester 15 Credits

ENGL 1100	Writing I .....	(3)
CHEM 1300	General Chemistry I* .....	(4)
BIOL 1800	General Biology I* .....	(4)
MATH 1300	Precalculus .....	(4)

\*General Biology and General Chemistry require the completion of the Math Placement test prior to enrollment. Students that are able to co-enroll with Basic Math II will be accepted into Biology and Chemistry courses.

#### Spring Semester 14 Credits

ENGL 1200	Writing II .....	(3)
CHEM 1400	General Chemistry II .....	(4)
BIOL 1900	General Biology II .....	(4)
	LA&S Elective .....	(3)

### SOPHOMORE YEAR

#### Fall Semester 17 Credits

BIOL 2300 <b>OR</b> 2800	Ecology ( <b>OR</b> Genetics) .....	(4)
CHEM 2000	Organic Chemistry I .....	(4)
MATH ≥1300	Math Elective** .....	(3)
	LA&S Elective .....	(3)
	LA&S Elective .....	(3)

\*\*Those who are considering medical, dental, and pharmacy schools will have to take Calculus I and Applied Statistics.

#### Spring Semester 17 Credits

BIOL 2800	Genetics .....	(4)
CHEM 2100	Organic Chemistry II .....	(4)
	LA&S Elective .....	(3)
	LA&S Elective .....	(3)
	LA&S Elective .....	(3)

### JUNIOR YEAR

#### Fall Semester 17 Credits

BIOL 3030	Foundations of Biochemistry .....	(3)
PHYS 2300	General Physics I .....	(4)
BIOL 1200	Anatomy and Physiology I .....	(4)
	LA&S Elective .....	(3)
	Free Elective .....	(3)

#### Spring Semester 14-15 Credits

BIOL ≥2000	Biology Elective*** .....	(3-4)
PHYS 2400	General Physics II .....	(4)
BIOL 1300	Anatomy and Physiology II .....	(4)
	Free Elective .....	(3)

\*\*\*Cell Biology, Developmental Biology, and a course in Microbiology are strongly recommended as biology electives.

### SENIOR YEAR

#### Fall Semester 15-17 Credits

BIOL ≥2000	Biology Elective*** .....	(3-4)
BIOL ≥2000	Biology Elective .....	(3-4)
	Free Elective .....	(3)
	Free Elective .....	(3)
	Free Elective .....	(3)

#### Spring Semester 13-16 Credits

BIOL >3000	Biology Elective (Capstone) .....	(4)
BIOL ≥2000	Biology Elective <b>OR</b>	
	Independent Study <b>OR</b> Internship .....	(3-6)
	Free Elective .....	(3)
	Free Elective .....	(3)

#### LA&S Elective List

- 1 AOM attribute (Art or Music)
- 1 ART attribute (the Arts)
- 1 CTW attribute (Citizenship & The World)
- 3 credits HAF attribute (Health/Fitness)
- 1 HIST subject (History)
- 1 HMN attribute (Human Behavior)
- 1 LIT attribute (Literature)

#### Advanced LA&S Options Area

The four required courses in Chemistry fulfill the 12-credit Option B of the LA&S Advanced Curriculum Requirement.

An Independent Study or Internship may count as 1 elective but is not required.

Introduction to Psychological Science is strongly recommended as the HMN elective. Those who plan to take MCAT are also strongly advised to take Introduction to Sociology as an elective.

#### Global Diversity Area

Two courses taken must meet the Global Diversity requirement: GDAN course + (GDC or GDCN course) **OR** GDCN course + (GDA or GDAN course). These courses are allowed to satisfy this requirement and another requirement at the same time.

Completion of 120 credits required for graduation.

Rev. 9-2017

## Neuroscience and Behavior B.S. (Bachelor of Science)

### FRESHMAN YEAR

<b>Fall Semester</b>		<b>15 Credits</b>
ENGL 1100	Writing I.....(3)	
CHEM 1300	General Chemistry I*.....(4)	
BIOL 1800	General Biology I*.....(4)	
MATH 1300	Precalculus.....(4)	

\*General Biology and General Chemistry require the completion of the Math Placement test prior to enrollment. Students that are able to co-enroll with Basic Math II will be accepted into Biology and Chemistry courses.

<b>Spring Semester</b>		<b>14 Credits</b>
ENGL 1200	Writing II.....(3)	
CHEM 1400	General Chemistry II.....(4)	
BIOL 1900	General Biology II.....(4)	
PSY 1100	Introduction to Psychological Science.....(3)	

### JUNIOR YEAR

<b>Fall Semester</b>		<b>16-17 Credits</b>
BIOL ≥2000	Biology Elective**.....(3-4)	
PHYS 2300	General Physics I.....(4)	
PSY 3500	Psychology of Learning	
<b>OR</b> PSY 3550	<b>OR</b> Cognition.....(3)	
	Free Elective.....(3)	
	Free Elective.....(3)	

<b>Spring Semester</b>		<b>13-14 Credits</b>
BIOL ≥2000	Biology Elective.....(3-4)	
PHYS 2400	General Physics II.....(4)	
	LA&S Elective.....(3)	
	Free Elective.....(3)	

\*\*At least two of the five Biology electives must be selected from the following: BIOL 2600 Animal Behavior, BIOL 3250 Cell Biology, BIOL 3550 Developmental Biology, or BIOL 4700 Animal Physiology.

#### LA&S Elective List

- 1 AOM attribute (Art or Music)
- 1 ART attribute (the Arts)
- 1 CTW attribute (Citizenship & The World)
- 3 credits HAF attribute (Health/Fitness)
- 1 HIST subject (History)
- 1 HMN attribute (Human Behavior)
- 1 LIT attribute (Literature)

#### Advanced LA&S Options Area

The four required courses in Chemistry fulfill the 12-credit Option B of the LA&S Advanced Curriculum Requirement.

An Independent Study or Internship may count as 1 elective but is not required.

#### Global Diversity Area

Two courses taken must meet the Global Diversity requirement: GDAN course + (GDC or GDCN course) **OR** GDCN course + (GDA or GDAN course). These courses are allowed to satisfy this requirement and another requirement at the same time.

### SOPHOMORE YEAR

<b>Fall Semester</b>		<b>17 Credits</b>
BIOL 2300 <b>OR</b> 2800	Ecology ( <b>OR</b> Genetics).....(4)	
CHEM 2000	Organic Chemistry I.....(4)	
MATH ≥1300	Math Elective.....(3)	
	LA&S Elective.....(3)	
	LA&S Elective.....(3)	

<b>Spring Semester</b>		<b>17 Credits</b>
BIOL 2800	Genetics.....(4)	
CHEM 2100	Organic Chemistry II.....(4)	
BIOL 2025	Neuroscience.....(3)	
	LA&S Elective.....(3)	
	LA&S Elective.....(3)	

### SENIOR YEAR

<b>Fall Semester</b>		<b>15-17 Credits</b>
BIOL ≥2000	Biology Elective.....(3-4)	
BIOL ≥2000	Biology Elective.....(3-4)	
	LA&S Elective.....(3)	
	LA&S Elective.....(3)	
	Free Elective.....(3)	

<b>Spring Semester</b>		<b>13 Credits</b>
BIOL ≥3000	Biology Elective (Capstone).....(4)	
	Free Elective.....(3)	
	Free Elective.....(3)	
	Free Elective.....(3)	

Completion of 120 credits required for graduation.

Rev. 9-2017

## Initial Licensure in Secondary Teaching — Biology (B.A.)

### FRESHMAN YEAR

<b>Fall Semester</b>		<b>15 Credits</b>
ENGL 1100	Writing I.....	(3)
CHEM 1300	General Chemistry I*.....	(4)
BIOL 1800	General Biology I*.....	(4)
MATH 1300	Precalculus.....	(4)

\*General Biology and General Chemistry require the completion of the Math Placement test prior to enrollment. Students that are able to co-enroll with Basic Math II will be accepted into Biology and Chemistry courses.

<b>Spring Semester</b>		<b>17 Credits</b>
ENGL 1200	Writing II.....	(3)
CHEM 1400	General Chemistry II.....	(4)
BIOL 1900	General Biology II.....	(4)
GEOG 1000	Earth System Science.....	(3)
	Health & Fitness.....	(3)

### JUNIOR YEAR

<b>Fall Semester</b>		<b>16-17 Credits</b>
BIOL 3250	Cell Biology.....	(4)
CHEM 2000	Organic Chemistry I.....	(3)
	PHYS Elective.....	(3-4)
	Foreign Language.....	(3)
ENG 4700	Teaching Reading and Writing Across the Content Area.....	(3)

<b>Spring Semester</b>		<b>16-17 Credits</b>
	Biology Elective (Capstone).....	(4)
	Foreign Language.....	(3)
	Biology Elective.....	(3 or 4)
EDUC 3122	Sheltered English Immersion.....	(3)
	LA&S Elective.....	(3)

#### LA&S Elective List

- 1 AOM attribute (Art or Music)
- 1 ART attribute (the Arts)
- 1 CTW attribute (Citizenship & The World)
- 3 credits HAF attribute (Health/Fitness)
- 1 HIST subject (History)
- 1 HMN attribute (Human Behavior)
- 1 LIT attribute (Literature)

#### Advanced LA&S Options Area

Review the three options with your advisor and submit your decision to the Registrar's Office by completion of 60 credits.

#### Free Electives

It is recommended that students consider their career goals in selecting their free electives by seeking advice from their academic advisor and/or the pre-health advisor. Examples of recommended electives are courses in biology, mathematics, physics, geophysical sciences, computer science and/or industrial technology.

### SOPHOMORE YEAR

<b>Fall Semester</b>		<b>17 Credits</b>
BIOL 1200	Anatomy and Physiology I.....	(4)
BIOL 2300	Ecology.....	(4)
BIOL 2860	Introduction to Secondary Teaching.....	(3)
MATH 1700	Applied Statistics.....	(3)
	Foreign Language.....	(3)

<b>Spring Semester</b>		<b>14 Credits</b>
BIOL 1300	Anatomy and Physiology II.....	(4)
BIOL 2800	Genetics.....	(4)
SPED 3800	Secondary Programs for Adolescents with Special Needs**.....	(3)
	Foreign Language.....	(3)

\*\*This course requires successful passage of both Communication and Literacy MTEL (Both Reading and Writing Subtests).

### SENIOR YEAR

<b>Fall Semester</b>		<b>13-15 Credits</b>
BIOL 4850	Methods in Teaching Science.....	(3)
	LA&S Elective.....	(3)
	LA&S Elective.....	(3)
	LA&S Elective.....	(3)
	Free Elective.....	(1-3)

<b>Spring Semester</b>		<b>12 Credits</b>
BIOL 4860/4870	Biology Practicum.....	(9)
BIOL 4012	Practicum Seminar.....	(3)

**Chemistry Seminar** fulfills the Capstone requirement for the Secondary Education —Chemistry Major.

#### Global Diversity Area

Two courses taken must meet the Global Diversity requirement: GDAN course + (GDC or GDCN course) OR GDCN course + (GDA or GDAN course). These courses are allowed to satisfy this requirement and another requirement at the same time.

## Secondary Education — Biology (B.S.)

### FRESHMAN YEAR

#### Fall Semester 15 Credits

BIOL 1800	General Biology I*.....	(4)
CHEM 1300	General Chemistry I*.....	(4)
ENGL 1100	Writing I.....	(3)
MATH 1300	Precalculus.....	(4)

\*General Biology and General Chemistry require the completion of the Math Placement test prior to enrollment. Students that are able to co-enroll with Basic Math II will be accepted into Biology and Chemistry courses.

#### Spring Semester 17 Credits

ENGL 1200	Writing II.....	(3)
CHEM 1400	General Chemistry II.....	(4)
BIOL 1900	General Biology II.....	(4)
GEOG 1000	Earth Systems Science.....	(3)
	LA&S Elective.....	(3)

### JUNIOR YEAR

#### Fall Semester 14 Credits

BIOL 3250	Cell Biology.....	(4)
PHYS 2300	General Physics I.....	(4)
	LA&S Elective.....	(3)
	LA&S Elective.....	(3)

#### Spring Semester 14-15 Credits

BIOL ≥2000	Biology Elective.....	(3-4)
BIOL ≥3000	Biology Elective (Capstone Course).....	(4)
ENG 4700	Teaching Reading and Writing Across the Content Area.....	(3)
PHYS 2400	General Physics II.....	(4)

#### LA&S Elective List

- 1 AOM attribute (Art or Music)
- 1 ART attribute (the Arts)
- 1 CTW attribute (Citizenship & The World)
- 3 credits HAF attribute (Health/Fitness)
- 1 HIST subject (History)
- 1 HMN attribute (Human Behavior)
- 1 LIT attribute (Literature)

#### Advanced LA&S Options Area

The four required courses in Chemistry fulfill the 12-credit Option B of the LA&S Advanced Curriculum Requirement.

Foreign language proficiency at the intermediate level required for Bachelor of Arts candidates.

#### Global Diversity Area

Two courses taken must meet the Global Diversity requirement: GDAN course + (GDC or GDCN course) **OR** GDCN course + (GDA or GDAN course). These courses are allowed to satisfy this requirement and another requirement at the same time.

### SOPHOMORE YEAR

#### Fall Semester 17 Credits

BIOL 2300 <b>OR</b> 2800	Ecology ( <b>OR</b> Genetics).....	(4)
BIOL 2860	Introduction to Secondary Teaching.....	(3)
CHEM 2000	Organic Chemistry I.....	(4)
MATH 1700+	Applied Statistics.....	(3)
	LA&S Elective.....	(3)

#### Spring Semester 17 Credits

BIOL 2800	Genetics.....	(4)
CHEM 2100	Organic Chemistry II.....	(4)
SPED 3800	Secondary Programs for Adolescents with Special Needs.....	(3)
	LA&S Elective.....	(3)
	LA&S Elective.....	(3)

### SENIOR YEAR

#### Fall Semester 14-15 Credits

BIOL ≥2000	Biology Elective.....	(3-4)
BIOL 4850	Methods in Teaching Science.....	(3)
EDUC 3122	Sheltered English Immersion.....	(3)
	LA&S Elective.....	(3)
	Free Elective.....	(2)

#### Spring Semester 12 Credits

BIOL 4860	Biology Practicum in a Secondary School I.....	(4.5)
BIOL 4870	Biology Practicum in a Secondary School II.....	(4.5)
BIOL 4012	Practicum Seminar.....	(3)

Completion of 120 credits required for graduation.

Rev. 7-2017

# Suggested Four-Year Plan of Study BIOLOGY/CHEMISTRY



## Chemistry B.S. (Bachelor of Science)

### FRESHMAN YEAR

Fall Semester		15 Credits
CHEM 1300	General Chemistry I*	(4)
ENGL 1100	Writing I	(3)
MATH 1300	Precalculus	(4)
BIOL 1800	General Biology I*	(4)

\*General Biology I and General Chemistry I require the completion of the Math Placement test prior to enrollment. Those eligible to take Basic Math II will be accepted into Biology and Chemistry courses if they concurrently enroll in Basic Math II.

Spring Semester		14 Credits
CHEM 1400	General Chemistry II	(4)
ENGL 1200	Writing II	(3)
MATH 2300	Calculus I	(4)
	LA&S Elective	(3)

### JUNIOR YEAR

Fall Semester		16-17 Credits
CHEM 3600 OR	Descriptive Inorganic Chemistry OR	
CHEM 3200	Physical Chemistry I	(3-4)
PHYS 2700 OR	Calculus-Based Physics II OR	
PHYS 2400	General Physics II	(4)
	LA&S Elective	(3)
	LA&S Elective	(3)
	Free Elective	(3)

Spring Semester		15-16 Credits
CHEM 3030**	Foundations of Biochemistry	(3)
CHEM 4750 OR	Chemistry Seminar	
CHEM ≥3000	Chemistry Elective	(3-4)
	LA&S Elective	(3)
	Free Elective	(3)
	Free Elective	(3)

\*\*Student may also fulfill the biochemistry requirement by taking BIOL 3450 Biochemistry.

#### LA&S Elective List

- 1 AOM attribute (Art or Music)
- 1 ART attribute (the Arts)
- 1 CTW attribute (Citizenship & The World)
- 3 credits HAF attribute (Health/Fitness)
- 1 HIST subject (History)
- 1 HMN attribute (Human Behavior)
- 1 LIT attribute (Literature)

#### Advanced LA&S Options Area

Review the three options with your advisor and submit your decision to the Registrar's Office when you reach Junior status.

#### Free Electives

It is recommended that students consider their career goals in selecting their free electives by seeking advice from their academic advisor and/or the pre-health advisor. Examples of recommended electives are courses in biology, mathematics, physics, geophysical sciences, computer science and/or industrial technology.

Chemistry Seminar fulfills the Capstone requirement for this Major.

#### Global Diversity Area

Two courses taken must meet the Global Diversity requirement: GDAN course + (GDC or GDCN course) OR GDCN course + (GDA or GDAN course). These courses are allowed to satisfy this requirement and another requirement at the same time.

### SOPHOMORE YEAR

Fall Semester		14 Credits
CHEM 2000	Organic Chemistry I	(4)
MATH 2400	Calculus II	(4)
	LA&S Elective	(3)
	LA&S Elective	(3)

Spring Semester		15 Credits
CHEM 2400	General Analytical Chemistry	(4)
CHEM 2100	Organic Chemistry II	(4)
PHYS 2600 OR	Calculus-Based Physics I OR	
PHYS 2300	General Physics I	(4)
	LA&S Elective	(3)

### SENIOR YEAR

Fall Semester		15-17 Credits
CHEM 3600 OR	Descriptive Inorganic Chemistry OR	
CHEM 3200	Physical Chemistry I	(3-4)
CHEM ≥3000	Chemistry Elective	(3-4)
	Free Elective	(3)
	Free Elective	(3)
	Free Elective	(3)

Spring Semester		15-16 Credits
CHEM 4750 OR	Chemistry Seminar OR	
CHEM ≥3000	Chemistry Elective	(3-4)
	Free Elective	(3)
	Free Elective	(3)
	Free Elective	(3)

Completion of 120 credits required for graduation.

Rev. 7-2017



## Secondary Education — Chemistry (B.S.)

### FRESHMAN YEAR

<b>Fall Semester</b>	<b>15 Credits</b>
ENGL 1100	Writing I .....(3)
CHEM 1300	General Chemistry I* ..... (4)
MATH 1300	Precalculus ..... (4)
BIOL 1800	General Biology I* ..... (4)

\*General Biology I and General Chemistry I require the completion of the Math Placement test prior to enrollment. Those eligible to take Basic Math II will be accepted into Biology and Chemistry courses if they concurrently enroll in Basic Math II.

<b>Spring Semester</b>	<b>14 Credits</b>
ENGL 1200	Writing II .....(3)
CHEM 1400	General Chemistry II ..... (4)
MATH 2300	Calculus I ..... (4)
	LA&S Elective .....(3)

### JUNIOR YEAR

<b>Fall Semester</b>	<b>16-18 Credits</b>
CHEM 3600 OR	Descriptive Inorganic Chemistry OR
CHEM 3200	Physical Chemistry I ..... (3-4)
PHYS 2700 OR	Calculus-Based Physics II OR
PHYS 2400	General Physics II ..... (4)
CHEM≥3000	Chemistry Elective ..... (3-4)
	LA&S Elective .....(3)
	Free Elective .....(3)

<b>Spring Semester</b>	<b>15 Credits</b>
CHEM 4750	Chemistry Seminar .....(3)
CHEM 3030	Foundations of Biochemistry** .....(3)
ENGL 4700	Teaching Reading and Writing Across the Content Area .....(3)
	LA&S Elective .....(3)
	Free Elective .....(3)

\*\*Student may take BIOL 3450 to fulfill the biochemistry requirement.

#### LA&S Elective List

- 1 AOM attribute (Art or Music)
- 1 ART attribute (the Arts)
- 1 CTW attribute (Citizenship & The World)
- 3 credits HAF attribute (Health/Fitness)
- 1 HIST subject (History)
- 1 HMN attribute (Human Behavior)
- 1 LIT attribute (Literature)

#### Advanced LA&S Options Area

Review the three options with your advisor and submit your decision to the Registrar's Office by completion of 60 credits.

#### Free Electives

It is recommended that students consider their career goals in selecting their free electives by seeking advice from their academic advisor and/or the pre-health advisor. Examples of recommended electives are courses in biology, mathematics, physics, geophysical sciences, computer science and/or industrial technology.

Completion of 120 credits required for graduation.

### SOPHOMORE YEAR

<b>Fall Semester</b>	<b>14 Credits</b>
CHEM 2000	Organic Chemistry I ..... (4)
CHEM 2860	Introduction to Secondary School Teaching .....(3)
MATH 2400	Calculus II ..... (4)
	LA&S Elective .....(3)

<b>Spring Semester</b>	<b>15 Credits</b>
CHEM 2400	General Analytical Chemistry ..... (4)
CHEM 2100	Organic Chemistry II ..... (4)
SPED 3800	Secondary Programs for Adolescents (14-22) with Disabilities .....(3)
PHYS 2600 OR	Calculus-Based Physics I OR
PHYS 2300	General Physics I ..... (4)

### SENIOR YEAR

<b>Fall Semester</b>	<b>15-16 Credits</b>
CHEM 3600 OR	Descriptive Inorganic Chemistry OR
CHEM 3200	Physical Chemistry I ..... (3-4)
CHEM 4850	Methods in Teaching Science .....(3)
EDUC 3122	Sheltered English Immersion .....(3)
	Free Elective .....(3)
	Free Elective .....(3)

<b>Spring Semester</b>	<b>12 Credits</b>
CHEM 4860	Chemistry Practicum in a Secondary School I ..... (4.5)
CHEM 4870	Chemistry Practicum in a Secondary School II ..... (4.5)
CHEM 4012	Practicum Seminar .....(3)

Chemistry Seminar fulfills the Capstone requirement for this major.

#### Global Diversity Area

Two courses taken must meet the Global Diversity requirement: GDAN course + (GDC or GDCN course) OR GDCN course + (GDA or GDAN course). These courses are allowed to satisfy this requirement and another requirement at the same time.

Rev. 7-2017

## Appendix J - Rotation of BIOL and CHEM Courses

<i>Biology</i>			
BIOL	1000	Introduction to Life Science	Fall, Spring, Summer (also online)
BIOL	1010	Introduction to Environmental Science	Usually fall semester; not offered in F 18
BIOL	1200	Anatomy & Physiology I	Fall, Summer
BIOL	1300	Anatomy & Physiology II	Spring, Summer
BIOL	1400	General Botany	Less than once every two years
BIOL	1500	Seminar in Modern Biology	Less than once every two years
BIOL	1600	Introductory Research in Biology	As needed – special scheduling
BIOL	1650	Nutrition	Every Semester - online
BIOL	1700	Human Biology	Less than once every two years
BIOL	1750	Human Genetics	Less than once every two years
BIOL	1800	General Biology I	Fall, Spring, Summer
BIOL	1900	General Biology II	Spring, Summer
BIOL	2100	Flora of New England	Summer Only – every 2 years
BIOL	2150	General Microbiology	Fall
BIOL	2300	Ecology	Fall
BIOL	2420	Human Physiology	Less than once every two years
BIOL	2500	Histology	Less than once every two years
BIOL	2600	Animal Behavior	Every Other Spring
BIOL	2650	Neuroscience	Spring
BIOL	2700	Medical Microbiology	Spring
BIOL	2800	Genetics	Every Semester
BIOL	2860	Introduction to Secondary Teaching	Fall
BIOL	3000	Parasitology	Every other Fall
BIOL	3010	Invertebrate Biology	Every other Fall
BIOL	3030	Foundations of Biochemistry	Every Fall
BIOL	3100	Conservation Biology	Every Other Year
BIOL	3250	Cell Biology	Every Fall
BIOL	3300	Entomology	Less than once every two years
BIOL	3350	Cell Culture Techniques	Every Spring
BIOL	3450	Biochemistry	Every Other Year - Spring
BIOL	3550	Developmental Biology	Spring
BIOL	3650	Plant Biology	Every Other Year - Fall
BIOL	3700	Bioethics	Less than once every two years
BIOL	3800	Vertebrate Biology	Less than once every two years
BIOL	4020	Medicinal Chemistry	Every three years - fall
BIOL	4250	Endocrinology	Less than once every two years
BIOL	4500	Molecular Biology	Every other year - spring
BIOL	4600	Evolution	Every other Year - fall
BIOL	4700	Animal Physiology	Every other year - fall
BIOL	4800	Neurobiology	Less than once every two years
BIOL	4810	Immunology	Every Other Year
BIOL	4850	Methods in Teaching Science	Alternate years - Fall
BIOL	4901-4903	Independent Study	As needed – special scheduling



BIOL	4860, 4870	Biology Practicum in a Secondary School I and II	As Needed
BIOL	4950, 4960	Internship	As needed – special scheduling
BIOL	4975	Directed Study	As needed – special scheduling
ENSC	1000	Introduction to Environmental Science (BIOL-1010)	Fall
<i>Chemistry</i>			
CHEM	1000	Chemistry in a Changing World	Fall
CHEM	1200	Chemistry for Health Sciences	Every Semester
CHEM	1300	General Chemistry I	Fall; Spring (limited seats)
CHEM	1400	General Chemistry II	Spring
CHEM	1600	Introductory Research in Chemistry	As needed – special scheduling
CHEM	2000	Organic Chemistry I	Fall
CHEM	2100	Organic Chemistry II	Spring
CHEM	2400	General Analytical Chemistry	Spring
CHEM	2860	Intro to Secondary Teaching	Fall
CHEM	3030	Foundations of Biochemistry	Fall
CHEM	3200	Physical Chemistry I	Alternate years - Spring
CHEM	3300	Physical Chemistry II	Less than once every two years
CHEM	3600	Descriptive Inorganic Chemistry	Alternate years - Fall
CHEM	4000	Natural Products	Less than once every two years
CHEM	4012	Practicum Seminar	As needed
CHEM	4020	Medicinal Chemistry	Every three years - fall
CHEM	4040	Advanced Synthetic methods	Less than once every two years
CHEM	4200	Polymer Chemistry	Less than once every two years
CHEM	4400	Forensic Chemistry	Every three years - fall
CHEM	4500	Organic Spectroscopy	Less than once every two years
CHEM	4600	Chemical Instrumentation	Less than once every two years
CHEM	4750	Chemistry Seminar	Spring
CHEM	4850	Methods in Teaching Science	Alternate years - Fall
CHEM	4860	Chemistry Practicum I	As needed
CHEM	4870	Chemistry Practicum II	As needed
CHEM	4940	Internship	As needed – special scheduling
CHEM	4900	Independent Study in Chemistry	As needed – special scheduling
CHEM	4950	Internship	As needed – special scheduling
CHEM	4975	Directed Study	As needed – special scheduling

## Appendix K: Student Handbook



# Department of Biology and Chemistry

<http://www.fitchburgstate.edu/academics/academic-departments/biology-chemistry/>

# Undergraduate Student Handbook

August 2017

# 1. Vision, Mission & Student Outcomes

## 1.1 Vision Statement

The Department of Biology and Chemistry provides undergraduate and graduate students with the opportunity to learn in the physical and life sciences. Focusing on processes, concepts, and critical thinking skills, we build the foundation students need to actively participate in scientific inquiry and the discovery of knowledge. Our approach to education and research imparts students with a way of thinking about and understanding our natural world that will guide them throughout their professional and public lives.

The Department places a high value on interdisciplinary research, collaboration, and partnerships with other educators on and off campus. A rich collaborative community is fostered through internships, independent studies, and student collaborations with active faculty research programs; an environment that mirrors the diverse world that we share. As a department we work diligently to incorporate innovations in technology, research, and education that build upon our current strengths and meet the demands of a dynamic environment.

## 1.2 Mission Statement

Fitchburg State University is committed to excellence in teaching and learning and blends liberal arts and sciences and professional programs within a small college environment. Our comprehensive public university prepares students to lead, serve, and succeed by fostering lifelong learning and civic and global responsibility. The Department of Biology and Chemistry is central to this mission because it contains two basic science majors on campus - biology and chemistry, along with minors in biology, chemistry, and neuroscience and behavior. In our role as one of the core academic departments that has traditionally constituted a liberal arts and sciences education, we prepare students whose main interest is in a scientific career as well as provide foundational experiences for other majors on campus (e.g. nursing and exercise science) and offer courses for non-majors seeking to fulfill the scientific component of their liberal arts and science education.

We strive to:

- Produce students who are well prepared for careers and advanced study in the Biological Sciences and related fields.

- Maintain a high level of scholarly activity in a variety of fields associated with Biology, Chemistry and Science Education.
- Serve the needs of the entire college and specific academic departments through our curricular offerings and involvement in the college community.
- Provide state of the art pedagogical approaches as well as utilize appropriate equipment, technology, and resources for teaching, learning and research in the Sciences and Science Education.
- Recruit and retain qualified students for our academic programs from a variety of backgrounds.

### **1.3 Student Outcomes**

Students who successfully complete a major in Biology will:

- Demonstrate a command of key concepts from a broad range of course topics, including cell and molecular biology, genetics, organismal biology, evolution, ecology, developmental biology, and topics from advanced electives.
- Identify and solve biological problems by using critical thinking.
- Propose alternative, testable hypotheses to explain patterns and phenomenon in nature.
- Collect, summarize and interpret empirical and quantitative data.
- Construct and present scientific reports as papers, posters, and oral presentations.
- Possess specific skills and knowledge necessary to pursue careers in the biological sciences.
- Effectively read, analyze, synthesize and write about historical and contemporary advances in the biological sciences.
- Demonstrate technical skills appropriate for jobs in the laboratory, field and/or classroom.
- Understand and perform appropriate practices for lab safety, including health and environmental concerns.
- Recognize ethical dimensions surrounding the decisions made in the name of biological science.
- Understand and express the roles biological sciences play in society

## **2. Faculty and Staff Information**

The Department of Biology and Chemistry currently has 20 full-time faculty - 13 biologists and 7 chemists. In addition, part-time faculty members (adjuncts) are appointed to teach introductory biology and chemistry courses. There is a full-time administrative assistant and

three laboratory technicians. These technicians play a vital role in setting up labs, ordering and stocking lab supplies, and most importantly, maintaining and enforcing health and safety regulations. The current Department Chair, Dr. Mel Govindan, has served in this position since July, 2014.

Below is the office location of all faculty and staff members in the department as well as a brief description of their teaching and research interests:

<b>Name</b>	<b>Office</b> (Science Center)	<b>Title</b>	<b>Teaching/Research Interests</b>
Awasabisah, Dennis	223	Assistant Professor of Chemistry	bioinorganic, organic, and inorganic chemistry
Barrette, Melissa	220	Administrative Assistant	
Cratsley, Christopher	225	Professor of Biology	Behavior ecology, biology education
Downs, Emma	327	Assistant Professor of Chemistry	inorganic chemistry
Fiedler, Steven	335	Assistant Professor of Chemistry	physical chemistry
Govindan, Meledath	220B	Professor of Chemistry	organic chemistry, natural products chemistry
Grimm, Lisa	231	Assistant Professor of Biology	cell biology, immunology, science education
Hoey, Meg	228	Professor of Biology	genetics, plant biology
Kilpatrick, Elizabeth	224	Assistant Professor of Biology	immunology, virology, anatomy, physiology
Kowlzan, Karen	346	Laboratory Technician	
Krieser, Ronald	338	Associate Professor of Biology	genetics, molecular biology

Krishnamurthy, Mathangi	227	Assistant Professor of Chemistry	organic chemistry, medicinal chemistry
Legare, Melissa	238	Laboratory Technician	
Ludlam, John	226	Associate Professor of Biology	ecology, environmental science
Murray, Ian	236	Laboratory Technician	
Nosek, Michael	224	Professor of Biology	cell biology, biochemistry
O'Connor, Aisling	330	Associate Professor of Chemistry	analytical & green chemistry, science education
Picone, Christopher	336	Associate Professor of Biology	ecology, environmental science
Rehrig, Erin	230	Associate Professor of Biology	plant biology, science education
Rollins, Sean	237	Associate Professor of Biology	microbiology, infectious diseases
Samulak, Billy	333	Assistant Professor of Chemistry	analytical chemistry, biochemistry, science education
Schoenfeld, Thomas	334	Associate Professor of Biology	anatomy, physiology, neuroscience
Soczek, Mary Lou	325	Adjunct Instructor	Intro to Life Sciences
Welsh, Daniel	233	Assistant Professor of Biology	fish morphology, ecology, evolution, behavior, natural history
Williams, Eric	235	Assistant Professor of Biology	developmental biology, cancer biology and physiology.

### 3. Curriculum (See also Section 4)

The Biology and Chemistry Department offers the following degrees: Bachelor of Science (BS), Bachelor of Arts (BA) degrees in Biology, and the Bachelor of Science degrees in Chemistry and Chemistry Education.

All Biology majors follow a general program of study which includes of four core courses, and six electives including a capstone course. In the capstone course, students apply their understanding of the process of scientific inquiry to research projects. Within the Biology major, students may also elect to pursue one of several tracks or concentrations to achieve a more focused course of study in contemporary, specialized fields.

#### 3.1 Required Courses for Biology, BS

- **Core Courses**

BIOL 1800 - General Biology I

BIOL 1900 - General Biology II

BIOL 2300 - Ecology

BIOL 2800 - Genetics

- **Elective Courses:** Biology majors also take six advanced electives at or above BIOL 2000. Independent study, directed study or internship may each count as one advanced BIOL elective in a student's program of study. Courses with a separate lecture and lab registration count as a single elective: the lab portion of a course does not constitute a distinct biology elective.
- **Capstone Course:** One of the six electives must be a designated Capstone course. Students in the Capstone course conduct a research project to demonstrate their skills in research design and analysis. The Capstone course also meets the University's Listening and Speaking and Junior/Senior Writing requirement. Capstone courses must be taken at Fitchburg State: courses that transfer as the equivalent course will not fulfill this requirement. Independent studies (BIOL 4903) require approval by the departmental curriculum committee in order to fulfill the Capstone requirement.

BIOL 3550 - Developmental Biology

BIOL 3650 - Plant Biology

BIOL 4500 - Molecular Biology

BIOL 4700- Animal Physiology

BIOL 4903 - Independent Study (requires department approval)

- **Required Courses in Related Sciences Subjects:** In addition to biology courses, Bachelor of Science (BS) students are required to take the following courses in related sciences and two mathematics courses at or above MATH 1300.

CHEM 1300 - General Chemistry I

CHEM 1400 - General Chemistry II

CHEM 2000 - Organic Chemistry I

CHEM 2100 - Organic Chemistry II

PHYS 2300 - General Physics I

PHYS 2400 - General Physics II

### **3.2 Required Courses for Biology, BA**

The core, electives and capstone course requirements for BA students are identical to those for the BS degree as described above.

**Required Courses in Related Sciences:** In addition to biology courses, Bachelor of Arts students are required to take courses in related sciences and two courses in mathematics at or above MATH 1300

CHEM 1300 - General Chemistry I

CHEM 1400 - General Chemistry II

CHEM 2000 - Organic Chemistry I

One PHYS course

One GEOG course

- a. **BA language Requirement:** Foreign language proficiency at the intermediate level. This usually means 2 years of a single language unless the student can take a CLEP test to pass the first year (basic level) courses. Some may come in with A.P. credits as well. See the details of FSU's CLEP acceptance policy in Section 4.4.

### **3.3 Biology Concentrations/Tracks** (BS only)

Students may elect to pursue one of several tracks or concentrations within the major for a more focused course of study in contemporary, specialized fields of biology. The following concentrations are offered:

Biology with Initial Teacher Licensure

Biotechnology

Environmental Biology



### **3.4 The Chemistry Major**

There are two separate degree programs: B.S. in Chemistry and B.S. in Chemistry with Initial Teacher Licensure in Secondary Education. Both have the same core courses:

- General Chemistry I and II
- Organic Chem I and II
- General Analytical Chemistry
- Physical Chemistry I
- Inorganic Chemistry
- Foundations of Biochemistry
- Chemistry Seminar

Courses in Related Disciplines:

- General Biology I
- Pre-calculus (MATH 1300)
- Calculus I (MATH 2300) and Calculus II (MATH 2400)
- General Physics I and II (PHYS 2300-2400) or  
Calculus-based Physics I and II – PHYS 2600-2700.

B.S. in Chemistry requires all of the above courses plus two electives chosen from chemistry courses at or above 3000-level.

B.S. in Chemistry – Secondary Education requires all the above required courses, one chemistry elective at or above 3000 and several education courses.

Chemistry majors are recommended to take the calculus-based physics sequence (PHYS 2600-2700).

Two electives are offered in 2017-18: Medicinal Chemistry in fall and Proteomics in spring.

### **3.5 Four-Year Plans of Study**

Recommended 4-year plans of study are available for all the programs. They can be found at: <http://www.fitchburgstate.edu/offices-services-directory/career-counseling-and-advising/four-year-plans-of-study-by-major/>

### **3.6 Transfer & Change of Major Students**

Students who transfer from another school or major will need to develop a unique plan of studies with their advisor. The amount of time it will take to complete the major will depend on the number of relevant courses already taken prior to the transfer into the program.

## **4. Advising, Requirements, and General Policies** (see also Section 3)

Every major in the department is given a faculty member as their advisor. Students are required to see their advisor twice a year (during advising periods - once in the fall semester and once in the spring semester) and are encouraged to see them more often as the advisor may assist with many issues.

### **4.1 Biology Program – New Requirement**

Beginning fall of 2016, the following curriculum change went into effect for those students who started that year. Students who came in before fall 2016 have the option of switching their Catalog year to 2016-17 but they need to do that by completing a form to be submitted to the Registrar. A student cannot go back and opt for an older Catalog year.

- **Minimum grade of 2.0 in General Biology I (BIOL 1800) and General Chemistry I (CHEM 1300)** to remain in the major. A student failing to make this grade in his/her first attempt will get one more chance to repeat the course. After that they will be dropped from the major and should meet with their advisor to choose a new major.

### **4.2 Other important aspects of the biology curriculum**

- Gen Bio I and II can be taken out of sequence. Most students start with Gen Bio I in fall and move to Gen Bio II in spring. Students are strongly encouraged to take it in this order.
- Genetics requires Gen Bio I as a pre-requisite.
- Beginning Fall 2017, Ecology will only be offered in fall. It is recommended that students take Ecology in fall and Genetics in spring of their sophomore year. A student could wait until the fall of their junior year to take it if they were not able to fit into their sophomore year schedule. Ecology requires either Gen Bio I or II as pre-req or co-enrolled with a red card.
- **Grade of 1.7 minimum.** Almost all BIOL and CHEM courses that have pre-requisites require that the students get at least a 1.7 in the pre-requisite courses. For example, you must earn at least a 1.7 in General Chemistry II before you can move on to Organic Chemistry I. The only exceptions are a few upper-division biology and chemistry electives. The 2.0 requirement in General Biology I and General Chemistry I supersedes this requirement.

- **Biotechnology concentration** requires taking Cell Biology and three other courses from the following five:  
BIOL 3450 - Biochemistry; BIOL 3900 - General Microbiology; BIOL 4500 - Molecular Biology; BIOL 3350 - Cell Culture Techniques; BIOL 4810 - Immunology.
- **Environmental Biology** concentration.
  - a. **For those students who matriculated before fall 2015**, it requires Introduction to Environmental Science (BIOL 1010). One of the electives must be an Internship (BIOL 4950) at 3-6 credits. Independent Studies or another course may be approved on a case by case basis to replace the internship. In lieu of two semesters of physics students can take any PHYS or GEOG courses  $\geq 2000$  level, including Oceanography and Computer Applications in Geography/Earth Science.
  - b. **Beginning Fall 2015 the requirement has changed.** Physics I and II are now required. BIOL 1010 is replaced by Conservation Biology as a required course. Two GEOG courses are required: at least one course must come from the Cluster 1 consisting of GEOG 2100, GEOG 2500, GEOG 3110, or GEOG 4600. Another course must come from the Cluster 2 consisting of GEOG 4500, GEOG 3120, GEOG 4000, GEOG 4400, or GEOG 2400. This reduces the Biology elective to 5 courses including Capstone.
- **Health Sciences concentration** requires: Biochemistry (either BIOL 3030 or 3450) as one of the electives and Anatomy and Physiology I and II. A Microbiology course (Medical Microbiology or General Microbiology), Developmental Biology, and Cell Biology are strongly recommended; so also Applied Statistics. Those who are interested in medical school should take Introduction to Psychological Sciences and Introduction to Sociology as a preparation for the MCAT test on these topics. Please be aware that students interested in pursuing graduate school in the health field do not *need* to take this concentration as long as they meet the pre-requisites for their intended health professional program.
- **Neuroscience and Behavior concentration:** Among the six BIOL electives required for the BS in Biology, including the Capstone, students must take BIOL 2650 (Neuroscience) and at least two courses providing additional perspectives to the study of neuroscience and behavior (BIOL 2600, 3250, 3550 and 4700). They also need to take PSY 1100 plus 3500 or 3550.
- **Biochemistry:** Foundations of Biochemistry (BIOL/CHEM 3030, 3 cr.) will be offered every fall and BIOL 3450 (Biochemistry with lab, 4 cr.) every other spring semester. Both courses require Organic I as pre-requisite and BIOL 3450 has an additional Genetics pre-requisite. BIOL 3030 can count as an elective for the biology major or towards the chemistry minor (if a student takes it as CHEM 3030) but it cannot be counted for BOTH.

### **4.3 Chemistry Minor**

The Chemistry minor is very achievable for Biology majors and may open up employment possibilities. It requires General Chemistry I and II, Organic I and II,

General Analytical Chemistry and one course at or above 2000-level (23-24 credit). The students must meet the 50% rule (i.e., only 50% of the coursework can be transferred from outside Fitchburg State) and the minimum GPA of 2.0 in the CHEM courses. Foundations of Biochemistry can only be used as a Biol elective for the Biology major or Chem elective for the Chemistry Minor; but not both.

#### **4.4 Biology Minor**

The Biology minor is something a chemistry major could take and requires the additional courses in General Biology II plus 10 more credits in biology courses at or above 2000 level.

#### **4.5 Neuroscience, Behavior, and Cognition Minor**

The Neuroscience, Behavior, and Cognition minor is an interdisciplinary program designed to provide students with the opportunity to explore the biological basis of behavior, consciousness, perception and cognition. All NB&C minors will take two biology and two psychology core courses, two electives in biology or psychology making up the 18 credits required for the minor. Students interested in pursuing a minor are advised to consult with their academic advisor and also should refer to further details in the University Catalog:

<http://www.fitchburgstate.edu/academics/undergraduate/undergraduate-day-programs/all-minors/>

#### **4.6 Fitchburg State University's Policies on AP and CLEP Credits**

**AP Credits:** Generally, AP course credits for students who score 3, 4, or 5 on the Advanced Placement (AP) examination. See the [Academic Glossary](#) of the University Catalog for the advanced placement courses accepted. Students need to have official AP scores sent by the College Board to the Registrar in order to get credit. The score report you had sent when you applied to FSU may not be sufficient as it may not have contained scores of all the AP exams you took.

For the **CLEP exams**, Fitchburg State University adheres to the standards established by the American Council on Education granting credit for tests on which a score of 50 has been achieved. This credit is awarded only to students enrolled in degree programs at Fitchburg State University. The nearest CLEP exam site is at the testing center of Mount Wachusett Community College (978) 630-9244. Here is how the Registrar gives credits for the foreign language tests.

- **French** – based on score; pass-62 will give the student FREN 1000 and FREN 1100. A score of 63+ will grant those two courses, as well as FREN 2000 and FREN 2100.
- **German** – based on score; pass-58 will give the student GER 1000 and GER

1100. A score of 59+ will grant those two courses, as well as GER 2000 and GER 2100.

- **Spanish** – based on score; pass-59 will give the student SPAN 1000 and SPAN 1100. A score of 60+ will grant those two courses, as well as SPAN 2000 and SPAN 2100.

There are CLEP tests in many other disciplines. However, students interested in graduate, medical or P.A. schools are discouraged from taking CLEP tests as these programs would not accept these credits for pre-requisite courses, such as Biology, Chemistry, English, Physics, and Math. In addition Biology and Chemistry CLEP credits only carry elective course credits – they do not get credit for BIOL 1800 or CHEM 1300. CLEP credits are accepted for other courses not required as pre-requisites.

Students planning to take French, Spanish or Latin are required to take a placement test if the student is native speaker of a foreign language or has completed a high school level course in French, Spanish or Latin. This will allow someone to be placed in the appropriate level in these languages. Please see the [Placement Test website](#) for additional information.

## 5. Internships and Independent Research Projects

The Department of Biology and Chemistry provides learning and resume building opportunities for students through internships and independent studies. Internships send students into work environments in their chosen fields in order to provide real world experience and networking opportunities. Over the past few years we have had students work in a variety of industrial and academic lab settings. Examples include

Cape Cod Museum of Natural History

Charles River Labs Inc.

City of Fitchburg, Leominster Conservation Commission

Crocker Elementary School, Fitchburg, MA

Devens Natural Resource Management

Environmental Protection Agency

FLO Chemical Corporation

Food and Drug Administration (Washington Center Internships)

Leominster Health Alliance Hospital

Mass General Hospital

MIT Biomaterials and Engineering Lab

Museum of Science, Boston

New England Peptide Inc.

Oxbow Associates, Inc. – Environmental Consultants  
Pediatric Medicine at Southboro Medical Group, Southboro, MA  
PCI Synthesis Inc.  
Psychiatric Associates, Wellesley, MA  
Quest Diagnostics  
Second Chance Animal Shelter, East Brookfield, MA  
Southwick Zoo  
UMass Medical School  
University of Connecticut

- If students are interested in internships, they should contact their advisors who will help them initiate the process which will include selection of an internship site, development of a resume and cover letter and completion of paperwork including the Internship Contractual Agreement. On the second floor of the Science building, there is a bulletin board designated to provide information about internship opportunities. Additional information is also posted on the various Blackboard sites specifically for students in various concentrations. The Fitchburg State Internship Handbook (PDF) provides additional information including forms, evaluation process and academic credit. Please see more information here:  
<http://www.fitchburgstate.edu/academics/undergraduate/internships/looking-for-an-internship/>

**Independent Study:** During independent studies, students participate in research under the guidance of a faculty member of the student's choosing. Independent studies allow students to engage in the scientific process, improve critical thinking skills and learn laboratory techniques. Each spring, the entire university community at Fitchburg State recognizes the achievements of undergraduate student scholars and researchers at the Undergraduate Research Conference. At this event, many biology and chemistry majors present their research in the form of a poster presentation or talk and are provided the opportunity to share and receive feedback from the larger campus community.

- If students are interested in independent studies, they should contact the faculty member whose research interests align with their own. The research areas of each faculty member are summarized in the Faculty Profiles link that can be accessed via the Department of Biology and Chemistry website at  
<http://www.fitchburgstate.edu/academics/academic-departments/biology-chemistry/>.

**Introduction to Research:** Students who are in the beginning of their academic career in the department (freshmen and sophomores) are offered opportunities to assist in research projects conducted by faculty. They can earn academic credit by registering for BIOL 1600 or CHEM 1600 - Introductory Research. This course provides students with the opportunity to engage in

scientific research. Participants work under the supervision of faculty to contribute to the lab's current, ongoing research projects. This course may be repeated once but only 2 credits can be earned in total. Restricted to Biology and Chemistry majors and by permission of the instructor. Graded on a S/U scale. For each credit earned, the student is expected to work 3 hours in the lab of the investigator. Please contact your advisor if you are interested in participating.

## **6. Graduate and Professional School Preparation and Opportunities:**

Admission into programs in the health professions such as medicine, dentistry, nursing, pharmacy, optometry and veterinary medicine are highly competitive and require careful preparation and planning. Our pre-health professions program has an advisor, Dr. Meledath Govindan, with the knowledge to advise students interested in pursuing these careers. He works with students to help them with course selection, exam preparation and other admissions requirements. Dr. Govindan works as a complement to your academic advisor to prepare you to be a competitive candidate for these programs.

The Department of Biology has partnerships with other institutions in the areas of medicine and biotechnology which provide students with an opportunity to gain acceptance without having to go through the regular application process. These opportunities include the following:

- The Lake Erie College of Osteopathic Medicine (LECOM) Early Acceptance Program permits students to apply for early, provisional acceptance into the following programs: Doctor of Osteopathic Medicine, Doctor of Dental Medicine and Doctor of Pharmacy. Students with qualifying SAT scores and GPA can apply within the first two years of their program of study. Interested students should talk with Dr. Govindan and visit the following link: <https://lecom.edu/admissions/entrance-requirements/college-of-osteopathic-medicine-entrance-requirements/>.
- Any student with a B.S. in biology or chemistry and with a minimum GPA of 3.2 will be automatically eligible for admission into the Northeastern University College of Science MS in Biotechnology Program. This is a non-thesis graduate program designed to prepare students for careers in biotechnology and includes a six month co-op assignment with an industry employer to provide real world experience. For more information about the program, visit the following link: <http://www.northeastern.edu/cos/biotech/educational-degree-programs/>.

## 7. Student Resources

### 7.1 Biology & Chemistry Departmental Resources:

- Biology & Chemistry Department Office SCI 220

**Dr. Meledath Govindan**, Chairperson (e-mail: mgovindan@fitchburgstate.edu)

**Melissa Barrette**, Administrative Assistant (Phone: 978-665-3246; e-mail: mbarrette@fitchburgstate.edu)

Dr. Govindan prefers to be contacted via e-mail except for emergencies, when he can be reached by calling the department office, staffed by Melissa Barrette, Administrative Assistant. She can answer many student questions or put you in contact with someone who can! She also has copies of departmental and university forms. In addition, she can help you to contact faculty members.

- Faculty Mailboxes SCI 222: Each faculty member has a mailbox in this room. They are arranged alphabetically by last name. Students can use the mailboxes to drop off assignments, forms etc. for faculty members.
- Advisors: Every biology major is assigned a faculty advisor. If you are not sure who your advisor, you can find the information on DegreeWorks (Web4) or by contacting Melissa Barrette in the department office.
- Pre-Health Advisor: Dr. Meledath Govindan serves as the university's pre-health advisor. Any students interested in a career in the health sciences should contact him.
- Faculty Offices: The faculty offices are located on the second and third floors of the Condike Science wing. Office room numbers are posted outside the department office (SCI 220).
- Faculty Schedules: All faculty members have their class and office hour schedules posted on a noticeboard on the 2<sup>nd</sup> floor of the Condike Science wing between SCI 218 and SCI 220.
- Job/Internship Noticeboard: This noticeboard is located on the 2<sup>nd</sup> floor of the Condike Science wing.
- Facebook Page: <https://www.facebook.com/FitchburgStateUniversityBioChem/>
- Biology & Chemistry Club: The goal of the Biology and Chemistry Club is to develop a community of students interested in the fields of biology, chemistry, and other natural and applied sciences. In addition, they foster interaction between the students and faculty of the Biology and Chemistry department. Meetings are generally held on



Tuesdays at 3:30 pm and many events are scheduled throughout the year. See their website for further information: <https://orgsync.com/58081/chapter>

## 7.2 Campus Wide Resources:

The Academic Support Center in the Hammond Building houses a number of academic and personal support services, which are available for all students.

- **Tutor Center**: The Tutor Center's peer tutors offer free individual and group peer tutoring in a variety of subjects. Location / Phone Number: Hammond 306 / 978-665-3499. <http://www.fitchburgstate.edu/offices-services-directory/tutor-center/>
- **Counseling Services**: The Counseling Services Office offers a range of services including individual, couples and group counseling, crisis intervention, psychoeducational programming, outreach workshops, and community referrals. Counseling services are confidential and are offered at no charge to all enrolled students. Location / Phone Number: Hammond 317 / 978-665-3152. <http://www.fitchburgstate.edu/offices-services-directory/counseling-services/>
- **Disability Services**: Disability Services provides reasonable and appropriate accommodations for Fitchburg State students with documented disabilities, allowing equal access to all university programs and services. Location / Phone Number: Hammond 303 / 978-665-4020. <http://www.fitchburgstate.edu/offices-services-directory/disability-services/>
- **Career Counseling and Advising Center**: This center provides services such as career counseling, academic coaching, advising for Pre-Majors and advising for students experiencing academic difficulty. Location / Phone Number: Hammond 318 / 978-665-3151. <http://www.fitchburgstate.edu/offices-services-directory/career-counseling-and-advising/>
- **Math Center**: The Math Center is a free walk-in tutoring service for all Fitchburg State University students. Location / Phone Number: Hammond 306A / 978-665-3499
- **Expanding Horizons**: Expanding Horizons is a federally funded student support services program for first generation undergraduate university students, low income students, or students with disabilities. Location / Phone Number: Hammond 315 / 978-665-3064.
- **Writing Center**: At the Writing Center, individual writing tutoring is provided by peer tutors. Writing Peer Tutors work together with writers at all levels, in all stages of the writing process, and in all areas of study. Location / Phone Number: Hammond 306 / 978-665-3499
- **International Education Office**: This office supports students seeking study abroad

opportunities (including faculty-led study abroad courses offered throughout the year and in summer), as well as providing support to undergraduate and graduate international students. In addition, they promote cross-cultural awareness on campus. Location / Phone Number: Hammond 316 / 978-665-3089.

<http://www.fitchburgstate.edu/offices-services-directory/international-education/>

- **Placement Test Center:** This center oversees and administers required placement tests in math, reading and writing for new freshman and transfer students. Foreign language placement testing is also offered. Location / Phone Number: Office - Hammond 306, Test Site – Hammond 101 / 978-665-3499.  
<http://www.fitchburgstate.edu/offices-services-directory/placement-center/>
- **Center for Diversity and Inclusiveness (CDI):** The center coordinates and maintains a campus-wide program that reflects the University's mission to support the development of the whole person, by engaging students, in an inclusive environment, through the promotion of active involvement, collaboration, education and leadership opportunities and ensuring each students goal fulfillment. Location / Phone Number: Hammond G04 / 978-665-3399. [http://www.fitchburgstate.edu/offices-services-directory/center\\_diversity\\_inclusiveness/](http://www.fitchburgstate.edu/offices-services-directory/center_diversity_inclusiveness/)

## Appendix L: Pre-Medical Program, LECOM, and Northeastern Biotechnology MOU

### Pre-Medical Program

At Fitchburg State University, the Pre-Medical Program encompasses the advising program provided to students interested in pursuing postgraduate studies in the medical sciences. This includes medicine, dentistry, veterinary medicine, optometry, chiropractic medicine, physician's assistant, physical therapy, podiatric medicine, and other allied health professions.

Fitchburg State offers a B.S. Degree in Biology with [Health Sciences Concentration](#). This is especially designed for preparing students for admission to postgraduate programs in the health professions. However, it is not required that students opt this major. For more information please go to the following links.

The program assists students in pre-professional preparation for careers in the medical sciences including medicine (allopathic and osteopathic), dentistry, veterinary medicine, podiatric medicine, chiropractic medicine, optometry, physician's assistant, physical therapy, and other allied health professions. Because of the fact that medical science professions require specific preparation, students must work closely with the Health Professional Advisor to plan a suitable program of study. This generally involves selection of an appropriate major, required courses, internships and volunteer service opportunities in the health profession, clinical exposure to medical fields, and research. Students are also expected to consult the catalogs (or websites) of the particular health professional schools he/she is interested to determine the specific requirements for admission. This is the responsibility of the student. The information provided here and elsewhere is only intended to guide you.

Admission to most health professions schools is extremely competitive, requiring strong academic performance, satisfactory scores on standardized admissions test (e.g., MCAT, DAT, OAT, PCAT, VAT, GRE, etc.), and evidence of leadership, service, and a working knowledge of the health professions.

Academic preparation generally includes a minimum of two semesters each of general biology, general chemistry, organic chemistry, calculus, general physics and English. Beginning the 2015 admission cycle AAMC (American Association of Medical Colleges) is planning to change both the MCAT and prerequisite course requirements for admission to U.S. medical schools. Biochemistry will be required and additional advanced biology electives, such as cell biology, genetics, developmental biology and microbiology are strongly recommended. Additionally MCAT will be revised to include an additional section: Psychological, Social and Biological Foundations of Behavior. This necessitates that the students acquire the necessary competencies by taking courses in these areas. Introductory courses in psychology and sociology will also be required. (Note: at this time these additional requirements apply only to admission to M.D. programs in U.S. medical colleges; however it is anticipated that the others will follow the lead and change their requirements as well).

To complete this preparation at Fitchburg State, the following courses are recommended:

- General Biology - BIOL 1800-1900
- Anatomy and Physiology – BIOL 1200-1300
- General Chemistry - CHEM 1300-1400
- Organic Chemistry - CHEM 2000-2100
- Mathematics (Applied Statistics and Calculus) – MATH 1300, 1700, 2300

- General Physics – PHYS 2300-2400
- General Psychology – PSY 1100
- Introduction to Sociology – SOC 1100
- English – Writing I and II and possibly two additional courses

Pharmacy, Physician's Assistant, Dentistry (some), and certain other programs may also require microbiology and it is strongly recommended that students also take courses in cell biology, genetics and developmental biology, if possible.

While it is recommended that students follow the B.S. Biology/Health Sciences program, pre-health professional students can major in any of the available majors at Fitchburg State. However, the fact that many of the above courses are required courses for the biology major, it is likely that the student will chose this. Careful planning is required to complete the required coursework in a timely manner with excellent grade-point-average.

## Summer Research and Enrichment Programs in Biomedical and Health Sciences

Clark University

### Special Programs

UMASS Medical School - Worcester MA - Summer Enrichment Program.

UMASS Medical School Summer Research Fellowship Program - Undergraduate Research.

Massachusetts Life Sciences Center Internship Challenge Program

SMDEP (Summer Medical and Dental Education Program)

Summer Undergraduate Research Opportunities at the Case Western Reserve University School of Medicine in Cleveland, Ohio

Des Moines University's second annual free summer enrichment program

The Ohio University College of Osteopathic Medicine (OU-COM) will again host the Summer Scholars Program

Gateways to the Laboratory Summer Program in New York City

Nebraska Summer Research Program

### Other Pre-Medical Programs

Many of these programs give preference to minority, disadvantaged, and first-generation college students (economically and educationally).

Caltech Pasadena- Minority Undergraduate Research Fellowships (MURF)

<http://sfp.caltech.edu/programs>

Cornell Graduate School Minority Program Internship for Under-Represented Minority College Students

[weill.cornell.edu/gradschool/summer/index.html](http://weill.cornell.edu/gradschool/summer/index.html)

Cornell-Travelers Fellowship for Minorities (Premedical Summer Research Program)

[www.med.cornell.edu/education/programs/tra\\_sum\\_res.html?name1=Travelers+Summer+Research+Fellowship+Program&type1=2Active](http://www.med.cornell.edu/education/programs/tra_sum_res.html?name1=Travelers+Summer+Research+Fellowship+Program&type1=2Active)

Harvard University: Project Success: Opening the Door to Biomedical Careers (College Program): <https://mfdp.med.harvard.edu/dcp-programs/college>

Howard University Advanced Health Careers Enrichment Program:

<http://healthsciences.howard.edu/education/schools-and-academics/pharmacy/center-excellence/components/summer-enrichment>

<http://healthsciences.howard.edu/education/schools-and-academics/pharmacy/center-excellence/components/summer-enrichment/advanced-college>

Illinois College of Optometry: Focus on Your Future

<http://www.ico.edu/admissions/events-for-prospective-students/focus-on-your-future/>

Massachusetts General Hospital: Summer Research Trainee Program (SRTP)

<http://www.massgeneral.org/mao/education/internship.aspx?id=5>

Medical College of Wisconsin: Summer Research Training Program

<http://www.mcw.edu/Diversity-Programs.htm?DocID=197951#.VHzEs7Eo7IU>

Michigan State University College of Human Medicine (MSU-CHM): Premedical Achievement Program (PMAP) [www.mdadmissions.msu.edu](http://www.mdadmissions.msu.edu)

The Ohio State University: I-DOC. Summer program for pre-optometry students

[optometry.osu.edu/IDOC](http://optometry.osu.edu/IDOC)

Ohio University College of Osteopathic Medicine: Summer scholars program

[www.oucom.ohiou.edu/SummerScholars](http://www.oucom.ohiou.edu/SummerScholars)

Ohio State University – SUCCESS Program. We are trying to get the word out about SUCCESS, as one of the goals of the program is to get diverse students into the biomedical research pipeline. I will attach to this note our flyer, or students can be directed to the SUCCESS website,

<http://go.osu.edu/success>. Students get housing and a \$4000 stipend. Plus...we will cover the cost of up

to 2 parents to attend the end-of-summer celebration and research presentation by the students. The application for the program is already up on the website, and apps are due by March 1.

Rutgers University: Project Learn [www.ihhpar.rutgers.edu/projectlearn/](http://www.ihhpar.rutgers.edu/projectlearn/)

Stanford University School of Medicine- Health Careers Opportunity Program (HCOP):

[http://med.stanford.edu/summer\\_programs/](http://med.stanford.edu/summer_programs/)

UCLA Premedical Enrichment Program (UCLA PREP)

<http://www.medstudent.ucla.edu/offices/aeo/prep.cfm>

University of California, Berkeley: Opto-Camp

[optometry.berkeley.edu/opt\\_txtpp/admissions/admitoptocamp.html](http://optometry.berkeley.edu/opt_txtpp/admissions/admitoptocamp.html)

The Ohio State University College of Optometry IDOC Program (Improving Diversity in Optometric Careers) [optometry.osu.edu/IDOC](http://optometry.osu.edu/IDOC)

UNC-CH School of Medicine: The Medical Education Development (MED) Program

<http://www.med.unc.edu/medprogram/med-program>

Summer Academic Enrichment Program (SAEP) at Virginia Commonwealth University (VCU)

For all those pre health juniors, seniors and soon to be post baccalaureates, SAEP is an intensive, six week inter professional academic enrichment program designed to enhance the academic preparation of individuals actively pursuing enrollment in a health professions school. See: [www.dhsd.vcu.edu/programs/college/saep.html](http://www.dhsd.vcu.edu/programs/college/saep.html).  
Deadline: February 15.

### Other Summer Research/Internship Programs in the Sciences

University of Cincinnati College of Medicine- Summer Undergraduate Research Program.

<http://med.uc.edu/SURF>

University of Pittsburgh- Summer Premedical Academic Enrichment Program (SPAEP)  
deadline: March 1 of each year [www.medschool.pitt.edu/future/future\\_03\\_office.asp](http://www.medschool.pitt.edu/future/future_03_office.asp)

Albert Einstein College of Medicine- Summer Research Fellowship Program

[www.aecom.yu.edu/home/community\\_programs.asp](http://www.aecom.yu.edu/home/community_programs.asp)

Case Western Reserve- National Institutes of Health/ National Heart, Lung and Blood Institute Summer Research Program for Minorities

[www.nhlbi.nih.gov/funding/training/redbook/brtpug.htm](http://www.nhlbi.nih.gov/funding/training/redbook/brtpug.htm)

Creighton University- Summer Research Training Program

[www.creighton.edu/hsmaca/summer\\_research\\_training.htm](http://www.creighton.edu/hsmaca/summer_research_training.htm)

Weill Cornell/Rockefeller/Sloan-Kettering: Tri-Institutional MD-PhD Program- Summer Program, Gateways to the Laboratory [www.med.cornell.edu/mdphd/summerprogram](http://www.med.cornell.edu/mdphd/summerprogram)

Dana-Farber – Harvard Cancer Center CURE Program. The DF/HCC Continuing Umbrella of Research

Experiences (CURE) program provides training experiences for high school and undergraduate students from underrepresented minority populations interested in a career in science or research. Students engage in hands-on, mentored research with basic, clinical, population science or nursing research investigators in research environments within DF/HCC. <http://cure.dfhcc.harvard.edu/>

Dartmouth Medical School (New Hampshire): Summer Undergraduate Research Fellowships



[www.dartmouth.edu/~surf/](http://www.dartmouth.edu/~surf/)

Joslin Summer Research Program: Joslin Diabetes Center, Harvard University Medical School

[www.joslinresearch.org/HomeDir/summer\\_research\\_program.asp](http://www.joslinresearch.org/HomeDir/summer_research_program.asp)

National Institutes of Health. Undergraduate Scholarship Program.

<https://www.training.nih.gov/programs/ugsp>

New York University Minority Internship Program

[www.med.nyu.edu/sackler/programs/summer.html](http://www.med.nyu.edu/sackler/programs/summer.html)

The Leadership Alliance Summer Research-Early Identification Program

<http://www.theleadershipalliance.org/Programs/SummerResearch/ProgramStructure/tabid/242/Default.aspx>

Community Based Dental Education: Summer Programs at various locations

[www.dentalpipeline.org/au\\_aboutus.html](http://www.dentalpipeline.org/au_aboutus.html)

University of Michigan 10-Week Undergraduate Research Academy. The deadline is February 15. For more information and application to the academy, please click on the image below. If you have problems viewing the link, please visit:

<http://www.med.umich.edu/ohei/program/research.html>

UMass Boston Summer Undergraduate Research. Here is wonderful opportunity to do research in biology and possibly get credit as well. There is a stipend of \$7600 - the largest amount I have seen for this kind of activity. Early application is encouraged as I am certain the competition would be tough. Ideally, you should apply during the winter break.

[www.reu.umb.edu](http://www.reu.umb.edu).

Final note: Watch the bulletin board on the 2 Floor of Condike Science Bldg for notices

on programs that come our way during the winter months.

Dr. Matthew Zanghi for completing his residency in internal medicine at the University of Massachusetts School of Medicine, Worcester, MA

Dr. Marcos Bachman for completing his M.D. from the University of Massachusetts School of Medicine, Worcester, MA

Gloria Addo and Marie Pry for admission to the Pharm.D. Program at MCPHS University, Worcester, MA

Mina Daniel for admission to the Pharm.D. Program at Western New England University, Springfield, MA

Marlene Ferreira for admission to the Post Baccalaureate Nursing Program at MCPHS in Worcester, MA

Marina Konomi, and Christina Kosmidis for admission to the P.A. Program at MCPHS in Worcester, MA

Christopher Fiske, Georgina Asada, Clever Chaves, Lindsey Farnsworth, and Ethan Borges for early acceptance to the D.O. Medical School Program at LECOM.

## LECOM Early Acceptance Programs

Guarantee your acceptance to medical school at the Lake Erie College of Osteopathic Medicine (LECOM) with one of the following programs:

- [Doctor of Osteopathic Medicine](#)
- [Doctor of Dental Medicine](#)
- [Doctor of Pharmacy](#)

LECOM schools reserve up to fifteen seats a year for Fitchburg State University students. You'll complete a four-year degree on our campus before moving to the LECOM location that offers your program.

## Who is Lake Erie College?

Lake Erie College of Osteopathic Medicine is a private institution with a main campus in Erie, PA that includes a location at Seton Hill in Greensburg, PA, and a branch campus in Bradenton, FL.

- Programs leading to the Doctor of Osteopathic Medicine degree are located in Erie, Seton Hill, and Bradenton.
- The Doctor of Pharmacy programs are located at both the Erie, PA and Bradenton, FL campuses, or may be earned through a Distance Education Pathway.
- The Doctor of Dental Medicine program is located at the Bradenton, FL campus, with fourth-year, dental outreach offices in Erie, PA and DeFuniak Springs, FL.

## About the program

The LECOM Early Acceptance Program has two phases:

- Phase I consists of four years of undergraduate education at Fitchburg State University.
- Phase II is the graduate training within the desired program.

Apply as a high school senior, or during your first two years of study at Fitchburg State. Students interviewing successfully are granted provisional acceptance into the program.

## Program Requirements

- Combined Critical Reading & Math SAT Score of 1170 or better, or
- An ACT score of 26 or better, and
- An unweighted high school GPA of 3.5 or better

Students who score between 1130-1169 on their SATs may qualify if their GPA is at least a 3.6.

# MEMORANDUM OF AGREEMENT

between

Northeastern University



and

Fitchburg State University



This memorandum of understanding (MOU) is intended to act as a pipeline agreement between the College of Science Masters in Biotechnology Program at *Northeastern University* (herein after referred to as Northeastern) and *Fitchburg State University* (herein after referred to as Fitchburg State.) The proposal outlines benefits students would receive related to admission to the MS in Biotechnology graduate program at Northeastern. This MOU will be in effect from April 15, 2017 to April 16, 2018 at which time it will be reviewed and considered for renewal. Either party can request a renegotiation of this agreement.

**Terms and Conditions:**

1. Any student graduating with a Bachelor of Science degree in Biology or Chemistry from Fitchburg State University with a minimum grade-point average (GPA) of 3.2 will be eligible for admission directly into the Northeastern University College of Science MS in Biotechnology Program. Students seeking admission pursuant to this MOU must apply through Northeastern University's standard application system, providing an unofficial transcript at the time of application and an official transcript upon acceptance; however, a personal statement and letters of recommendation will NOT be required. The \$75 application fee will also be waived. Northeastern retains ultimate control and authority for its admissions decisions, and each such decision is made on a case-by-case basis.
2. Students from Fitchburg State with a GPA less than 3.2 are encouraged to apply through the College of Science traditional application process, and the application fee will be waived. No other application requirements will be waived.
3. A minimum of two seats per entry term (Fall or Spring) will be reserved for students from Fitchburg State.
4. Neither party will use the names, logos, trademarks or other intellectual property of the other without the prior expressed written consent of the other. Notwithstanding

the foregoing, Fitchburg State can use the name of Northeastern University when publicizing their undergraduate programs to potentially eligible students.

5. Both parties will comply with all academic regulations applicable to their respective students and operations.
6. This agreement constitutes the entire agreement between the parties with respect to the subject matter hereof and may only be amended or extended in writing signed by the parties' duly authorized representatives. The parties enter into this agreement as independent contractors, and no other relationship is intended to or shall be construed to arise here from, including but not limited to employment, joint venture or partnership.

APPROVED BY:



Kenneth Henderson, Dean, College of Science  
Northeastern University

4/6/17

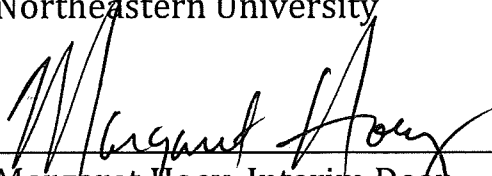
Date



Jared Auclair, Director of Biotechnology  
Northeastern University

4/6/2017

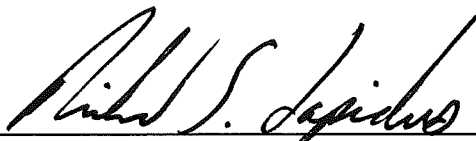
Date



Margaret Hoey, Interim Dean  
Health and Natural Sciences  
Fitchburg State University

3/31/17

Date



Richard Lapidus, President  
Fitchburg State University

4/3/17

Date



## Appendix M: Curriculum Mapping and Assessment

**Table M1.** List 37 BioCore areas of content knowledge that every Biology major should understand. With each concept, faculty scored how much they covered it in their core biology courses. 0 - Not covered, 1 - Several Minutes, 2 - Part of a lecture/lab, 3 - Most of a lecture/lab, 4 - Several lectures/labs, 5 - Several weeks of lecture/lab. The last column is cumulative amount of coverage of that concept across all four core courses. Those concepts with below-average coverage (bottom 25% and 50% quartiles) were used for the curriculum map of upper-level courses, whose data were transformed into the NMDS plot in **Figure 4**.

CORE CONTENT AREA	Major Subdisciplines of Biology (= Scales)	Specific Concepts	Gen Biol I	Gen Biol II	Genetics	Ecology	Cum Coverage
<b>EVOLUTION</b>	Molecular/Cellular/Developmental Biology	Multiple molecular mechanisms, including DNA damage and errors in replication, lead to the generation of random mutation. These mutations create new alleles that can be inherited via mitosis, meiosis, or cell division	2.5	0.67	4	0	7.2
	Molecular/Cellular/Developmental Biology	Mutations and epigenetic modifications can impact the regulation of gene expression and/or the structure and function of the gene product.	2.5	0.67	4	0	7.2
	Physiology	Most organisms have anatomical and physiological traits that tend to increase their fitness for a particular environment	0.5	3.3	2	2	7.8
	Physiology	Morphological and physiological systems are constrained by ancestral structures, physical limits, and the requirements of other physiological systems, leading to trade-offs.	0.5	2	0	2	4.5
	Ecology/Evolutionary Biology	The characteristics of populations change over time due to changes in allele frequencies. Changes in allele frequencies are caused by random and nonrandom processes- specifically mutation, natural selection, gene flow, and genetic drift. Not at all of these changes are adaptive	0.67	4	0	0	4.7
	Ecology/Evolutionary Biology	Natural selection has favored adaptations that increase fitness. If some alleles confer higher fitness than others in a particular environment, frequency of those alleles will tend to increase in the population.	0.75	4.3	0.5	0.5	6.1
	Ecology/Evolutionary Biology	Fitness is an individual's ability to survive and reproduce. It is environment-specific and depends on both abiotic and biotic factors. Evolution of optimal fitness is constrained by existing variation, trade-offs, and other factors	0.5	3.3	0	1	4.8

	Ecology/Evolutionary Biology	All species alive today are derived from the same common ancestor. New species arise when population become genetically isolated and diverge due to mutation, natural selection, and genetic drift. Phylogenetic trees depict relationships among ancestral and descendant species, and are estimated based on data. The structure of molecules or organisms may be similar due to common ancestry or selection for similar function.	0.5	4	2	1.5	8.0
<b>INFORMATION FLOW</b>	Molecular/Cellular/Developmental Biology	In most cases, genetic information flows from DNA to mRNA to protein, but there are important exceptions	3.5	0	4.5	0	8.0
	Molecular/Cellular/Developmental Biology	Gene expression and protein activity are regulated by intracellular and extracellular signaling molecules. Signal transduction pathways are crucial in relaying these signals	1.75	0.67	3.5	0	5.9
	Molecular/Cellular/Developmental Biology	The signals that a cell receives depend on its location, and may change through time. As a result, different types of cells express different genes, even though they contain the same DNA.	2	0.67	2	0	4.7
	Physiology	Information stored in DNA is expressed as RNA and proteins. These gene products impact anatomical structures and physiological function	2.75	0.67	3.5	0	6.9
	Physiology	Organisms have sophisticated mechanisms for sensing changes in the internal or external environment. They use chemical, electrical, or other forms of signaling to coordinate responses at the cellular, tissue, organ, and/or system level	0.5	2	2	0	4.5
	Ecology/Evolutionary Biology	A genotype influences the range of possible phenotypes in an individual; the actual phenotype results from interactions between alleles and the environment	1.5	0.67	4	1.5	7.7
	Ecology/Evolutionary Biology	Individuals transmit genetic information to their offspring	2.25	3.3	4	0.5	10.1
<b>STRUCTURE FUNCTION</b>	Molecular/Cellular/Developmental Biology	The structure of a cell- its shape, membrane, organelles, cytoskeleton, and polarity- impacts its function	3.75	1.3	0.5	0	5.6

	Molecular/Cellular/ Developmental Biology	The three dimensional structure of a molecule and its subcellular localization impact its function, including the ability to catalyze reactions or interact with other molecules. Function can be regulated through reversible alterations of structure e.g. phosphorylation.	3.25	0	2	0	5.3
	Physiology	Physiological functions are often compartmentalized into different cells, tissues, organs, and systems, which have structures that support specialized activities.	0.75	2	0	0	2.8
	Physiology	The size, shape, and physical properties of organs and organisms all affect function. The ratio of surface area to volume is particularly critical for structures that function in transport or exchange of materials and heat.	0.5	3.7	0	1	5.2
	Physiology	Structure constrains function in physiology; specialization for one function may limit a structure's ability to perform another function.	0.5	1.3	0	1	2.8
<b>TRANSFORMATIONS OF ENERGY AND MATTER</b>	Molecular/Cellular/ Developmental Biology	Energy captured by primary producers is stored as chemical energy. This stored energy can be transferred through a series of biochemical reactions to ATP for immediate use in the cell.	3.25	0	0	1	4.3
	Physiology	Energy captured by primary producers is stored as chemical energy and transferred to ATP, which is required for energetically demanding activities necessary for life, including synthesis, transport, and movement.	3.5	1.7	0	1.5	6.7
	Ecology/Evolutionary Biology	Energy captured by primary producers is stored as chemical energy. At each trophic level, most of this energy is used for maintenance, with a relatively small fraction available for growth and reproduction. As a consequence, each trophic level in an ecosystem has less energy available than the preceding level.	0.75	0	0	5	5.8
	Molecular/Cellular/ Developmental Biology	In cells, the synthesis and breakdown of molecules is highly regulated. Biochemical pathways usually involve multiple reactions catalyzed by enzymes that lower activation energies. Energetically unfavorable reactions are driven by coupling to energetically favorable reactions such as ATP hydrolysis.	2	0	2	0	4.0

	Molecular/Cellular/Physiology	Due to the inefficiency of biochemical reactions within an organism (e.g., cellular respiration), transformations of matter and energy are never 100% efficient.	1.75	0.67	0	3	5.4
	Ecology/Evolutionary Biology	Chemical elements are cycled among the abiotic and biotic components of an ecosystem; changes in the amount and distribution of chemical elements can impact the ecosystem.	0.5	0	0	4	4.5
	Molecular/Cellular/Developmental Biology	Intracellular and intercellular movement of molecules occurs via 1) energy-demanding transport processes and 2) random motion. A molecule's movement is affected by its thermal energy, size, electrochemical gradient, and biochemical properties.	2.75	0.67	0	0	3.4
	Physiology	Organisms have limited energetic and material resources which must be distributed across competing functional demands. These include movement of material across gradients, growth, maintenance, and reproduction, inevitably leading to trade-offs.	0.5	1	0	1.5	3.0
<b>SYSTEMS</b>	Molecular/Cellular/Developmental Biology	Cells receive a complex array of chemical and physical signals that vary in time, location, and intensity over the lifespan of the organism; a cell's response depends on integration and coordination of these various signals.	1.25	1.3	1	0	3.6
	Physiology	Organ systems are not isolated, but interact with each other through chemical and physical signals at the level of cells, tissues, and organs.	0.25	1	0	1	2.3
	Ecology/Evolutionary Biology	The size and structure of populations are dynamic. A species' abundance and distribution is limited by available resources and by interactions between biotic and abiotic factors.	0.25	0.33	0	5	5.6
	Ecology/Evolutionary Biology	Competition, mutualism, and other interactions are mediated by each species' morphological, physiological, and behavioral traits.	0.25	2	0	4	6.3
	Molecular/Cellular/Developmental Biology	During development, the signals a cell receives depend on its spatial orientation within the embryo and its intercellular interactions. As a consequence, cells adopt different cell fates depending on their local environment and/or cell lineage.	0.75	1	0	0	1.8
	Molecular/Cellular/Developmental Biology	Alteration of a single gene or molecule in a signaling network may have complex impacts at the cell, tissue or whole-organism level.	1.25	0.67	3	0	4.9

	Physiology	In the face of environmental changes, organisms may maintain homeostasis through control mechanisms that often use negative feedback; others have adaptations that allow them to acclimate to environmental variation.	<b>0.5</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>5.5</b>
	Ecology/Evolutionary Biology	Ecosystems are not isolated and static--they respond to change, both as a result of intrinsic changes to networks of species and as a result of extrinsic environmental drivers. Within an ecosystem, interactions among individuals form networks; changes in one node of a network can cause changes in other nodes--directly or indirectly.	<b>0.25</b>	<b>0.67</b>	<b>0</b>	<b>4</b>	<b>4.9</b>
	Ecology/Evolutionary Biology	Biodiversity (genetic, species, and ecological) impacts many aspects of ecosystems.	<b>0.25</b>	<b>1.33</b>	<b>0</b>	<b>1.5</b>	<b>3.1</b>

**Assessment Questions used in pre- and post-tests.** The following questions were administered in intro level and capstone courses to assess disciplinary knowledge at several points during a student's time in our program. The questions come from select group of topics from the AAAS BioCore, our revised learning outcomes.

**Cell 1. Your bone cells, muscle cells, and skin cells look different because**

- A. Different genes are active in each kind of cell
- B. They contain different numbers of genes
- C. Each cell contains different kinds of genes
- D. Each cell has a different mutation

**Cell 2. Choose the process that requires an input of energy**

- A. Active transport
- B. Movement of water through a plasma membrane
- C. Diffusion of glucose across a plasma membrane down a concentration gradient
- D. Diffusion of oxygen across the plasma membrane

**Cell 3. What does it mean for a gene to be “expressed”?**

- A. It is transcribed to RNA and then translated into a protein
- B. It is mutated to a different form
- C. It is inserted into a bacterial plasmid
- D. It is inactivated using methyl groups
- E. It is quickly replicated during cell division

**Cell 4. A main form of energy stored inside a cell is:**

- A. DNA
- B. ATP
- C. RNA
- D. Ribosome

**Energy 5. A tropical rainforest is an example of an ecosystem. Which of the following statements about matter and energy in a tropical rainforest is the most accurate?**

- A. Energy is recycled, but matter is not recycled.
- B. Matter is recycled, but energy is not recycled.
- C. Both matter and energy are recycled.
- D. Neither matter nor energy are recycled.

**Energy 6. The organisms at the top of a food web:**

- A. accumulate all of the energy that existed in the consumed organisms that were lower in the food web.
- B. have less available energy than trophic levels below it.
- C. have the same amount of accumulated energy as each of the trophic levels below it.
- D. have available to it all of the energy of the food web.

**Evolution 10. In an imaginary insect species, the dominant allele G codes for dark green color and the recessive allele g codes for light green color. Suppose a population of these insects moves into a habitat with light-colored leaves, such as a grassland. The lighter insects are better camouflaged and can escape predators. What changes would you expect in subsequent generations?**

- A. No change in frequencies of alleles or phenotypes.
- B. Increase of the recessive allele frequency, but no change of phenotype because that allele is recessive
- C. Increase of the frequency of the dominant allele and the dark color
- D. Increase of the frequency of the recessive allele and light color
- E. Increase of the recessive allele and eventually genetic co-dominance

**Evolution 11. The process of 9. \_\_\_\_\_ generates variation while 11. \_\_\_\_\_ produces adaptation to the environment.**

- A. natural selection
- B. mutation
- C. genetic drift
- D. gene flow

**Evolution 7. Speciation requires \_\_\_\_\_.**

- A. periods of rapid evolutionary change
- B. genetic isolation
- C. long periods of time
- D. geographic isolation

**Evolution 8. If an organism has a greater fitness than other individuals of the same population, then the organism \_\_\_\_\_.**

- A. lives longer than others
- B. competes for resources more successfully than others
- C. mates more frequently than others
- D. utilizes resources more efficiently than others
- E. leaves more offspring than others

**Evolution 9. The process of 9. \_\_\_\_\_ generates variation while 11. \_\_\_\_\_ produces adaptation to the environment.**

- A. natural selection
- B. mutation
- C. genetic drift
- D. gene flow

**Experiments 12. You want to measure the effect of light waves on plant photosynthesis. You design an experiment that exposes corn plants to light at 4 different wavelengths and measure O<sub>2</sub> production as an indication that photosynthesis is occurring. In this experiment**

- A. corn is the dependent variable and wavelength is the independent variable
- B. wavelength is the dependent variable and corn is the independent variable
- C. O<sub>2</sub> is the dependent variable and wavelength is the independent variable
- D. wavelength is the dependent variable and O<sub>2</sub> is the independent variable

**Experiments 13. Which of the statements below best describe the hypothesis being tested in the experiment described above?**

- A. There is a relationship between O<sub>2</sub> production and the variety of corn.
- B. There is a relationship between the growth of corn plants and the amount of O<sub>2</sub> they produce.

- C. There is a relationship between the growth of corn plants and the amount of light to which they are exposed.
- D. There is a relationship between the amount of O<sub>2</sub> produced by corn plants and the wavelength of light to which they are exposed.
- E. There is no relationship between photosynthesis and production of O<sub>2</sub> in corn plants.

**Experiments 14. The role of a control in an experiment is to**

- A. ensure that the experiment is repeatable
- B. identify all factors in the experiment that affect the dependent variable
- C. provide a basis of comparison to the experimental group
- D. evaluate if lab equipment is working correctly in the experiment

**Physiology 15. If the body is too warmd, glands in the skin secrete sweat to cool the body. This is an example of:**

- A. homeostasis using negative feedback
- B. homeostasis using positive feedback
- C. osmoregulation using negative feedback
- D. thermoregulation using positive feedback

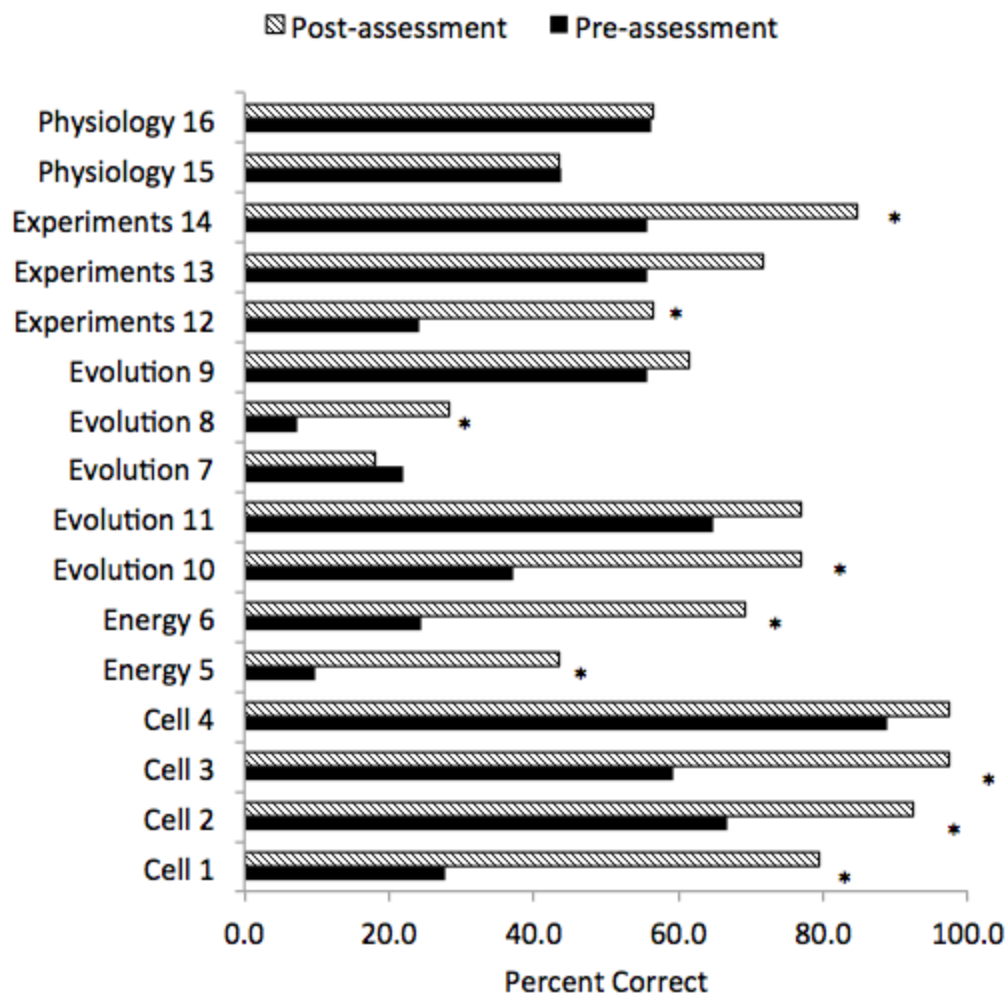
**Physiology 16. Consider the following three species of ectotherms.**

**Species**

	A. <i>Plethodon cinereus</i>	B. <i>Rana catesbiana</i>	C. <i>Thamnophis sirtalis</i>
Surface Area =	16 cm <sup>2</sup>	400 cm <sup>2</sup>	200 cm <sup>2</sup>
Volume =	2 cm <sup>3</sup>	500 cm <sup>3</sup>	50 cm <sup>3</sup>
Surface Area/Volume =	8	0.8	4

**Write the letter (A, B or C on your bubble sheet) of the species that will heat up the fastest if lying in the sun.**





**Figure M-1.** Percent correct on pre- and post-assessment exam by Biology majors (Spring and Fall 2017). Asterisks indicate a statistically significant difference between pre- and post-test proportion correct by Chi-square analysis with Program R (pre-test n = 41-54, post-test n = 39). Only Biology majors taking General Biology for the first time were included in the pre-test data, and transfer students were excluded from this analysis.

In general, pre- and post-test results (Figure M-1 above) supported the findings from our curriculum mapping. Students scored highly in pre- and post-assessment on basic cell and molecular biology content (Cell 2, 3,4). More advanced concepts like “Your bone cells, muscle cells, and skin cells look different because different genes are active in different types of cells” (Cell 1) and explaining the genetic mechanism of natural selection (Evolution 10) showed strong and statistically significant improvement from pre- to post-assessment. Students typically take multiple courses in cell, genetics, and molecular biology throughout the curriculum and are repeatedly exposed to ideas like gene expression and alleles.

While students were generally comfortable defining natural selection and mutation (Evolution 9, 11) on the pre-test and post-test, questions about speciation and fitness (Evolution 7, 8) had low scores on the pre-test and post-test scores were lowest of all the questions. In our curriculum

students may not be exposed to evolutionary processes outside of a few lectures in freshman biology.

Similarly, no significant improvement was found for physiology topics (Physiology 15, 16). Curriculum mapping showed that few physiology courses were available to students outside of the health science concentration.

Students showed significant improvement on questions related to energy transformation (Energy 5, 6), content that is covered in the required 2000 level Ecology course.

Finally, students showed gains in the ability to identify dependent and independent variables in experiments and identify the purpose of control groups (Experiments 12, 14). While this assessment is a first step, one goal of the department is to clarify what skills students really need in Capstone courses/signature experiences, and then devise a means to evaluate whether they are learning those skills.

**Table M-2:** Average coverage\* in Biology courses reported from a faculty survey for skills/competencies listed in the Biology Student Learning Outcomes. Shaded cells with average coverage > 2.

Skills	Problem Solving	Biological Literature and Information Management	Laboratory Safety	Communication	Team
GBI	4	0	3.3	3	2.7
GBII	4	2	2.3	4	3
Genetics	4	3	3	3.5	4.5
Ecology	5	4.5	1.5	4.5	4
AP	0.3	0	2.3	0.67	0.7
Plant Biology	4	3	2	4	2
Biochem 3030	0	0	0	0	1
Evolution	0	4	0	4	2
Molecular Biology	4	4	4	4	4
Immunology	2	4	0	3	4
Animal Behavior	5	4	1	4	4

Cons Bio	2	4	0	4	4
Aging Topics Course	4	4	0	4	4
Neuroscience	0	3	0	2	1
Marine	2	4	0	3	4
Invertebrate Biology	1	2	2	3	4
Animal Physiology	4	2	2	2	2
Methods in Teaching Science	2	1	0	1	2
Practicum Seminar	0	0	0	0	0
Practicum in a Secondary School	2	0	3	5	0
Internship	5	3	3	4	5
Independent Study	5	3.3	2	4	3.3
General Microbiology	3	3	4	3	2

\* Coverage was ranked as: 0 - Not covered, 1 - Several Minutes, 2 - Part of a lecture/lab, 3 - Most of a lecture/lab, 4 - Several lectures/labs, 5 - Several weeks of lecture/lab. Averaged columns with multiple instructors reporting for a course.

## Appendix N: SPECIAL STUDIES 2013-2017

Semester/Year	Full Project Title	Student(s)	Instructor
	<b>RESEARCH PROJECTS</b>		
	<b>INDEPENDENT STUDIES</b>		
<b>BIOLOGY</b>			
Fall 13	Fish Biology and Behavior	Charly Alvarez	Ludlam, John
Spring 13	Effects of a Dam on Stream Habitat Integrity at Wekepeke Brook	Andrew Henderson	Ludlam, John
Spring 13	Studies of Mitochondrial DNA Heteroplasmy in HEP G2 Cells	Alex Munding	Nosek, Michael
Spring 13	The Chemistry of Olfaction	Nicholas Gulbrandsen	Schoenfeld, Thomas
Fall 14	A strategy to examine the function of Dnase II in chicken fibroblast cells	Natalie DiNardo	Krieser, Ronald
Fall 14	The expression of DNase II $\beta$ in chicken DF-1 fibroblast cells	Robert Pijewski	Krieser, Ronald
Fall 14	Evolution of DNase II Gene - Inhibition of DNase IIb Gene in Chicken Phagocytes will cause Engulfed Apoptotic Cell DNA to Persist	David Koch	Krieser, Ronald
Spring 14	Effects of Sudden Environmental Changes on the Herpetological Community of Hudson High School	Cothran, Erin M.	Ludlam, John
Spring 14	Culturing and Maintaining an Immortalized Human Beta Cell Line (EndoC-betaH1)	Kayla Ross	Nosek, Michael
Spring 14	Study of Mitochondrial Function (Respiration) in Effected Fibroblast Cells of a Friedreich's Ataxia Patient	John Brooks	Nosek, Michael
Spring 14	Using DNA Barcoding to supplement a plant survey	Kyle Cormier	Rehrig, Erin
Spring 14	Persistent Neurogenesis in Adult Mouse Olfactory Epithelium	Robert Pijewski	Schoenfeld, Thomas
Fall 15	Distribution of <i>Palaemon macrodactylus</i> and <i>Palaemon elegans</i> along the Massachusetts coastline	Katelyn Wiita	Ludlam, John
Fall 15	Effects of Leaf Litter on Eastern Red-backed Salamander Movement	Ayla Sheridan	Welsh, Daniel
Fall 15, Spring 16	Bacillus Anthracis Genes	Diane Flanagan	Rollins, Sean
Spring 15	Measuring Photosynthesis in plants after insect feeding	Jon Beaulieu,	Rehrig, Erin

		Stephanie Martarano	
Spring 15	Assessing plant growth and non-invasive species in Wikipoke	Renee Pearce	Rehrig, Erin
Spring 15	Development of Olfactory Neurons in Mice	Robert Pijewski	Schoenfeld, Thomas
Spring 15	Lab Animal Welfare	Devon Picard	Schoenfeld, Thomas
Spring 15	Influence of Salinity on Growth Rate of Blacknose Dace ( <i>Rhinichthys atratulus</i> )	Michael Leva	Welsh, Daniel
Summer 15	Changes in stream metabolism in response to upstream reservoirs, nutrients, and light	Eva McCown	Ludlam, John
Summer 15	Changes in stream metabolism in response to upstream reservoirs, nutrients, and light	Brenda Maloughney, Ellen Purington	Ludlam, John
Summer 15	The affect of salinity on the egg hatching of the blacknose dace: <i>Rhinichthys atratulus</i>	Sarah Berlinger (Grad Student)	Welsh, Daniel
Fall 16	Uncovering the Function of DNaseII $\beta$ in DF-1 Chicken Fibroblast Cells	Alexander Steacy	Grimm, Lisa
Fall 16	Measuring Ethylene after herbivory, effects of frass	Mikayla Porter, Diedre Raboin	Rehrig, Erin
Fall 16	IS: Persist Olfactory Neurogen	Innocent Lutaya	Schoenfeld, Thomas
Fall 16	Residual Anal Sheath Length Differences Related to Current and Spawning Habitat	Erica Boucher	Welsh, Daniel
Fall 16	Intra- and Inter-individual differences in fish scale size	Caitlin Barbadoro	Welsh, Daniel
Fall 16	Comparison of fish parasites across populations	Zachary Zoufaly	Welsh, Daniel
Spring 16	Applied Aquatic Biology	Katelyn Wiita, Stacey Mauro	Ludlam, John
Fall 17	Induction and Progression of mtDNA Deletion Mutations in Cultured Cells	Michael McGrath	Nosek, Michael
F16, SP17, F17	Uncharged-tRNA Induced Riboswitches In <i>Bacillus cereus</i> and anthracis	John Sanford	Rollins, Sean
Fall 17	Intra- and Inter-individual differences in fish scale size	Alexandra LaBollita, Olivia Piscitelli	Welsh, Daniel
Spring 17	IS: Fat and SKN-1	Jacquelyn Durkan, Hannah Lombardo	Karagodsky, Natalie

Spring 17	Analysis of Mitochondrial DNA from two closely related species of chipmunk, T. Merriami and T. Obscurus	Matthew Cabral	Nosek, Michael
Spring 17	The Development of Western Blot Analysis for the Detection of Frataxin Proteins in Cultured Cells	Trenton Garlington	Nosek, Michael
Summer 17	Health of the Nashua River	Arianna Nickerson	Welsh, Daniel
<b>CHEMISTRY</b>			
Spring 13	Quantification of artificial dyes in beverages	Theresa Madrigal	Aisling O'Connor
Spring 13	Development of Lab Activities for High School Chemistry Using the Vernier SpectroVis Plus Spectrophotometer	Nicholas Ludden	Aisling O'Connor
Fall 15	Synthesis of unnatural amino acids using Click chemistry	Eric Ouellette	Krishnamurthy, Mathangi
Summer 15	Kinetic Analysis of Aldolase	Alex Serino & Barry Bouchard	Samulak, Billy
Fall 16	Phase Effects on the Nanoparticle Permeation Process	Alexander Steacy	Fiedler, Steven
Fall 16	Synthesis of pyrimidone and thiopyrimidone derivatives by Biginelli reaction	Kara Hudson and Marney Shattuck	Krishnamurthy, Mathangi
Fall 16	Enzymatic Assays of Crosslinked Proteins	Tim Brinkman & Duluc Huynh	Samulak, Billy
Spring 16	Synthesis of thiazole derivatives	John Sanford	Krishnamurthy, Mathangi
Spring 16	Synthesis of imidazole derivatives	Nicole Conley	Krishnamurthy, Mathangi
Fall 17	Analysis of Heavy Metals in Cosmetics	Yanarilista Rosario	Aisling O'Connor
Fall 17	Effects of Ligands on Silver Nanoparticles as Catalysts for Nitrile Hydration	Sarah Laleme	Downs, Emma
Fall 17	Phase Effects III: Ensemble Effects	Reginald Sarpong	Fiedler, Steven
Fall 17	Synthesis of dication DNA intercalators	Georgina Asadu	Krishnamurthy, Mathangi
Fall 17	Chemistry demonstrations and hands-on activities for middle school students	Mariah Irwin	Krishnamurthy, Mathangi
Fall 17	Synthesis of dication DNA intercalators	Islynn Agyepong Boakye	Krishnamurthy, Mathangi

Fall 17	Quantification and Mass Spectrometry Analysis of Crosslinked Proteins	Yelitza Rosario	Samulak, Billy
Spring 17	Study of Silver Nanoparticle Leaching in Commercial Products	Charles Goss	Downs, Emma
Spring 17	Phase Effects II: Dynamical Considerations	Alexander Steacy	Fiedler, Steven
Spring 17	Synthesis of unnatural amino acids with triazole side chains	Kara Hudson	Krishnamurthy, Mathangi
Spring 17	SDS-PAGE Analysis of Crosslinked Proteins	Tim Brinkman	Samulak, Billy
Spring 17	Functional Enzymatic Analysis of Crosslinked Proteins	Mike McGrath	Samulak, Billy
Spring 17	Mass Spectrometry & Crosslinked Aldolase	Blake Phinney	Samulak, Billy
Spring 17	Experiments for 3rd and 4th Graders at McKay Arts Academy	Melanie Bauer	Samulak, Billy
Spring 17	Preparation of Quinoline-heme Adducts	Enrique Coello	Awasabisah, Dennis

### INTRODUCTORY RESEARCH (1 credit each)

<b>BIOLOGY</b>			
Fall 16	Development of Cell Culture Assays for Detecting Apoptosis	Anthony Manganaro	Grimm, Lisa
Fall 16	DNase2 Alpha, an enzyme necessary for survival. Why don't chickens have it,	Kyle Hofer	Krieser, Ronald
Fall 16	The Growth Characteristic of Friedreich's Ataxia Fibroblasts In Glucose vs Galactose Media.	Gabriel Gavrilov	Nosek, Michael
Fall 17	Research in Neurobiology	Ethan Borges	Schoenfeld, Thomas
Fall 17	Variation in fish scale morphology	Gregory Gundberg	Welsh, Daniel
Spring 17	RBL-2H3 Basophilic Leukemia Cells Grown in Culture	Nathan Vitale	Nosek, Michael
Spring 17	Intra- and Inter-individual differences in fish scale size	Kelly Palmer, Arianna Nickerson, Olivia Piscitelli, Alexandra LaBollita	Welsh, Daniel
<b>CHEMISTRY</b>			
Fall 16	Heme and Heme Model Complexes	Wilkerson Pierre	Awasabisah, Dennis
Spring 17	Diffusion of Carbonaceous Particles	Reginald Sarpong	Fiedler, Steven



## INTERNSHIPS

<b>BIOLOGY</b>			
Fall 13	Ranger with the US Army Corps of Engineers, Uxbridge, MA	Shannon Schaeffer	Picone, Christopher
Spring 13	Internship: Water Quality Monitoring	Stephen Miller	Ludlam, John
Spring 13	Internship: Fort Devens	Andrew Henderson	Ludlam, John
Summer 13	Internship: Fort Devens	Charly Alvarez	Ludlam, John
Fall 14	Management of Natural Resources on a Military Base (Fort Devens, MA)	Tanner Bachand	Grimm, Lisa
Spring 14	Pepperell Logging (wetland delineation with plants and soils)	Lana Estes	Picone, Christopher
Spring 14	Afterschool STEM program at Crocker School	Brianna Uga, Natalie Peterson	Rehrig, Erin
Summer 14	Internship: Magic Wings Butterfly Conservatory	Kyle Cormier	Ludlam, John
Spring 15	Supervised student teacher at Leominster High School	Lauryn Larson	Rehrig, Erin
Summer 15	Leominster Conservation Agent and Land Use Office	Marco Bangrazi	Picone, Christopher
Summer 15	Assisting with Veterinary help at Second Chance Animal Shelter	Stacey Mauro	Rehrig, Erin
Fall 16	Medical Assistant at Westborough Pediatrics	Jackie Mellado	Rehrig, Erin
Fall 17	Shadowing a PA at Student Health Services (FSU)	Gisela Yeboah	Samulak, Billy
Spring 17	Herpetological monitoring of Wood Frogs and Garter Snakes at Wachusett State Park	Christine Fanning	Ludlam, John
Spring 17	Animal care at Animal Adventures (Bolton, MA)	Danielle Boisvert	Picone, Christopher
Spring 17	In-school STEM tutor (part of Cleghorn center)	Nicole Conley	Rehrig, Erin
Spring 17	Duschenne Muscular Dystrophy (Solid Biosciences)	Lindsey Hyde	Rollins, Sean
Spring 17	Verification of Botanical Nomenclature	Erica Boucher	Welsh, Daniel
Summer 17	Doctor Directed Visits at VCA Lancaster Animal Hospital	Jessica Galvin	Welsh, Daniel
<b>CHEMISTRY</b>			
Summer 17	Internship in Biomaterials and Engineering, MIT, Cambridge	Mikaela Berthiaume	Govindan, Mel
Summer 17	Internship at New England Peptide (Gardner, MA)	Meghan Umbrello	Samulak, Billy