WASHINGTON COLLEGE

August 8, 2018

Dr James D. Fielder
Secretary of Higher Education
Maryland Higher Education Commission
Nancy S. Grasmick Building, 10th Floor
6 North Liberty Street
Baltimore, MD 21201

Dear Dr Fielder,

For many years, Washington College has had an area of emphasis in biochemistry located in its chemistry and biology programs. Student interest in biochemistry has grown, however, and a degree in biochemistry is becoming a requirement not only for graduate programs in biochemistry but also for many entry- and advanced-level positions in science research.

So, over the course of 2017-18, faculty members from the departments of biology and chemistry have worked to create a freestanding program in biochemistry. I am writing to request approval of this new program in biochemistry and molecular biology at Washington College.

We believe that offering this program will advance the liberal arts mission of the college and help us attract academically talented students. Like all Washington College programs, the biochemistry program will be firmly grounded in the value of liberal learning: analytical thought, clear communication, aesthetic insight, ethical sensitivity and civic responsibility. This program will also contribute to our strategic initiative to advance and enhance interdisciplinary teaching and learning.

The biochemistry and molecular biology program will require already-existing courses in biology, chemistry, physics and mathematics. It will require only one additional course, a senior capstone experience, which existing biology and chemistry faculty have agreed to include in their teaching loads. Having added several incremental faculty lines in both fields in recent years, Washington College is very well-positioned to offer this program with existing resources.

Thank you for your consideration; we look forward to hearing from you soon.

Sincerely,

Patrice DiQuinzio
Provost and Dean of the College

300 WASHINGTON AVENUE, CHESTERTOWN, MARYLAND 21620
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# Cover Sheet for In-State Institutions
## New Program or Substantial Modification to Existing Program

| Institution Submitting Proposal | Washington College |
|---|---|

*Each action below requires a separate proposal and cover sheet.*

- (●) New Academic Program
- ( ) New Area of Concentration
- ( ) New Degree Level Approval
- ( ) New Stand-Alone Certificate
- ( ) Off Campus Program
- ( ) Substantial Change to a Degree Program
- ( ) Substantial Change to an Area of Concentration
- ( ) Substantial Change to a Certificate Program
- ( ) Cooperative Degree Program
- ( ) Offer Program at Regional Higher Education Center

Payment Submitted: (●) Yes ( ) No

Payment Type: ( ) R*STARS (●) Check

Date Submitted: 8/16/2018

| | | |
|---|---|---|
| Department Proposing Program | Biology and Chemistry Department's | |
| Degree Level and Degree Type | Bachelor of Science | |
| Title of Proposed Program | Biochemistry and Molecular Biology | |
| Total Number of Credits | 128 | |
| Suggested Codes | HEGIS: 041400 | CIP: 260210 |
| Program Modality | (●) On-campus ( ) Distance Education (*fully online*) ( ) Both | |
| Program Resources | (●) Using Existing Resources ( ) Requiring New Resources | |
| Projected Implementation Date | (●) Fall ( ) Spring ( ) Summer | Year: 2018 |
| Provide Link to Most Recent Academic Catalog | URL: https://www.washcoll.edu/live/files/8108-2018-2019-catalog | |
| Preferred Contact for this Proposal | Name: Matt Kibler | |
| | Title: Director of Institutional Research and Assessment | |
| | Phone: (410) 778-7862 | |
| | Email: mkibler2@washcoll.edu | |
| President/Chief Executive | Type Name: Kurt M. Landgraf | |
| | Signature: Kurt Landgraf | Date: 8/15/18 |
| | Date of Approval/Endorsement by Governing Board: | 05/18/2018 |

Revised 6/13/18

Proposal for Biochemistry and Molecular Biology Program at Washington College

**A. Centrality to Institutional Mission and Planning Priorities:**

1. *Provide a description of the program, including each area of concentration (if applicable), and how it relates to the institution's approved mission.*

Washington College seeks the creation of a new, interdisciplinary program in Biochemistry and Molecular Biology (BMB) that will advance the liberal arts mission of the college and better meet the needs of our students and prepare them to be scientists in the 21st century. While originally a subfield within biology and chemistry, biochemistry has since grown into a major field in its own right, with a wide range of subdisciplines contained within the heading of biochemistry and molecular biology. The proposed program will build on current strengths within the Biology and Chemistry departments and allow students to gain a broad foundation in concepts and techniques essential for success at the interface between these two disciplines. This new program will support our mission, specifically, developing "habits of analytic thought" and enhancing our "broad curriculum of study."

2. *Explain how the proposed program supports the institution's strategic goals and provide evidence that affirms it is an institutional priority.*

The Biochemistry and Molecular Biology program supports Washington College's Strategic Plan. Washington College wants to be innovative and keep pace with the challenges and changing opportunities in today's world. Specifically, the creation of this program will support Goal 1, Objective D, both listed below for context:

> **GOAL 1: Reaffirm the College's core mission of providing a superior liberal arts education to prepare our students for the challenges of the 21st century.**
>
> > **Objective D:** Expand opportunities for interdisciplinary cooperation to meet emerging student interests.

The new program will be an institutional priority. Faculty and administration both believe in its creation. The addition of a Biochemistry and Molecular Biology program was approved by the faculty in both the Biology and Chemistry Departments, the entire Natural Science Division, the Curriculum Committee, and the full faculty, in that order.

3. *Provide a brief narrative of how the proposed program will be adequately funded for at least the first five years of program implementation. (Additional related information is required in section L.)*

For the foreseeable future the BMB program will require no additional funding outside of our current Biology and Chemistry department budgets. Since this is an interdisciplinary program, it will be supported by both the Biology and Chemistry departments. In the first five years of its implementation we do not expect to need additional resources to support it. We do not expect this program to attract many additional students to Washington College in the short term until it builds a reputation. We believe this program will be an ideal option for students who are already

majoring with a B.S. in Biology while additionally taking a heavy Chemistry course load and receiving no recognition for it, or vice versa.

4. *Provide a description of the institution's a commitment to:*
    a) *ongoing administrative, financial, and technical support of the proposed program*

This is an interdisciplinary program being built out of our already approved Biology and Chemistry programs. These programs already have administrative, financial and technical support. It will require no additional resources because at this time we are not creating new courses and we do not need to hire new faculty. Students will be satisfying the requirements of this program by completing courses that are already offered.

    b) *continuation of the program for a period of time sufficient to allow enrolled students to complete the program.*

If, by chance, we decided to discontinue the program we would allow sufficient time for enrolled students to complete the program with no issues. In this instance it would be easy to satisfy the requirement since there are no courses specific to the proposed program. The courses necessary to complete the BMB program would continue to be offered through both the Biology and Chemistry Departments causing no problems.

**B. Critical and Compelling Regional or Statewide Need as Identified in the State Plan:**

1. *Demonstrate demand and need for the program in terms of meeting present and future needs of the region and the State in general based on one or more of the following:*
    a) *The need for the advancement and evolution of knowledge*

    b) *Societal needs, including expanding educational opportunities and choices for minority and educationally disadvantaged students at institutions of higher education*

    c) *The need to strengthen and expand the capacity of historically black institutions to provide high quality and unique educational programs*

Biochemistry and Molecular Biology is an interdisciplinary field combining biology and chemistry with fundamental concepts learned in both physics and mathematics. While originally a subfield within biology and chemistry, biochemistry has since grown into a major field in its own right, with a wide range of sub disciplines contained within the heading of biochemistry and molecular biology. The proposed program will build on current strengths within the Biology and Chemistry departments and allow students to gain a broad foundation in concepts and techniques essential for success at the interface between these two disciplines. Students completing the BMB program will be prepared for a variety of career opportunities, including biomedical research, a range of health professions, and post-graduate education.

2. *Provide evidence that the perceived need is consistent with the **Maryland State Plan for Postsecondary Education**.*

The Maryland State Plan for Post-secondary Education (2017-2021) has three goals: access, innovation, and student success. We believe the proposed program will improve student success, in particular strategy 6, improving student experience facilitating prompt completion of degree requirements. Since 2001, we have had over 200 students graduate from a combination of chemistry and biology programs, including double majoring or a major and a minor. These various degree paths have shortcomings that range from either not enough chemistry content to not enough biology content. This problem is exacerbated by the fact that each of the current options with biology and chemistry ranges from 64-72 credit hours and requires additional elective coursework to ensure a well-rounded education in biochemistry. By creating a standalone Biochemistry and Molecular Biology program, we are allowing students to complete a more tailored program of study that affords them more flexibility to take advantage of other curricular opportunities at our college, like majors or minors outside of the Natural Science and Mathematics division and study abroad. Students who complete a Biochemistry and Molecular Biology degree will be prepared for a variety of career opportunities, including biomedical research, a range of health professions, and post-graduate education.

**C. Quantifiable and Reliable Evidence and Documentation of Market Supply and Demand in the Region and State**:

1. *Describe potential industry or industries, employment opportunities, and expected level of entry (ex: mid-level management) for graduates of the proposed program.*
2. *Present data and analysis projecting market demand and the availability of openings in a job market to be served by the new program.*
3. *Discuss and provide evidence of market surveys that clearly provide quantifiable and reliable data on the educational and training needs and the anticipated number of vacancies expected over the next 5 years.*

Surveys of our alumni give us encouragement that students who pursue the Biochemistry and Molecular Biology degree will work in the field or continue their education in the field before entering the labor market. Students from our Biology and Chemistry program report that they are working in the industry, attending medical school, and attending graduate school. For example, our double majors in Biology and Chemistry report that 53% have attended graduate school, 26% have attended medical school, 16% work in the industry, and 5% are teachers. Since these are the students who are being targeted for the BMB proposal, we expect similar results.

The table below provides the industries and jobs that students who complete the Biochemistry and Molecular Biology program might pursue. This data comes from the Bureau of Labor Statistics employment projection website. Specifically, this data shows that there will be an 11.5% growth in the number of Biochemistry related jobs between 2016 and 2026. We have identified other fields that students might enter with a BMB degree and each projects job growth over the next ten years. In all cases students would most likely be given entry level positions with the opportunity to advance their careers

with experience. We added an additional column to show the type of education needed for the proposed field as well as median salary. Depending on the field students will need to pursue an advanced degree.

| SOC | Occupation | 2016 | 2026 | Growth | Typical entry-level education | 2017 median annual wage |
|---|---|---|---|---|---|---|
| 19-1021 | Biochemists and biophysicists | 31,500 | 35,100 | 11.50% | Doctoral or professional degree | 91,190 |
| 19-1012 | Food scientists and technologists | 17,000 | 18,000 | 5.70% | Bachelor's degree | 63,660 |
| 19-1042 | Medical scientists | 120,000 | 136,100 | 13.40% | Doctoral or professional degree | 82,090 |
| 19-1022 | Microbiologist | 232,000 | 25,100 | 8.20% | Bachelor's degree | 69,960 |
| 19-1031 | Conservation Scientist | 22,300 | 23,700 | 6.30% | Bachelor's degree | 61,480 |
| 19-4021 | Biological technicians | 82,100 | 90,400 | 10.20% | Bachelor's degree | 43,800 |
| 25-1042 | Biological science teachers | 62,300 | 71,700 | 15.20% | Bachelor's degree | 78,240 |
| 29-2011 | Medical and clinical technologists | 171,400 | 191,200 | 11.50% | Bachelor's degree | N/A |

4. *Provide data showing the current and projected supply of prospective graduates.*

The chart below shows our enrollment in Biology and Chemistry programs over the last five years. Over the past five years, there has been an average 18.6% growth in dual Biology and Chemistry enrollments and consistently about 24% of our Biology and Chemistry students are enrolled in a combination of the two programs.

| | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | Average |
|---|---|---|---|---|---|---|
| **Biology Majors** | 83 | 124 | 115 | 134 | 138 | 119 |
| **Chemistry Majors** | 28 | 30 | 25 | 25 | 26 | 27 |
| **TOTAL** | 111 | 154 | 140 | 159 | 164 | 146 |

| | 2013-14 | 2014-15 | 2015-16 | 2016-17 | 2017-18 | Average |
|---|---|---|---|---|---|---|
| **BIO Major with CHE Minor** | 16 | 28 | 20 | 30 | 33 | 25 |
| **CHE Major with BIO Minor** | 3 | 3 | 2 | 2 | 4 | 3 |
| **BIO&CHE Double Majors** | 6 | 8 | 7 | 6 | 6 | 7 |
| **TOTAL** | 25 | 39 | 29 | 38 | 43 | 35 |

The chart below gives the number of graduates of Biochemistry and Molecular Biology programs in the state over the past five years. We also included the number of graduates of BMB programs at some of our peer schools outside of the state. These numbers confirm our belief that students who are interested in both Biology and Chemistry will be attracted to this new Biochemistry and Molecular Biology program.

| Number of Graduates | 2013 | 2014 | 2015 | 2016 | 2017 | Average |
|---|---|---|---|---|---|---|
| Goucher College | 4 | 3 | 2 | 3 | 7 | 4 |
| Hood College | 4 | 7 | 10 | 7 | 5 | 7 |
| Mount Saint Mary's University | 7 | 4 | 8 | 13 | 12 | 9 |
| St. Mary's College of MD | 17 | 12 | 15 | 9 | 8 | 12 |
| Stevenson University | | 1 | 10 | 17 | 12 | 10 |
| **Peer Institutions** | | | | | | |
| Albion College | 17 | 21 | 12 | 8 | 9 | 13 |
| Allegheny College | 12 | 7 | 10 | 16 | 21 | 13 |
| Juniata College | 3 | 4 | 10 | 16 | 9 | 8 |
| Muhlenberg College | 6 | 11 | 8 | 4 | 10 | 8 |
| Ursinus College | 9 | 16 | 11 | 8 | 12 | 11 |
| Washington & Jefferson College | 4 | 10 | 9 | 10 | 10 | 9 |

**D. Reasonableness of Program Duplication:**

1. *Identify similar programs in the State and/or same geographical area. Discuss similarities and differences between the proposed program and others in the same degree to be awarded.*
2. *Provide justification for the proposed program.*

In addition to the Maryland schools listed in the chart for section C.4., the following colleges have a program similar to the one we are proposing: University of Maryland Eastern Shore, University of Maryland College Park, University of Maryland Baltimore, and Washington Adventist. Salisbury has a minor in Biochemistry but does not have a standalone program.

The Biochemisty and Molecular Biology program that we are proposing is to accommodate current students enrolled at Washington College that are pursuing a combined Biology and Chemistry track. As shown in the previous section, the number of students enrolled on this track has been growing over the past five years. Without a combined program option, it is taking students longer to complete their desired track and it gives them less time to be able to pursue other areas of interest.

While there are other similar programs in the state we do not anticipate our program affecting their programs or enrollment. Again, our program is going to accommodate the students already choosing Washington College. Also, in general, we are enrolling a different group of students than most of the other schools with the similar program listed above.

**E. Relevance to High-demand Programs at Historically Black Institutions (HBIs)**

1. *Discuss the program's potential impact on the implementation or maintenance of high-demand programs at HBI's.*

The addition of this new Biochemistry and Molecular Biology program will have minimal impact on Historically Black Institutions. The closest HBI to Washington College is the University of Maryland, Eastern Shore. In the 2016 – 17 academic year, UMES conferred 684 degrees, only 4 of these degrees were in Biochemistry. This is not a high-demand program at UMES. Also, as stated before, we don't see this program as an avenue for major steps towards enrollment growth. Rather, we see this program as an alternative path for students who are interested in both Biology and Chemistry.

**F. Relevance to the identity of Historically Black Institutions (HBIs)**

1. *Discuss the program's potential impact on the uniqueness and institutional identities and missions of HBIs.*

The Biochemistry and Molecular Biology program, as proposed, is a fairly common program and does not reflect the uniqueness and institutional identities and missions of HBIs. We are not adding content to our curriculum, rather, we are giving students a different path towards completion of a program that combines content from our already approved Biology and Chemistry programs.

**G. Adequacy of Curriculum Design, Program Modality, and Related Learning Outcomes** (as outlined in COMAR 13B.02.03.10):

1. *Describe how the proposed program was established, and also describe the faculty who will oversee the program.*

Over the past five years the number of student's double-majoring in Biology and Chemistry, or receiving a major in one and minor in the other has been increasing. The combined interface of these programs is Biochemistry and Molecular Biology. The downside to students who were following one of the paths described, if they were interested specifically in Biochemistry and Molecular Biology, is that each have their shortcomings that range from either not enough chemistry content to not enough biology content. This problem is exacerbated by the fact that each of the current options within biology and chemistry ranges from 64-72 credit hours and requires additional elective coursework to ensure a well-rounded education in biochemistry. By creating a standalone Biochemistry and Molecular Biology major, we are allowing students to complete a more tailored program of study that affords them more flexibility to take advantage of other curricular opportunities at Washington College, like majors or minors outside of the Natural Science and Mathematics division and study abroad.

The Biochemistry and Molecular Biology program is interdisciplinary and therefore will have leadership from the Biology and Chemistry departments. The chairs from each department, or

their designated substitutes, will oversee all tasks related to the major including assigning advisees, assessment, and SCE advising.

2. *Describe educational objectives and learning outcomes appropriate to the rigor, breadth, and (modality) of the program.*

Students who graduate with a degree in Biochemistry and Molecular Biology will be able to think like a scientist, will have extensive biochemical knowledge, will be well versed in biochemical techniques and technologies, and will be able to communicate to a diverse audience in both written and oral forms. Further discussion of these core areas of assessment is discussed in the sections below.

**Thinking like a Scientist:** Upon completion of a major in Biochemistry and Molecular Biology, students will be able to tackle biochemical problems in a scientific manner using observations, well-thought hypotheses, predictions, and sound experimental design. Additionally, students will be able to read and critically evaluate the scientific literature.

- Explain the importance of the scientific method to understanding natural phenomena.
- Critically evaluate experimental data and primary papers, develop a hypothesis, and design experiments to address an interesting and novel problem.
- Demonstrate an awareness of ethical issues in the molecular life sciences.
- Demonstrate the ability to think in an integrated manner and look at problems from different perspectives.

**Biochemical Knowledge:** Upon completion of a major in Biochemistry and Molecular Biology, students will have knowledge of the core concepts that pertain to the field of Biochemistry which can be applied to their careers and/or graduate studies.

- Articulate the Central Dogma of Biochemistry, including the biology and chemistry roles of DNA, RNA, and proteins.
- Describe relationships between structure and function for the four classes of macromolecules (nucleic acids, proteins, carbohydrates, and lipids).
- Analyze bioinformatics data (e.g., sequence homology) and use it to predict function in the context of evolution.
- Use chemical and biological principles to describe reactions and interactions of biomolecules and interpret experimental data on biomolecules using knowledge of chemical structure and function.
- Integrate chemical and biological perspectives to identify, describe and evaluate metabolic themes and strategies, including the dynamic roles of significant small molecules (e.g. ATP, NADH) and the interactions of macromolecules.

**Biochemical Techniques and Technology:** Upon completion of a major in Biochemistry and Molecular Biology, students will have the ability to perform laboratory techniques used in Biochemistry and Molecular Biology.

- Understand and apply the theory underlying essential biochemistry and molecular biology techniques.
- Propose wet-lab experiments and *in-silico* investigations to answer questions and solve problems.
- Capably work in a biochemistry laboratory, carrying out methods, using instrumentation, and documenting work appropriately.

**Oral and Written Communication:** Upon completion of a major in Biochemistry and Molecular Biology, students will be able to communicate, both orally and in written form, in a scientific manner. Students will also be able to explain complex biochemical and molecular biological concepts to scientists and nonscientists.

- Communicate science in writing and orally for both expert and non-expert audiences.
- Work collaboratively in and outside the class setting.

*3. Explain how the institution will:*
   *a) provide for assessment of student achievement of learning outcomes in the program*
   *b) document student achievement of learning outcomes in the program*

Student learning outcomes will be assessed through two processes. Our Student Learning Outcomes Assessment process is conducted annually by every department. In addition, we have a procedure for assessing learning outcomes for our general education requirements. Departments and coordinators for the general education learning outcomes must document the assessments and submit them to the Assessment Committee. These reports are then delivered to necessary stakeholders and archived on the Institutional Research website for internal purposes and future accreditation requirements.

*4. Provide a list of courses with title, semester credit hours and course descriptions, along with a description of program requirements*

The Biochemistry and Molecular Biology program requires students to complete both the institutions distribution requirements as well as the program specific requirements. A description of the Washington College distribution requirements are attached as Appendix A. The course catalog entry for the BMB program is attached as Appendix B. It details the specific requirements of the program. Detailed course descriptions for each of the courses within the program are listed in Appendix C.

A list of courses from the Biology and Chemistry Departments that make up the proposed program with their course number, title, and semester credit hours is included here for quick reference (full course descriptions are in Appendix C):

| Course Number | Course Name | Credits |
|---|---|---|
| BIO 111 | General Biology I w/Lab | 4 |
| BIO 112 | General Biology II w/Lab | 4 |
| BIO 305 | Genetics | 4 |
| BIO 409 | Biochemistry | 4 |
| CHE 120 | Chemical Principles of Organic Molecules | 4 |
| CHE 140 | Reactivity of Organic Molecules w/Lab | 4 |
| CHE 220 | Quantitative Chemical Analysis w/Lab | 4 |
| CHE 303 | Chemistry of Biological Compounds w/Lab | 4 |
| CHE 305 | Chemical Thermodynamics & Kinetics w/Lab | 4 |
| CHE 306 | Quantum Chemistry & Spectroscopy w/Lab | 4 |
| BIO 392 | Biology Junior Seminar | 0 |
| CHE 492 | Chemistry Senior Seminar | 2 |

*Please note that students must also take two Biology electives from the 200-400 level and one Chemistry elective from the 200-400 level. More details about the courses available are listed with the catalog entry in Appendix B.

5. *Discuss how general education requirements will be met, if applicable.*

This will be an interdisciplinary program built from courses in the Biology and Chemistry Departments. There will be no specific BMB courses which means that the program itself will not offer an option for students outside of the program to satisfy a piece of Washington College's general education requirement.

Students within the BMB program will have the same General Education requirements as all other programs. As stated in the College Catalog, Washington College's liberal arts and sciences commitment means that students explore many areas of interest and develop the capacity to reason, to appreciate literature and the arts, and to make the connection between courses of study and their implications in society. To ensure this broad intellectual foundation, Washington College has established a set of guidelines concerning its General Education, which include:

- a required first-year seminar course called the Global Perspectives Seminar (GRW 101)

• a Writing Program containing four requirements (known as W1-W4) that move from the first year through the senior capstone experience
• the Foreign Language requirement (0 – 2 courses depending on incoming proficiency level)
• three courses distributed between the Nature Sciences and a Quantitative skills course, to include at least one laboratory course and at least one Quantitative course
• three courses in the Humanities and Fine Arts, including at least one course from each
• three courses in the Social Sciences including courses from two different departments

The first- and second-year general education requirements are designed to introduce students to an intellectual community and give them the basis to declare a major that focuses on one or more disciplines.

6. *Identify any specialized accreditation or graduate certification requirements for this program and its students.*

Not Applicable

7. *If contracting with another institution or non-collegiate organization, provide a copy of the written contract.*

Not Applicable

8. *Provide assurance and any appropriate evidence that the proposed program will provide students with clear, complete, and timely information on the curriculum, course and degree requirements,nature of faculty/student interaction, assumptions about technology competence and skills,technical equipment requirements, learning management system, availability of academic supportservices and financial aid resources, and costs and payment policies.*

The catalog entry for the proposed Biochemistry and Molecular Biology program is attached as Appendix B. It is made available on the Washington College website at www.washcoll.edu. The catalog gives students clear and complete details about the requirements of the BMB program. Course descriptions include prerequisites. Faculty regularly provide students information about the learning management system and academic support services in their syllabi. In addition, both of our instructional technologists, who are responsible for our LMS, and staff in our academic support areas regularly communicate with students to inform them of the services their offices provide. Financial aid and cost resources are made available to students on the financial aid section of our website and business office section of our website. In addition, students are able to be in touch directly with these offices in person, by phone, or by email whenever they have questions.

*9. Provide assurance and any appropriate evidence that advertising, recruiting, and admissions materials will clearly and accuratelyrepresent the proposed program and the services available.*

Our Enrollment Management team works directly with faculty when they are putting together advertising and/or admissions materials to be sure that information is clear and accurate. The Biochemistry and Molecular Biology website will also be a major resource for students. At Washington College, all websites are maintained by the individual departments. This helps to ensure that content is accurate and relevant for anyone who visits the site.

**H. Adequacy of Articulation**

1. *If applicable, discuss how the program supports articulation with programs at partner institutions. Provide all relevant articulation agreements.*

Not Applicable

**I. Adequacy of Faculty Resources** (as outlined in COMAR 13B.02.03.11).

1. *Provide a brief narrative demonstrating the quality of program faculty. Include a summary list of faculty with appointment type, terminal degree title and field, academic title/rank, status (full-time, part-time, adjunct) and the course(s) each faulty member will teach (in this program).*

The faculty teaching courses in the Biochemistry and Molecular Biology program are primarily tenured and tenure track faculty from the Biology and Chemistry departments. The proposed program will not require us to make any changes to the makeup in the staffing of either the Biology or Chemistry departments. The faculty members bring diverse training to these courses to provide our students with different perspectives on the topics being discussed. For example, Dr. Mindy Reynolds has been a member of the American Society of Biochemistry and Molecular Biology for 12 years. In 2015 Professor Reynolds was awarded the Society of Toxicology Undergraduate Educators Award. Currently, the Chemistry department has a tenured biophysical chemist, Dr. James Lipchock, who will teach three courses required for the proposed BMB major, as well as one in-depth elective course in Biophysical Methods. The department's organic chemists, Dr. Aaron Amick (tenured) and Dr. Anna Smith (visiting assistant professor), will be contributing two required introductory courses as well as two elective courses titled Organic Mechanisms and Synthesis and Introduction to Medicinal Chemistry to the proposed BMB major. The Chemistry department will be hiring a tenure-track assistant professor in bioorganic chemistry in the 2019-2020 academic year who is slotted to contribute additional in-depth electives to the proposed BMB major. Additionally, Dr. Lipchock and Dr. Amick have vibrant research programs in biophysical chemistry and physical organic chemistry that have published numerous peer-reviewed publications with undergraduate co-authors and have a variety of interests that align with the learning goals of the proposed BMB major.

A summary of the courses our faculty will teach is in the table on the next page.

| Faculty Name | Degree | Title & Rank | Status | Courses |
|---|---|---|---|---|
| Martin Connaughton | PhD | Co-Chair and Associate Professor of Biology, Tenured | Full-time | BIO 112, BIO 392 |
| Mindy Reynolds | PhD | Chair and Associate Professor of Biology, Tenured | Full-time | BIO 111, BIO 409, BIO 205, BIO 392 |
| Kathleen Verville | PhD | Associate Professor of Biology, Chair of the Premedical Committee, Tenured | Full-time | BIO 111, BIO 203, BIO 392 |
| Aaron Krochmal | PhD | Associate Professor of Biology, Tenured | Full-time | BIO 111, BIO 112, BIO 392 |
| Jennie Carr | PhD | Assistant Professor of Biology, Tenure Track | Full-time | BIO 112, BIO 392 |
| Robin Van Meter | PhD | Assistant Professor of Environmental Science/Studies and Biology, Tenure Track | Full-time | BIO 112, BIO 392 |
| Jim Windelborn | PhD | Assistant Professor of Biology, Tenure Track | Full-time | BIO 111, BIO 112, BIO 392 |
| Mala Misra | PhD | Assistant Professor of Biology, Tenure Track | Full-time | BIO 111, BIO 302, BIO 392 |
| Jennifer Wanat | PhD | Assistant Professor of Biology, Tenure Track | Full-time | BIO 111, BIO 209, BIO 207, BIO 392 |
| Aaron Amick | PhD | Associate Professor of Chemistry and Department Chair, Tenured | Full-time | CHE 120, CHE140, CHE 320, CHE 340, CHE 492 |
| Anne Marteel-Parrish | PhD | Professor of Chemistry, Co-Chair of the Chemistry Department, Creegan Chair in Green Chemistry, Tenured | Full-time | CHE 120, CHE 492 |
| Dana Chatellier | MA | Laboratory Instructor | Part-time | CHE 120 |
| James Lipchock | PhD | Assistant Professor of Chemistry, Tenure Track | Full-time | CHE 120, CHE 220, CHE 303, CHE 405, CHE 492 |
| Rick Locker | PhD | Clarence C. White Associate Professor of Chemistry, Tenured | Full-time | CHE 220, CHE 305, CHE 306, CHE 492 |
| Betsy Moyer Taylor | MA | Lecturer in Chemistry | Full-time | CHE 120, CHE 140, CHE 220, |
| Leslie Sherman | PhD | Co-Chair of the Environmental Science and Studies Department; W. Alton, Jones Associate Professor of Chemistry, Tenured | Full-time | CHE 220, CHE 492 |
| Anna J. Smith | PhD | Visiting Assistant Professor of Chemistry | Full-time | CHE 120, CHE 140 |

2. *Demonstrate how the institution will provide ongoing pedagogy training for faculty in evidenced-based best practices, including training in:*

    a) *Pedagogy that meets the needs of the students*

Currently, faculty members have access to a variety of professional development and pedagogical training opportunities at Washington College. All faculty members are eligible for annual conference travel funds. In recent years the chemistry department faculty have attended the following conferences that are related to the proposed Biochemistry and Molecular Biology (BMB) major: Gordon Research Conference on Physical Organic Chemistry, Annual Experimental NMR Conference, Annual Protein Society Symposium, and the Middle Atlantic Association of Liberal Arts Chemistry Teachers. Faculty also have access to the Washington College Center for Teaching and Learning that offers a wide variety of programming on pedagogical development as well as Faculty Enhancement Funds that are used to further the scholarly pursuits of faculty members. Faculty also have access to a wide variety of chemical and biochemical journals supplied through the American Chemical Society and faculty can also acquire needed journal articles through interlibrary loan.

    b) *The learning management system*

Washington College has two full-time Instructional Technologists that are responsible for management of Canvas, our learning management system. They hold workshops throughout the year for faculty to provide training on the new features that are available as well as provide refreshers on commonly used pieces. Additionally, during new faculty orientation, faculty members are introduced to the Instructional Technologists and the services they provide. The Instructional Technologists are available throughout the year to meet with faculty about how best to incorporate the learning management system into their courses.

    c) *Evidenced-based best practices for distance education, if distance education is offered.*

We do not offer any distance education courses.

**J. Adequacy of Library Resources** (as outlined in COMAR 13B.02.03.12)**.**

1. *Describe the library resources available and/or the measures to be taken to ensure resources are adequate to support the proposed program.* ***If the program is to be implemented within existing institutional resources****, include a supportive statement by the President for library resources to meet the program's needs.*

This program will be implemented using existing institutional resources. A statement of support from our President, Kurt Landgraf, addressing both this piece of the proposal and section K.1. is included in our submission application after the appendices.

**K. Adequacy of Physical Facilities, Infrastructure and Instructional Equipment** (as outlined in COMAR 13B.02.03.13)

1. *Provide an assurance that physical facilities, infrastructure and instruction equipment are adequate to initiate the program, particularly as related to spaces for classrooms, staff and faculty offices, and laboratories for studies in the technologies and sciences. If the program is to be implemented within existing institutional resources, include a supportive statement by the President for adequate equipment and facilities to meet the program's needs.*

This program will be implemented using existing institutional resources. A statement of support from our President, Kurt Landgraf, addressing both this piece of the proposal and section J.1. is included in our submission application after the appendices.

2. *Provide assurance and any appropriate evidence that the institution will ensure students enrolled in and faculty teaching in distance education will have adequate access to:*

   a) *An institutional electronic mailing system, and*
   b) *A learning management system that provides the necessary technological support for distance education*

Not applicable

**L. Adequacy of Financial Resources with Documentation** (as outlined in COMAR 13B.02.03.14)

1. *Complete **Table 1: Resources and Narrative Rationale**. Provide finance data for the first five years of program implementation. Enter figures into each cell and provide a total for each year. Also provide a narrative rationale for each resource category. If resources have been or will be reallocated to support the proposed program, briefly discuss the sources of those funds.*

The table on the next page represents the combined resources of both the Biology and Chemistry departments. As stated throughout this proposal, the Biochemistry and Molecular Biology program is being built out of two well established programs. The BMB program will not receive its own resources so portraying the resources available in this way is the best way to estimate. In putting this proposal together we assume that a modest increase in tuition of 2% over the next five years will be the reason for the availability of additional resources. The number of F/T students was estimated using the five year average number of majors in the Biology and Chemistry departments.

| TABLE 1: RESOURCES: | | | | | |
|---|---|---|---|---|---|
| **Resources Categories** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| 1. Reallocated Funds | 0 | 0 | 0 | 0 | 0 |
| 2. Tuition/Fee Revenue (c + g below) | $ 7,938,624 | $ 8,097,265 | $ 8,259,366 | $ 8,424,581 | $ 8,593,083 |
| a. Number of F/t Students | 173 | 173 | 173 | 173 | 173 |
| b. Annual Tuition/Fee Rate | $ 45,888 | $ 46,805 | $ 47,742 | $ 48,697 | $ 49,671 |
| c. Ttal F/T Revenue (a x b) | $ 7,938,624 | $ 8,097,265 | $ 8,259,366 | $ 8,424,581 | $ 8,593,083 |
| d. Number of P/T Students | 0 | 0 | 0 | 0 | 0 |
| e. Credit Hour Rate | - | - | - | - | - |
| f. Annual Credit Hour Rate | - | - | - | - | - |
| g. Total P/T Revenue (d x e x f) | - | - | - | - | - |
| 3. Grants, contracts, & Other | 0 | 0 | 0 | 0 | 0 |
| 4. Other Sources | 0 | 0 | 0 | 0 | 0 |
| Total (Add 1-4) | $ 7,938,624 | $ 8,097,265 | $ 8,259,366 | $ 8,424,581 | $ 8,593,083 |

2. *Complete **Table 2: Program Expenditures and Narrative Rationale**. Provide finance data for the first five years of program implementation. Enter figures into each cell and provide a total for each year.*

Program expenditures were built combining the budgets of both the Biology and Chemistry departments. Again, the Biochemistry and Molecular Biology program is being built out of the Biology and Chemistry program. At this time, and for the foreseeable future, BMB will not have its own budget. Combining expenditures is the best way to estimate the expenses. There will be no changes in the number of faculty in the departments or changes in the types of expenses incurred by either department as a result of the Biochemistry and Molecular Biology program. A modest increase of 2% per year for employee compensation and no increase in related departmental expenses is projected for budgetary planning. The proposed program will have no additional impact on the budget.

| TABLE 2: EXPENDITURES: | | | | | |
|---|---|---|---|---|---|
| **Expenditure Categories** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| 1. Faculty (b + c below) | $ 1,558,145 | $ 1,589,308 | $ 1,621,094 | $ 1,653,516 | $ 1,686,586 |
| a. #FTE | 17 | 17 | 17 | 17 | 17 |
| b. Total Salary | $ 1,246,516 | $ 1,271,446 | $ 1,296,875 | $ 1,322,813 | $ 1,349,269 |
| c. Total Benefits | $ 311,629 | $ 317,862 | $ 324,219 | $ 330,703 | $ 337,317 |
| 2. Admin. Staff (b + c below) | $ 18,750 | $ 19,125 | $ 19,508 | $ 19,898 | $ 20,296 |
| a. #FTE | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| b. Total Salary | $ 15,000 | $ 15,300 | $ 15,606 | $ 15,918 | $ 16,236 |
| c. Total Benefits | $ 3,750 | $ 3,825 | $ 3,902 | $ 3,980 | $ 4,059 |
| 3. Support Staff (b + c below) | $ 31,250 | $ 31,875 | $ 32,513 | $ 33,163 | $ 33,826 |
| a. #FTE | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| b. Total Salary | $ 25,000 | $ 25,500 | $ 26,010 | $ 26,530 | $ 27,061 |
| c. Total Benefits | $ 6,250 | $ 6,375 | $ 6,503 | $ 6,633 | $ 6,765 |
| 4. Equipment | $ 82,500 | $ 82,500 | $ 82,500 | $ 82,500 | $ 82,500 |
| 5. Library | $ 5,850 | $ 5,850 | $ 5,850 | $ 5,850 | $ 5,850 |
| 6. New or Renovated Space | $ 0 | $ 0 | $ 0 | $ 0 | $ 0 |
| 7. Other Expenses | $ 107,244 | $ 107,244 | $ 107,244 | $ 107,244 | $ 107,244 |
| TOTAl (Add 1-7) | $ 1,803,739 | $ 1,835,902 | $ 1,868,708 | $ 1,902,170 | $ 1,936,302 |

**M. Adequacy of Provisions for Evaluation of Program** (as outlined in COMAR 13B.02.03.15).

1. *Discuss procedures for evaluating courses, faculty and student learning outcomes.*
2. *Explain how the institution will evaluate the proposed program's educational effectiveness, including assessments of student learning outcomes, student retention, student and faculty satisfaction, and cost-effectiveness.*

The Biochemistry and Molecular Biology program will be subject to the same requirements for assessment and evaluation as existing programs. All Washington College students complete course evaluations at the end of each of their courses. The results of these evaluations are delivered to department chairs and the Dean and Provost of the College for use in tenure and promotion decision making.

Washington College has worked hard to ensure that the assessment activities we pursue are actually meaningful and help us improve the teaching and learning priorities that we identify as being most important. We have established a regular practice of assessment that is manageable and sustainable. Every year each department completes a Student Learning Outcomes Assessment (SLOA) report that outlines measurable objectives, describes how assessment data are captured, and presents student learning outcomes data. It also summarizes changes that the departments have made in response to previous assessment. In addition, every three years, each department submits Department Program Assessment and Planning (DPAP) reports in which

they reflect on the programmatic strengths and challenges of the previous three years and set a plan for moving forward. While SLOA reports focus on student learning outcomes, DPAP reports provide an opportunity to focus on issues other than student learning outcomes, such as enrollment growth, changes in the field, and strategic academic priorities.

**N. Consistency with the State's Minority Student Achievement Goals** (as outlined in COMAR13B.02.03.05).

1. *Discuss how the proposed program addresses minority student access & success, and the institution's cultural diversity goals and initiatives.*

The recruitment and retention of minority students is a priority for Washington College. In fall 2015, 12.8% of undergraduates were minority students and 5.2% African American. The good news for the College is that the diversity of incoming classes has been steadily increasing, even exceeding 20% for first-time, full-time students in fall 2016.

**O. Relationship to Low Productivity Programs Identified by the Commission:**

1. *If the proposed program is directly related to an identified low productivity program, discuss how the fiscal resources (including faculty, administration, library resources and general operating expenses) may be redistributed to this program.*

Not applicable

**P. Adequacy of Distance Education Programs** (as outlined in COMAR 13B.02.03.22)

1. *Provide affirmation and any appropriate evidence that the institution is eligible to provide Distance Education.*

Not applicable

2. *Provide assurance and any appropriate evidence that the institution complies with the C-RAC guidelines, particularly as it relates to the proposed program.*

Not applicable

## Appendix A: Distribution Requirements

Students are required to complete courses from the four categories listed below, unless a waiver is granted on the basis of Advanced Standing credits (AP, CIE, CLEP, or IB) or Transfer Credit equivalency. Other than the Natural Science component, combining courses from two departments to satisfy part of a distribution requirement is not allowed without permission from the chairs of the two departments involved. This permission must be obtained by the student and submitted in writing to the Associate Provost for Academic Services before the student takes the second of the two courses. Students may not use a single course to satisfy more than one distribution requirement simultaneously. However, courses offered to satisfy distribution requirements may also count toward any number of major or minor requirements.

I. Foreign Language Requirement – Students must complete one or two courses in a foreign language depending on their placement level.
II. Natural Science and Quantitative Requirement – Students must complete three courses, with at least one satisfying the Natural Science component and another satisfying the Quantitative component. The third course is the student's option but must follow a set of pairing rules. Generally, this means students take the second course in the sequence of either their Natural Science or Quantitative component choice. A complete description of this requirement is included in Appendix E.
III. Humanities and Fine Arts Requirement – Students must complete three courses, with at least one satisfying the Humanities component and another satisfying the Fine Arts component. The third course is the student's option but must follow a set of pairing rules. Generally, this means students take the second course in the sequence of either their Humanities or Fine Arts component choice.
IV. Social Science Requirement – Students must complete three courses, with at least two from the same department.

# Biochemistry and Molecular Biology

**Division of Natural Sciences and Mathematics**

**Biology Faculty Members**
Mindy Reynolds, Biology Chair
Martin Connaughton, Biology Associate Chair
Jennie Carr
Aaron Krochmal
Mala Misra
Robin Van Meter
Kathleen Verville
Jennifer Wanat
James Windelborn

**Chemistry Faculty Members**
Aaron Amick, Chemistry Chair
James Lipchock
Rick Locker
Anne Marteel-Parrish
Leslie Sherman
Anna Smith

The biochemistry and molecular biology (BMB) major is a rigorous interdisciplinary program that allows students to gain a broad foundation in concepts and techniques essential for success at the interface between biology and chemistry. Students completing the BMB major will be prepared for a variety of career opportunities, including biomedical research, a range of health professions, and post-graduate education. This program is jointly administered by representatives of the Biology and Chemistry Departments.

## REQUIREMENTS FOR THE BIOCHEMISTRY AND MOLECULAR BIOLOGY MAJOR

The BMB major requires six courses in biology, six courses in chemistry, the General or College Physics sequence, Differential and Integral Calculus, and a BMB Senior Capstone Experience for a total of 70 credits.

| Course Code | Course Name | Credits |
|---|---|---|
| BIO 111 | General Biology I w/Lab | 4 |
| BIO 112 | General Biology II w/Lab | 4 |
| BIO 209 | Genetics w/ Lab | 4 |
| BIO 409 | Biochemistry | 4 |

| | | |
|---|---|---|
| BIO 200-400 | 2 BIO electives from Category II. At least one of these must be at the 300-level or above.<br><br>BIO 310 Microbial Ecology and BIO 350 Toxicology many not be counted as an elective course. | 8 |
| CHE 120 | Chemical Principles of Organic Molecules w/Lab | 4 |
| CHE 140 | Reactions of Organic Molecules w/Lab | 4 |
| CHE 220 | Quantitative Chemical Analysis w/Lab | 4 |
| CHE 303 | Chemistry of Biological Compounds w/Lab | 4 |
| CHE 305 **OR** CHE 306 | Chemical Thermodynamics & Kinetics w/Lab **OR**<br><br>Quantum Chemistry & Spectroscopy w/Lab | 4 |
| CHE 200-400 | CHE elective at the 200-level or above from the list below:<br><br>CHE 320 Intro Medicinal Chemistry, CHE 340 Organic Mechanisms and Synthesis w/Lab, CHE 405 Biophysical Methods, or other approved Special Topics course. | 4 |
| BIO 392 | Biology Junior Seminar | 0 |
| CHE 492 | Chemistry Senior Seminar | 2 |
| BMB SCE | Senior Capstone Experience | 4 |
| PHY 111/101 | General or College Physics I w/Lab | 4 |
| PHY 112/102 | General or College Physics II w/Lab | 4 |
| MAT 201 | Differential Calculus | 4 |
| MAT 202 | Integral Calculus | 4 |
| | **Total Credits:** | **70** |

Based on the above academic requirements, below is a typical plan of study for students wishing to complete the BMB major in four years. Given the flexibility in the proposed curriculum, this plan can be condensed to three years to accommodate students who begin the major late, desire to graduate in three years or choose to study abroad.

| Year | Fall Semester | Spring Semester |
|---|---|---|
| First | General Biology I<br>Chemical Principles of Organic Molecules<br>First-Year Seminar<br>Distribution | General Biology II<br>Reactions of Organic Molecules<br>Distribution<br>Distribution |
| Sophomore | BIO Elective from Category II<br>Quantitative Chemical Analysis<br>Differential Calculus<br>Distribution | Chemistry of Biological Compounds<br>Integral Calculus<br>Distribution<br>Distribution |
| Junior | Biochemistry<br>General or College Physics I<br>Distribution<br>Elective | Genetics<br>General or College Physics II<br>Distribution<br>Elective<br>Biology Junior Seminar (0 credits) |
| Senior | BIO Elective from Category II<br>CHE 305 OR CHE Elective<br>Chemistry Senior Seminar (2 credits)<br>Elective<br>Elective | CHE 306 OR CHE Elective Senior Capstone Experience Elective<br>Elective |

**Majoring or Minoring in Biology and Chemistry**
Due to the interdisciplinary nature of the biochemistry and molecular biology major, students who major in BMB cannot double major or minor in chemistry or biology.

**Seminar Requirements**
All junior BMB majors will participate in BIO 392 Biology Junior Seminar which focuses on searching the biological literature, reading of primary literature, and preparing students to be engaged in the Senior Capstone Experience. All senior BMB majors will participate in CHE 492 Chemistry Senior Seminar which focuses on (1) understanding contemporary moral/societal issues in chemistry with an emphasis on sustainability science literacy, and (2) introducing grant writing and the principles of an effective research proposal with the presentation of an integrative research proposal being the culmination of seminar. Therefore, at the end of this course, the following "4 Cs" will have been practiced and mastered: Critical thinking and problem solving, Communication, Collaboration, and Creativity and innovation.

**Senior Capstone Experience**
For the senior capstone experience, students will either be advised by a Biology or Chemistry faculty member. Students will be able to choose from two different options to complete the SCE which includes an experimental project or a written monograph on a

topic of their choosing. Senior capstone students will be assigned to a faculty advisor by the Co-Program Chairs in consultation with program faculty. Seniors present the results of their project in a poster session that is open to the College community. The program has a set of Senior Capstone Experience Guidelines that are distributed to both junior and senior BMB majors each Fall. Students must enroll in BMB SCE in their final semester to obtain credit for the Senior Capstone Experience. The Senior Capstone Experience is graded according to the Washington College grading system, which involves the use of letter grades (A-F).

**Internship and Research Opportunities**
BMB majors are strongly encouraged to participate in internships during their undergraduate education. These experiences afford students the opportunity to enhance their understanding of biochemical concepts, gain additional laboratory experience, and/or network with other scientists and professionals. Internships may be located on or off-campus and may occur at any point during the academic year. Students wishing to earn course credit for an internship must gain approval from the BMB program chairs prior to beginning the internship.

A number of stipend-bearing internships and research opportunities exist for BMB majors. Summer on-campus research projects as well as summer and semester-long off-campus internships not only provide additional laboratory experience, but also allow students the opportunity to explore, in depth, areas of biochemistry and molecular biology not covered in the core curriculum. Off-campus and on-campus internships may or may not bear credit.

**Distribution Courses**
Students are instructed to consult section of the catalog on Distribution Requirements to see what courses count for distribution.

**Advanced Placement Credit**
Students are instructed to consult either the Biology or Chemistry Department catalog section to determine the policy on Advanced Placement or IB credit.

**Transfer Credit**
Students are instructed to consult either the Biology or Chemistry Department catalog section to determine the policy on transfer credit.

**NOTE ABOUT PREREQUISITES**
To enroll in any course, a student must complete and successfully pass all prerequisites that are required.

**Course Descriptions**
Descriptions of the courses required for the BMB major can be found under the biology or chemistry department catalog sections titled course description.

The following are a list of the courses, with descriptions, within the Biology and Chemistry programs. Not all of these courses are required as part of the proposed Biochemistry and Molecular Biology program but they could be used as an elective.

## BIOLOGY COURSES

**111, 112. General Biology with laboratory**
This course provides an introduction to living systems. Topics studied include biomolecules, cell structure and function, metabolism, genetics and molecular biology (111) and diversity of life, physiology of plants and animals, evolution, and ecology (112). The laboratory complements the lecture and also provides an introduction to experimentation and communication of experimental results. These courses are designed for students with a strong interest in the biological sciences and are prerequisites for upper-level biology courses. An honors section of BIO 111 and of BIO 112 is offered. Biology 111 or permission of instructor is required for Biology 112.

**203. Microbiology with laboratory**
A study of microorganisms (viruses, bacteria, fungi, and protists). Topics include microbial physiology, metabolism, growth, and genetics; infectious diseases; interaction of the microbe and host; and environmental microbiology. The laboratory portion of the course emphasizes staining techniques; culture methods; environmental, food, and medical microbiology; identification of unknown bacteria; and an independent research project.
*Prerequisite: Biology 111-112.*

**205. Cell Biology with laboratory**
An examination of the structure and function of cells. Topics covered will include the various chemical components and physical factors which contribute to cell structure and function. Lectures will also include surveys of cellular diversity and subcellular organization, including organelles, membranes, and the cytoskeleton. The laboratory explores these components using microscopy, tissue culture, and molecular techniques. Biology 205 provides a broad foundation for subsequent cellular, molecular, biochemical and genetics courses.
*Prerequisite: Biology 111-112.*

**206. Ecology with laboratory**
A study of the fundamentals of ecology. Topics include the relationship between organisms and their physical environments; population growth, regulation, and interactions; the nature and diversity of biological communities; and ecosystem structure and function. Approximately half of the weekly laboratories will involve off-campus field trips for the collection of data from various ecosystems, while the remaining half will involve processing of collected data.
*Prerequisite: Biology 111-112.*

**BIO 208. General Zoology with laboratory**
General Zoology topics range from taxonomy and systematics to the basic patterns of form and function that characterize the major groups of animals. Lecture and laboratory work will include functional morphology, reproduction, development, evolution, and

ecology from simple protozoans through complex vertebrate taxa. Emphasis will be on the diverse adaptations of animals to the aquatic and terrestrial habitats in which they live.
*Prerequisite: Biology 111-112.*

**209. Genetics with laboratory**
A study of heredity in cells, individuals, and populations, and of the molecular expression of genes. The course emphasizes genetic analysis in both lab and lecture. Topics in the laboratory include experiments in transmission, population, cellular, and molecular genetics using a variety of organisms as models.
*Prerequisite: Biology 111-112*

**210. Community Ecology of Coastal Maine**
This summer course focuses on the biological communities of coastal Maine as represented by the communities within Acadia National Park on Mount Desert Island, ME. Students visit and characterize many of the diverse forest and marine communities represented on the island. The course begins with a consideration of the geological, oceanographic and climatic features of coastal Maine. Other topics considered in lecture and through data collection and observation in the field include succession, disturbance, species diversity, vertical and horizontal community structure, physical and biological stresses on communities, bottom-up and top-down regulation of community structure, and competitive and positive interactions among species.
*Prerequisite: Biology 112.*

**211. Plant Biology with laboratory**
An introduction to plants emphasizing their diversity, structure, function, and ecology. The laboratory includes field trips to collect local flora and explores plant cells and tissues, physiological processes and environmental influences on growth and metabolism.
*Prerequisite: Biology 111-112.*

**221. The Bermuda Environment**
This summer course will investigate the complex ecology of the Bermuda Islands, the impact that human habitation has had on their natural history, and current environmental concerns and means of mitigating those concerns. Major areas of study will include (but not be limited to) coral reef ecology/symbioses, mangrove community ecology and environmental relevance, architectural and military influences during colonization, fisheries practices (past, present and future) and current concerns and problems, and ecotourism and associated environmental impacts. (Also ENV 221)
*Prerequisite: Environmental Studies 101, or Biology 111-112, or permission of the instructor.*

**228. Ornithology with laboratory**
An in-depth study of birds with respect to their evolutionary history, structural and physiological adaptations, behavior, and ecology. The laboratory component of this course will focus on the identification of local species of birds and reinforcement of lecture topics in the field. The lab will also introduce students to research techniques used to study birds in the field and will include visits to the Chester River Field Research Station and River and Field Campus (RAFC).
*Prerequisite: Biology 111-112.*

**301. Integrative Human Anatomy with laboratory**
A comparative study of the major body systems of vertebrates, with emphasis placed on system structure, function, and evolutionary modification across vertebrate phylogeny. Laboratory work consists of detailed systems-level examination and comparative dissection in numerous representative vertebrates.
*Prerequisite: Biology 111-112 and one 200-level biology course.*

**302. Developmental Biology with laboratory**
Examines embryo development, focusing on cellular and regulatory mechanisms that guide the process. We will cover the events of development from fertilization through organogenesis in a range of animal systems including sea urchins, Drosophila, amphibians, chickens and mammals. This course will also examine the role of developmental biology in medicine including stem cells. The laboratory portion is an investigative approach to the study of animal development, emphasizing cellular and molecular techniques that will complement many of the topics covered in lecture using sea urchin and chicken animal models.
*Prerequisite: Biology 111-112 and one 200-level biology course. Biology 205 recommended.*

**303. Parasitology with laboratory**
An introduction to the phenomenon of parasitism, the study of parasites and their relationships to hosts. Lecture and laboratory studies emphasize the morphology, taxonomy, life history, and host-parasite relationships of protozoa, helminths, and arthropods of medical and veterinary importance.
*Prerequisite: Biology 111-112 and one 200-level biology course.*

**309. Marine and Estuarine Biology with laboratory**
A study of marine and estuarine ecosystems. The biological, chemical, and physical parameters influencing these ecosystems will be discussed and the natural history, physiology, and ecology of selected ecosystems, invertebrate, and vertebrate phyla will be emphasized. About one-half of the laboratory will be spent in off-campus field trips and will include a two-or three-day mandatory trip to a field station. There will be some extra expense to the student, probably not more than $80.
*Prerequisite: Biology 111-112 and one 200-level biology course.*

**310. Microbial Ecology with laboratory**
A study of microbes, particularly the bacteria, fungi, and protists, and their relationship to the natural environment. Specific topics include microbes in terrestrial and aquatic habitats; microbial interactions with other microbes, plants, and animals; microbial enumeration and activity determination; and biogeochemical cycling. These topics will be explored with emphasis on microbial physiology, metabolism, and adaptation. The laboratory portion of the course will focus on the Chesapeake Bay region and will include an independent research project.
*Prerequisite: Biology 111-112 and one 200-level biology course. Biology 203 recommended.*

**311. Neurobiology with laboratory**
This course will present an overview of the field of neurobiology. We will discuss the structure and components of the nervous system, the development of the nervous

system including early events that specify neuronal cells and processes required for neuronal migration and function. In addition, we will examine the methods of communication within the nervous system and include and overview of some of the sensory systems that relay environmental cues for processing in the CNS. We will explore the general maintenance and repair within the nervous system. As well as explore topics of neurological diseases/disorders via student presentations. The purpose of this laboratory is for you to become familiar with the neuroanatomy as well as experimental techniques used in the field of neuroscience both by hands on experience and reading/presenting journal articles. The laboratory is designed to help you to develop your skills in carrying out experiments and analyzing/presenting experimental data.
*Prerequisite: Biology 111-112 and one 200-level biology course.*

**313. Wetlands Ecology with laboratory**
Wetlands Ecology provides an in-depth examination of the function and types of wetlands with an emphasis on ecosystem services, biodiversity and conservation. Lecture will include a broad overview of the role wetlands play in larger ecosystems as well as the hydrology, geology, chemistry, trophic interactions and species common to these unique aquatic systems. Laboratories will include a large field-based component where students will learn to identify wetlands and their associated flora and fauna.
*Prerequisite: BIO 111-112, and BIO 206 or ENV 294 Applied Ecology*

**314. Biotechnology and Molecular Biology with laboratory**
This course introduces the tools and techniques of biotechnology. While the discipline of biotechnology is founded in molecular biology, its tools can be applied to tackle problems in all branches of biology from cell biology to evolution. This course provides the conceptual background for understanding the basis of biotechnology and emphasizes laboratory activities related to DNA and DNA-RNA-protein interconnections. Students will learn standard techniques in DNA analysis and cloning.
*Prerequisite: Biology 111-112. and two upper-level biology courses or permission of the instructor.*
*Corequisite: Chemistry 112 or 140.*

**315. Ecophysiology with laboratory**
This course will examine how organisms' physiological responses have evolved in response to ecological challenges, such as fluctuating or extreme conditions in their environment. Discussions of physiological adaptations will integrate topics from a variety of fields, including behavior, ecology, and molecular biology. A particular emphasis will be given to interactions between vertebrate animals and their biotic and abiotic environments. The laboratory component of the course will include both in-lab and field activities.
*Prerequisite: Biology 111-112 and one 200-level biology course.*

**328. Behavioral Ecology with laboratory**
This course addresses how animal behavior has evolved in response to ecological pressures in the environment. Topics covered in the course include competition, sexual selection, parent-offspring conflict, social interactions, and game theory. Laboratory work will include discussions of primary literature, activities in the classroom, and field excursions.

*Prerequisite: Biology 111-112 for all enrolled, BIO 206 for BIO majors, ENV 294 for ESI/EST majors, or permission of instructor.*

**336. Ichthyology with laboratory**
Ichthyology encompasses the study of fishes. Topics will include the systematics, physiology, behavior, ecology, and evolution of this diverse group. Identification of specimens during a weekly lab will familiarize students with the major fishes of the Chesapeake region. A multi-week independent project will familiarize students with the scientific method and with aspects of fish behavior. Field trips to the fish collection at the Smithsonian Museum of Natural History, the largest in the world, and to the National Aquarium in Baltimore will broaden the perspective of the course. There may be some additional cost to the students for these trips, though not more than $50.
*Prerequisite: Biology 111-112 and one 200-level biology course.*

**350. Introduction to Toxicology with laboratory**
This course introduces basic concepts of toxicology that pertain to human health and the environment. Topics include principles underlying dose-response relationships, absorption, distribution, metabolism and elimination. Many of these concepts are reinforced through the use of a case-study approach where a pertinent environmental issue is incorporated into the ongoing lecture and laboratory.
*Prerequisite: Biology 111 and Chemistry 201 or 120 and 140, or permission by the instructor*

**351. Evolution with laboratory**
An in-depth examination of various components of evolutionary biology. Topics covered in the course will include (but are not limited to) evolutionary mechanisms, genetics, speciation, adaptation, extinction, evolutionary history, and analysis of evolutionary relationships. Laboratory exercises will emphasize the discussion and analysis of primary literature articles supplemented by laboratory- and field-based observations.
*Prerequisite: Biology 111-112 and one 200-level biology course.*

**392. Biology Junior Seminar**
Biology majors participate with faculty in the department's weekly Biology Seminar in the spring semester of the junior year. Instruction focuses on searching the biological literature, reading of primary literature, and preparing students to be engaged in the Senior Capstone Experience. Biology Junior Seminar is a non-credit bearing course.

**404. Immunology with laboratory**
An examination of the specific defense system of mammals. Topics include leukocyte characteristics and their responses to antigen; antigen characteristics; antibody structure, diversity, function, genetics, and synthesis; the major histocompatibility complex; vaccines; and disorders of the immune system. The laboratory focuses on animal handling, antibody purification, and detection of antigen-antibody interactions.
*Prerequisite: Biology 111-112 and one 200-level biology course.*
*Corequisite: Chemistry 112 or 140*

**409. Biochemistry with laboratory (CHE 309)**
An examination of living systems at the chemical level. Topics will include structure and function of macromolecules, cellular energetics, cellular respiration, with a particular

focus on protein structure and enzyme function. A laboratory will be conducted weekly to introduce students to experimental techniques and molecular modeling.
*Prerequisite: Biology 111 and Chemistry 202 or Chemistry 120, 140, 220, and 240*

**415. Evolutionary Biology - Honors**
Evolutionary Biology is a seminar-style class revolving around discussion of readings from popular literature and scientific papers drawn from the primary literature. Topics of consideration will include natural selection, sexual selection, speciation, the co-evolution of man and disease, the selfish gene, and battle of the sexes as it is fought on the molecular level. The course will include a number of short writing assignments. Periodic Friday recitation sessions will be used for debates, oral presentations, videos, and other activities.
*Prerequisite: Biology 111-112 and two 200-level biology courses, college GPA of 3.4 or higher.*

**424.** Integrative Human Physiology **with laboratory**
A comparative study of physiological processes in animals. Topics will include gas exchange, circulation, water and ion balance, and excitable cells. As a comparative study, we will examine a variety of animals that are adapted to function in diverse environments. A weekly laboratory illustrates physiological principles.
*Prerequisite: Biology 111-112 and two 200-level biology courses.*

## CHEMISTRY COURSES

**120. Chemical Principles of Organic Molecules**
This one-semester course provides a foundation in the fundamental principles of chemical structure and reactivity of organic molecules. Key topics include atomic and molecular structure, intramolecular and intermolecular forces, organic functional groups, thermochemistry, acid/base equilibria, kinetics, and basic organic reaction mechanisms. Laboratory work is designed to complement lecture material. Three hours of lecture and three hours of laboratory each week. (Offered every semester)

**140. Reactions of Organic Molecules**
Reactions of Organic Molecules (CHE 140) builds upon the fundamental principles discussed in CHE 120 Chemical Principles of Organic Molecules. This course will focus on the reactivity of organic molecules, including aliphatic and aromatic hydrocarbons, their halogenated derivatives, and molecules containing heteroatoms such as oxygen, nitrogen, and sulfur, alone or those incorporated in biologically relevant molecules. Particular emphasis is placed on the structure and function of organic molecules important in biological systems as well as the discussion of reaction mechanisms. Students will also be exposed to chemical synthesis and the use of modern spectroscopic techniques for the determination of molecular structure. This course will meet for three hours of lecture and three hours of lab per week. *Prerequisites. Chemistry 120.* (Offered annually: Spring)

**201, 202. Organic Chemistry I, II**

This two-semester sequence is concerned with the molecular architecture and chemical reactivity of a broad spectrum of organic molecules, including aliphatic and aromatic hydrocarbons, their halogenated derivatives, and molecules containing oxygen and nitrogen, alone or in one or more combinations. Particular emphasis is placed on the structure and function of organic molecules important in biological systems. Heavy emphasis is given to the study of reaction mechanisms. Three hours of lecture and three hours of laboratory each week. *Prerequisite. Chemistry 112 or its equivalent. Chemistry 112 and Chemistry 201 is a prerequisite for Chemistry 202.* (Offered annually)

**210. (ENV 210) Environmental Chemistry**
The cycling of natural chemical species and pollutants in the water, soil and air of our earth system is a major component of our complex ecosystem. In this environmental chemistry course, students will develop an understanding of the transport and reactions controlling natural chemical species in our environment, as well as the cycling of pollutants. Students will study current issues of water, soil and air pollution, and how society is working towards reducing the movement of pollutants through our environment. In the laboratory portion of the class, students will investigate the water quality of local water bodies, including the Chester River, as well as conduct hands-on experiments related to the environmental topics studied in class. Three hours of lecture and three hours of laboratory each**.** *Prerequisites. Chemistry 120 and 220.* (Offered Spring semester)

**220. Quantitative Chemical Analysis**
This one-semester course is intended to provide an introduction to analytical methods utilized in chemistry. Both classical and instrumental methods of analysis are considered. A detailed treatment of simple and complex chemical equilibria with particular emphasis on acid-base, oxidation-reduction, and precipitation equilibria is presented as a basis for the classical gravimetric and titrimetric methods. The instrumental techniques include electroanalytical, UV-visible molecular spectroscopy, atomic spectroscopy, and chromatography. Other topics include a review of intermolecular forces and states of matter. Three hours of lecture and three hours of laboratory each week. Offered every semester. *Prerequisite: Chemistry 120.* (Offered every semester)

**240. Chemistry of the Elements**
Chemistry of the Elements is a one-semester course that builds on knowledge acquired in Chemical Principles of Organic Molecules and Quantitative Chemical Analysis. This course covers the properties of all groups of elements in the periodic table with the exception of organic carbon chemistry. It also helps students discover the relationships between elements in different groups and understand the chemical reactions they undergo. The course focuses on the properties and reactions of selected important, essential, but also unusual elements and compounds such as transition metals and organometallic complexes. The course goal is to demonstrate that the study of elements other than carbon is not an isolated branch of chemistry but is relevant in our everyday life as well as to many scientific fields such as pharmacy, medicine, biology, geology, environmental science, and materials science. An essential component of the course is a three-hour laboratory session which introduces students to how inorganic elements, not commonly covered in a regular general chemistry course, are used in their environmental, biochemical, and industrial contexts. An introduction of green chemistry principles to inorganic compounds is also presented in the lab portion of this newly

designed course. This course is required for Chemistry majors (ACS and non-ACS track) as well as for students on the pre-health professions track. It serves as an elective for Chemistry minors and meets the requirement for the ACS certification as a foundation course in Inorganic Chemistry. *Prerequisite: Chemistry 120 and Chemistry 220* (Offered annually: Spring)

**301. Analytical Chemistry**
This course is intended to be an introduction to analytical chemistry. Both classical and instrumental methods of analysis are considered. A detailed treatment of simple and complex chemical equilibria with particular emphasis on theoretical aspects of acid-base, oxidation-reduction, complex formation, and precipitation equilibria is presented as a basis for the classical gravimetric and titrimetric methods. The instrumental techniques included electroanalytical, uv-visible molecular spectroscopy, atomic spectroscopy, and chromatography. Applications of the techniques to inorganic, organic, biochemical, and environmental analysis are covered in the lecture and lab components of the course. Three hours of lecture and three hours of laboratory each week. *Prerequisite. Chemistry 112.* (Offered annually: Fall)

**303. Chemistry of Biological Compounds**
This course is designed to provide a comprehensive introduction to the structure and function of biological molecules at the molecular level. Using post-translational modification of proteins as a guide, we will explore intermolecular interactions, biomolecular structure (proteins, nucleic acids, carbohydrates and lipids) and fundamental concepts in mechanistic enzymology. Students will learn to interpret biochemical data, predict the impact of mutations associated with disease and visualize biomolecular structures with the aid of computer software commonly utilized in the field. Additional topics include: RNA transcription, protein translation, enzyme engineering and more. Three hours of lecture and three hours of laboratory each week. *Prerequisite. Chemistry 202 or Chemistry 140 and Chemistry 220.* (Offered annually)

**305. Chemical Thermodynamics and Chemical Dynamics**
Thermodynamics is the study of the behavior of matter and the transformation between different forms of energy on a macroscopic scale. Chemical dynamics is the study of the rate at which the macroscopic properties and composition of matter change. These changes can involve either transport properties, such as thermal conductivity, viscosity, and diffusion or chemical kinetics. Some of the chemical kinetics topics covered are rate laws, temperature effects on reaction rates, reaction rate theories, reaction mechanisms, and enzyme catalysis. Applications of chemical thermodynamics and chemical dynamics are drawn from environmental chemistry and biochemistry. Laboratory exercises include determination of thermodynamic properties and kinetics experiments. Three hours of lecture and three hours of laboratory each week. *Prerequisite: Chemistry 112 and Mathematics 202 or Chemistry 120, Chemistry 220, and Mathematics 202. Co-requisite: Physics 111 or Physics 101.* (Offered annually: Fall)

**306. Quantum Chemistry and Spectroscopy**
Quantum chemistry is the application of quantum mechanics to the field of chemistry. Topics included in the discussion of quantum chemistry are the early development of quantum mechanics, quantum mechanical models for molecular vibrations and rotations, and electronic structure of atoms and molecules. Spectroscopy is the study of the interactions of electromagnetic radiation with matter, and is the principal experimental

tool used to investigate the predictions made using quantum mechanics. The laboratory exercises include spectroscopy experiments and the use of molecular modeling programs. Three hours of lecture and three hours of laboratory each week. *Prerequisite: Chemistry 112 and Mathematics 202 or Chemistry 120, Chemistry 220, and Mathematics 202. Co-requisite: Physics 112 or Physics 102.* (Offered annually: Spring)

**309. (BIO 409) Biochemistry**
An examination of living systems at the chemical level. Topics will include structure and function of macromolecules, cellular energetics, cellular respiration, and photosynthesis. A laboratory will be conducted weekly to introduce students to experimental techniques. *Prerequisite: Biology 111 and Chemistry 202 or Biology 111, Chemistry 140, and Chemistry 220.* (Offered annually: Fall)

**310. Greener and Sustainable Chemistry**
Environmentally friendly scientists are increasingly conscious about the need to make chemistry "greener." The goal of this course is to present a different perspective regarding chemistry and its applications in academia and industry worldwide. This course will cover both the theoretical and practical aspects of green and sustainable chemistry. The introduction will include the foundations of green chemistry and sustainability as well as a description of the tools and principles it employs. There will be an in-depth study concerning the evaluation of methods and tools in designing environmentally benign reactions and chemicals. Real-world examples will be used to illustrate the goals of green chemistry. Throughout the semester students will have the opportunity to enhance their writing and oral presentation skills and improve their communication and discussion abilities. Three hours of lecture each week. *Prerequisite or co-requisite: Chemistry 140.* (Offered Spring: in rotation with Chemistry 410)

**311. Inorganic Chemistry**
This course is an in-depth study of structure and bonding in molecules. Topics include atomic structure, symmetry and bond theory, ionic and covalent bonding, coordination and organometallic chemistry, and catalysis. The laboratory work focuses on the synthesis and characterization of the following: main group compounds, bioinorganic molecules, zeolites, coordination and organometallic complexes used in catalysis. It also introduces green inorganic chemistry, computational chemistry, and metal complexes used in bioinorganic chemistry. Three hours of lecture and three hours of laboratory per week. *Co-requisite: Chemistry 305 or permission of the instructor.*

**314. Instrumental Methods of Analysis**
This course examines instrumental methods based on their selectivity, sensitivity, and detection limits. Instrumental systems are analyzed in terms of electronics, computers, and optics. The following topics are included: Molecular and atomic spectroscopy, electroanalytical techniques, and separation techniques. Applications of the techniques to inorganic, organic, biochemical and environmental analysis are covered in the lecture and lab components of the course. The laboratory emphasizes the critical evaluation of data. Three hours of lecture and three hours of laboratory each week. *Prerequisite: Chemistry 120, Chemistry 140 and Chemistry 220.* (Offered annually: Spring)

**320. Introduction to Medicinal Chemistry**

This course is an introduction to the field of Medicinal Chemistry and will focus heavily on the chemistry of pharmacological agents as well as their synthesis. Attention will also be placed on enzyme mechanisms and how bioactive molecules affect their activity. This course meets three hours each week. *Prerequisite. Chemistry 202 or Chemistry 120, Chemistry 140, and Chemistry 220.* (Offered Biennially)

**340. Organic Mechanisms and Synthesis**
Organic Mechanisms and Synthesis delves deeper into the concepts from Reactions of Organic Molecules (CHE 140). In this course, students will learn about modern organic reactions, their mechanisms, and the application of these reactions in organic synthesis. Students will also be exposed to polymer and supramolecular chemistry, with a focus on the synthesis and properties of these compounds and their applications. The laboratory component of this course will provide students the opportunity to learn techniques that are required for the synthesis and characterization of organic, inorganic, and organometallic compounds, as well as, teach students how to think strategically about the chemical reactions needed to complete a chemical synthesis. This course will meet for three hours of lecture and three hours of lab per week. *Prerequisite. Chemistry 120 and Chemistry 140. Co-requisite: Chemistry 220* (Offered annually: Fall)

**403. Advanced Organic Chemistry**
This course expands upon the topics discussed previously in the two semesters of organic chemistry. Topics that are covered are: Frontier Molecular Orbital (FMO) Theory and how this can be applied to chemical reactivity, Pericyclic Reactions, Linear Free-Energy Relationships, Molecular Rearrangements, Heterocyclic Chemistry, and Organometallic Chemistry. Heavy emphasis will be on reaction mechanisms and synthesis. *Prerequisite: Chemistry 140 and Chemistry 340.*

**405. Biophysical Methods**
This course explores experimental methods used to characterize the structure and dynamics of biological molecules. An emphasis will be placed on the theory behind the techniques and the data obtained, in addition to the biological interpretation of the results. Topics include: biomolecule synthesis and purification, NMR spectroscopy, x-ray crystallography, fluorescence spectroscopy, and more. Three hours of lecture each week. *Prerequisites: Mathematics 202 and Chemistry 303 or 309.*

**410. Fundamentals of Materials Science**
Our lives are influenced by all types of materials in transportation, housing, clothing, communication, recreation, and food production. The development and advancement of societies have been dependent on the ability to use existing materials, produce, manipulate, and select new materials suitable in many technologies that make our existence more comfortable. This course depicts relationships between the processing of a material, its structure, and finally its performance based on its properties in terms of the design, production, and utilization of the material. The overall goal of this course is to become familiar with the selection process that scientists and engineers use when designing a suitable material at a reasonable cost with minimal environmental impact. Three hours of lecture each week. *Prerequisite or co-requisite: Chemistry 305 or Chemistry 306 or permission of the instructor* (Offered Spring: in rotation with Chemistry 310)

**392. Chemistry Junior Seminar**
This seminar course attempts to prepare our Chemistry majors for their future professional career so they become successful professionals and experts in the Chemistry field. This junior seminar course introduces students to professional preparation, scientific literacy proficiency, and research ethics. It is expected that at the end of this course, our majors will 1) understand the variety of career options available to chemists, 2) become proficient at literature searching, reading, and interpreting, and 3) realize the importance of the scientific code of conduct.
*Prerequisite: chemistry major and junior status.* (Offered in the Spring)

**492. Chemistry Senior Seminar**
This senior seminar course builds on the skills developed in CHE 392 and focuses on 1) understanding contemporary moral/societal issues in chemistry with an emphasis on sustainability science literacy, and on 2) introducing grant writing and the principles of an effective research proposal with the presentation of an integrative research proposal being the culmination of seminar. Therefore, at the end of this course, the following "***4 Cs***" will have been practiced and mastered: **C**ritical thinking and problem solving, **C**ommunication, **C**ollaboration, and **C**reativity and innovation.
*Prerequisite: chemistry major and senior status.* (Offered in the Fall)

WASHINGTON COLLEGE

June 22, 2018

James D. Fielder, Jr., Ph.D., Secretary
Maryland Higher Education Commission
6 North Liberty Street
Baltimore, MD 21201

Dear Dr. Fielder:

We are preparing a proposal for the approval from the Maryland Higher Education Commission of a Biochemistry major at Washington College. I am writing to provide an assurance that the library resources, physical facilities, infrastructure and instruction equipment are adequate to support the proposed program. In fact, the program will be implemented within existing institutional resources. The library resources and physical facilities are both sufficient because the Biochemistry major is being built out of our current Biology and Chemistry curriculum. There will be no additional classes required.

Thank you for your consideration of our proposal. We appreciate your service of higher education in the state of Maryland.

Sincerely,

Kurt M. Landgraf
Washington College
Klandgraf2@washcoll.edu
410-778-7201