**MARYLAND HIGHER EDUCATION COMMMISSION**
**ACADEMIC PROGRAM PROPOSAL**

## PROPOSAL FOR:

**_____ NEW INSTRUCTIONAL PROGRAM**

**_X_ SUBSTANTIAL EXPANSION/MAJOR MODIFICATION**

**_____ COOPERATIVE DEGREE PROGRAM**

**_X_ WITHIN EXISTING RESOURCES or ____ REQUIRING NEW RESOURCES**

*For each proposed program, attach a separate cover page.*

WASHINGTON COLLEGE
Institution Submitting Proposal

September 1, 2018
Projected Implementation Date

| | |
|---|---|
| Bachelor of Science<br>Award to be Offered | Chemistry<br>Title of Proposed Program |
| 1905<br>Suggested HEGIS Code | 40.0501<br>Suggested CIP Code |
| Chemistry<br>Department of Proposed Program | Anne Marteel-Parrish<br>Name of Department Head |

| | | |
|---|---|---|
| Patrice DiQuinzio<br>Contact Name | pdiquinzio2@washcoll.edu<br>Contact E-Mail Address | 410-778-7202<br>Contact Phone Number |

2/20/18
Signature and Date — President/Chief Executive Approval

February 23rd, 2018
Date — Date Endorsed/Approved by Governing Board

WASHINGTON COLLEGE

February 20, 2018

James D. Fielder, Jr
Secretary of Higher Education
Maryland Higher Education Commission
Nancy S. Grasmick Building, 10th floor
6 North Liberty St
Baltimore, MD 21201

Dear Dr Fielder,

Over the course of a year, the Washington College Chemistry Department has significantly revised the curriculum of the chemistry major. The College faculty are very supportive of this effort and voted to approve these curriculum revisions on November 6, 2017. I am writing to request approval of these curriculum revisions by the Maryland Higher Education Commission.

As we indicate in our proposal, this curricular change will provide better coverage of chemical concepts that are important in biochemical and biological systems earlier in the curriculum, create more flexibility in course sequencing for students and allow all departmental faculty to teach in the introductory courses. This revised curriculum also reflects chemistry in the 21st century, which is increasingly interdisciplinary and biochemical in focus. We believe that this more interdisciplinary approach to the natural science disciplines is entirely in keeping with the liberal arts mission and focus of Washington College.

The new introductory sequence in chemistry in particular is better aligned with current students' high school background in chemistry and with their interests in science. It will thus generate more enthusiasm for chemistry and, we hope, lead to more students taking more chemistry courses. We anticipate that this revised curriculum will allow more students to double major, combining a chemistry major with a major in biology, environmental science or physics, or to major in another subject area and minor in chemistry. These changes are also consistent with our American Chemical Society certified chemistry major.

Another advantage of this revision is that it shifts the more complex quantitative chemical concepts into Quantitative Chemical Analysis, a recommended second-year course. This sequencing gives students more time to take quantitative courses that will prepare them for the mathematical content in our chemistry courses.

You will find additional details about both the changes we have approved and the rationale for those changes in the accompanying proposal. Thank you very much for your consideration. We look forward to hearing from you.

Sincerely,

Patrice DiQuinzio, PhD
Provost and Dean of the College

Proposal for Chemistry Program Modification at Washington College

## A. Centrality of proposed major to mission and planning priorities, relationship to the program emphasis as outlined in the mission statements, and an institutional priority for program development.

1. *Program description and alignment with mission*

Washington College proposes a modification to its Chemistry program that we believe will continue to 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. We are proposing a reorganization of the content in our introductory and foundational Chemistry courses. Content of the curriculum is not being deleted, only restructured. We believe this will generate greater enthusiasm for the study of chemistry and better serve the needs of chemistry majors and non-majors. Part of Washington College's mission is to provide academic rigor in a supportive community and to develop analytic thought in our students. The proposed modification to our Chemistry program strongly support these aspects of our mission.

*Alignment with institutional strategic goals*

Washington College is committed to increasing enrollment and retention as part of its strategic goals. The proposed changes in the Chemistry program are innovative in the field and will be attractive to prospective students interested in Chemistry as a major and other fields where courses of study in Chemistry are required. The proposed changes were made with students in mind. The changes will be friendlier to student's schedules because they will be able to take the first course in the sequence in either the fall or spring semester rather than just the fall under the old curriculum. Math skills that can sometimes be a roadblock for students are later in the course sequence so that students can take a college-level math course before needing those skills in Chemistry. We believe that both of these reasons will have a positive impact on retention and could help with recruitment as well.

## 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:*
   - *The need for the advancement and evolution of knowledge;*
   - *Societal needs, including expanding educational opportunities and choices for minority and educationally disadvantaged students at institutions of higher education;*

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

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 modification to the Chemistry program is innovative and will also improve student success. The field of Chemistry has undergone a transformation in the first decade of the 21st century, shifting to a greater emphasis on the biological aspects of chemistry. However, the traditional chemistry curriculum has not been able to effectively adapt to this change. Our proposed curricular change will provide better coverage of chemical concepts that are important in biochemical and biological systems earlier in the curriculum and create more flexibility in course sequencing for students. An additional challenge with the current General Chemistry curriculum is that it is highly math intensive. While these skills are essential for a chemistry major to master, the mathematical rigor in General Chemistry often overwhelms first-years students with weaker math backgrounds and inhibits their ability to understand foundational chemistry concepts. Restructuring our courses will allow us to move some of the mathematical content into second year courses, which affords students the opportunity to complete quantitative skills courses in their first year at Washington College before attempting chemistry courses with a greater mathematical content.

**C. Quantifiable and reliable evidence and documentation of market supply & demand in the region and State**

1. *Present data and analysis projecting market demand and the availability of openings in a job market to be served by the new program.*
2. *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.*
3. *Data showing the current and projected supply of prospective graduates.*

The U.S. Bureau of Labor Statistics projects that there will be a 7% growth in the number of Chemistry related jobs between 2016 and 2026. This gives reason to continue offering the program and also validates the need to make changes to keep up with the changing demands of the field.

Enrollment in our chemistry courses has increased but we have seen a slight dip in the number of majors and graduates over the past few years. We feel this is in part because if a student didn't start in our General Chemistry I and II sequence in the fall of their freshmen year it would be very difficult to complete the program starting in the sophomore year. The proposed change will allow students to start the program in the spring semester making Chemistry available to more students.

| | 2012-13 | 2013-14 | 2014-15 | 2015-16 | 2016-17 | Five-year Average |
|---|---|---|---|---|---|---|
| Enrollment | 530 | 608 | 599 | 657 | 664 | **612** |
| Majors | 39 | 42 | 36 | 27 | 28 | **34** |
| Graduates | 10 | 11 | 14 | 8 | 11 | **11** |

**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.*

This is a program modification. We are not duplicating the program. There will not be any impact on other institutions.

**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 HBIs.

There will be no impact on HBIs. Chemistry is already an approved program. We don't expect to draw students away from other institutions based on our proposed changes.

**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

There will be no impact on the uniqueness and institutional identities and missions of the HBIs. The proposed modification in the Chemistry program does not add or delete content from the curriculum.

**G. Adequacy of curriculum design and delivery to related learning outcomes consistent with Regulation .10 of this chapter:**

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

Under this program modification the following courses will be removed from our current program:

| | |
|---|---|
| CHE 111: General Chemistry I | CHE 112: General Chemistry II |
| CHE 201: Organic Chemistry I | CHE 202: Organic Chemistry II |
| CHE 301: Analytical Chemistry | CHE 311: Inorganic Chemistry |

See Appendix A for the full course list of proposed changes/new courses. Again, the content is not being deleted from the curriculum, just restructured. The changed curriculum will introduce our students to chemistry from a context that we believe will generate greater enthusiasm for the study of chemistry and better serve the needs of chemistry majors and non-majors. Instead of the traditional General Chemistry sequence, the gateway to our new chemistry major will be a course entitled Chemical Principles of Organic Molecules. This course will introduce many concepts typically covered in General Chemistry, but from the perspective of organic molecules. This new introductory course will provide the necessary background for our students to successfully transition into two new secondary courses, entitled Reactions of Organic Molecules and Quantitative Chemical Analysis, which will serve as foundational courses in organic and analytical chemistry. Upon completion of these secondary courses, students will have several options for how they complete the subsequent coursework required for the chemistry major. Two new required courses include Chemistry of the Elements and Organic Mechanisms and Synthesis, both of which will have a laboratory component. These courses will help ensure that our majors not only gain sufficient exposure to more advanced concepts in inorganic and organic chemistry, but also that they are adequately prepared to work as independent scientists in our Senior Capstone Experience and careers beyond Washington College.

2. *Describe the educational objectives and intended student learning outcomes.*

**CHE 120: Chemical Principles of Organic Molecules w/Lab**

**Course Objectives:**

Students will:

1) Be provided an overview of the fundamental chemical properties essential for understanding organic and biological molecules, specifically atomic and molecular structure, intramolecular and intermolecular forces, thermodynamics, acids and bases, kinetics, and basic reaction mechanisms.
2) Improve problem-solving skills.
3) Develop fundamental laboratory skills.
4) Learn material necessary for success in upper level science courses, post-graduate studies, and future career paths.
5) Instill a sense of importance and understanding for chemistry in our everyday lives.

## CHE 140: Reactions of Organic Molecules w/Lab

**Student Learning Goals in Lecture:**

1) Understand the reactions of aliphatic hydrocarbons, alkyl halides, alkenes, alkynes, and aromatic hydrocarbons and how these reactions apply to biological systems.
2) Predict the products of organic reactions.
3) Explain the underlying chemical reason for certain reactivity and selectivity.
4) Formulate reaction mechanisms, using curved arrow formalism, for the transformation of the aforementioned functional groups in both laboratory and enzymatic reactions.
5) Understand and interpret organic nomenclature.
6) Interpret and use spectroscopic data to identify the structure of organic compounds.
7) Understand and plan the synthesis of organic compounds.

**Student Learning Goals in Lab:**

1) Synthesize organic compounds.
2) Perform and justify the separation techniques used in purifying organic compounds.
3) Use various spectroscopic methods to identify products of a chemical reaction and to assess the purity of these products.
4) Draw thoughtful and chemically sound conclusions from the various data collected.
5) Demonstrate safe laboratory and chemical hygiene practices.
6) Effectively work as a member of a team.
7) Properly maintain a laboratory notebook.
8) Write and communicate in a technical manner.

## CHE 220: Quantitative Chemical Analysis w/Lab

1) Understand the general steps in the analytical process.
2) Develop critical reasoning skills regarding quality assurance and calibration methods
3) Develop a greater understanding of chemical measurements and statistics
4) Understand how selected forms of instrumental analysis (i.e., gravimetric and combustion analysis, acid-base titrations, electrochemistry, spectrophotometry, atomic spectroscopy, chromatography, mass spectrometry) may be utilized for quantitative measurements.
5) To understand the difference between accuracy and precision and the concept of significant figures.
6) To use the basic tools of the trade while learning analytical chemistry by doing in the laboratory.

**CHE 240: Chemistry of the Elements w/Lab**

**Student Learning Goals in Lecture:**

Students will:

1) Be introduced to molecular symmetry and spectroscopy with respect to covalent bonding
2) Be able to describe the structures of metallic and ionic solids
3) Understand the synthesis, structure, and physical properties of selected main group elements
4) Be introduced to transition metal complexes and coordination chemistry as well as organometallic chemistry
5) Be exposed to specials topics such as catalysis and important industrial processes and inorganic nanomaterials
6) Be provided an understanding of chemical reactions in which inorganic elements are used in real-life applications and in a specific context such as "The Greenhouse Effect", "Ionic Balances in Living Cells", "Aluminum: the Toxic Ion", "Macular Degeneration and Singlet Oxygen" or "Platinum Complexes and Cancer Treatment".

**Student Learning Goals in Lab:**

Students will:

1) Be introduced to how inorganic elements, not commonly covered in a regular general chemistry course, are used in their environmental, biochemical, and industrial contexts.
2) Understand how green chemistry principles are applied to the synthesis and characterization of inorganic compounds.
3) Learn how to use state-of-the-art characterization tools.
4) Improve their critical thinking and data interpretation skills.
5) Improve their writing and presentation skills.

**CHE 340: Organic Mechanisms and Synthesis w/ Lab**

**Student Learning Goals in Lecture:**

1) Understand how to apply molecular orbital theory to describe the reactivity of organic compounds.
2) Explain the underlying chemical reasons for certain reactivity and selectivity.
3) Formulate reaction mechanisms for the various reactions that are discussed.

4) Apply the organic reactions discussed to design concise syntheses of organic compounds.
5) Understand the synthesis of polymers and other supramolecular structures.
6) Understand the properties of polymers and other supramolecular structures.

**Student Learning Goals in Lab:**

1) Complete multi-step organic syntheses to obtain usable quantities of pure products 2) Perform and justify the separation techniques used in purifying organic compounds.
3) Use various spectroscopic methods to identify products of a chemical reaction and to assess the purity of these products.
4) Draw thoughtful and chemically sound conclusions from the various data collected.
5) Demonstrate safe laboratory and chemical hygiene practices.
6) Effectively work as a member of a team.
7) Properly maintain a laboratory notebook.
8) Understand how to search the chemical literature using SciFinder Scholar effectively.
9) Write and communicate technically.
10) Become self-sufficient and independent in the laboratory.

CHE 340 Organic Mechanisms and Synthesis will fulfill the W3 writing requirement. The writing in this course will focus attention on the methods and modes of writing and critical thinking specific to the discipline of chemistry. Students will build upon the knowledge and skills learned previously in W1 and W2 courses, and this course will begin to prepare students for their Senior Capstone Experience (SCE). The student learning goals for writing are:

● Critical Thinking: the ability to raise questions and identify problems related to particular subjects or situations and to make thoughtful decisions based on that analysis, through writing, reading, and research;
● Writing Process: the ability to use appropriate strategies for generating, developing, composing, and revising writing and research;
● Rhetorical Knowledge: the ability to analyze and act on understandings of audiences, purposes, and disciplinary contexts in creating and comprehending texts;
● Knowledge of Conventions: an awareness of the formal guidelines, ranging from matters of grammar and style to conventions of research and documentation that define what is considered to be correct and appropriate to writing in a particular discipline or context.

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

Appendix B shows how the proposed, new classes fit into Washington College's general education requirements. Changes are highlighted. Students in the Chemistry program will continue to have the same General Education requirements as all other majors. 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.

The proposed changes to the Chemistry program will have an impact on how students use Chemistry classes to satisfy the Natural Science general education requirement. Again, appendix B shows how the proposed, new classes fit into the requirement. Changes are highlighted.

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

We will continue to offer the option for students to complete the American Chemical Society certified version of our Chemistry program.

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

   Not applicable

## H. Adequacy of articulation

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

Not applicable

## I. Adequacy of faculty resources (as outlined in COMAR 13B.02.03.11).

*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.*

The faculty teaching courses in the Chemistry program are primarily tenured and tenure track faculty. The proposed changes will not require us to make any changes to the makeup in the staffing of the department. A summary of the new courses our faculty will teach is in the table below.

| Faculty Name | Degree | Title & Rank | Status | Courses |
|---|---|---|---|---|
| Aaron Amick | PhD | Associate Professor of Chemistry and Department Chair, Tenured | Full-time | CHE 120, CHE 140, CHE 340 |
| Anne Marteel-Parrish | PhD | Professor of Chemistry, Co-Chair of the Chemistry Department, Creegan Chair in Green Chemistry, Tenured | Full-time | CHE 120, CHE 220, CHE 240 |
| Dana Chatellier | MA | Laboratory Instructor | Part-time | |
| James Lipchock | PhD | Assistant Professor of Chemistry, Tenure Track | Full-time | CHE 120, CHE 220 |
| Rick Locker | PhD | Clarence C. White Associate Professor of Chemistry, Tenured | Full-time | CHE 120, CHE 220 |
| Betsy Moyer Taylor | MA | Lecturer in Chemistry | Full-time | CHE 120 |
| Leslie Sherman | PhD | Co-Chair of the Environmental Science and Studies Department; W. Alton, Jones Associate Professor of Chemistry, Tenured | Full-time | CHE 120, CHE 220 |
| Anna J. Smith | PhD | Visiting Assistant Professor of Chemistry | Full-time | CHE 120, CHE 140 |

**J. Adequacy of library resources (as outlined in COMAR 13B.02.03.12).**

*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.*

There are no changes to the content of the chemistry curriculum. The library will be able to continue fulfilling the needs of the department with no changes.

**K. Adequacy of physical facilities, infrastructure and instructional equipment (as outlined in COMAR 13B.02.03.13)**

*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.*

There is not going to be a change in the number of sections of courses offered in a semester with the proposed changes to the Chemistry program. Facilities, infrastructure, and equipment will continue to be adequate for the department's needs.

**L. Adequacy of financial resources with documentation (as outlined in COMAR 13B.02.03.14)**

*1. Complete Table 1: Resources and Table 2: Expenditure. Finance data(pdf) for the first five years of program implementation are to be entered. Figures should be presented for five years and then totaled by category for each year.*
*2. Provide a narrative rational for each of the resource category. If resources have been or will be reallocated to support the proposed program, briefly discuss the sources of those funds.*

This is a program modification so there aren't funds that need to be reallocated. The chart below assumes a 2% increase in tuition and a continued 5 year average for the number of majors in the Chemistry program.

| TABLE 1: RESOURCES: | | | | | |
|---|---|---|---|---|---|
| **Resource 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) | $1,560,192 | $1,591,370 | $1,623,228 | $1,655,698 | $1,688,814 |
| a. Number of F/T Students | 34 | 34 | 34 | 34 | 34 |
| b. Annual Tuition/Fee Rate | $45,888 | $46,805 | $47,742 | $48,697 | $49,671 |
| c. Total F/T Revenue (a x b) | $1,560,192 | $1,591,370 | $1,623,228 | $1,655,698 | $1,688,814 |
| 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 External Sources | 0 | 0 | 0 | 0 | 0 |
| 4. Other Sources | 0 | 0 | 0 | 0 | 0 |
| TOTAL (Add 1 – 4) | $1,560,192 | $1,591,370 | $1,623,228 | $1,655,698 | $1,688,814 |

There will be no changes in the number of faculty in the department or changes in the types of expenses incurred by the department. A modest increase of 2% per year for employee compensation and no increase in related departmental expenses is projected for budgetary planning. The Chemistry program will continue to be supported in the same way it has in the overall College budget. The proposed changes will have no impact on the budget.

| **TABLE 2: EXPENDITURES:** | | | | | |
|---|---|---|---|---|---|
| **Expenditure Categories** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| 1. Faculty (b + c below) | $632,109 | $641,751 | $657,646 | $670,799 | $684,215 |
| a. # FTE | 7.33 | 7.33 | 7.33 | 7.33 | 7.33 |
| b. Total Salary | $507,597 | $514,749 | $528,104 | $538,666 | $549,439 |
| c. Total Benefits | $124,512 | $127,002 | $129,542 | $132,133 | $134,776 |
| 2. Admin. Staff (b + c below) | $9,375 | $9,563 | $9,754 | $9,949 | $10,148 |
| a. # FTE | .25 | .25 | .25 | .25 | .25 |
| b. Total Salary | $7,500 | $7,650 | $7,803 | $7,959 | $8,118 |
| c. Total Benefits | $1,875 | $1,913 | $1,951 | $1,990 | $2,030 |
| 3. Support Staff (b + c below) | $15,625 | $15,938 | $16,256 | $16,581 | $16,913 |
| a. # FTE | .25 | .25 | .25 | .25 | .25 |
| b. Total Salary | $12,500 | $12,750 | $13,005 | $13,265 | $13,530 |
| c. Total Benefits | $3,125 | $3,188 | $3,251 | $3,316 | $3,383 |
| 4. Equipment | $27,500 | $27,500 | $27,500 | $27,500 | $27,500 |
| 5. Library | $2,000 | $2,000 | $2,000 | $2,000 | $2,000 |
| 6. New or Renovated Space | | | | | |
| 7. Other Expenses | $35,748 | $35,748 | $35,748 | $35,748 | $35,748 |
| TOTAL (Add 1 – 7) | $722,357 | $732,500 | $748,904 | $762,577 | $776,524 |

**M. Adequacy of provisions for evaluation of program (as outlined in COMAR 13B.02.03.15).**

*Discuss procedures for evaluating courses, faculty and student learning outcomes.*

The Chemistry program will continue to be subject to the same requirements 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 Commission's minority student achievement goals (as outlined in COMAR 13B.02.03.15).**

*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.**

*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. If proposing a distance education program, please provide evidence of the Principles of Good Practice** (as outlined in COMAR 13B.02.03.22C).

Not applicable

**Appendix A: Course changes in the Chemistry program change proposal**
5 courses)

**CHE 120, Chemical Principles of Organic Molecules, 4 credits**
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.

**CHE 140, Reactions of Organic Molecules w/ Lab, 4 credits**
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.

**CHE 220, Quantitative Chemical Analysis, 4 credits**
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.

**CHE 240, Chemistry of the Elements (Subtitle: Introduction to Inorganic Chemistry as a foundation course), 4 credits**
CHE-240 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.

**CHE 340, Organic Mechanisms and Synthesis w/ Lab, 4 credits**
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.

**Appendix B: Natural Science and Quantitative Requirement**

**II. Natural Science and Quantitative Requirement** *(Students must complete three courses, with at least one satisfying the Natural Science component [letter A] and another satisfying the Quantitative component [letter B]. The third course is the student's option but must follow the pairing rules explained below.)*

**A. Natural Science Component:** To fulfill the overall requirement with *two* Natural Science courses and *one* Quantitative course, complete either option below:

**Option 1: Complete a natural science general sequence.** This option is strongly recommended for students who plan to major in biology, chemistry, environmental studies, physics, or psychology or who intend to apply to medical or veterinary school. These sequences are also recommended for students seeking teacher certification or who otherwise have a strong interest in the sciences:

BIO 111, 112. General Biology
CHE 120 and 140 or 220 Chemical Principles of Organic Molecules, Reactions of Organic Molecules, Quantitative Chemical Analysis
CHE 111, 112. General Chemistry
PHY 101, 102. College Physics (algebra-based)
PHY 111, 112. General Physics (calculus-based)

**Option 2: Complete any two natural science courses.** Any two of the non-major science courses on this list may be taken, or one may be paired with a course from the list under Option 1.

BIO 100. Current Topics in Biology
BIO 104. Ecology of the Chesapeake Bay *(may not be paired with CRS 240)*
CHE 110. Chemistry of the Environment
CRS 240. Estuarine Science *(may not be paired with BIO 104)*
PHY 100. Concepts in Contemporary Physics
PHY 105. Astronomy
ENV 140. Exploring the Solid Earth
ENV 141. Atmosphere, Ocean, and Environment

Any *one* course from either option above will fulfill the Natural Science component for students taking *two* Quantitative courses.

**B. Quantitative Component:** To fulfill the overall requirement with two Quantitative Skills courses and one Natural Science course, complete one of the following two course sequences exactly as listed below:

BUS 109, 209. Managerial Statistics and Financial Analysis
ECN 215, 320. Data Analysis and Econometrics
MAT, CSI Any combination of two Mathematics (MAT) and/or Computer Science (CSI) courses
MUS Any combination of two Music Theory courses (MUS 131, 132, 231, 232)

Any *one* of the following courses will fulfill the Quantitative component for students who complete *two* Natural Science courses:

BUS 109. Managerial Statistics
ECN 215. Data Analysis
MAT, CSI Any Mathematics (MAT) or Computer Science (CSI) course
MUS Any Music Theory course (MUS 131, 132, 231 or 232)
PHL 108. Logic
PSY 209. Statistics and Experimental Design

Note: PHL 108 and PSY 209 may not be paired with another course to satisfy the Quantitative component of this requirement. One of these courses may be used to satisfy the Quantitative component only by students taking two courses to satisfy the Natural Science component of the Natural Science and Quantitative requirement.

Additionally, students fulfilling the Quantitative component with two courses may use BUS 109 and MAT 109 interchangeably; however, students may only receive credit for one Statistics course.