

**PROGRAM REVIEW**  
**Fairmont State Board of Governors**

\_\_\_\_\_ Program with Special Accreditation      **X**   Program without Special Accreditation

Date Submitted \_\_\_\_\_

Program   **B.S. in Biology**   \_\_\_\_\_  
Degree and Title

**INSTITUTIONAL RECOMMENDATION**

The institution is obligated to recommend continuance or discontinuance of a program and to provide a brief rationale for its recommendation:

- \_\_\_\_\_ 1. Continuation of the program at the current level of activity;
- \_\_\_\_\_ 2. Continuation of program with corrective action (for example, reducing the range of optional tracks or merging programs);
- \_\_\_\_\_ 3. Identification of the program for further development (for example, providing additional institutional commitment);
- \_\_\_\_\_ 4. Development of a cooperative program with another institution, or sharing courses, facilities, faculty, and the like;
- \_\_\_\_\_ 5. Discontinuation of the Program

**Rationale for Recommendation:**

<u>  <b>Biology Program Faculty</b>  </u> Signature of person preparing report:	_____ Date
_____ Signature of Dean	_____ Date
_____ Signature of Provost and Vice President for Academic Affairs:	_____ Date
_____ Signature of President:	_____ Date
_____ Signature of Chair, Board of Governors:	_____ Date

# Executive Summary for Program Review

(not to be more than 2-3 pages)

## **Name and degree level of program**

Biology – Bachelors of Science

## **External reviewer(s)**

Dr. Greg Bradley-Popovich  
Associate Professor  
School of Exercise Science and Athletic Training  
West Virginia Wesleyan

## **Synopses of significant findings, including findings of external reviewer(s)**

## **Plans for program improvement, including timeline**

- Develop a Cell Biology course – first offered Spring 2018
- Improve methodology for tracking graduates – ongoing and immediate
- Improve collection and analysis of BIOL 1105/1106 pre- and post-quiz data – review Spring 2018 and implement Fall 2018.
- Increase student participation in research – discussion and planning Spring 2018, implement fall 2018.
- Develop a rigorous, two-semester Human Anatomy and Physiology course for biology majors – pilot offering Fall 2020.

## **Identification of weaknesses or deficiencies from the previous review and the status of improvements implemented or accomplished**

Weakness from previous review:

- Testing scores below the National average on Educational Testing Service [ETS] examinations in the areas of cell biology and molecular genetics.
- Less than desirable numbers of students engaged in undergraduate research
- Poor retention of biology students in entrance level biology courses, particularly BIOL 1105 and 1106.

Improvements implemented or accomplished:

- We have significantly updated our Genetics and Molecular Biology course to include more modern concepts and techniques.
- We have developed a new, 300-level Cell Biology course that will also address and reinforce the concepts students learn in their other upper-level courses.
- We are currently contemplating changing the curriculum to only require one semester of organic chemistry for biology majors.
- We are monitoring the progress of students in BIOL 1105 and 1106 by administering pre- and post-course surveys.

- BIOL 4485 – Senior Seminar now requires a faculty-mentored, independent student research project and presentation at the West Virginia Academy of Sciences. In the past two years, 95% of all students have earned above 70%, with the majority receiving about 80%.
- The College of Science and Technology obtained significant funding through a Title III grant to address the problem of retention in introductory courses. Our focus was threefold: 1. To hire a STEM (Science, Technology, Engineering and Math) Learning Coordinator to work with faculty on curriculum redesign and to coordinate the student peer mentoring program. 2. To establish Student peer mentoring programs in the College of Science & Technology. 3. To improve learning technology in the classroom and laboratory. In addition, there is an endowment challenge in the last two years of the grant to leverage philanthropic support for the University by providing Federal funds to match private donations. Our STEM coordinator has worked closely with our faculty. Improvements include a complete overhaul of BIOL 1105/1106 labs and a successful peer mentoring project. Our goal was to have at least 70% of students enrolled in pilots of redesigned Biology courses complete the courses with a C or higher (Baseline: 65%). Redesigned courses were piloted in Fall 2014 and Spring 2015, with a combined average of 67% of students completing with a C or higher. In Fall 2014, 71% of students completed Biological Principles I with a C or higher. In Spring 2015, only 63% of students completed Biological Principles II with a C or higher. We noticed that enrollment in Biological Principles II was higher than in previous years. We also note that the majority of redesign efforts were focused on Principles I. Overall, we were encouraged by the data. We are seeing a trajectory toward improved student success in these courses.

### Five-year trend data on graduates and majors enrolled

Fall Term	Majors enrolled	Majors graduated
2012	69	9
2013	61	10
2014	58	13
2015	79	8
2016		13
Total	(+)	53

### Summary of assessment model and how results are used for program improvement

Over the past five years we have identified and quantified our expectations for students in the Biology program as a series of outcomes, direct measures, and satisfactory performance standards in TaskStream. Our Biology program currently has three outcomes:

- *Program Outcome 1:* Demonstrate a broad range of fundamental biological facts and theories.
- *Program Outcome 2:* Organize and critically evaluate biological information and present it clearly in written form.
- *Program Outcome 3:* Organize and critically evaluate biological information and present it clearly in oral form.

Overall, our students have demonstrated a gradual increase in proficiency during the review period.

**Data on student placement (for example, number of students employed in positions related to the field of study or pursuing advanced degrees)**

Category	Graduates	
	Number	Percent
Unknown	27	51%
Employed in Field	7	13%
Employed out of field	1	2%
Graduate school	4	8%
Professional school	14	26%
Total	53	

**Final recommendations approved by governing board**

# PROGRAM REVIEW

FAIRMONT STATE UNIVERSITY	
Program:	Biology
School:	College of Science and Technology
Date:	

## Program Catalog Description

Biology, the study of life, is a wide-ranging and rapidly growing discipline. Understanding biology requires a working knowledge of all the sciences, especially chemistry and mathematics. The biology program at FSU strives to provide students with a broad-based education in all fields of biology as well as a fundamental knowledge of chemistry and mathematics. Students are required to complete basic courses in biology designed to provide a comprehensive understanding of living organisms. Electives allow students the flexibility to gain additional knowledge in an area of interest. No minor is required for biology majors.

A four-year B.S. degree in biology will prepare students to compete for entry level jobs such as lab technician, wildlife biologist, research scientist or naturalist, among others. While a bachelor's degree in biology will help students get a job, many careers require additional education beyond the B.S. degree. Many of our best students compete successfully for admission to graduate study at institutions across the country. A biology degree will also provide pre-professional training required by fields such as dentistry, medicine, pharmacy, and veterinary medicine.

Students who major in biology select one of the following degree programs:

1. The B.S. in Biology degree as preparation for employment, professional school or graduate study.
2. The B.S. in Biology degree with an emphasis in biotechnology as preparation for employment, professional school, or graduate study.
3. The B.A. in Education degree with a specialization in biology, as preparation for teaching biology in grades 9-Adult. All courses must be completed prior to admission to Secondary Student Teaching/Clinical III.

In addition to meeting the graduation requirements listed for the B.S. in Biology or B.A. in Education degree, students must also:

1. Obtain a grade of "C" or better in BIOL 1105, 1106, 2202, and 2203
2. Successfully complete an assessment exam during their final year (this exam is given every spring semester).

## VIABILITY (§ 4.1.3.1)

### Enrollments, Applicants, graduates

There are no specific program requirements for students to declare a major in biology. Any student admitted to the university can declare a major in biology. Enrollment in the first year biology course for the review period 2013-2017 required an ACT science reasoning score of 21 or better (or equivalent). Students who did not meet this requirement could still declare their major as biology but needed to complete remedial courses before beginning the curriculum. However, this requirement has been dropped and only an ACT Composite score of 18 is currently required for admission to the program. This should serve to greatly increase enrollment in the biology major. It might also increase the DFW rate and we will be monitoring this.

### Rationale for removal of prerequisites for BIOL 1105 – Principles of Biology I and BIOL 1106 – Principles of Biology II

The faculty of the biology program reviewed the performance of students in BIOL 1105 from fall 2014 through fall 2017. No significant correlation was found between grades earned in the class and ACT science reasoning score. The best correlation (but still not significant) was between the ACT composite score and earned grade. Students with a higher ACT composite score were more likely to be successful in BIOL 1105 (success defined as a grade of C or better) but there was not a significant difference in success between students with an ACT composite score ranging between 18 to 21. Since an ACT composite score of 18 is required for admission to Fairmont State we see no reason to prevent any student admitted to Fairmont State from enrolling in BIOL 1105 or BIOL 1106. (Table 8)

### Student enrollment

Biology majors during the fall and spring semesters of the academic years of 2013 – 2017 averaged 66.1 students, up from an average of 63 students during the 2008 -- 2012 review period. Student enrollment tended to increase from 2013 – 2017. The minimum number (52) occurred in spring 2013 and the maximum (86) in the spring of 2016. (Table 1).

### Graduation rates

Graduation numbers during this same time period have ranged from 8 in 2016 to 13 in 2015 and 2017 (mean  $10.6 \pm 2.3$ ) (Table 2). Graduates are reported by academic year (Fall 2016 graduates are reported in the 2017 year). Table 2 shows an increase in graduates in the recent years. The cause of this is likely based on an increased number of biology majors during the 2013-2017 reporting period.

We have compiled a list of all recent graduates and to the best of our knowledge, their current employment or continuing education status (Table 6). The biology program has no formal mechanism for tracking graduates so the information in this Table is obtained from faculty memory, Fairmont State Biology Facebook page, Survey Monkey, and contacts faculty may have with former students. A summary of what graduates are doing is given below. Of the graduates we have knowledge of, 95% are either employed in a biologically related field (which we define as an area which did not require any additional education beyond the biology degree) or are enrolled in graduate or professional school. This is up from 70% in the previous 5 year review.

## Summary of Education and/or Employment Status of Recent Graduates of the Biology Program

Category	Graduates	
	Number	Percent
Unknown	27	51%
Employed in Field	7	13%
Employed out of field	1	2%
Graduate school	4	8%
Professional school	14	26%
Total	53	100%

9 alumni have responded to the survey.

- There were at least 7 female and 2 male respondents.
- Five students are currently employed full-time. The remaining four students are enrolled in post-graduate programs. Six of these positions are either directly or somewhat related to their studies in biology.
- Three of the students are currently (or have been in the past 6 years) enrolled in graduate or professional degree programs.

### Positive aspects of the FSU Biology Program:

Survey results indicated that overall, our graduates were very pleased with their undergraduate education at FSU and how well it prepared them for employment or graduate/professional school.

- 100% of the respondents stated that FSU prepared them “adequately”, “more than adequately”, or “very well” for graduate or professional school.
- 100% of the respondents stated that FSU prepared them “adequately”, “more than adequately”, or “very well” for their current career. All respondents are either generally or very satisfied with their careers so far.
- Eight of the nine respondents were either “generally satisfied” or “very satisfied” with their undergraduate education at FSU. Seven of those “probably would” or “definitely” would encourage a high school senior to attend FSU; the other two respondents answered “maybe.”
- With regard to their “development and preparedness for life after FSU,” the majority of students responded with “more than adequately” or “very well” in the following categories:
  - Writing clearly and effectively
  - Working effectively as a member of a team
  - Acquiring new skills and knowledge on their own
  - Communicating well orally
  - Being an effective leader
  - Using quantitative tools
  - Thinking analytically and logically
  - Gaining in-depth knowledge of a field
  - Understanding the process of science and experimentation
  - Developing career- or work-related knowledge and skills
  - Identifying moral and ethical issues
  - Acquiring broad knowledge
  - Judging the merits of arguments based on sources, methods, and reasoning
  - Functioning independently without supervision
  - Synthesizing and integrating ideas
  - Developing or clarifying a personal code of values or ethics
- “I believe that Fairmont State prepared me well for my career. My professors went out of their way to provide all the resources their students might need and even still are providing me recommendations for jobs. You couldn’t find those kind of professor/student interactions in undergrad at a larger school.”

## Areas that will strengthen our Biology Program:

Several graduates provided thoughtful responses that we have addressed over the past five years:

- “I think the genetics course could be updated to include more technology both in the class room and especially in the lab. Some PCR, cloning, transforming, maybe sequencing? I feel this class could really be improved with a face lift in material.
  - We have significantly updated our Genetics and Molecular Biology course to include more modern concepts and techniques. We are not currently equipped to carry out the sequencing ourselves, but could outsource this process to Marshall for a fee.
  - We have developed a new, 300-level Cell Biology course that will also address and reinforce the concepts students learn in their other upper-level courses.
- “Two semesters of organic chemistry are not required for many graduate programs. Therefore it would be more beneficial to require one semester of organic chemistry and concentrate on getting classes such as anatomy and physiology that will be required for many graduate programs or students may find much more beneficial.”
  - We are currently contemplating changing the curriculum to only require one semester of organic chemistry for biology majors.
- “Students should be encouraged, maybe even required, to participate in undergraduate research to ensure that they are ready for graduate schools or employment in research fields.”
  - Senior Seminar students are now required to conduct a faculty-mentored research project and present their results at the West Virginia Academy of Sciences meeting. In addition, most of our faculty either mentor students in their own research projects and/or arrange for them to get internship experience at other institutions during the summer.

## Program Courses

For the reporting period (2013-2017) students majoring in Biology complete nine core biology courses (See Table 14). In addition, students are required to complete three biology electives from a field of six courses, four chemistry courses, one semester of Calculus and the University general studies requirements. Students are required to complete the first four biology courses (BIOL 1105, 1106, 2202, and 2203) with a grade of C or better to continue in the program. Students pursuing a biology certification for their education degree complete eight core courses. They do not take BIOL 3390 – Molecular Biotechnology, nor are they required to take any electives. They are not required to take organic chemistry.

Enrollments in courses for the biology major are provided in Table 3. Table 3 shows a significant difference in the number of students enrolled in BIOL 1105 and BIOL 1106 as compared to the upper-level courses. At first glance this might be considered a retention issue (retention is discussed in the Graduation/retention section). However BIOL 1105 and 1106 are also service courses because other program require these courses, but not necessarily the upper-level courses; for example: Exercise Physiology, Forensic Science, the biotechnology area of emphasis, and many pre-professional areas of study all require BIOL 1105 and 1106.

## Service courses

Service course total enrollments are provided in Table 4. Demand for service courses has declined slightly during the review period. The SCIE prefix identifies all courses that meet the general studies scientific discovery requirement. Although many sections of these courses are taught by adjuncts, the goal of the college is to have at least one full time faculty member teaching a section of

these courses every term. This faculty member serves as a point of contact for adjunct instructors.

Service courses offered during the 2013-2017 review period include the following:

- **BIOL 1104 – Biosphere:** This course is the first in a three course science content sequence for elementary education majors. It also satisfies 4 hours of the general studies scientific discovery requirement. An average of 45.4 students per academic year enrolled in BIOL 1104 during the 2013-2017 review period, ranging from a low of 33 students in 2013 to a high of 52 students in 2014.
- **BIOL 1180/1 – Anatomy and Physiology:** This is a new course created in 2016-17 designed to fulfill the requirements of many programs, the largest being nursing. Previously, full time biology faculty taught some sections of HLCA 1170 and 1171, the version of Anatomy and Physiology owned by the Community and Technical College. 94 students were enrolled during the 2016-17 academic year. Enrollment in this course is expected to increase.
- **BIOL 2205 – Technical Microbiology:** This course is a requirement in several allied health programs, primarily the nursing and veterinary technology programs. Other programs/majors that recommend/require BIOL 2205 include respiratory therapy, medical laboratory technology, and pre-pharmacy. This course also qualifies as an optional course for biology minors. BIOL 2205 was offered during both fall and spring semesters except during spring 2016, with an average enrollment of 158.7 students per year (excepting 2015-16). This course is taught by full time biology faculty.
- **SCIE 1100 – Human Biology:** This is currently one of the “workhorse” SCIE courses (those courses that enroll the most students) that satisfies the general studies scientific discovery requirement. For the 2013-2017 review period, biology majors could also take Human Biology if they did not have the prerequisites for the first biology major course. (This requirement has since been discontinued.) Enrollment in the course dropped during the review period, from a high of 314 students in 2012-13 to a low of 120 students in 2016-17. This reflects the overall drop in enrollment over the past five years, and may also be due in part to the availability of other SCIE courses both online and without a separate lab component.
- **SCIE 1103 – Science that Matters I:** This course uses learning modules that were originally developed at the University of South Florida. Fairmont State was one of the first institutions to implement these modules. Enrollment in the course dropped during the review period, from a high of 365 students in 2012-13 to a low of 134 students in 2016-17. Once again, we feel that this reflects the overall drop in enrollment over the past five years, and may also be due in part to the availability of other SCIE courses both online and without a separate lab component.
- **SCIE 1105 – Environmental Science:** This course is offered spring semester each year and is used to fulfill the general studies science requirement. It maintained an average enrollment of 21.6 students during the review period. It meets twice a week, with the course divided into lecture and activity components. It is taught by a full time instructor.
- **SCIE 1107 – Geographic Information Systems (GIS):** This course may be used to fulfill general studies science credits, and is a required course for a degree in the Population Studies Program. An average of 10.5 students were enrolled every spring semester (except 2014-15, when it was not offered) during the review period. The course meets twice per week and for four hours credit which also makes it popular with students.
- **SCIE 1110 – Chemistry of Life:** This course was offered during 2012-13 and has since been discontinued.
- **SCIE 1199 – Evolution of Ethics and Human Nature:** This course was offered on a trial basis during 2012-13 and has since been replaced with SCIE 1221 – Evolution and Human Nature.
- **SCIE 1221 – Evolution and Human Nature:** This course has been offered since 2013-14. Enrollments have declined slightly during the review period.

## Success rates Service Courses

Service course success rates are provided in Table 5a (for courses with the BIOL prefix) and Table 5b (for courses with the SCIE prefix) . In these Tables “success” is defined as the percentage of students who passed (received a grade of A, B, C or D) compared to the total number of students who enrolled in the class (received a grade of A, B, C, D, W, F, I, or NR). Students who dropped the course prior to the drop deadline are not included. The average success rate is 76.8%, with a range from 55% to 95%.

## Off campus courses

None of the science courses for biology majors are taught off main campus. One biology course, BIOL 1180 Human Anatomy & Physiology, is also taught online. One service course, SCIE 1100 Human Biology, is taught at the Caperton Center in Clarksburg and as a high school dual enrollment course. Tables 7a (courses with a BIOL prefix) and Table 7b (for courses with a SCIE prefix) list all courses taught on and off campus. Of the courses listed, 90% of all students are instructed in the classroom on the main campus.

## Cost per student credit hour

We don't have access to specific cost for the biology program, but we present the costs for our College of Science and Technology compared to other Schools and Colleges at FSU in Table 11. Our cost per credit hour are slightly above the average for the institution, but the costs per student FTE major are below average. We rank well below the School of Fine Arts, School of Education/Health & Human Performance, and the School of Nursing and Allied Health Administration for the direct cost per instructional credit hour, and below School of Fine Arts and the School of Nursing and Allied Health Administration for costs per student FTE major.

## General Studies Requirements Met

The biology program is in compliance with the Fairmont State Degree definition and general studies requirements. (See Table 14)

## Assessment Requirements

Over the past five years we have identified and quantified our expectations for students in the Biology program as a series of outcomes, direct measures, and satisfactory performance standards in TaskStream. Most of our assessments are conducted in four upper level classes (BIOL 3306 – Ecology, BIOL 3368 or 3370 – Animal or Plant Physiology, BIOL 3390 – Molecular Biotechnology, and BIOL 4485 - Senior Seminar). Our Biology program currently has three outcomes:

- *Program Outcome 1:* Demonstrate a broad range of fundamental biological facts and theories.
- *Program Outcome 2:* Organize and critically evaluate biological information and present it clearly in written form.
- *Program Outcome 3:* Organize and critically evaluate biological information and present it clearly in oral form.

*Program Outcome 1 Measure 1:* ETS exam given to graduating seniors every spring.

The Biology program has given the Educational Testing Service Major Field Test in Biology to graduating seniors since 1999. Our satisfactory performance standard is that all of the students in our graduating class will score within one standard deviation of the national average or better for the total score AND in each of the four subcategories: 1. Cell Biology. 2. Molecular/Genetics. 3. Organismal. 4. Population/Ecology/Evolution. Over the review period 75% to 100% of our students met this satisfactory performance standard for the total score (Table 12a) and 69% to 100% of our students met this standard for the four subcategories Table 12b).

*Program Outcome 2 Measure 1 and 2:* The satisfactory performance standard is that students score 70% or higher using the specified rubric for the last lab report in BIOL 3306 – Ecology (*Measure 1*) and BIOL 3368 or 3370 – Animal or Plant Physiology, and BIOL 3390 – Molecular Biotechnology (*Measure 2*). Available data shows an overall gradual increase in student performance (Table 13).

*Program Outcome 3 Measure 1:* The satisfactory performance standard is that students score 70% or higher using the specified rubric for the final presentation at the West Virginia Academy of Sciences in BIOL 4485 – Senior Seminar. Available data shows that all students exceeded expectations in 2015-16, and all students except one scored above 70% in 2016-17.

## Adjunct use

Tables 9a (for courses with a BIOL prefix) and, 9b (for courses with a SCIE prefix) list enrollments in biology courses taught over the last five years by full-time and part time faculty members. Of the total enrollment, 97% of the students in courses with a biology prefix are taught by full-time faculty. These numbers include both lecture and lab sections.

Courses taught by full time faculty are listed in Table 10. Not all of the 9-12 month, full time faculty in Tables 9a, 9b and 10 are members of the biology department. Dr. Gilberti, former Dean of the College of Science and Technology, is listed at one instructor of record for Bio 4998, but the biology faculty members actually advise these students on their research projects. Dr. Andreas Baur and James Weekly are full-time members of the chemistry program and routinely help teach our biochemistry course.

Several of our full-time faculty members also teach courses with other prefixes, including SCIE (Human Biology, Science That Matters, Evolution of Human Nature, Environmental Science, Geographic Information Systems, and Chemistry of Life) and FORS (Forensic Science) classes. SCIE courses are

listed in Table 9b; FORS courses are listed in Table 10. Many adjuncts are required to help offer the SCIE non-majors general studies courses.

## Graduation/Retention Rates

See Graduation rates in the Enrollment Section on page 2. Retention rates are extremely difficult to determine with the data provided. At this point we can postulate many exit points from the program other than graduation (for example: change majors, transfer to another institution, acceptance into professional school, dropping out), and a detailed examination of the retention rate would require an analysis of each individual student's progress through the curriculum. Currently it is very laborious to get this information from the University and in some cases the information is simply not available (for example we may not be able to determine if a student transferred or dropped out. All we know is that they did not register for classes in a given semester.

Also, the pre-professional students (especially students focused toward pharmacy or dentistry school) are accepted early into the professional program. In the last two years we have had two junior undergraduate biology majors enroll in WVU dental school and have not completed their Fairmont State degree. Recently we have noticed an increasing number of students beginning their educational career at Fairmont State with the intent of transferring to another institution (usually WVU) after one or two years. Both of these situations negatively affect our retention and graduation rate, but as far as these particular students are concerned, their time at Fairmont State has been a success and has helped them move toward their professional goal. It is not clear how to measure these students, but counting them as retention or graduation losses does not seem reasonable.

The retention rate for full time students only includes individuals with their primary major as Biology. Excluded are dual majors, and all pre-professional majors. This under represents the true number of Biology majors as many of these individuals will change their major to biology in order to graduate with a Biology degree, as they cannot graduate with a pre-professional degree (it does not exist). This can be seen in the enrollments in Biology 1105/1106 (Table 3). This is also complicated by the lack of identification of students so their status can be followed through time. These retention rates, although seemingly low, reflect national trends where failure rates in introductory STEM course range from 30 to 85% (Faculty Focus, 28 Sep 2012).

## Previous Program Review Results

Upon completion of the Biology Program students are expected to have an understanding of major biological concepts and awareness of how these are connected within various areas of the biological and physical sciences. This expectation is dependent upon students having a working knowledge of programmatic learning outcomes. There have been a number of programmatic weaknesses that have been identified which include:

- Testing scores below the National average on Educational Testing Service [ETS] examinations in the areas of cell biology and molecular genetics.
- Less than desirable numbers of students engaged in undergraduate research
- Poor retention of biology students in entrance level biology courses, particularly BIOL 1105 and 1106.

Listed below is a description of a number of changes that were implemented to correct these identified weaknesses.

## *PERFORMANCE OF STUDENTS ON NATIONAL TESTING IN THE DISCIPLINES OF CELL AND MOLECULAR/GENETICS*

One weakness identified from the previous review was that students' performance on ETS examinations was below the National average in the areas of cell biology and molecular/genetics. It was attempted to improve the performance of our students on these examinations by increasing the coverage of cell biology topics in the introductory course BIOL 1106. We are pleased to report an overall increase in student performance during the review period. We plan to continue with an emphasis of cell structure and function in BIOL 1106, but institute an additional 300 level course solely dedicated to cell biology. In addition to reinforcing concepts covered in BIOL 1106, this newly instituted 300 level cell biology course will be cutting edge in that it will cover advanced topics. Also, this course will be interfaced with genetics and molecular biology, which we expect will concomitantly and synergistically enhance students' understanding in all three disciplines. The pilot Cell Biology course is being offered during Spring 2018. Student performance on National exams with regard to the disciplines of cell, genetics and molecular biology will be closely monitored.

### *BIOL 1105 PRE/POST KNOWLEDGE SURVEY*

We are monitoring the progress of students in BIOL 1105 and 1106 by administering pre- and post-course surveys. Available data for 2015 shows that for the quiz given prior to the start of the term, the class as a whole answered 33.7% of the questions correctly. At the end of the term, the class as a whole answered 41.3% of the questions correctly. (Table 15)

### *ENHANCING UNDERGRADUATE RESEARCH ACTIVITIES*

A goal of the Biology Program over this review period was to enhance undergraduate research activities both as programmatic courses and as independent research projects. It has become increasingly clear that mentored undergraduate research projects promote the growth and development of students while providing opportunities for those students who wish to pursue terminal degrees. It is also understood that a commitment by faculty to engage in competitive scientific research is an integral and necessary part of satisfying the student's desire to participate in undergraduate research projects.

To further this goal, BIOL 4485 – Senior Seminar now requires a faculty-mentored, independent student research project and presentation at the West Virginia Academy of Sciences. In the past two years, 95% of all students have earned above 70%, with the majority receiving about 80%.

Efforts have been made to promote faculty involvement in basic research. In addition to mentoring and developing students, faculty involvement in basic research inherently sustains faculty growth and development by enabling them to keep abreast of their field. It is realized that when faculty are engaged with students performing undergraduate research there is no boundary between teaching and scientific exploration. Students engaged in research with individual professors both within and outside of BIOL 4485 have the opportunity to present their work at scientific meetings and defend their work in a public forum thus promoting specific skills such as organizing their thoughts and justifying their data. In essence, it provides a bridge between the two activities of publication and teaching at the undergraduate level.

Initiatives were taken to secure funding in support of undergraduate research. These initiatives include: the Summer Undergraduate Research Program [SURE] and NIH funding. In addition, there are opportunities for specialized funding provided by Fairmont State University to be dedicated to undergraduate research. This has resulted in an increase of students engaged in undergraduate research during the academic year as part of the curriculum and as summer independent study projects. The experience of undergraduate research along with presentations and publications has enhanced the participating students' curriculum vitae, thus supporting their opportunity to gain acceptance to quality

institutions of graduate education. Most of our students who go on for terminal degrees are those students who have engaged in undergraduate research. We will continue this initiative in the belief that increased research activity assists the students in meeting their purposes in life and puts them on the path of obtaining the level of significance that one gains through commitment to excellence in their chosen profession.

#### *INCREASING STUDENT RETENTION IN BIOL 1105 AND 1106*

Together with the School of Business, the College of Science and Technology obtained significant funding through a Title III grant to address the problem of retention in introductory courses. Our Title III project—“Revitalizing Curricula as Experiential, Collaborative and Technology-Rich”—was primarily focused on improving the academic quality of our programs. We identified courses within the College of Science and Technology that had high rates of students withdrawing or earning grades of D or F (primarily BIOL 1105/1106 within the Biology program), and we implemented strategies in an effort to improve student success in these high-risk courses. Ultimately, our goal was to improve retention by revitalizing curricula to help enable student success in some of the most challenging courses on campus. The primary strategies in which our project were engaged included the following: course redesign and pilot-testing; peer mentoring; faculty development; designing and equipping classrooms and other learning spaces that promote collaborative and engaged learning; and continuing to create technology-rich learning environments.

Faculty redesigned BIOL 1105 and 1106, including a complete overhaul of the laboratory exercises and incorporation of educational technology, including the use of Turning Point clickers and incorporation of Pearson Mastery. Student peer mentoring programs were developed in Year 2 and continue to be very popular with students in our introductory courses. In Year 3, STEM had 20 student peer mentors supporting 24 lecture sections and nine corresponding lab sections. Altogether, more than 700 students from all six schools and colleges on campus were being served through group study sessions, lab assistance, one-on-one tutoring, and for-credit sections of Math support courses. The Biology program itself has had between three and five student peer mentors per semester assisting with lecture material and serving as informal teaching assistants in laboratories. Student peer mentors were supervised by the two Learning Coordinators and received on-going training and support through regularly scheduled meetings. The peer mentoring program benefited peer mentors as well as those students who are being served by peer mentors. For the peer mentors themselves, this program provided tremendous opportunities and experiences. They have received extensive training and on-going development by working closely with the Learning Coordinators. The peer mentors in the College of Science and Technology met weekly with the STEM Learning Coordinator to discuss select educational literature they read to help them better fulfill their roles as peer mentors. One of the STEM peer mentors (a nontraditional student who already has a degree in art, had worked in art therapy, and is now enrolled in chemistry courses in pursuit of attending medical school) wrote in an email to the STEM Learning Coordinator: “Being part of your peer mentoring program has by far been my best experience at Fairmont and one of the best and most unique experiences in my academic career. I feel really honored to be a part of it and am incredibly thankful for the experience.” Another peer mentor said that being a peer mentor has convinced her of her future career path. She said, “This experience has helped me to know for sure that I want to teach at the high school level.” Participating in the peer mentoring program provides the mentors with valuable opportunities to, as Fairmont State’s mission statement says, “discover roles for responsible citizenship that promote the common good.”

Our goal was to have at least 70% of students enrolled in pilots of redesigned Biology courses complete the courses with a C or higher (Baseline: 65%). Redesigned courses were piloted in Fall 2014 and Spring 2015, with a combined average of 67% of students completing with a C or higher. In Fall 2014, 71% of students completed Biological Principles I with a C or higher. In Spring 2015, only 63% of students completed Biological Principles II with a C or higher. We noticed that enrollment in Biological Principles II was higher than in previous years. We also note that the majority of redesign efforts were focused on Principles I. Overall, we were encouraged by the data. We are seeing a trajectory toward improved student success in these courses.

Improved retention in these introductory courses is important to the overall success of the Biology Program. Enhancing student performance and retention will have the effect of decreasing the number of years to graduate and sustaining the critical number of students needed in upper level courses. This increase in the number of students in later semesters of the Biology Program will enable a variety of upper level electives to be offered. This will also address the current weakness of a limited number of choices of biology electives which do not necessarily meet the professional interests of the students.

#### *PLANS FOR PROGRAM IMPROVEMENT, INCLUDING TIMELINE*

- **Develop a Cell Biology course** – first offered Spring 2018.
- **Improve methodology for tracking graduates.** We have updated our survey and will be sending it out early in the school year to gather as much data as possible. We will also place a centralized data table on the V:\ drive so faculty can enter information about graduates as it comes to their attention through other, more informal pathways. (Implementation immediate.)
- **Improve collection and analysis of BIOL 1105/1106 pre- and post-quiz data.** Pre- and post-test quizzes were consistently administered by lab instructors for BIOL 1105 and 1106 during the review period, but the data was not always compiled. We have identified a point person to gather all of this data twice per semester, and analysis will be performed every semester and recorded in TaskStream. Data from our previous review (2008-2012) indicated that the BIOL 1105/1106 pre- and post-test does give us some idea of our strengths and deficiencies in instruction in these courses, so we plan to continue this particular assessment. (Implementation immediate.)
- **Increase student participation in research:** BIOL 4485 – Senior Seminar now requires a faculty-mentored, independent student research project and presentation at the West Virginia Academy of Sciences. We are planning to involve ALL biology in student research. Incentives include counting senior research as separate research credits that would count towards our course load. We are also investigating student research methodology at similar institutions, and are discussing the possibility of a co-op style arrangement in which students could earn research credit either on or off campus. We continue to keep track of funding opportunities for external internships (for example, REU's) and other research opportunities. (Implementation immediate.)
- **Develop a rigorous, two-semester Human Anatomy and Physiology course** to meet the needs of pre-professional programs and serve as biology electives (Pilot course tentatively scheduled for Fall 2020).

## ADEQUACY (§ 4.2.4.2)

### Faculty Data

Faculty Data Sheets Attached

### Accreditation/national standards

There is no national body that specifically accredits biology programs. There is not a national consensus regarding standards for undergraduate general biology programs.

## NECESSITY (§ 4.1.3.3)

### Placement and success of graduates - Similar Programs in WV

In the north-central area of West Virginia, there are B.S. degree programs in biology offered at WVU, Salem International University, WV Wesleyan, and Alderson Broaddus College. The latter three are private schools with significantly higher tuition than Fairmont State. Compared to WVU, we offer smaller classes and full-time faculty that teach all lecture and lab sections. Many lower division courses at WVU are taught by graduate teaching assistants. Our smaller class size allows us to offer more personal attention in the lecture and more hands-on experience in the laboratory, both in the field and in the laboratory.

## CONSISTENCY WITH MISSION (§ 4.1.3.4)

The Biology program supports the mission of Fairmont State by offering students with a comprehensive biology curriculum that provides an excellent preparation for a variety of careers, including those requiring advanced degrees. Program faculty are committed to high-quality classroom instruction and meaningful collaborations between students and faculty in performance of original research. Further support of the mission is obtained by the fostering of initiative and independence within the students thereby promoting lifelong learning while in the process of mastering the techniques and principles of biology. Reflection and synthesis of biological concepts is encouraged to increase the students' critical understanding of the discipline and thus advance their ability to apply its concepts. Members of the program faculty also provide instruction that meets the goals of the Scientific Discovery component of Fairmont State's General Studies curriculum.

Student clubs (for example, Tri-Beta Biology Honors Society) along with many independent undergraduate research opportunities provide students (both biology majors and non-majors) with opportunities to engage the wider community and develop lifelong learning skills. Our Tri-Beta club has recently experienced a resurgence and an increasing number of students have become involved in the past two years.