Northampton Community College

Biological Science

Associate in Science
Preliminary Program Audit
2014-2019

External Auditor:
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PURPOSE

The Biological Science program at Northampton Community College offers an Associate in Science (AS) degree designed to prepare students for transfer to four-year institutions. The Program's curriculum parallels the first two years of the baccalaureate programs into which many NCC students transition. In addition, NCC offers dual admission agreements with a variety of colleges, through which the receiving institution guarantees transfer of credits, given the student's good standing. The program has also met the requirements for acceptance into the state TAOC agreement insuring that graduating students transfer their entire first two years into any of the 11 state supported four-year institutions. More importantly, the Program prepares students to excel in the ever-changing, ever-growing field of biological sciences.

CURRICULUM (Appendices A, B, C)

Courses
First Semester

COLS101	College Success	1 credits
BIOS107	Biology I	4 credits
CHEM120	General Chemistry I	4 credits
ENGL101	English I	3 credits
MATH140 or MATH 180	College Algebra or Calculus I	3/4 credits
	Total:	**15/16**

Second Semester

BIOS150	Biology II	4 credits
CHEM220	General Chemistry II	4 credits
ENGL151L	English II	3 credits
CMTH102	Introduction to Communication	3 credits
MATH145 or MATH181	Trigonometry or Calculus II	3/4 credits
	Total:	**17/18**

Third Semester

BIOS2__	Biology Elective ++	4 credits
CHEM201G	Organic Chemistry I	4 credits
PSYC103	Introduction to Psychology	3 credits
	General Education Elective (SIT)	3 credits
	Total:	**14**

Fourth Semester

BIOS2__	Biology Elective ++	4 credits
CHEM251	Organic Chemistry II	4 credits
	General Education Elective (AH)	3 credits
	Electives	6 credits
	Total:	**17**

Total Credits: 63-65

Students entering the Program are expected to have an adequate background in chemistry and algebra. To help those students that are not prepared the faculty has worked with the learning center and the Science Resource Center to provide free walk in tutoring for all classes. Programs are also run through the learning center on metric topics, study skills, and term paper preparation. This commitment by the faculty has led to the successful transfer of NCC students to more than a dozen transfer institutions in fields as diverse as veterinary medicine, environmental science, medicine, pharmacy, and teaching. Many students seek out research or internship opportunities.

To address these many disparate career fields in biological sciences and to best mirror the curricula of transfer institutions, the Program maintains a state of flexibility. Students were and are currently required to take a minimum of 63 credits.

A. Changes in Curriculum since 2015

In late 2017 a Guided Pathways project was begun. The rationale for this project was to provide advisors with a clear description of the series of courses necessary to obtain the degree. It was found that too many students were incorrectly advised as to their course selection and sequence, and so were forced to spend added semesters that often led to them not completing. The first step in this project was the development of a program map. (Appendices). This map shows the sequence of courses, and the semesters and campuses where they are offered. It also gives a list of the schools where most of our students transfer and the types of careers and salaries they might obtain. The program learning outcomes are also stated.

In the second phase the curriculum was tightened. The specific math courses were set in order to ensure transfer students would at least be calculus ready. Charlie Rinehimer collected data from Bio 2 classes that showed that 65% of our majors are interested in professional careers as physicians, physician's assistants, veterinarian, pharmacists, etc.
With that data it was decided that Into to Psychology be a required elective.

Once the guided pathway map was established, the courses were examined to determine how they achieve our learning outcomes. The following table shows where outcomes were introduced (I), reinforced (R), or moved toward expert (E). Note: the faculty objected to the expertise category since they realized our students were nowhere near that level.

B. Sanofi Pasteur

Sanofi Pasteur in Swiftwater, PA, has generously chosen to fund the Monroe Campus at NCC with a Grant totaling $164,508. The monies from this grant have been used in part to spearhead a Strategic Planning Initiative headed by Co-PI's Beatriz Villar (Biological Sciences) and Danielle Ringhoff (Chemistry) to bring greater visibility to Undergraduate Research Experiences (URE) and encourage faculty and students to become involved in URE across both Bethlehem and Monroe campuses.

The Strategic Plan and Goals include, but not limited to, advancing and increasing URE at NCC, following the national CCURI model (Community College Undergraduate Research Initiative), to successfully implement and establish inquiry-based and high-impact teaching practices from introductory courses and across disciplines; and investigating the current state of UREs at NCC while addressing faculty strengths and research interests, barriers to implementation and opportunities for collaborations with four-year institutions and community organizations with research opportunities; developing URE models considering the characteristics of our institution, its faculty and students. The plan will determine a cost effective and evidence based approach, will address faculty strengths and research interests and barriers to implementation. Information about URE opportunities will be available to all faculty and students by creating a resource center with information availability through the Center for Teaching and Learning Technology (CTLT) website.

One barrier to implementation of URE identified by faculty was a lack of support in remuneration for actual time and effort required to mentor students completing a 1.0 credit (3-laboratory hour) research experience. The latest Faculty Contract for the years 2019-2022 has addressed this issue, removing this barrier.

Faculty have completed URE with students, and will continue in the future, in areas including use of two permanent research sites at Monroe Campus: An avian research site has been established at the Monroe Campus, and a Greenhouse is currently under construction on the Monroe Campus. Both of these areas lend themselves to cross-disciplinary work with the chemistry department and students.

Four Students each year over 4 years (16) were awarded Sanofi Grants of $5,000 based upon financial need and merit within the STEM fields.

In determining the effectiveness of URE offerings at NCC, we have also outlined some short-term and long-term evaluation guideposts. For the short term, it would be important to assess both conceptual knowledge and development of skills in URE students. Consider a range of outcomes and the duration/timing of the URE, lending flexibility for both independent research activities and classroom-embedded models; examine the impact of UREs on different student populations (diversity); and to examine the impact on the faculty/mentor to understand how URE alters their sense of effectiveness and satisfaction. In the Long-term, it would be critical to know impacts on retention rates of students involved in UREs, to follow up with transfer institutions of students involved in UREs while at NCC, and to assess changes to the number and level of faculty/mentors involved in UREs.

C. Program Outcomes

Program Outcome	BIOS 107	BIOS 150	BIOS 206	BIOS 210	BIOS 260	BIOS 240	CHEM 120	CHEM 220	CHEM 201(G)	CHEM 251
Understand fundamental concepts of Biology, which characterize the various life science fields including: • Botany • Environmental Science • Genetics • Cellular and Molecular Biology • Zoology	I I,E I,E	I,R,E R I,E	E	I,E	I,E	I, E				
Demonstrate oral and written communication skills necessary for sharing discipline-specific knowledge and communicating professionally.	I	R	E	E	E	E	I	R	R	R
Conduct scientific inquiry and research on biological science topics as they relate to science, technology and society.	I	R	E	E	E	E	I	R		
Proficiently function in • laboratory and • field settings Using modern scientific instrumentation, including microscopes, measuring devices, and computer technology.	I	R R	R E	R E	E	I, E	I	R	R	R
Demonstrate understanding of the fundamentals of lab safety, to ensure both personal and environmental safety.	I	R	R	R	R	I,E	I	R	R	R
Understand the use of the scientific method, interpretation of scientific data, and scientific literature.	I	R	E	E	E	E	I,E	R	R	R
Be prepared to transfer to a four-year Bachelor's Program or a pre-med, pre-vet, or other pre-professional program.	I	R	R,E	R	E	E	E	E	R	R

ASSESSMENT AND CLASSROOM ACTIVITIES

The Cluster has embraced the College's "atmosphere of assessment." To focus our assessment efforts the cluster created a chart to show which assessment techniques, in which courses, were addressing the learning outcomes.

Not all courses address each program outcome, but each outcome was structured to be assessed concretely within a specific course. Program outcomes, their relevant courses, and examples of assessments of the outcomes are included.

Program Outcome	Relevant Course(s)	Assessment
Understand fundamental concepts of Biology, which characterize the various life science fields including: • Botany • Environmental Science • Genetics • Cellular and Molecular Biology • Zoology	 BIOS 107, 150 BIOS 206, 210 BIOS 107, 150, 260 BIOS 107 BIOS 150 BIOS 140	 Exams; quizzes; current news review; lab practicals; lab assignments Exams; lab assignments; field assignments Exams; assignments; lab reports; case study review Exams; lab reports Exams; Show-and-tell; lab quizzes and assignments
Demonstrate oral and written communication skills necessary for sharing discipline-specific knowledge and communicating professionally.	All Program Courses	Department-wide use of laboratory notebooks or reports and research papers / oral presentations
Conduct scientific inquiry and research on biological science topics as they relate to science, technology and society.	BIOS 107, 150,140, 206, 210, 260; CHEM 120, 220	Current news reviews; laboratory exercises; original research paper
Proficiently function in • laboratory and • field settings Using modern scientific instrumentation, including microscopes, measuring devices, and computer technology.	 All Program Courses BIOS 150, 206, 210, 140, 260	 Data collection exercises; lab quizzes; practical and appropriate use of instruments Field quizzes; assignments
Demonstrate understanding of the fundamentals of lab safety, to ensure both personal and environmental safety.	All Program Courses	Safety rules quiz; observation and reinforcement
Understand the use of the scientific method, interpretation of scientific data, and scientific literature.	All Program Courses	Lab assignments; quizzes; papers; case studies; Exams
Be prepared to transfer to a four-year Bachelor's Program or a pre-med, pre-vet, or other pre-professional program.	All Program Courses	Successful completion of Program

The faculty have worked to incorporate new technology and service learning into their curricula. Examples of the work done in the past five years are included below.

A. Service Learning

Explicit in our mission, we at Northampton Community College seek "to provide excellent, accessible and comprehensive learning experiences in partnership with the dynamic, diverse communities we serve." One tool that many of our faculty use to fulfill this mission is service learning, a student experience that, at its core connects community engagement to classroom learning. Beyond simple volunteerism, service learning "allows the student to participate in service activities that meet community needs and at the same time provide reflection opportunities in order to gain further understanding of course content…."

While the Department has not yet created a common set of guidelines for biology majors' performing service learning in their courses, the "typical" expectation is that: students performing service learning commit to at least 20 hours of work with a community partner over the course of the semester; students performing service learning also complete an reflection assignment or report at the end of their work, and; the work relates to the course in which the students is enrolled (i.e., students do not simply "volunteer," they learn and serve).

In 2018, the Director of Community Engagement, Debra Bohr, retired. Dr. Stanley Ebede replaced her in 2019. Dr. Ebede is still fitting into the position and so data on exactly which facilities our students worked in are not available at this time. He has developed a new website at https://www.northampton.edu/center-for-civic-and-community-engagement.htm

B. Biology I Assessment (Dr. Jeannie Smith)

2019 Biology Program Assessment Project:

Jeannie M. Smith, Ph.D., Assistant Professor of Biology, Northampton Community College

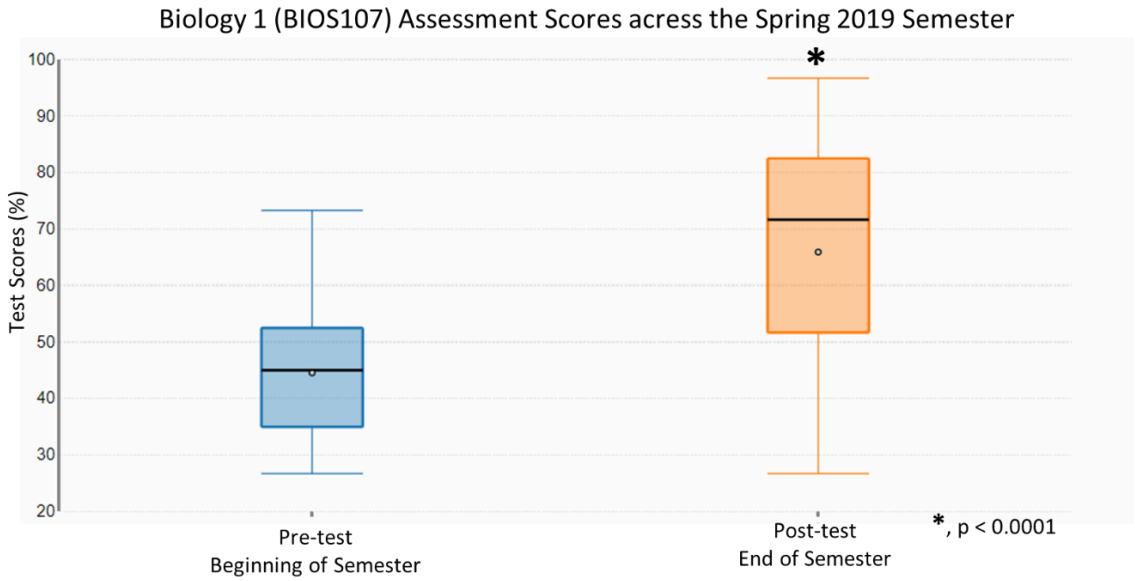
Spring 2019 semester students of BIOS107_03, Biology 1, were given a Biology Placement Exam originated by Montgomery County Community College (MCCC). This test's initial purpose for MCCC is to determine whether the incoming students have meet the prerequisites for placement into their Biology courses. (Test Document is attached). The question set in this exam includes the cumulative information taught throughout the BIOS107, Biology 1, course here at Northampton Community College.

I used this Biology placement test as an assessment tool in order to examine the student's learning, understanding, and retention of course work across the semester.

As a pre-test, the students were given the exam their first week of classes. Then during their 14th week of classes, they again took the same test (as a post-test measurement).

A paired-samples t-test compared the test scores of the students at the start of the semester (pre-test; prior to completing the course) and at the end of the semester (post-test; after completing the course).

There was an extremely significant difference, with an increase in the scores for the post-test (M=65.92, SD=20.45) and as compared to the pre-test (M=44.54, SD=12.61) scores; t (21)=7.46, $p < 0.0001$; (p=0.0000012). The average improvement of scores between the post-test and pre-test = 21.38% (SEM $\pm$ 2.86), with the greatest score improvement of 43.3%.



D. Daily class assessment using "clickers"

Dr. Rinehimer has used individual polling devices (clickers) to assess the student's understanding of the previous lecture. Students are asked, anonymously, a series of multiple choice, or true and false, questions related to the previously covered material. The program gives percentages of students that choose each answer. If the correct answer is given by less that 60% of the class the information is immediately reinforced. Although his results are anecdotal, it seems that the clickers have increased classroom performance. Students polled at the end of the semester have given a 92% positive response to the use of the clickers.

E. Academic Rigor Analysis (See Appendix D)

The Academic Affairs Department enlisted the faculty assistance in reviewing that all programs contain at a minimum of four 200 level courses, and that the courses are of consistently strong rigor. The biology department reviewed and see the appendix for those areas of assessment

PROGRAM FACULTY

The courses in Biological Science are taught by both tenured and tenure-track professors, as well as by adjunct faculty. The majority of sections of Program courses are taught by full-time faculty; however for courses such as Biology I, adjunct faculty are hired to teach occasionally when multiple sections are offered per semester on both the Bethlehem and Monroe Campuses.

A. Course Stewardship

A member of the full-time faculty assumes responsibility for each particular program course. While this structure is informal and voluntary, the Cluster works well together, and members gladly assume courses for which they are responsible. For their course, the faculty member serves as a course coordinator to: research and recommend text(s) for the course; develop innovative labs and coordinate with lab staff; communicate concerns about and successes in the course to the Cluster; maintain and manage up-to-date course outlines and syllabi; and; communicate with adjunct (as well as full-time) faculty teaching that course; to ensure consistency between sections and across the campuses. This informal mentoring contributes to the cohesiveness of the Cluster and ensures consistent delivery of instruction in multiple sections of the same course taught by a variety of different faculty.

Program course section size is limited to 24 students due to the lab component. Some sections of the lecture component are combined and this results in faculty: student ratios of 1:48. In lab faculty student ratios are consistently maintained at 1:24.

B. Full-Time Faculty

Five full time faculty were added to the cluster during this cycle based on replacements or enrollment growing trends. Two were to fill vacated positions at the Bethlehem campus in Biology. At the Monroe campus, one was a replacement in Chemistry and one was a replacement in biology, and the last new one was an Anatomy and Physiology faculty at Monroe.

TABLE 5. Current full-time faculty in Biology and Chemistry.

Faculty Member	**Date Hired**	**Credentials**
Burch, Paula	Fall 2015	MS, Eastern Kentucky University
Mattes, Karen	Spring 2010	M.S., East Stroudsburg University
Gelormo, David[1,3]	Fall 2004	Ph.D., Lehigh University
Klein, Karen [1]	Fall 2010	M.S., East Stroudsburg University
Kresge, Kathleen[1]	Spring 2005	Ph.D., Lehigh University
Massie, Sonia[1]	Fall 2017	MS pursuing EdD Drexel University
Leiser, John[1]	Fall 2004	Ph.D., Lehigh University
Magilton, William[1,3]	Spring 2010	M.S., Lehigh University
Rinehimer, Charles[1]	Fall 2002	V.M.D., University of Pennsylvania
Richardson, Jennifer	Fall 2017	MS Portland State University
Ringhoff, Danielle [1,3]	Fall 2016	PhD, Lehigh University

Smith, Jeannie [1]	Fall 2015	PhD, Lehigh University
Villar, Beatriz[1]	Fall 2006	Ph.D., Univ de Santiago de Compostela

[1]Currently teaches Program courses.
[3]Chemistry

The Biology Program is part of the Science Cluster. A faculty member selected by the cluster handles cluster coordination activities. These activities include, but are not limited to: schedule oversight; conducting cluster meetings; facilitating work recommended by the cluster; communicating with the Dean; attending AHS Leadership team meetings. The Cluster Chair also coordinates activities with faculty on the Monroe Campus, who in addition to their faculty appointments assist the Assistant and Associate Deans of Monroe with scheduling and staffing needs.

C. Staff and Adjunct Faculty

The Cluster is fortunate to have a seasoned steady core of adjunct faculty who work for NCC on a regular basis. There is good communication with the adjunct faculty through the work of the cluster leader, the full-time faculty, and the lab assistants.

The Biology laboratory assistant for Bethlehem is Daniel Peters (BS in Biology from East Stroudsburg University) and the Chemistry lab assistant is Darryl Peters (BS in Chemistry from East Stroudsburg University) provide outstanding support to the Cluster through maintenance of the multiple labs and the setup for the instructional labs. The Bethlehem campus also has three part time laboratory assistants, Keith Davis, (MS in Chemistry from Lehigh University), Robyn Davis, (MS in Biology from East Stroudsburg University), and April Todd-Gannon, (AS in Biology, Chemistry).

The fulltime lab assistant at the Monroe Campus is Megan Warnkin (AS Biology-Environmental Studies, Warren County Community College). The three lab assistants work well to ensure consistency in the student laboratory experiences on both campuses. Monroe campus also has two part time lab assistants; Selena Jones (BS in Biology, minor in Chemistry from East Stroudsburg University) and Melissa Doll, (BS in Biotechnology from East Stroudsburg University).

Adjunct faculty teaching Program Courses on the Bethlehem and Monroe Campuses over the course of the audit cycle. It should be noted that the adjunct pool is very fluid and the number listed indicates any courses that were over the past five years, even if it was for a single lab.

Faculty Name	Campus	Degree
Al-Rashid, Ziyad[3]	Bethlehem	PhD, University of Minnesota
Austin, Kelly	Online	PhD, State University of NY
Balum, Joseph	Bethlehem	MS East Stroudsburg University
Bartlett, Becky	Bethlehem	MA, Lehigh University

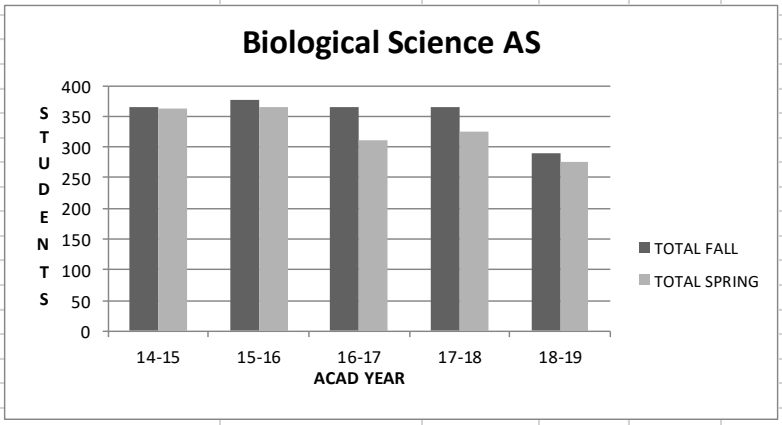
Bennett, Shauna	Bethlehem	PhD, University of Michigan
Beautreau, Denise [3]	Monroe	MS Long Island University
Bielski, Roman[3]	Bethlehem	PhD Polish Academy of Sciences
Bird, Meaghan	Monroe	MS East Stroudsburg University
Brands, Alexander	Bethlehem	PhD Washington University
Bratis, Dean	Bethlehem	PhD, St. Louis University
Byrne, Mary	Bethlehem	PhD, Temple University
Clauser, Amanda	Bethlehem	MS, East Carolina University
Coryell, Anne Marie	Bethlehem/Online	DC, Palmer College of Chiropractic
Couret, Jennifer	Monroe	PhD, Rutgers University
Creegan, Janet	Monroe	MS, East Stroudsburg University
Davis, Keith[3]	Bethlehem/Online	MS, Lehigh University
Davis, Robyn	Bethlehem/Online	MS, East Stroudsburg University
Dewhurst, John [3]	Bethlehem	PhD, University of New Hampshire
DiAngelis, Keri	Monroe	MS, East Stroudsburg University
DiStasio, Anthony	Monroe	MS Wagner College
Farag, Hosam	Monroe	MD, Alexandria College of Medicine
Fenderson, Faith	Bethlehem	PhD, University of Washington
Fleming, Edward[3]	Bethlehem	PhD, Boston College
Folio, Cathreine	Monroe	MS, University of Denver
Follweiler, Douglas[3]	Bethlehem	PhD, University of Pennsylvania
Follweiler, Joanne [3]	Bethlehem	PhD, University of Pennsylvania
Fromert, Gary	Monroe	MS, East Stroudsburg University
Gallo, Catherine	Monroe	MS, East Stroudsburg University
Gilstrap, Darin	Bethlehem	MS, Long Island University
Glover, Lisa[3]	Bethlehem	MS, Lehigh University
Good, David	Monroe/Bethlehem	MS East Stroudsburg University
Haller, Thomas[3]	Bethlehem	MS, University of Delaware
Hornbach, Peter[3]	Bethlehem/Monroe	MS, West Chester University
Huang, Wun-Ing Jessica	Bethlehem	Ph.D., Univ. of Pittsburgh
Irvin, Carl	Bethlehem/Online	MS East Stroudsburg University
Jackson, Richard	Monroe	PhD University of Massachusetts, Amherst
Katz, Richard	Monroe	MD St Christopher's College of Medicine, Dakar Senegal
Kavanau, Christopher	Bethlehem	PhD, Mt. Sinai School of Medicine
Kish, Peter	Monroe	PhD. Oklahoma State University
Koch, Andrew	Bethlehem	MS, Wilkes University
Kressly, Doris	Bethlehem	MS, Atlanta University
Kurt, Anita	Bethlehem	PhD Kanpur University, Kanpur, India
Laskowski, Jennifer	Monroe	MPA, BS Misericordia University
Lavelle, Joseph[3]	Bethlehem	PhD, Lehigh University
Lee-Bond, Sharon	Online	PhD, Thomas Jefferson University
Martin, John	Monroe	MS Northern Illinois University

McGovern, Thomas	Bethlehem	DC National College of Chiropractic
Morgan, David [3]	Monroe	MS Lehigh
Nicolello, Angela	Bethlehem	MeD Iona College
Palermo, Anthony	Bethlehem	DC Life Chiropractic College
Patra, Guy [3]	Monroe	PhD Paris V. Descartes
Pekala, Richard	Bethlehem	PhD University of Massachusetts
Petrous, Monica	Bethlehem	MS, Syracuse University
Proud, Daniel	Bethlehem	PhD, University of Louisiana at Lafayette
Prozonic, Judith[3]	Monroe	MS Temple University
Raker, David	Bethlehem	MS University of Scranton
Reese, Kyle	Bethlehem	MS East Stroudsburg University
Roberts, Carolyn	Bethlehem	MS, university of Illinois
Rosengrant, Kimberly	Monroe/Online	MS East Stroudsburg University
Ruschman, Ross	Monroe	MS East Stroudsburg University
Santostefano, Jeana	Bethlehem	MSN, University of Scranton
Sawyer, Brandy	Bethlehem	MS California University of PA
Schmittel, Julie	Bethlehem	MED DeSales University
Schrader, Kandiss	Bethlehem	BS, Fairfield University
Schreffler, Lisa	Monroe	MS East Stroudsburg University
Serfas, Michael	Monroe	PhD University of Illinois of Chicago
Shevalier, Richard	Monroe/Bethlehem	MA, State University of New York at Binghamton
Shea, Patricia	Bethlehem	MS, East Stroudsburg University
Shonk, Amy	Monroe	MS East Stroudsburg University
Smith Elizabeth [3]	Bethlehem	MS, Catholic University
Smith, Jason[3]	Bethlehem	MS Wilkes
Speicher, Jacalyn	Monroe	MeD. Post University
Stein, Eileen	Bethlehem	MeD Kutztown
Stewart, Nakosi	Bethlehem	MS Florida Agricultural & Mechanical University
Swineford, Patricia	Monroe	MS Pennsylvania State University
Thompson, Lucile	Bethlehem	PhD, Lehigh University
Thompson, Tanya	Bethlehem/Online	PhD East Stroudsburg University
Turkos, Robert	Monroe	MS Carnegie Institute of Technology
Vedage, Gamini[3]	Bethlehem	PhD, Lehigh University
Wagh, Smita	Bethlehem	MS, Lehigh University

ENROLLMENT

Enrollment in the program has been steadily dropping over the period. This mirrors the drop in enrollment college-wide. A decrease in the number of students graduating high schools in our supporting districts, as well as, many students transferring out or dropping out of rigorous courses coupled with a favorable economy, are the primary causes. However, Biological Science still ranks as the third largest program at the college.

Biological Science AS	TOTAL ENROLLMENT						
BIOD							
		ACAD YR	14-15	15-16	16-17	17-18	18-19
FALL							
FULL-TIME			209	212	193	203	166
PART-TIME			155	164	171	163	124
TOTAL FALL			364	376	364	366	290
SPRING							
FULL-TIME			202	190	164	186	140
PART-TIME			161	176	147	140	136
TOTAL SPRING			363	366	311	326	276



CURRENT STUDENTS, PROGRAM GRADUATES, & TRANSFERS

One of the principle purposes of the Program is the successful transfer of Biology majors to four-year institutions. As a result, matriculation from NCC is not always a goal of students enrolled in the Biology curriculum. However, students most often transfer successfully, and, following transfer, their GPA's typically increase, indicating the academic rigor and success of NCC's Biology Program.

The number of credits lost through the transfer process is minimal, particularly among those students with a declared major at NCC that is consistent with the program into which they transfer at the 4-year institution. The TAOC agreement with the state supported schools will now ensure transfer of the first two years to those institutions.

Each year a few of the graduates enter the workforce; however, the majority continue their education at a four-year college or university. This low graduation rate is indicative of the Program's success as a transfer program. Matriculation number and the intentions of graduates are included below.

Numbers of graduates from the Biology Program over the course of the audit cycle along with their post-NCC intentions.

Biological Science Degree	Aug. '13	Aug. '14	Aug. '15	Aug. '16	Aug. '17	Aug. '18
	Dec. '13	Dec. '14	Dec. '15	Dec. '16	Dec. '17	Dec. '18
	May '14	May '15	May '16	May '17	May '18	May '19
# of Graduates	30	23	40	30	32	
employed	3	1	4	3	5	
job hunting	0	0	1	0	0	
continuing ed.	25	16	32	23	25	
other	2	6	3	4	2	
Employed Graduates	3	1	4	3	5	
Additional Data Not Avail.	–	–	–	–	–	–
related	0	0	2	1	2	
unrelated	2	0	1	2	0	
unrelated by choice	1	1	1	0	3	
Median starting salary (if>2 reported)	–	–	–	–	–	–

FACILITIES

There has been one major renovation during the cycle. In 2016, the Science Resource Center opened on the second floor of Penn Hall. This was the brainchild of Vice President Carolyn Bortz. The center provides duplicate models, slides, and specimens from all biology courses as well as providing free walk in tutoring. The center is open six days a week. Since its inception, data has shown a strong increase in success of students who have used the resource. It is a model-tutoring center.

Bethlehem SRC				Monroe Learning Center		
Semester	**BIOS students**	**CHEM students**		**Semester**	**BIOS students**	**CHEM students**
Fall 2015	362	206				
Spring 2016	341	166				
Fall 2016	378	191				
Spring 2017	296	231				
Fall 2017	306	191				
Spring 2018	327	154				
Fall 2018	387	207				
Spring 2019	361	162				
Fall 2019	472	215		**Fall 2019**	157	54

PROGRAM COSTS & INCOME (see appendix D)

Tuition has decreased over the past five years due to the decrease in students; also, the expenses and overhead have also decreased. The cost per FTE has risen as salaries have increased and material expenses have increased to maintain the rigorous and state of the art equipment.

EXTERNAL AUDITOR REPORT

Northampton County Community College
Biological Sciences Associate in Science

External auditor report

Submitted by M. Kathryn Iovine, PhD
Professor of Biological Sciences at Lehigh University

Brief review of program areas:

Curriculum – The courses for the program include 1 year of introductory Biology classes, plus 1 year of Biology electives. This is in addition to math, English, Psychology, and non-science electives. The curriculum is therefore broad and provides students with a firm foundation in college-level courses. Students are also well-prepared by lab courses that emphasize safety and data management, and often have an inquiry-based component. In addition, students have opportunities outside of specific classes to engage in independent research, and to present their findings (i.e. whether to others in their class, to the campus community, or at local conferences). These opportunities support classroom learning and give students confidence in their abilities.

Faculty and Staff – The program uses a combination of tenure/tenure-track faculty and adjunct faculty. All have advanced degrees at the Master's or PhD levels. Full-time faculty size has grown modestly within the audit period to accommodate increasing student enrollments. The program also employs full-time and part-time lab assistants at both Bethlehem and Monroe campuses. The lab assistants provide crucial support for faculty teaching the instructional labs.

Faculty were enthusiastic about discussing their courses and ways that they engage with students in and out of the classroom. In addition to classes, faculty mentor students doing independent projects outside of coursework.

Students – Students enter the program for a variety of reasons, including lower cost compared to most 4-year programs, uncertainty about career choice but wanting more exposure to biological sciences, and wanting to focus on improving their grades. As a result, students enter the program at very different levels of preparedness. However, despite entering at different levels, most graduates go on to transfer to 4-year colleges. Students said that the coursework was sometimes challenging but that they felt prepared for transferring into the next program. Students felt very strongly that the faculty are all excellent teachers. More than one said that they didn't have any bad teachers at NCC, and that this was especially true for their science classes. Students also felt that faculty provided a route for students to network with experts across the campus.

Not all students were aware of research opportunities outside of the classroom, and some stated that they would be interested in such opportunities. When asked about the "College Success" course, most students felt this course could be improved. There was a sense that the course was a lot of 'busy work' and was mostly based on common sense. Students that took the course online (and at their own pace) seemed less negative about the class. And, there was a sense that different instructors may include different content that also influenced student experiences in the course.

Facilities and equipment – There are seven lab spaces that are used for both the Chemistry and Biology courses. The spaces appear to have ample bench space and equipment. The Science Resource Center (SRC) is a huge benefit to both the students and the faculty. This room provides a space for students to review course material (including histology slides and various models), and also provides a space for tutoring. Assessments of student GPAs indicate that student success is enhanced by access to the SRC.

Conclusions and Recommendations:

Areas of strength – Strengths include the quality of the faculty and their level of engagement with students, the SRC, student preparation in lecture and lab courses, and the sense of collegiality of faculty, staff, and students. Faculty are also committed to continuing assessment of their classes and programs, which should facilitate future success.

Areas of concern – Concerns about the program are minimal. One minor concern is that not all students seem not to be aware of independent research opportunities. These opportunities should be better communicated so that students feel that they have equal access to research. A second concern is the trend of reduced enrollments in college programs. This trend is not specific to NCC.

Recommendations – One curricular recommendation is to enhance the use of statistics, or to somehow add a statistics component to the program. Rigor and reproducibility in research are important priorities for all federally funded programs (and NCC is in this pipeline). Students seem to have strong access to lab safety and data management. Statistics is another component that will only continue to become more important with time.
A second recommendation for the curriculum is to rethink the syllabus and/or teaching modality for the College Success course. While this course isn't specific to the Biological Science program, the quality and perception of the course impacts their students.
A final recommendation is to work with faculty to rethink how classroom and lab spaces are used to enhance the integration of lecture and lab material, and possibly to enhance student research outside of the classroom. If possible, provide a space for independent research projects so that students have more time and access to inquiry-based projects/research. Related, it may be beneficial to allow more flexible use of teaching space so that (for example) wait times in certain labs could be paired with lecture time for those courses.

CONCLUSIONS & RECOMMENDATIONS

Areas of Strength In agreement with the external auditor, in that we have a rigorous program with strong full time and adjunct faculty. We have strong professional laboratory assistants and equipment.

Areas of Concern In agreement with the external auditor to look at enhancing the research and statistical analyses of the course content.

Recommendations Recommendation is to continue the courses and program, grow enrollment and assess the diversity, equity and inclusion of the course and program within the next three years.

Charles Rinehimer, VMD.
Professor

Judith Rex, PhD, RN, BC
Dean, Allied Health & Science Division

Biological Science

Degree awarded Associate in Science

Narrative

Are you interested in pursuing a bachelor's degree in Biological Science? Are your career goals in the areas of medicine or scientific research? Northampton's Biological Science program is an affordable way to start. With a curriculum, that parallels the first two years of most four-year programs, NCC can save you thousands of dollars on your undergraduate degree.

NCC's program can be customized to prepare you for the range of majors and fields that are based in biological sciences, including environmental sciences, genetics, molecular biology and more. By working closely with an advisor, you can choose the right electives, and stay on track with the requirements of the transfer college of your choice.

Features

Northampton has dual admissions agreements with a variety of colleges. These arrangements enable you to have admission to Northampton and the four-year institution you select. You will receive close advising, and, based on your performance, our agreements guarantee your easy transfer of credits. NCC also offers a transfer agreement with Pennsylvania State University-Berks/Lehigh Valley and State University of New York-College of Environmental Sciences and Forestry.

Requirements

We expect you to have an adequate background in chemistry and algebra. If you need to develop this background, you may take the necessary preparatory classes prior to, or during your first semester.

Notes

Please note that General Ecology, Organic Chemistry I, and Genetics are only offered in the Fall semester, and Organic Chemistry II is only offered in the Spring semester. Employment of biological technicians is projected to grow 7 percent from 2018 to 2028, faster than the average for all occupations. Continued growth in biotechnology and medical research is expected to increase demand for these workers.

Students interested in graduate programs in Veterinary Medicine should contact Dr. Charles Rinehimer. Contact the Admissions Office at 610-861-5500 for further information.
Career Potential: Leading to transfer degrees for careers in: Research, Teaching, Medicine, Forestry Management, Biotechnology, Pharmaceutical Technology, Environmental Studies, Veterinary Medicine

NCC students have transferred to: Cedar Crest College, East Stroudsburg University Florida Institute of Technology, Kutztown University, Millersville University, Moravian College Pennsylvania State University, Rochester Institute of Technology, Temple University, University of Colorado, West Chester University, Many others nationwide

Program Outcomes

Graduates of the program will:

- Understand fundamental concepts of Biology, which characterize the various life science fields including Botany, Environmental Science, Genetics, Cellular and Molecular Biology and Zoology.
- Demonstrate oral and written communication skills necessary for sharing discipline-specific knowledge and communicating professionally.
- Conduct scientific inquiry and research on biological science topics as they relate to science, technology and society.
- Proficiently function in laboratory and field settings, using modern scientific instrumentation, including microscopes, measuring devices, and computer technology.
- Demonstrate understanding of the fundamentals of lab safety, to ensure both personal and environmental safety.
- Understand the use of the scientific method, interpretation of scientific data, and scientific literature.
- Be prepared to transfer to a four-year Bachelor's Program or a pre-med, pre-vet, or other pre-professional program.

Biological Science

First Semester

COLS101	College Success	1 credits
BIOS107	Biology I	4 credits
CHEM120	General Chemistry I	4 credits
ENGL101	English I	3 credits
MATH140	College Algebra	
	OR	
MATH180	Calculus I	3/4 credits
	Total:	**15-16**

Second Semester

BIOS150	Biology II	4 credits
CHEM220	General Chemistry II	4 credits
ENGL151L	English II	3 credits
CMTH102	Introduction to Communication	3 credits
MATH145	Trigonometry	

	OR	
MATH181	Calculus II	3/4 credits
	Total:	**17-18**

Third Semester

BIOS2__	Biology Elective ++	4 credits
CHEM201G	Organic Chemistry I	4 credits
PSYC103	Introduction to Psychology	3 credits
	General Education Elective (SIT)	3 credits
	Total:	**14**

Fourth Semester

BIOS2__	Biology Elective ++	4 credits
CHEM251	Organic Chemistry II	4 credits
	General Education Elective (AH)	3 credits
	Electives	6 credits
	Total:	**17**

Total Credits: 63-65

+ Mathematics Elective options: **MATH140** + **MATH145** *or* **MATH180** + **MATH181**. To insure transfer, electives should be selected to meet the requirements of the appropriate transfer institution.
++ Biology Electives: Students are required to take two of four Biology courses of **BIOS206**, **BIOS210**, **BIOS240** or **BIOS260**. For students with an Environmental Science intent, **BIOS206** and **BIOS210** are recommended. For students with an Integrative Biology intent, **BIOS260** and either **BIOS206** or **BIOS210** are recommended.

- For the Electives, students must select one course from the list of approved courses in each of the following categories: Arts & Humanities (AH) and Social Science: Societies and Institutions over Time (SIT).
- One course must be designated Diversity and Global Awareness (D).
- Completion of **CHEM201G** satisfies the program-related Writing Intensive (WI) requirement. In addition, one Elective course must be taken in a Writing Intensive (WI) section.
- Computer competencies are included in various program courses. Thus, completing the program automatically satisfies the computing requirement for this program.

Career Potential: Leading to transfer degrees for careers in: Research, Teaching, Medicine, Forestry Management, Biotechnology, Pharmaceutical Technology, Environmental Studies, Veterinary Medicine

NCC students have transferred to: Cedar Crest College, East Stroudsburg University Florida Institute of Technology, Kutztown University, Millersville University, Moravian College Pennsylvania State University, Rochester Institute of Technology, Temple University, University of Colorado, West Chester University, Many others nationwide

BIOS – Biological Science

BIOS 104 Field Ecology (Cr4) (3:3)
This course provides a survey of the principles and techniques of ecology. Class work stresses the theories behind the field work, including the structure of the physical and biotic components of the environment, conservation and preservation of wildlife and natural resources, biogeography and classification. Laboratory work is centered around field experiences. This course is designed for students not intending to major in science. Field work, including structure of the physical and biotic components of the environment, conservation and preservation of wildlife and natural resources, biogeography, and classification, laboratory work centered around field experiences. Core: SCI.

BIOS 105 Contemporary Biology (Cr4) (3:2)
Designed for students not intending to major in science or the allied health fields; develops an awareness of the impact of biology on individuals and the environment and an understanding of the process of science, ecology, cells, genetics, selected human systems and evolution. Not more than one of BIOS 103, BIOS 105, BIOS 107, or BIOS 115 may count for credit towards the same degree. Course numbers ending with G are Writing Intensive (WI). Approved for the Honors Program. Also available through Online Learning. Core: SCI.

BIOS 107 Biology I (Cr4) (3:3)
Designed for science majors. Utilizing an evolutionary approach, the molecular basis of life will be studied, including such topics as the scientific method, chemistry, cell structure and function, cellular respiration, photosynthesis, mitosis, meiosis, genetics, and evolution. Not more than one of BIOS 103, BIOS 105, BIOS 107, or BIOS 115 may count for credit toward the same degree. Core: SCI.

BIOS 110 In Your Genes: Introduction to Modern Genetics (Cr4) (3:2)
Designed for students with an interest in modern genetics and the Human Genome Project, the course will develop an awareness of the impact of genetics on individuals, society, and the environment. The course's goal is to empower students to make informed decisions about ethical dilemmas in genetics that society will face in the next generation. Not intended for Biological Science or Allied Health majors. Core: SCI.

BIOS 115 Essentials of Biology (Cr4) (3:2)
This course is designed to build skills necessary for successful completion of advanced Biology courses, especially those in the Allied Health fields. Basic topics such as the metric system, atomic structure, and informational literacy will be covered, as well as more in depth biological subjects such as cell structure and function, and human genetics. This course will concentrate on the principles of biology related to the human body, but will not cover body systems, evolution or other topics of general interest. Not more than one of BIOS 103, BIOS 105, BIOS 107, or BIOS 115 may count for credit toward the same degree. Core: SCI.

BIOS 126 Environmental Science (Cr4) (3:3)
This course introduces the study of human impact on the environment and fundamental principles of ecology. The effects of pollution and human disruption on the natural systems of the Earth will be studied, including water, air, and habitat destruction. Municipal solid waste issues, hazardous materials, alternative energy, and public policy (Federal, State, and Local levels) are also addressed. While there are some lab experiments carried out in the lab, laboratory work will center around field experience. This course is designed for students not intending to major in science. Core: SCI, D.

BIOS 130 Basics of Human Anatomy and Physiology (Cr4) (3:2)
This course is designed to introduce students to the basics of the structure and function of the human body, of the inter-relation of the body systems and an understanding of homeostasis and its role in disease. This course is not intended for Allied Health majors and science majors. BIOS130 will count as SCI for Healthcare Office AAS students only. Only one of BIOS130 or BIOS160 or BIOS 204 can be used for credit in the same program. Restricted to Social Work Degree, Healthcare Office Coordinator Degree, Health Care Billing and Coding Specialized Diploma, Health Care Office Specialist Certificate, and Medical Assistant Specialized Diploma majors only.

BIOS 150 Biology II (Cr4) (3:3)
Using an evolutionary framework, this course is a survey of the major taxonomic divisions and hierarchical organization of living systems on the planet. This course emphasizes eukaryotic organisms as it illustrates the similarities and differences in living forms through descriptions of their anatomy, physiology, ecology, reproduction, and development. Prereq.- BIOS 107. Core: SCI.

BIOS 160 Human Biology (Cr4) (3:3)
This course is designed to introduce students to the structure and function of the human body. The course begins with a review of biochemistry and cell structure. It then uses a systems approach to examine the parts and workings of the skeletal, muscular, nervous, digestive, endocrine, immune, cardiovascular, urinary and reproductive systems. Not more than one of BIOS 130, BIOS 160, or BIOS 204 may count for credit towards the same degree. Prereq. - High school biology or BIOS 105 or BIOS 107 or BIOS 115. Core: SCI.

BIOS 180 Introduction to Forensic Science (Cr4) (3:2)
This course provides an introduction to the field of forensic science as applied to criminal investigations and the law. This course will employ a data-driven approach to solving simulated criminal cases using a variety of scientific methods to examine physical evidence. Evidence-based lab experiments include examinations of soil samples, hair fiber, blood patterns, fingerprints, and ballistics and will be conducted to build a logical case in a criminal investigation. The laboratory will culminate in a final project employing a number of these methods. Limitations and abilities of experimental techniques will also be examined throughout the course.

BIOS 202 Microbiology for Allied Health (Cr4) (3:3)
This course will provide students with a foundation in the principles of morphology and physiology as they apply to microbes. The control of bacteria and other microorganisms will be discussed. This course will also look into the medical and economic importance of microorganisms and the role of pathogens. The laboratory portion of the course will focus on aseptic techniques, biochemical analysis off bacteria, the isolation, identification and enumeration of bacteria. This course is oriented toward students who are interested in the Allied Health field. This course is not intended for the biology major. BIOS 202 and 240 may not both be used for credit. Prereq.- BIOS 107, or BIOS 115, or BIOS 160, or BIOS 204, or VETC 101. Core: SCI.

BIOS 204 Human Anatomy and Physiology I (Cr4) (3:3)
This course is a thorough introduction to the structure and function of the human body. The course will include a survey of biochemistry, cell biology, histology, and the anatomy and physiology of the integumentary, skeletal, muscular and nervous systems of the body. Not more than one of BIOS 130, 160 or 204 may count for credit toward the same degree. Prereq. - One year of high school biology or BIOS 107 or BIOS 115

BIOS 206 General Ecology (Cr4) (3:3)
The study of interrelationships between organisms and their environment. Topics include physical factors, adaptation of species, energy flow, nutrient cycling, biogeography, population dynamics, community structure and function, ecosystems analysis, ecological management applications, and the effects of human impact. Most lab work is conducted in the field. Prereq. - BIOS 107 and BIOS 150. Core: SCI.

BIOS 210 Environmental Biology (Cr4) (3:3)
Utilizing an ecosystem approach, this course provides a survey of the broad topics of ecology and the environmental sciences. This approach gives an integrative study of the interactions of living systems with the physical world. Particular emphasis will be placed on conservation at the local level (Pocono Mountain and Lehigh Valley) and how these issues relate to global concerns. Topics include aquatic as well as terrestrial ecosystems, pollution, and the distinction between conservation and preservation. Prereq.- BIOS107. Core: D.

BIOS 220 Field Zoology (Cr4) (3:3)
This course provides an overview of animal groups, emphasizing the vertebrate fauna of eastern Pennsylvania. The lecture portion of the course will cover concepts in animal morphological and behavioral adaptations, ecological relationships, evolutionary history, and conservation. Laboratory sessions will include a number of field trips to local sites of interest and will focus on species identification and animal survey methods. Prereq.- BIOS 150.

BIOS 230 Field Botany (Cr4) (3:3)
This course provides an overview of plant groups, emphasizing the terrestrial flora of eastern Pennsylvania. The lecture portion of the course will cover concepts in plant morph morphology and adaptations, ecological relationships, evolutionary history, and conservation. Laboratory sessions will include a number of field trips to local sites of interest and will focus on species identification and animal survey methods. Prereq.- BIOS 150.

BIOS 240 Microbiology (Cr4) (3:3)
This course will provide an introduction into the field of microbiology and will include discussions of prokaryotic, eukaryotic and acellular microbes. It is cover the characteristics, growth and metabolism of the microbes, as well as how microbes interact with other organisms and their environment. The lab component emphasizes aseptic techniques and methods of isolation, enumeration, staining, and biochemical characterization. It is intended to fulfill one of the biology elective requirements for biology majors during their sophomore semester. BIOS 202 and 240 may not both be used for credit. Prereq.- BIOS 150, CHEM 120.

BIOS 254 Human Anatomy and Physiology II (Cr4) (3:3)
This course is designed as a continuation of BIOS 204 and will cover the following systems: circulatory, lymphatic, endocrine, respiratory, digestive, urinary, and reproductive systems. Additional topics will include water, electrolyte and acid/base balance and nutrition, metabolism and energy balance. Prereq.- BIOS 204 with a C or better.

BIOS 260 Genetics (Cr4) (3:3)
This course provides an introduction to the fundamentals of genetics. Topics of investigation include principles of Mendelian genetics, chromosomal theory, DNA structure, gene structure and expression, and population genetics. Lab investigations will utilize traditional as well as novel methods of genetic analysis including the extraction and manipulation of DNA, gel electrophoresis, and polymerase chain

reactions (PCR). Prereq.- BIOS 150, CHEM 220.

BIOS 281 Research in Biology (Cr1) (0:0)
An independent, experimental investigation of an area of biology selected by the students in consultation with and under the guidance of a biology faculty member; both library and laboratory research is required. Offered on demand with the approval of the science cluster. Prereq. -GPA of 2.5 or higher in at least 8 credits of biology and 4 credits of chemistry plus permission of the science cluster. Repeatable; may be taken 3 times with a limit of 9 credits total from any combination of BIOS 281/282/283.

BIOS 282 Research in Biology (Cr2) (0:0)
An independent, experimental investigation of an area of biology selected by the students in consultation with and under the guidance of a biology faculty member; both library and laboratory research is required. Offered on demand with the approval of the science cluster. Prereq. - GPA of 2.5 or higher in at least 8 credits of biology and 4 credits of chemistry plus permission of the science cluster. Repeatable; may be taken 3 times with a limit of 9 credits total from any combination of BIOS 281/282/283.

BIOS 283 Research in Biology (Cr3) (0:0)
An independent, experimental investigation of an area of biology selected by the students in consultation with and under the guidance of a biology faculty member; both library and laboratory research is required. Offered on demand with the approval of the science cluster. Prereq. - GPA of 2.5 or higher in at least 8 credits of biology and 4 credits of chemistry plus permission of the science cluster. Repeatable; may be taken 3 times with a limit of 9 credits total from any combination of BIOS 281/282/283.

BIOS 291 Special Studies in Biological Science (Cr1)
See Statement on Special Studies. Offered on demand.

BIOS 292 Special Studies in Biological Science (Cr2)
See Statement on Special Studies. Offered on demand.

BIOS 293 Special Studies in Biological Science (Cr3)
See Statement on Special Studies. Offered on demand.

BIOS 294 Special Studies in Biological Science (Cr4)
See Statement on Special Studies. Offered on demand.

Program Name: A S, Biological Sciences

Mapping Completion Date: 11/13/17

Effective Date: Fall 2018

Pre-Degree Requirements (if any):

Program Specific: Adequate background in chemistry and algebra. If needed, preparatory classes are suggested prior to, or during first semester.

Reading and Writing Placement: Based upon placement rules for ENG101 eligibility

Mathematics Placement: Based upon MATH placement rules

SEMESTER-BY-SEMESTER PROGRAM PLAN FOR FULL-TIME STUDENTS

Plans can be modified to fit the needs of part-time students by adding more semesters

Semester 1							
Course # (listed in preferred order of completion)	Course Title (course title as listed in college catalog)	Credits (credits earned for completion of course)	Degree(s) (degrees where course fulfills a requirement)	Course Type (core/required for program or elective & type)	Gen Ed Requirement (if applicable)	Term/Location Offered (F, W, SP, SU) (Beth, Monroe, Fowler, Online)	Pre-requisites/Co-requisites
COLS101	College Success	1	AS	FYE[1]		F, SP, SU, Beth, Mon, Online	
BIOS107	Biology I	4	AS	Core	SCI	F, SP, Beth, Mon, SU1-Mon	
ENGL101	English I	3	AS	Core	Communication	F, SP, SU, Beth, Mon, Online	English Placement Test
CHEM120	General Chemistry I	4	AS	Core		F and SP – Beth, Mon SU1-Mon	MATH 022, CHEM 011,
MATH140 Or MATH180	College Algebra Or Calculus I	3	AS	Specified elective[2]	QL	F, SP, SU, Beth, Mon, Online	Based upon MATH placement rules
	Total Semester Credits:	15					
Semester 2							
Course #	Course Title	Credits	Degree(s)	Course Type	Gen Ed	Term/Location Offered	Pre-requisites/Co-requisites
BIOS150	Biology II	4	AS	Core		F, SP, Beth, Mon, SU2-Mon	BIOS 107
CHEM220	General Chemistry II	4	AS	Core		F-Mon, SP-Beth, Mon SU1-Beth, SU2-Mon	CHEM 120
CMTH102	Speech Communication	3	AS	Core	Communication	F, SP, SU, Beth, Mon,	

						Online	
ENGL151L	English II (literature)	3	AS	Core	Communication	F, SP, SU, Beth, Mon, Online	ENGL 101
MATH 145 Or MATH 181	Trigonometry Or Calculus II	3	AS	Specified elective[2]	QL	F, SP, SU, Beth, Mon, Online	Based upon Math Placement rules
	Total Semester Credits	17					

Semester 3							
Course #	Course Title	Credits	Degree(s)	Course Type	Gen Ed	Term/Location Offered	Pre-requisites/Co-requisites
CHEM201G	Organic Chemistry I	4	AS	Core	WI	F-Beth, Mon; SP-Mon	CHEM 220 and ENGL 101
BIOS2--	Biology Elective	4	AS	Specified elective[3]		Depends on elective	Depends on elective
PSYCH103	Introduction to Psychology	3	AS	GE[4]	SSHB elective	F, SP, SU, Beth, Mon, Online	ENG101
	Elective (AH or SIT Electives)	3	AS	GE[4]	AH, SIT	Depends on elective	
	Total Semester Credits	14					

Semester 4							
Course #	Course Title	Credits	Degree(s)	Course Type	Gen Ed	Term/Location Offered	Pre-requisites/Co-requisites
BIOS 2--	Biology Elective	4	AS	Specified elective[3]		Depends on elective	Depends on elective
CHEM 251	Organic Chemistry II	4	AS	Core		Beth – SP only Monroe – F, SP	PRE - CHEM 201
	Elective (AH or SIT Electives)	3	AS	GE[4]	AH, SIT	Depends on elective	
	Electives	5	AS	Elective		F, SP, SU; Beth, Monroe, Online	
	Total Semester Credits	16					
	Total Degree Credits:	62					

Notes*:*

- *[1] This course is required in the first semester for all students new to college. Counts also as an elective.*
- *[2] For the two Mathematics electives students are recommended to follow one of the two options:*

  MATH 140 College Algebra and MATH 145 Trigonometry
  MATH 180 Calculus I and MATH 181 Calculus II

  Most of these electives are offered at both campuses and online during the Fall, Spring and Summer semesters, but summer offerings are limited. Make sure you plan the correct sequence if you are taking summer classes.

- *[3]Biology electives: Students are required to take two of three Biology courses of 206 (General Ecology), 210 (Environmental Biology), 240 (Microbiology) or 260 (Genetics).*
  - *For students with an Environmental Science intent, BIOS 206 and BIOS 210 are recommended*
  - *For students with an Integrative Biology intent, BIOS 260 and either BIOS 206 or BIOS 210 are recommended*

  These Biology electives have the following prerequisites:

  BIOS 206: BIOS 107 and 150 BIOS 210: BIOS 107 BIOS 240: BIOS 150 and CHEM 220 BIOS 260: BIOS 150 and CHEM 220

  To plan the correct sequence, be aware that these electives are not offered at both campuses each semester:
  BIOS 206: F-Beth, Mon BIOS 210: SP-Beth, Mon BIOS 240: F-Mon, SP-Beth, Mon BIOS 260: F-Beth, SP-Mon

- *[4]For the Electives, students must select one course from the list of approved courses in each of the following categories: Arts & Humanities (AH), Social Science: Societies and Institutions over Time (SIT) and Social Science: Scientific Study of Human Behavior (SSHB)*
  - *One course must be designed Diversity and Global Awareness (D)*
  - *Completion of CHEM 201G satisfies the program-related Writing Intensive (WI) requirement. In addition, one Elective course must be taken in a Writing Intensive (WI) section.*
  - *Computer competencies are included in various program courses. Thus, completing the program automatically satisfies the computing requirement for this program.*

  Some recommended electives are PSYC103G, GEOG 121, GEOG 140, SOCA103, BIOS126, BIOS 210, GEOG 210, HUMA 150, CHEM 260, HEAL150, NUTR105, PHYS 101.

Program Narrative:

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NCC's program can be customized to prepare you for the range of majors and fields that are based in biological sciences, including environmental sciences, genetics, molecular biology and more. By working closely with an advisor, you can choose the right electives, and stay on track with the

requirements of the transfer college of your choice.

Program Learning Outcomes:
Graduates of the program will:

1- Understand fundamentals concepts of Biology, which characterize the various life science fields including Botany, Environmental Science, Genetics, Cellular and Molecular Biology and Zoology.
2- Demonstrate oral and written communication skills necessary for sharing discipline-specific knowledge and communicating professionally.
3- Conduct scientific inquiry and research on biological science topics as they relate to science, technology and society.
4- Proficiently function in laboratory and field settings, using modern scientific instrumentation, including microscopes, measuring devices and computer technology.
5- Demonstrate understanding of the fundamentals of lab safety, to ensure both personal and environmental safety.
6- Understand the use of the scientific method, interpretation of scientific data and scientific literature.
7- Be prepared to transfer to a four-year Bachelor's Program or a pre-med, pre-vet or other pre-professional programs.

Program Requirements:
We expect you to have an adequate background in chemistry and algebra. If you need to develop this background, you may take the necessary preparatory classes prior to, or during your first semester.

Transfer Information:

- *NCC has dual admissions agreements with a variety of colleges. These arrangements enable you to have admission to Northampton and the four-year institutions you select*
- *NCC offers transfer agreement with Pennsylvania State University-Berks/Lehigh Valley and State University of New York College of Environmental Sciences and Forestry.*
- *NCC students have transferred to Cedar Crest College, East Stroudsburg University, Florida Institute of Technology, Kutztown University, Millersville University, Moravian College Pennsylvania State University, Rochester Institute of Technology, Temple University, University of Colorado, West Chester University, Many others nationwide.*

Career Information:

- Completion of the Biological Sciences program leads to transfer degrees in: Research, Teaching, Medicine, Forestry Management, Biotechnology, Pharmaceutical Technology, Environmental Studies, and Veterinary Medicine.

Career	Typical Education	Annual Wage (2017)
Biological Technicians	Bachelor's degree	$39,862
Bioinformatics Technicians	Bachelor's degree	$42,683
Environmental Scientist	Bachelor's degree	$56,161
Agricultural Technicians	Master's or Professional degree	$43,318
Environmental Restoration Planner	Master's or Professional degree	$56,161
Veterinarian	Doctoral Degree or more	$55,844
Teacher, Postsecondary	Doctoral Degree or more	$78,003
Molecular and Cellular Biologists	Doctoral Degree or more	$81,578
Bioinformatics Scientist	Doctoral Degree or more	$81,578
Physician	Doctoral Degree or more	$210,052

- *Link to Career Coach. https://northampton.emsicc.com/*

IN 2017 A RIGOR ANALYSIS WAS CONDUCTED TO ENSURE THAT COURSES WERE KEEPING TO THE RIGOR REQUIRED TO MEET THE LEARNING OUTCOMES. THE REPORT FOLLOWS.

PROGRAM RIGOR ANALYSIS

Name of Program: Biological Science

Type of Program (AA, AS, or AAS): AS

Total number of credits: 63/65

The table below lists elements of analysis in reviewing academic rigor in the program. The elements will include a review of program learning outcomes, program sequencing, the curriculum arrangement, and transferability (for AA and AS degrees.) Discuss each element and record faculty feedback/consensus in the evidence column. Confirm whether acceptable or not and complete the Action Plan column where changes are deemed necessary. FACULTY INVOLVED IN THE ANALYSIS: JOHN LEISER, KATHLEEN KRESGE, JEANNIE SMITH, BEATRICE VILLAR, KAREN KLEIN, CHARLIE RINEHIMER

ELEMENTS	EVIDENCE DESCRIBE ANALYSIS/DATA/ DISCUSSION	ACCEPTABLE	NOT ACCEPTABLE	ACTION PLAN/ RESPONSIBLE PARTY
Review of Program Learning Outcomes Do program Learning Outcomes reflect level of knowledge, skills, & competencies for an Associate degree? Do the Learning Outcomes describe the characteristics of graduates from the program? Record evidence of faculty discussions/analysis in the "Evidence" column to the right.	In compliance to Middle State Commission on Higher Education, Standard III (Design and Delivery of the Student Learning Experience), the Learning Outcomes 2 - 6 directly demonstrate that the Biological Sciences curriculum is "designed so that students acquire and demonstrate essential skills including at least oral and written communication, scientific and quantitative reasoning, critical analysis and reasoning, technological competency, and	☒	☐	Currently there is a lack of funding for "graduated student follow-up" analysis. We would like to research the progression of our graduates as they continue through their bachelor's degree to assess their level of preparedness

ELEMENTS	EVIDENCE DESCRIBE ANALYSIS/DATA/ DISCUSSION	ACCEPTABLE	NOT ACCEPTABLE	ACTION PLAN/ RESPONSIBLE PARTY
	information literacy." Supporting evidence is demonstrated by the Independent Research Projects/Written papers/Oral presentation requirements conducted in the required program courses Biology 1, BIOS107 and Biology 2, BIOS150. In addition, two biology electives are also required for program graduation and all four of the available biology electives incorporate scientific experimentation and report writing. Student success in the 200-level courses demonstrates the characteristics of Biological Sciences graduates			obtained through their Associate degree program.
Do program Learning Outcomes reflect appropriate growth according to Bloom's taxonomy (move students toward higher level thinking and problem solving)? *(See Bloom's taxonomy and verbs and additional resources on the final pages of this document)* Record evidence of faculty discussions/analysis in the "Evidence" column to the right.	*Graduates of the program will:* 1. **Understand** fundamental concepts of Biology, which characterize the various life science fields including Botany, Environmental Science, Genetics, Cellular and Molecular Biology and Zoology. 2. **Demonstrate** oral and written communication skills necessary for sharing discipline-specific knowledge and communicating professionally. 3. **Conduct** scientific inquiry	☒	☐	

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	and research on biological science topics as they relate to science, technology and society. 4. Proficiently **function** in laboratory and field settings, using modern scientific instrumentation, including microscopes, measuring devices, and computer technology. 5. **Demonstrate** understanding of the fundamentals of lab safety, to ensure both personal and environmental safety. 6. **Understand** the use of the scientific method, **interpretation** of scientific data, and scientific literature. 7. Be prepared to transfer to a four-year Bachelor's Program or a pre-med, pre-vet, or other pre-professional program. The Program Learning Outcomes for the A.S. in Biological Sciences are not necessarily annotated in temporal order, although the program itself builds students from a level of fundamental understanding (outcomes 1, 6) of scientific concepts through the creation and evaluation of their own			

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	experiments (3). That is, the terms in bold above show the progression in students' experiences from understanding (Blooms Level II "Understand") and demonstration (Blooms Level III "Apply") of knowledge and skills to the conducting (Blooms VI "Create") and interpretation (Blooms IV "Analyze") of scientific experiments.			
Does the course sequence supports student acquisition of and development of disciplinary and/or career knowledge. Record evidence of faculty discussions/analysis in the "Evidence" column to the right.	Yes. Students get a foundation in cellular, molecular and organismal biology during their first two semesters in Biology I & II. During their second year, they build upon this foundation by taking two biology electives that will further prepare them to transfer to a four year program.	x	☐	
Are the program courses arranged to support measurable progression in learning/critical thinking/problem-solving?	Yes. Students must apply the knowledge and skills they gain in Biology I & II in the 200 level biology electives they choose. For example, students learn about the scientific method in Biology I. In Microbiology, they must apply that method to design and carry out an original experiment.	☒	☐	
Does the course sequence include appropriate pre-requisite courses to support learning/critical thinking/ problem-solving? Record evidence of faculty discussions/analysis in the	Yes, Students are required to take Biology I before Biology II. Biology II is a pre-requisite for BIOS206, BIOS240 and BIOS260. There are	☒	☐	

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"Evidence" column to the right.	currently no math or writing pre-requisites for the biology courses. However, adding these requirements may improve student success in these courses.			
Are there a sufficient number of 200-level courses required? ENTER THE NUMBER IN THE DEGREE HERE: _____ **MINIMUM OF 4 REQUIRED IN THE DEGREE PROGRAM** (These 4 required 200 level courses can include general education, electives or program courses) If < 4, are there required courses in the degree that are 100-level that have 200-level rigor. If yes, list courses here: *If renumbering a course is being considered, a Course Rigor Analysis worksheet is available to document this assessment. Please consult your dean for that worksheet.* For programs not meeting the minimum requirement, please note in the evidence column how you will meet that requirement. (Justify current rigor or note recommendations for change.)	BIOS 206 General Ecology BIOS 260 Genetics BIOS 240 Microbiology BIOS 210 Environmental Biology CHEM 220 General Chemistry 2 CHEM201 Organic Chemistry 1 CHEM 251 Organic Chemistry 2	☒	☐	
Review of Transferability ***(Complete this section for programs designed for transfer AA/AS/some AAS)*** Can graduates of the program transfer easily? List top transfer institutions for your program. Are their articulation/transfer agreements for this program? Include a list of or links to these agreements. List top transfer institutions for the degree here:	The curriculum is designed for easy transfer to most four year institutions The top transfer schools are ESU, Kutztown, DeSales, Penn State, Shippensburg and Lehigh The Biology program is in compliance with the State TEOC agreement so that the entire program will transfer to all 11 of the	☒	☐	Data from Mark Henry, transfer office

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Data source:	state supported schools. In addition there are transfer agreements with SUNY and Delaware Valley University.			
Do courses in the major transfer count toward the four year degree program?		☒	☐	
Review of Career Readiness – Preparation for Employability *(Complete this section for programs designed to prepare graduates for direct employability - AAS)* Are program learning outcomes aligned with employer/business/industry/accreditation agency expectations? If yes: how is this verified? If no, complete action plan/responsibility column. Placement data indicates employability (Refer to Placement Report) Data source: Frequent employers: Quantity/quality of employer feedback(if available): Summary of graduate surveys	Program learning outcomes are designed to prepare students for transfer to a four-year institution. Up until the early 2000's graduate surveys were conducted to try to measure the success of the transfer students based on their first semester GPA after transfer. This initiative was dropped due to poor response and monetary restraints. When data was available over a ten-year period transfer student's GPA went up a few tenths from their GPA at NCC indicated an adequate level of preparedness.	☐	☒	Department will work with Dorothy Schramm, directive of institutional effectiveness and Mark Henry, transfer, to design a survey to be administered to the transfer students. Charlie has already reached out to Bio 2 students to ask them if they would be willing to sign a release that would permit the college to obtain their first semester grades from their transfer institution.

Biological Science is always below the institutional average cost per FTE.

	FY2019	FY2018	FY2017	FY2016	FY2015
Program Income					
Tuition	1,289,737	1,583,549	1,481,762	1,592,016	1,535,056
Local Reimb	219,162	262,784	243,115	255,658	249,151
Operating Reimb	512,684	600,015	559,162	465,858	431,511
Stipend Reimb				366,739	364,336
Total Income	2,021,583	2,446,348	2,284,039	2,680,271	2,580,054
Program Costs					
Direct Costs	905,911	994,903	923,793	953,841	928,430
Indirect Costs	1,000,810	1,129,632	997,839	1,046,587	1,013,108
Total Costs	1,906,722	2,124,535	1,921,631	2,000,428	1,941,537
FTE	260.83	327.40	313.63	341.45	343.18
Income per FTE	7,751	7,472	7,283	7,850	7,518
Cost per FTE	7,310	6,489	6,127	5,859	5,657
Inst Avg Cost per FTE	7,933	7,075	6,703	6,416	6,144
Rank	91 of 133	86 of 126	97 of 132	101 of 129	88 of 119