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| **PROGRAM NAME:** Biotechnology | **AUTHORING TEAM CONTACT:** Carole Twichell |
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| GUIDELINES  Time Frames   1. Scope:   The time frame of program review is five years, including the year of the review.  Data being reviewed for any item should go back the previous four years, unless not available.   1. Deadline Dates:   January 15th – Program Review Document due to Department Dean for review (Deans may require submissions at their own, earlier due date)  February 1st – Program Review Document due to Program Review Steering Committee   1. Years:   Years 1 & 3 – Implement Action Plan of (CIP) and collect data  Years 2 & 4 – Analyze data and findings, Update Action Plan  Year 5 – Write Program Review of past 5 years; Write Continuous Improvement Plan (CIP) and create new Action Plan  LENGTH OF RESPONSES: Information provided to each question may vary but should be generally kept in the range  of 1-2 pages or 500-1,000 words.  **EVIDENCE GUIDELINES**: In the following sections, you will be asked to provide evidence for assertions made.   1. Sources: This evidence may come from various sources including professional accreditation reviews, THECB, Texas Workforce Commission’s CREWS, Institutional Research Office (IRO), National Student Clearinghouse, IPEDS, JobsEQ, EMSI Career Coach, and may be quantitative and/or qualitative. If you are unfamiliar with any of these information sources, contact the Institutional Research Office at: [effectiveness@collin.edu](mailto:effectiveness@collin.edu). Use of additional reliable and valid data sources of which you are aware is encouraged. 2. Examples of Evidence Statements: 3. Poor example: Core values are integrated into coursework. (Not verifiable) 4. Good example: Core values are integrated into coursework through written reflections. (Verifiable, but general) 5. Better example: Core values are integrating into coursework through written reflections asking the student to describe how s/he will demonstrate each of the core values in his or her professional life and demonstrated through service learning opportunities. (Replicable, Verifiable)   **FOR MORE INFORMATION:** The Program Review Portal can be found at <http://inside.collin.edu/institutionaleffect/Program_Review_Process.html>*.* Any further questions regarding Program Review should be addressed to the Institutional Research Office ([effectiveness@collin.edu](mailto:effectiveness@collin.edu), 972.599.3102). |

**Introduction/Preface**

EXECUTIVE SUMMARY

**Briefly summarize the topics that are addressed in this self-study, including areas of strengths and areas of concern. (Information to address this Executive Summary may come from later sections of this document; therefore, this summary may be written after these sections have been completed.)** Please do not include information in this section that is not already provided elsewhere in this submission. Using the questions in the template as headings in the Executive Summary can provide structure to the overview document (see below for suggested format).

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| **Executive Summary (suggested sections/format-not required format)**  What does our program do?  Why do we do the things we do: Program relationship to the College Mission & Strategic Plan.  Why we do the things we do? Program relationship to student demand.  Why we do the things we do? Program relationship to market demand.  How effective is our curriculum and how do we know?  How effectively do we communicate, and how do we know?  How well are we leveraging partnership resources and building relationships, and how do we know?  How have past Continuous Improvement Plans contributed to success?  How will we evaluate our success? |

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| **Complete the Executive Summary below after you have completed your review.** 1)What does our program do?  Collin College’s Biotechnology Program prepares students interested in research and scientific careers to enter entry-level positions in cellular and molecular biology research in academia, as well as in industrial laboratories. The aim is to prepare them for research positions in academia, medical school and/or pharmaceutical/biotech laboratories such as medicine, diagnostics, agriculture, pharmacology etc. Upon completion of the program, students are able to make solutions (including lab math), use common equipment found in a biotechnology laboratory, purify and work with nucleic acids and proteins, culture organisms and work in a regulated environment, just to name a few skills they are required to master. Our program prepares students and makes them competitive for technicians’ positions in local laboratories, as well as joining more advanced university level biotech programs. The technician position is the lowest level position for which the program prepares students. For more aspiring students, our program prepares them for higher level science/pre-med programs. At least three of our students have successfully entered medical schools and are currently physicians or are in the process of finishing medical school.  Many of our students have entered jobs where they work in research labs, product testing, technical support, or as laboratory staff members, others have gone on to pursue a BS or higher.  2)Why do we do the things we do:  Program relationship to the College Mission & Strategic Plan.  The college’s mission is to challenge students to use critical thinking, to help them acquire high level and unique biotechnology laboratory skills, and develop an understanding of the research mind-set. Our courses prepare our students to learn independence in a laboratory, to go beyond memorization, to master scientific processes, and to develop skills in analytical thinking, speaking and presentation. Through the biotechnology program, our students have the opportunity to participate in conferences such as the SEA-PHAGES Bacteriophage Conference, the Community College Undergraduate Research Initiative (CCURI), and the Plano campus’s own STEM research symposium to present their research. Such opportunities are rarely offered at the two-year college level nationwide.  The second and third of Collin College’s strategic plans are to implement strategies to make our biotech program a strong, prestigious and recognized  program nationwide; and to create integrated pathways to support articulation of our students with Texas universities and gateways for students to expand their education in other ways, such as medical school or research. Such partnerships have been created with Texas A&M-Commerce, Texas A&M-Texarkana, the University of North Texas Health Science Center, Texas A&M University, and UT Southwestern research labs. We have explored partnerships with the University of Texas at Dallas, Texas A&M – Corpus Christi, Texas A&M – Central Texas, and Tarleton State.  Collin College was awarded a portion of $8.8 million by the bureau of the US Economic Development Administration (EDA) Good Jobs National grant “North Texas Biotech Workforce Development” (2022-2024) to increase biotechnology education in north Texas. Collin College, as the only north Texas school with an existing biotechnology program, is to serve in an advisory and mentoring role as well as a  training site for students.  3)Why do we do the things we do? Program relationship to student demand.  We are proud of the 18 students who were awarded biotechnology certificates (ABTE, BITE and BTEC) in the last five years (2017-2021 data).  Most (13 out of 18) of our students were awarded the level-1 certificate; however, 5 of them earned an advanced certificate as well. One of the challenges we face is identifying interested students prior to enrollment in our biotech courses. Once students start the freshman biotech courses and learn more about our program and its outcomes, they become more interested in pursuing the biotech certification path. A DFW industry survey done in spring of 2021 indicates there will be 1,100 biotech jobs over the next 3 years as more life science businesses move into the area.  In the prior program review, it was noted that enrollment in biotech courses declined and one of the stated reasons was that the courses, Introduction to Biotechnology I and II (BIOL 1414 and 1415) were slated for deletion from the Academic Course Guide Manual (ACGM). Despite being maintained in the ACGM, a major challenge we faced was the erroneous mislabeling of the two introductory biotech courses (BIOL 1414 and BIOL 1415) from Banner as not being part of the core. It took years for this error to be fixed in 2022. Unfortunately, during this time, enrollment in the two introductory biotech courses declined dramatically. The mistake and lack of information about the biotech courses being part of the core component, lead a decline in enrollment in the Biotech courses. We are in dire need of support from the advising department to rectify the situation.  Even now, we hear from students that if they had known that biotech was part of core, they would have enrolled earlier. To rectify this, we have made a point to emphasize the academic and core status of our courses on advertising.  As part of the campaign to maintain the status of BIOL 1414 and 1415, we have been working hard to create articulations with more local/state universities. We have faced difficulties in this endeavor. TAMU-Corpus Christi agreed to accept our biotech courses for credit, unfortunately, Collin College never signed the agreement.  A similar issue arose in partnerships with UNT and TAMU-Texarkana, due to a change of leadership at the institutions that occurred before we could form an agreement or after the agreement was signed, respectively.  4) Why we do the things we do? Program relationship to market demand.  In 2021, local bioscience employers were surveyed as to their hiring needs for the next three years.  Their encouraging response was that over 1100 entry-level jobs will be coming to north Texas in the timeframe between 2021 and 2024.  These jobs include lab technicians, and many of which require certificate-level education.  In addition, some description specifically mention the need for a certificate in biotechnology.  As the only college currently offering a certificate in biotech, we can fill a much needed role in the area.  One of the companies coming to Collin County is Evolve Biologics, who will be hiring hundreds of employees starting in late 2024, and putting them to work in our own “backyard” in Sachse, Texas.  Although there is a need for trained technicians, and biotech programs are valuable, there are relatively few programs offered nationwide, at both the 2- and 4-year levels. There seems to be a lack of communication between career providers, schools, and potential students. Biotech/pharma labs need to know about biotech programs that are built to instruct and train future biotech technicians, and students need to know about the jobs/biotech labs they can integrate after receiving their certification. It has been an ongoing issue for decades, and the progress toward change is extremely slow.  Advertising is key to increasing the pipeline of future biotech students. At Collin College, we have been proactive and participated in biotechnology workforce fairs in DFW, as well as attending events at local high schools (Allen High School (Fall 2022), McKinney High School (date uncertain)) and career fairs (Workforce Career Fair – Plano Campus (Fall 2022), CAST, Science Teacher of Texas Conference (Fall 2022)) to make the community aware of our biotech program and availability of students to sit for the BACE (biotechnician assistant credentialing exam). Biotechnology job postings nationwide often require a bachelor's degree or higher. However, the job description and skills listed are ones that are mastered by our certificate students. The bias towards preferentially hiring undergraduate and graduate-level individuals to entry-level jobs will be difficult to break.  Our local BIO (the national industry advocacy group) affiliate, BioNorthTX, has been working to make local employers aware of the educational facilities that train entry-level workers, including Collin College, to encourage them to recruit and hire locally. The EDA grant is positioning 2-year biotech programs and employers to partner in training and employing graduates.  5) How effective is our curriculum and how do we know?  According to the Collin College Program Review (2021-2022 data), we had only 18 completers over the last five years, but our average number of completers per year has increased during this review period. In 2017, we had only one, but in 2018 and 19, we had three. In 2021 and 2022 we had six and five, respectively. This increase is heartening, in light of the shut downs and schedule difficults wrought by the pandemic. If we include data from fall of 2022, we have met the target of 5 completers per year (average). (See table in Section III)  This success was not achieved without a struggle on part of the biotech faculty who consistently teach small classes (typically per head as an overload), even as overall enrollment at the Plano campus declined. Our faculty puts students first, and goes the extra mile to help students achieve their goals to earn their level 1 and 2 certificates.  At Collin, we utilize a modified version of the curriculum and teaching materials from the Austin Community College (ACC) Biotech Program. Austin Community College has developed a strong biotech curriculum that meets the Texas Skill Standards for Biotechnology as well as incorporates recommendations of their industry advisory board. We also incorporate such skills and recommendations from our advisory board into our biotech curriculum, to meet our local biotech industry needs.  Our next step is to explore the potential for dual-credit students who are already enrolled in related workforce programs, or students that have completed a high-school-level course sequence in biotechnology.  Such a model has been successful in schools in both the Austin and Houston areas. The main difference is that their high school teachers are teaching biotech in the high school, while we would teach the courses at the community college. We have highly trained biotech faculty, with extensive experience teaching biotech curriculum; we also have a well equipped biotech lab, and are exploring the possibility of holding a biotech class at the Allen Technical Campus. The dual credit biotech path is without doubt a solid and potentially very successful one. Through dual credit partnership at Plano ISD high school, and potentially at other high schools, students could earn their level -1 or advanced certificates while finishing high school. This positions them to go to work in a lab after graduating or work at a university lab as they continue their education.  As a member of InnovATEBio, the national center for biotechnology education, funded by the National Science Foundation’s Advanced Technological Education wing, we have coordinated our curriculum with schools across Texas, and aligned our skills taught with those across the nation, but adapted to the local needs.  Our biotech students can be confident that they will be able to keep up with industry demands, should they have to move from the north Texas area.  The partnership also affords us opportunities for professional development and training in cutting-edge technologies.  6) How effectively do we communicate, and how do we know?  Our primary means of communicating with our students has been through flyers, though we have also participated in career fairs both at the high school and college level.  We have provided Advising with program material to aid them in advising students.  For at least two semesters before 2023, biotechnology students were highlighted on the Collin website, to demonstrate programs the college offers.  We advertise our upcoming classes with postings around the Plano campus, and our flyers were shown on CougarTV.  We do not currently have a website other than the Biotechnology information page on the Collin website, but that page has information about the program and the two certificates we offer, including course substitutions.  Information on our program can also be found on the grant-funded websites associated with our biotech education organizations.  We have shared our flyers and program information with other biology faculty, asking them to post the information in class or on their Canvas pages.  We have posted flyers outside of science classrooms to attract the attention of science students.  At Springfest in 2022, we produced a slideshow about the entire biology department, which showcased biotech as a program that offers students the opportunity to do research and present at conferences.  In surveying students enrolled in BIOL 1414 (Introduction to Biotechnology I), the majority of students found the course through browsing the course catalog or reading the website. We believe that increasing visibility in advising, and providing advising with the correct selling points, will increase enrollment, because if merely reading the description of biotech in the catalog is enticing enough to enroll, having an advisor mention the courses as another way to get core science credit will be even more so.  7) How well are we leveraging partnership resources and building relationships, and how do we know?  Our best and strongest partnerships have been with other institutions that teach biotech.  From our inception as a biotech program, we have been a part of Bio-Link, the national center for biotechnology education.  Through Bio-Link, our faculty received professional development, curriculum resources, and specialized training.  Using the partnerships developed through Bio-Link, and later through InnovATEBio, the successor to Bio-Link, we have applied for and been awarded grants to promote biotech concepts in other courses, to bring a biotech credentialing exam to areas without one, to communicate the importance of undergraduate research in a science education, and more.  We have been recognized as a valuable asset to the area by the economic development group, BioNorthTX, which has invited our faculty members to speak on the need for technician education in the area, and by local universities who wish to create biotech undergraduate degrees that can serve as a pathway from two-year to four-year higher education.  We have drafted potential articulation agreements with UNT, TAMU-Texarkana, Texas Tech, TAMU-Corpus Christi, TAMU-Commerce, and UNTHSC.  However, none of the planned articulations came to full reality, and the opportunity it would have afforded our students was lost.  We have created research pipelines with UTD and TWU.  We were able to fully utilize the Bridges program with TWU, but UTD did not provide as many research opportunities for our students as was anticipated.  10) How have past Continuous Improvement Plans contributed to success?  The benefit of creating and carrying out Continuous Improvement Plans has been to define the outcomes that we (and our industry members) want for our biotech students.  Once these goals were written down, we were able to create action plans to make sure that they would be achieved.  Program learning outcomes are meant to reflect marketable skills that graduates of the program should exhibit.  Towards that end, the skills that we chose to assess in our CIP are basic and fundamental.  Five program learning outcomes were created during this review period.  In addition to the benchmarks previously developed as part of the CIP, two of the other three outcomes developed dealt with the fundamental need for mathematics, and the common laboratory skills of carrying out and interpreting electrophoresis gels.  Since it was emphasized that PLOs should be assessed in each required class, a fifth goal was added that could be assessed in our Quality Assurance course in which students must describe the steps involved in the FDA, Food and Drug Administration, drug approval process as well as discuss ethical issues that may be associated with politicization of drug approvals.  11) How will we evaluate our success?  Most programs are able to use graduation rates or numbers of completers as a metric for success. This is of course our goal as well, but until numbers rise, we will determine success by the outcomes of our biotech students. Our graduates have become lab technicians at Collin College and elsewhere; a few of them followed the medical field and are currently either physicians or finishing medical school. Our students won over the hearts of several local industries and prestigious research labs such as the Petrie and Sadek research labs at UTSouthwestern Medical center in Dallas, Biosynthesis, Santa Cruz, and especially the product testing company Microconsult, who has offered jobs to nearly every one of our interns that interviewed there.  Collin’s biotechnology program started over 22 years ago, at a time when no other college in the area offered one. We were probably ahead of our time as the program was established before there was a concerted economic push toward developing a life science sector in the DFW region. Still. we are proud of the skills and knowledge our biotech students gain in the program. Our courses teach independence and how to utilize critical thinking in a lab setting. The lab skills have made them successful in the workplace as well as prepared them to successfully transfer to 4-year schools. |

Section I. *Are We Doing the Right Things?*

**1. WHAT DOES OUR PROGRAM DO?**  
 **What is the program and its context?**This section is used to provide an overview description of the program, its relationship to the college and the community it serves. **Keep in mind the reviewer may not be familiar with your area**. Therefore, provide adequate explanation as needed to ensure understanding.

*Suggested points to consider:*

* *Program’s purpose (Include the program’s purpose/mission statement if one exists.)*
* *Program learning outcomes or marketable skills*
* *Brief explanation of the industry/industries the program serves*
* *Career paths and/or degree paths it prepares graduates to enter*
* *What regulatory standards must the program meet (THECB, Workforce, external accreditation)*

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| Collin College’s Biotechnology Program prepares students interested in scientific research and careers to enter positions in cellular and molecular biology in academia, as well as various industrial laboratories. With the technological advances in bioscience research, biotech students (freshman and returning students) enrolled in our program, have the opportunity to familiarize themselves with the modern biotechnological methods and technologies related to agriculture, medicine, diagnostics, the environment, pharmaceuticals, and other applications in research. They will master basic knowledge and skills that have been identified by our industry advisory committee to be required for entry level technician positions. Our program prepares our students and makes them competitive for technicians’ positions in local laboratories, as well as joining more advanced university level science programs. Students are well suited to transfer into university programs to complete a bachelor’s of science degree in various disciplines. However, there are few upper division “biotechnology” specific programs in the state or nation.  Our program offers both level-1 and level-2 certificates. Available jobs typically list BS degrees as the preferred credential, so the certificates provide skills that enable students to work in labs, to gain valuable experience, while pursuing a BS. Despite having a workforce program, our certificates offer 2 out of 4 courses for the Level-1, and 6 of 9 courses for the Advanced Certificate that will transfer as academic credit, though all courses can be used as electives for students pursuing an AA or AS degree; many times they serve as electives in 4-year degrees to which students transfer. In addition, we are working to change the mindset of an industry that believes that they need to hire 4-year and graduate workers, when a well-trained certificate holder can do the job just as well. |

**2. WHY DO WE DO THE THINGS WE DO: PROGRAM RELATIONSHIP TO THE COLLEGE MISSION & STRATEGIC PLAN.**

* **Provide program-specific evidence of actions that document how the program supports the College’s** [**mission statement**](https://www.collin.edu/aboutus/)**:** “*Collin County Community College District is a student and community-centered institution committed to developing skills, strengthening character, and challenging the intellect.”*
* **Provide program-specific evidence that documents how the program supports the College’s strategic plan (2020-2025 Strategic Plan)**: <https://www.collin.edu/aboutus/strategic_goals.html>.

*Suggested/possible points to consider:*

* *What evidence is there to support assertions made regarding how the program relates to the mission and strategic plan?*
* *Think broadly-increasing completion, articulation agreements, pathways from high schools, etc.*
* *Analyze the evidence you provide. What does it show about the program?*

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| The Mission of Collin College states that Collin College is a student and community-centered institution committed to developing skills, strengthening character, and challenging the intellect.The courses included in the biotechnology program, especially BIOL 1414 and 1415, and those with the prefix BITC, exemplify the goals of developing skills and challenging the intellect. In all of these courses, students are challenged to move beyond memorization of facts to develop critical thinking and transferable skills, like data interpretation, communication and the ability to work independently. The majority of the courses in our certificates include a laboratory component, and the lab courses typically include authentic research, such as viral discovery, genome annotation, biomanufacturing and genetic studies. According to studies, participating in authentic research promotes independence in the lab, increased interest and retention in higher education, gains in analytical thinking and speaking skills, and advancement in future professional development. (Gaspar, 2013) In addition, biotechnology students often have the opportunity to participate in meetings such as the SEA-PHAGES Bacteriophage Conference, the Community College Undergraduate Research Initiative (CCURI), and the Plano campus’s own STEM research symposium to present their research, something that is not frequently offered in science programs at the 2-year college level.  The second of Collin’s strategic goals is to implement strategies to be a national exemplar in program and student outcomes. Currently, Collin College is the only two-year college offering Biotechnology courses in the DFW area. Spurred on by the increase in the biotechnology industry in our area (D Magazine), Dallas College and Tarrant College are actively pursuing the formation of their own biotech certificates and/or associate degrees. Collin College stands at the critical point of being able to guide these schools in their endeavors, and has been awarded a grant pursuant to those aims. We are serving as an example for the other schools in biotechnology education in north Texas.  Dr. Kirkpatrick serves as a mentor for the American Association of Community Colleges’ MentorLinks program. She just completed the 2018-2021 cohort, mentoring Southeast Community College Biotechnology Program in Lincoln, Nebraska. She is currently serving as a mentor and advisory board member for the Biotechnology Program at Wake Tech Community College in Raleigh, North Carolina, 2021-2024. The purpose of the MentorLinks program is to assist the mentee programs to reach specific goals for growing and/or starting a program. Dr. Kirkpatrick assists her mentees by sharing experiences, curriculum, making connections to other programs nationally in order to accelerate the mentee’s program development. Dr. Kirkpatrick’s partnership with these other colleges, through MentorLinks, ties her affiliation with Collin College into a larger biotechnology network and positions our college as a mentor as well. As a NSF-funded endeavor, connections through MentorLinks helps keep all partner schools up-to-date with changes in the field, and allows for participation in national networking conferences. This helps maintain the science community’s awareness of Collin College.  The third strategic goal for the college is to create integrated pathways to support articulation of our students. Our advisory board has endorsed such agreements, though we have been unable to secure any in a meaningful way. For over a decade, the biotechnology professors at Collin College have worked with Texas universities to craft articulation pathways to provide pipelines for our biotech partner schools. We, and other biotech programs in the state, have had limited success in solidifying articulation agreements. However, it has become clear that the post-pandemic student wishes for variety in their course delivery, so we have continued to create online options, not only in our own classes, but in our articulations. In addition, we have hosted a few dual-credit students over the years, and based on the success seen by some of our partner schools, a valuable and potentially robust pathway may be formed by expanding biotechnician education to our county high school students.  In the prior program review, it was noted that enrollment in biotech courses declined and one of the stated reasons was that the courses, Introduction to Biotechnology I and II (BIOL 1414 and 1415) were slated for deletion from the ACGM. Collin co-led a statewide campaign, which included all colleges in the state offering biotech courses, to maintain the academic status of these two courses. After a two-plus-year battle, the Texas Higher Education Coordinating Board (THECB) committee voted to maintain the courses in the ACGM by a very narrow margin. The academic status of these courses is a critical component for articulations. As part of the campaign, it became clear that there is industry support for biotech programs, but few pathways of meaningful articulation. We continue to work on this effort.  We have been working on this over the past several years, but have made limited progress. We developed agreements with Texas A & M Texarkana (TAMU-T), and TAMU Corpus Christi in which all courses in the biotech program transfer for credit. Shortly after signing the agreement with TAMU-T, leadership changed at that institution, and their biotechnology program was apparently abandoned. Collin College never signed the agreement with TAMU-CC (reasons unknown to the authors), though Del Mar College in Corpus Christi was able to take advantage of the agreement that we developed. Del Mar biotech students seamlessly articulate all of their biotech credits into a University Studies Degree, often with an emphasis in the business to meet the needs of small biotech start-up companies.  We have pursued agreements with University of North Texas (UNT)-Frisco and main campus, TAMU-Central Texas, Texas Tech (through the CHEC), and TAMU-Commerce with limited success. Our lack of success ranges from changes in leadership, lack of faculty support at the university, or the inability to get required signatures from Collin leadership. For instance, an individual from UNT, with whom we developed articulation pathways, retired and the proposals seemed to die on the vine. Other pursuits have died for one reason or another.  We currently have an agreement with UNT Health Science Center in Ft Worth (UNTHSC) whose bachelors of biotechnology degree was recently approved by the state. This agreement will allow our students to seamlessly transfer all Collin Biotech credits into an online BS in Biotechnology. This is an incredibly important opportunity for students who are unable to relocate in order to finish a bachelor's degree. It is awaiting administrative signatures.  Despite having a teaching staff of two, with a full-time lab assistant for most of this review period, the biotech program professors bring a diversity of expertise to the classroom, from the use of animal models to the manipulation of bacterial and mammalian cells. Graduates of the biotech certificate program have gone on to become valuable lab assistants on our campuses. Our students have so impressed their supervisors during their internships that they have attracted no less than three faculty members to Collin College, all who wanted to be a part of the school that offered such quality training for lab workers.  Grants:  During the course of this review period, we have participated in several grants that contributed to the strategic goals of leadership and partnership.     |  |  | | --- | --- | | Grant | Value to Collin College | | EDA Good Jobs grant “North Texas Biotech Workforce Development” (2022-2024), Co-PI | Collin College is a partner for developing a short-term training program to meet local industry needs for biotech and health care systems. Participation will increase the visibility of the program to industry as well as provide partnerships with other institutions, both 2-year and 4-year. | | “Industry-Recognized Credentialing System (IRCS)” National Science Foundation-Advanced Technological Education (ATE) grant, 2021-2024, Co-PI | Collin College established as an exam testing site, allows students to sit for the exam without cost; increase in industry recognition of the credentialing exam, recently approved by Texas Education Agency (TEA) for Career and Technical Education (CTE) credential – this will translate into increased high school offerings/enrollment and potential articulation for biotech. This has provided the opportunity to meet with a large number of industry leaders, locally and nationally, to learn their employment/skill needs and have a dialogue about biotech training and wages. June, 2022, 6 exams were administerd and more are planned for this spring. | | American Association of Community Colleges MentorLinks Program, Mentor, Biotechnology Programs  Southeast Community College, Lincoln, NE (2019-2022), Wake Tech Community College, Raleigh, NS, (2021-2023) | Provides opportunity for mentor training and networking at the national level with other biotech programs (both mentee programs and well-established programs); increases visibility of the program, provides opportunity to learn what others are doing to recruit students and grow programs to help ours. | | Austin Communitey College Bio-Link Regional Center (AC2) Advanced Technological Education (ATE) Regional Center Grant; 2014-2019; Co-PI | Allowed for release time for: professional development, coordination of efforts to maintain Intro to Biotech I and II courses (BIOL 1414 & 1415) in the ACGM, development of research-based labs for BIOL 1406, articulation agreements. | | Carl Perkins Equipment Grant for SEA-PHAGES | Procured equipment for SEA-PHAGES project in BIOL 1414, it is also used in other courses and aspects of the program, including internships. |   As part of our efforts to increase awareness of biotechnology, and inspired by the professional development that we received, the biotechnology faculty were instrumental in creating a new lab manual for use in the General Biology 1 course (BIOL 1406). Our creation of this, and the piloting of this curriculum eventually caused an evolution of the attitudes of many Collin College biology faculty towards the existing “traditional” biology labs that have remained virtually unchanged since the founding of the college. The potential change to the biology lab curriculum will be voted upon by the biology faculty in May of 2023. The changes that may be codified as a result of our influence will align our students’ experience with that recommended by Vision and Change, the 2010 recommendation made by a conference organized by the American Association for the Advancement of Science. This long-overdue change would not have come about without the influence of our biotechnology program.  The biggest “why” for why we do the things we do - why we fight to keep our program going and keep the courses on the calendar - is for our students. We want to ensure that biotechnology students succeed in their careers or continuing education, wherever they go after their time at Collin. Our students have gone on to finish their undergraduate education, or apply and enter graduate or professional school, because of the way in which both content mastery and technical skills are emphasized, with a focus on experiential learning and skill-building which develops the critical thinking they need as they continue their education. Many students come into the program so afraid of math, lab math especially, that they feel they are doomed for failure. However, we work to have them master material, meaning they correct and practice, rather than fail. It is so gratifying to have students go from “no clue” to teaching others how to work the problems, then to succeed in the workplace. We have been a part of the transformation of many students that were empowered by what they learned in our courses. Our former students have told us how easy some of their lab classes were at their four-year schools, because they had already done the experiments being presented in their upper division courses while they took freshman and sophomore courses in the biotech program. We are proud to be able to repeat these anecdotes. Other of our students have entered careers, either locally or after a move to other areas of the country. Employers on our Advisory Board have commended us on the excellent preparation of these students for the workplace. We are proud to have played a role in their successes.  Gasper BJ, Gardner SM. Engaging Students in Authentic Microbiology Research in an Introductory Biology Laboratory Course is Correlated with Gains in Student Understanding of the Nature of Authentic Research and Critical Thinking. J Microbiol Biol Educ. 2013 May 6;14(1):25-34. doi: 10.1128/jmbe.v14i1.460. PMID: 23858351; PMCID: PMC3706163. |

**3. Why we do the things we do: Program relationship to student demand**

**Make a case with evidence to show that students want the certificate. Discuss whether or not there appears to be any disproportionate enrollment by gender, race, and ethnicity (compared to Collin College’s overall student demographic distributions** [**http://inside.collin.edu/iro/programreview/prfilehostpage.html**](http://inside.collin.edu/iro/programreview/prfilehostpage.html)**). If any differences exist discuss possible reasons why the gap exists, and plans to address these issues to close gaps in enrollment rates between groups of students (refer to the Program Review portal for Enrollment Reports and Average Section Size data files for your program** **<http://inside.collin.edu/institutionaleffect/Program_Review_Process.html>).**

*Suggested/possible points to consider:*

* *What is the enrollment pattern? Declining, flat, growing, not exhibiting a stable pattern, please explain. For required program courses where there is a pattern of low enrollment (fewer than 15 students), explain your plan to grow enrollment and/or revise the curriculum.*
* *What are the implications for the next 5 years if the enrollment pattern for the past 5 years continues?*
* *Describe any actions taken to identify and support students enrolled in program-required courses early in the degree plan. If no actions are taken at the present, please develop* *and describe a plan to do so.*
* *How does your program support (or plan) to support attraction of a diverse student population?*
* *Check with Institutional effectiveness for Data Reports -names of reports*
* *Analyze the evidence you provide. What does it show about the program?*

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| In the last five years (2017-2021), 18 students were awarded biotechnology certificates. The majority of these have been in the last three years when 11 students were awarded a level-1 certificate (BITE or BTEC) and 4 students an advanced certificate (ABTE). Many of the students that earn the Level-One certificate go on to earn the Advanced certificate as well.    Enrollment in the first course in our program, BIOL 1414, has fallen since 2021, though, as we will show, this is part of a trend that had started earlier. Even so, completion rates had remained miniscule and flat, until we enacted changes that made completion easier by offering additional course substitutions. This change has the potential to increase the number of completers per year.  However, easy completion is secondary to filling classes. Since 2021, we have rarely had a biotech I class that hit the threshold of 10 students. The other biotech classes typically do not recruit students from courses other than biotech I, so as the enrollment in that class declines, the other classes do as well. One of the consequences of fewer students is a decrease in the reach of word-of-mouth advertising. Central to the success of the program is filling seats in BIOL 1414. If enrollment in that course cannot be increased, there will be severe consequences for the program.  Identifying students prior to enrollment is difficult, since the introductory courses do not have prerequisites and students often self-enroll into the courses/program. Students enrolled in BIOL 1414 were surveyed, and most did not mention using our advising services. Students that make inquiries through our career coaches, such as Scott Hensley, are often directed to speak to biotech faculty.  Once enrolled, students become interested in taking other biotechnology courses and working towards the certificate. The Biotech club (active through 2020) held events at student organization fairs and other events on campus to increase awareness of our program and courses. Since the dissolution of the club, biotechnology faculty have presented at the workforce fair and at other events, both on and off campus.  Since the previous biotechnology program review, the courses, Introduction to Biotechnology I and II (BIOL 1414 and 1415), were maintained in the Academic Course Guide Manual (ACGM). Collin took part in a statewide campaign to maintain the academic status of these two courses. However, when the status of the two courses was in question, the endorsement of the courses as being core components was removed from Banner in error. This error was overlooked for years, until it was finally brought to the attention of the biotechnology lab assistant. It then took more than a year before the error was corrected, sometime in 2022 (see screenshots showing Banner entry in Spring 2022). During the time between the removal of the endorsement and its reinstatement, enrollment in the introductory courses declined. While correlation does not indicate causation, it does suggest a contributing factor for lower enrollment. Anecdotally, faculty members have heard from students that they were not advised that the biotech courses count towards their core component, even though that fact never changed. This confusion is likely due to students self-selecting biotech, rather than hearing about biotech through advising. It also suggests that interest in biotech would rise if the fact that they are core courses were emphasized during advising. Faculty have made efforts to inform advisors about the program and the benefits to students and continue to do so.  While it is not clear why enrollment numbers have fallen since 2021, it does seem to be part of an overall trend in the declining student population at the Plano Campus. If biotech students are usually recruited from students that already take classes at Plano, then the declines should parallel each other. One target for recruiting is students that have taken BIOL 1406, which is a required course for the Advanced Certificate. In fall of 2022, a flyer was sent to every faculty member who taught 1406, asking them to share it with their students (see flyer in Section VI).    Listing of courses that count towards the Biology core component for the AA and AS degrees. 1414 and 1415 are listed.    Banner entry from the spring 2022 semester for 1414, still showing that the course does not count towards the core, or as a life science course. This error has been corrected.    Banner entry from the spring 2022 semester for 1415, still showing that the course does not count towards the core, or as a life science course. This error has been corrected.    Banner entry from the spring 2022 semester for 1406 as comparison. The Attributes for this course indicate that it counts both as Life and Physical Science credit, and counts as a core component.  The following excerpt is from a report produced in 2022 by Sophia Hines, former biotechnology lab assistant:  Enrollment Numbers  When analyzing the current state of our Biotechnology Program, enrollment in BIOL1414 serves as a benchmark given that students cannot continue to the higher courses without this introductory course.    Removal from the Academic Course Guide Manual (ACGM)  Deeper investigation showed all Biotech courses were set to be removed from the ACGM in 2017, but lobbying changed this decision. Despite this reversal, all BIOL1414/1415 courses for all institutions were removed from TCCNS in 2017 as funding was set to be removed August 31, 2017. The ACGM in 2018 has the courses listed for scheduled deletion, but the 2019 version has them back with no qualifiers. While some schools offering biotech programs had their courses relisted on TCCNS in the following years, Collin College, as well as others like Temple College, were never listed again. Our course catalog descriptions have always matched the ACGM descriptions.  Banner Attributes Removed  Additionally, for Collin College, these courses lost their “Attributes” on Banner to be included in the course offerings for “Life & Physical Sciences” or “Component Area Option” around the same time. They did not show in the available courses if students searched by Attributes. If students found the courses through other search methods, the Attributes column was blank or said “No Attributes” which indicated the courses would not fulfill any part of a degree plan. This is despite the courses still being listed as Life & Physical Science options in the printed course catalog every year  Conclusion  In summation, the low student enrollment can be traced back to the courses inaccurately being removed from the ACGM in 2017. Collin College should have filed to have them relisted on TCCNS the following year as students will not enroll in a course they are not sure will transfer to other schools. This coincided with the “Life & Physical Science” attribute being removed from Banner. Students are less likely to enroll in a course that will not fulfill a requirement of their degree plan. Even with this partially remedied now, some of the Collin’s websites do not list the courses as options for fulfilling degree requirements. Fixing these errors and increasing community outreach will return the Biotechnology Program back to its previous levels of success. Finalizing articulation agreements will create an even greater boost in enrollment.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  During the campaign to maintain the academic status of BIOL 1414 and 1415, it became clear that there is industry support for biotech programs, but few pathways of meaningful articulation. We have been working on this over the past years, but have made limited progress. We developed agreements with Texas A & M Texarkana (TAMU-T) and TAMU Corpus Christi that would accept all courses in the biotech program for credit. Shortly after signing the agreement with TAMUT, leadership changed at that institution, and their biotechnology program was apparently abandoned. Collin College never signed the agreement with TAMU-CC (reasons unknown to the authors), though Del Mar College in Corpus Christi was able to take advantage of the agreement that we developed. Del Mar biotech students seamlessly articulate all of their biotech credits into a University Studies Degree, often with an emphasis in the business to meet the needs of small biotech start-up companies.  Our advisory board has endorsed such agreements, though we have been unable to secure any more. We have pursued an agreement with University of North Texas (UNT)-Frisco and main campus with limited success. We currently have an agreement long awaiting administrative signatures with UNT Health Science Center (UNTHSC) whose bachelors of biotechnology degree was recently approved by the state. This agreement will allow our students to seamlessly transfer all Collin Biotech credits into an online Bachelor of Science in Biotechnology. This is an incredibly important opportunity for students who are unable to relocate in order to finish a bachelor's degree.  Enrollment in BIOL 1414, Intro to Biotech I, is a good indicator of interest in biotech, since it is the first class that certificate-seekers take. Before the pandemic, enrollment in the course was steady, though just under the minimal course enrollment of 10-15 students. From spring of 2018 to fall of 2020, enrollment in that class had an average of 9.8 students, except for the spring semester of 2020, when it was not offered. Since the spring of 2021, enrollment has fallen to an average of 5.75 students. In case the decline is due to scheduling conflicts or a desire to take fewer in-person classes, we are exploring different ways to offer the classes, testing hybrid versions of Intro to Biotech I & II and Genetics (BIOL 1414, 1415, and 2416).  As a measure of which students will persist in the biotech program and earn their certificate, enrollment in Intro to Biotech II, BIOL 1415, is the best indicator to examine. This course is typically offered once per year, and usually has an enrollment of 7-8 students (see enrollment table below). This means that roughly one-half of the students who take Intro to Biotech I decide to continue toward their certificate. This is encouraging in that it demonstrates that biotechnology is of interest to more than just those committed to a career in laboratory science. It also points to the probability that increasing enrollment in Intro to Biotech I will increase certificate seekers. In an attempt to increase the number of students that continue in the program, we are seeking ways to pursue more undecided students, such as dual-credit workforce students.  It has been clear to us that the requirement for students to complete an internship has been the primary reason for students to leave before completing a biotech certificate. While we believe that gaining practical experience is essential for the success of our students, and an external internship is the best way to gain this experience, we understand that not every student is going to have the flexibility to participate in an external learning experience. In addition, students that have completed only a handful of courses have a difficult time being competitive for internship openings. For this reason, we reevaluated this requirement during this review period and now provide our students with an alternative to meet the learning objectives of the program.  First, it came to our attention that the way the internship course was being run was more appropriate for a co-operative learning experience than an internship. According to the Workforce Education Course Manual (WECM), courses with the number 2486 are internships, not co-ops. Four-hour co-ops have a requirement for 16 classroom hours, in addition to 20 hours of work per week, while internships have no classroom requirement, and a workload of 12 hours per week. We worked with the Curriculum Advisory Board to clarify the internship requirements on the course syllabus, so that our biotech interns would need to log 192 work hours during the semester versus the 320+16-hour requirement.  Secondly, we felt that requiring an internship for the completion of the level 1 certificate was unrealistic. Based on comments by our advisory board, Level 1 certificate students have only completed two lab courses and have not learned enough microbiology or chemistry to be marketable in this area. However, it is their opinion that the experience and skills gained by participation in a more self-reliant working environment is valuable to students when seeking employment. In speaking to faculty in other biotech programs across the state and nation, we learned that they teach internship classes on-campus, “apprenticing” their students with faculty mentors to complete this requirement. Based on this information and approval from our advisory board, we elected to add a course substitution to the degree plan so that our students could earn credit for the internship requirement. We added BITC 2431, Cell Culture Techniques, as a substitution for the internship requirement for the level 1 certificate only. This allows students to complete their level 1 certificate entirely on campus, and opens the door to international students who cannot legally work off-campus. This change went into effect in fall of 2022, and two students immediately enrolled in classes to complete their level 1 certificate. This was very encouraging, because it means that students will be able to complete the program every semester that the four level 1 courses are offered, and will dramatically increase the rate of completion. While previously, they had to wait on the availability of an internship opportunity, now they only have the limitation of classroom seats and course offerings.  Recruitment efforts up until recently have mainly focused on increasing advertising through word-of-mouth. Students in Intro to Biotech I were surveyed to ask them how they learned about the biotech program. The majority of the responses stated that they learned about it through the Collin website, or through reading through the course catalog. Few said that they heard about it through advising, so we feel that this is an avenue that should be expanded. We have created “upcoming courses” advertisements to display for the past several semesters. It has been suggested that we advertise to students enrolled in BIOL 1406, and we feel that this may be valuable, but recently we have not had the course schedule finalized for the next semester in time to reach out to students before the break begins. It might be possible to email students as the semester ends, or put a sign up near registration such as the Honors College does for its programs, in order to reach more students. We could ask biology instructors if we could visit their courses, and sell their students on the benefits of biotech education.  If enrollment remains steady at 5.7 students enrolling in 1414 per semester, it will be problematic, but if enrollment returns to 10-15 per semester, as it was in 2020, it will be consistent with state enrollment in biotech programs. This does not mean that it should be our goal, but that it would be understandable, and should allow us to reach the goal of five graduates per year. Additionally, to reach this goal, we should ensure that BIOL 1415, BITC 1340 and BITC 2431 are offered every year, and aggressively advertised with the straightforward path to earning the level 1 certificate. Also, as the employer needs for entry level technicians increases in our region, as well as, new opportunities for articulation, we believe we will recruit more students to enroll in the courses and obtain a certificate.  Something that will have a dramatic and immediate impact on our graduation rate will be finding the students who have completed all of the requirements for certification, but did not apply for graduation. It is estimated that there are at least 6 students in this category, and steps are currently being taken to contact these students and remedy the problem. A significant problem is that students complete their certificate requirements but have declared general studies or something else as their major. In order to earn their certificate, they must declare they are biotech certificate seekers, but they don’t know that they can do this, or how to do it. We, the faculty, are working with advising to ensure that these completers do not fall through the cracks and are currently following-up with former students who are in this situation.    Duplicated Enrollment in Courses by Term  Academic Years 2017-2018 through 2021-2022    The single student in BITC 2486 reflects a change made in 2022 to stop using BIOL 2389 as the recommended co-op course for our students.  In the same year that enrollment began to drop in the biotechnology classes, 2021, enrollment in other biology classes, including 1406 and 2416 also dropped. The graph below shows Plano campus enrollment in BIOL 1406:      During this same period, biotech enrollment in 1414 went from 58 students per year in 2017-18 to 21 per year in 2021-22.  The decrease in demand of the biotech classes may be a symptom of a general decrease in Plano campus enrollment.    Beginning in 2019, enrollment started to fall, falling again in 2021. Since recruitment into biotech has partially hinged on word-of-mouth, having fewer students on Plano Campus means fewer mouths to speak, and fewer ears to hear. |

**4. Why we do the things we do: Program relationship to market demand**

**Make a case with evidence to show that employers need and hire the program’s graduates. Some resources to utilize for information could be: JobsEQ** [**http://inside.collin.edu/iro/programreview/202021/ProgramLaborMarketInfo\_2020-21AY.pdf**](http://inside.collin.edu/iro/programreview/202021/ProgramLaborMarketInfo_2020-21AY.pdf)**, Burning Glass, O-Net** [**https://www.onetonline.org**](https://www.onetonline.org)**, Texas Labor Market Information** [**https://www.twc.texas.gov/businesses/labor-market-information**](https://www.twc.texas.gov/businesses/labor-market-information)**.**

*Suggested/possible points to consider:*

* *How many program-related jobs are available in the DFW Metroplex for program graduates? If the majority of related jobs in the DFW Metroplex require a baccalaureate degree, provide evidence that you have a current signed articulation agreement with one or more transfer institutions or that you plan to develop one.*
* *What proportion of the program’s graduates (seeking employment) found related employment within six months of graduation?*
* *What changes are anticipated in market demand in the next 5 years? Do program completers meet, exceed, or fall short of local employment demand? How will the program address under- or over-supply?*
* *Identify and discuss the program’s strengths and weaknesses related to market demand.*

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| Nationwide, biotech programs are small, yet unquestionably valuable. Even schools in biotech hotspots such as the San Francisco bay area of California have classes with only 20 students. In Austin, Texas, where biotech graduates have a job-placement rate of nearly 100%, classes have low enrollment. This points to a systemic problem - communication between career providers, schools, and potential students is practically non-existent. Businesses need to be made aware that programs exist to train workers, and students need to be made aware that the businesses/careers are out there. But - and this is critical - businesses need to write their job descriptions such that associate’s and certificate-earners will apply, and no longer say that the minimum educational requirement for a lab technician job is a bachelor's degree.  Pursuant to the goal of increasing communication about biotech education, we have made known our presence in the North Texas bioscience community. We have presented at and attended several events where we have pressed this point, and have accumulated allies (BionorthTX, and other Advisory Board members such as representatives from Texas A&M, UNTHSC and Dallas College) that are also spreading this message that our students are skilled for working in life science labs. It was through such contacts that we are partners on the EDA grant and this grant collaboration will address this knowledge gap between educators and industry. Another important issue to be addressed with industry, both regionally and nationally, is that trained personnel need to be paid a living wage. Many of the companies fail to pay wages competitive with jobs at the local grocery store. This is especially true during/after the pandemic when finding employees became very competitive. This is a point that is being pressed through meetings with industry leaders, both locally and nationally.  Additionally, at Collin, we have participated in the Workforce Fair (spring 2022, inaugural event), an event designed to attract students to and inform students of the various workforce training opportunities available at Collin. At the event in spring 2022, we invited an industry representative, and former student, who started as co-op student working for one of our Advisory Board partners, and who now runs their Microbiology lab, to represent her company. We have also participated at high school college and career fairs to spread awareness of our program.  Collin is a sub-award on Dallas College’s award, the Good Jobs Grant “Grow the Biotech Workforce in North Texas to Meet Emerging Skill Needs via a Collaborative Partnership,” in partnership with Dallas College, Tarrant College and the University of Texas Arlington, among other life science related organizations. A survey of life science employers estimates over 1,100 jobs in the next 3 years for entry-level biotech workers in the metroplex. Evolve Biologics will be opening a manufacturing plant in Sachse and estimates they will have over 300 job openings in the next 1-2 years. We are in communication and have met with Evolve representatives regarding training and hiring needs over the next months. Biotech students are very well suited to fill these positions. “Over the next three years, Dallas Fort-Worth is projected to add over 200,000 jobs,” according to Ben Magill, associate vice chancellor of economic opportunity, workforce and advancement at Dallas College. “And this award will help us establish the critical economic and workforce development infrastructure needed to fill those jobs, increase economic mobility for underserved communities and create additional jobs. This award will be a catalyst. Healthcare and healthcare support occupations are expected to be the fastest growing industry sector among those jobs, expanding by about 8 percent or more in the next few years,” said Magill, who also founded Dallas College’s Labor Market Intelligence Center and was the architect of Dallas College’s successful EDA application. (see EDA award press release, appendix)  A casual search for local jobs in biotechnology results in hits that state a requirement for a bachelor's degree or higher, yet list skills that are taught, and mastered, by our certificate students. Our local BIO affiliate, BioNorthTX, has been working to make local employers aware of the educational facilities that train entry-level workers, including Collin College, to encourage them to recruit and hire locally. The hurdle to overcome - the fact that job postings state a requirement for baccalaureate or graduate degrees - is one that can only be surmounted on a case-by-case basis. We have begun to do so by inviting these employers to join our advisory board, and have changed some minds, but this cannot be our only means of progress. The best ambassador to send to these companies to change their minds is a student intern, educated by Collin College, who is more than capable of doing the work they require. In addition, our students may transfer their credits to a university and complete a bachelor’s degree, which can also help with job applications.  https://www.dmagazine.com/publications/d-ceo/2022/september/dceo-healthcare-annual/dfw-is-in-the-midst-of-a-biotech-boom/  “DFW Is in the Midst of a Biotech Boom” https://www.dmagazine.com/publications/d-ceo/2022/september/dceo-healthcare-annual/dfw-is-in-the-midst-of-a-biotech-boom/  Press release and survey results from EDA grant available as attachment. |

Section II. *Are We Doing Things Right?*

**5. How effective is our curriculum, and how do we know?**

**A. Make a case with evidence that there are no curricular barriers to program completion. Review data related to course enrollments, course completion rates, course success rates, and the frequency with which courses are scheduled to identify barriers to program completion.**

*Suggested/possible points to consider:*

* *Number of students who completed the program awards in each of the last 4 years? If the number of graduates does not average 5 or more per year, describe your plan to increase completions and address this issue in the Continuous Improvement Plan (CIP).*
* *At what point(s) are substantive percentages of students dropping out of the program? Use data in the “Program-Based Course Performance” tool to examine enrollment flow through the program curriculum. Does the data suggest any curricular barriers to completion? Address problems in the CIP.*
* *Analyze the course success rates and the course completion rates of each course in your program. Address problems in the CIP.*

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| The required courses for the Level 1 certificate are BIOL 1414, 1415 (Intro to Biotech I & II), BITC 1340 (Quality Assurance in Bioscience) and either BITC 2431 (Cell Culture Techniques) or BITC 2486 (Co-op). BIOL 1414 is offered every semester to increase interest in the biotech program. Enrollment in this course before 2021 has been steady at an average of 9.8 students per semester, at which point, it decreased (see Section 3 for more details). BITC 1340 was offered during each long semester for the past two years, and BIOL 1415 and BITC 2431 were offered once per year. BITC 2486 can be offered during any long semester or 10-week summer semester as needed. These courses have lower enrollments than BIOL 1414, because often students taking the first biotech course do not plan to switch majors to biotechnology, they are simply filling a science credit. However, often students who took the Intro to Biotech course to fulfill their science credit, then changed majors and got a certificate.  *The Advanced Certificate also requires BIOL 1406, CHEM 1411, MATH 1314, BIOL 2416. Multiple sections of each of these courses are offered during every long semester, and during the summer as well, with the exception of BIOL 2416. The internship requirement, BITC 2486, can be offered every long semester or 10-week summer semester, as needed.*  *However, availability of classes has not been the only factor or issue to be considered as a barrier to completion. The requirement for an internship and the hours required for it, has been the primary reason that students do not exit our program quickly and/or do not get a certificate. Internships can be costly for employers. Paid internships require spare capital, something that many academic labs do not have, and unpaid interns constitute a risk, since insurance protection only covers paid workers. Because of this, employers are often forced to pay their interns out of obligation, so they are not financially able to offer a position every semester. Another complaint that we hear from industry partners is that they invest in these interns for a semester, only to find that the students leave as soon as they get course credit. This makes them very hesitant to offer internship positions.*  *Other schools with biotech programs have solved this problem by creating in-house internships, where students work as paid lab assistants, gaining experience preparing class materials, doing housekeeping in the lab, and working with faculty to develop protocols. In doing this, their students not only gain skills in accountability and self-reliance, and learn about the business of academia, but they have experience in a job that they can then put on their resume. Job postings frequently require prior experience, even for entry-level jobs, and in-house internships are a “safe” way to do this.*  *We, at Collin, have offered a few students an in-house internship, whether it was due to their visa status, their schedule, or not being able to find an external employer willing to take an intern at the time. In contrast to the in-house internships offered by partners such as Austin Community College (ACC), Collin interns are not eligible for pay. We have been told that there is a college policy against students being paid to earn course credit. The reasoning is flawed, though, as most internships and cooperative learning experiences are paid, and also result in course credit. We’re not certain this is an actual Collin College policy. Interns at ACC are supervised by lab staff and/or by an available professor, and are able to work independently on their projects. Interns at Collin must be immediately and continuously supervised by their faculty coordinator (with few exceptions another faculty member), and are not allowed to work independently at all, for even a minute. These Collin College requirements dramatically restrict the schedule for interns to get hours, to only the spare time of the faculty coordinator (who is teaching overloads).*  *The Plano campus labs have hired biotech students and biotech completers time and again, and have offered these students permanent positions no less than a dozen times since the program started. Currently, there are three lab workers at the Plano campus that are biotech graduates, and one more at another campus. Before the position of lab assistant was filled by Sophia Hines, all but two of the biotech lab assistants were former students. If each large Collin campus would offer, through HR, a single position of “lab intern” with the same duties, safety training and pay as a student worker, biotech students could fill them every semester, and we would not have this barrier to completion.*  2017 2018 2019 2020 2021 Total    *The fall 2021 section of BITC 2431 had a success rate of 66%. This was due to one of the three students essentially auditing the course and declined to take any exams. He was up-front about this from the beginning of the semester and was not a certificate seeker, nor was he the typical student in our classes. He was also enrolled in BIOL 1415 and BITC 1340 during the same semester, again, participating only when he wanted to and not taking exams.*  *BIOL 1414 was reported to have a 5-year success rate of 66% during the Associate of Science program review. This is mainly due to a drop in student retention during the pandemic, as well as a decrease in attendance during that time. Students cannot keep up in class when they do not attend regularly. As can be seen in the tables below, a number of other freshman-level courses suffered with success rates during this same period. Even so, with the exception of 2020-2021, BIOL 1414 outperformed BIOL 1406, its most closely-resembling course.*      *We believe that this is not a typical outcome for this course, and will resolve without intervention. Efforts to increase engagement in the course have been implemented. The adoption of a new, OER textbook and new, more engaging labs have increased student retention in this course.*    *If we further compare the performance of 1414 with 1406, we can see that both success rates and retention rates for all years except for 2020 are higher in 1414:* |

**B. Show evidence that the institutional standards listed below have been met. For any standard not met, describe the plan for bringing the program into compliance.**

1. **Completers Standard: Average 25 completers over the last five years or an average of at least five completers per year.**  
   Number of completers: 18 in last five years.  
   If below the state standard, attach a plan for raising the number of completers by addressing barriers to completion and/or by increasing the number of students enrolled in the program. Definition of completer—Student has met the requirements for a degree or certificate (Level I or II)
2. **Licensure Standard: 93% of test takers pass licensure exams.**If applicable, include the licensure pass rate: Credentialing exam has not been in place long enough to evaluate  
   For any pass rate below 93% (Collin College’s standard), describe a plan for raising the pass rate.
3. **Retention Standard: 78% of students enrolled in program courses on the census date should still be enrolled on the last class day (grades of A through F).**Include the retention rate: 93%  
   If the retention rate is below 78%, describe a plan for raising the course completion rate.

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| Credit hour standard: there are no more than 60 hours in the program plan.  The two certificates have 15 and 34 hours.   1. Completers Standard: Average 25 completers over the last five years or an average of at least five completers per year.   State- and nation-wide, biotech programs have seen a decline in enrollment due to factors that include the pandemic. In our area, the greatest barrier to completion has been available labs in which students can complete the internship requirement. In an attempt to make completion easier, we submitted and successfully presented a change to our Curriculum Advisory Board to allow BITC 2431 to substitute for BITC 2486 in the Level 1 certificate, beginning in fall of 2022. In addition, we worked to correct the number of required hours to 192 to meet the WECM requirements for a four-hour internship. We have work to do on increasing enrollment, but even with modest gains, the goal of 5 completers per year can easily be met by using BITC 2431 as an alternative to an external internship.  In the last three years, we have met the target of an average of 5 completers per year. We attribute this success to the willingness of faculty to teach small classes, and to changes made in the internship course. We are aware that there are a number of students that have fulfilled the requirements for the Level-1 certificate, but did not complete a petition to graduate; we are trying to find them, have them complete the necessary paperwork and award them certificates.  We wish to explore the potential for dual-credit students, or students that have completed a high-school-level course sequence in biotechnology. This model has been utilized successfully in schools in both the Austin and Houston area, with high school teachers being trained in biotechnology from the community college. In our area, partnership with Texas Project Lead the Way may be a better option, as PLTW already has a high school curriculum in biomedical science that teaches the skills covered in BIOL 1414 and 1415. By bringing these high school students to our college, they may be able to enter at the midway point for the Level 1 certificate, or one-quarter of the way through our advanced certificate.  Our school’s Collegiate Academy has called for degree plans to be pitched offering students the chance to earn an associate’s degree by the end of high school. An idea proposed by our faculty is to increase enrollment and completion by partnering with the Collegiate Academy to marry the Level 1 certificate with a science-focused A.S. degree.  2) Licensure Standard: 90% of test takers pass licensure exams.  The Biotechnician Assistant Credentialing Exam (BACE), developed by the University of Florida and run out of a non-profit associated with the UF, Biotility, has recently been accepted as a CTE credentialing exam by the State of Texas (August 2022). The exam was offered for the first time at Collin College in May of 2022 to six students, five of whom passed at least one of the two portions of the exam (Knowledge or Lab Skills), and four who passed both portions. That 67% success rate is in line with national averages for this exam, and shows that our program has the rigor necessary to prepare students for the workforce. Three of the students who took the exam had only completed one course in our program (BIOL 1414). We would like to explore the potential to offer credit by exam in BIOL 1414 for successful earning of this credential, which should increase enrollment in BIOL 1415 and the sophomore-level biotech courses and provide a means to recruit from high school populations who are offering the exam.  3)Retention  Retention is high in biotech courses. In most classes, 100% of the students who are enrolled after census complete the entire course. The worst retention numbers were in 2021, post Covid closures, which also had week-to-week retention problems in multiple classes; other science faculty reported many classes meeting with only a few enrolled students attending. But even in 2021, the only class in which retention fell below 78% was in the cell culture class, where one out of the three students in the class did not finish the semester. That student was up-front about it - he was not a degree seeker, and only wanted to take the class until he learned what he thought he should. In 2022, as a whole, biotech students were eager to learn the content and to participate in the labs. Biotech classes are very hands-on compared to many science courses; they utilize team based and project-based learning practices; all of which support student interest and retention. |

**C. Make a case with evidence that the program curriculum is current.**

*Suggested/possible points to consider:*

* *How does the program curriculum compare to curricula at other schools? Review programs at two or more comparable colleges. Discuss what was learned and what new ideas for improvement were gained.*
* *How does the program curriculum align with any professional association standards or guidelines that may exist?*
* *Is the curriculum subject to external accreditation? If so, list the accrediting body and the most recent accreditation for your program.*

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| *If the program curriculum differs significantly from these benchmarks, explain how the Collin College curriculum benefits students and other college constituents.*  How does the program curriculum compare to curricula at other schools? Review programs at two or more comparable colleges. Discuss what was learned and what new ideas for improvement were gained.  ○ In 2012, the Texas community colleges that offer biotechnology (Austin CC, Collin, Lone Star, and DelMar) met to coordinate curriculum. Together, we produced a handbook to be used as a guide in teaching biotechnology at the junior college level. The same courses are offered statewide, with the same Texas Skills Standards for Biotechnology. Students who take these courses should be able to seamlessly transfer between any of the partner colleges in Texas, and with little difficulty to programs in other states. Collin College biotechnology curriculum was developed to meet the Texas Skill Standards for Biotechnology (TSSB). In 2011, Collin was recognized for integrating the skill standards into the curriculum. However, since we no longer have an AAS in Biotechnology (suspended in 2012/13 due to low number of completers), we don’t qualify to be TSSB recognized, but we maintain alignment with the skills standards in our curriculum. Often students in the program often already hold BS degrees and are taking the courses in order to gain marketable skills, thus obtain a certificate. The main other source of students in the program are those who intend to transfer to a 4 year program and are taking the courses for interest and/or to gain skills. For these reasons, we offer the 2 certificates that address the needs of both populations of students. The advanced certificate is more appropriate for those seeking further training after obtaining a BS. However, the 2 certifications are stackable.  ○ Collin utilizes a modified version of the curriculum and teaching materials from Austin Community College (ACC) Biotech Program. ACC curriculum was developed to meet the Texas Skill Standards for Biotechnology (TSSB) as well as incorporate recommendations of their industry advisory board. We, too, incorporate the skills into our curriculum based on recommendations of our advisory board, so we meet the needs of our local industry. ACC utilizes an open source textbook and lab manuals for most courses. We use those materials, as well as, resources that accompany the education kits utilized in the labs. For instance, the life science company, Bio-Rad, has a Protein Purification Series that takes students through the entire upstream and downstream processes of purifying a specific protein that is expressed in bacterial cells. The kits provide both technical and background material for students. Students are able to work through the multi-step processes from start to finish. The kits often provide extension activities that we utilize to demonstrate the real-world applications of the activities. We enhance those materials with information gleaned through professional development and networking opportunities in which we have participated.  ○ The ACC curriculum, due to its alignment with the Texas Skill Standards for Biotechnology, is utilized by other colleges with biotechnology programs in the state. Lone Star and Del Mar colleges utilizes similar curriculum in their programs. In fact, we often share curriculum between programs when needed. Each program varies in the local needs of their region and/or the expertise of their faculty by the nature of the projects that are incorporated into the courses. However, the major skills and concepts of the courses are very similar.  ○ Additionally, our Intro to Biotech I & II courses (sometimes Genetics) are part of a national science crowdsourcing program. “SEA PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science) is a two-semester, discovery-based undergraduate research course that begins with simple digging in the soil to find new viruses that infect bacteria (bacteriophages), but progresses through a variety of microbiology techniques and eventually to complex genome annotation and bioinformatic analyses” https://seaphages.org/. Our students do the discovery portion in the first course, BIOL 1414, and annotation in the second, BIOL 1415, sometimes Genetics. Through this program, students have participated in regional and national conferences, doing oral and poster presentations and have multiple authorships of genome annotations submitted to GenBank (the national repository for genetic sequences). Due to Covid-19, the in-person conferences haven’t taken place since 2019, but our students presented their work in a virtual conference in 2020 and have continued to submit genome annotations annually. We hoped this year will see the reinstatement of in-person presentations, but they will be vitual again, we will investigate the opportunity to present. The SEA PHAGES curriculum is updated by subject matter experts, in an ongoing manner to remain current. Faculty participate in online training forums to remain current and to gain access ot updated teaching materials as they come available. Gene annotations change often, so maintaining currency is important when teaching this valuable skill.  ● How does the program curriculum align with any professional association standards or guidelines that may exist?  o The Collin curriculum was developed to meet the Texas Skill Standards for Biotechnology (TSSB). In 2009-11, Collin biotechnology faculty participated with other biotech programs in the state to develop skill standards for each course offered in biotechnology programs. In 2011, Collin was recognized for integrating the skill standards into the curriculum. However, since we no longer have an AAS in Biotechnology, we don’t qualify to be TSSB recognized, but we maintain alignment with the skills standards in our curriculum.  ● Is the curriculum subject to external accreditation? If so, list the accrediting body and the most recent accreditation for your program.  o Collin is a testing site for the Biotechnician Assistant Credentialing Exam (BACE). Dr. Kirkpatrick is a co-principal investigator on a National Science Foundation Advanced Technological Education (NSF ATE) grant “Industry Recognized Credentialing System”. The aim of the grant is to have more industry leaders recognize the BACE as a hiring credential for entry level positions. Professor Twichell is the state coordinator to increase regional industry recognition of the exam and delivery of the exam to students across the state. The grant pays the $150 fee for students to sit for the exam. The exam was recently accepted by the Texas Education Agency as a Career and Technical Education recognized credential. In June 2022, Collin Biotech students sat for the BACE, 4 of the 6 passed the exam (a score of 80 is considered passing, 1 student earned a 78). The exam will be delivered in fall and spring semesters. The BACE is vetted and annually reviewed by a national industry advisory committee, so it remains current with industry needs. Exam questions change annually and supporting materials are updated based on the recommendations of the national industry advisory committee. The committee consists of individuals from both small and large life science companies from across the nation. As part of the EDA grant, we are introducing the BACE and the skills covered, to regional industry leaders in an effort to increase the recognition of the credential and its use as a preferred hiring credential over a BS degree.  ● Comparison of our Certificates with those found elsewhere in Texas:  o The Level 1 and 2 certifications of Collin College and ACC most closely align. However, Collin no longer offers the BITC 2411 Instrumentation course, and rarely offers the BITC 2441 Molecular Bio Techniques course due to low enrollment. The other programs, including ACC, offer BITC-1491 Special Topics in Biological Technology/ Technician, a course in Biomanufacturing that takes students through the upstream and downstream processes of manufacturing biological materials. Collin has not had a local need for such a course. However, that may be changing soon, based on the fact that Evolve Biologics, a bio-manufacturing company, is relocating its manufacturing facility in Sachse and expects to employ 300+ technicians starting in 2024. Additionally, Collin’s Advanced certificate differs from those at ACC and LSC in the prerequisites required by their programs (a BS and/or more chemistry courses). Because of the difference in prerequisites, Collin’s advanced certificate includes Biology, Chemistry and Algebra as required courses.     |  |  | | --- | --- | | Level 1 Certificate Requirements - Collin (15 hours) | Austin Community College (17-18 hours) | | Introduction to Biotechnology I | same | | Introduction to Biotechnology II | same | | Quality Assurance in the Biosciences | same | | Internship | same | |  | ACC also requires students to take a college readiness course |  |  |  |  |  | | --- | --- | --- | --- | | Advanced Certificate Requirements - Collin (34 hours) | Austin Community College (Advanced Tech Cert-31 hours) | DelMar College (Level II Cert-37 hours) | Lone Star College (Advanced Tech Cert-30 hours) | | Introduction to Biotechnology I | same | same | prerequisite | | Introduction to Biotechnology II | same | same | same | | Quality Assurance in the Biosciences | same | not required | not required | | Internship | same | same | same | | Cell Culture Techniques | same | same | same | | Genetics | Molecular Biology\* Techniques\* | Molecular Biology\* | Molecular Biology\* | | Biology I | prerequisite | same | prerequisite | | College Algebra | prerequisite | same | prerequisite | | Chemistry I | prerequisite | same | prerequisite | |  | also requires biomanufacturing\*\* and instrumentation\*\* | also requires composition, biochemistry\*\* and speech | also requires bioinformatics\*\*, instrumentation\*\*, bioethics\*\*, biomanufacturing\*\* and medical biotechnology\*\* |   \*The outcomes of Genetics and Molecular Biology Techniques are similar and the courses may be considered as meeting the same objectives in the certificate  \*\*Courses not/no longer offered at Collin  Program Information for these colleges taken from:  https://www.austincc.edu/academic-and-career-programs/areas-of-study/science-engineering-and-math/biotechnology  https://www.delmar.edu/degrees/biotechnology/index.html  https://www.lonestar.edu/programs-of-study/biotechnology.htm |

**D. Present evidence from advisory committee minutes, attendance, and composition that the advisory committee includes employers who are actively engaged on the committee and who are representative of area employers.**

1. How many employers does your advisory committee have? 19 (12 active, 7 inactive)

2. How many employers attended the last two meetings? 8 in March, 7 in November

3. How has the advisory committee impacted the program over the last five years (including latest trends, directions, and insights into latest technologies)?

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| What is an Advisory Board and Why is it Important?  THE PURPOSE OF THE ADVISORY COMMITTEE  Workforce education programs at Collin College are a vital part of both the college and the community. Since these programs are designed to prepare students for employment and continuous learning in rapidly changing business; human service, and technical environments; it is essential that the college establish and maintain partnerships with knowledgeable individuals in local communities. The success of Collin College’s Workforce education programs relies on the active involvement of such advisory committee individuals.  THE ROLE OF THE ADVISORY COMMITTEE  According to the Guidelines for Instructional Programs in Workforce Education, (GIPWE), provided by the Texas Higher Education Coordinating Board, institutions must establish an industry-based advisory committee for each Workforce education program or cluster of closely related programs. Programmatic advisory committees may also be required by the accrediting agencies of some professions. The broad purposes of an advisory committee are: 1) to help the college document the need for a Workforce education program; and 2) to ensure that the program has both adequate resources as well as a well-designed curriculum to provide students with the skills and knowledge necessary to successfully meet the needs of business and industry. The advisory committee is one of the principle means of ensuring meaningful business and industry participation in program creation, enhancement, and revision.  Collin College and the EDA grant partners have recently been accepted to the Business & Industry Leadership Team (BILT) Academy *Cohort 3,* an NSF supported program that helps colleges/programs build their industry team and update their curriculum to best meet the needs of their local industry. We began the program in November, 2022, and will be working to build the advisory board, aka, business and industry leadership team to better serve the needs and ensure that our curriculum and program is up to date and relevant. The BILT Academy consists of one on one coaches and a yearlong training process to implement the BILT model <https://www.pathwaystoinnovation.org/bilt-academy/>. We are in the process of planning an orientation meeting, which will be followed by an employer evaluation of the knowledge and skills for the curriculum. This will be an interative process of updating curriculum, followed by industry approvals. Industry will also be tasked with predicting coming trends that should be incorporated into curriculum.  December 15, 2018 - Alejandra Vasco (BRIT), Courtland Imel (Ceutical Labs), Suzanne Armand (Ceutical Labs), JeanMarie Verchot (Texas Agrilife)  October 2, 2020 - Juan Gonzales (UTD), Courtland Imel (Ceutical Labs), Bill Bryan (Microconsult, Inc.), Peggy Shadduck (UNT)  March 19, 2021 - Courtland Imel (Ceutical Labs)  Suzanne Armand (Ceutical Labs)  October 8, 2021 - Bill Bryan (Microconsult, Inc.), Michael Mathis (UNTHSC), Tom Tubon (BioMade), Bruce Bonnell (UNT), Kathleen Otto (BioNorthTX), Megan Marcus (UTA), Ron Branning (retired biotech), Jill Baker (Signature Biologics), Subrata Batabyal (Nanoscope),  Courtland Imel (Ceutical Labs)  March 30, 2022 - Courtland Imel (Ceutical Labs), Suzanne Armand (Ceutical Labs), Charles Randklev (Agrilife), Kathleen Otto (BioNorthTX), Jenny Ligon (TAMU), Bruce Bonnell (UNTHSC), Ben Magill (DCC), Subrata Batabyal (Nanoscope)  November 18, 2022 - Kathleen Otto (BioNorthTX), Jenny Ligon (TAMU), Bruce Bunnell (UNTHSC), Ben Magill (DCC), Subrata Batabyal (Nanoscope), Sophia Hines (Signature Biologics), Michael Mathis (UNTHSC) |

4. Briefly summarize the curriculum recommendations made by the advisory committee over the last five years.

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| In the last five years, our advisory board has recommended that we focus on basic lab skills. Specifically mentioned was data keeping, understanding of chemistry and lab equipment, skills in graphing, and techniques in molecular detection. Our employers generally believe that we are doing a good job of doing this. We have also been advised on what employers are looking for in applications for employment, and how to ensure that our students’ applications are taken seriously.  Our members are alarmed by the possibility that undergraduate biotech education might disappear from the region, and encourage us to form partnerships with universities and state organizations (such as Texas Healthcare and Bioscience Institute;THBI) to increase awareness of the importance of programs such as ours. |

**E**. **Make a case with evidence that the program is well managed.**

*Suggested/possible points to consider (Data can be found at* [**http://inside.collin.edu/institutionaleffect/Program\_Review\_Process.html**](http://inside.collin.edu/institutionaleffect/Program_Review_Process.html)**):**

* *Average class size*
* *Grade distributions*
* *Contact hours taught by full-time and part-time faculty*
* *Identify all courses that have a success rate below 75%. If any of these are core courses, visit with the discipline lead for the course(s) in question to determine whether or not the content of the course(s) is appropriate to the workforce program learning outcomes. Using assessment evidence and instructor observations, identify the student learning outcomes that are the greatest challenges for students in courses with low success rates. Explain what instructional and other intervention(s) might improve success rates for each identified course.*
* *How well are general education requirements integrated with the technical coursework?*
* *Student satisfaction: What evidence do you have that students are satisfied with the program? What kinds of complaints are made to the associate dean/director by program students?*

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| Average class size   * The average class size for Intro to Biotech I, BIOL 1414 before 2021 was 9.8 students/section. In 2021, enrollment decreased due to multiple reasons that are not fully understood, but are common to other in-person courses since the pandemic. Enrollment in Intro to Biotech II, BIOL 1415 and Quality Assurance, BITC 1340 is 4-5 students/semester, and in Cell culture techniques, BITC 2431 is 3-4. General Biology 1 (BIOL 1406), and the other core courses in the certificate remain at significant enrollment, though the number of in-person sections of BIOL 1406 have sharply decreased since the pandemic, the opening of the Wylie and iCOLLIN campuses, and the removal of BIOL 1406 as a prerequisite for Anatomy and Physiology I. Genetics, BIOL 2416, has also seen a decrease in enrollment since 2021.   Grade distributions   * The majority of students in biotech classes pass when they persist in the courses. The goal in the training is to have the students master the materials and skills, so there are many opportunities for repetition and remediate in order for students to succeed.   Contact hours taught by full-time and part-time faculty   * All biotech courses are taught by 2 full-time faculty. In recent years, most biotech courses have been taught “per-head” when the number of enrolled students dropped below 10.   Identify all courses that have a success rate below 75%. If any of these are core courses, visit with the discipline lead for the course(s) in question to determine whether or not the content of the course(s) is appropriate to the workforce program learning outcomes. Using assessment evidence and instructor observations, identify the student learning outcomes that are the greatest challenges for students in courses with low success rates. Explain what instructional and other intervention(s) might improve success rates for each identified course.   * The fall 2021 section of BITC 2431 had a success rate of 66%. This was due to one of the three students essentially auditing the course and declined to take any exams. He was up-front about this from the beginning of the semester and was not a certificate seeker, nor was he the typical student in our classes. He was also enrolled in BIOL 1415 and BITC 1340 during the same semester, again, participating only when he wanted to and not taking exams. * BIOL 1414 was reported to have a 5-year success rate of 66% during the Associate of Science program review. This is mainly due to a drop in student retention during the pandemic, as well as a decrease in attendance during that time. Students are not able keep up in class when they do not attend regularly, this is especially true in laboratory classes such as biotech. As can be seen below, a number of other freshman-level courses suffered with success rates during this same period. Even so, with the exception of 2020-2021, BIOL 1414 outperformed BIOL 1406, its most closely-resembling course.     We believe that this is not a typical outcome for this course, and will resolve without intervention. Efforts to increase engagement in the course have been implemented. The adoption of a new, OER textbook and new, more engaging labs have increased student retention in this course.    If we further compare the performance of 1414 with 1406, we can see that both success rates and retention rates for all years except for 2020 are higher in 1414:    General education requirements are integrated with the technical coursework, but only into the advanced certificate. Biology 1, chemistry 1 and college algebra are required courses. These are distributed throughout the certificate plan and should not pose a scheduling or content issue.  Because biotechnology students in BIOL 1414 and 1415 are participants in the Science Education Alliance - Phage Hunters Advancing Genomics and Evolution Science program through the Howard Hughes Medical Institute, they take a satisfaction survey at the end of their semester. The results are compared not only to other students in SEA-PHAGES programs, but to other students in more traditional science classes. Our biotech students report equal to or higher scores in project ownership and self-efficacy than the program mean for SEA-PHAGE students across the nation, and the survey also shows that they feel an emotional connection with their work, indicating satisfaction. A Persistence In the Sciences (PITS) survey report is included with this review as a reference. Similar results are obtained every semester.  The main complaint seen on student evaluations is that students would like more test preparation. Prior to the change to an open-access manual, we got complaints about the previous textbook. We responded to these complaints by replacing the book, and now we have received positive comments on this change.  In order to make enrolling in courses easier on the student, we have offered three of our required classes partially or fully online – Quality Assurance, BITC 1340, is entirely online, and the lecture portions of BIOL 1415 and 2416 are offered online for the first time in fall of 2022. We believe that requiring students to be on campus for less time during the week will make the courses more appealing and convenient. The next course that we will explore teaching as a hybrid course is 1414.  As mentioned above, recruiting from high schools, offering our classes as part of a dual-credit program, or pursuing credit-by-exam for successful completion of the BACE should also increase enrollment in our courses.  BIOL 1406, 1414, 2416, BITC 1340, CHEM 1411 and MATH 1314 are offered every spring and fall semester, with BIOL 1406, CHEM 1411 and MATH 1314 also offered in summer sessions. BIOL 1415 is typically every spring and BITC 2431 is offered every fall. Students may take BIOL 1414 and 1415, BITC 1340 concurrently, and may take BITC 2431 concurrently if the student has completed BIOL 1406. BITC 2486 may be taken after the student has completed nine hours of program courses, and may enroll at the beginning of the spring, summer III or fall semesters. All courses are taught by full-time faculty.  The average class size for BIOL 1414 was 9.8 students per semester before 2021, when numbers decreased to 5 students per semester. Enrollment in BIOL 1415 and BITC 2431 is consistent at 4-5 students each semester that it is offered. The online class, BITC 1340 usually has between 3-5 students per semester. Two sections of BIOL 2416 (genetics) are offered per semester. Prior to 2021, enrollment was near capacity, but since then, enrollment decreased in the morning section to around 12, and to around 15 in the evening section. Overall enrollment at the Plano campus has seen a steady decrease since 2019-18, presumably due to other campuses opening. Biology 1406 in particular has seen a dramatic decrease in enrollment since 2018. Therefore, decreased enrollment in the biotech courses may be following the same trend with fewer overall numbers at the campus and in lower level science courses. |

**6. How effectively do we communicate, and how do we know?**

**A. Make a case with evidence that the program literature and electronic sites are current, provide an accurate representation of the program, and support the program’s recruitment plan, retention plan and completion plan.**

*Suggested/possible points to consider:*

* *Demonstrate how the unit solicits student feedback regarding its website and literature and how it incorporates that feedback to make improvements.*
* *How does the program ensure that students are informed/aware of program literature? Is program literature made accessible to all students (i.e. can they obtain the information they need)?*
* *Designate who is responsible for monitoring and maintaining the unit’s website, and describe processes in place to ensure that information is current, accurate, relevant, and available.*

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| Our primary means of communicating with our students has been through flyers. We have used a flier created by the college PR program, and have posted upcoming classes on flyers placed outside the Plano campus labs and outside of Academic Affairs. We have given flyers and information pamphlets to Advising for them to post and to aid them in advising students.  Currently, the biotechnology program does not have a website other than the Biotechnology information page on the Collin website. This page provides information on the two certificate levels that we offer.  Biotechnology faculty manned a booth at the 2022 Workforce Fair in the spring. At that event, we recruited an industry representative to talk with interested students about a career in biotech, specifically in product testing laboratories. At the event, we handed out information about our classes, certificates, and the credentialing exam that our students could take after completing classes (BACE).  In previous semesters, we have asked fellow biology faculty to inform students about the biotech classes we offer. This fall, we took it a step further by emailing all biology faculty a flier that we asked to be posted on their Canvas homepages. Some faculty agreed to do this to promote the program. Planned for March of 2023, another Workforce Fair will be offered both in-person and online.  At Springfest in 2022, Carole Twichell produced a slideshow about the entire biology department, which showcased biotech as a program that offers students the opportunity to do research and present at conferences.  When the flier produced by the PR department was originally made, we presented it at the Advisory Board meeting for approval. Changes suggested by the employers in attendance were used to update the flier. When flyers or promotional material are made, they are submitted to PR for approval before distribution. This has created some time delays making the messages less effective, but the reasoning is understood.  We sought CAB approval for all changes to curriculum and catalog entries. In 2022, we proposed changes both to the structure of the internship course to better align it with the ACGM/WECM guidelines and to allowable course substitutions for the certificates. Both were approved and these changes were noted on the district webpage. It was proposed that we contact students affected by these changes, to inform them that they may apply for graduation under the new requirements for the certificate.  Because of our partnerships with InnovATEBio, formerly Bio-Link, web materials produced through those grants, such as www.biotech-careers.org, lists the Collin College Biotech Program, as well as biotech employers in our area. This webpage is viewed by students across the country, and we routinely recommend it to potential students as a way of understanding the demand for a biotechnology workforce and the educational requirements for various careers.    Flyer from fall 2022    Flyer from spring 2023    Article published in Allen Image (2018) on the self-directed research carried out by biotechnology student Wesley Neuner.    Biotech-Careers.org connects students with training programs and jobs. Collin College is among the training programs listed.    The InnovATEBio website provides students, instructors and employers with information to grow the bioscience industry in the country. We are among the schools listed with biotech programs in Texas. |

**B. In the following Program Literature Review Table, document that the elements of information listed on the website and in brochures (current academic calendars, grading policies, course syllabi, program handouts, program tuition costs and additional fees, description of articulation agreements, availability of courses and awards, and local job demand in related fields) were verified for currency, accuracy, relevance, and are readily available to students and the public. Please fill out the table only for this prompt (B.), no analysis is necessary here.**

**Program Literature Review Table**

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| Title | Type (i.e. URL, brochure, handout, etc.) | Date of Last Review/Update |  | Responsible Party |
| Earn Your Biotech Certificate in One Semester! | poster/flier intended for students and advising | 5/1/2022 | Current Accurate Relevant Available | Biotech faculty/PR vetted |
| Study Biotechnology this Spring 2023 Semester! | poster/flier intended for students and advising | 12/1/2022 | Current Accurate Relevant Available | Biotech faculty/PR vetted |
| Biology at Collin College - Plano | Slideshow for SpringFest | 4/1/2021 | Current Accurate Relevant Available | Academic Affairs |
| Biotechnology | Program Flier | 10/1/2020 | Current Accurate Relevant Available | Public Relations |
| InnovateBio Website | https://innovatebio.org/program/collin-college | continuously updated | Current Accurate Relevant Available | Biotech faculty associated with the InnovATEBio grant |
| Biotech-Careers | biotech-careers.org | Click or tap to enter a date. | Current Accurate Relevant Available | Webmasters contracted by an NSF ATE grant (InnovATEBio) |
| Click or tap here to enter text. | Click or tap here to enter text. | Click or tap to enter a date. | Current Accurate Relevant Available | Click or tap here to enter text. |
| Click or tap here to enter text. | Click or tap here to enter text. | Click or tap to enter a date. | Current Accurate Relevant Available | Click or tap here to enter text. |
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**7. How well are we leveraging partnership resources and building relationships, and how do we know?**

**Partnership Resources: On the table below, list any business, industry, government, college, university, community, and/or consultant partnerships, including internal Collin departments, to advance the program outcomes.**

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| Articulation agreements: As part of the campaign to maintain the status of BIOL 1414 and 1415, it became clear that there is industry support for, but few pathways of, meaningful articulation. We have been working on this over the past several years, but have made limited progress. We developed agreements with Texas A & M Texarkana (TAMU-T) and TAMU Corpus Christi that would accept all courses in the biotech program for credit (both academic and workforce). Shortly after signing the agreement with TAMU-T, leadership changed at that institution, and their biotechnology program was suspended. Collin College never signed the agreement with TAMU-CC (reasons unknown to the authors), though Del Mar College in Corpus Christi was able to take advantage of the agreement that we developed. Del Mar biotech students seamlessly articulate all of their biotech credits into a University Studies Degree, often with an emphasis in the business to meet the needs of small biotech start-up companies.  Our advisory board has endorsed such agreements, though we have been unable to secure any others in a meaningful way. We have pursued an agreement with University of North Texas (UNT)-Frisco and main campus with limited success. We had a number of meetings to discuss pathways, course substitutions, etc. However, when one of the group retired, the articulation died on the vine and we have not been able to make the appropriate contacts with anyone interested in pursuing the project.  We currently have an agreement awaiting administrative signatures with UNT Health Science Center (UNTHSC) whose bachelors of biotechnology degree was recently approved by the state. This agreement will allow our students to seamlessly transfer all Collin Biotech credits, both from Level 1 & 2 certificates into an online Bachelor of Science degree in Biotechnology. This is an incredibly important opportunity for students, especially those who are unable to relocate in order to finish a bachelor's degree.  Grants: We have leveraged partnerships to write grants. To date, we have been or are funded on three grants: NSF ATE Funded AC2 Bio-Link Regional Center Grant (NSF DUE 1501207;2015-2021) and Industry Recognized Credentialing System Grant (NSF DUE 2054895; 2021-2024) and the U.S. Economic Development Administration (EDA) grant, “Grow the Biotech Workforce in North Texas to Meet Emerging Skill Needs via a Collaborative Partnership” (2022-2024; https://www.dallascollege.edu/news/pages/newsitem.aspx?ArticleId=168). Dr. Kirkpatrick was/is a coPI on the grants and Professor Twichell was/is working on the grant goals. The NSF ATE grants have enabled us to maintain the two biotech courses in the ACGM, incorporate undergraduate research projects into our courses, offer the credentialing exam to our students (at no cost to them), and pursue articulation agreements. The EDA grant was just funded through Dallas College this September, but we are already making progress with partners in the DFW region to increase the biotech workforce in the region. Collin College is a subaward on the grant. We wrote/submitted another grant to NSF ATE in October, but due to a glitch in the system the grant was not accepted. We intend to resubmit for the next round or to another funding agency.  Industry Recognized Credentialing System Grant (IRCS; NSF DUE 2054895) whose goal is to anchor a unified credentialing system by expanding adoption of the Biotechnology Assistant Credentialing Exam (BACE). Credentialing provides industry a validated talent pool and job candidates a mechanism to showcase mastery of competencies and skills. Collin College students, and others, can sit for the credentialing exam for free (normally a $150 fee). Professors Twichell and Kirkpatrick took part in professional development, Industrial Biotechnology Teacher Experience (IBTE). The primary aim of IBTE is to provide experience with the skills, techniques, and knowledge to teach biotechnology curricula in the context of working in the biotech industry. In addition, there is guidance and practice with the preparative steps necessary for the hands-on components of the program. Industry experience includes the design, development, testing, and manufacture of a biopharmaceutical product. It is a 4-week online and 1-week in-person training. Professor Twichell earned the credential at the end of the training. This partnership provided opportunities for us and our students. We currently regularly interact with many educators across the state and nation. As part of the grant, we will be taking part in a documentary highlighting the credential and biotechnology as a career pathway. We will be able to use this in our marketing materials.  In the prior program review, it was noted that the courses, Introduction to Biotechnology I and II (BIOL 1414 and 1415) were slated for deletion from the ACGM. Collin co-led a statewide campaign, which included all colleges in the state offering biotech courses, to maintain the academic status of these two courses. After an over two-year battle, the THECB committee voted to maintain the courses in the ACGM by a very narrow margin. The academic status of these courses is a critical component for articulations. The partnership with the other biotech programs in the state were crucial to the success of the campaign.  Curriculum: Another way that we have leveraged our partnerships and resources is through the acquisition of curriculum from Austin Community College (ACC) and Northeast Biomanufacturing Center and Collaborative (NBC2). ACC has significant funding to write open source textbooks and laboratory manuals. We also use the textbook and materials from their Quality Assurance in the Biosciences course (BITC 1340). The open source textbooks are used so our students are not required to purchase textbooks and lab manuals for their courses. They also ensure the materials are up to date and meet the skill standards put forth from the Texas Skill Standards Board for biotechnology and biomanufacturing. We have incorporated materials for making antibodies in culture cells from NBC2 into the Cell Culture course (BITC 2431). Professor Twichell attended a professional development workshop learning the techniques to incorporate into the courses. Any time we need a resource for curriculum, we can reach out to any of dozens of biotech programs in the nation and get materials.  Working Partners: Bridgette Kirkpatrick and Carole Twichell were participants in an NSF ATE grant-funded workshop series to develop strategies to form better relationships with employers and other community partners to further the goals of biotech education. They attended virtual workshops as a part of this program, which provided tips such as the creation of documents, agreements, pitches, and strategies to increase the number of partners or advisory board members. We have successfully added members to our advisory board.  MentorLinks: Dr. Kirkpatrick serves as a mentor for the American Association of Community Colleges’ MentorLinks program. She just completed the 2018-2021 cohort, mentoring Southeast Community College Biotechnology Program in Lincoln, Nebraska. She is currently serving as a mentor and advisory board member for the Biotechnology Program at Wake Tech Community College in Raleigh, North Carolina, 2021-2024. The purpose of the MentorLinks program is to assist the mentee programs to reach specific goals for growing and/or starting a program. Dr. Kirkpatrick assists her mentees by sharing experiences, curriculum, making connections to other programs nationally in order to accelerate the mentee’s program development. This is another way to keep abreast of changes in biotech across the nation and network with others about changes and exchange information.  BioNorthTX is the regional life science and healthcare advocacy group. We have loosely been involved in industry advocacy groups over the past several years, however, the biotech/life sciences groups in the region have not been consistently represented. We met with the new and current CEO of BioNTX, Kathleen Otto, a couple of years ago. From that meeting we have established a very positive relationship in which we have attended IC3 Life Science Summit for the past 2 years. Dr Kirkpatrick presented about the workforce needs and credentialing at the 2021 event. Three of our students volunteered and attended the 2022 event. Additionally, this relationship led to the partnership on the EDA, Good Jobs Grant. This partnership has precipitated introduction to multiple companies that have or are going to move into the region. We hope to have them join our Business and Industry Leadership Team (BILT). Dr Kirkpatrick is currently a member of Cohort 3 of the BILT Academy (2022-23) in an effort to build a robust Leadership team for the EDA grant and for our biotech program, simultaneously. BioNTX will take part in the BILT Academy as well.  Community College Undergraduate Research Initiative/Undergraduate Research partnerships: One of the products of the AC2 Bio-Link Regional Center Grant partnership was the incorporation of research into the biotechnology and genetics courses. Additionally, Dr Kirkpatrick incorporated research into an Honors Biology lab. The Prevalence of Antibiotic Resistance in the Environment (PARE) project was used for multiple semesters in that course. Multiple extensions of the project involved undergraduate research under the CASMNS umbrella with multiple faculty and student presentations at regional and national conferences.  The Intro to Biotech I & II courses are part of a national science crowdsourcing program. “SEA PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science) is a two-semester, discovery-based undergraduate research course that begins with simple digging in the soil to find new viruses, but progresses through a variety of microbiology techniques and eventually to complex genome annotation and bioinformatic analyses” https://seaphages.org/. Our students do the discovery portion in the Intro to Biotech I course and annotation in the Intro to Biotech II course. Students have participated in regional and national conferences, doing oral and poster presentations and have multiple authorships of genome annotations submitted to GenBank (the national repository for genetic sequences) as a result of participating in this program.  The professional development (PD) involved in becoming a “SEA PHAGES” school, Cohort 9, led Professors Lawson (now teaching at Baylor University), Twichell and Kirkpatrick to initiate changes into the general biology (BIOL 1406) labs. The PD for SEA PHAGES involved justification and student learning advances from incorporating authentic research opportunities into undergraduate courses. Our focus became a project-based approach to incorporate Vision and Change (www.visionandchange.org) recommendations which emphasize integrating scientific competencies that underlie the process of science into the biology laboratory curriculum. While these proposed changes didn’t always go smoothly and were originally met with resistance, changes are currently being incorporated into the lab. A multi-campus committee, District Biology Curriculum Team (DBCT) was formed as a result, which includes membership from all campuses. We collectively assess curricular changes and have developed a new laboratory manual. We are in the final stages of piloting labs that include student research that have a biotech focus. During the pandemic, this committee worked extremely well together to meet the immediate need to develop online labs for the short term and then making changes in curriculum for summer, then hybrid classes the following fall. The fact that the committee was in place and had been working together, streamlined the processes that had to be accomplished in such a short time. We have since worked with Dr. Rebecca Orr as she developed the online biology labs for iCollin.  BioMADE: Collin College was the recipient of a bio-manufacturing equipment grant and are current members of BioMADE www.biomade.org/. We received the equipment and software that enables remote monitoring and induction of bacterial cells in culture. The equipment will expose students to technologies currently being used in industry and will be incorporated into classes in the spring of 2023. Dr Kirkpatrick attended the BioMADE Annual meeting in June, 2022, she took part in the Biomanufacturing Education and Workforce Development Summit stakeholder event in June, 2022 that focused on bioindustrial manufacturing, a biomanufacturing laboratory training workshop in August, 2022. These opportunities are important in staying abreast of not only new technologies, but also, the state of biotechnology education across the nation. It also provides networking opportunities with biotech colleagues from other programs to exchange ideas and best practices, as well as discuss common challenges and how to best overcome them. |

**Partnership Resources Table\*\***

|  |  |  |  |
| --- | --- | --- | --- |
| Partner/Organization | Description | Formal Agreement Duration,  if any. | How is it Valuable to the Program? |
| AC2 (ended 2021) | NSF ATE regional grant | 2015-2021 | Kept BIOL 1414, 1415 in ACGM  time to do that, work on articulations, started SEA PHAGES, undergrad research for biology lab |
| HHMI SEA PHAGES | Undergraduate crowdsourcing research initiative | 2016-present | Curriculum, opportunity for students to present research, travel, publications in GenBank |
| BioMADE | National Biomanufacturing consortium | 2021-present | Equipment grant, workshop training, attended meeting and summit (professional development) |
| BioNorthTX | Regional Industry advocacy group | 2021-present | Attend summits, introductions to industry members, grants partners EDA grant, presentations, student access |
| MentorLinks | American Association of Community Colleges grant | 2019-present | involvement with national biotech programs, fund travel for professional development and networking |
| BACE NSF ATE Grant | Funded to expand the use of the BACE credentialing exam into 5 states, including Texas | 2021-present | BACE credentials are value-added to a student’s resume; helps with job search after graduation; may recruit high school students, interact with industry locally and in other states |
| Working Partners | Grant provides education to teachers and school admins to better work with employers | N/A | Tips for building partnerships, organizing goals and communicating with community stakeholders |
| District Biology Curriculum Team | Committee formed from biology faculty across the Collin College district | N/A | Review of curriculum, especially for biology I courses; increases awareness of biotechnology through authentic research |
| InnovateBIO | NSF ATE Center for Biotechnology | N/A | curriculum resources, professional development, networking, free advertising through website; increase awareness of biotech nationwide |

**8. What professional developmental opportunities add value to your program?**

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| --- |
| Addenda attached  The biotechnology faculty have been active in national organizations that connect biotech programs. They have been on leadership teams for regional and national grants that promote biotech education. They have presented at numerous national conferences, as well as local meetings.  In summer of 2014, the biotechnology faculty conceived the idea to update the curriculum of the BIOL 1406 general biology 1 lab to utilize and emphasize the techniques of biotechnology. Within three years, the District Biology Curriculum Team was formed to develop inquiry-based curriculum for the biology lab. While the original idea was to increase awareness of biotechnology, and to implement the current ideas in science education, it has morphed into a district-wide push towards updating and improving curriculum. |

**Provide a List of professional development activities employees have participated in since the last program review.**

**Employee Resources Table\*\***

|  |  |  |  |
| --- | --- | --- | --- |
| Employee Name | Role in Unit | Professional Development Summary | How is it Valuable to the Unit? |
| Bridgette Kirkpatrick | Instructor | See Appendix | Remain current in technologies and trends, funding opportunities, equipment procurement |
| Carole Twichell | Instructor | See Appendix | Remain current in the needs of the industry, add innovation to curriculum |
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\*\*For convenience, if providing a listing of professional development activities, this list may be included in this document as an appendix.

**9. Are facilities, equipment, and funding sufficient to support the program? If not, please explain.**

**[OPTIONAL—Only respond to prompt 9 if you are requesting improved resources for your program. If current facilities and budget are adequate, please proceed to prompt 10.]**

**Make a case with evidence that current deficiencies or potential deficiencies related to facilities, equipment, maintenance, replacement, plans, or budgets pose important barriers to the program or student success.** As part of your response, complete the resource tables, below, to supportyour narrative.

*Possible points to consider:*

* *The useful life of structure, technologies and equipment*
* *Special structural requirements*
* *Anticipated technology changes impacting equipment sooner than usual*

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| Current facilities and funding are satisfactory. No additional funds are being requested. |

**Facilities Resources Table\*\***

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| Significant Pieces of Equipment | Description  (i.e. Special Characteristics) | Meets Needs (Y or N):  Current For Next 5 Years | | Analysis of Equipment Utilization |
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**Equipment/Technology Table ($5,000 or more) \*\***

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| Current Equipment Item or Budget Amount | Description | Meets Needs (Y or N):  Current For Next 5 Years | | For any “N”, justify needed equipment or budget change |
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**Financial Resources Table\*\***

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| Source of Funds (i.e. college budget, grant, etc.) | Meets Needs (Y or N):  Current For Next 5 Years | | For any “N”, explain why | For any “N”, identify expected source of additional funds if needed |
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Section III.Continuous Improvement Plan (CIP)

**10. How have past Continuous Improvement Plans contributed to success?**

Program Review at Collin College takes place for each unit or program every five years. During the last (fifth) year, the program evaluates the data collected during the CIP process.

**Please describe how you have used your Continuous Improvement Plan (CIP) to make the following improvements to your program over the past 4 years (your last program review can be found on the Program Review Portal):**

* 1. **Program Learning Outcomes/Program Competencies**
  2. **Overall improvements to your program**

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| Five program learning outcomes were created during this review period. Two of these, one concerned with pipetting accuracy (a very basic, but critically important skill in lab science), and the other with sterile technique (also critically important in most applications of biotechnology), had been previously developed as part of the CIP. Two of the other three outcomes developed dealt with the fundamental need for mathematics, and the common laboratory skills of carrying out and interpreting electrophoresis gels. Since it was emphasized that PLOs should be assessed in each required class, a fifth goal was added that could be assessed in our Quality Assurance course in which students must describe the steps involved in the FDA, Food and Drug Administration, drug approval process as well as discuss ethical issues that may be associated with politicization of drug approvals.  Program learning outcomes are meant to reflect marketable skills that graduates of the program should exhibit. Towards that end, the skills that we chose to assess in our CIP are basic and fundamental. During this past review period, we chose to focus on pipetting and sterility. Both of these skills rely heavily on the development of “muscle memory” to ensure that the techniques are carried out the same way every time. To prepare students for assessment, it has been imperative to provide adequate opportunity to practice the proper technique.  The benefit of creating and carrying out the CIP has been to define the outcomes that we (and our industry members) want for our biotech students. Once these goals were written down, we were able to create action plans to make sure that they would be achieved. As can be seen in the results from the last 4 years, we reached the goals in most of the outcomes. Since the PLOs were created during this review period, we believe that the next assessment point in year two will have even higher returns.  We presented our proposed program learning outcomes and assessments to our advisory board in March, 2021 and they agreed with what we considered to be the most valuable takeaways from our certificates. |

**\*Please attach previous CIP Tables in the appendix**

**11. How will we evaluate our success?**

**NOTE: Please contact the institutional effectiveness office if you need assistance filling out the CIP tables.**

As part of the fifth year Program Review, the program should use the observations and data generated by this process along with data from other relevant assessment activities to develop the program’s CIP and an action plan for the next two years. At the conclusion of the first two years, data collected from the first year, plus any other relevant data that was collected in the interim, should be used to build on the accomplishments of those first two years by developing another two-year action plan for the CIP to help the program accomplish the expected outcomes established in its CIP or by implementing one of your other plans.

**Based on the information, analysis, and discussion that have been presented up to this point, summarize the strengths and weaknesses of this program. There should be no surprise issues here! This response should be based on information from prior sections of this document. Describe specific actions the faculty intends to take to capitalize on the strengths, mitigate the weaknesses, improve student success and program learning outcomes.** **Provide the rationale for the expected outcomes chosen for the CIP(s).**

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| Our greatest strength has been the commitment of the faculty to student success. For multiple semesters during this review period, the biotechnology faculty have taught classes at per head rates, in order to allow our students the opportunity to earn a biotechnology certificate. In addition, our faculty are linked to national biotechnology organizations to be able to adapt at a moment’s notice to new trends in skills and updating curriculum in a meaningful way.  The biotechnology program was started over 22 years ago, and was probably ahead of its time in this area. However, the skills that students acquire in the program have been beneficial in their success in the workplace as well as in transfer to 4-year schools. In 2006, Collin College began the task of integrating these courses into the Academic Course Guide Manual (ACGM), which would allow the courses to count as academic and not workforce credit. This was a concerted effort between multiple institutions (including 4-year universities) to transform the courses to true academic status and rigor, not just simply change the names and numbers. We were successful both in integrating them into the ACGM, then later in defending their continuance in the ACGM. The academic status of the courses is important for them to be maintained in the core curriculum, in which students can take skill-building classes that count toward their degrees and will transfer to 4-years schools. We have found that many of our students are either degree holding individuals (mainly BS) who cannot get jobs for lack of workforce skills or are interested in science/research, but wish to pursue a 4-year degree. Therefore, we’ve worked to minimize the number of courses required to prepare them to go into the workplace and be successful.  The main weakness of the program is its small number of completers due to the fact that students typically use the courses to leapfrog from community college to a 4-year degree. Students take biotech courses while getting an associate’s degree and are usually awarded only the higher (AS) degree, even when they qualify for the certificate. This issue came to light as we were identifying completers (or those who should have completed based on their course work), and learned that the degree auditing system does not easily identify and deliver multiple awards in a single semester. So multiple students have been awarded their AS, but never their certificate(s). We are working with the registrar’s office to identify students and assist them in the navigation of degree audits, declaring majors and/or completing substitution paperwork to have students awarded the certificates they earned. Our dean’s office has identified more than 5 current and recent students that should be awarded certificates, and are working to contact the students.  It is a current practice of the biotechnology instructors to keep track of which students have taken which classes, and who is approaching or has completed the requirements for attaining a certificate. To address the problem of missed completion, our plan is to connect these students with the appropriate office to obtain a degree audit and change their major if necessary to be awarded the certificate. The student will then be able to receive their award and will have the option to change their major back to AS, if desired.  Collin Biotechnology faculty are well connected with the biotechnology educators on a state and national scale. We actively participate in professional development, both attending and presenting at conferences and online webinars. We are active in grant writing, when we are supported to do so. We are currently working on two grants that were awarded, an NSF ATE grant to support credentialing in biotech and a Good Jobs grant to bring a labor force to the DFW area. We have written and submitted an additional NSF ATE grant to investigate a model of a remote teaching network that can be used nationally. However, due to a glitch in the grants.gov system, it wasn’t sent for review. We will re-submit next cycle or to another funding agency.  A national survey of biotechnology educators conducted in 2017 by the AC2 BioLink Regional Grant (NSF DUE: 1501207) team revealed many common challenges faced by biotech programs. Responding to the prompt “My greatest challenge as a bioscience educator is…”, in the survey, biotechnology faculty cited issues with low enrollment and difficulty recruiting students into the programs due to lack of transferability of the courses. Most often, Biotech courses are considered to be workforce and the credits are difficult to seamlessly transfer into 4-year degree programs. All too often, job postings in the life sciences state a minimum of a bachelor’s degree for entry level positions. However, traditional biology degrees can fail to adequately prepare students with the necessary skills required to work in the laboratory, even at the lowest level. The system is unfortunate for students and industry alike. To compound the issue, university instructors may not be as up to date and familiar with the latest techniques used in industry as those at two-year schools with biotech programs. This theme is consistent with what we have experienced in our program at Collin. |

**12. Complete the Continuous Improvement Plan (CIP) tables that follow.**

Within the context of the information gleaned in this review process and any other relevant data, identify program priorities for the next two years, **including at least one program learning outcome (or program competency)**, and focus on these priorities to formulate your CIP. You may also add short-term administrative, technological, assessment, resource or professional development outcomes as needed.

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| For the next review period, we will focus on math skills and the molecular biology skill of running and interpreting an electrophoresis gel. It was also decided that the measures to evaluate success should be reevaluated to make reporting easier.  5th PLO (CIP table only has room for 4 outcomes)   1. Expected Outcome: Students will understand the process of drug approval and the importance of regulations 2. Measures: Short essay graded by rubric 3. Target: 70% of students will score at least an 85%   A 6th Improvement Goal, to be considered as a possibility for year 3, is to evaluate the ways that we work to ensure completion. We plan to informally evaluate ourselves in this two-year period, and the practices that have been described in Section 11 of this document. |

**Table 1. CIP Outcomes, Measures & Targets Table (focus on at least one for the next two years)**

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| --- | --- | --- |
| **A. Expected Outcomes**  Results expected in this unit  (e.g. Authorization requests will be completed more quickly; Increase client satisfaction with our services) | **B. Measures**  Instrument(s)/process(es) used to measure results  (e.g. sign-in sheets, surveys, focus groups, etc.) | **C. Targets**  Level of success expected  (e.g. 80% approval rating, 10 day faster request turn-around time, etc.) |
| Students will be able to use laboratory math techniques to calculate dilutions and plan multicomponent solutions. | Individual math test | 70% of students will receive a 100% on test |
| Students will demonstrate accurate pipetting skills. | Completion of report and analysis Faculty will report accuracy on Google Doc. | 70% of students will demonstrate accuracy of greater than 95% |
| Students will demonstrate proper sterile technique and use of a biosafety hood. | Part 1 on individual practical test Faculty will report percent correct on Google Doc. | 70% of students will receive at least a 90% on this portion of test |
| Students will demonstrate their ability to run and interpret an agarose electrophoresis gel. | Completion of report and analysis | 70% of students will receive at least a 90%. |

**Continuous Improvement Plan**

**Outcomes might not change from year to year. For example, if you have not met previous targets, you may wish to retain the same outcomes. *You must have at least one program learning outcome.* You may also add short-term administrative, technological, assessment, resource or professional development goals, as needed. Choose 1 to 2 outcomes from Table 1 above to focus on over the next two years.**

**A. Outcome(s)** -Results expected in this program (from column A on Table 1 above--e.g. Students will learn how to compare/contrast Conflict and Structural Functional theories; increase student retention in Nursing Program).

**B. Measure(s)** –Instrument(s)s/process(es) used to measure results (e.g. results of essay assignment, test item questions 6 & 7 from final exam, end of term retention rates, etc.).

**C. Target(s)** -Degree of success expected (e.g. 80% success rate, 25 graduates per year, increase retention by 2% etc.).

**D. Action Plan** -Implementation of the action plan will begin during the next academic year. Based on analysis, identify actions to be taken to accomplish outcome. What will you do?  
**E. Results Summary** - Summarize the information and data collected in year 1.  
**F. Findings** - Explain how the information and data has impacted the expected outcome and program success.   
**G. Implementation of Findings** – Describe how you have used or will use your findings and analysis of the data to make program improvements.

**Table 2. CIP Outcomes 1 & 2**

|  |  |
| --- | --- |
| 1. **Outcome #1** Students will be able to use laboratory math techniques to calculate dilutions and plan multicomponent solutions. | |
| 1. **Measure (Outcome #1)**   Individual math test | 1. **Target (Outcome #1)**   70% of students will receive a 100% on test |
| 1. **Action Plan (Outcome #1)**   Repeatedly expose students to math in all biotech classes, and administer a low-stakes assessment before the PLO assessment | |
| 1. **Results Summary (Outcome #1) TO BE FILLED OUT IN YEAR 2** | |
| 1. **Findings (Outcome #1) TO BE FILLED OUT IN YEAR 2** | |
| 1. **Implementation of Findings (Outcome #1) TO BE FILLED OUT IN YEAR 2** | |

**Table 2. CIP Outcomes 1 & 2 (continued)**

|  |  |
| --- | --- |
| 1. **Outcome #2** Students will demonstrate their ability to run and interpret an agarose electrophoresis gel | |
| 1. **Measure (Outcome #2)**   Completion of report and analysis | 1. **Target (Outcome #2)**   70% of students will receive at least a 90%. |
| 1. **Action Plan (Outcome #2)**   Students will receive instruction in electrophoresis and will be familiarized with the concept of standard curves through other assays. The use of software programs such as Excel to create graphs will also be taught. | |
| 1. **Results Summary (Outcome #2) TO BE FILLED OUT IN YEAR 2** | |
| 1. **Findings (Outcome #2) TO BE FILLED OUT IN YEAR 2** | |
| 1. **Implementation of Findings (Outcome #2) TO BE FILLED OUT IN YEAR 2** | |

**What happens next? The Program Review Report Pathway**

1. **Following approval by the Steering Committee,**

* Program Review Reports will be evaluated by the Leadership Team;
* After Leadership Team review, the reports will be posted on the Intranet prior to fall semester;
* At any point prior to Intranet posting, reports may be sent back for additional development by the unit.

1. **Unit responses to the Program Review Steering Committee recommendations received before July 31st will be posted with the Program Review Report.**
2. **Leadership Team members will work with program supervisors to incorporate Program Review findings into planning and activity changes during the next five years.**

**Please make sure to go back and complete your Executive Summary at the start of the Review.**