

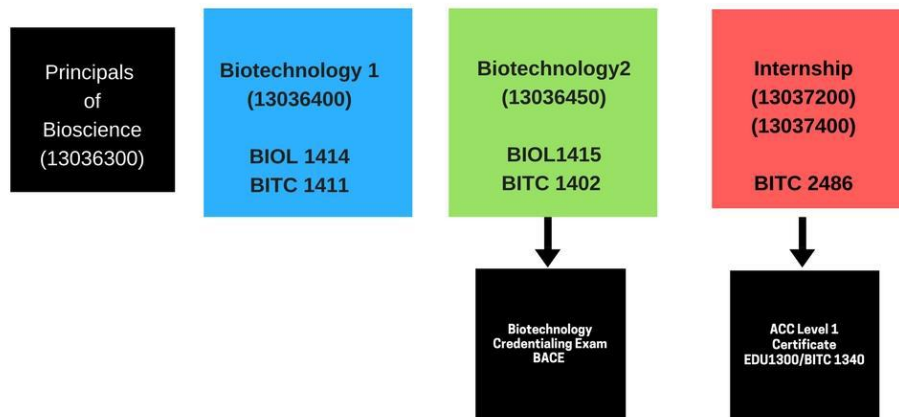
The Texas Biotechnology Pathway: Start up Manual



Texas/ACC STEM High



School Biotechnology Pathway



InnovATEBIO, National Biotechnology Education Center: <https://innovatebio.org/>

AC2 Biotech Teacher Mentor Network: <http://txbiotech1.weebly.com>



Thank you for considering the Texas High School Biotechnology Pathway in your school district!

This packet is intended to outline the collaboration and opportunities that the AC2 Bio-Link Regional Center can bring to your school's CTE Pathway Courses. The High School Dual Enrollment Austin Community College Level I Biotechnology Certificate Pathway is designed to train high school students for entry-level employment in the Texas Biotechnology industry. This industry is well established in Texas and continues to grow which has created a high need for a skilled workforce. The pathway consists of three courses and the curriculum covers the necessary TEKS, industry standards, and associated student assessments validated by Texas Biotechnology industry. Students completing this program can seek entry-level employment directly out of high school or can bridge to the AC2's Biotechnology Community College Programs to earn more advanced certificates or degrees.

Program information and Teacher Support can be found at <http://txbiotech1.weebly.com>.

Industry in Texas

Texas is home to some of the largest manufacturers in the medical device industry with more than a dozen Fortune 1000 medical device giants having manufacturing or management operations in the state. Texas is also a leading pharmaceutical research state and ranks #2 in amount of clinical trials (~18,500 studies underway) and is home to six of the top 100 research medical schools according to *U.S. News & World Report* (Texas Biotechnology Industry, 2015). More than 61% of Texas biotech employment is in research & development (R&D) and testing related fields. Many of the largest private biotech R&D firms in the world operate in Texas. In fiscal year 2013 alone, Texas public institutions of higher education expended almost \$2.9 billion on medical and life sciences research. In January 2015, the 84th Texas Legislature proposed to eliminate the Emerging Technology Fund and use the ETF's unexpended expenses to create the Governor's University Research Initiative. The Governor's University Research Initiative would provide matching funds to help Texas institutions of higher education recruit prestigious, nationally-recognized researchers to their faculty. Also found in Texas is the Texas Medical Center, considered the largest concentration of medical experts and professionals in the world, and the 8th largest business district in the world. It conducts \$3.4 billion in research annually.

-THBI Report, 2016

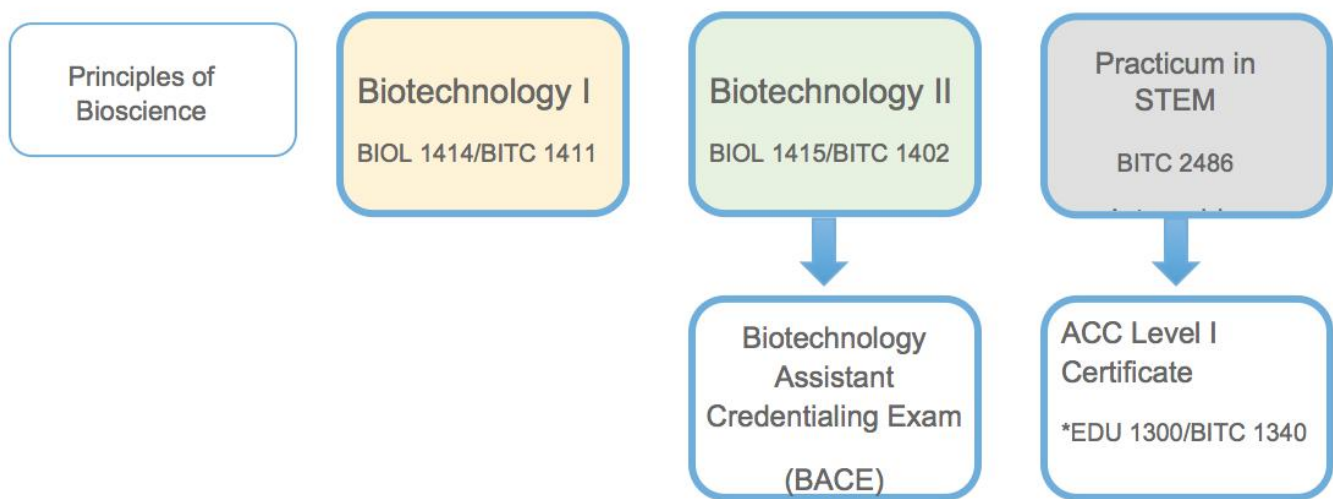
For more information on the Texas Biotechnology Industry, please visit <https://businessintexas.com/business-sectors/biotech/>



Level 1 Certification Pathway

The CTE Texas Essential Knowledge and Skills includes a series of Biotechnology courses created to enable student in high school to earn certification and build their science research skills for employment or future college studies.

TEA/ACC Pathway Courses



Course Descriptions

Principles of Bioscience: An entry-level pathway course designed to introduce students to the various applications of biotechnology in the context of careers in bioscience. Although it is not a science credit, it is strongly advised that the course contains a hands-on introductory lab component as well as a college and career focus.

Biotechnology 1: An introduction to the field of biotechnology including applications of biotechnology in molecular biology, biochemistry, research, bioethics, and laboratory safe practices in a regulated environment. The course is supplemented with exciting hands-on laboratory exercises, and real-world research and industry applications which enable the student to master basic skills in working in a biotechnology lab; solution preparation, safe handling of hazardous material, nucleic acid isolation, recombinant DNA cloning, PCR and ELISA. The course concludes with a bioscience career exploration including applied research, biomanufacturing, biomedical devices, and clinical trials.

Biotechnology 2: Course to focus on an integrative approach to the study of biomolecules with an emphasis on protein structures, functions and uses in a regulated biotechnology laboratory. Students will investigate the mechanisms involved in the transfer of from DNA sequences to proteins to biochemical functions. The course will integrate biological and chemical concepts with laboratory techniques that are used in research and industry; protein and enzyme assays, column chromatography, FPLC, spectrophotometry, PAGE and Western Blotting. Critical thinking will be applied in laboratory exercises using inquiry-based approaches, troubleshooting and analyzing experimental data. The course concludes with advanced resume writing and interviewing skills.

Practicum in STEM: Informal internship experience where students are closely supervised under a mentor and apply their entry level knowledge and training in a bioscience laboratory. The experience may be internal to the college where the student works on independent projects such as assisting in classroom laboratory preparation or protocol development under the supervision of an ACC instructor. Or the experience can be external to the college, where the student is mentored and supervised by a workplace employee. This may be paid or unpaid experience.

BACE Exam: The Biotechnician Assistant Credentialing Exam (BACE) is an industry-recognized exam designed to assess core skills and knowledge sets identified by industry, and represented within the academic and performance standards of Florida's secondary Biotechnology program. The test has been vetted by the state's industry organization BioFlorida, representing more than 3,000 companies and research organizations in the biotechnology, pharmaceuticals, medical devices and bioagriculture sectors. The test is currently being piloted by Texas High Schools and vetted by Texas industry. Any student in any state may take the BACE exam. For more information, please visit:

<http://biotility.research.ufl.edu/biotechnician-assistant-credential-bace.html>

BITC 1340 Quality Assurance for the Biosciences: Quality assurance principles and applications. Includes quality assurance principles as they apply to biotechnology regulated and non-regulated work environments. In depth analysis of a broad range of quality systems and regulations including GXP, ISO9000, Lean and Six Sigma as they apply to the biotechnology, biopharmaceutical, bioscience, and biomedical device industries. This course is currently under submission for an innovative TEA course number.

ACC Level 1 Certificate: Level 1 certificate offered from ACC. Students anywhere in Texas may articulate with ACC's Biotechnology program for certificate courses:

- EDU 1300 or a course from core studies 3 hours
- BIOL 1414 or BITC 1411 4 hours
- BIOL 1415 or BITC 1402 4 hours
- BITC 2486 4 hours
- BITC 1340 3 hours

18 hours for Level 1 Certificate

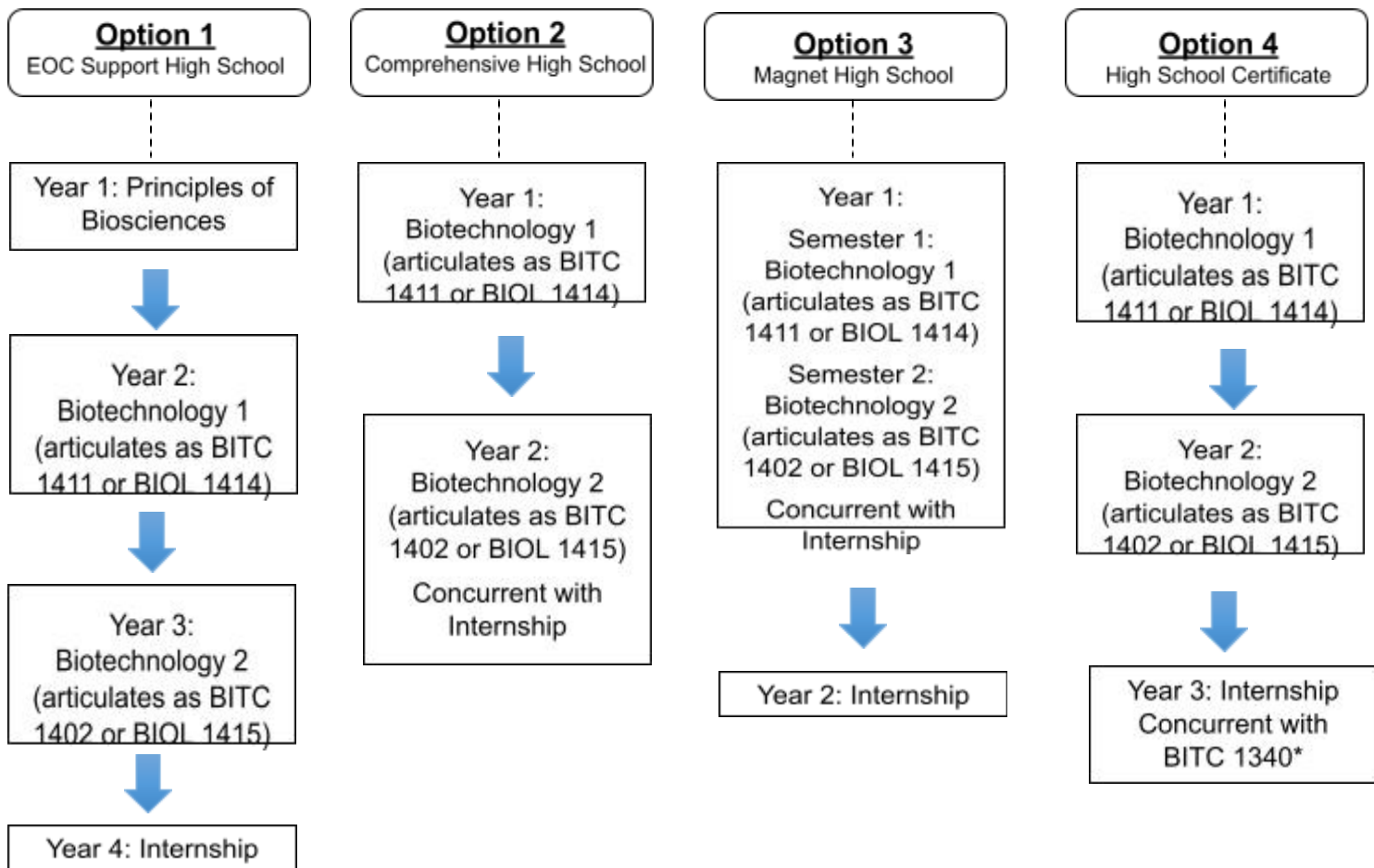
Multidisciplinary Science Credit Options

AC2 can help you design a course sequence specific to your school needs and population.

TEA Biotechnology I and II Courses can be offered as:

- an Advanced Science credit in all endorsements at any school.
- as a sequence of courses for a STEM endorsement with certificate option.
- a course in a Health Science endorsement sequence.

Pacing Options for the Biotechnology Pathway



*BITC 1340 is a 16 week online CE course taught through Austin Community College

Course Articulations with Community College

Articulation Agreements are available between current TEA CTE Courses and your local community if they offer the biotechnology courses in the Table 1. If your local community college does not offer biotechnology courses, you may articulate with Austin Community College from anywhere in the state of Texas.

Conditions for Articulation with Austin Community College:

- Must attend the ACC Biotechnology High School Training within one year of articulation
- Must join Mentor Network
- Must complete labs as outlined in the ACC Lab Manuals
- Students must score 70 or better on the End of Course exam and have an 80 or better average in the class

TEA/CTE Biotechnology High School

Entry Level Community College Articulations

| TEA Innovative Course 2003-2005 | TEA Course Science Credit 2006-2009 | TEA Course Science and CTE Credit 2010-2017 | TEA Science, CTE, Certificate Credit 2017-2022 | Articulated Course | Academic Course |
|---------------------------------|-------------------------------------|---|--|------------------------------|------------------------|
| | Biotechnology | Biotechnology | Principles of Bioscience §130.403 (13036300) | none | none |
| Biotechnology Elective credit | Advanced Biotechnology | Advanced Biotechnology | Biotechnology 1 §130.415 (13036400) | BITC 1411 | BIOL 1414 |
| | | SCI Res & Des | Biotechnology 2 §130.416 (13036450) | BITC 1402 | BIOL 1415 |
| | | None | Quality Assurance in BioScience (N1303771) | BITC 1340 (online or hybrid) | BITC 1340 (online) |
| | | Practicum in STEM or SCIRES&DES | Practicum in STEM §130.418 (13037200) (13037400) | BITC 2486 (Internship) | BITC 2486 (Internship) |

Articulated vs. Dual Credit

In our efforts to continue support for the high school Biotechnology Program, ACC is providing the following options to school districts interested in offering articulated courses leading to certification.

Courses can be offered as a dual college credit course, a hybrid of dual college credit and credit-in-escrow, or solely as a credit-in-escrow course. **Both types of courses can be used to fulfill the ACC Level 1 certificate requirements.**

- o **Credit in Escrow : BITC 1411 and BITC 1402** ACCTech (formerly referred to as Tech Prep) is a way to start a college technical major in high school. In an ACCTech program, students begin their course of study in high school and continue in a community or technical college. ACCTech programs combine the academic courses needed for success in college AND technical courses that begin to prepare you for a career. Students in ACCTech programs can earn from two to 31 hours of college credit that is held in escrow until they graduate from high school. Once they graduate from high school and complete ANY course at ACC, they can claim their banked credit and complete the remainder of their degree program.
- o **Dual Credit: BIOL 1414 and BIOL 1415** To take the course for college credit, students must select the level 1 biotechnology certificate when applying to ACC to waive TSI compliance. The ISD will pay the teacher's salary and there will be no change in scheduling, ACC will schedule the course to match your decision of time. The course will be listed in the ACC semester course schedule, however, only the students at your high school will be allowed to enroll in the course.

Teacher Qualifications for ACC credit:

- o **BITC courses:** Any high school Biotechnology teacher can articulate with ACC by attending the articulation meeting, attending the summer training workshop and joining our AC2 Mentor Network. Schools outside of the ACC district can articulate with ACC if your local community college does not offer BITC courses.
- o **BIOL Courses:** Instructors must meet SACS requirements to be hired by ACC as an Adjunct Faculty Member. The teacher will have to meet SACs requirements for teaching a workforce course at ACC and ACC's criteria for adjunct faculty. This criteria means the teacher needs to have 18 graduate hours in a science area, attend the annual safety training, and turn in a portfolio as required.

AC2 can help create a pathway based on your teacher and students. Contact jkeelen@austincc.edu for help in setting up courses and articulations.

Benefits of the Biotechnology Pathway vs. PLTW Biomedical

- Biotechnology I and Biotechnology II are Advanced Science credit for all TEA pathways and endorsement plans. They can be offered as single courses integrated into a Health Science pathway or as sequence courses in a STEM pathway. They can also be offered as a hands-on science lab option course in other endorsement plans.
- Biotechnology courses are CTE funded at 700.00/class with additional consumable support from AC2 Bio-link Regional grant.
- The Biotechnology Pathway offers a Level 1 Entry Certificate and an exam based certification via BACE.
- Coursework and labs were developed in collaboration with local industry, community colleges and College and Career Readiness.
- AC2 offers FREE instructional support in the form of summer workshops, mentoring, and curriculum sharing.
- There are opportunities for dual credit or articulated credit with local community colleges.
- Teachers receive training, support, and mentoring via AC2 bio-link Regional Center Grant.
- Curriculum and labs based on TEKS and National Biotechnology Skill Standards.
- Student may participate in an industry internship.
- Students and teachers are connected to local industry and college programs.
- Students leave the classroom job ready with lab and soft skills.

Building a Biotechnology Program

How to start a program: <http://txbiotech1.weebly.com/how-to-start-a-program.html>

Fall 2020:

- o Review the Biotechnology Program Start Up Manual
- o Determine if you are qualified to teach the course
 - o BITC vs. BIOL
- o Build your campus pathway
 - o Offer Biotechnology 1 to all students to increase enrollment and build courses
 - o Advertise to freshman
- o Determine a marketing strategy for recruitment
- o Gather currently available district resources
- o Research available articulation agreements
- o Join the AC2 Mentor Network for support and monthly meetings <http://txbiotech1.weebly.com>
- o Contact jkeelen@austincc.edu for help!

Spring 2021:

- o Contact and meet with your CTE campus manager to discuss:
 - o Start-up funds
 - o Needs assessments
 - o Articulations
 - o Request Travel funds for teacher summer training
- o Sign up for ACC High School Biotechnology Teacher Training (<http://txbiotech1.weebly.com>)
- o Recruit students for your program
- o Advertise Courses/Student Recruitment/Career Day
- o Make contacts with local industry
- o Contact and meet with your community college articulation team
 - o Discuss support needed
 - o How credit will articulate

Summer 2021:

- o Attend ACC Summer Workshop Training
- o Complete TEA Texas Gateway Course
- o Inventory equipment that has been purchased

Fall 2022:

- o Submit Needs Assessment form to CTE
- o Order consumables

Equipment Start Up

Start-up costs can range from \$1,000-\$40,000 depending on support from your community college, local businesses and your district CTE department.

Equipment Start Up List can be found at <http://txbiotech1.weebly.com/how-to-start-a-program.html>

Current high schools have used one or more of the options below to obtain funding:

1. Submit request to the district CTE department for new program start-up cost of 45K.
2. Accumulate equipment over 3 years from CTE needs assessment request.
3. Borrow equipment from local community college or businesses.
4. Use science department equipment. Many science departments already used biotechnology equipment such as micropipettes, electrophoresis gels and PCR machines.
5. Ask the district science department to check out from the regional center and share between multiple campuses.
6. Apply for grants:

<http://www.bio-rad.com/webroot/web/pdf/corporate/literature/science-teacher-grants-application.pdf>

We can help you identify resources in your district and local community.

Cost for Yearly Consumables

Consumable cost/course/year can be covered CTE allotments (\$700/class)

- BIOL 1414: \$700-\$1000*
- BIOL 1415: \$700-\$1000*
- BITC 1340: None
- Internship: Vary

*Depends on the size of classes

Sample BioRad Consumable Order: <http://tinyurl.com/jng7k99>

Curriculum: Currently under construction and revision.....

There are several curriculum guides depending on how you will offer the class, your student population and resources available. The Biotechnology curriculum complies with the Texas Essential Knowledge and Skills (TEKS) and the Texas Skills Standards Board (TSSB).

Curriculum and power points from the Texas PD can be found here:

https://www.dropbox.com/sh/i7o5r5fv7g7fmkx/AABc0BN7BoKbJ_P_rMPQ38lra?dl=0

Lesson plans developed for TEA CTE:

<https://www.dropbox.com/home/TEA%20Lessons/Biotech%20lessons%202018>

Other Curriculum Resources: <http://txbiotech1.weebly.com/curriculum.html>

AustinISD Pacing Guides:

https://drive.google.com/drive/folders/1qTbPYB12mBeJTOJKvm-7JkJYM_iWRaKS?usp=sharing

Austin Community College Curriculum:

<https://drive.google.com/drive/folders/0B8eqR72dt7ZpWWhueDBnXzZSa3c?usp=sharing>

Ongoing Support

ACC Biotechnology High School Summer Workshop

The free Biotechnology High School Summer Workshop serves the purpose of introducing teachers to online curriculum resources that are available to them and also provides teachers with hands-on biotechnology experience. Some workshop modules will be career-centered and explore skills, knowledge, and career paths appropriate for scientists. Other workshop sessions will focus on curriculum implementation strategies. And lastly, there will be workshop sessions to train teachers to use lab equipment and carry out basic biotechnology lab protocols. Please visit <http://txbiotech1.weebly.com/workshopsmeetings.html> to view previous workshop agendas, dates and location.

Mentor Network

A mentor network is being established through an NSF funded ATE Center in Biotechnology grant. The network currently supports biotechnology teachers across the state of Texas through a monthly webinar. The mentor network, once developed, will partner high school biotechnology teachers with a master high school teacher and a community college faculty member in biotechnology. Please sign up if you are interested in participating and more info will be disseminated as it becomes available. Link to join the mentor network: <http://txbiotech1.weebly.com/become-an-ac2-biotech-member.html>

Contact Us:

Kaci Myrick and Jessica Manchaca, Texas Lead Biotechnology Teachers, currently teach the dual credit Biotechnology pathway in articulation with Austin Community College. Contact Kaci at kaci.myrick@austincc.edu or jessica.manchaca@austincc.edu.

Jennifer Lazare: Jennifer taught the dual credit Biotechnology Pathway for 15 years at an Austin high school and currently serves as the InnovATEBIO Mentor Network Coordinator. Contact Jennifer with any questions at jkeelen@austincc.edu

Linnea Fletcher: Linnea serves as the director for InnovATEBIO, ACC Biotechnology department head and served has participated on numerous state and federal grants in the area of Biotechnology. She started the ACC Biotechnology Program. Contact Linnea with any questions at linneaf@austincc.edu

Master Teachers: These teachers are contacts for different areas of Texas and currently teach Biotech/Biomedical in their local high schools.

Central Texas: Jennifer Lazare jkeelen@austincc.edu
Kaci Myrick kaci.myrick@austinisd.org

East Texas: Jessica Manchaca jessica.menchaca@dvisd.net

West Texas: Guadalupe Tapia gmtapia@episd.org
Arlene Perez aperez7@episd.org

Valley Area: Deborah Overrath deborah.overath@tsc.edu

Resources:

InnovATEBIO, National Biotechnology Education Center: <https://innovatebio.org/>

Texas Biotech Teacher Mentor Network: <http://txbiotech1.weebly.com>

ACC Biotechnology Department: <http://sites.austincc.edu/biotech/>



<https://www.facebook.com/groups/txbiotech/>



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