

This template is to be used only by programs that have received specific written approval from the Provost's office to proceed with internal proposal development and review. The proposal template should be completed in full and submitted to the University Provost's Office [mailto: curriculumplanning@asu.edu]. It must undergo all internal university review and approval steps including those at the unit, college, and university levels. A program **may not** be implemented until the Provost's Office notifies the academic unit that the program may be offered.

College/School/Institute: New College of Interdisciplinary Arts and Sciences
Department/Division/School: Mathematical and Natural Sciences
Proposing Faculty Group (if applicable):
Is this an official joint degree program? No, this is not a joint degree program

If "Yes" List all the additional college(s)/school(s)/institute(s) that will be involved in offering the degree program and providing the necessary resources. Note: All units offering this program must have collaborated in the proposal development and completed the appropriate unit and college/school approvals.

Degree type: BS-Bachelor of Science
 If other; provide degree type title and proposed abbreviation:
Name of degree program (major): Biotechnology & Bioenterprise
Are any concentrations to be established under this degree program? No, concentrations will not be established.
Is a program fee required? No, a program fee is not required.
What is the first catalog year available for students to select on the undergraduate application for this this program? 2017-18
Delivery method: On-campus only (ground courses and/or iCourses)
Note: Once students elect a campus or On-line option, students will not be able to move back and forth between the on-campus and the ASU Online options. Approval from the Office of the University Provost and Philip Regier (Executive Vice Provost and Dean) is required to offer programs through ASU Online.

Campus/Locations: indicate all locations where this program will be offered.

Downtown Phoenix Polytechnic Tempe West Other: _____

Proposal Contact

Name: Todd Sandrin **Title:** Professor and Associate Dean
Phone number: 3-6934 **Email:** Todd.Sandrin@asu.edu

DEAN APPROVAL(S)

**This proposal has been approved by all necessary unit and College/School levels of review.
 I recommend implementation of the proposed organizational change.**

College/School/Division Dean name:

Signature  _____ **Date:** 6/8/2016

College/School/Division Dean name:
(if more than one college involved)

Signature _____ **Date:** / /20

Note: An electronic signature, an email from the dean or dean's designee, or a PDF of the signed signature page is acceptable.

1. Purpose and Nature of Program

Provide a brief program description. Include the distinctive features of the program that make it unique.

The BS in Biotechnology and Bioenterprise will provide students with the requisite interdisciplinary and practical experience in biotechnology research and associated business/entrepreneurship skills to develop and market biotechnological innovations and solutions to problems facing the biotechnology and health sciences communities in the West Valley, the state, nation, and beyond. The program is unique with regard to its focus on blending biotechnology and entrepreneurship. We have worked with other units offering degree programs interfacing technology and entrepreneurship (e.g., the Technology Entrepreneurship and Management Program at the Polytechnic School in the Ira A. Fulton Schools of Engineering as well as the Molecular Biology and Biotechnology program offered by the School of Life Sciences in CLAS; see attached impact statements) to ensure this degree program complements existing degree programs at ASU. This degree program leverages transfer partnerships between ASU's West campus and nearby community colleges with degree programs in biology and biotechnology, particularly Glendale Community College's biotechnology program. The curriculum emphasizes course work in the biological, biomolecular, and biotechnological sciences that underpin biotechnology and affords students the ability to tailor the degree to their specific interests and aspirations through focus areas in biotechnology, bioenterprise, and biostatistics. The curriculum is aligned with needs articulated by both partners that prepare students for this program (e.g., community colleges and high schools) as well as entities that will employ graduates of the program (e.g., local and national biotechnology firms, local startups). This program is especially transfer-friendly for students from nearby community colleges. The program also will dovetail with New College efforts to work with leaders in local government to bring biotech industry/opportunity to the West Valley and the areas immediately surrounding ASU's West campus.

2. Student Learning Outcomes and Assessment Methods

A. Knowledge, competencies, and skills

List the knowledge, competencies, and skills students should have when they graduate from the proposed degree program. You can find examples of program Learning Outcomes at (<https://uoeee.asu.edu/plan-outcomes>).

Graduates will demonstrate knowledge of principles of biotechnology and bioenterprise, which include biotechnological applications of biology, chemistry, cell biology, microbiology as well as fundamentals of entrepreneurship and business innovation.

B. Assessment

Describe the plan and methods to assess whether students have achieved the knowledge, competencies and skills identified in the Learning Outcomes. You can find examples of assessment methods at (<https://uoeee.asu.edu/creating-plan>).

Outcome 1: Students will learn and apply concepts, models, and techniques related to entrepreneurship, creativity and innovation.

Method 1.1

Students' ability to employ and apply key concepts will be assessed by a final exam in TEM 230.

Performance Criterion 1.1

75% of students in TEM 230 (Creativity and Business Innovation) will pass the final exam with scores of 70% or higher.

Outcome 2: Students will appropriately employ key concepts and in core areas of biology, chemistry, cellular biology and microbiology.

Method 2.1

Student's ability to employ and apply key concepts will be assessed by a final exam in BIO 353, MIC 443 and MIC 444.

Performance Criterion 2.1

75% of students in BIO 353 (Cell Biology) will pass the final exam with scores of 70% or higher; 75% of students in MIC 443 (The Microbial Universe) will earn scores of 80% or higher on a cumulative writing assignment in the course in which students synthesize information from ten journal articles in the peer-reviewed literature; and 75% of students in MIC 444 (The Microbial Universe Laboratory) will pass the final exam with scores of 70% or higher.

3. Academic Curriculum and Requirements

A. Major Map.

Attach a copy of the “proposed” major map for this degree program and each concentration(s) to be offered. Instructions on how to create a “proposed major map” in BAMB can be found in the Build a Major Map Training Guide.

B. Summary of credit hours required for this program

Total credit hours must be 120 and include first year composition, general studies, core/required courses, program specific electives, and any additional requirements (e.g., concentration credits).

Requirements	Credit Hours
First Year Composition	6
ASU 101 (or Equivalent)	1
General Studies	35
Core/required courses	46
Program specific electives	15
Additional requirements	17
Other; please explain	
Total	120

C. Core/Required Courses.

- i. Total required and/or core course credit hours:

46

- ii. List the name, prefix, and credit hours for each required/core course for this program

BIO 181: General Biology I (4)
BIO 182: General Biology II (4)
BIO 353: Cell Biology (3) AND BIO 354 Cell Biology Laboratory (1)
CHM 113: General Chemistry I (4)
CHM 116: General Chemistry II (4)
CHM 233: General Organic Chemistry I (3) AND CHM 237: General Organic Chemistry Laboratory I (1)
CHM 234: General Organic Chemistry II (3) AND CHM 238: General Organic Chemistry Laboratory II (1)
LSC 347: Fundamentals of Genetics (3) AND LSC 348 Fundamentals of Genetics Laboratory (1)
LSC 484: Internship (3)
MIC 443: The Microbial Universe (3) AND MIC 444: The Microbial Universe Laboratory (1)
PHY 101: Introduction to Physics (4)
TEM 230: Creativity/Business Innovation (3)

D. Program Specific Electives.

- i. Total required program elective credit hours:

14-17*

Students are required to select one of three areas of focus: Biostatistics, Biotechnology, or Bioentrepreneurship. Each area of focus includes five courses; however, the credits vary.

Biostatistics Focus Area (17 credit hours)
Biotechnology Focus Area (14 credit hours)
Bioentrepreneurship Focus Area (15 credit hours)

- ii. List the name, prefix, and credit hours for any program specific electives for this program:

Biostatistics Focus Area (17 credit hours)
MAT 270: Calculus with Analytic Geometry I (4)
MAT 271: Calculus with Analytic Geometry II (4)
STP 280: Probability and Statistics for Researchers (3)
STP 281: Statistical Analysis for Researchers (3)
STP 310: Design and Analysis of Experiments (3)

Biotechnology Focus Area (14 credit hours)
BCH 371: Modern Concepts in Biochemistry (3) AND BCH 372: Modern Concepts in Biochemistry Laboratory (1)
BIO 443: Applied Molecular Genetics and Genomics (3) AND LSC 447 Molecular Genetics Laboratory (1)
MAT 210: Brief Calculus (3)
STP 226: Elements of Statistics (3)

Bioentrepreneurship Focus Area (15 credit hours)
MAT 210: Brief Calculus (3)
STP 226: Elements of Statistics (3)
TMC 310: Promotion of the Enterprise (3)
TMC 320: Funding the Enterprise (3)
TMC 330 Leading the Enterprise (3)

E. Additional Program Requirements, if any:

List and describe any capstone experiences, milestone, and/or additional requirements.

NONE

F. Concentrations

i. Are any concentrations to be established under this degree program? **No, concentrations will not be established.**

ii. If yes, are concentrations required? No, concentrations will not be required.

iii. List courses & additional requirements for the proposed concentration (s):

Concentration Name	Total credit hours	Core/Required Courses for Concentration (Prefix, # & Title)	Total Core credit hours	Program Specific Electives (include course name and prefix)	Total Elective credit hours	Additional Requirements (i.e. milestones, capstones)

4. New Course Development

A. Will a new course prefix (es) be required for this degree program? No

If yes, list prefix name(s) (i.e. ENG- English)

Note: A request for a New Prefix form must be completed for each new prefix required and submitted with this proposal: http://provost.asu.edu/files/shared/curriculum/Prefix_Request.doc.

B. New Courses Required for Proposed Degree Program.

List all new courses required for this program, including course prefix, number and course description.

No new courses are needed to establish this degree program. Per the attached major map, the degree program includes courses in New College, the Fulton Schools (i.e., TEM courses), and CLAS (MMB courses).

Note: New course requests must be submitted electronically via Curriculum ChangeMaker and undergo all internal university review and approval steps including those at the unit, college, and university levels.

5. Program Need

Explain why the university needs to offer this program (include target audience and market).

The university needs to offer this program to: 1) better meet the needs and professional aspirations of prospective students, particularly transfer students and 2) to leverage ASU resources to catalyze growth in biotechnology in Arizona.

The Director of GCC's biotechnology program has indicated that a transfer-friendly ASU degree program in biotechnology at a nearby campus, such as ASU's West campus would be very attractive to GCC graduates. The degree program described in this proposal was created in close collaboration with GCC and will clearly meet the needs of GCC graduates and those from other community colleges. In addition, Grand Canyon University has recently launched a degree program in the biomolecular sciences (Biochemistry and Molecular Biology BS) that further underscores prospective student interest in degree programs in this discipline in the West Valley.

With regard to catalyzing growth in biotechnology in Arizona, the proposed degree was developed in consultation with BioInspire (<http://bioaccel.org/subsidiary/bioinspire>), which supports bioscience entrepreneurs and start-ups to grow and diversify the region's economy. BioInspire believes the proposed degree program is uniquely sensitive to industry needs and well-positioned to have positive and measurable economic impact on biotechnology in Arizona.

The BLS Occupational Outlook Handbook does not contain data for bioentrepreneurs or biotechnologists per se, but indicates job growth in related fields including biological technicians (5% growth) and biomedical engineering (much faster than average growth, 23%). The target audience and market includes first-time freshman and transfer students from community colleges with interest in biotechnology and the associated, requisite entrepreneurship skills to bring biotechnological innovations and solutions to market.

6. Impact on Other Programs

List other academic units that might be impacted by the proposed program and describe the potential impact (e.g., how the implementation of this program might affect student headcount/enrollment, student recruitment, faculty participation, course content, etc. in other programs). Attach letters of collaboration/support from impacted programs.

College of Liberal Arts & Sciences (CLAS) -- School of Life Sciences (SoLS)

SoLS offers a BS in Molecular Biosciences and Biotechnology (MBB). The proposed degree has been developed in consultation with the Director of SoLS, Bert Jacobs, and Director of the Molecular Biosciences and Biotechnology program, Wim Vermaas. While Molecular Biosciences and Biotechnology and the proposed degree both have focus on biotechnology, impacts on student headcount/enrollment should be minimal (see attached impact statement), in part because of the different focus of the degree programs (the proposed degree focuses more heavily on entrepreneurship) and many students to be served by the proposed degree program are not likely to be able to travel to the Tempe campus to participate in the Molecular Biosciences and Biotechnology program. The Molecular Biosciences and Biotechnology program may be positively

impacted by future inclusion of MBB courses as options for students enrolled in the proposed degree program (the biotechnology focus area, in particular).

Fulton Schools of Engineering - the Polytechnic School

As with the College of Liberal Arts and Sciences, the proposed degree has been developed in close consultation and collaboration with the Fulton Schools of Engineering, particularly the Technology, Entrepreneurship and Management (TEM) program. As with Molecular Biosciences and Biotechnology, minimal impacts of the proposed degree are anticipated (see attached impact statement). The proposed degree program focuses exclusively on biotechnology (rather than the broader technology focus of the Technology, Entrepreneurship and Management program), and many students to be served by the proposed degree program are not likely to be able to travel from the West Valley to the Polytechnic campus to participate in the Technology, Entrepreneurship and Management program. The Technology, Entrepreneurship and Management program will be positively impacted in that TEM courses will be available as iCourses for West campus students enrolled in the proposed degree program.

7. Projected Enrollment

How many new students do you anticipate enrolling in this program each year for the next five years?

5-YEAR PROJECTED ANNUAL ENROLLMENT					
	1st Year	2nd Year (Yr 1 continuing + new entering)	3rd Year (Yr 1 & 2 continuing + new entering)	4th Year (Yrs 1, 2, 3 continuing + new entering)	5th Year (Yrs 1, 2, 3, 4 continuing + new entering)
Number of Students Majoring (Headcount)	15	30	45	60	70

8. Accreditation or Licensing Requirements

If applicable, provide the names of the external agencies for accreditation, professional licensing, etc. that guide your curriculum for this program, if any. Describe any requirements for accreditation or licensing.

NA

9. Faculty & Staff**A. Current faculty**

List the name, rank, highest degree, area of specialization/expertise and estimate of the level of involvement of all current faculties who will teach in the program.

New College Faculty

Jennifer Broatch, Assistant Professor, Ph.D., Biostatistics; teaches courses in Statistics focus area

Thomas Cahill, Associate Professor, Ph.D., Chemistry; teaches introductory chemistry courses

Lara Ferry, Professor, Ph.D., Biology; teaches introductory biology courses

Jennifer Hackney Price, Assistant Professor, Ph.D., Cell Biology; teaches introductory biology and cell biology courses

Peter Jurutka, Associate Professor, Ph.D., Molecular Biology; teaches biochemistry and appl. molec. genetics courses

Pamela Marshall, Associate Professor, Ph.D., Genetics; teaches genetics courses

Todd Sandrin, Professor, Ph.D., Microbiology; teaches microbiology course required for degree

Carl Wagner, Associate Professor, Ph.D., Synthetic Organic Chemistry; teaches organic chemistry courses

TEM Faculty

Aram Chomina-Chavez, Lecturer, MBA, real-world, real-time industry practices including: crowdfunding, beta development, capital structure, guerrilla marketing, international business, experiences in hiring/firing, and negotiations.

Steven Cho, Lecturer, Ph.D., Entrepreneurship, strategic marketing, product development, design for quality, operations and leadership

Carolyn Hirata, Lecturer & Program Chair, M.Tech, Management, leadership development, team building

Chad Kennedy, Lecturer, Ph.D., Technology and Engineering-based entrepreneurship

B. New Faculty:

Describe the new faculty hiring needed during the next three years to sustain the program. List the anticipated hiring schedule and financial sources for supporting the addition of these faculty members.

No new faculty are required to establish and sustain the program.

C. Administration of the program.

Explain how the program will be administered for the purposes of admissions, advising, course offerings, etc. Discuss the available staff support.

The program will be administered through existing ASU admissions and ASU New College advising. In particular, New College advising affiliated with the School of Mathematical and Natural Sciences will be primarily responsible for advising students in this degree program.

10. Resources (necessary to launch and sustain the program)**A. Required resources:**

Describe any new resources required for this program's success, such as new support staff, new facilities, new library resources, new technology resources, etc.

No new support staff, facilities, library resources, or technology resources are required to launch and sustain this degree program.

B. Resource acquisition:

Explain how the resources to support this program will be obtained.

Most of the financial resources for supporting this program will come from reallocation of New College funds. Other funds will come from increased tuition revenue from new students who will be attracted to this degree and will not need to go to another institution to pursue a BS in Biotechnology and Bioenterprise.

APPENDIX
OPERATIONAL INFORMATION FOR UNDERGRADUATE PROGRAMS
(This information is used to populate the Degree Search/catalog website.)**1. Program Name (Major):** Biotechnology and Bioenterprise**2. Program Description** (150 words maximum)

The School of Mathematical and Natural Sciences offers a BS degree in biotechnology and bioenterprise in the New College of Interdisciplinary Arts and Sciences at the West campus of Arizona State University.

This program provides students with essential transdisciplinary and practical experience in biotechnology research. Students will acquire the associated business and entrepreneurship skills needed to develop and market biotechnological innovations and solutions to problems facing the biotechnology and health sciences communities in Arizona, the nation and beyond. The program emphasizes course work in the biological, biomolecular and biotechnological sciences, which are key components that underpin biotechnology. Students will be able to tailor the degree to their specific interests and aspirations through focus areas in biotechnology, bioenterprise and biostatistics. The program is unique due to its focus on blending biotechnology and entrepreneurship.

3. Contact and Support Information

Building Name, code and room number: (<i>Search ASU map</i>)	FAB N100
Program office telephone number: (<i>i.e. 480/965-2100</i>)	602/543-6050
Program Email Address:	mnsadvising@asu.edu
Program Website Address:	https://newcollege.asu.edu/college-degree-programs/undergraduate

4. Delivery/Campus Information Delivery: On-campus only (ground courses and/or iCourses)

Note: Once students elect a campus or On-line option, students will not be able to move back and forth between the on-campus and the ASU Online options. Approval from the Office of the University Provost and Philip Regier (Executive Vice Provost and Dean) is required to offer programs through ASU Online.

5. Campus/Locations: indicate all locations where this program will be offered.

Downtown Phoenix Polytechnic Tempe West Other:

6. Additional Program Description Information

- A. Additional program fee required for this program? No
- B. Does this program have a second language requirement? No

7. Career Opportunities & Concentrations

Provide a brief description of career opportunities available for this degree program. If program will have concentrations, provide a brief description for each concentration. (150 words maximum)

Graduates of this program will be prepared for careers such as:

- bioentrepreneur
- cell biologist
- clinical trials manager
- educator
- laboratory researcher
- microbiologist
- portfolio manager
- patent agent
- project manager
- regulatory affairs manager

8. Additional Admission Requirements

If applicable list any admission requirements (freshman and/or transfer) that are higher than and/or in addition to the university minimum undergraduate admission requirements.)

None

9. Keywords

List all keywords used to search for this program. Keywords should be specific to the proposed program.

biotechnology, entrepreneur, entrepreneurship, biomedical, bioscience, biopharmaceutical, regulatory affairs

10. Advising Committee Code

List the existing advising committee code to be associated with this degree. UGNC02

Note: If a new advising committee needs to be created, please complete the following form:
[Proposal to create an undergraduate advising committee](#)

11. First Required Math Course

List the first math course required in the major map. Varies depending on Focus Area. Students in Biostatistics Focus Area complete MAT 270 in Term 1. Students in Biotechnology or Bioentrepreneurship Focus Area complete MAT 210 in Term 1.

12. WUE Eligible:

Has a request been submitted to the Provost by the Dean to consider this degree program as eligible for WUE? Yes

Note: No action will be taken during the implementation process with regards to WUE until approval is received from the Provost.

13. Math Intensity:

- List the highest math course required on the major map. (This will not appear on Degree Search.) Depends on the Area of Focus. Students in Biotechnology Focus area and Bioentrepreneurship will take STP 226. Students in Biostatistics Focus Area will take MAT 271 and STP 310.
- What is the math intensity as indicated by the highest math required on the major map? Math intensity categorization can be found here: <https://catalog.asu.edu/mathintensity> Substantial

14. CIP codes

Identify CIP codes that should be displayed on Degree Search. CIP codes can be found at: <http://www.onetonline.org/crosswalk/CIP/>.

41.0101	.....	26.0210
51.0719	.....	26.1104
52.0210	.....	26.1199
26.0502	.....	26.9999
26.0204	.....	51.2011

Are any specific career codes (SOC/ONET codes) to be omitted from the CIP codes selected above?
(i.e. "Omit 25-10312.00 Engineering Teachers, Postsecondary from CIP code 14.0501 Bioengineering and Biomedical Engineering.")

Omit 11-9199.07 and
11-9199.04 from CIP
52.0210

15. Area(s) of Interest

A. Select **one (1)** primary area of interest from the list below that applies to this program.

- | | |
|------------------------------------------------------|--------------------------------------------------------------------|
| <input type="checkbox"/> Architecture & Construction | <input type="checkbox"/> Health & Wellness |
| <input type="checkbox"/> Arts | <input type="checkbox"/> Humanities |
| <input type="checkbox"/> Business | <input type="checkbox"/> Interdisciplinary Studies |
| <input type="checkbox"/> Communications & Media | <input type="checkbox"/> Law, Justice & Public Service |
| <input type="checkbox"/> Computing & Mathematics | <input checked="" type="checkbox"/> STEM |
| <input type="checkbox"/> Education & Teaching | <input type="checkbox"/> Science |
| <input type="checkbox"/> Engineering & Technology | <input type="checkbox"/> Social and Behavioral Sciences |
| <input type="checkbox"/> Entrepreneurship | <input type="checkbox"/> Sustainability |
| <input type="checkbox"/> Exploratory | |

B. Select **one (1)** secondary area of interest from the list below that applies to this program.

- | | |
|------------------------------------------------------|--------------------------------------------------------------------|
| <input type="checkbox"/> Architecture & Construction | <input type="checkbox"/> Health & Wellness |
| <input type="checkbox"/> Arts | <input type="checkbox"/> Humanities |
| <input type="checkbox"/> Business | <input type="checkbox"/> Interdisciplinary Studies |
| <input type="checkbox"/> Communications & Media | <input type="checkbox"/> Law, Justice & Public Service |
| <input type="checkbox"/> Computing & Mathematics | <input type="checkbox"/> STEM |
| <input type="checkbox"/> Education & Teaching | <input type="checkbox"/> Science |
| <input type="checkbox"/> Engineering & Technology | <input type="checkbox"/> Social and Behavioral Sciences |
| <input checked="" type="checkbox"/> Entrepreneurship | <input type="checkbox"/> Sustainability |
| <input type="checkbox"/> Exploratory | |

The following fields are to be completed by the Office of the University Provost.

CIP Code: _____

Plan Code:



2016 - 2017 Major Map

Biotechnology & Bioenterprise, (Proposed)

NKHJMNU


Hide Course List(s)/Track Group(s)


Term 1	0 - 15 Credit Hours	Critical course signified by	Hours	Minimum Grade	Notes
	BIO 181: General Biology I (SQ) OR BIO 182: General Biology II (SG)		4	C	<ul style="list-style-type: none"> An SAT, ACT, Accuplacer, IELTS, or TOEFL score determines placement in first-year composition courses. ASU Mathematics Placement Test score determines placement in mathematics course. ASU 101 or college-specific equivalent First-Year Seminar required of all freshman students. NEW 101 satisfies this requirement. IAS 300 (3 credit hours) is required for all transfer students in place of NEW 101. Focus Area Course: Biostatistics Focus Area complete MAT 270; Biotechnology or Bioentrepreneurship Focus Area complete MAT 210. General Electives credit hours will be adjusted depending on focus area chosen. Discuss with your advisor.
	MAT 210: Brief Calculus (MA) OR MAT 270: Calculus with Analytic Geometry I (MA)		3-4	C	
	CHM 113: General Chemistry I (SQ)		4	C	
	ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107 or ENG 108: First-Year Composition		3	C	
	NEW 101: The ASU New College Experience		1		
	Term hours subtotal:		15-16		



Term 2	16 - 30 Credit Hours	Critical course signified by	Hours	Minimum Grade	Notes
	BIO 181: General Biology I (SQ) OR BIO 182: General Biology II (SG)		4	C	<ul style="list-style-type: none"> Focus Area Course: Biostatistics Focus Area complete MAT 271; Biotechnology or Bioentrepreneurship Focus Area complete STP 226.
	MAT 271: Calculus with Analytic Geometry II (MA) OR STP 226: Elements of Statistics (CS)		3	C	
	CHM 116: General Chemistry II (SQ)		4	C	
	ENG 101 or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107 or ENG 108: First-Year Composition		3	C	
	Elective		1		
	Complete ENG 101 OR ENG 105 OR ENG 107 course(s).				
	Complete Mathematics (MA) requirement.				
	Term hours subtotal:		15		



Term 3	31 - 44 Credit Hours	Critical course signified by	Hours	Minimum Grade	Notes
	CHM 233: General Organic Chemistry I AND CHM 237: General Organic Chemistry Laboratory I		4	C	
	PHY 101: Introduction to Physics (SQ)		4	C	
	Cultural Diversity in the U.S. (C)		3		
	Literacy and Critical Inquiry (L)		3		
	Complete CHM 113 AND CHM 116 course(s).				
	Complete First-Year Composition requirement.				


Term hours subtotal: 14

Term 4	45 - 60 Credit Hours	Critical course signified by	Hours	Minimum Grade	Notes
	CHM 234: General Organic Chemistry II AND CHM 238: General Organic Chemistry Laboratory II		4	C	<ul style="list-style-type: none"> Focus Area Course: Biostatistics Focus Area complete STP 280; Biotechnology Focus Area complete BIO 443 AND LSC 347; Bioentrepreneurship Focus Area complete TMC 310.
	TEM 230: Creativity and Business Innovation		3	C	
	Historical Awareness (H)		3		
	Humanities, Arts and Design (HU)		3		
	Social-Behavioral Sciences (SB)		3		
	Term hours subtotal:		16		

Term 5	61 - 74 Credit Hours	Necessary course signified by	Hours	Minimum Grade	Notes
	BIO 353: Cell Biology AND BIO 354: Cell Biology Laboratory		4	C	<ul style="list-style-type: none"> IAS 300 (3 credit hours) is required for all transfer students.
	LSC 347: Fundamentals of Genetics AND LSC 348: Fundamentals of Genetics Laboratory		4	C	
	Humanities, Arts and Design (HU)		3		
	Upper Division Literacy and Critical Inquiry (L) OR IAS 300: Adult Career Development (L or SB)		3		
	Term hours subtotal:		14		

Term 6	75 - 89 Credit Hours	Necessary course signified by	Hours	Minimum Grade	Notes
	BCH 371: Modern Concepts in Biochemistry AND BCH 372: Modern Concepts in Biochemistry Laboratory OR STP 281: Statistical Analysis for Researchers OR TMC 330: Leading the Enterprise		3-4	C	<ul style="list-style-type: none"> Focus Area Course: Biostatistics Focus Area complete STP 281; Biotechnology Focus Area complete BCH 371 AND BCH 372; Bioentrepreneurship Focus Area complete TMC 330.
	BIO 443: Applied Molecular Genetics and Genomics AND LSC 447: Molecular Genetics Laboratory OR STP 280: Probability and Statistics for Researchers (CS) OR TMC 310: Promotion of the Enterprise		3	C	
	Social-Behavioral Sciences (SB) AND Global Awareness (G)		3		
	Complete 2 courses: Upper Division Elective		6		
	Term hours subtotal:		15-16		

Term 7	90 - 105 Credit Hours	Necessary course signified by	Hours	Minimum Grade	Notes
	MIC 443: The Microbial Universe AND MIC 444: The Microbial Universe Laboratory		4	C	<ul style="list-style-type: none"> Focus Area Course: Biostatistics Focus Area complete STP 310; Biotechnology General Elective; Bioentrepreneurship Focus Area complete TMC 320. General Electives credit hours will be adjusted depending on focus area chosen. Discuss with your advisor.
	STP 310: Design and Analysis of Experiments OR TMC 320: Funding the Enterprise OR Biotechnology Focus Area Elective		3	C	
	Upper Division Humanities, Arts and Design (HU) OR Upper Division Social-Behavioral Sciences (SB)		3		
	Complete 2 courses: Upper Division Elective		6		
	Term hours subtotal:		16		

Term 8	106 - 120 Credit Hours	Necessary course signified by	Hours	Minimum Grade	Notes
	LSC 484: Internship		3		<p>Upper Division Language and Cultures: Requirement satisfied through the following: * Completion of six semester hours of upper-division courses that have a Global Awareness (G) or Cultural Diversity (C) designation, in addition to the courses used to meet the University General Studies requirements or four (4) sequential semesters of one foreign language or two (2) semesters of a current computer language. Adjustment to upper division hours is required if lower division courses are used.</p>
			6	C	

Complete 2 courses:
Upper Division Elective

6

Term hours subtotal: 15

Biotechnology Focus Area	Bioentrepreneurship Focus Area	Biostatistics Focus Area
MAT 210: Brief Calculus (MA)	MAT 210: Brief Calculus (MA)	MAT 270: Calculus with Analytic Geometry I (MA)
STP 226: Elements of Statistics (CS)	STP 226: Elements of Statistics (CS)	MAT 271: Calculus with Analytic Geometry II (MA)
BIO 443: Applied Molecular Genetics and Genomics AND LSC 447: Molecular Genetics Laboratory	TMC 310: Promotion of the Enterprise	STP 280: Probability and Statistics for Researchers (CS)
BCH 371: Modern Concepts in Biochemistry AND BCH 372: Modern Concepts in Biochemistry Laboratory	TMC 320: Funding the Enterprise	STP 281: Statistical Analysis for Researchers
	TMC 330: Leading the Enterprise	STP 310: Design and Analysis of Experiments

[Hide Course List\(s\)/Track Group\(s\)](#)

Total Hours: 120

Upper Division Hours: 45 minimum

Major GPA: 2.00 minimum

Cumulative GPA: 2.00 minimum

Total hrs at ASU: 30 minimum

Hrs Resident Credit for

Academic Recognition: 56 minimum

Total Community College Hrs: 64 maximum

Total College Residency Hrs: 12 minimum

General University Requirements Legend

General Studies Core Requirements:

- Literacy and Critical Inquiry (L)
- Mathematical Studies (MA)
- Computer/Statistics/Quantitative Applications (CS)
- Humanities, Arts and Design (HU)
- Social-Behavioral Sciences (SB)
- Natural Science - Quantitative (SQ)
- Natural Science - General (SG)

General Studies Awareness Requirements:

- Cultural Diversity in the U.S. (C)
- Global Awareness (G)
- Historical Awareness (H)

First-Year Composition

General Studies designations listed on the major map are current for the 2016 - 2017 academic year.



MEMO

Date: July 26, 2016

To: Marlene Tromp
Dean, New College of Interdisciplinary Arts and Sciences

From: Todd Sandrin
Associate Dean, New College of Interdisciplinary Arts and Sciences
Faculty, School of Mathematical and Natural Sciences

On behalf of the School of Mathematical and Natural Sciences, I am submitting our proposal to establish a BS in Biotechnology and Bioenterprise.

The proposal has received faculty approval through appropriate governance procedures in the School of Mathematical and Natural Sciences as well as relevant academic units throughout the university.

I have reviewed the proposal and verified that the proposal is complete and all supplemental materials are included.

Attachments: Proposal to Establish Undergraduate Program, Impact Statement from College of Letters and Sciences, Impact Statement from the Fulton School of Engineering, Draft Major Map.

NEW COLLEGE OF INTERDISCIPLINARY ARTS & SCIENCES

MAILING ADDRESS: PO BOX 37100, PHOENIX, AZ 85069-7100

STREET/SHIPPING ADDRESS: 4701 W. THUNDERBIRD ROAD, GLENDALE, AZ 85306-4908

(602) 543-6000 FAX: (602) 543-6004

Tosha Ruggles

From: Duane Roen
Sent: Friday, April 29, 2016 1:15 PM
To: Todd Sandrin
Cc: Tosha Ruggles; Peter Jurutka
Subject: RE: Biotechnology & Bioenterprise BS

Todd,

The degree plan looks great. The College of Letters and Sciences is happy to support it.

Best,
Duane

Duane Roen
Vice Provost, Polytechnic campus
Dean, College of Letters and Sciences
Dean, University College
Arizona State University
480-727-6513
duane.roen@asu.edu

From: Todd Sandrin
Sent: Friday, April 29, 2016 12:08 PM
To: Duane Roen
Cc: Tosha Ruggles; Peter Jurutka
Subject: Biotechnology & Bioenterprise BS

Dear Duane,

As you may be aware, New College is developing a degree in Biotechnology & Bioenterprise. I append below a brief description of this degree that we envision serving particularly well transfer students in the West Valley. We have engaged the Polytechnic School of IAFSE and SoLS in the development of this degree, and we believe it is wonderfully complementary to offerings in CLS. In addition, we believe the degree will serve the currently unmet needs of placebound ASU students with interests in this field.

In addition, I attach draft documents (proposal and course checksheet) that provide additional detail.

Might you be so kind as to provide an impact statement? I'm happy to converse with you further about this program, and don't hesitate to let me know if I can help in any way.

Thanks, Duane!

Todd

Todd R. Sandrin, Ph.D.

Professor – School of Mathematical and Natural Sciences

Associate Dean – New College | *Director* - NCUIRE

New College | **Arizona State University**

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The BS Biotechnology & Bioenterprise will provide students with the requisite interdisciplinary and practical experience in biotechnology research and associated business/entrepreneurship skills to develop and market biotechnological innovations and solutions to problems facing the biotechnology and health sciences communities in the West Valley, the state, nation, and beyond. The program is unique with regard to its focus on blending biotechnology and entrepreneurship. We have worked with other units offering degree programs interfacing technology and entrepreneurship (e.g., the Technology Entrepreneurship and Management Program at the Polytechnic School in the Ira A. Fulton Schools of Engineering as well as the Molecular Biology and Biotechnology program offered by the School of Life Sciences in CLAS; see attached impact statements) to ensure this degree program complements existing degree programs at ASU. In addition, this degree program leverages from transfer partnerships between ASU West and nearby community colleges with degree programs in biology and biotechnology, particularly Glendale Community College's biotechnology program. The curriculum emphasizes coursework in the biological, biomolecular, and biotechnological sciences that underpin biotechnology and affords student the ability to tailor the degree to their specific interests and aspirations through focus areas in biotechnology, bioenterprise, and biostatistics. The curriculum is aligned with needs articulated by both partners that prepare students for this program (e.g., community colleges and high schools) as well as entities that will employ graduates of the program (e.g., local and national biotechnology firms, local startups). This program is especially transfer-friendly for students from nearby community colleges. The program also will dovetail with New College efforts to work with leaders in local government to bring biotech industry/opportunity to the West Valley and the areas immediately surrounding the West Campus.

Stacey Kimbell

From: Tosha Ruggles
Sent: Monday, June 06, 2016 8:32 AM
To: Stacey Kimbell
Subject: FW: Biotechnology & Bioenterprise BS

Tosha Ruggles, Ed.D.

Assistant Director, Academic Services
New College of Interdisciplinary Arts and Sciences
Arizona State University, West Campus
Tosha.Ruggles@asu.edu
[\(602\) 543-6357](tel:(602)543-6357)
[New College of Interdisciplinary Arts and Sciences Graduate Admissions](#)
[FAQs about your graduate application](#)

From: Todd Sandrin
Sent: Friday, May 06, 2016 3:59 PM
To: Tosha Ruggles <tosha.ruggles@asu.edu>
Cc: Peter Jurutka <Peter.Jurutka@asu.edu>
Subject: FW: Biotechnology & Bioenterprise BS

So, I think we now have all of the impact statements we requested.

Todd

From: Michael Angilletta
Sent: Friday, May 06, 2016 3:46 PM
To: Todd Sandrin <Todd.Sandrin@asu.edu>
Cc: Bertram Jacobs <bjacobs@asu.edu>; Scot Schoenborn <Scot.Schoenborn@asu.edu>
Subject: RE: Biotechnology & Bioenterprise BS

Dear Todd,

The proposed degrees were reviewed by members of our faculty in the MBB program and by our advising staff. The Biotechnology track, as laid out in the proposal, is similar to our MBB degree, but does not require the 6 hours of research/internship and requires fewer MBB-related labs. SOLS does not think that the proposed degrees will compete too strongly with MBB on the Tempe campus. That said, SOLS would oppose online courses that duplicate required courses in our MBB major. Obviously, we are concerned that such courses would draw students from Tempe and reduce enrollment in our face-to-face courses.

Thanks in advance for this consideration when developing your new program.

Best regards,
Mike

Michael J. Angilletta Jr.

Professor & Senior Sustainability Scholar
Associate Director of Undergraduate Programs

School of Life Sciences
Arizona State University
Tempe, AZ 85287

From: Todd Sandrin

Sent: Wednesday, April 20, 2016 2:45 PM

To: Bertram Jacobs <bjacobs@asu.edu>

Cc: Marilyn Jones <Marilyn.Jones@asu.edu>; Willem Vermaas <wim@asu.edu>; Michael Angilletta <Michael.Angilletta@asu.edu>; Peter Jurutka <Peter.Jurutka@asu.edu>; Tosha Ruggles <tosha.ruggles@asu.edu>

Subject: Biotechnology & Bioenterprise BS

Dear Bert,

Thanks so much for finding time to converse with me this morning regarding development of our Biotechnology & Bioenterprise BS degree program. I look forward to working with you and your colleagues to develop and steward this degree program.

Per our conversation, I understand that:

- Relevant MBB courses that can be offered in a mode (hybrid, quite possibly) accessible to ASU West students can be added in the future as course options in the Biotechnology focus area.
- We will establish a steering committee that meets regularly to ensure the degree program is: a) well-coordinated across ASU, b) meeting student needs, c) meeting the needs of the market, and d) transfer-friendly. Members on this committee would likely include representatives of SoLS, New College, MCCCDC, and an industry partner(s) in biotech. Already, we have a curriculum development committee with representatives from MCCCDC, an industry partner (BioInspire), and New College. We look forward to welcoming to the steering committee a member of your faculty.
- We will continue to converse regularly and engage the steering committee to eliminate unnecessary duplication/redundancies among this program and others across ASU while we ensure that students across the Phoenix metropolitan area have broad access to this degree program.

I attach a draft course checklist and degree proposal. I welcome your feedback on these documents.

Might you reply to this email to provide the required **impact statement** we need to move forward with development of this degree?

Thanks!
Todd

Todd R. Sandrin, Ph.D.

Professor – School of Mathematical and Natural Sciences

Associate Dean – New College | Director - NCUIRE

New College | Arizona State University

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Tosha Ruggles

From: Carolyn Hirata
Sent: Friday, April 29, 2016 10:46 AM
To: Todd Sandrin; Chad Kennedy; Carolyn Hirata
Cc: Peter Jurutka; Tosha Ruggles; Ann McKenna; James Collofello
Subject: RE: proposed Biotechnology & Bioenterprise BS degree

Hi Todd,

This email is to provide your program with an impact statement from the Technological Entrepreneurship and Management (TEM) Program. We are excited about the BS Biotechnology & Bioenterprise degree in the School of Mathematical and Natural Sciences at west campus and appreciate the opportunity to partner with class offerings and new class developments.

We will offer our TEM 230 *Creativity and Business Innovation* as part of your major map and TMC 310 *Promotion of the Enterprise* (with an emphasis on entrepreneurship marketing), TMC 320 *Funding the Enterprise* (with an emphasis on entrepreneurial financing), and TMC 330 *Leading the Enterprise* (with an emphasis on human capital and its influence on organizational success) as part of the focus areas for this degree.

The TEM faculty is happy to support the degree and will, at the appropriate time, discuss with you development of new entrepreneurship courses that may complement biotechnology research and associated entrepreneurship skills. We do not see this degree as having any adverse, but rather a positive, impact on the BS Technological Entrepreneurship and Management (TEM) Program. We look forward to further collaboration with you.

Best,
Carolyn

Carolyn Hirata, MST
Program Chair, Technological Entrepreneurship & Management
Honors Faculty, Barrett, The Honors College
Fulton Schools of Engineering
ASU at Poly Campus
Ofc: 480.727.1625
carolyn.hirata@asu.edu

From: Todd Sandrin
Sent: Wednesday, April 20, 2016 2:49 PM
To: Carolyn Hirata; Chad Kennedy
Cc: Peter Jurutka; Tosha Ruggles
Subject: proposed Biotechnology & Bioenterprise BS degree

Hi Chad and Carolyn,

Thanks so much for finding time to converse yesterday. I attach to this email the documents we discussed. I welcome your feedback on these.

Might you reply to this email (copying your relevant colleagues in the Polytechnic School and/or IAFSE that you mentioned yesterday) to provide the required **impact statement** we need to move forward with development of this degree?

Thanks so much!

Todd

Todd R. Sandrin, Ph.D.

Professor – School of Mathematical and Natural Sciences

Associate Dean – New College | *Director* - NCUIRE

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