



March 12, 2018

Centers for Medicare & Medicaid Services
Department of Health and Human Services
Attention: CMS-3326-NC
Mail Stop C4-26-05
7500 Security Boulevard
Baltimore, MD 21244-1850

By electronic submission to <http://www.regulations.gov>.

RE: **CMS-3326-NC** – Revisions to Personnel Regulations and other Regulations under the Clinical Laboratory Improvement Amendments of 1988 (CLIA)

Dear Administrator:

American Medical Technologists (AMT) appreciates the opportunity to respond to CMS's January 9, 2018, Request for Information (RFI) concerning prospective revisions to personnel requirements and other regulations under the Clinical Laboratory Improvement Amendments of 1988 (CLIA).

AMT is a leading certification organization and professional society for clinical laboratory professionals and other allied health personnel. Established in 1939 and headquartered in Rosemont, Illinois, AMT has over 80,500 active member-certificants, including approximately 12,000 Medical Technologists (MTs) and Medical Laboratory Technicians (MLTs), as well as around 6,700 registered phlebotomy technicians and clinical laboratory assistants. AMT's certification programs are fully accredited by the National Commission for Certifying Agencies (NCCA), the accrediting arm of the Institute for Credentialing Excellence.

AMT applauds CMS's initiative to review the existing CLIA regulations, particularly as they relate to personnel standards. With minor exception, the CLIA personnel rules have not undergone revision since they were initially adopted in 1992. With major changes having taken place in both clinical laboratory technology and the laboratory workforce, the time is ripe for CMS to review in depth the current CLIA personnel standards.

As a personnel certification body, AMT will focus its comments and recommendations on those subjects with which we are most involved. Accordingly, the following comments address only a select subset of the inquiries posed by CMS in its January 9, 2018 RFI.

A. Clarifications of degree(s)

1. Bachelor's Degree in Nursing. A bachelor's degree in nursing (B.S.N.) is not equivalent to a bachelor's in biological science and should not, by itself, be treated as qualifying a nurse to perform or supervise high complexity testing. Nurses are indispensable members of the healthcare delivery team, but their nursing education covers a broad range of medical disciplines at a general level, and provides neither the didactic nor the clinical training to perform highly complex diagnostic testing. Nursing degree programs lack both the scope and depth of coursework in biological and other natural sciences that are required for a baccalaureate degree in biology. Nor do nursing programs include *any* clinical training in diagnostic laboratory testing.

For comparison purposes, AMT has attached two "Major Maps" outlining recommended and required courses for bachelor's degree programs at Arizona State University (ASU) in (1) biological science and (2) nursing. The nursing program requires *no* upper division science coursework (courses numbered 300-499), whereas the biological science program requires at least 22 credit-hours of upper division sciences, including genetics, advanced biochemistry, and cell biology among others, in addition to lower division biology and chemistry courses.

Ironically, the CLIA standards for high-complexity testing personnel who hold an *associate's* degree (or equivalent) require a greater concentration of coursework in biology, chemistry, and/or medical laboratory technology (24 credit-hours; *see* 42 C.F.R. § 493.1489(b)(2)) than is typically required for a four-year B.S.N. degree (16 credit-hours; *see* attached Major Map for ASU's B.S.N. degree). Additionally, individuals qualifying via an associate's degree must have completed either an accredited clinical laboratory training program or have at least three months' documented laboratory training in each specialty in which the individual performs high complexity testing (42 C.F.R. § 1498(b)(2)(ii)(B)).

Allowing personnel with a nursing degree to perform high-complexity testing might be justified if the CLIA regulations additionally required didactic and clinical training in laboratory science, but they do not. As the rules stand now, the degree is all that is needed to perform even the most complex diagnostic testing procedures.

AMT accordingly urges CMS to rescind the policy announced in Memorandum S&C-16-18-CLIA with respect to bachelor's degrees in nursing. Particularly in view of the rapid advances that have occurred in diagnostic technologies, including molecular and genetic testing, accepting nursing degrees, without more, threatens the quality of highly complex testing as well as patient safety.

If CMS nevertheless determines that nursing degrees will continue to be treated as a degree in a biological science, at a minimum the agency should superimpose a

requirement that the nursing graduate have additional training and experience in clinical diagnostic testing. Before a nursing graduate is qualified to perform high-complexity testing, he/she should be required to complete an accredited laboratory training program or other approved, documented laboratory training, such as is required by certification organizations (including AMT and the ASCP Board of Certification) to qualify B.S. graduates in majors other than medical technology or laboratory science.¹

2. Physical Sciences and Non-traditional Degrees. The current CLIA rules provide that an individual may perform high complexity testing if he/she possesses a bachelor's degree (or higher) in "a chemical, physical, biological" science. No additional training or experience in laboratory technology is required for those holding such a degree. CMS has asked for input on what should be considered a physical science degree for CLIA purposes, and under what circumstances other non-traditional degrees should be deemed to qualify for high-complexity testing.

AMT concurs with CMS's concern that certain degrees falling within the ambit of physical sciences, such as astronomy, physics, and earth sciences, do not include in their curricula coursework related to clinical laboratory technology. The same is true for numerous alternative and non-traditional degree programs. AMT believes, however, that the title of a degree should not be determinative of whether it qualifies under the CLIA personnel rules. Rather, the content of the curriculum should govern whether the degree sufficiently prepares the graduate to perform clinical diagnostic testing.

For high complexity testing, the CLIA rules should require that any degree in a physical science or an alternative degree program must include at least 35 semester-hours in biological science, chemistry and mathematics, which is consistent with the eligibility criteria for MT(AMT) and MLS(ASCP) certification for individuals in programs other than medical laboratory science. If CMS does not adopt the 35-semester-hour requirement, it should, at a bare minimum, require the minimum distribution of coursework in biology, chemistry, and/or laboratory technology that is required under § 1498(b)(2)(ii) for individuals qualifying via an associate's degree equivalency route –

¹ To be certified at the MT(AMT) level under AMT's "Alternate Education" route, an individual must, in addition to holding a baccalaureate degree from an accredited college or university, have completed at least 35 semester hours of coursework across various subjects related to the clinical laboratory sciences, such as biological science, microbiology, organic chemistry, biochemistry, mathematics, etc., *and* must either (1) have completed an accredited medical technology training program after earning the baccalaureate degree, or (2) have completed a minimum of one year of approved clinical laboratory experience including rotation through Blood Banking, Microbiology, Chemistry and Hematology sections of the laboratory.

i.e., either (1) 24 semester hours of medical laboratory technology courses; or (2) 24 semester hours of science courses that include: (i) Six semester hours of chemistry; (ii) Six semester hours of biology; and (iii) Twelve semester hours of chemistry, biology, or medical laboratory technology in any combination. There is no justification for requiring a lesser amount of didactic education in the laboratory sciences in a baccalaureate program than the agency requires for an associate's degree.

Further, and just as importantly, CMS should amend section 483.1489(b) to require that any personnel qualifying by virtue of a degree in a chemical, physical, or biological science – or via an alternative/non-traditional degree program – must have additional training and/or experience in clinical laboratory technology. For those whose experience is obtained in other than an accredited clinical laboratory training program, a minimum of one year's full-time (or equivalent) experience should be required. Additionally, any work experience should be required to include rotation through each section of the laboratory in which the individual will perform diagnostic testing (Blood Banking, Microbiology, Chemistry, Hematology, etc.).

B. Other Requirements for CLIA Personnel Categories

1. Competency Assessments by General Supervisors. AMT strongly believes that personnel who qualify as general supervisors under the rules for high complexity testing should be allowed to perform competency assessment for testing personnel performing moderate complexity testing in laboratories that perform both moderate and high complexity testing.

AMT applauds CMS for pointing out the anomaly that under current regulations, because there is no general supervisor category for moderate complexity testing, only those qualifying as technical consultants (with at least a bachelor's degree) may perform competency assessments on moderate complexity testing personnel. This stands in contrast to the regulatory scheme for high complexity testing, under which general supervisors (who may qualify with an associate's degree plus experience under § 493.1461(c)(2)) are able to perform competency assessments on personnel performing high complexity testing. As a result, in labs that perform both high and moderate complexity procedures, a B.S.N. (RN) can perform competency assessments on moderate complexity personnel, whereas an MLT (with an associate's degree but infinitely more clinical lab training than a typical RN) cannot. The anomaly makes no sense and should be rectified through an amendment of the rules.

2. Primary Source Verification of Qualifications through Private-Sector Certifications – In Memorandum S&C-16-18-CLIA, CMS announced a policy that laboratories regulated under CLIA may henceforth use third-party Primary Source Verification (PSV) companies to confirm that the asserted training, degrees and

credentialing have been achieved or conferred on the various categories of laboratory personnel. This policy was welcomed by AMT and the laboratory community as a whole. However, the Memorandum went on to reaffirm CMS's longstanding position that private sector certifications of generalist laboratory personnel – such as MT(AMT), MLT(AMT), MLS(ASCP) and MLT(ASCP) – may *not* be used by surveyors to verify the required education and training of lab personnel. AMT strongly urges CMS to reverse this position and accept voluntary certifications at the MT/MLS and MLT level as an alternative route to qualifying high- and moderate-complexity testing personnel.

Each of the major national certifying organizations for clinical laboratory personnel, including AMT and the ASCP-BOC, have qualification standards for generalist personnel at the technologist and technician levels that equal or exceed the minimum qualifications under CLIA for high and moderate complexity testing. These certifying organizations conduct their own thorough primary source verification of education and training received by each certification candidate, in addition to administering a competency-based examination. Each certifying organization also requires periodic demonstration of continued competence to retain current certification. In short, documentation of current certification at the MT/MLS or MLT level provides assurance that an individual at least meets and likely exceeds the minimum CLIA testing personnel standards, and further demonstrates the employee's commitment to remaining current in his or her profession. There is no sound reason for CMS to reject current certification as less reliable than a copy of a degree or transcript to document compliance with CLIA's personnel requirements.

In June 1995, AMT filed a rulemaking petition with the Department of Health and Human Services (HHS) requesting that HHS initiate a process to recognize established private-sector certifications of generalist laboratory personnel as an alternative route to meet the qualifications for testing personnel in clinical laboratories performing high and moderate complexity testing. AMT's petition was formally endorsed in correspondence to HHS by several leading associations for clinical laboratory personnel: the American Association for Clinical Chemistry (AACC), the American Society for Clinical Laboratory Science (ASCLS), and the National Certification Agency for Medical Laboratory Personnel (NCA). (NCA has since been merged into the ASCP-BOC). Although HHS acknowledged the petition and said it would be considered as the agency finalized the CLIA regulations, it never formally acted upon the petition.

The factors that supported AMT's 1995 rulemaking petition apply with even greater force today. Since that time the leading certifying organizations for generalist lab personnel (AMT and ASCP-BOC) have implemented mandatory continuing competency requirements with which its certificants must comply in order to maintain current certification. It also bears emphasis that every state that requires licensure of clinical lab personnel relies heavily on passage of a professional, private-sector certification exam to qualify for a license. CMS nevertheless has declined thus far to accept professional

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certifications of generalist personnel as indicia of CLIA qualifications, even though Memorandum S&C-16-18-CLIA states that possessing a license in a state that requires licensure shall be deemed conclusive evidence that the individual meets the CLIA standards. The agency's reasoning in this regard is incongruous and difficult to reconcile.

AMT therefore again urges CMS to amend its regulations to accept current, voluntary private-sector certifications at the MT/MLS and MLT levels as an alternate route to documenting qualifications for moderate- and high-complexity testing personnel. Those certifications provide at least the same of assurance as other third-party PSV services that the certified individual meets the pertinent CLIA education and training requirements. Allowing surveyors to use documentation of current certifications would be a major assist to the surveyors and to the personnel whose qualifications are being verified.

In closing, AMT appreciates the opportunity to provide input on prospective revisions to the CLIA regulations, particularly as they relate to personnel qualifications. We have opted not to comment at this time on other topics raised in the RFI (proficiency testing referrals; histocompatibility; CLIA fees, etc.) that are more on the periphery of AMT's mission and expertise.

Sincerely,



Christopher A. Damon
Executive Director

Attachments

ATTACHMENTS

**Illustrative Comparison of “Major Maps” at
Arizona State University
for
B.S. Degree in Nursing
and
B.S. Degree in Biological Science**








2018 - 2019 Major Map Nursing - Traditional BSN (BSN)

Degree: BSN

College/School: College of Nursing and Health Innovation

Location: Downtown Phoenix campus, ASU@TheGilaValley

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

Term 1	0 - 14 Credit Hours Critical course signified by 	Hours	Minimum Grade	Notes
	CHM 101: Introductory Chemistry (SQ) OR BIO 201: Human Anatomy and Physiology I (SG)	4	C	<ul style="list-style-type: none"> • An SAT, ACT, Accuplacer, IELTS, or TOEFL score determines placement into first-year composition courses • Mathematics Placement Assessment score determines placement in mathematics course • ASU 101 or college-specific equivalent First-Year Seminar required of all freshmen students. • In order to advance into the Traditional Prelicensure Clinical Nursing Program, you must meet all of the Continuing Eligibility Criteria each semester (see bottom of major map for more details). • Select your career interest area and play me3@ASU. • Create a first draft resume. • Explore Study Abroad options.
	ENG 101: First-Year Composition or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107: First-Year Composition or ENG 108: First-Year Composition	3	C	
	MAT 142: College Mathematics (MA)	3	C	
	Humanities, Arts and Design (HU) OR Social-Behavioral Sciences (SB)	3	C	
	ASU 101-NU: The ASU Experience	1		
	Minimum 3.50 GPA ASU Cumulative.			
	Term hours subtotal:	14		
Term 2	14 - 30 Credit Hours Critical course signified by 	Hours	Minimum Grade	Notes

❗ CDE 232: Human Development (SB) OR PSY 101: Introduction to Psychology (SB)	3	C
❗ CHM 101: Introductory Chemistry (SQ) OR BIO 201: Human Anatomy and Physiology I (SG)	4	C
❗ ENG 101: First-Year Composition or ENG 102: First-Year Composition OR ENG 105: Advanced First-Year Composition OR ENG 107: First-Year Composition or ENG 108: First-Year Composition	3	C
❗ HCR 210: Ethics for the Health Care Professional (HU) OR HCR 220: Introduction to Health Professions and the U.S. Health Care System (H) OR HCR 230: Culture and Health (C & G)	3	C
❗ Approved Statistics Course AND Computer/Statistics/Quantitative Applications (CS)	3	C
❗ Minimum 3.50 GPA ASU Cumulative.		
Complete ENG 101 OR ENG 105 OR ENG 107 course(s).		
Term hours subtotal:		16

- In order to advance into the Traditional Prelicensure Clinical Nursing Program, you must meet all of the Continuing Eligibility Criteria each semester (see bottom of major map for more details).
- Network in your career interest area.
- Join a student club or professional organization.
- Secure a part-time job or volunteer experience.
- Explore options for summer employment.
- Apply for summer Study Abroad.

Term 3 30 - 44 Credit Hours Critical course signified by ❗





	Hours	Minimum Grade
❗ BIO 202: Human Anatomy and Physiology II (SG)	4	C
❗ CDE 232: Human Development (SB) OR PSY 101: Introduction to Psychology (SB)	3	C
❗ HCR 210: Ethics for the Health Care Professional (HU) OR HCR 220: Introduction to Health Professions and the U.S. Health Care System (H) OR HCR 230: Culture and Health (C & G)	3	C
❗ MIC 205: Microbiology (SG) AND MIC 206: Microbiology Laboratory (SG)	4	C
❗ Minimum 3.50 GPA ASU Cumulative.		
Complete Mathematics (MA) requirement.		
Term hours subtotal:		14

- In order to advance into the Traditional Prelicensure Clinical Nursing Program, you must meet all of the Continuing Eligibility Criteria each semester (see bottom of major map for more details).
- Develop your skills.
- View the Traditional Prelicensure Clinical Nursing Program Advancement Workshop.

Term 4 44 - 57 Credit Hours Critical course signified by ❗







	Hours	Minimum Grade
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	HCR 210: Ethics for the Health Care Professional (HU) OR HCR 220: Introduction to Health Professions and the U.S. Health Care System (H) OR HCR 230: Culture and Health (C & G)	3	C
	HCR 240: Human Pathophysiology	4	C
	NTR 241: Human Nutrition	3	C
	Elective	3	
	Minimum 3.50 GPA ASU Cumulative.		
Milestone: Completion of all non-coursework Nursing requirements (e.g. immunizations/titers, fingerprint clearance card, background check, CPR/BLS certification, etc.) for continuation into the Traditional Prelicensure Clinical Nursing Program.			
Term hours subtotal:		13	

- In order to advance into the Traditional Prelicensure Clinical Nursing Program, you must meet all of the Continuing Eligibility Criteria each semester (see bottom of major map for more details).
- Submit your Clinical Nursing Advancement Application by February 1 for summer/fall start or September 1 for spring start.

Term 5 57 - 73 Credit Hours Necessary course signified by 

	Hours	Minimum Grade	Notes	
	NUR 311: Pharmacology in Nursing	3	C	• Develop your professional online presence.
	NUR 325: Health and Illness Concepts I	3	C	
	NUR 330: Professional Nurse Attributes (HU)	3	C	
	NUR 336: Experiential Learning	3	C	
	NUR 346: Nursing Practice: Adults and Elders	1	Y	
	NUR 352: Fundamental Concepts in Nursing	3	C	
Term hours subtotal:		16		

Term 6 73 - 89 Credit Hours Necessary course signified by 

	Hours	Minimum Grade	Notes
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★	NUR 315: Nursing Research and Application to Practice (L)	3	C
★	NUR 326: Health and Illness Concepts: Adults and Psychiatric/Mental Health	4	C
★	NUR 337: Experiential Learning: Intermediate	2	C
★	NUR 347: Nursing Practice: Childbearing Family	1	Y
★	NUR 348: Intermediate Nursing Practice: Adults	2	Y
★	NUR 349: Nursing Practice: Psychiatric Mental Health--Preicensure BSN	1	Y
★	NUR 353: Integration of Concepts Across the Lifespan: Conception to End of Life	3	C
★	Complete Cultural Diversity in the U.S. (C) AND Global Awareness (G) AND Historical Awareness (H) course(s).		
Term hours subtotal:		16	

- Use Handshake to research employment opportunities.
- Complete an in person or virtual practice interview.

Term 7 89 - 105 Credit Hours Necessary course signified by ★

		Hours	Minimum Grade
★	NUR 404: Professional Nurse Concepts: Intermediate	2	C
★	NUR 425: Health and Illness Concepts: Adults and Pediatrics	4	C
★	NUR 436: Experiential Learning: Advanced	3	C
★	NUR 446: Complex Nursing Practice: Adults	1	Y
★	NUR 447: Nursing Practice: Pediatrics	1	Y
★	NUR 452: Concepts in Population-Based Health	3	C
★	NUR 458: Interprofessional Education and Collaboration Seminar	2	C
Term hours subtotal:		16	

- Gather professional and academic references.
- Explore graduate programs.

Term 8 105 - 120 Credit Hours Necessary course signified by ★

		Hours	Minimum Grade
★	NUR 405: Professional Nurse Concepts: Advanced	3	C
★	NUR 437: Experiential Learning: Readiness to Practice	3	C
★	NUR 448: Nursing Practice Readiness	3	Y
★	NUR 453: Integration Concepts in the Health Care (L)	3	C
★	NUR 459: Interprofessional Education and Collaboration Seminar: Advanced	3	C
Term hours subtotal:		15	

- Study for the National Council Licensure Examination (NCLEX).
- Connect with us as a member of our alumni community.

- In order to advance into the Traditional Prelicensure Clinical Nursing Program, you must meet all of the Continuing Eligibility Criteria each semester. Student Services will review all criteria each semester.

The Continuing Eligibility Criteria are as follows:

- Full time (12 or more credits per semester) and continuous enrollment in accordance with Major Map
- Maintain On Track status for terms 1-4
- 3.50 minimum semester ASU GPA in terms 1-4 (includes +/- in computation)
- Complete remaining 4 or fewer prerequisites in the 4th term
- Successful completion of all screening items
- Grades of C or better in critical (prerequisite) courses

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

Approved Statistics (CS) Courses

EDP 454: Statistical Data Analysis in Education (CS)

PAF 301: Applied Statistics (CS)

SBS 304: Social Statistics I (CS)

SOC 390: Social Statistics I (CS)

STP 226: Elements of Statistics (CS)

STP 231: Statistics for Life Science (CS)

SWU 321: Statistics for Social Workers (CS)

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

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 2018 - 2019 academic year.

2018 - 2019 Major Map







Biological Sciences (Biomedical Sciences) (BS)




Degree: BS

College/School: College of Liberal Arts and Sciences

Location: Tempe campus


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

Term 1	0 - 15 Credit Hours Critical course signified by 	Hours	Minimum Grade	Notes
	LIA 101: Student Success in the College of Liberal Arts and Sciences	1		<ul style="list-style-type: none"> Mathematics Placement Assessment score determines placement in mathematics and science courses LIA 101 or other First-Year Seminar is required of all freshman students An SAT, ACT, Accuplacer, IELTS, or TOEFL score determines placement into first-year composition courses Select your career interest area and play me3@ASU.
	BIO 281: Conceptual Approaches to Biology for Majors I (SQ)	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	
	STP 231: Statistics for Life Science (CS)	3	C	
	Term hours subtotal:	15		
Term 2	15 - 32 Credit Hours Critical course signified by 	Hours	Minimum Grade	Notes
	BIO 282: Conceptual Approaches to Biology for Majors II	4	C	<ul style="list-style-type: none"> Join a student organization Create a resume & Handshake account with the Career & Professional Development Center Explore research opportunities
	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	
	MAT 251: Calculus for Life Sciences (MA)	3	C	
	Social-Behavioral Sciences (SB) AND Global Awareness (G)	3		
	 Complete BIO 281 AND BIO 282 course(s).			
	 Complete ENG 101 OR ENG 105 OR ENG 107 course(s).			
	Term hours subtotal:	17		
Term 3	32 - 46 Credit Hours Critical course signified by 	Hours	Minimum Grade	Notes

 BIO 340: General Genetics OR MBB 347: Molecular Genetics: From Genes to Proteins	4	C
CHM 231: Elementary Organic Chemistry (SQ) AND CHM 235: Elementary Organic Chemistry Laboratory (SQ)	4	C
CLAS Science and Society Elective	3	C
Humanities, Arts and Design (HU) AND Historical Awareness (H)	3	
 Complete First-Year Composition requirement.		
 Complete Mathematics (MA) requirement.		
Term hours subtotal:	14	




- Pre-health students should take CHM 233 and CHM 237 instead of CHM 231 and CHM 235. See pre-health website for more information.
- If CHM 233 and 237 are taken, then CHM 234 and 238 must be taken the following semester
- Explore extracurriculars (i.e. service learning, community service, internships, research, student involvement, shadowing, etc.)
- Attend a Study Abroad 101 Session

Term 4 46 - 61 Credit Hours Critical course signified by 

	Hours	Minimum Grade
 BIO 345: Organic Evolution	3	C
Literacy and Critical Inquiry (L)	3	
Social-Behavioral Sciences (SB) AND Cultural Diversity in the U.S. (C)	3	
<i>Complete 2 courses:</i> Elective	6	
Term hours subtotal:	15	

- Pre-health students should take CHM 234 and CHM 238 instead of the elective in this term. See pre-health website for more information.
- If CHM 233 and 237 are taken, then CHM 234 and 238 must be taken the following semester
- Explore or pursue internship opportunities
- Meet with the Career & Professional Development Center to learn how to develop skills

Term 5 61 - 75 Credit Hours Necessary course signified by 

	Hours	Minimum Grade
 BCH 361: Advanced Principles of Biochemistry AND BCH 367: Elementary Biochemistry Laboratory	4	C
 BIO 353: Cell Biology	3	C
 BIO 360: Animal Physiology	3	C
PHY 101: Introduction to Physics (SQ)	4	C
Term hours subtotal:	14	

- Pre-health students should take PHY 111 and PHY 113 instead of PHY 101 in this term. See pre-health website for more information.
- Meet with your advisor to discuss ways to maximize your remaining time at ASU

Term 6 75 - 90 Credit Hours Necessary course signified by 

	Hours	Minimum Grade
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★ BIO 351: Developmental Biology OR BIO 420: Immunology: Molecular and Cellular Foundations OR BIO 440: Functional Genomics OR BIO 462: Endocrine Physiology OR BIO 467: Neurobiology	3	C
BIO 312: Bioethics (HU)	3	C
Humanities, Arts and Design (HU)	3	
Upper Division Elective	4	
Elective	2	
★ Complete Cultural Diversity in the U.S. (C) AND Global Awareness (G) AND Historical Awareness (H) course(s).		
Term hours subtotal:	15	

- Pre-health students should take PHY 112 and PHY 114 instead of an elective in this term. See pre-health website for more information.
- BIO 312 may be used to satisfy an upper division Science and Society credit for the College of Liberal Arts and Sciences provided it is not being used to satisfy an HU credit for general studies.
- Some upper division Medicine in Society and Biomedical Research Courses require prerequisites, which may be taken as electives.
- Research employment opportunities or graduate school programs

Term 7 90 - 106 Credit Hours Necessary course signified by ★

	Hours	Minimum Grade
★ Upper Division Biomedical Research Course OR Upper Division Medicine in Society Course	4-2	C
Upper Division CLAS Science and Society Elective	3	C
Upper Division Literacy and Critical Inquiry (L)	3	
Elective OR BIO 484: Internship OR MIC 484: Internship OR MBB 484: Internship	3	
Elective	3	
Term hours subtotal:	16-14	

- Courses from the Medicine in Society and Biomedical Research groups must include at least one course from each group and at least one lab course.
- Some upper division Medicine in Society and Biomedical Research Courses require prerequisites, which may be taken as electives.
- Explore or apply for full-time career opportunities or graduate school
- Meet with your advisor to verify remaining degree requirements have been met

Term 8 106 - 120 Credit Hours Necessary course signified by ★

Hours **Minimum Grade** **Notes**

★	BIO 351: Developmental Biology OR BIO 420: Immunology: Molecular and Cellular Foundations OR BIO 440: Functional Genomics OR BIO 462: Endocrine Physiology OR BIO 467: Neurobiology	3	C
★	Upper Division Biomedical Research Course OR Upper Division Medicine in Society Course	2-4	C
	Upper Division Elective	3	
	<i>Complete 2 courses:</i> Elective	6	
Term hours subtotal:		14-16	

- Courses from the Medicine in Society and Biomedical Research groups must include at least one course from each group and at least one lab course.
- Continue to apply for full-time career opportunities or graduate school

- Some upper division Medicine in Society Courses require lower division prerequisites, which may be taken as electives. See list of Suggested Electives provided.

All students pursuing a B.S. or B.S.P. degree in the College of Liberal Arts and Sciences must complete two courses from the Science and Society list found at <https://clas.asu.edu/advising-and-academic-services/science-and-society>. At least one of the two courses must be upper division. Students must earn a C or better in the courses, and no more than one of the two can also be used to simultaneously fill a requirement of the major, minor or related area. Science and Society courses cannot also be used to fill the general studies HU, SB, SQ or SG requirements.

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

Medicine in Society	Biomedical Research	Suggested Electives
ASB 301: Global History of Health (SB & G & H)	BIO 342: General Genetics Laboratory	ASB 100: Introduction to Global Health (SB & G) or SSH 100: Introduction to Global Health (SB & G)
ASB 355: Traditional Medicine and Healing (HU or SB)	BIO 343: Genetic Engineering and Society (L)	ASB 102: Introduction to Cultural Anthropology (SB & G)
ASB 443: Cross-Cultural Studies in Global Health ((L or SB) & G)	BIO 352: Laboratory in Vertebrate Developmental Anatomy	ASB 222: Buried Cities and Lost Tribes ((HU or SB) & G & H)
ASB 452: Community Partnerships for Global Health (SB)	BIO 355: Introduction to Computational Molecular Biology (CS)	ASB 223: Aztecs, Incas and Mayas ((HU or SB) & G & H)
ASM 345: Disease and Human Evolution	BIO 361: Animal Physiology Laboratory	ASM 104: Bones, Stones, and Human Evolution (SB or SG)
BIO 302: Cancer--Mother of All Diseases (L)	BIO 415: Biometry (CS)	BIO 331: Animal Behavior
BIO 311: Biology and Society	BIO 435: Research Techniques in Animal Behavior	BIO 455: Introduction to Comparative Genomics or BMI 465: Introduction to Comparative Genomics
HPS 331: History of Medicine (HU & H)	BIO 450: Advanced Developmental Biology	HST 101: Global History Since 1500 (HU & H & G)
SSH 401: Health and Human Biology	BIO 451: Cell Biotechnology: Cell Culture, Immunocytochemistry and Bioimaging	MBB 445: Techniques in Molecular Biology/Genetics or MIC 445: Techniques in Molecular Biology/Genetics
SSH 404: Medical Anthropology: Culture and Health (SB & C)	BIO 455: Introduction to Comparative Genomics	MIC 420: Immunology: Molecular and Cellular Foundations
	MBB 446: Techniques in Molecular Biology/Genetics Lab or MIC 446: Techniques in Molecular Biology/Genetics Lab	
	MIC 421: Experimental Immunology	
	MIC 425: Advanced Immunology	

Notes:

- Please keep in mind that the applicability of a specific transfer course toward an ASU degree program depends on the requirements of the department, division, college or school in which you are enrolled at ASU. Transfer agreements that guarantee the completion of university level requirements do not necessarily meet college and major requirements. Please consult with an advisor for more information.

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 2018 - 2019 academic year.