

recommended or suggested for students interested in a legal career. Pre-law students should take the Law School Admission Test during the summer before or the fall term/semester of their senior year. For further advice, students should consult early in their freshman or sophomore year at UNT with Dr. Kimi King, the pre-law advisor, in Wooten Hall, Room 148. E-mail: prelaw@unt.edu.

Department of Biological Sciences

Main Departmental Office
Biological Sciences Building, Room 210
P.O. Box 305220
Denton, TX 76203-5220
940-565-2011

Web site: www.biol.unt.edu

Undergraduate Advising Office
Biological Sciences Building, Room 127
940-565-3627
Fax: 940-565-3821

Art Goven, Chair

Faculty

Professors Atkinson, Beitingger, Burggren, Chapman, Dickson, Dickstein, Fitzpatrick, Fuchs, Goven, Gross, Jagadeeswaran, Kennedy, Kunz, La Point, O'Donovan, Pirtle, Waller, Zimmerman. *Associate Professors* Benjamin, Hunt von Herbing, Root, Schwark, Shah, Sinclair, Smith, Tam, Venables. *Assistant Professors* Ayre, Dzialowski, Huggett, Hughes, Padilla, Roberts, Stevens, Thompson. *Lecturer* Burseson.

Introduction

Modern biology encompasses the study of all aspects of living systems from the molecular basis of genetic inheritance to the interactions between organisms and the environment. The mission of the Department of Biological Sciences is to provide quality education leading to bachelor's, master's and doctoral degrees in biology, environmental biology, biochemistry and allied health sciences. A vital component of that mission is scholarly activity, and faculty in the department conduct relevant basic and applied research and provide professional expertise and service to local, state and national constituencies. Central to our mission is quality teaching,

and faculty engage in instructional development to enhance their abilities to train professionals who will have the most up-to-date skills and professional ethics for meeting the demands of a technological society. Our success is measured by the success of our students and the quality of our intellectual contributions to the improvement of society.

Preprofessional Programs

See "Preprofessional Programs" in the College of Arts and Sciences section of this catalog.

Programs of Study

The department offers undergraduate and graduate programs in the following areas:

- Bachelor of Arts with majors in biology and biochemistry;
- Bachelor of Science with a major in cytotechnology;
- Bachelor of Science in Biology;
- Bachelor of Science in Biochemistry;
- Bachelor of Science in Medical Technology;
- Master of Arts,
- Master of Science, and
- Doctor of Philosophy, all with a major in biology;
- Master of Science, and
- Doctor of Philosophy, both with a major in biochemistry;
- Master of Science, and
- Doctor of Philosophy, both with a major in environmental science; and
- Master of Arts,
- Master of Science, and
- Doctor of Philosophy, all with a major in molecular biology.

Concentrations under the biology major at the master's and doctoral level are available in ecology, microbiology and plant science.

Recommended four-year undergraduate courses of study are listed in this catalog. Additional copies are available in the Undergraduate Advising Office, Room 127 of the Biological Sciences Building.

Students seeking teacher certification in secondary education should consult with advisors in both the College of Education and the Department of Biological Sciences. A 2.75 cumulative grade point average is required in the teaching field to enter the certification program. The use of the term "advanced" as applied to courses means any upper-division (3000- or 4000-level) course.

Admission to Majors in Biology and Biochemistry

Entering students interested in majoring in biology or biochemistry will be classified as pre-majors

and will be advised by the department. Admission to the university does not guarantee admission to the major. To be admitted to the major (and be eligible to enroll in advanced biology and biochemistry courses), a pre-major must meet all the requirements listed below.

Admission to Biology Major

Complete at least 30 hours of college courses and:

- complete BIOL 1710/1730 or 1711/1733, 1720/1740 or 1722/1744, and two selections from BIOL 2041/2042 or 2140 or 2241, each with a grade of C or better;
- complete CHEM 1410/1430 or 1412/1430 or 1413/1430, 1420/1440 or 1422/1440 or 1423/1440, 2370/3210, each with a grade of C or better;
- complete MATH 1650 or the placement equivalent;
- have at least a 2.5 GPA on the required biology, chemistry and mathematics courses listed above; and
- have a minimum 2.0 UNT grade point average.

Admission to Biochemistry Major

Complete at least 30 hours of college courses and:

- complete BIOL 1710/1730 or 1711/1733, 1720/1740 or 1722/1744 or 2041/2042, each with a grade of C or better;
- complete CHEM 1410/1430 or 1412/1430 or 1413/1430, 1420/1440 or 1422/1440 or 1423/1440, 2370/3210, each with a grade of C or better;
- complete MATH 1650 or the placement equivalent;
- have at least a 2.5 GPA on the required biology, chemistry and mathematics courses listed above; and
- have a minimum 2.0 UNT grade point average.

Bachelor of Arts

Major in Biology Degree Requirements

1. **Hours Required and General/College Requirements:** A minimum of 120 semester hours, of which 42 must be advanced, and fulfillment of degree requirements for the Bachelor of Arts degree as specified in the "General University Requirements" in the Academics section of this catalog and the College of Arts and Sciences requirements.

2. **Major Requirements:** BIOL 1710/1730 or 1711/1733; 1720/1740 or 1722/1744; two selections from 2041/2042 or 2140 or 2241; 3451/3452, 3510/3520, and one physiology course with laboratory chosen from 3800/3810, 4501/4502, 4503/4504, or 4505/4506; plus 7 additional advanced hours

for which each course used must be a minimum of 3 hours. BIOL 3350, 3360, 3500, 4050, 4160, 4170, 4180, 4190, 4800, 4900/4910, 4920 and 4940/4950 may not be applied to the biology requirements for the BA.

3. **Other Course Requirements:** ENGL 2700 (replaces ENGL 1320 in university core); PHYS 1410/1430 or 1510/1530, 1420/1440 or 1520/1540; MATH 1710 (1650 prerequisite) or equivalent.

4. **Chemistry Requirements:** The completion of these requirements will satisfy the requirements for a minor in chemistry. A minimum of 20 hours, including CHEM 1410/1430 or 1412/1430 or 1413/1430; 1420/1440 or 1422/1440 or 1423/1440; 2370/3210; 2380/3220 or equivalent; plus 4 advanced hours chosen from CHEM 3451/3452, CHEM 3530 or BIOC 3621/3622. Premedical and pre-dental students are advised to substitute both BIOC 4540 and 4550 for BIOC 3621/3622.

5. **Electives:** See four-year plan.

6. **Other Requirements:** A minimum 2.5 grade point average must be maintained on all advanced courses in the division of sciences.

BA with a Major in Biology

The following four-year plan is one example of a variety of ways in which you can complete your chosen degree in four years, and will serve as guide for you to design your pathway to degree completion. Variations will depend on whether you need to take prerequisites or have college credit from exams or dual enrollment.

The College of Arts and Sciences expects you to have completed the State recommended high school program and be ready to enroll for Language 2040 or a mathematics course above college algebra. If you are not prepared for this level, the necessary prerequisites will either replace electives or increase the hours required for the degree.

FRESHMAN YEAR

FALL	HOURS
BIOL 1710/1730, Principles of Biology I and Laboratory, or BIOL 1711/1733, Honors Principles of Biology I and Laboratory (may be used to satisfy a portion of the Natural Sciences requirement)**	4
CHEM 1410/1430, General Chemistry I and Laboratory, or CHEM 1412/1430, General Chemistry for the Honors College and Laboratory, or CHEM 1413/1430, Honors General Chemistry I and Laboratory**	4
ENGL 1310, College Writing, or ENGL 1313, Computer Assisted College Writing I*	3
MATH 1710, Calculus I**	4
Total	15

SPRING		HOURS	SENIOR YEAR	
BIOL 1720/1740, Principles of Biology II and Laboratory, or BIOL 1722/1744, Honors Principles of Biology II and Laboratory (may be used to satisfy a portion of the Natural Sciences requirement)**		4	FALL	HOURS
CHEM 1420/1440, General Chemistry II and Laboratory, or CHEM 1422/1440, General Chemistry II for the Honors College and Laboratory, or CHEM 1423/1440, Honors General Chemistry II and Laboratory		4	BIOL Elective (advanced, see major requirements)	3
ENGL 2700, Technical Writing*		3	CHEM (advanced, see major requirements)	4
Social and Behavioral Sciences*		3	Elective (advanced)	3
Total		14	Elective (advanced)	3
			Elective (advanced)	3
			Elective (advanced)	3
			Elective (advanced)	3
			Elective (advanced)	3
			Total	16
			SPRING	HOURS
			BIOL Elective (advanced, see major requirements)	4
			Elective (advanced)	3
			Elective (advanced)	3
			Elective (advanced)	3
			Elective (advanced)	3
			Total	16
SOPHOMORE YEAR				
FALL	HOURS			
BIOL (2000 level, see requirements)	3–4			
CHEM 2370/3210, Organic Chemistry and Laboratory	4			
LANG 2040, Foreign Language (intermediate, may be used to satisfy a portion of the Understanding the Human Community requirement)**	3			
PSCI 1040, American Government*	3			
Elective	1			
Total	14–15			
SPRING	HOURS			
BIOL (2000 level, see requirements)	3–4			
CHEM 2380/3220, Organic Chemistry and Laboratory	4			
LANG 2050, Foreign Language (intermediate, may be used to satisfy a portion of the Understanding the Human Community requirement)**	3			
PSCI 1050, American Government*	3			
Humanities*	3			
Total	16–17			
JUNIOR YEAR				
FALL	HOURS			
BIOL 3451/3452, Genetics and Laboratory	4			
BIOL 3510/3520, Cell Biology and Laboratory	4			
HIST 2610, United States History to 1865*	3			
PHYS 1410/1430, General Physics I and Laboratory, or PHYS 1510/1530, General Physics I with Calculus and Laboratory	4			
Total	15			
SPRING	HOURS			
HIST 2620, United States History Since 1865*	3			
PHYS 1420/1440, General Physics II and Laboratory, or PHYS 1520/1540, General Physics II with Calculus and Laboratory	4			
BIOL, Physiology and Laboratory requirement	4			
Visual and Performing Arts*	3			
Total	14			

*See the University Core Curriculum section of this catalog for approved list of course options.
 **See Arts and Sciences degree requirements section of this catalog for approved list of course options.

Actual degree audits may vary depending on availability of courses in a given semester.

Some courses may require prerequisites not listed. Students may wish to use opportunities for electives to complete a minor of their choice or secondary education courses for teacher certification.

Bachelor of Science in Biology

Degree Requirements

1. Hours Required and General/College Requirements: A minimum of 120 semester hours, of which 42 must be advanced, and fulfillment of degree requirements for the Bachelor's degree as specified in the "General University Requirements" in the Academics section of this catalog and the College of Arts and Sciences requirements.

Foreign Language Requirement Options: Students may complete either of two options to satisfy the College of Arts and Sciences foreign language requirement:

Option I: Must attain intermediate II level (2050) in a foreign language or pass appropriate proficiency exam(s) as specified by the College of Arts and Sciences.

Option II: Complete three courses from the approved groups listed below (a minimum of 9 hours). A student who wishes to fulfill the foreign language requirement by Option II must first be counseled by an undergraduate advisor of the Department of Biological Sciences and must obtain written approval of Option II for inclusion in the student's degree audit. Students must choose one

course from each group listed below for a total of 9 hours. All courses must be a minimum of 3 hours. Special Problems 4900-4910 and Cooperative Education 4920 are excluded.

Group I: ENGL 4180.

Group II: One biology course at the 3000 level or higher or one additional course from Group III. If a biology course is used, it must be a course that counts for the major.

Group III: Select one course from the following: biochemistry or chemistry courses at the 3000 level or higher if they are not used to complete the major requirement for advanced chemistry; computer science courses for computer science majors that are above the CSCE 1020 level; ENGL 4190, 4250; GEOG 4400, 4500, 4520, 4550, 4560; MATH 1680 or other math course above the level of MATH 1710; PHIL 3250; PSYC 4640; physics courses for physics majors at the 3000 level or higher.

All courses must be appropriate for majors within the department that offers them. Normal limitations for undergraduate enrollment in graduate classes will still apply.

2. Major Requirements: A major of 42 hours in the biological sciences, of which 28 must be advanced. Required courses: BIOL 1710/1730 or 1711/1733, 1720/1740 or 1722/1744; two selections from BIOL 2041/2042 or 2140 or 2241; BIOL 3451/3452, 3510/3520; and one physiology course with laboratory chosen from BIOL 3800/3810, 4501/4502, 4503/4504, or 4505/4506; plus 16 advanced hours (excluding BIOL 3350/3360, 3500, and 4050) of which 2 courses must be with laboratory.

By selecting upper-division biology courses from a subdiscipline, it is possible for the BS student to establish, unofficially, an area of study in general biology, ecology, microbiology, animal physiology/neuroscience, cell and molecular biology/genetics, or the plant sciences in consultation with the undergraduate advisor. The subdisciplines of general biology, microbiology, plant sciences, ecology and neuroscience have been defined with the courses listed below. Please consult with the undergraduate advising secretary in Room 127 of the Biological Sciences Building for further information.

- **Ecology.** 16 advanced hours selected from the following: BIOL 3000, 3150, 3160, 3170, 4000, 4051/4052, 4070, 4091/4092, 4100, 4260, 4280, 4380, 4400, 4420, 4440, 4560, 4570/4580, 4650 and 4720.
- **General Biology.** 16 advanced hours selected from the following: BIOL 3000, 3050, 3331, 3381/3382, 4070, 4091/4092, 4110, 4201/4202, 4250, 4260, 4300, 4420, 4460, 4480, 4501/4502, 4505/4506, 4530/4540, 4570/4580 and 4750/4760.

- **Microbiology.** 16 advanced hours selected from the following: BIOL 3381/3382, 4091/4092, 4160 or 4180, 4201/4202, 4260, 4501/4502, 4530/4540, 4570/4580 and 4770.
 - **Neuroscience.** 16 advanced hours selected from the following: BIOL 4110, 4220, 4250, 4300, 4570/4580 and 4750/4760.
 - **Plant Sciences.** 16 advanced hours selected from the following: BIOL 3160, 3170, 4000, 4051/4052, 4070, 4130, 4250, 4260, 4280, 4400, 4503/4504 and 4570/4580.
3. **Other Course Requirements:** ENGL 2700 (replaces ENGL 1320 in university core); PHYS 1410/1430 or 1510/1530, 1420/1440 or 1520/1540; MATH 1710 (1650 prerequisite) or equivalent.
 4. **Chemistry Requirements:** The completion of these requirements will satisfy the requirements for a minor in chemistry. A minimum of 20 hours, including CHEM 1410/1430 or 1413/1430; 1420/1440 or 1423/1440; 2370/3210; 2380/3220 or equivalent, plus 4 advanced hours chosen from CHEM 3451/3452, 3530 or BIOC 3621/3622. Premedical and pre-dental students are advised to substitute both BIOC 4540 and 4550 for BIOC 3621/3622.
 5. **Electives:** See four-year plan.
 6. **Other Requirements:** A minimum 2.5 grade point average must be maintained on all advanced courses in the division of sciences.

BS in Biology–Option I

The following four-year plan is one example of a variety of ways in which you can complete your chosen degree in four years, and will serve as guide for you to design your pathway to degree completion. Variations will depend on whether you need to take prerequisites or have college credit from exams or dual enrollment.

The College of Arts and Sciences expects you to have completed the State recommended high school program and be ready to enroll for Language 2040 or a mathematics course above college algebra. If you are not prepared for this level, the necessary prerequisites will either replace electives or increase the hours required for the degree.

FRESHMAN YEAR

FALL	HOURS
BIOL 1710/1730, Principles of Biology I and Laboratory, or BIOL 1711/1733, Honors Principles of Biology I and Laboratory (may be used to satisfy a portion of the Natural Sciences requirement*)	4

CHEM 1410/1430, General Chemistry I and Laboratory, or CHEM 1412/1430, General Chemistry for the Honors College and Laboratory, or CHEM 1413/1430, Honors General Chemistry and Laboratory**	4
ENGL 1310, College Writing I, or ENGL 1313, Computer Assisted College Writing I*	3
MATH 1710, Calculus I	4
Total	15

SPRING	HOURS
BIOL 1720/1740, Principles of Biology II and Laboratory, or BIOL 1722/1744, Honors Principles of Biology II and Laboratory (may be used to satisfy a portion of the Natural Sciences requirement*)	4
CHEM 1420/1440, General Chemistry II and Laboratory, or CHEM 1422/1440, General Chemistry for the Honors College and Laboratory, or CHEM 1423/1440, Honors General Chemistry and Laboratory	4
ENGL 2700, Technical Writing*	3
Social and Behavioral Sciences*	3
Total	14

SOPHOMORE YEAR

FALL	HOURS
BIOL (2000 level, see requirements)	3–4
CHEM 2370/3210, Organic Chemistry and Laboratory	4
LANG 2040, Foreign Language (intermediate, may be used to satisfy a portion of the Understanding the Human Community requirement)**	3
PSCI 1040, American Government*	3
Elective	1
Total	14–15

SPRING	HOURS
BIOL (2000 level, see requirements)	3–4
CHEM 2380/3220, Organic Chemistry and Laboratory	4
LANG 2050, Foreign Language (intermediate, may be used to satisfy a portion of the Understanding the Human Community requirement)**	3
PSCI 1050, American Government*	3
Humanities*	3
Total	16–17

JUNIOR YEAR

FALL	HOURS
BIOL 3451/3452, Genetics and Laboratory	4
BIOL 3510/3520, Cell Biology and Laboratory	4
HIST 2610, United States History to 1865*	3
PHYS 1410/1430, General Physics I and Laboratory, or PHYS 1510/1530, General Physics I with Calculus and Laboratory	4
Total	15

SPRING	HOURS
HIST 2620, United States History Since 1865*	3
PHYS 1420/1440, General Physics II and Laboratory, or PHYS 1520/1540, General Physics II with Calculus and Laboratory	4
BIOL, Physiology and Laboratory requirement (advanced)	4
Visual and Performing Arts*	3
Elective	1
Total	15

SENIOR YEAR

FALL	HOURS
BIOL (advanced, with laboratory; see major requirements)	4
BIOL Elective (advanced, see major requirements)	4
CHEM Elective (advanced, see major requirements)	4
Elective (advanced)	3
Total	15

SPRING	HOURS
BIOL Elective (advanced, see major requirements)	4
BIOL Elective (advanced, see major requirements)	4
Elective (advanced)	3
Elective (advanced)	2
Elective	3
Total	16

**See the University Core Curriculum section of this catalog for approved list of course options.*

***See Arts and Sciences degree requirements section of this catalog for approved list of course options.*

Actual degree audits may vary depending on availability of courses in a given semester.

Some courses may require prerequisites not listed.

Students may wish to use opportunities for electives to complete a minor of their choice or secondary education courses for teacher certification.

Bachelor of Science

Major in Cytotechnology

The Department of Biological Sciences offers a Bachelor of Science with a major in cytotechnology in affiliation with the Berkshire Medical Center School of Cytotechnology in Pittsfield, Mass., and the Mayo School of Health Sciences in Rochester, Minn., both of which are approved by the American Medical Association.

Students complete a minimum of 86 semester hours at UNT (prior to entering clinical training) and a minimum of 12 months of clinical training (for a minimum of 39 semester hours) at any

American Medical Association-approved school of cytotechnology to complete the degree.

Upon graduation, students are eligible to take national examinations given by the American Society of Clinical Pathologists (ASCP). Upon passing the registry examination, the student is considered a certified cytotechnologist. The awarding of the degree is not contingent upon students' passing the national board examination.

Degree Requirements

1. Hours Required and General/College Requirements: A minimum of 125 semester hours, of which 42 must be advanced, and fulfillment of degree requirements for the Bachelor's degree as specified in the "General University Requirements" in the Academics section of this catalog and the College of Arts and Sciences requirements.

2. Major Requirements: Satisfactory completion of a minimum of 12 months of professional training at an approved cytotechnology school as verified by an official transcript sent to the UNT cytotechnology program director. The transcript is evaluated by the director, who recommends to the dean of the College of Arts and Sciences and the Registrar that a minimum of 39 hours of credit be granted for the completed professional training. These hours are exempt from the UNT residency requirement.

3. Other Course Requirements: Completion of the following preprofessional requirements before clinical training with a minimum GPA of 2.5 for upper-division courses in the division of sciences:

- BIOL 1710/1730 or 1711/1733, 2041/2042, 3451/3452, 3510/3520, 3800/3810, 4300, 4770 and BIOC 3621/3622, plus 4 hours selected from BIOL 3000, 3381/3382 or 4201/4202. 35 hours.
- CHEM 1410/1430, 1420/1440 and 3601/3602. 12 hours.
- MATH 1680, 3 hours.
- MGMT 3720, 3 hours.
- PSYC 1630, 3 hours. (PSYC 1630 also will satisfy Social and Behavioral Sciences requirement of the University Core Curriculum.)
- ENGL 2700, 3 hours.
- Professional training courses at an approved school of cytotechnology. Minimum of 39 hours.

4. Minor Requirements: None.

5. Electives: See four-year plan.

6. Other Requirements:

- Submission to the program director of a transcript evaluation request, including the name(s) of cytotechnology school(s) where the student is applying.
- Filing in the program director's office before leaving campus, the name of an accredited cytotechnology school to be attended.

BS with a Major in Cytotechnology

The following four-year plan is one example of a variety of ways in which you can complete your chosen degree in four years, and will serve as guide for you to design your pathway to degree completion. Variations will depend on whether you need to take prerequisites or have college credit from exams or dual enrollment.

The College of Arts and Sciences expects you to have completed the State recommended high school program and be ready to enroll for Language 2040 or a mathematics course above college algebra. If you are not prepared for this level, the necessary prerequisites will either replace electives or increase the hours required for the degree.

FRESHMAN YEAR

FALL	HOURS
BIOL 1710/1730, Principles of Biology I and Laboratory, or BIOL 1711/1733, Honors Principles of Biology I and Laboratory (may be used to satisfy a portion of the Natural Sciences requirement)**	4
CHEM 1410/1430, General Chemistry I and Laboratory, or CHEM 1413/1430, Honors General Chemistry and Laboratory**	4
ENGL 1310, College Writing I, or ENGL 1313, Computer Assisted College Writing I*	3
MATH 1680, Elementary Probability and Statistics**	<u>3</u>
Total	14

SPRING	HOURS
BIOL 2041/2042, Microbiology and Laboratory	4
CHEM 1420/1440, General Chemistry II and Laboratory, or CHEM 1422/1440, General Chemistry for the Honors College and Laboratory, or CHEM 1423/1440, Honors General Chemistry and Laboratory	4
ENGL 2700, Technical Writing*	3
PSYC 1630, General Psychology I (may be used to satisfy Social and Behavioral Sciences requirement*)	<u>3</u>
Total	14

SOPHOMORE YEAR

FALL	HOURS
BIOL 3451/3452, Genetics and Laboratory	4
CHEM 3601/3602, Organic Chemistry and Laboratory	4
PSCI 1040, American Government*	3
Humanities*	<u>3</u>
Total	14

SPRING	HOURS
BIOC 3621/3622, Elementary Biochemistry and Laboratory	4

BIOL 3510/3520, Cell Biology and Laboratory	4
PSCI 1050, American Government*	3
Understanding the Human Community*	3
Total	14

JUNIOR YEAR

FALL	HOURS
BIOL 3800/3810, Animal Physiology and Laboratory	4
HIST 2610, United States History to 1865*	3
MGMT 3720, Organizational Behavior	3
Visual and Performing Arts*	3
Understanding the Human Community*	3
Total	16

SPRING	HOURS
BIOL 4300, Histology	4
BIOL 4770, Biotechnology	3
BIOL (advanced, see major requirements)	4
HIST 2620, United States History Since 1865*	3
Total	14

SENIOR YEAR

Before attending a clinical school of cytotechnology approved by the American Medical Association in collaboration with the American Society of Cytotechnology, students must apply and be accepted by the school. A minimum of 39 hours of professional cytotechnology courses during approximately 12 months is required to complete the senior year of this program. Successful completion of the first three years does not guarantee admission into a clinical school. Contact the Cytotechnology Program Director. (39 hours total)

**See the University Core Curriculum section of this catalog for approved list of course options.*

***See Arts and Sciences degree requirements section of this catalog for approved list of course options.*

Actual degree audits may vary depending on availability of courses in a given semester. Some courses may require prerequisites not listed.

Bachelor of Science in Medical Technology

The Department of Biological Sciences offers a Bachelor of Science in Medical Technology in affiliation with the following schools of clinical laboratory science (medical technology) that are approved by the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS), in cooperation with the Commission on Accreditation of Allied Health Education Programs:

- Texas A&M University – Corpus Christi: Joe Lewis, MD, Medical Director; Christina Thompson, EdD, MT (ASCP) (SBB), Program Director

- Scott and White, Temple: Kathleen Jones, MD, Medical Director; Mary Ruth Beckham, MEd, MT (ASCP), Program Director
- Tarleton State University at All Saints Hospital, Fort Worth: Clifton Daniel, MD, Medical Director; Sally Lewis, MS, MT (ASCP), Program Director
- The Methodist Hospital, Houston: Christopher Leveque, MD, Medical Director; Judy Jobe, BS, MT (ASCP), Program Director
- The University of Texas M.D. Anderson Cancer Center, Houston: Jeffrey Terrance, MD, Medical Director; Karen McClure, BS, MT (ASCP) (SBB), Program Director
- United Regional Medical Health Care System (School of Medical Technology), Wichita Falls: Stuart Smith, MD, Medical Director; Gwen Morman, MA, MS, MT (ASCP), Program Director

Students complete a minimum of 86 semester hours at UNT (prior to entering clinical training) and a minimum of 12 months of clinical training (for a minimum of 39 semester hours) at any NAACLS-approved school of medical technology to complete the degree.

Upon graduation, students are eligible to take national examinations given by the American Society of Clinical Pathologists (ASCP) and the National Credentialing Agency (NCA) for Laboratory Personnel. The ASCP and the NCA examinations are administered by computer several times a year. Upon passing the registry examination(s) the student is considered a certified medical technologist or certified laboratory scientist. The awarding of the degree is not contingent upon students' passing national board examinations.

Medical Laboratory Technicians (MLTs) with an associate's degree and who have completed MLT training in a Committee on Allied Health Education and Accreditation Program may reduce the time required in clinical training by being accepted into a Medical Laboratory Technicians Articulation Program at one of UNT's clinical affiliates.

Degree Requirements

1. **Hours Required and General/College Requirements:** A minimum of 125 semester hours, of which 42 must be advanced, and fulfillment of degree requirements for the Bachelor's degree as specified in the "General University Requirements" in the Academics section of this catalog and the College of Arts and Sciences requirements.
2. **Major Requirements:** Satisfactory completion of a minimum of 12 months of professional training at an approved medical technology school as verified by an official transcript sent to the UNT medical technology program director. The transcript is evaluated by the director who recommends to the dean of the College of Arts and Sciences and the Registrar

that a minimum of 39 hours of credit be granted for the completed professional training. These hours are exempt from the UNT residency requirement.

3. **Other Course Requirements:** BIOL 1710/1730 or 1711/1733, 2041/2042, 3381/3382, 3510/3520, 3800/3810 and 4201/4202; plus two courses to be selected from BIOL 3451/3452, 4091/4092, 4300, and 4570 or 4770; CHEM 1410/1430, 1420/1440, 3601/3602; BIOC 3621/3622; ENGL 2700; MATH 1680; MGMT 3720. Completion of 12 months of clinical training (for a minimum of 39 semester hours) at any NAACLS-approved school of medical technology to complete the degree.

4. **Minor Requirements:** None.

5. **Electives:** See four-year plan.

6. **Other Requirements:**

- A minimum 2.5 grade point average for upper-division courses in the sciences.
- Submission to the program director of a transcript evaluation request, including the name(s) of medical technology school(s) where the student is applying.
- Filing, in the program supervisor's office before leaving campus, the name of an accredited medical technology school to be attended.

BS in Medical Technology

The following four-year plan is one example of a variety of ways in which you can complete your chosen degree in four years, and will serve as guide for you to design your pathway to degree completion. Variations will depend on whether you need to take prerequisites or have college credit from exams or dual enrollment.

The College of Arts and Sciences expects you to have completed the State recommended high school program and be ready to enroll for Language 2040 or a mathematics course above college algebra. If you are not prepared for this level, the necessary prerequisites will either replace electives or increase the hours required for the degree.

FRESHMAN YEAR

FALL	HOURS
BIOL 1710/1730, Principles of Biology I and Laboratory, or BIOL 1711/1733, Honors Principles of Biology I and Laboratory (may be used to satisfy a portion of the Natural Sciences requirement)**	4
CHEM 1410/1430, General Chemistry I and Laboratory, or CHEM 1412/1430, General Chemistry for the Honors College and Laboratory, or CHEM 1413/1430, Honors General Chemistry and Laboratory (may be used to satisfy a portion of the Natural Sciences requirement)**	4

ENGL 1310, College Writing I, or ENGL 1313, Computer Assisted College Writing I*	3
MATH 1680, Elementary Probability and Statistics**	<u>3</u>
Total	14

SPRING HOURS

BIOL 2041/2042, Microbiology and Laboratory 4	
CHEM 1420/1440, General Chemistry II and Laboratory, or CHEM 1422/1440, General Chemistry for the Honors College and Laboratory, or CHEM 1423/1440, Honors General Chemistry and Laboratory**	4
ENGL 2700, Technical Writing*	3
Social and Behavioral Sciences*	<u>3</u>
Total	14

SOPHOMORE YEAR

FALL	HOURS
BIOL 3800/3810, Animal Physiology and Laboratory	4
CHEM 3601/3602, Organic Chemistry and Laboratory	4
PSCI 1040, American Government*	3
Humanities*	<u>3</u>
Total	14

SPRING HOURS

BIOC 3621/3622, Elementary Biochemistry and Laboratory	4
BIOL 3381/3382, Medical Bacteriology and Laboratory	4
PSCI 1050, American Government*	3
Understanding the Human Community*	<u>3</u>
Total	14

JUNIOR YEAR

FALL	HOURS
BIOL 3510/3520, Cell Biology and Laboratory	4
BIOL Elective (advanced, see major requirements)	4
HIST 2610, United States History to 1865*	3
MGMT 3720, Organizational Behavior	<u>3</u>
Total	14

SPRING HOURS

BIOL 4201/4202, Immunology and Laboratory 4	
HIST 2620, United States History Since 1865*	3
BIOL (advanced, see major requirements)	3-4
Visual and Performing Arts*	3
Understanding the Human Community	<u>3</u>
Total	16-17

SENIOR YEAR

Before attendance at a school of clinical laboratory science (medical technology) approved by the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) American Medical Association, student must apply and be accepted by the school. A

minimum of 39 hours of professional medical technology courses during approximately 12 months is required to complete the senior year of this program. Successful completion of the first three years does not guarantee admission into a school of clinical laboratory science. Contact the Medical Technology Program Director. (39 hours total)

**See the University Core Curriculum section of this catalog for approved list of course options.*

***See Arts and Sciences degree requirements section of this catalog for approved list of course options.*

Actual degree audits may vary depending on availability of courses in a given semester. Some courses may require prerequisites not listed.

Bachelor of Arts Major in Biochemistry

The Bachelor of Arts degree with a major in biochemistry allows a less structured curriculum with more elective options than the Bachelor of Science in Biochemistry. Further, it serves as an excellent degree program for those who wish to teach sciences at the high school level in the areas of biochemistry, chemistry and biology. Additionally, the program serves well those who wish to go into medicine, dentistry or other biologically related professional programs of study.

Degree Requirements

1. **Hours Required and General/College Requirements:** A minimum of 120 semester hours, of which 42 must be advanced, and fulfillment of degree requirements for the Bachelor's degree as specified in the "General University Requirements" in the Academics section of this catalog and the College of Arts and Sciences requirements.

2. **Major Requirements:** Major of 33 hours in biochemistry, of which 19 must be advanced. Required courses: CHEM 1410/1430 or 1412/1430 or 1413/1430, 1420/1440 or 1422/1440 or 1423/1440, 2370/3210, 2380/3220, 3451/3452, and 3530; BIOC 3621/3622, 4570 and 4580. BIOC 4540, 4550 and 4560 may be substituted for BIOC 3621/3622.

3. **Other Course Requirements:** ENGL 2700 (replaces ENGL 1320 in university core); MATH 1710 (prerequisite- MATH 1650); PHYS 1510/1530 and 1520/1540.

4. **Minor Requirements:** Minor of 20 hours in biology, including BIOL 1710/1730 or 1711/1733, 1720/1740 or 1722/1744 or 2041/2042, 3510/3520, plus an additional 8 hours of advanced biology courses with laboratories.

5. **Electives:** See four-year plan.

6. **Other Requirements:** GPA of 2.5 on all advanced courses attempted in the division of sciences.

BA with a Major in Biochemistry

The following four-year plan is one example of a variety of ways in which you can complete your chosen degree in four years, and will serve as guide for you to design your pathway to degree completion. Variations will depend on whether you need to take prerequisites or have college credit from exams or dual enrollment.

The College of Arts and Sciences expects you to have completed the State recommended high school program and be ready to enroll for Language 2040 or a mathematics course above college algebra. If you are not prepared for this level, the necessary prerequisites will either replace electives or increase the hours required for the degree.

FRESHMAN YEAR

FALL	HOURS
BIOL 1710/1730, Principles of Biology I and Laboratory, or BIOL 1711/1733, Honors Principles of Biology I and Laboratory (may be used to satisfy a portion of the Natural Sciences requirement)**	4
CHEM 1410/1430, General Chemistry I and Laboratory, or CHEM 1412/1430, General Chemistry for the Honors College and Laboratory, or CHEM 1413/1430, Honors General Chemistry and Laboratory (may be used to satisfy a portion of the Natural Sciences requirement)**	4
ENGL 1310, College Writing I, or ENGL 1313, Computer Assisted College Writing I*	3
MATH 1710, Calculus I**	<u>4</u>
Total	15

SPRING	HOURS
BIOL 1720/1740, Principles of Biology II and Laboratory, or BIOL 1722/1744, Honors Principles of Biology II and Laboratory, or BIOL 2041/2042, Microbiology and Laboratory	4
CHEM 1420/1440, General Chemistry II and Laboratory, or CHEM 1422/1440, General Chemistry for the Honors College and Laboratory, or CHEM 1423/1440, Honors General Chemistry and Laboratory**	4
ENGL 2700, Technical Writing*	3
Social and Behavioral Sciences*	<u>3</u>
Total	14

SOPHOMORE YEAR

FALL	HOURS
CHEM 2370/3210, Organic Chemistry and Laboratory	4
LANG 2040, Foreign Language (intermediate, may be used to satisfy a portion of the Understanding the Human Community requirement)**	3
PHYS 1510/1530, General Physics I with Calculus and Laboratory	4
PSCI 1040, American Government*	<u>3</u>
Total	14

SPRING	HOURS
CHEM 2380/3220, Organic Chemistry and Laboratory	4
LANG 2050, Foreign Language (intermediate, may be used to satisfy a portion of the Understanding the Human Community requirement)**	3
PHYS 1520/1540, General Physics II with Calculus and Laboratory	4
PSCI 1050, American Government*	3
Humanities*	<u>3</u>
Total	17

JUNIOR YEAR

FALL	HOURS
BIOC 3621/3622, Elementary Biochemistry with Laboratory	4
BIOL 3510/3520, Cell Biology and Laboratory	4
CHEM 3451/3452, Quantitative Analysis with Laboratory	4
HIST 2610, United States History to 1865*	<u>3</u>
Total	15

SPRING	HOURS
BIOC 4570, Biochemistry and Molecular Biology of the Gene	3
BIOC 4580, Molecular Biology and Biotechnology Laboratory	2
CHEM 3530, Physical Chemistry for Life Science	4
HIST 2620, United States History Since 1865*	3
Visual and Performing Arts*	<u>3</u>
Total	15

SENIOR YEAR

FALL	HOURS
BIOL Elective (advanced, with laboratory; see major requirements)	4
Elective (advanced)	3
Elective (advanced)	3
Elective	3
Elective	<u>3</u>
Total	16

SPRING	HOURS
BIOL Elective (advanced, with laboratory; see major requirements)	4
Elective (advanced)	3
Elective (advanced)	2
Elective	3
Elective	<u>2</u>
Total	14

**See the University Core Curriculum section of this catalog for approved list of course options.*

***See Arts and Sciences degree requirements section of this catalog for approved list of course options.*

Actual degree audits may vary depending on availability of courses in a given semester.

Some courses may require prerequisites not listed. Students may wish to use opportunities for electives to complete a minor of their choice or secondary education courses for teacher certification.

Bachelor of Science in Biochemistry

This professional degree is designed for the students planning careers in biochemistry, medicine, clinical chemistry or other health-related areas of chemistry.

Degree Requirements

1. Hours Required and General/College Requirements: A minimum of 120 semester hours, of which 42 must be advanced, and fulfillment of degree requirements for the Bachelor's degree as specified in the "General University Requirements" in the Academics section of this catalog and the College of Arts and Sciences requirements.

Foreign Language Requirement Options: Students may complete either of two options to satisfy the College of Arts and Sciences foreign language requirement:

Option I: Must attain intermediate II level (2050) in a foreign language or pass appropriate proficiency exam(s) as specified by the College of Arts and Sciences.

Option II: Complete three courses from the approved groups below (a minimum of 9 hours). A student who wishes to fulfill the foreign language requirement by Option II must first be counseled by an undergraduate advisor of the Department of Biological Sciences and must obtain written approval of Option II for inclusion in the student's degree plan. Students must choose one course from each group as follows for a total of 9 hours. All courses must be a minimum of 3 hours. Cooperative Education (4920) is excluded:

Group I: ENGL 4180.

Group II: One biochemistry course at the 3000 level or higher, including special problems; or one additional course from Group III.

Group III: Select one course from the following (excludes special problems 4900-4910 courses): biology courses at the 3000 level or higher if they are not used to complete a biology minor; chemistry courses at the 3000 level or higher if they are not used in the biochemistry major; computer science courses for computer science majors that are above the CSCE 1020 level; ENGL 4190, 4250; GEOG 4400, 4500, 4520, 4550 and 4560; MATH 1680; other math courses above the level of MATH 1720; PHIL 3250; PSYC 4640; or physics courses for physics majors at the 3000 level or higher.

2. **Major Requirements:** A major of at least 39 hours in chemistry/biochemistry, of which 25 semester hours must be advanced, including CHEM 1410/1430 or 1413/1430, 1420/1440 or 1423/1440, 2370/3210, 2380/3220, 3451/3452, 3510 and 3520; BIOC 4540, 4550, 4560, 4570 and 4580.

3. **Other Course Requirements:** ENGL 2700 (replaces ENGL 1320 in university core); MATH 1710 and 1720; PHYS 1510/1530, 1520/1540, or 1710/1730, 2220/2240.

4. **Minor Requirements:** A minor of 20 hours in biology, including BIOL 1710/1730 or 1711/1733, 1720/1740 or 1722/1744 or 2041/2042, 3451/3452 and 3510/3520, plus 4 advanced hours in biology with laboratory.

5. **Electives:** See four-year plan.

6. **Other Requirements:** GPA of 2.5 on all advanced courses attempted in the division of sciences.

BS in Biochemistry–Option I

The following four-year plan is one example of a variety of ways in which you can complete your chosen degree in four years, and will serve as guide for you to design your pathway to degree completion. Variations will depend on whether you need to take prerequisites or have college credit from exams or dual enrollment.

The College of Arts and Sciences expects you to have completed the State recommended high school program and be ready to enroll for Language 2040 or a mathematics course above college algebra. If you are not prepared for this level, the necessary prerequisites will either replace electives or increase the hours required for the degree.

FRESHMAN YEAR

FALL	HOURS
BIOL 1710/1730, Principles of Biology I and Laboratory, or BIOL 1711/1733, Honors Principles of Biology I and Laboratory (may	

be used to satisfy a portion of the Natural Sciences requirement)**	4
CHEM 1410/1430, General Chemistry I and Laboratory, or CHEM 1412/1430, General Chemistry for the Honors College and Laboratory, or CHEM 1413/1430, Honors General Chemistry and Laboratory (may be used to satisfy a portion of the Natural Sciences requirement)**	4
ENGL 1310, College Writing I, or ENGL 1313, Computer Assisted College Writing I*	3
MATH 1710, Calculus I	4
Total	15

SPRING HOURS

BIOL 1720/1740, Principles of Biology II and Laboratory, or BIOL 1722/1744, Honors Principles of Biology II and Laboratory, or BIOL 2041/2042, Microbiology and Laboratory	4
CHEM 1420/1440, General Chemistry II and Laboratory, or CHEM 1422/1440, General Chemistry for the Honors College and Laboratory, or CHEM 1423/1440, Honors General Chemistry and Laboratory**	4
ENGL 2700, Technical Writing*	3
MATH 1720, Calculus II	3
Total	14

SOPHOMORE YEAR

FALL	HOURS
CHEM 2370/3210, Organic Chemistry and Laboratory	4
LANG 2040, Foreign Language (intermediate, may be used to satisfy a portion of the Understanding the Human Community requirement)**	3
PHYS 1510/1530, General Physics I with Calculus and Laboratory, or PHYS 1710/1730, Mechanics and Laboratory	4
PSCI 1040, American Government* Social and Behavioral Sciences*	3
Total	17

SPRING HOURS

CHEM 2380/3220, Organic Chemistry and Laboratory	4
LANG 2050, Foreign Language (intermediate, may be used to satisfy a portion of the Understanding the Human Community requirement)**	3
PHYS 1520/1540, General Physics II with Calculus and Laboratory, or PHYS 2220/2240, Electricity and Magnetism and Laboratory	4
PSCI 1050, American Government*	3
Total	14

JUNIOR YEAR

FALL	HOURS
BIOL 3451/3452, Genetics and Laboratory	4
CHEM 3451/3452, Quantitative Analysis and Laboratory	4
CHEM 3510, Physical Chemistry I	3
HIST 2610, United States History to 1865*	3
Humanities*	<u>3</u>
Total	17

SPRING	HOURS
BIOC 4570/4580, Biochemistry and Molecular Biology of the Gene and Laboratory	5
CHEM 3520, Physical Chemistry II	3
HIST 2620, United States History Since 1865*	3
Visual and Performing Arts*	<u>3</u>
Total	14

SENIOR YEAR

FALL	HOURS
BIOC 4540/4560, Biochemistry I and Laboratory	5
BIOL 3510/3520, Cell Biology and Laboratory	4
Elective (advanced)	3
Elective	<u>3</u>
Total	15

SPRING	HOURS
BIOC 4550, Biochemistry II	3
BIOL Elective (advanced, with laboratory)	4
Elective (advanced)	2
Elective	3
Elective	<u>2</u>
Total	14

*See the *University Core Curriculum* section of this catalog for approved list of course options.

**See *Arts and Sciences degree requirements* section of this catalog for approved list of course options.

Actual degree audits may vary depending on availability of courses in a given semester.

Some courses may require prerequisites not listed.

Teacher Certification

The College of Arts and Sciences encourages students to explore teaching at the secondary level as a career option. The student's academic advisor in the Dean's Office for Undergraduates and Student Advising in GAB, Room 220, can assist students with specific requirements for teacher certification.

Requirements utilizing the BA degree in Biochemistry with Certification in Chemistry: BIOC 3621/3622, 4570, 4580; BIOL 1710/1730 or 1711/1733; BIOL 1720/1740 or 1722/1744 or 2041/2042; BIOL 3451/3452, 3510/3520, 4700; 4 hours of approved biology with lab; CHEM 1410/1430 or 1412/1430 or 1413/1430;

CHEM 1420/1440 or 1422/1440 or 1423/1440; CHEM 2370/3210, 2380/3220, 3451/3452, 3530; PHYS 1510/1530, 1520/1540. Upon completion of this program, students will be prepared to sit for the certification examinations in Chemistry.

Requirements utilizing the BA degree in Biochemistry with Certification in Science: BIOC 3621/3622, 4570, 4580; BIOL 1710/1730 or 1711/1733; BIOL 1720/1740 or 1722/1744 or 2041/2042; BIOL 2140, 3451/3452, 3510/3520, 4700; CHEM 1410/1430 or 1412/1430 or 1413/1430; CHEM 1420/1440 or 1422/1440 or 1423/1440; CHEM 2370/3210, 2380/3220, 3451/3452, 3530; GEOG 1710; PHYS 1052, 1510/1530, 1520/1540. Upon completion of this program, students will be prepared to sit for the certification examinations in Science.

Requirements utilizing the BA degree in Biology with Certification in Life Science: BIOL 1710/1730 or 1711/1733; BIOL 1720/1740 or 1722/1744; BIOL 2041/2042, 2140, 3451/3452, 3510/3520, 3800/3810, 4051/4052, 4700; CHEM 1410/1430 or 1412/1430 or 1413/1430; CHEM 1420/1440 or 1422/1440 or 1423/1440; CHEM 2370/3210, 2380/3220; BIOC 3621/3622; PHYS 1510/1530, 1520/1540. Upon completion of this program, students will be prepared to sit for the certification examinations in Life Science.

Requirements utilizing the BA degree in Biology with Certification in Science: BIOL 1710/1730 or 1711/1733; BIOL 1720/1740 or 1722/1744; BIOL 2041/2042, 2140, 3451/3452, 3510/3520, 3800/3810, 4051/4052, 4700; CHEM 1410/1430 or 1412/1430 or 1413/1430; CHEM 1420/1440 or 1422/1440 or 1423/1440; CHEM 2370/3210, 2380/3220; BIOC 3621/3622; GEOG 1710; PHYS 1052, 1510/1530, 1520/1540. Upon completion of this program, students will be prepared to sit for the certification examinations in Science.

See major for additional course work and GPA requirements.

Students must also complete the required 21 hours in upper-level education courses (EDSE 3800, 3830, 4060, 4070, 4108, 4118, 4840) and meet all GPA requirements to apply for state certification. In order to enroll for the first required education course, the student must make application to the certification program in the College of Education in Matthews Hall, Room 105.

All state certification requirements and information on required examinations is available on the web site of the State Board for Educator Certification (SBEC), www.sbec.state.tx.us

Certificate in Biomedical Criminalistics

Advances in technology have created a need for students in basic sciences to apply the tools of technology to a wide variety of criminal investigations. The forensic science program offers a certificate in biomedical criminalistics for biological sciences and chemistry students. The certificate is designed to enable students in degree programs in biological sciences and chemistry to begin careers in forensic laboratories. Students must complete 20 hours of course work, including CJUS 3330, 4360; BIOL 3331, 4240; and CHEM 4631/4632. Contact the forensic science program office or visit the web site for more information (www.forensic.unt.edu).

Minor in Biological Sciences

A minor in the biological sciences can be satisfied by completing BIOL 1710/1730 or 1711/1733, 1720/1740 or 1722/1744, 2041/2042 and BIOL 3350/3360 or 3451/3452 (only one can be counted toward minor), plus one 4-hour upper-level laboratory course or two 3-hour upper-level lecture courses (excluding BIOL 3500, 4160/4170, 4180/4190, 4480, 4800, 4900/4910 and 4920) selected in consultation with an advisor in the Department of Biological Sciences.

Graduate Degrees

The department offers degree programs leading to the Master of Arts (MA), Master of Science (MS) and Doctor of Philosophy (PhD) with a major in biology; MS and PhD with a major in biochemistry; MS and PhD with a major in environmental science; and MA and MS with a major in molecular biology. A PhD with a major in molecular biology is offered through the Federation of North Texas Area Universities, of which UNT is a member.

Students who intend to proceed with graduate study should take the Graduate Record Examination (GRE) during their senior year. For specific information on graduate degree programs, consult the *Graduate Catalog*.

Courses of Instruction

All Courses of Instruction are located in one section at the back of this catalog.

Course and Subject Guide

The "Course and Subject Guide," found in the Courses of Instruction section of this book, serves as a table of contents and provides quick access to subject areas and prefixes.

Department of Chemistry

Main Departmental Office
Chemistry Building, Room 101
P.O. Box 305070
Denton, TX 76203-5070
940-565-2713
Fax: 940-565-4318

E-mail: chem@unt.edu
Web site: www.chem.unt.edu

Undergraduate Advising Office
Chemistry Building, Room 207
940-565-3554
Fax: 940-369-8474

Michael G. Richmond, Chair

Faculty

Professors Acree, Borden, Chyan, Cundari, Kelber, J. Marshall, P. Marshall, Richmond, Schwartz, Theriot, Thomas. *Associate Professors* Golden, Mason, Omary, Wilson. *Assistant Professors* Cooke, Selby, Stockland, Verbeck. *Lecturers* Dandekar, Schaake.

Introduction

Chemistry, the study of matter and its reactions, provides a basic understanding needed to deal with a variety of societal and scientific needs, including energy, food production, health and medicine, biotechnology, new materials, environmental concerns, new processes, and national defense. Chemistry is a science central to the study of modern physics, biology and medicine.

Current frontiers of experimental chemical investigation involve the areas of chemical reactions and reactivity, synthesis, analytical methods, catalysis and life processes.

Preprofessional Programs

See "Preprofessional Programs" in the College of Arts and Sciences section of this catalog.

Programs of Study

The department offers undergraduate and graduate programs in the following areas:

- Bachelor of Arts with a major in chemistry;
- Bachelor of Science in Chemistry;
- Master of Science, and
- Doctor of Philosophy, both with a major in chemistry.