

# CHEM 4930: Select Topics in Chemistry – Biosynthetic Chemistry (Spring 2026)

**CHEM 253 Mondays and Wednesdays 3.30 – 4.20 pm**

## Instructor Information

**Dr. Elizabeth Skellam, PhD**

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**Office hours:** Monday 2.30 – 3.30pm (in person), directly after class, or by appointment (please e-mail in advance to schedule).

## Course Description, Structure, and Objectives

Biosynthetic chemistry (also known as Biosynthesis) refers to the natural processes that living organisms use to synthesize highly complex organic molecules from simple building blocks. Typically, these biosynthetic pathways are multi-step, enzyme-catalyzed reactions resulting in one major product.

This course will focus on biosynthesis related to natural products (also known as secondary metabolites or specialized metabolites) such as polyketides, non-ribosomal peptides, terpenes, and hybrid molecules, since many are the inspiration for drug discovery, agrochemicals, pigments and chemical biology tools.

The course objectives include being able to recognize, understand, and explain:

- The major classes of natural products
- The enzymes required for synthesizing different classes of natural products
- Tailoring enzymes, co-enzymes, and co-factors
- Organic mechanisms often observed in biosynthesis
- Strategies for engineering natural product biosynthesis

## Course Requirements/Schedule

| Date        | Topic   | Assignment           | Percentage of Final Grade |
|-------------|---|----------------------|---------------------------|
| 1/12        | Introduction to natural products and drug discovery           | Journal article      |                           |
| 1/14        | Sources of natural products and isolation techniques          | Journal article      |                           |
| 1/19        | <b>MLK Holiday</b>  |                      |                           |
| 1/21        | Primary vs. secondary metabolism; enzymes & cofactors         | Practice problems    | 1%                        |
| 1/26        | Chemistry of pyridoxal phosphate (PLP)                        | Practice problems    | 1%                        |
| 1/28        | Chemistry of NAD(P)H / NAD(P)+                                | Practice problems    | 1%                        |
| 2/2         | Chemistry of FAD / FMN  | Practice problems    | 1%                        |
| <b>2/4</b>  | Chemistry of ATP  | <b>Problem set 1</b> | 10%                       |
| 2/9         | Chemistry of co-enzyme A                                      | Practice problems    | 2%                        |
| 2/11        | Chemistry of S-adenosyl methionine                            |                      |                           |
| 2/16        | Chemistry of heme   |                      |                           |
| <b>2/18</b> | <b>Exam 1</b>   |                      | 15%                       |
| 2/23        | Polyketide biosynthesis and polyketide synthases              | Practice problems    | 2%                        |
| 2/25        |   |                      |                           |
| 3/2         | Non-ribosomal peptides and non-ribosomal peptide synthases    | Practice problems    | 2%                        |
| 3/4         |   |                      |                           |
| 3/9         | <b>Spring Break</b>   |                      |                           |
| 3/11        |   |                      |                           |
| 3/16        | Terpene biosynthesis and terpene synthases                    | Practice problems    | 2%                        |
| 3/18        |   |                      |                           |
| 3/23        | Alkaloid biosynthesis   | Practice problems    | 1%                        |
| 3/25        |   |                      |                           |
| 3/30        | Natural products of mixed biosynthetic origin                 | <b>Problem set 2</b> | 10%                       |
| 4/1         |   |                      |                           |
| 4/6         | <b>Exam 2</b>   |                      | 15%                       |
| 4/8         | Pericyclic reactions  | Journal article      |                           |
| 4/13        | Tailoring enzymes   | Practice problems    | 2%                        |
| 4/15        |   |                      |                           |
| 4/20        | Biosynthetic gene clusters and genome mining                  | <b>Problem set 3</b> | 10%                       |
| 4/22        | Synthetic biology approaches for engineering natural products | Database exercise    | 5%                        |
| 4/27        |   |                      |                           |
| 4/29        | Review  |                      |                           |
| 5/6         | <b>Final Exam (**12.30 – 2.30pm**)</b>                        |                      | 20%                       |

**NOTE:** students will be notified by Eagle Alert if there is a campus closing that will impact a class and describe that the calendar is subject to change, citing the [Campus Closures Policy \(https://policy.unt.edu/policy/15-006\)](https://policy.unt.edu/policy/15-006).

## Assessing Your Work

In this course, I want you to engage deeply with the materials and develop your own critical thinking and writing skills. For this reason, **the use of Generative AI (GenAI) tools like ChatGPT are not permitted.** While these tools can be helpful in some contexts, they do not align with our goal of fostering the development of your independent thinking. Using GenAI to complete any part of an assignment, exam, or coursework will be considered a violation of academic integrity, as it prevents the development of your own skills, and will be addressed according to the [Student Academic Integrity policy \(https://policy.unt.edu/policy/06-003\)](https://policy.unt.edu/policy/06-003).

Your grade will be determined by weekly assignments, problem sets, mid-term exams, and a final comprehensive exam.

**Weekly assignments** include reading assigned journal articles, turning in completed problem sets, and in-class participation in exercises.

**Problem sets** are take-home assignments that can be attempted using class materials and assigned readings. You may discuss problems with classmates but all final answers should be your own and justifications provided.

**Mid-term and final examinations** will be comprehensive open book exams covering material up to the exam.

**NOTE:** Missed tests and examinations will receive a grade of zero. If you will be absent, notify me in advance. If you have a valid reason, alternative arrangements will be made.

Grading scale:

A = 90 -100%

B = 80 – 89%

C = 70 – 79%

D = 55 – 69%

F = 0 – 54%

**NOTE:** Every student in my class can improve by doing their own work and trying their hardest with access to appropriate resources. Students who use other people’s work without citations will be violating **UNT’s Academic Integrity Policy**. Please read and follow this important set of [guidelines for your academic success \(https://policy.unt.edu/policy/06-003\)](https://policy.unt.edu/policy/06-003). If you have questions about this, or any UNT policy, please email me or come discuss this with me during my office hours.

## Attendance and Participation

Research has shown that students who attend class are more likely to be successful. You should attend every class unless you have a university excused absence such as active military service, a religious holy day, or an official university function as stated in the [Student Attendance and Authorized Absences Policy \(PDF\)](https://policy.unt.edu/policy/06-039) (<https://policy.unt.edu/policy/06-039>). If you cannot attend a class due to an emergency, please let me know. Your safety and well-being are important to me.

This course is designed as an interactive course with class discussions, exercises, literature assignments, complementing the class materials. You will earn participation points for engaging with these materials with opportunities for extra credit available.

## Required/Recommended Materials

***Required readings, practice problems, and additional exercises will be posted on Canvas as PowerPoint slides decks and supplementary PDFs ahead of class.***

The following textbooks are recommended to supplement your learning:

- The Chemical Biology of Human Vitamins, C. T. Walsh and Y. Tang, 2019, Royal Society of Chemistry
- Medicinal Natural Products, P. M. Dewick, 2012 (3<sup>rd</sup> Edition), Wiley
- Natural Product Biosynthesis Chemical Logic and Enzymatic Machinery, C. T. Walsh and Y. Tang, 2023 (2<sup>nd</sup> Edition), Royal Society of Chemistry

**NOTE:** This course has digital components. To fully participate in this class, students will need internet access to reference content on the Canvas Learning Management System and [faculty member to include other required equipment or software such as a webcam, microphone, Adobe Photoshop, etc.]. If circumstances change, you will be informed of other technical needs to access course content. Information on how to be successful in a digital learning environment can be found at [Learn Anywhere](https://online.unt.edu/learn) (<https://online.unt.edu/learn>).

## How to Succeed in this Course

*Connect with me during class, through email & Canvas and/or by attending office hours. During busy times, my inbox becomes rather full, so if you contact me and do not receive a response within two business days, please send a follow up email. A gentle nudge is always appreciated.*

Office hours (see date / time above) provide an opportunity for you to ask questions and receive help with understanding class material. I strongly encourage you to attend whenever you need clarification on course materials.

The University of North Texas makes reasonable accommodations for students with disabilities. To request accommodations, you must first register with the Office of Disability Access (ODA) by completing an application for services and providing documentation to verify your eligibility each semester. Once your eligibility is confirmed, you may request your letter of accommodation. ODA will then email your

faculty a letter of reasonable accommodation, initiating a private discussion about your specific needs in the course.

You can request accommodations at any time, but it's important to provide ODA notice to your faculty as early as possible in the semester to avoid delays in implementation. Keep in mind that you must obtain a new letter of accommodation for each semester and meet with each faculty member before accommodations can be implemented in each class. You are strongly encouraged to meet with faculty regarding your accommodations during office hours or by appointment. Faculty have the authority to ask you to discuss your letter during their designated office hours to protect your privacy. For more information and to access resources that can support your needs, refer to the [Office of Disability Access](https://studentaffairs.unt.edu/office-disability-access) website (<https://studentaffairs.unt.edu/office-disability-access>).

UNT strives to offer a high-quality education in a supportive environment where you can learn, grow, and thrive. As a faculty member, I am committed to supporting you, and I want to remind you that UNT offers a range of mental health and wellness services to help maintain balance and well-being. Utilizing these resources is a proactive way to support your academic and personal success. To explore campus resources designed to support you, check out [mental health services](https://clear.unt.edu/student-support-services-policies) (<https://clear.unt.edu/student-support-services-policies>), visit [unt.edu/success](https://unt.edu/success), and explore [unt.edu/wellness](https://unt.edu/wellness). To get all your enrollment and student financial-related questions answered, go to [scrappysays.unt.edu](https://scrappysays.unt.edu).

## Supporting Your Success and Creating an Inclusive Learning Environment

Every student in this class should have the right to learn and engage within an environment of respect and courtesy from others. We will discuss our classroom's habits of engagement and I also encourage you to review UNT's student code of conduct so that we can all start with the same baseline civility understanding ([Code of Student Conduct](https://policy.unt.edu/policy/07-012)) (<https://policy.unt.edu/policy/07-012>).