## Chem 329: Antibiotics

Fall 2025

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| **Time/Location:** | WF, 1:00-2:15 pm, SCCT G042 |
| **Professor:** | Michael A. Welsh<br>Science Center 1075<br>mwelsh@hamilton.edu |
| **Office Hours:** | Monday, 1 – 3 pm<br>Wednesday, 3 – 5 pm<br>Thursday, 10 am – noon<br>or by appointment (email to schedule) |
| **Digital Resources** | Blackboard – all course documents will be posted here. |
| **Textbook** | *Antibiotics: Challenges, Mechanisms, Opportunities*<br>by Walsh and Wencewicz (a digital copy is on Blackboard) |

### Course Objectives

Antibiotics are molecules that arrest the growth of bacteria or kill them outright. The main objective of this course is to introduce you to the major classes of antibiotics, focusing on their structures and cellular targets. You will learn about how antibiotics are discovered, how they are synthesized, and how resistance to these compounds has developed. Along the way, you will gain familiarity with a variety of topics in microbial biochemistry, with an emphasis on biosynthesis of the bacterial cell envelope.

Specific Learning Goals

- Gain an in-depth understanding of the structural basis for antibiotic mode of action.
- Learn the structure and function of the essential polymers that comprise the bacterial cell envelope.
- Understand why antibiotics resistance occurs and common mechanisms of drug resistance.
- Develop experience and familiarity with searching the scientific literature and reading primary research articles.
- Increase your oral communication and scientific presentation skills.

### Course Format and Presentations

I will give three lectures at the beginning of the course to introduce you to essential background information and broad themes. After that, each class day will be centered on student presentations and group discussions of research papers.

Antibiotic Presentation

You will be assigned a major structural/mechanistic class of antibiotic or a topic in antibiotic research. Your job will be to independently research that antibiotic or topic and then give a 30 min presentation that teaches your fellow classmates all about it.

*Detailed guidelines for researching and preparing this presentation are posted to Blackboard.*

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| **Grading** | | |
|---|---|---|
| | Antibiotic Presentation | 50% |
| | Test | 20% |
| | Participation / Engagement | 30% |

A rubric that I will use to evaluate your antibiotic presentations is posted on Blackboard, and I will give you a grade and written feedback after your talk.

Class participation will be especially relevant during our group discussions of papers. I expect you to have read the papers before each class and to be ready to discuss them. To help you know how you're doing, I will enter a score into Blackboard for your participation on a given day. You can receive "++" for excellent participation, "+" for good participation, and "–" for inadequate participation.

**Test** – We will have one take-home, open-note, closed-internet test that will occur during finals week. The test questions will be written, in part, by you! You will write one multiple choice and one short answer question dealing with your assigned antibiotic/topic. You will also write a second pair of questions dealing with an antibiotic/topic that you were *not* assigned. Instructions for preparing these questions will be provided as we near the end of the semester. Submit your questions to Prof. Welsh by email no later than December 5.

**Attendance** – This is a discussion-based, student-led course; therefore, your attendance is mandatory. *Notify me asap if you must miss class for illness or emergency so that we can make alternate plans*. Unexcused absences will dramatically lower your participation grade.

**Office Hours** – I will be in my office at the times indicated above. Please drop in if you need my help! If you want to meet to discuss your presentations, it will be best to email me to schedule a separate meeting. But, if I am in my office with the door open, you should feel free to drop in. I am always happy to talk to students.

**Academic Accommodations** – The College provides support for students with disabilities. If you have academic accommodations that will be relevant to this course, please let me know at the outset so we can plan to best implement them. Questions about academic accommodations can be directed to Allen Harrison (aharriso@hamiton.edu), Assistant Dean for International Students and Accessibility.

**Honor Code** – Hamilton College's honor code applies in full to this course. Your presentations must be your own work – do not use generative AI tools – and they must cite all sources. If you have questions about how to properly cite a source, or whether citation is appropriate, ask me!

**Chem 329: Antibiotics** Fall 2025

**Course Schedule**

| Date | Topic |
|---|---|
| Oct 22 | Course Introduction; Topic Selection; searching the literature |
| Oct 24 | Lecture: Methods to Identify Antibiotics |
| Oct 29 | Lecture: Antibiotic Biosynthesis |
| *Oct 31 | Lecture: The Bacterial Cell Envelope; Paper 1: D-alanylation of lipoteichoic acids (Walker) |
| Nov 5 | *Inhibition of Cell Wall Synthesis*: β-lactams (1), vancomycin and substrate binders (2) |
| *Nov 7 | *Antibiotic Resistance* (3); Paper 2: Vancomycin Resistance (Walsh) |
| Nov 12 | *Membrane Disruptors*: colistin, daptomycin (4); *Antifungals*: clotrimazole, amphotericin B (5) |
| Nov 14 | *Inhibition of Protein Synthesis*: aminoglycosides, tetracyclines (6); linezolide, macrolides (7) |
| Nov 19 | *Inhibition of DNA Synthesis*: fluoroquinolones (8); *Inhibition of RNA Synthesis*: rifamycins (9) |
| Nov 21 | *Inhibition of Folate Synthesis*: trimethoprim, sulfonamides (10); *Antivirulence Agents* (11), |
| *Dec 3 | *Tuberculosis* (12); Paper 3: Inhibition of mycolic acid synthesis (Sacchetini, McNamara) |
| *Dec 5 | Paper 4: Inhibition of outer membrane protein insertion (Lewis) ***Test Q's Due*** |
| *Dec 10 | Paper 5: Inhibition of Lipopolysaccharide Transport (Kahne, Roche) |
| *Dec 12 | Paper 6: A Lasso Peptide Antibiotic (Wright) |
| Finals | Take-home test due by Weds |

* = there is assigned reading for this day.