

Term Information

Effective Term Spring 2016

General Information

Course Bulletin Listing/Subject Area Microbiology
Fiscal Unit/Academic Org Microbiology - D0350
College/Academic Group Arts and Sciences
Level/Career Graduate
Course Number/Catalog 7070
Course Title Antibiotics
Transcript Abbreviation Antibiotics
Course Description This is a literature-based course using a combination of faculty lectures and student-led discussions. This course will introduce students to the major classes of antibiotics, their modes of action, and the various resistance mechanisms that counteract their inhibitory activities.
Semester Credit Hours/Units Fixed: 3

Offering Information

Length Of Course 14 Week, 7 Week, 12 Week (May + Summer)
Flexibly Scheduled Course Never
Does any section of this course have a distance education component? No
Grading Basis Letter Grade
Repeatable No
Course Components Lecture
Grade Roster Component Lecture
Credit Available by Exam No
Admission Condition Course No
Off Campus Never
Campus of Offering Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites Graduate status or permission of the instructor
Exclusions

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code 26.0502
Subsidy Level Doctoral Course
Intended Rank Masters, Doctoral

Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Knowledgably describe the major types of antibiotics and their modes of action
- Knowledgably describe the common mechanisms of antibiotic resistance
- Discuss the biosynthesis of the polyketide antibiotics
- Understand current views on the roles of antibiotics in nature and the origin of resistance genes
- Read and critically evaluate research papers in microbiology and present key findings of research papers clearly to an audience of peers

Content Topic List

- The major classes of antibiotics: structures and biosynthesis
- Mechanisms of action
- Resistance mechanisms to antibiotics

Attachments

- Lett_M6050.pdf: Letter of intent
(Cover Letter. Owner: Daniels, Charles John)
- M6050_Antibiotics.pdf: Syllabus
(Syllabus. Owner: Daniels, Charles John)
- Concurrence_requests.pdf: Concurrence requests
(List of Depts Concurrence Requested From. Owner: Daniels, Charles John)
- Concurrence_M6050.pdf: Concurrence letters
(Concurrence. Owner: Daniels, Charles John)

Comments

- Please find enclosed Concurrence responses from OSBP, MCDB and Biophysics. We are also requesting that the course be assigned a 7000-level number, 7070. Following the comments from Dr. Magliery the Microbiology faculty agreed that a 7000-level designation was more appropriate based on both the content and the intended audience.
(by Daniels, Charles John on 09/09/2015 02:44 PM)
- See email *(by Hogle, Danielle Nicole on 09/09/2015 01:31 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Daniels, Charles John	08/20/2015 06:30 PM	Submitted for Approval
Approved	Daniels, Charles John	08/20/2015 06:31 PM	Unit Approval
Approved	Fink, Steven Scott	08/21/2015 08:22 AM	College Approval
Revision Requested	Hogle, Danielle Nicole	09/09/2015 01:31 PM	ASCCAO Approval
Submitted	Daniels, Charles John	09/09/2015 02:43 PM	Submitted for Approval
Approved	Daniels, Charles John	09/09/2015 02:44 PM	Unit Approval
Approved	Fink, Steven Scott	09/09/2015 04:17 PM	College Approval
Pending Approval	Nolen, Dawn Vankeerbergen, Bernadette Chantal Hanlin, Deborah Kay Jenkins, Mary Ellen Bigler Hogle, Danielle Nicole	09/09/2015 04:17 PM	ASCCAO Approval

August 20, 2015

Dear Colleagues,

The Department of Microbiology is requesting approval for a new graduate-level course, Microbiology 6050, entitled "Antibiotics".

Courses specializing in the physiology of antibiotic producing microbes and the actions of these molecules is a critically important area of molecular life science training that is not current being addressed in courses at OSU. The relevance of this area is reflected in new funding initiatives at the national level and research in this area is urgently needed. The proposed course will help to fill this void. Interacting with OSU faculty members who are leading researchers in the field will help to prepare our students for this challenge.

The course is structured as a combined faculty lecture, student-driven discussion. Following a faculty led introduction, students will critically evaluate landmark and current research in the fields of antibiotic biogenesis, modes of antibiotic action and mechanisms of resistance.

The course will be an elective for Microbiology graduate students and supports a number of our general Graduate program learning goals. These include:

- Demonstrate a broad base of knowledge in several areas, including microbial physiology, genetics, biochemistry, and pathogenesis.
- Demonstrate in-depth knowledge in an area of interest.
- Effectively communicate science through oral and written presentations to both scientific and general audiences.

We also feel that the course may appeal to a wider audience; the broad nature of the material will be of interest to students in many of the Life Science Network programs.

We look forward to your response.

Sincerely,



Charles J. Daniels, Ph.D.
Professor
Vice Chair for Teaching and Undergraduate Affairs

DRAFT SYLLABUS
Antibiotics
Microbiology 6050
3 Credit Hours
Spring Semester 2016

Instructor: Kurt Fredrick, Ph.D.
Professor
Department of Microbiology
Office: 286 Aronoff
Email: fredrick.5@osu.edu
Phone: (614) 292-6679
Office hours: TBA

Class Meetings: Monday, Wednesday and Friday (55 min): Location TBA

Course Description: One of the major advances in medicine was the discovery of antibiotics—“magic bullets” that could specifically target bacteria causing an infection without side effects on the patient. Today, these powerful drugs are losing their effectiveness, due to an increasing prevalence of resistance mechanisms. This is arguably one of the most serious issues facing modern medicine. This course will introduce students to the major classes of antibiotics, their modes of action, and the various resistance mechanisms that counteract their inhibitory activities. The course will also cover the biosynthesis of certain types of antibiotics, the ability of antibiotics to regulate gene expression, and the mechanisms of DNA transfer between microbes responsible for the spread of resistance genes in nature.

Prerequisites: Graduate standing or permission of instructor

Class design: This is a literature-based course using a combination of faculty lectures and student-led discussions. Each topic will be introduced with a lecture, and followed up by student-led discussion of 2-3 relevant papers. All students will be responsible for studying the assigned papers thoroughly in preparation for the discussion.

Textbook: The course will focus on primary literature and will not have an assigned textbook. Students who would like additional background can refer to the following general references:

Walsh, C. (2003). *Antibiotics: Actions, Origins, Resistance* (Washington DC: ASM Press).

Thaker, M., Spanogiannopoulos, P., and Wright, G.D. (2010). The tetracycline resistome. *Cellular and molecular life sciences* : CMLS 67, 419-431.

Putman, M., van Veen, H.W., and Konings, W.N. (2000). Molecular properties of bacterial multidrug transporters. *Microbiology and molecular biology reviews* : MMBR 64, 672-693.

Grading: Students will be evaluated based on their contributions to the discussion (30%) and their performance on two in-class quizzes (30%) and a final exam (40%).

Course outline:

Week	Topic
1	Introduction, discussion of historic papers
2	Inhibitors of peptidoglycan synthesis
3	Ribosome inhibitors: Tetracyclines
4	Ribosome inhibitors: Aminoglycosides
5	Ribosome inhibitors: Macrolides
6	Secondary effects of translation inhibitors
7	RNA polymerase inhibitors: Rifamycins
8	Topoisomerase inhibitors: Quinolones
9	Mobile DNA elements
10	Antibiotics as effectors of gene regulation
11	Polyketide antibiotic synthesis
12	Human microbiota and lessons from <i>C. difficile</i> infections
13	Bacterial persisters
14	Agricultural use of antibiotics

Assigned readings (representative subset; final list of 28 yet to be determined)

- Burdett, V. (1991). Purification and characterization of Tet(M), a protein that renders ribosomes resistant to tetracycline. *The Journal of biological chemistry* 266, 2872-2877.
- Burdett, V. (1996). Tet(M)-promoted release of tetracycline from ribosomes is GTP dependent. *Journal of bacteriology* 178, 3246-3251.
- Donadio, S., Staver, M.J., McAlpine, J.B., Swanson, S.J., and Katz, L. (1991). Modular organization of genes required for complex polyketide biosynthesis. *Science* 252, 675-679.
- Douthwaite, S., Jalava, J., and Jakobsen, L. (2005). Ketolide resistance in *Streptococcus pyogenes* correlates with the degree of rRNA dimethylation by Erm. *Molecular microbiology* 58, 613-622.
- Fleming, A. (1929). On the Antibacterial Action of Cultures of a Penicillium, with Special Reference to Their Use in the Isolation of B. Influenzae. *Brit J Exp Pathol* 10, 226-236.
- Horinouchi, S., and Weisblum, B. (1980). Posttranscriptional modification of mRNA conformation: mechanism that regulates erythromycin-induced resistance. *Proceedings of the National Academy of Sciences of the United States of America* 77, 7079-7083.
- Kannan, K., Kanabar, P., Schryer, D., Florin, T., Oh, E., Bahroos, N., Tenson, T., Weissman, J.S., and Mankin, A.S. (2014). The general mode of translation inhibition by macrolide antibiotics. *Proceedings of the National Academy of Sciences of the United States of America* 111, 15958-15963.
- Kimura, T., Ohnuma, M., Sawai, T., and Yamaguchi, A. (1997). Membrane topology of the transposon 10-encoded metal-tetracycline/H⁺ antiporter as studied by site-directed chemical labeling. *The Journal of biological chemistry* 272, 580-585.
- Moazed, D., and Noller, H.F. (1987). Chloramphenicol, erythromycin, carbomycin and vernamycin B protect overlapping sites in the peptidyl transferase region of 23S ribosomal RNA. *Biochimie* 69, 879-884.
- Nishino, K., and Yamaguchi, A. (2001). Analysis of a complete library of putative drug transporter genes in *Escherichia coli*. *Journal of bacteriology* 183, 5803-5812.
- Pape, T., Wintermeyer, W., and Rodnina, M.V. (2000). Conformational switch in the decoding region of 16S rRNA during aminoacyl-tRNA selection on the ribosome. *Nature structural biology* 7, 104-107.
- Perez-Fernandez, D., Shcherbakov, D., Matt, T., Leong, N.C., Kudyba, I., Duscha, S., Boukari, H., Patak, R., Dubbaka, S.R., Lang, K., et al. (2014). 4'-O-substitutions determine selectivity of aminoglycoside antibiotics. *Nature communications* 5, 3112.
- Peske, F., Savelsbergh, A., Katunin, V.I., Rodnina, M.V., and Wintermeyer, W. (2004). Conformational changes of the small ribosomal subunit during elongation factor G-dependent tRNA-mRNA translocation. *Journal of molecular biology* 343, 1183-1194.
- Tenson, T., Lovmar, M., and Ehrenberg, M. (2003). The mechanism of action of macrolides, lincosamides and streptogramin B reveals the nascent peptide exit path in the ribosome. *Journal of molecular biology* 330, 1005-1014.
- Vazquez-Laslop, N., Thum, C., and Mankin, A.S. (2008). Molecular mechanism of drug-dependent ribosome stalling. *Molecular cell* 30, 190-202.
- Xue, Y., and Sherman, D.H. (2000). Alternative modular polyketide synthase expression controls macrolactone structure. *Nature* 403, 571-575.
- Yamaguchi, A., Akasaka, T., Ono, N., Someya, Y., Nakatani, M., and Sawai, T. (1992). Metal-tetracycline/H⁺ antiporter of *Escherichia coli* encoded by transposon Tn10. Roles of the aspartyl residues located in the putative transmembrane helices. *The Journal of biological chemistry* 267, 7490-7498.

Learning Outcomes:

Successful students will be able to...

- Knowledgably describe the major types of antibiotics and their modes of action
- Knowledgably describe the common mechanisms of antibiotic resistance
- Discuss the biosynthesis of the polyketide antibiotics
- Understand current views on the roles of antibiotics in nature and the origin of resistance genes
- Read and critically evaluate research papers in microbiology
- Understand commonly employed methods in microbiology research
- Accurately interpret raw and processed data sets in research papers
- Present key findings of research papers clearly to an audience of peers
- Identify strong arguments supported by conclusive data; identify weak arguments supported by inconclusive data
- Argue the merits and/or weaknesses of published work from a knowledgeable perspective
- Read research papers with high efficiency

Academic Misconduct: It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed, illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct (http://studentaffairs.osu.edu/info_for_students/csc.asp).

Disability: Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated, and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; <http://www.ods.ohio-state.edu/>.

List of departments we have requested concurrence for Microbiology 6050,
Antibiotics:

MCDB

OSBP

Biophysics