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	6050
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)

Comments

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
Pending Approval	Nolen,Dawn Vankeerbergen,Bernadette Chantal Hanlin,Deborah Kay Jenkins,Mary Ellen Bigler Hogle,Danielle Nicole	08/21/2015 08:22 AM	ASCCAO Approval

THE OHIO STATE UNIVERSITY

College of Arts and Sciences
Division of Natural and Mathematical Sciences

Department of Microbiology

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614-292-2301 Phone
614-292-9120 Fax

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.

Perquisites: 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 addition 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 *C. difficile* 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