

**University of Guelph  
College of Biological Science  
Department of Molecular and Cellular Biology**

**COURSE OUTLINE**

**Microbial Cell Biology (MICR\*4520)  
Fall 2015**

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**Course Description**

This course explores the structure-function relationships of macromolecular complexes and cellular ultrastructures involved in fundamental microbial processes. The structures of macromolecular machines will be considered from the perspective of the cellular requirements for survival in different environments, and will be discussed in the context of their integration into cell division and the bacterial cell cycle, as well as their exploitation as targets for antibiotics and other therapeutic approaches.

**Course Instructor**

Dr. Chris Whitfield, Office SCIE 4245, [cwhitfie@uoguelph.ca](mailto:cwhitfie@uoguelph.ca), ext. 53361.  
Office hours: by appointment

**Teaching Assistant**

Christian Castroverde, [ccastrov@uoguelph.ca](mailto:ccastrov@uoguelph.ca)

**Course Schedule**

Lectures: 1:00 -2:20PM, Tuesdays & Thursdays, SCIE 2315

**Learning Outcomes**

By the end of this course, students should be able to:

- Understand the impact of macromolecular complexes and cellular ultrastructure in relation to essential microbial processes, antimicrobial resistance and pathogenicity
- Appreciate the diversity and complexity of microbial cellular structures and the structure-function relationships that promote cell growth and viability
- Understand the application and limitations of contemporary experimental approaches and evaluate the quality of experimental design, data analysis and conclusions presented in current literature

- Develop critical thinking skills by analyzing data in the current literature and synthesize major implications of findings
- Expand scientific writing skills to promote and develop effective communication

### Course Resources

There is no assigned textbook for this course. Instead, students are expected to complement class learning with assigned readings from the current scientific literature. A reading list will be assigned for each lecture topic. This course will be run using Courselink: <https://courselink.uoguelph.ca/shared/login/login.html>

### Course Structure

Lectures will mostly comprise presentations by the instructor. However students will be encouraged to discuss (in class) relevant current scientific literature.

### Tentative Lecture Schedule

Classes	Date(s)	Lecture Topic
1	September 10	Introduction to microbial cell biology
2	September 15	Issues in antibiotic resistance and drug discovery <ul style="list-style-type: none"> <li>• history of antibiotic development</li> <li>• conventional antibiotic targets</li> <li>• classical and new approaches in drug discovery</li> <li>• alternative approaches for combatting infections</li> </ul>
3-5	September 17, 22 & 24	The basis for the Gram-stain reaction; structures and functions of bacterial cell envelopes <ul style="list-style-type: none"> <li>• Gram-positive bacteria</li> <li>• Gram-negative bacteria</li> <li>• mycobacteria</li> <li>• Archaea</li> </ul>
6-8	September 29, October 1 & 6	Cell wall growth and remodeling <ul style="list-style-type: none"> <li>• peptidoglycan assembly</li> <li>• cell wall inhibitors; mechanisms and resistance</li> </ul>
9	October 8	MIDTERM 1 (in class)
10	October 13	No class - Fall study break day

11	October 15	Assembly of microbial glycostructures <ul style="list-style-type: none"> <li>• lipopolysaccharides</li> <li>• capsules and exopolysaccharides</li> <li>• protein glycosylation</li> </ul>
12, 13	October 20 & 22	Nucleoid structure <ul style="list-style-type: none"> <li>• bacterial nucleoid architecture &amp; chromosome organization</li> <li>• DNA topology</li> <li>• gyrase inhibitors</li> </ul>
14	October 27	Bacterial cell cycle <ul style="list-style-type: none"> <li>• DNA dynamics</li> <li>• regulation and coordination of replication</li> <li>• chromosome segregation and nucleoid exclusion</li> <li>• sporulation</li> </ul>
15,16	October 29 & November 3	Cell Division <ul style="list-style-type: none"> <li>• cell polarity and defining the mid-cell</li> <li>• FtsZ and the Z-ring</li> <li>• the divisome</li> <li>• atypical systems</li> </ul>
17	November 5	Cytoskeletal Filaments and Subcellular Localization <ul style="list-style-type: none"> <li>• cell shape determination</li> <li>• chromosome/plasmid partitioning</li> <li>• proteins clusters, microcompartments and organelles</li> </ul>
18	November 10	MIDTERM II (in class)
19-21	November 12 & 17	Synthesis and assembly of proteins <ul style="list-style-type: none"> <li>• ribosome function and antibiotic mechanisms</li> <li>• insertion of cytoplasmic membrane proteins</li> <li>• assembly of lipoproteins &amp; outer membrane proteins</li> <li>• sortase enzymes</li> </ul>
22, 23	November 24 & 26	Protein secretion systems <ul style="list-style-type: none"> <li>• overview of the different systems</li> <li>• relationships to other cellular structures &amp; processes</li> </ul>
24	December 1	Wrap-up
25	December 3	class rescheduled from Oct 13 class cancelled - study time!

FINAL EXAM	December 8; 2:30 Location TBD	
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## Methods and Description of Assessments

Grading for this course will comprise the following three components:

Midterm Exam I\*: **25%** of final Grade

Midterm Exam I\*: **30%** of final Grade

Final Examination: **45%** of final grade

*\*Please ensure you are present for the midterm exams as there will be **NO** opportunity available to take the exam at an alternate time. If the midterm is missed, academic consideration will only be given providing the appropriate documentation is presented (a note from a physician or academic councillor). In this event, the marks from the midterm will be transferred to the final exam.*

## Important Dates

September 10 (Thursday): first lecture in MICR\*4520, 1:00pm

October 8 (Thursday): midterm examination I, 1:00pm in SCIE2315

November 10 (Tuesday): midterm examination II, 1:00pm in SCIE2315

December 8 (Tuesday): final exam at 2:30 PM, location TBD

## Course and University Policies

### When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, student ID#, and e-mail contact, and be prepared to provide supporting documentation. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

### Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Centre for Students with Disabilities as soon as possible.

For more information, contact CSD at 519-824-4120 ext. 56208, or email [csd@uoguelph.ca](mailto:csd@uoguelph.ca), or see the website: <http://www.csd.uoguelph.ca/csd/>

### Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

### E-mail Communication

As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

### Drop Date

The last date to drop one-semester Fall 2015 courses, without academic penalty, is **Friday November 6**. For regulations and procedures for Dropping Courses, see the Undergraduate Calendar:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

### Copies of out-of-class assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

### Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded in any electronic media without the permission of the presenter, whether the instructor, a classmate or guest lecturer.

### Grading

If you are absent from classes during the semester, you will be expected to make up missed lecture material on your own. Any assignment handed in late will be penalized 5% for every day that it is late.

## **General Campus Resources**

If you are concerned about any aspect of your academic program:

Make an appointment with a program counsellor in your degree program.

<http://www.bsc.uoguelph.ca/index.shtml> or

<https://www.uoguelph.ca/uaic/programcounsellors>

If you are struggling to succeed academically:

There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist.

<http://www.learningcommons.uoguelph.ca/>

If you are struggling with personal or health issues:

Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance.

<https://www.uoguelph.ca/counselling/>

Student Health Services is located on campus and is available to provide medical attention.

<https://www.uoguelph.ca/studenthealthservices/clinic>

For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations.

<http://www.uoguelph.ca/~ksomers/>

If you have a documented disability or think you may have a disability:

The Centre for Students with Disabilities (CSD) can provide services and support for students with a documented learning or physical disability. They can also provide information about how to be tested for a learning disability.

For more information, including how to register with the centre please see:

<https://www.uoguelph.ca/csd/>