

**University of Guelph**  
**College of Biological Science**  
**Department of Molecular and Cellular Biology**  
**COURSE OUTLINE**  
**MICR\*3260: Microbial Adaptation**  
**Winter 2016**

**Course description**

**MICR\*3260 Microbial Adaptation W (3-1) [0.50]**

In this course students examine the physiological responses of bacteria to their diverse and changing environments. By using information technologies to access and analyze the relevant research literature, students learn how and why researchers study this subject, and how research outcomes are evaluated.

*Prerequisites:* BIOC\*3560, MBG\*3080

**Teaching team**

*Lecturer:* Dr. Janet M. Wood, Office SCIE4251, Extension 53866

*Teaching Assistant:* Mara Goodyear, Office SCIE3246

*Communications:* We will meet with you in our classes and Labs, via Courselink-based announcements and discussions and via email. Our addresses are [jwood@uoguelph.ca](mailto:jwood@uoguelph.ca) and [mgoodyea@uoguelph.ca](mailto:mgoodyea@uoguelph.ca). We will also meet with you individually, by appointment.

**Course schedule**

*Lectures:* Tuesday and Thursday, 10:00-11:20 am, Alexander 218, starting on January 12<sup>th</sup>, 2016

*Literature Research Labs:* Monday or Tuesday (12:30-13:20) or Wednesday (11:30-12:20), SCIE1306, starting on January 18<sup>th</sup>, 2016

**Learning goals and outcomes**

By completing this course you will:

1. learn how microbes respond to their diverse and changing environments. Topics for study in 2016 include strategies for adaptation to environmental change, selection and utilization of carbon/nitrogen/energy supplies, motility and chemotaxis, quorum sensing, global regulation and exemplary stress tolerance mechanisms (acid tolerance and osmotic stress tolerance).
2. use relevant information technologies to access and analyze the research literature (research articles, review articles, conference reports and technical sources).
3. learn how and why researchers study this subject.
4. understand how to evaluate primary research reports.
5. submit appropriately documented scientific reports based on your analysis.

## Course Resources

Web Sites: <http://www.uoguelph.ca/mcb/teaching/micr3260/> and [Courselink](#)

## Reference Material:

The course is based on information available in assigned reference texts and review articles. The textbooks are available at the McLaughlin Library Reserve Desk (most relevant material is also found in earlier editions). The textbooks provided overlapping coverage of most topics. The review articles are available online through Courselink and McLaughlin Library Course Reserve.

*Brock*: M.T. Madigan, J.M. Martinko, D.A. Stahl & D.P. Clark. 2012. **Brock Biology of Microorganisms**, 13<sup>th</sup> Edition, Pearson/Benjamin Cummings, San Francisco, CA, QR41.2 B77 2012 (Chapter citations (below) and images included in Powerpoint slides are from the 13<sup>th</sup> edition; similar information is found in the 14<sup>th</sup> edition).

*Lehninger*: D.L. Nelson & M.M. Cox. 2008. **Lehninger Principles of Biochemistry**, 5<sup>th</sup> Edition, W.H. Freeman and Company, New York, QP 514.2.L425 2008 (Chapter citations (below) and images included in Powerpoint slides are from the 5<sup>th</sup> edition; similar information is available in: the 6<sup>th</sup> Edition)

*Slonczewski*: J.L. Slonczewski & J.W. Foster. 2014. **Microbiology – An Evolving Science**, 3<sup>rd</sup> Edition, WW Norton & Co, Inc, New York, NY, QR41.2 .S585 2014 (similar information is found in the 2<sup>nd</sup> edition)

The following resources will be useful for the Literature Research Lab:

Knisely, K. (2013) **A student handbook for writing in biology, Fourth edition**. Sinauer Associates, Inc., Sunderland, Massachusetts (QH304 .K59 2013, on reserve)

**EcoSal Plus** by A Böck, R Curtis III, JB Kaper, PD Karp, FC Neidhardt, T Nyström, JM Slauch and CL Squires, Executive Editors, American Society for Microbiology, Washington, DC. Available online: <http://www.asmscience.org/content/journal/ecosalplus>

## Course Content

You will attend lectures, discuss questions, read assigned references, and complete in-class quizzes and a final exam. In the Literature Research Lab you will select a topic related to the course material, analyze a primary research article that has contributed to our understanding of that topic, then report on the outcome and impact of the analyzed research. This work will be completed independently and with the Instructors in the Literature Research Lab, with reference to the lab web site: <http://www.uoguelph.ca/mcb/teaching/micr3260/>.

The assigned readings listed below will support the lectures.

## Reading Assignments by Lecture Topic:

### *Genetic and Biochemical Strategies for Adaptation*

Please review relevant information in these Chapters to ensure that you have essential background knowledge:

*Lehninger*: Chapters 5, 6, 11, 12 and 28

*Brock*: Chapters 6, 8 and 10

*Slonczewski*: Chapters 8 and 10

### *Selection and Utilization of Carbon/Energy Supplies*

*Brock*: Section 8.5

*Slonczewski*: Section 10.2

**Goerke, B. and Stuelke, J.** (2008) Carbon catabolite repression in bacteria: many ways to make the most out of nutrients. *Nat Rev Microbiol* **6**: 613–624. (particularly pages 613-617)

### *Selection and Utilization of Nitrogen/Energy Supplies*

*Lehninger*: Section 22.1

*Brock*: Sections 13.10, 13.11, 13.14, 13.15 and 8.7

*Slonczewski*: Sections 10.7, 15.5, 15.6

**Dixon, R. and Kahn, D.** (2004) Genetic regulation of biological nitrogen fixation. *Nat Rev Microbiol* **2**: 621-631.

**Sparacino-Watkins, C., Stolz, J.F. and Basu, P.** (2014) Nitrate and periplasmic nitrate reductases. *Chem Soc Rev* **43**: 676–706. (particularly sections 1-2.1, 2.4, 2.5, 3.6)

**Krell, T., Lacial, J., Busch, A., Silva-Jiménez, H., Guazzaroni and M.-E., Ramos, J.L.** (2010) Bacterial sensor kinases: diversity in the recognition of environmental signals. *Annu Rev Microbiol* **64**: 539–59. (particularly pages 539-547)

### *Motility and Chemotaxis*

*Brock*: Sections 3.13-3.15 & 8.8

*Slonczewski*: Sections 3.7 & 10.7

**Jarrell, K.F. and McBride, M.J.** (2008) The surprisingly diverse ways that prokaryotes move. *Nat Rev Microbiol* **6**: 466–476.

**Wadhams, G.H. and Armitage, J.P.** (2004) Making sense of it all: bacterial chemotaxis. *Nat Rev Mol Cell Biol* **5**: 1024-1037.

### *Quorum Sensing*

*Brock*: Sections 8.9, 17.12 & 25.11

*Slonczewski*: Section 10.8

**Ng, W.-L. and Bassler, B.L.** (2009) Bacterial quorum-sensing network architectures. *Annu Rev Genet* **43**: 197–222.

### *Stress Tolerance: Global Regulation*

*Brock*: Section 4.12, 6.15 & 9.12

*Slonczewski*: Sections 5.1, 5.4, 5.5

**Battesti, A., Majdalani, N. and Gottesman, S.** (2011) The RpoS-mediated general stress response in *Escherichia coli*. *Annu Rev Microbiol* **65**: 189–213. (particularly pages 189-199)

### *pH Homeostasis*

**Krulwich, T.A., Sachs, G. and Padan, E.** (2011) Molecular aspects of bacterial pH sensing and homeostasis. *Nat Rev Microbiol* **9**: 330–43.

### *Osmoregulation*

**Wood, J.M.** (2011) Osmotic Stress in **Bacterial Stress Response**, 2nd Edition Chapter 9, pp133-168. G. Storz and R. Hengge, eds. ASM Press, Washington D.C.

**Booth, I.R.** (2014) Bacterial mechanosensitive channels: progress towards an understanding of their roles in cell physiology. *Curr Opin Microbiol* **18**: 16–22.

### *Responsible Conduct in Research*

Committee on Science, Engineering, and Public Policy, National Academies of Science, USA. 1995. [On being a scientist, responsible conduct in research, 2nd Edition](#). National Academy Press.

### **Methods of Assessment and Important Dates**

<b>Assessment</b>	<b>Weight</b>	<b>Date</b>	<b>Course Activity</b>	<b>Addresses Learning Outcome</b>
Quiz 1	10	In Class, Feb 2 <sup>a</sup>	Lecture	1,5
Report 1	20	Feb 26 <sup>b</sup>	Lab	2-5
Quiz 2	10	In Class, Mar 15 <sup>a</sup>	Lecture	1,5
Report 2	20	Mar 29, 4 pm <sup>b</sup>	Lab	2-5
Discussion	5	In Class, Mar 31/Apr 5 <sup>c</sup>	Lab	2-5
Final Exam	35	Apr 21, 11:30 <sup>a</sup>	Lecture	1,5

Footnote <sup>a</sup> Quiz questions will be assigned on Courselink one week in advance of each Quiz date. No electronic devices may be present at student desks/tables during the quizzes or the final exam.

Footnote <sup>b</sup> Completed Lab Reports must be delivered, in the format specified by the course web site, as a hard copy to room SCIE4251 *and* as an electronic copy to the Courselink Dropbox, both before 4 pm on Feb 26th (Report 1) and Mar 29th (Report 2). Lab Report components are specified in detail at: <http://www.uoguelph.ca/mcb/teaching/micr3260/>.

Footnote <sup>c</sup> All students are required to participate in class presentations on both days.

## **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, 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>

*Students in MICR3260* who do not complete Quizzes, submit Reports or participate in Discussions on time will be assigned grades of zero unless extenuating circumstances are adequately documented within two weeks of the requirement date. Requirements will be waived or rescheduled only if appropriate documentation is provided.

### 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 Student Accessibility Services (and Centre for Students with Disabilities) as soon as possible.

For more information, contact Student Accessibility Services at 519-824-4120 ext. 56208 or email <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 <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 courses, without academic penalty, is the 40<sup>th</sup> class day. To confirm the actual date please see the schedule of dates in the Undergraduate Calendar. 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 or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

### Grading

Policies regarding Quizzes, Reports, Discussions and the Final Exam are recorded above (p 3).

### **Campus Resources**

The Academic Calendar is the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs: <http://www.uoguelph.ca/registrar/calendars/index.cfm?index>

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:

- Student Accessibility Services (formerly Centre for Students with Disabilities) 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/>