MICR*3260 Microbial Adaptation

Winter 2019
Section(s): C01

Department of Molecular and Cellular Biology
Credit Weight: 0.50
Version 1.00 - January 07, 2019

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1 Course Details

1.1 Calendar Description

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.

Pre-Requisite(s): BIOC*3560, MBG*3080

1.2 Course Description

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.

1.3 Timetable

Timetable is subject to change. Please see WebAdvisor for the latest information

MICR*3260*0101, MICR*3260*0102. Lectures Tuesdays, Thursdays 10.00-11.20. Lab Mondays 09.30-10.20

MICR*3260*0104 Lectures Tuesdays, Thursdays 10.00-11.20. Lab Fridays 09.30-10.20

All lectures in MCKN 029

All labs in SSC 1306

1.4 Final Exam

Weighting: 30%

Location: TBA

Date: Week 14

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2 Instructional Support

2.1 Instructional Support Team

Instructor: Muhammad M Zaman
Email: mzaman02@uoguelph.ca
Office: SC1 4445

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3 Learning Resources

3.1 Required Resource(s)

http://www.uoguelph.ca/mcb/mcb2/teaching/micr3260/index.sht (Website)
http://www.uoguelph.ca/mcb/mcb2/teaching/micr3260/index.sht

Courselink (Website)
https://courselink.uoguelph.ca/shared/login/login.html

M.T. Madigan, J.M. Martinko, K.S. Bender, D.H. Buckley, & D.A. Stahl. 2015. Brock Biology of Microorganisms, 14th Edition, Pearson/Benjamin Cummings, San Francisco, CA, QR41.2 .B77 2015 (Textbook)

D.L. Nelson & M.M. Cox. 2013. Lehninger Principles of Biochemistry, 6th Edition, W.H. Freeman and Company, New York, 2013 (Textbook)

J.L. Slonczewski & J.W. Foster. 2014. Microbiology – An Evolving Science, 3rd Edition, WW Norton & Co, Inc, New York, NY, QR41.2 .S585 2014 (Textbook)

3.2 Recommended Resource(s)

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

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 (Textbook)
http://www.asmscience.org/content/journal/ecosalplus

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4 Learning Outcomes

There are five learning outcomes. By completing this course you will:

4.1 Course Learning Outcomes

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

1. Learn how microbes respond to their diverse and changing environments. Topics for study in 2017 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.
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.

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5 Teaching and Learning Activities

You will attend lectures, discuss questions, read assigned references, and complete midterm and final exams. 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 with reference to the Lab web site: http://www.uoguelph.ca/mcb/mcb2/teaching/micr3260/index.shtml.

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 & 28

Brock: Chapters 2, 4, 6 & 7

Slonczewski: Chapters 8 & 10

Selection and Utilization of Carbon/Energy Supplies

Brock: Section 7.5

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. (pages 613-617)

Selection and Utilization of Nitrogen/Energy Supplies

Lehninger: Section 22.1

Brock: Sections 3.15, 3.17, 7.7, 7.13, 14.12

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. (sections 1-2.1, 2.4, 2.5, 3.6)

Krell, T., Lacal, 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. (pages 539-547)

Motility and Chemotaxis

Brock: Sections 2.17-2.19 & 7.8

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 7.9, 14.24 & 22.11

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 2.8, 5.14 & 5.15

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. (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.

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

Midterm Exam

- Weight: 20%
- Date: Week 5
- Activity: Lecture
- LO covered: 1, 5

Report 1

- Weight: 20%

- Date: Week 6
- Activity: Lab
- LO covered: 2-5

Report 2

- Weight: 20%
- Date: Week 11
- Activity: Lab
- LO covered: 2-5

Discussion

- Weight: 10%
- Date: Week 12
- Activity: Lab
- LO covered: 2-5

Final Exam

- Weight: 30%
- Date: Week 14
- Activity: Lecture
- LO covered: 1,5

Footnote a Completed Lab Reports must be delivered, in the format specified by the course web

site, as a hard copy to room SSC4251 and as an electronic copy to the Courselink Dropbox, both before 4 pm on Feb 17th (Report 1) and Mar 28th (Report 2). Lab Report components are specified in detail at: http://www.uoguelph.ca/mcb/mcb2/teaching/micr3260/index.shtml.

Footnote b Every students is required to attend the class presentations on both days.

5.1 Lecture

Week 1

Topic(s): Lecture 1: Strategies

Lecture 2: Strategies/Literature Research Lab Orientation

Week 2

Topic(s): Lecture 3: Carbon/Energy

Lecture 4: Carbon/Energy

Week 3

Topic(s): Lecture 5: Bibliographic Software Tutorial

Lecture 6: Carbon/Energy

Week 4

Topic(s): Lecture 7: Carbon/Energy/Nitrogen?

Lecture 8: Nitrogen

Week 5

Topic(s): Lecture 9: Nitrogen

Lecture 10: Midterm

Week 6

Topic(s): Lecture 11: Motility?

Lecture 12: Chemotaxis

Week 7

Topic(s): Midsemester Break

Week 8

Topic(s): Lecture 13: Chemotaxis - Article Review

Lecture 14: Chemotaxis

Week 9

Topic(s): Lecture 15: Quorum Sensing

Lecture 16: Quorum Sensing

Week 10

Topic(s): Lecture 17: Quorum Sensing

Lecture 18: Global Regulation/Stress Tolerance

Week 11

Topic(s): Lecture 19: Osmoregulation

Lecture 20: Osmoregulation

Week 12

Topic(s): Lecture 21: Osmoregulation

Lecture 22: Research Article Discussion

Reference(s): :

Week 13

Topic(s): Lecture 23: Research Article Discussion

Lecture 24: Course Eval; Review

Classes End

Week 14

Topic(s): Final Exam

5.2 Lab

Week 1

Topic(s): Lab 1: Independent Topic/Review Selection

Week 2

Topic(s): Lab 2: Research Article Selection

Week 3

Topic(s): Lab 3: Methodological Resources

Week 4

Topic(s): Lab 4: Human Context

Week 5

Topic(s): Lab 5: Intellectual Context

Week 6

Topic(s): Optional Consultation

Week 7

Topic(s): Midsemester Break

Week 8

Topic(s): Lab 8: Results

Week 9

Topic(s): Lab 9: Interpretation

Week 10

Topic(s): Lab 8: Subsequent Developments

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6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Midterm	20
Report 1	20
Report 2	20
Discussion	10
Final Examination	30
Total	100

6.2 Assessment Details

Midterm (20%)
Date: Week 5
Learning Outcome(s): 1,5

Report 1 (20%)
Date: Week 6
Learning Outcome(s): 1,2,3,4,5

Report 2 (20%)
Date: Week 11
Learning Outcome(s): 1,2,3,4,5

Discussion (10%)
Date: Week 12
Learning Outcome(s): 1,2,3,4,5

Final Examination (30%)
Date: Week 14
Learning Outcome(s): 1,5

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7 Department of Molecular and Cellular Biology Statements

7.1 Academic Advisors

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

- Make an appointment with a program counsellor in your degree program. B.Sc. Academic Advising or Program Counsellors

7.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: 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/
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help and http://www.lib.uoguelph.ca/get-assistance/studying/math-stats-help

7.3 Wellness

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/

8 University Statements

8.1 Email Communication

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

8.2 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. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

8.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for course registration are available in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

8.4 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.

8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

More information can be found on the SAS website
https://www.uoguelph.ca/sas

8.6 Academic Integrity

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 encourages academic integrity. 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.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

8.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars