

<b>Course Code &amp; No. - Section:</b>	BIOL 341/345 - Sections 1
<b>Course Title (Credits):</b>	Independent Study Microbiology (3) and Lab (1)
<b>Term &amp; Year:</b>	Spring 2015
<b>Course Ref. No. (CRN):</b>	
<b>Instructor:</b>	Dr. Suzanne Gollery
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<b>Office:</b>	TCES, room 223
<b>Office Hours:</b>	M 10:00-11:15 a.m., W 2:30-3:45 p.m., R 1:00-2:15 p.m. or by appointment
<b>Class Meeting Time:</b>	TBA – once per week
<b>Location:</b>	TCES 204 (lab)
<b>Prerequisites:</b>	BIOL 101 and BIOL 102
<b>Corequisites:</b>	BIOL 341 and BIOL 345 are co-requisites

### Course Descriptions:

**BIOL 341: Microbiology (3)** Prerequisites: BIOL 101, BIOL 102. Corequisite: BIOL 345.

Study of the phylogeny, physiology, identification, and ecology of microbes, including fungi, bacteria, algae, and protists. Applications include medicine, industry, brewing, and agriculture.

**BIOL 345: Microbiology Lab (1)** Corequisite: BIOL 341. Identification, physiology, and ecology of microbes.

**Student Outcomes for BIOL 341/345:** Upon completion of Microbiology and Lab, students will

1. demonstrate sufficient understanding of the diversity, physiology, genetics, and ecology of microbes to successfully answer related questions on pre-professional exams, such as the MCAT and GRE.
2. demonstrate sufficient understanding of the diversity, physiology, genetics, and ecology of microbes to undertake related graduate courses.
3. demonstrate understanding and appreciation of the significant roles of microbes in present day ecosystems, and in the evolution of all life on Earth.
4. demonstrate skill at reading and comprehending science texts and peer-reviewed science research articles.
5. demonstrate skill at critical analysis, logic, and problem solving involving facts and concepts of biochemistry, biology, and experimental data.
6. demonstrate competence at researching a science topic using library and internet sources, evaluating information obtained, and organizing the research into a written term paper with referenced sources.
7. demonstrate competence in laboratory techniques used to study microbes, including brightfield microscopy, microbial culture techniques, staining techniques, and molecular genetic techniques.
8. demonstrate competence communicating professionally in poster and scientific paper formats.

**Methods of Assessing Student Outcomes:** Student outcomes will be assessed using the following:

1. Homework sets will assess student comprehension of reading assignments.
2. Three unit exams and one final exam will assess the ability of students to remember, apply, and synthesize key facts and concepts of course content.
3. A term paper and related assignments will assess the ability of students to research a science topic, evaluate information, write, and revise a research paper.
4. A semester-long inquiry research project in microbiology will demonstrate competence using lab techniques.
5. A research report and poster will demonstrate ability to communicate as scientists do professionally.

**Instructional Strategies**

You will prepare for class by reading materials and answering questions provided by the instructor. Meeting time will be spent on 1) clarifying questions about the reading or homework 2) mini lectures to help explain particularly dense concepts, and 3) a semester-long guided inquiry research project identifying an unknown bacterial species isolated from the environment. You will spend additional time outside of class writing and revising a literary research paper on a course-related subject, working on the inquiry research project, and writing a scientific research paper and poster about your unknown bacteria research.

**Required Texts and Materials**

1. Madigan MT, Martinko JM, Stahl DA, and Clark DP. Brock biology of microorganisms, 14e, any version (Kindle, loose leaf, hard back, European edition). San Francisco (CA): Benjamin Cummings/Pearson; 2014. ISBN-13: 9780321897398
2. Sachs JS. Good germs, bad germs. New York (NY): Hill and Wang. 2007. ISBN: 978-0-8090-5063-5.
3. Chess, B. Laboratory applications in microbiology: a case study approach, 2<sup>nd</sup> ed., spiral bound. New York (NY): McGraw-Hill Higher Education; 2012. ISBN-13: 9780073402376
4. A bound laboratory notebook (carbon copy duplicate pages are not necessary)
5. Access to a computer (one that meets the published SNC Computer Requirements) and internet

**Attendance**

We should meet to discuss your progress weekly. For safety reasons, you should plan to work on your research project during the business day when faculty are present. A schedule of available times for lab work in TCES 204 will be posted outside that classroom door at the end of drop-add week.

**Course policies:****1) Food and drinks:**

Food and beverages, even drinking water, are FORBIDDEN by state and federal safety regulations in TCES 204, the biology lab. You must leave food and beverages outside of the lab room.

**2) Personal protection in the laboratory:**

You must wear a lab coat and gloves while working with microorganisms. Eye protection is also a good idea. You will get safety training and a lab orientation in the first week of class.

**3) Due dates and late work:**

Due dates for homework and other assignments are indicated on the schedule of classes. Because this is an independent study, late work will be accepted, but you run the risk of getting behind and having difficulty finishing the class if work is often late.

**4) E-mailed work:**

All work may be submitted by e-mail or in hard copy. The instructor will reply to verify that e-mailed work was received. It is the student's responsibility to follow up if the instructor does not reply about e-mailed work.

**5) Citing sources:**

Cite sources in your science writing using CSE style. Scientists routinely cite original sources for factual information that is not widely known. For example, one would not have to cite a source when one states that mutations introduce new genetic variability into the human genome, but one would cite a source when stating that mutations accumulate in *human* DNA at an average rate of 175 mutations per diploid genome per generation<sup>1</sup>. This web site has information about citing sources using CSE (Council of Science Educators) style, which is similar to that used by most scientific journals: [http://bcs.bedfordstmartins.com/resdoc5e/RES5e\\_ch11\\_s1-0003.html](http://bcs.bedfordstmartins.com/resdoc5e/RES5e_ch11_s1-0003.html). Nachman M W, Crowell S L. Estimate of the mutation rate per nucleotide in humans. Genetics 2000; 156: 297-304

**6) Modifications to the BIOL 341/345 course syllabus:**

This syllabus and schedule is intended to provide students with a clear and accurate outline of course content, student outcomes, class topics, assignments and due dates, and exam dates. Students should keep and refer to the syllabus regularly. The instructor reserves the right to make announced changes to the syllabus and class schedule at her discretion if it is in the best interest of the students to do so. Major changes, such as changes to exam dates or coverage and permanent changes to the schedule, will be e-mailed.

**Prim Library Resources**

Using the library's resources effectively (not just Internet resources) contributes to developing each of SNC's core themes by exposing students to high quality academic resources, diverse opinions, new ideas, and a future that includes building on a liberal arts education. It also establishes good habits that will serve students well in their professions. In this course, you will be expected to utilize the library's resources (either on-site or remotely) as you complete your assignments.

Prim Library Resources for BIOL 341/345: Microbiology and Lab include, but are not limited to:

1. Books (can be checked out):
  - a. In general, books related to biology have Library of Congress Classification numbers ranging from QH through RC. Books about biotechnology have LCC numbers beginning with TP. However, you will find books related to our course with other LCC numbers, so search the Prim Library Catalog using key words related to the topic that you are researching.
  - b. Goldbort, R. (2006) *Writing for Science*. New Haven: Yale University Press. LCC number: T11.G626 2006. A detailed resource for writing about science that includes tips on keeping lab notebooks while doing experiments, writing college lab reports, and using style elements like voice, tense, and other nuances appropriate to scientific writing.
  - c. Lipson, C. (2006) *Cite Right: a Quick Guide to Citation Styles*. Chicago: University of Chicago Press. LCC number PN171.F56L55 2006. Includes a section on CSE style.
2. Electronic databases (for peer-reviewed research articles, reviews, newspaper and magazine articles): Electronic databases most likely to include articles on biology topics are EBSCO: Academic Search Premier, Environment Complete, General Science Collection, GreenFILE, Health Source, Newspaper Source, and TOPICsearch; BioOne; and GREENR. If you want to access electronic databases when you are off campus, use your first initial and your last name as the username and your 9 digit student ID number as the password.
3. Hardcopy periodicals: Prim Library has current subscriptions for Science, New Scientist, Science News, and National Geographic Magazine. Any of these are likely to have articles about biology topics written for educated people who are not necessarily scientists. Full-text articles from many more periodicals are available through the electronic databases.
4. Lib Guides: <http://Libguides.sierranevada.edu> These web pages contain instructions about how to use resources available at Prim Library, how to evaluation the appropriateness of information from the Internet for a research paper, how to cite sources, and other topics related to finding and using information.

**The SNC Email System**

The SNC email system is the official communication vehicle among students, faculty members and administrative staff and is designed to protect the confidentiality of student information as required by the Family Educational Rights and Privacy Act of 1974 Act (FERPA). Students should check their college email accounts daily during the school year.

Students have a right to forward their SNC e-mail to another e-mail account (for example, @hotmail or @gmail). However, confidentiality of student information protected by FERPA cannot be guaranteed for SNC e-mail forwarded to an outside vendor. Having email redirected does not absolve a student from the responsibilities associated with official communication sent to his or her SNC email account.

**ADA Accommodations** In accordance with the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973, students with a documented disability are eligible for support services and accommodations. If a student wishes to request an accommodation, please contact the Director of Academic Support Services, Henry Conover, at (775) 831-1314 x7534, [hconover@sierranevada.edu](mailto:hconover@sierranevada.edu), office in Prim Library: PL-304.

**The Sierra Nevada College Mission Statement:**

Sierra Nevada College graduates will be educated to be scholars of and contributors to a sustainable world. Sierra Nevada College combines the liberal arts and professional preparedness through an interdisciplinary curriculum that emphasizes entrepreneurial thinking and environmental, social, economic and educational sustainability.

**The Core Themes:** Four core themes from the SNC mission are woven through all courses and the life of the community at SNC.

**Liberal Arts**

**Professional Preparedness**

**Entrepreneurial Thinking**

**Sustainability**

**Sanctions for Cheating and/or Plagiarism**

**The Honor Code**

The faculty of SNC believes students must be held to high standards of integrity in all aspects of college life in order to promote the educational mission of the College and to encourage respect for the rights of others. Each student brings to the SNC community unique skills, talents, values and experiences which, when expressed within the community, contribute to the quality of the educational environment and the growth and development of the individual. Students share with members of the faculty, administration and staff the responsibility for creating and maintaining an environment conducive to learning and personal development, where actions are guided by mutual respect, integrity, responsibility and trust. The faculty and students alike must make diligent efforts to ensure high standards are upheld by their colleagues and peers as well as themselves. Therefore faculty and students accept responsibility for maintaining these standards at Sierra Nevada College and are obligated to comply with its regulations and procedures, which they are expected to read and understand.

**Consequences of Violating the Student Honor Code**

SNC students and faculty share the responsibility for maintaining an environment of academic honesty. Thus, all are responsible for knowing and abiding by the SNC Faculty/Student Honor Code published in the current SNC Catalog. Faculty are responsible for presenting the Honor Code and the consequences of violating it to students at the start of their classes AND for reporting all incidences of academic dishonesty to the Provost. Students are responsible for knowing what constitutes CHEATING, PLAGIARISM and FABRICATION and for refraining from these and other forms of academic dishonesty. Violations of the Honor Code become part of a student's academic record.

- 1<sup>st</sup> Offense: Student receives a zero for assignment/exam and counseling with faculty on the honor code, consequences for violating the honor code, and the value of academic honesty in learning.
- 2<sup>nd</sup> Offense: Student fails course and receives counseling with faculty on the honor code, consequences for violating the honor code, and the value of academic honesty in learning.
- 3<sup>rd</sup> Offense: Student is expelled.

**Grading Policy**

Since BIOL 341 and 345 are corequisites, and the material of each is so integral to the other, assignments from each will contribute to an overall point total and the same letter grade will be awarded to both courses. The grading curve is based on a 1200-point scale, with 62.5% of points from BIOL 341 and 37.5% from BIOL 345. Sierra Nevada College awards half grades (e.g., A- or B+), so a student with a point total within 1.5% of the cutoff for the letter grade will earn the appropriate half grade.

**Grading Curve**

A	90 – 100%	1080 – 1200 points
B	80 – 89.9 %	960 – 1079 points
C	68 – 79.9%	816 – 959 points
D	58 – 67.9%	696 – 815 points
F	<58%	<696 points

Students may earn points in the following ways:

**BIOL 341 (62.5%):**

Homework – 12 best at 25 points each	300 points
Term paper assignments:	
Idea	5 points
Annotated bibliography	35 points
Introduction and outline	30 points
Completed term paper	80 points
Exams – 3 at 100 points each	300 points

**BIOL 345 (37.5%):**

Lab assignments (10 @ 20 points each)	200 points
Lab notebook	50 points
Research poster	100 points
Research paper	<u>100 points</u>
<b>Total</b>	<b>1200 points</b>

**Assignment details:**Weekly homework questions:

*Short description of the assignment:* Students will write and submit answers to several questions each week about assigned readings.

**Learning goals for the assignment:** Scientific studies on how people learn have shown repeatedly that we learn and remember more when we are active learners. This means that students will remember and be able to apply more facts and concepts about microbiology for a much longer time if they learn them by reading and writing about them, communicate about them with other people, and apply them to solve problems in different contexts, than if the same students come to class and passively listen to an instructor lecture about the facts and concepts while taking notes. The homework questions give students a chance to learn actively by reading and answering questions related to the reading. Students are encouraged to write questions asking for clarification of confusing material from the reading assignment and submit them to the instructor by 8 a.m. on class days. Class activities will provide time to address student questions, work in pairs or small groups to communicate about course content, and apply challenging and important concepts and facts to new situations. Students will gain much more from class activities if they come to class prepared, already having read the text, answered some questions, and figured out what they understand and what they find confusing.

**How to do the assignment:** Homework questions are found at the ends of chapters from which reading is assigned in the Madigan text or in the homework assignment table. Students may write answers by hand or on computers and print or e-mail completed assignment files. Due dates are given in the homework table and on the schedule of classes.

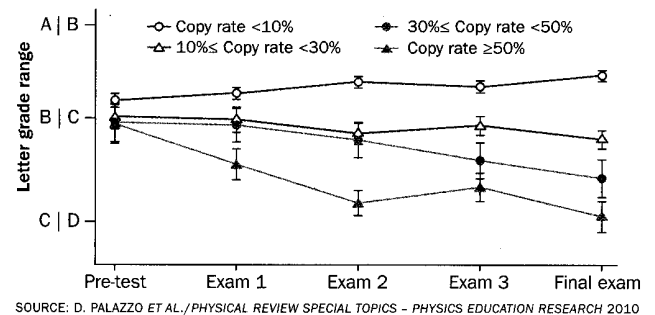
**Individual work:** Students must write answers to questions and all individual assignments in their own words. Students with answers that are identical to or paraphrased from other students work, the text, Wikipedia, or other published or internet sources will receive no credit for the assignment and consequences for violating the academic honesty policy will apply. Cheaters never learn!

**Scoring and feedback from the assignment:** Homework questions will be scored for completeness, that is, students will receive full credit for making a good attempt to answer all questions, regardless of whether or not they are ideal answers. The instructor will give students oral and written feedback on questions. Students should keep their evolving question answers in their text binders.

### Science Stats | CHEATERS NEVER LEARN

A study of MIT students found that those who copied others' homework more frequently did worse on exams over the course of a semester.

**Exam scores per percent of homework problems copied**



SOURCE: D. PALAZZO ET AL./PHYSICAL REVIEW SPECIAL TOPICS - PHYSICS EDUCATION RESEARCH 2010

4 | SCIENCE NEWS | May 8, 2010

**Term paper:** An important professional skill for scientists and health professionals is the ability to find current relevant information about science or health topics and evaluate the reliability of the information in forming questions, hypotheses, or conclusions. Thus, microbiology students will research and write about a course-related topic of their choice suggested on the assignment handout or chosen independently in consultation with the instructor. The term paper involves four assignments with separate due dates that will help students to schedule enough time to work on the term paper, choose appropriate sources, and receive feedback from the instructor prior to completion of the paper, which will improve the final paper for many students. Assignments are described on the term paper handout and due dates are listed on the handout and on the schedule of classes. Students may elect to revise the term paper for an improved grade after their final paper has been scored.

**Exams:** Three exams will cover material introduced since the last exam, although students will be asked to apply concepts and information learned previously when these are related to exam chapter content. Exams include multiple choice questions, since this format is used on standardized exams, such the GRE and MCAT. Other questions may include short answer, essay, or true-false formats. Exam questions will ask students to apply concepts and facts. Students will have hard copy exams.

**Final Exam:** A comprehensive final exam with a format similar to the four exams will be given at the end of the semester. The Microbiology final exam is scheduled for 3:00 – 6:00 p.m. on Tuesday, May 8, 2011. The final exam will include questions about material introduced since Exam 3, in addition to all previously-tested material.

**Lab:** The Chess Laboratory Applications in Microbiology text guides students to complete a semester-long research project characterizing and identifying bacterial species isolated from the environment. Microbiology lab grades will be based on research success, keeping a professional laboratory notebook, presentation of work in a scientific poster, and summarizing research in a research article similar to those submitted to peer-reviewed scientific journals.

**Midterm grades:** Midterm grades will be calculated using all work due through March 11, 2015. There will not be a midterm exam, per se.

**Proposed schedule for Independent Study Microbiology and Lab**

Week and dates	Reading assignments	Class topics/Lab activities	Assignments Due (by end of the week)
Week 1 Jan 20-23	Madigan Chapters 1 & 2 GG,BG Prologue and Part I Chess Case study 1	Microbiology overview and cell structures Lab orientation & safety Making sterile media (for week 2, plus test strain cultures)	Week 1 questions  Case 1 assignment
Week 2 Jan 26-30	Madigan Chapter 3, part I, & Chapter 5 (skip part VI for now) GG,BG Part II Chess Case studies 7 and 8	Microbial growth and factors that affect growth Culturing and isolating microbes	Week 2 questions  Case 7 and 8 assignments
Week 3 Feb 2-6	Madigan Chapter 4, part I, and Chapter 10 GG,BG Part III	Prokaryote genetics Make media & culture unknowns - Keep good notes on unknowns in lab notebook	Week 3 questions  Infectious disease paper idea
Week 4 Feb 9-13	Madigan Chapter 5, part VI & other antibiotic-resistance readings, Chapter 23 GG,BG Part IV Chess Case 9, Case 2 part II (review part I as needed)	The problem of antibiotic resistance & microbial interactions with humans Simple, negative, and Gram staining, measuring cells	Week 4 questions  Case 9 & notebook check (submit lab notebook on Fri - will be returned Mon)
Week 5 Feb 17-20	Madigan Chapters 8 & 9 GG,BG Part V Chess Cases 10 and 11	Viral diversity and viral genomes Capsule, acid-fast, and endospore staining	Week 5 questions  Annotated bibliography Chess cases 10 & 11 assignments
Week 6 Feb 23-27	GG,BG Part VI  Chess Exercises 40 and 41 (record in lab notebook) and Case 16	<b>Exam 1:</b> culturing microbes, microbial growth, growth control, prok. genetics, hygiene hypothesis, & viruses  Unknown motility and colony morphology; Effects of osmolarity on microbial growth	  Case 16 assignment
Week 7 March 2-6	Madigan Chapters 24 and 27 GG,BG Part VII and Coda Chess cases 14 and 15	Immunity and Host defenses; Diagnostic micro Effects of temperature and pH on microbial growth	Week 7 questions  Chess cases 14 and 15 assignments, notebook check
Week 8 March 9-13	Madigan Chapters 28 & 29  Chess Case 39	Epidemiology; Person-to-person diseases Plan biochemical tests & make media for them	Week 8 questions  Biochemical test plan



Week and dates	Reading assignments	Class topics/Lab activities	Assignments Due (by end of the week)
March 16-20		Spring break	
Week 9 March 23-27	Madigan Chapters 30 and 31 Handouts on isolating DNA from bacteria and PCR to amplify 16S rRNA gene	Vector-, soil-, water-, and food-borne diseases Isolate unknown DNA and PCR of 16S rRNA gene for DNA sequencing	Week 9 questions Infectious disease paper introduction and outline
Week 10 March 30-Apr 3	Madigan Chapters 32 and 11 Chess exercises for the biochemical tests you will do	Eukaryotic pathogens; Biotechnology Biochemical tests	Week 10 questions
Week 11 April 6-10	Chess exercises for the biochemical tests you will do	Exam 2: Epidemiology, immunity, infectious diseases, & biotechnology Biochemical tests	Lab notebook check
Week 12 April 13-17	Madigan Chapter 3 parts II & III, Chapter 13 Handout on DNA sequence analysis	Metabolic diversity in prokaryotes DNA sequence analysis and more tests if needed	Week 12 questions (may be postponed if more time needed) Infectious disease term paper
Week 13 April 20-24	Madigan Chapter 14 (and more time on Chapter 13 if needed) Scientific poster guidelines	Functional diversity in prokaryotes Work on unknown microbe poster	Week 13 questions Unknown microbe poster
Week 14 April 27-May 1	Madigan Chapters 19 and 20 Research paper guidelines	Microbial ecosystems and nutrient cycles Work on unknown microbe research paper	Week 14 questions
Week 15 May 1 and 2	Madigan Chapters 21 and 22 Research paper guidelines	Microbial symbioses and microbes in human ecosystems Work on unknown microbe research paper	Week 15 questions Unknown research paper and lab notebook
Final exam week	At a time that works for your schedule	Exam 3: Microbial diversity, metabolism, and ecology	