

EASTERN MICHIGAN UNIVERSITY
DIVISION OF ACADEMIC AFFAIRS

**REQUEST FOR INCLUSION OF A COURSE IN THE
GENERAL EDUCATION PROGRAM:
EDUCATION FOR PARTICIPATION IN THE GLOBAL COMMUNITY**

DEPARTMENT/SCHOOL: BIOLOGY COLLEGE: ARTS AND SCIENCES
DEPARTMENT CONTACT: TAMMY GRECO CONTACT PHONE: 487-4242
CONTACT EMAIL: TGRECO@EMICH.EDU

1. Subject Code, Number, and Title: BIOL 306 Cell and Molecular Biology and Genetics
Laboratory
2. Credit Hours 2
3. Course Description
4. This course is (check one):
 - an existing course with no revisions (need not go through the input system)
 - an existing course with revisions (attach this form to Request for Course Revision form)
 - a new course (attach this form to Request for New Course form)
5. Check the General Education requirement this course is intended to meet. If the course is to be proposed for more than one requirement, submit a separate form for each one.
 - Effective Communication**
 - Quantitative Reasoning (*QR designation*)**
 - Writing Intensive (*WI designation*)**
 - Perspectives on a Diverse World**
 - Global Awareness
 - U.S. Diversity
 - Knowledge of the Disciplines**
 - Arts
 - Humanities

Science

 Social Science

 Learning Beyond the Classroom (*LBC designation*)

- Self and Well Being
- Community Service, Citizenship, and Leadership
- Cultural and Academic Activities and Events
- Career and Professional Development
- International and Multicultural Experience
- Undergraduate Research

6. Rationale. Provide a concise, clear, jargon-free explanation of why this is a General Education course and how it fits into this specific area of the program. (The rationale should explain to students why they are taking the course. It should address both why it is part of the General Education program and why it fits into the particular category.) This rationale should appear on the general course syllabus provided here and should be included in specific course syllabi given to students. Note: *The Writing-Intensive courses are designed to provide students with the opportunity to continue to develop their writing through engagement with disciplinary strategies and conventions. Those proposing a WI course should explain in the rationale how and why the course is a writing-intensive course.*

BIOL 306 is designed to enable students to apply the scientific method to answering questions in cell and molecular biology and genetics. In this course, students learn how to document their experiments and progress in a formal laboratory notebook, how to present their findings in the format of a peer-reviewed scientific journal, and how to present their findings in the format of PowerPoint presentations. Of the final grade in BIOL 306, 65 percent is based on the writing assignments. Students are provided with the tools to enable them to communicate successfully their scientific findings as scientists. Written and oral feedback on smaller, staged writing assignments, as well as opportunities for revision, provide students with the skills to improve their writing and excel at writing complete scientific papers. The final experience in the course involves a group research project, for which each student writes a full-length scientific paper and contributes to a group oral presentation. Students who successfully complete BIOL 306 have the ability to read critically and evaluate peer-reviewed journal articles and present their own research in the same format. As such, BIOL 306 meets the requirements of a Writing Intensive Course in the Major of the General Education program.

Justification for allowing a 2-credit class to serve as a Writing Intensive Course:

In BIOL 306, a large portion of the course grade is based upon written assignments and presentations. In the typical 3-credit writing intensive course, there is a requirement for 30-60% of the points to come from writing, which translates into a requirement for 45-90% for a 2-credit class. In BIOL 306, 65% of the points come from writing assignments and presentations. In addition, it should be noted that this course meets for 4 hours each week, and demands extra time outside of class to carry out the group research project.

7. Clearly and concisely explain how this course meets each of the General Education outcomes for the requirement checked in number five (all outcomes should be addressed). To do this, (a) list the General Education outcomes for the requirement and explain how the course meets each outcome; and (b) explain, in general terms, the method(s) of evaluation to be used in the course and how these methods assess the degree to which students have met the General Education outcomes for this requirement.

Outcome 1: Develop and employ successful, flexible writing and reading strategies that support sustained inquiry in a discipline

The major goals of this course are to teach students how to carry out scientific research, and to provide valuable hands-on experience with modern research techniques. This process includes: (1) learning effective strategies to locate appropriate reference materials from the library and online databases (2) reading the primary literature for crucial background information, (3) formulating a hypothesis, (4) designing the proper methodology, (5) conducting research, (6) keeping a formal laboratory notebook, (7) interpreting the results, and finally, (8) communicating those results, both in written and oral genres. Because students have limited experience with this process when they start the course, the course is designed to guide students through each of these steps in a progressive fashion. In the early part of the course, student groups carry out lab exercises on a series of topics relating to cell and molecular biology and genetics (see syllabus for details). Students complete several small writing assignments relating to these lab exercises, and many of these writing assignments involve reading primary literature. These small writing assignments correspond to the different sections of an entire scientific report. The culmination of these introductory lab exercises and writing assignments is a group research project that is carried out over several laboratory meetings toward the end of the course (see Outcome 3). Two important components of this assignment are reading/evaluating scientific journal articles and writing a complete scientific paper in journal format. Students learn to develop flexible reading and writing strategies for the field of cell and molecular biology by having multiple writing assignments on different lab exercises (each of which requires an improvement in writing and reading skills), by having many different types of writing assignments, but most importantly, by applying the knowledge gained about writing in one assignment to the next assignment to improve future writing assignments.

Evaluation:

Because a major part of doing research involves communicating the results of that research, assignments involving writing and/or presentation constitute 65% of the grade in this class. During the first portion of the class, students hone their paper writing skills by writing sections of a scientific paper. Later in the semester, they apply the skills they gained during the first portion as they write a complete scientific research paper (see syllabus for details). To aid the students in developing their biological writing skills, students are encouraged to visit the EMU writing center and to submit rough drafts of the paper sections to their instructor. A draft of this assignment is required. The formal laboratory notebook is another very important writing assignment (see Outcome 4). There are multiple notebook collections over the course of the semester, and students receive more points for the later collections of the notebook than for the first collection, so that they can take advantage of extensive feedback on the first collection (see "Laboratory Notebook Guidelines"). Students will have demonstrated that they have flexible writing and reading strategies if they can apply the skills learned in earlier assignments on future assignments and their finished product shows improvement.

Outcome 2: Use writing strategies that achieve the purposes(s) for writing and address the expectations of audience(s) within a disciplinary context

Learning to write for a scientific audience is specifically addressed as students write sections of the scientific paper and through the draft & revision process associated with the final lab report. In order to help students learn how to write for a scientific audience, scientific writing and the attributes of various portions of a scientific research paper are discussed in class. Students are encouraged to submit drafts of paper sections, and those who do this receive written feedback, guidance, and constructive criticism. This constructive criticism about their writing provides a valuable learning experience because the feedback is tailored to the individual students and relates to his/her own writing skills. Feedback focuses on how to address the proper audience by providing comments on whether students are writing at the appropriate level for a scientific audience. Feedback focuses on the purpose of scientific writing by providing specific comments on the particular purpose of each section of the papers. Feedback also focuses upon general writing skills such as grammar and clarity.

Evaluation:

To provide general guidance about scientific writing, and concrete examples on correct and incorrect ways to write scientifically, students are provided with a handout entitled "Guidelines for Writing a Scientific Paper" (attached), and assigned the book "How to Write & Publish a Scientific Paper" by Robert A. Day. In preparation to write the various sections of a scientific paper, we devote time during class to discuss a sample scientific paper, highlighting its format and the content of each section. With each writing assignment, students are supplied a handout that specifically addresses how students should write for the correct purpose in each section of their papers. Students

are also provided with detailed rubrics specific to each assignment. These rubrics outline the specific expectations for each section of each report, and lay out detailed point allocations. On these rubrics, there are items listed in the Introduction and General Consideration sections that specifically address writing for a scientific audience (see attached rubrics).

Outcome 3: Formulate research questions and employ strategies for researching and responding to those questions

Developing effective research strategies is important for this course, and even more important in life. Because practice makes perfect, to encourage the development of effective research strategies, students are expected to retrieve articles from the primary scientific literature that relate to various topics of study, including the BIOL 306 Genome Project presentation and the final research project report and presentations. In preparation for these assignments (and others), the first laboratory meeting is spent in the computer center at Halle Library, under the guidance of Paula Storm (the science librarian) gaining hands-on experience using literature search tools. To illustrate how BIOL 306 students put these skills to use, for the final project students are provided with a mystery DNA sequence and required to use these and other skills developed in the class to formulate a research question and specific hypotheses, search the primary literature for other studies on related topics, design aspects of the methodology to be used, carry out experiments, record data and observations in a formal laboratory notebook, analyze data, and interpret their results in the context of their original hypotheses. This experience provides students with hands-on experience carrying out a small research project in cell and molecular biology from start to finish. The culmination of this project includes a group presentation and an individual paper (see outcome 5). Additionally, because students gain proficiency with literature search tools they will leave the class better prepared to obtain information independently and able to engage in lifelong learning.

Evaluation:

The outcome of employing strategies for researching and responding to research questions occurs throughout the semester. A substantial amount of time is spent in class discussing how to formulate and test hypotheses and the necessity of appropriate controls to enable data interpretation. Students also gain skills (during lab meeting #1 at Halle Library) and experience using literature databases as they work independently and as small groups to research their BIOL306 Genome project and final group research projects, respectively. Students are required to reference the primary literature for many of the writing assignments, and provide copies of full length research articles relating to their topic of interest for the Genome project and final research paper. The assessment of final papers is described in detail under outcome 5.

Outcome 4: Use discipline-specific genres to communicate information

There are three major genres used to communicate information in cell and molecular biology: 1) the scientific paper, 2) the scientific presentation, and 3) the formal laboratory notebook. BIOL 306 students gain experience with all three of these modes of communication. The lab notebook, in particular, is of extreme importance to scientific investigation that takes place in the laboratory, because it details specific aspects of experimental design and serves as a diary of observations. This sort of information is essential when interpreting data while preparing scientific communications, and invaluable when attempting to repeat experiments. Within a corporate lab environment (where some students of BIOL 306 may eventually be employed), information contained in lab notebooks has additional significance as it may be used as important evidence within patent applications, to support claims about a product, or as evidence for other sorts of litigation. Lab notebooks are invaluable documents for researchers in this field and it is essential that they clearly document experiment preparation & protocol, results, and conclusions in an organized fashion.

Evaluation:

Students gain experience with writing scientific papers in the various report section assignments, and in their final project paper (see attached rubric). Students gain experience with giving scientific presentations in the presentation required for “The EMU Biology 306 Genome Project” (see attached handout & rubric) and in their final presentation on their group research project. Students gain experience with keeping a formal laboratory notebook by having three collections of the laboratory notebook, with extensive feedback written on the notebook after each collection. Again, specific details are outlined in the rubrics in the attached “Laboratory Notebook Guidelines.”

Outcome 5: Understand conventions for communicating, disseminating and interpreting information within a discipline.

The students learn the conventions of writing scientific papers by reading journal articles, from the detailed handout on “Guidelines for Writing a Scientific Paper” (attached), and from feedback and constructive criticism of paper sections and the rough draft of the final research paper. The group research project provides students with an excellent opportunity to learn how to formulate a hypothesis, carry out an experiment and interpret research findings. Students are expected to understand the theory underlying the techniques used to test their hypotheses, to be able to evaluate data collected over the course of the experiment, and to be able to communicate the results and present conclusions based on the data in their final papers (see Results and Discussion sections of rubric for project paper). For example, as outlined in the rubric, students need to be able to present results in the correct figure or table format, as well as text format, evaluate results in light of their original hypotheses, compare results and conclusions to other studies, offer explanations for their results, and draw conclusions. Because the format used mimics a specific scientific journal (Plant Physiology), the students gain a clearer understanding about how scientific research is published. The students learn the conventions for giving a scientific presentation while carrying out the “EMU Biology 306 Genome Project” and the final group project research presentation.

The Biology 306 Genome Project presentations are short presentations that provide an icebreaker for public speaking in the class. These presentations give students an opportunity to improve their presentation skills and become more comfortable with public speaking within a friendly classroom environment before delivering their portion of the final group research project presentation. Guidelines, tips, and pointers about how to deliver a formal research presentation are provided to educate students about proper presentation organization, specifics about slide design and content, and other useful general information about public speaking.

Evaluation:

The final writing assignment based on the group research project is a complete scientific paper, which follows the format of a peer-reviewed journal, and includes seven sections: Abstract, Title, Introduction, Methods, Results, Discussion, and Literature Cited (see attached rubric for project paper grading). The feedback on earlier assignments in the course provides students with the necessary suggestions to improve their writing skills in all of these areas (feedback on report sections). After the presentation for the "Genome Project" (see rubric within handout), students receive essential feedback about presentations, which can then be incorporated into their final presentations. The details of all of these assignments, as well as the schedule, can be found in the attached syllabus.

8. Attach a syllabus (1-inch margins and 10-12 pt. font). The syllabus must include the rationale from #6 above and clearly reflect the outcomes and methods of evaluation detailed in #7 above.

Please submit all materials in electronic form.

Action of the Department/College

1. Department

Vote of department faculty: For _____ Against _____ Abstentions _____

Department Head

Date

2. College

College Dean

Date

Action of General Education Advisory Committee

Vote of General Education Committee: For _____ Against _____ Abstentions _____

Chairperson, General Education Advisory Committee
Date

Approval

Associate Vice-President for Undergraduate Studies and Curriculum

Date

CELL AND MOLECULAR BIOLOGY AND GENETICS LABORATORY
BIOL306, WINTER SEMESTER 2007

SYLLABUS

Course description: This laboratory course provides students with an opportunity to use molecular and cellular techniques to probe aspects of gene inheritance and expression. Students will develop critical reasoning and laboratory skills in preparation for advanced laboratory studies, independent research projects at the sub-organismal level, as well as for cooperative learning internships.

Prerequisite: BIOL301 & BIOL305 (may be taken as co-requisites)

Course objectives: This course is a hands-on laboratory experience in using molecular and cellular techniques to study concepts related to the central dogma of molecular biology. By the end of this course, you should be able to:

- Complete calculations and make solutions and dilutions commonly encountered in the molecular biology laboratory
- Carry out with competency laboratory techniques in cellular and molecular biology, including light & electron microscopy, organelle isolation, genomic and plasmid DNA isolation, PCR techniques, DNA and protein gel electrophoresis, bacterial transformation, bacterial cell culture, primer design, BLAST, heterologous protein expression and detection
- Document your experiments and progress in a formal laboratory notebook
- Analyze laboratory data
- Locate useful sources of information using online literature databases and obtain these sources from the library
- Work as a team to implement a research project and present the data as both a scientific paper and oral presentation
- **Work safely and have fun in the lab!**

Instructors: Dr. Aaron Liepman, EMU Biology Department, 487-1023, 304 Mark Jefferson, aliepman@emich.edu, Dr. Heidi Lemmerhirt, EMU Biology Department, 487-4107, 108 Mark Jefferson, hlemmerh@emich.edu.

Office Hours: **Dr. Liepman:** Monday 10:00 AM - Noon, Thursday 11 AM – 1PM, and other times by appointment, **Dr. Lemmerhirt:** Wednesday 10:00-11:30 AM, Thursday 2:00 - 3:30 PM, and by appointment.

Labs: The laboratory section will meet in room 529 Mark Jefferson from 1:00-4:50 p.m. on Tuesdays or Wednesdays. **Completion of all of the laboratory exercises is mandatory.** If you are unable to attend lab during the scheduled period for some unusual circumstance, please arrange to come in another time to complete the lab.

Textbook, Coursepack, and Electronic Reserves: There is neither a required textbook nor coursepack to purchase for this class. All course materials will be made available in electronic form at EMU-online (www.emuonline.edu). For information about using EMU-online, a good place to begin is (www.emuhelpdesk.com). Also, the following link (www.emuhelpdesk.com/registration/eCompanion%20Registration.pdf) will take you to a useful

technical support document. The BIOL306 EMU-online web materials will contain relevant information about the theory behind the experiments, protocols, and assignments, plus many other useful resources and weblinks. You are responsible for gaining access to the online materials through eCompanion, and printing out all appropriate lab protocols and other materials **before** coming to class – pop quizzes may be administered at any time! You should also check this site regularly for course information, including results of experiments. Every attempt will be made to post materials at least by the Friday prior to lab. **You are expected to have read the background material for the week’s lab and to have written out a flow diagram of the experiment in your lab notebook before you come to class each week.** Mini-lectures will be provided to go over and expand on this material, however these mini-lectures are intended to supplement, not to replace a thorough reading of the protocol.

THIS IS A WRITING INTENSIVE COURSE

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Grading: Up to 1000 total points may be earned in BIOL306. The point breakdown is detailed below:

EMU-online Syllabus Quiz & email	10 points
Lab notebook collections 1-3 (40 pts; 80 pts; 80 pts)	200 points
Problem sets 1 & 2 (25 points each)	50 points
Report sections 1-5 (40 points each)	200 points
Library Assignment & Introduction to BLAST	40 points
Midterm exam	150 points
Online midterm course evaluation	10 points
BIOL306 Genome Project	50 points
Project report (independent)	100 points
Project presentation (group)	100 points
Pop quizzes	50 points
Participation	40 points
Total	1000 points

Grades will be assigned based on the percentage of points earned:

93-100 = A, 90-92 = A⁻, 87-89 = B⁺, 83-86 = B, 80-82 = B⁻, 77-79 = C⁺, 73-76 = C, 70-72 = C⁻, 67-69 = D⁺, 63-66 = D, 60-62 = D⁻, below 60% = E.

Description of Assignments

Library Assignment & Introduction to BLAST: This is a two part assignment – the 1st part will be a brief introduction to some useful library resources related to Biology, Biotechnology, and other Life Sciences. The 2nd part of the assignment is an introduction to BLAST, a powerful tool for the analysis of nucleotide and protein sequences. The Introduction to BLAST will begin as an in-class computer exercise that will require completion outside of class. By the end of these assignments, you should be able to carry out a sequence similarity search, locate relevant sources of information related to sequences of interest, and obtain these sources of information through the Halle Library. Details about these assignments may be found in the “Assignments” section of the BIOL306 webspace at EMU-online.

EMU-online Syllabus Quiz & email: The first assignment for the semester consists of two parts. The first part (worth 5 points) is for you to access the BIOL306 webpages at EMU-online, and take the BIOL306 syllabus quiz. The second part (worth 5 points) is for you to send your instructor an introductory email at the appropriate address listed above. Additional instructions about this assignment may be found in the “Assignments” section of the BIOL306 webspace at EMU-online. You will receive 10 points for completing this assignment. Your email address will be added to an email distribution list for the course. **Please be sure to send your introductory message from an account that you check regularly** as email may be used to communicate important course information and announcements.

Laboratory Notebook: *You must purchase a bound composition or laboratory notebook with numbered pages for exclusive use in this course.* This notebook should be used for notes taken in preparation for an experiment, during the conduct of the experiment, and in the analysis of the results of an experiment. **You should have a separate notebook for lecture notes for this course and for the numerous protocols and other handouts.** A three ring binder to organize these other course materials is recommended. Notebooks will be collected three times during the semester and graded based on organization, clarity, precision, and completeness according to guidelines that will be provided. The laboratory notebook will constitute 20% of the course grade, so be sure to invest sufficient time and effort to prepare and maintain it correctly. Detailed laboratory notebook guidelines may be found in the “Course Home” section of the BIOL306 webspace at EMU-online.

Problem Sets: There will be two graded problem sets due during the semester geared toward developing skills in completing the calculations commonly encountered in the molecular biology laboratory. There will be similar problems on the midterm exam. The problem sets may be found in the “Assignments” section of the BIOL306 webspace at EMU-online.

Report Sections: Laboratory reports are formally written descriptions of experiments and their outcomes. They are to be written on a word processor and submitted in both electronic and paper forms. Laboratory reports are expected to be written as if they were prepared for publication in a

peer-reviewed journal. In order to learn the process of writing such a paper, you will be assigned sections of a paper to be written for many of the scheduled experiments. The sections of a paper include a title, abstract, introduction, materials and methods, results, discussion, and literature cited. Instructions will be provided on the BIOL306 EMU-online webpages about how to write each section, including grading guidelines.

Exams: An in-class midterm examination will take place on the week of November 12th. Failure to attend the exam will result in a grade of a zero (unless you can provide documentation of a legitimate unforeseen circumstance). In place of a final exam, the final class period will be used for lab clean up and the BIOL306 Project Symposium.

BIOL306 Genome Project: In order to become familiar with the vast array of sequenced genomes and the resources available at the library and online, you will research a genome of choice and present a summary of your findings as a report and a brief presentation to the class. Additional details about this assignment will be provided in the “Assignments” section of the BIOL306 webspace at EMU-online.

Project Report: The final several experiments (#5-7) will be devoted to group projects. Each project will be carried out by two or three students. **Each group member will be required to write an individual report about the project.** This report should be written according to the guidelines given for each individual section of a scientific paper. Grading guidelines for this report will be provided along with other information in the “Assignments” section of the BIOL306 webspace at EMU-online. Please retain evidence of your contributions to the group project in case group members do not contribute equally.

Project Presentation: Each group should prepare a PowerPoint presentation about their experiment, including an introduction containing relevant background information, the methods used, the results obtained, the conclusions that can be drawn from the data, and a sense of the future directions where the experiment could be taken. Group project presentations will be delivered during the BIOL306 Project Symposium that will take place during the final lab period. Additional details about the presentation and the BIOL306 Project Symposium will be provided in the “Assignments” section of the BIOL306 webspace at EMU-online.

Pop Quizzes: You are expected to review background lab materials prior to the lab period. Over the course of the semester, pop quizzes may be administered to gauge the level of preparation for the lab exercises. These quizzes will be a piece of cake for the prepared student!

Participation: These points are allocated to encourage participation by all students in class activities and discussions.

Grade grievances & re-grades: The laboratory meeting time is not the appropriate time to discuss grading issues. If you have questions about your grade, please make arrangements to discuss these during office hours or by appointment. BIOL306/591 students may request a re-grade on any assignment, quiz, or exam by filing a formal written re-grade request. This request must be filed within one week (7 calendar days) following the return of the assignment, quiz, or exam. The re-grade request must be typewritten and include the following pieces of information: 1) a description of the portion of the assignment/quiz/exam that you feel merits re-grading, and

2) an explanation of why you feel the answer should be re-graded. You must turn in the original graded assignment, quiz, or exam along with the re-grade request. Please note that any re-grade request may result in the entire assignment or exam being re-graded, possibly changing points awarded on additional questions other than those specified in the re-grade request.

Lab Safety: There are a variety of potential safety hazards present in the cellular & molecular biology and genetics lab. To ensure your safety, that of your labmates, and other members of the EMU community, please observe the following safety guidelines:

- Use appropriate safety equipment (e.g., gloves, goggles, etc.)
- Do not eat, drink, or apply cosmetics in the lab
- Keep your lab area clean and uncluttered
- Label all reagents
- Discard waste in appropriate manner – do not dump chemicals in the sink unless instructed
- Discard broken glass in the glass trash
- Know the location of safety equipment (e.g., fire extinguisher, first aid kit)
- **Remember, if you are not sure about something, please ask your instructor!**

Additional fine print...

Late Work Policy: We understand that at certain points of the semester you may find yourself inundated with work, and unable to complete an assignment by the deadline. In the event that this scenario presents itself, you have the option to submit a **single assignment up to one week late**, without penalty. Consider this a “get out of jail for free card,” and use it wisely (if at all). Any additional assignments submitted late (but within 1 week of the actual due date), will be assessed a late penalty equaling 25% of the possible points available for the particular assignment. If an assignment is not received within a week of the due date, no credit will be granted. **Please note: several assignments will not be accepted after the deadline, these include: the three laboratory notebook collections, the final lab report and project presentation, and problem set II.**

Religious Holidays: University policy recognizes the rights of students to observe religious holidays without penalty. If a religious holiday that you observe conflicts with the lab period, please provide advance notice to your instructor so that arrangements may be made for make-up work, etc. If satisfactory arrangements cannot be made, you have the right to appeal to the head of the department.

Academic Dishonesty: Academic dishonesty, including all forms of cheating and/or plagiarism, will not be tolerated in this class. Penalties for an act of academic dishonesty may range from receiving a failing grade for a particular assignment to receiving a failing grade for the entire course. In addition, you may be referred to the Office of Student Judicial Services for discipline that can result in either a suspension or permanent dismissal. The **Student Conduct Code** contains detailed definitions of what constitutes academic dishonesty, but if you are not sure about whether something you are doing would be considered academic dishonesty, please consult with your instructor.

Classroom Management Issues: Students are expected to abide by the **Student Conduct Code** and assist in creating an environment that is conducive to learning and protects the rights of all members of the University community. Incivility and disruptive behavior will not be tolerated and may result in a request to leave class and a referral to the Office of Student Judicial Services for discipline. Examples of inappropriate classroom conduct include repeatedly arriving late, using a cellular telephone, or talking while others are speaking. You may access the Student Conduct Code online at www.emich.edu/sjs

Accommodations for Special Needs: It is the responsibility of any student with a physical and/or mental disability which may interfere with his/her performance in class, to visit the Access Service Office (203 King Hall; 487-2470) to be evaluated. Please notify your instructor as soon as possible about your intention to be evaluated for a disability or if documentation has been approved. This process will greatly facilitate any necessary accommodations, and should be initiated as early during the semester as possible since retroactive accommodations are not possible.

Student and Exchange VISitor Statement (SEVIS): The Student Exchange Visitor Information System (SEVIS) requires F and J students to report the following to the Office of International Students (229 King Hall) within ten (10) days of any of the following events:

- Changes in your name, local address, major field of study, or source of funding
- Changes in your degree-completion date
- Changes in your degree-level (ex. Bachelors to Masters)
- Intent to transfer to another school

Prior permission from the Office of International Students is needed for the following:

- Dropping ALL courses as well as carrying or dropping below minimum credit hours
- Employment on or off campus
- Registering for more than one ONLINE course per term (F-visa only)
- Endorsing I-20 or DS-2019 for re-entry into the USA

Failure to report may result in the termination of your SEVIS record, arrest, and even deportation. In you have questions or concerns, contact the Office of International Students (not your instructor) at 487-3116.

Descriptions of Lab Exercises:

Library exercise: We'll take a short field trip to a computer lab in the Halle Library, where we'll begin with an introduction to the BIOL306/591 Genome Project. Next we will explore the resources available to EMU students and become familiar with effective literature search tactics, and gain the skills needed to acquire books, journal articles, and other information sources of interest from the Halle Library. You may use this time to begin researching for your BIOL306/591 Genome Project Presentation. Finally, we'll learn about BLAST, using an interactive tutorial at the National Center for Biotechnology Information (NCBI).

Experiment #1 Chlamydomonas deflagellation: This experiment will introduce students to basic methods in the molecular and cell biology laboratory including the use of micropipettes, the pH meter, digital balances, and light microscopes as well as experimental design and hypothesis generation.

Experiment #2 Subcellular fractionation: This experiment will introduce students to solution preparation and methods for isolating intact organelles, visualizing them under the microscope and assaying chlorophyll content.

Experiment #3 Polymerase chain reaction (PCR) amplification of Alu dimorphisms: This experiment will introduce students to the use of molecular and genetic techniques to identify individuals. Techniques used will include human genomic DNA isolation, polymerase chain reaction, and DNA gel electrophoresis.

Experiment #4 Handling and analysis of recombinant DNA: This experiment will introduce students to bacterial transformation with plasmid DNA, and techniques used to select and screen bacterial populations for cells containing a DNA molecule of interest. Techniques used will include bacterial transformation, selection, blue-white screening, plasmid DNA purification, and restriction analysis.

Experiment #5 Heterologous expression and protein detection: This experiment will introduce students to the production of recombinant proteins in bacteria and their detection using protein gel electrophoresis and enzyme assays.

Experiment #6 *In silico* and RT-PCR analysis of gene expression in *Arabidopsis thaliana*: This experiment will introduce students to the isolation of RNA from plant tissues, and the analysis of gene expression using computer databases and reverse transcriptase PCR.

**CELL AND MOLECULAR BIOLOGY AND GENETICS LABORATORY
BIOL306, WINTER SEMESTER 2007**

LABORATORY NOTEBOOK GUIDELINES

1st COLLECTION (40 pts): DUE JANUARY 23/24/25, 2007

2nd COLLECTION (80 pts): DUE FEBRUARY 20/21/22, 2007

3rd COLLECTION (80 pts): DUE APRIL 17/18/19, 2007

An essential part of this class will be the preparation and maintenance of a laboratory notebook. The laboratory notebook is an invaluable resource. It serves as a diary of experiments, and like a diary, the more detailed - the better! I cannot count how many times I have needed to consult a lab notebook for information about a protocol used for an experiment, to review a result, or to provide information to a colleague. Your lab notebook will be the biggest (and most valuable, percentage-wise) assignment in this class – totaling 20% of the course grade. With attention to detail and a modest investment of time **before, during, and after each lab**, this should also be the easiest assignment. Lab notebooks are best prepared incrementally, and you will do yourself a great service by keeping up the lab notebook as you progress through the semester. **Waiting until the last minute to complete the lab notebook is a *very bad idea*.**

When	What to do...
Before lab	<ol style="list-style-type: none"> 1. Read through the lab writeup and prepare a flow-chart summarizing the main procedures that will be conducted and the relationships of these procedures to one another. There is no need to re-write the entire protocol. 2. If necessary, prepare data tables in which to enter data collected during the laboratory procedure. 3. Answer as many questions for thought posed in the lab writeup as possible.
During lab	Collect and record data, note any departures from the lab writeup.
After lab	<ol style="list-style-type: none"> 1. Take a quick look through the notebook and clarify or annotate as needed. Sometimes details get lost when the experiment moves too quickly. It is best to do this soon after the lab, while details are still fresh in the mind. 2. Analyze the data collected by your group (and other groups – where possible), complete all necessary calculations. 3. Summarize conclusions you can make based on the results obtained by your group (and other groups – where possible). 4. Answer any remaining questions for thought posed in the lab writeup.

Table I. Laboratory notebooks, what to do, and when to do it

All laboratory notes should be recorded in a bound composition or laboratory notebook with numbered pages (you may hand-number the pages if you are unable to find a pre-numbered notebook). This notebook should be used exclusively for BIOL306 notes taken in preparation for an experiment, during the experiment, for the analysis of the results, and for summarizing conclusions after completing an experiment. Questions for thought (presented in italicized bold print) are included in the lab writeup to probe and reinforce your understanding of the material

covered in the lab. If you have difficulty answering these questions, re-read the lab writeup. If after doing this, you're still confused, discuss the question with your instructor.

Before you begin to use your lab notebook, write your name inside the notebook and on the cover. Reserve the first few pages for the table of contents to be completed as you complete experiments and enter information into the notebook. Laboratory notebooks should be handwritten in ink as the experiment proceeds. You need not copy the protocol in the lab manual word for word, instead you should refer to the name of the protocol, which numbered steps were completed, and any (even minor) deviations from the protocol as written.

In addition to notes taken during the conduct of the experiment, the laboratory notebook should contain:

- 1) A summary flowchart of each experiment **prepared prior to class**
- 2) Answers to all questions posed in the laboratory protocol
- 3) All calculations necessary for completion of the experiment
- 4) Copies of all gel pictures – make sure these are clearly labeled and interpretations noted
- 5) A record of all observations and other data generated
- 6) Interpretations and preliminary conclusions
- 7) Page numbers and dates on each page that correspond with the table of contents

The lab notebook should be kept in strict chronological order and all pages should be numbered and dated. You may start a new page when you begin a new experiment, but do not leave pages empty to go back and record part of an experiment later. Record experiments in the order that you do them, even if it differs from the order in the syllabus. It is important to label all entries in your notebook so that you or another reader can quickly determine what you were doing on a particular day. These labels should also be used in the table of contents. If the results or conclusions from a lab follow the conduct of the lab by several pages, a note should be made on the original page directing the reader to the page where these results or conclusions are located. To delete an entry, draw a line through it so that it is still legible and refer to the page number where the corrections can be located. The corrections should be dated with the date they were recorded. You will need a separate notebook for mini-lecture notes, handouts, and other class materials. A three-ring binder may be best for this purpose.

Your notebook should allow you to recall precisely what you did in the laboratory – and it will be especially important that you are able to do so when you are writing lab reports (and sections of lab reports). A good notebook should allow another student or the instructor to recreate your actions, including all mistakes or missteps made (some of the best scientific discoveries have been made by accident!). Notebooks will be graded according to the notebook grading guideline sheets that are provided. Grades will be based upon organization, clarity, precision, and completeness. **Please read through the guidelines so that you understand the expectations.** When submitting your notebook for grading, please be sure to include the corresponding grading sheet with your name on it. If you have any questions about notebooks, notebook policy, or anything else, please ask! Sample pages from an excellent lab notebook prepared by a former BIOL306 student are available for viewing in the DocSharing section.

Please NOTE: Laboratory notebooks will be collected only on the specified dates – late notebooks will not be accepted.

Guidelines for Laboratory Notebook Collection #1 (Due January 23/24/25, 2007)

Name:	EX	VG	GD	AV	BA	PO	Abs
Experiment Preparation – Flow-chart of the experiment is drawn up prior to beginning protocol. Preliminary calculations are completed and include units, conversion factors, and other relevant information.	8.0	7.2	6.4	5.6	4.8	4.0	0
Experimental Protocol – Published protocol or handout is referenced and exceptions to protocol are noted. Important details such as which lane on a gel each sample is loaded in and other useful notes on the conduct of the experiment are included. Calculations are completed	8.0	7.2	6.4	5.6	4.8	4.0	0
Results – The results of each part of each experiment are included in the notebook. Calculations are completed. Gel pictures and drawings are completely labeled.	8.0	7.2	6.4	5.6	4.8	4.0	0
Conclusions – Interpretations and preliminary conclusions are noted. For example, the sizes and putative identities of all bands on a gel (relative to the molecular weight markers that were used) are noted. All questions posed in the experiment protocol are answered.	8.0	7.2	6.4	5.6	4.8	4.0	0
Format, Organization & Neatness – Notebook is kept in strict chronological order, pages are not skipped. All entries are dated and identified with respect to the title or number of the experiment that they detail. Pictures and other materials are neatly taped in the notebook in the appropriate position. Lecture notes are not included in the laboratory notebook. An updated table of contents is included.	8.0	7.2	6.4	5.6	4.8	4.0	0
Total (40 points)							
Score (/ 40)							

Guidelines for Laboratory Notebook Collection #2 (Due February 20/21/22, 2007)

Name:	EX	VG	GD	AV	BA	PO	Abs
Experiment Preparation – Flow-chart of the experiment is drawn up prior to beginning protocol. Preliminary calculations are completed and include units, conversion factors, and other relevant information.	16.0	14.4	12.8	11.2	9.6	8.0	0
Experimental Protocol – Published protocol or handout is referenced and exceptions to protocol are noted. Important details such as which lane on a gel each sample is loaded in and other useful notes on the conduct of the experiment are included. Calculations are completed	16.0	14.4	12.8	11.2	9.6	8.0	0
Results – The results of each part of each experiment are included in the notebook. Calculations are completed. Gel pictures and drawings are completely labeled.	16.0	14.4	12.8	11.2	9.6	8.0	0
Conclusions – Interpretations and preliminary conclusions are noted. For example, the sizes and putative identities of all bands on a gel (relative to the molecular weight markers that were used) are noted. All questions posed in the experiment protocol are answered.	16.0	14.4	12.8	11.2	9.6	8.0	0
Format, Organization & Neatness – Notebook is kept in strict chronological order, pages are not skipped. All entries are dated and identified with respect to the title or number of the experiment that they detail. Pictures and other materials are neatly taped in the notebook in the appropriate position. Lecture notes are not included in the laboratory notebook. An updated table of contents is included.	16.0	14.4	12.8	11.2	9.6	8.0	0
Total (80 points)							
Score (/ 80)							

Guidelines for Laboratory Notebook Collection #3 (Due April 17/18/19, 2007)

Name:	EX	VG	GD	AV	BA	PO	Abs
Experiment Preparation – Flow-chart of the experiment is drawn up prior to beginning protocol. Preliminary calculations are completed and include units, conversion factors, and other relevant information.	16.0	14.4	12.8	11.2	9.6	8.0	0
Experimental Protocol – Published protocol or handout is referenced and exceptions to protocol are noted. Important details such as which lane on a gel each sample is loaded in and other useful notes on the conduct of the experiment are included. Calculations are completed	16.0	14.4	12.8	11.2	9.6	8.0	0
Results – The results of each part of each experiment are included in the notebook. Calculations are completed. Gel pictures and drawings are completely labeled.	16.0	14.4	12.8	11.2	9.6	8.0	0
Conclusions – Interpretations and preliminary conclusions are noted. For example, the sizes and putative identities of all bands on a gel (relative to the molecular weight markers that were used) are noted. All questions posed in the experiment protocol are answered.	16.0	14.4	12.8	11.2	9.6	8.0	0
Format, Organization & Neatness – Notebook is kept in strict chronological order, pages are not skipped. All entries are dated and identified with respect to the title or number of the experiment that they detail. Pictures and other materials are neatly taped in the notebook in the appropriate position. Lecture notes are not included in the laboratory notebook. An updated table of contents is included.	16.0	14.4	12.8	11.2	9.6	8.0	0
Total (80 points)							
Score (/ 80)							

**CELL AND MOLECULAR BIOLOGY AND GENETICS LABORATORY
BIOL306, WINTER SEMESTER 2007**

The EMU Biology 306 Genome Project

Objectives:

- Introduce students to genomics and the amazing, rapidly increasing collection of fully sequenced genomes from diverse organisms
- Increase proficiency with obtaining information from the library and reputable online sources
- Strengthen presentation skills

Assignment: This assignment is worth 50 points.

1) Choose an organism with a **fully-sequenced genome** to study. As of January 2007, over 400 completed genomes (eukaryotic + bacterial) have been deposited in the NCBI sequence database. There are many additional ongoing genome projects that are not yet complete, but these are not eligible for this assignment, nor are viral genomes. Some good sites where you may wish to begin looking are:

NCBI Genomic Biology: <http://www.ncbi.nlm.nih.gov/Genomes/> - this is probably the most complete and up-to-date genome resource

Genome News Network (GNN): <http://www.genomenetwork.org/> - another excellent resource, includes nice images of the organisms, but not updated as regularly

2) Become an expert about this fully sequenced genome by prospecting for information at the library and online. Print off the original journal article describing the genome sequence and include this as part of your report. You should be able to provide the following information about the organism of your choice (**make sure to cite your sources of information - even websites should be cited**):

- Scientific name of organism & common name(s) of organism (if applicable)
- Type of organism (i.e., archaea, bacteria, fungi, animal, plant, etc.)
- Taxonomic classification (full lineage)
- Habitat & distribution of organism
- One or more images (**be sure to cite the image source**)
- Utility of genome - Why sequence this genome? What uses may it have?
- Size of the genome – How many chromosomes? How many genes? How many nucleotides?
- Who sequenced the genome and where was it done?
- Why did you choose this genome to study?
- What is an interesting tidbit of information you learned about this organism?
- The reference for the fully sequenced genome, in the format shown.
- Links to at least three useful web resources/tools related to the sequenced genome of choice.
- **Students enrolled in BIOL591/592** should include an additional 2-3 slides summarizing information of interest from the primary research article describing the completed genome

NCBI provides several genomic biology tools and resources, including organism-specific pages that include links to many web sites and databases relevant to that species. We invite you to explore the links provided on this page.

Assembly and Annotation Information

- [AGP Resources](#)
- [Annotation Information](#)
- [Assembly Information](#)
- [Genome Glossary](#)
- [NCBI Handbook, Chapter 14: Genome Assembly and Annotation Process](#)

Genome Resources Workshops

Meeting Slides Date

Genome Resources

- ▶ [Entrez Genome](#)
- ▶ [Fungal Genomes Central](#) **NEW**
- ▶ [Genome Projects Database](#)
 - [Eukaryotic](#)
 - [Fungi](#)
 - [Insects](#)
 - [Mammals](#)
 - [Microbial](#)
 - [Plants](#)
- ▶ [Map Viewer](#)
- ▶ [Organelles](#)
- ▶ [Plant Genomes Central](#)
- ▶ **Viral Resources**
 - [Influenza Virus Resource](#)
 - [Retroviruses](#)
 - [Viral Genomes](#)

You'll find answers to many of these questions on the NCBI Genomic Biology webpages; a screenshot of the front page is shown above. To access some of the information you'll need, beneath the "Genome Resources" column, choose the type of organism whose genome interests you. For this example, Eukaryotic is chosen, but you are free to choose any eukaryotic (mammals, plants, fungi, or insect), or microbial species – no organelles or viruses, please.

23 Eukaryotic Genome Sequencing Projects Selected: Complete - 23, Assembly - 0, In Progress - 0

Organism Information			Sequence Information							Links									
Organism	Group	Subgroup	TaxID	Genome Size (Mb)	# Chr	Status	Method	Depth	Release Date	Center/Consortium	GB	PM	R	G	T	B	M	F	
Arabidopsis thaliana	Plants	Land Plants	3702	119.2	5	Complete	WGS & Clone-based		12/14/2000	Arabidopsis Genome Initiative [more]	GB	PM	R	G			B	M	F
Caenorhabditis elegans	Animals	Roundworms	6239			Complete	WGS		12/16/1998	C. elegans Sequencing Consortium	GB		R	G	T	B	M	F	
Candida glabrata CBS 138 CBS138	Fungi	Ascomycetes	284593	12.28	13	Complete	WGS	8X	07/02/2004	Genolevures [more]	GB	PM	R	G			B	M	F
Cryptococcus neoformans var. neoformans JEC21	Fungi	Basidiomycetes	214684	19.05	14	Complete	WGS	12.5X	01/07/2005	TIOR [more]	GB	PM	R	G			B	M	F

The screen that appears indicates that there are over 300 eukaryotic genome projects either completed or underway. Because we are interested only in completed genomes, make sure to select “Complete” under “Sequencing status” and then click go. Now only the 23 completed eukaryotic genomes are displayed. For this example, *Arabidopsis thaliana* was selected.

Genome Project > *Arabidopsis thaliana* (mouse-ear cress)

Small flowering plant of mustard family, became the first plant to be completely sequenced

Resource Links

NCBI Resources

- MapViewer
- Plant Central
- BLAST genome
- TaxPlot

Organism data in GenBank

- mRNA
- EST
- Genomic
- Protein

Sequencing Centers

- WashU
- MIPS
- CSH
- SPP Consortium
- CBC
- Genoscope
- Kazusa
- TIGR

Sequencing

Lineage: *Eukaryota; Virdiplantae; Streptophyta; Embryophyta; Tracheophyta; Spermatophyta; Magnoliophyta; eudicotyledons; core eudicotyledons; rosids; eurosids II; Brassicales; Brassicaceae; Arabidopsis; Arabidopsis thaliana*

Photo: courtesy of Luca Comai (University of Washington, Seattle, WA)

Search Map Viewer for Find Advanced Search

Available maps:

Now a screen displaying information about the *Arabidopsis thaliana* genome project is displayed. By exploring this page (the one corresponding to your organism of choice), you should find all of the information (and more) that you’ll need to make your presentation.

3) Report your findings to the class as a short (~5 minute) Powerpoint presentation. For your convenience a template is provided in the Doc Sharing section of the EMU-online BIOL306 webspace.

4) Contribute your presentation to become a chapter of the Virtual EMU Genome Project Encyclopedia (place your Powerpoint presentation in the BIOL306/591 Genome Project Dropbox on the EMU-online BIOL306 webspace), and submit a printout of your presentation and a paper copy of the original reference for the sequenced genome for addition to the BIOL306 Wall of Genomes

Note: Questions about the EMU Biology 306 Genome project are very likely to appear on the Midterm examination.

Grading Guidelines for BIOL306 Genome Project

Name:

	EX	VG	GD	AV	BA	PO	Abs
Presentation & report contains all requested information	25.0	22.5	17.5	12.5	10.0	5.0	0
Sources of information, photos, etc. are properly cited	5.0	4.0	3.0	2.0	1.5	1.0	0
Copy of original journal article describing genome sequence obtained	5.0						0
Powerpoint presentation and hardcopy of presentation submitted	5.0			2.5			0
Overall quality of presentation to class	10.0	9.0	8.0	7.0	6.0	5.0	0
Total (50 points)							
Score (/ 50)							

Comments:

**CELL AND MOLECULAR BIOLOGY AND GENETICS LABORATORY
BIOL306, WINTER SEMESTER 2007**

Final Lab Report Assignment

The final lab report will cover the heterologous expression laboratory exercises (lab #5). This report should contain all the sections of a standard scientific paper including an abstract, introduction, materials and methods, results, discussion, and literature cited section. Although groups will work together to prepare and present a group presentation related to these experiments, **each group member must write his or her own paper**. This paper is the principal means with which to assess each individual's understanding of the project and ability to communicate the results of the project. Therefore, it is critical that each student submit a unique report. You may work with other member(s) of your group to analyze data and discuss findings, but you should work individually to write your own paper, prepare figures, etc.

In addition to describing the procedures you carried out and the results of your experiments, it is important to place your work in the context of related work in a particular topic area. Each mystery ORF encodes a protein related to other(s) that have been characterized. After identifying and analyzing the protein encoded within your assigned mystery sequence using sequence analysis tools you should discover some excellent clues about your protein and its potential function(s). Use the information you discover to conduct a literature search using PubMed or other applicable databases. Identify at least four (of course, more than this are encouraged) relevant references from the primary literature (ie., peer reviewed journal articles, review articles are also OK) that describe research upon proteins related to your protein, and use these as sources of background information for your report. With your report, you should include full printouts of three of the most useful references that you found, with particularly relevant sections marked/highlighted. Remember to paraphrase information that you learn from your sources - do not simply copy excerpts from these articles into your paper, as this constitutes plagiarism. Instead, summarize relevant information *in your own words*. If you choose to use direct quotes from a published paper in your report, you must: 1) use quotation marks around the excerpt, **and** 2) cite the source of the excerpt. The use of direct quotes (even those that are properly cited) should not be necessary and is strongly discouraged. Plagiarism is a serious form of academic dishonesty; any report containing plagiarism will receive a grade of zero, and the author will be reported to EMU student judicial services. If you have questions about plagiarism, or anything else related to the final lab report, please ask your instructor.

Each of the sections should be formatted as detailed in the handouts for the individual report sections that have been posted previously within the BIOL306/591 webspace at EMU-Online. For additional tips about writing a scientific paper, you are encouraged to consult the book "How to write and publish a scientific paper" by Robert A. Day (call number T11.D33). This helpful book has been made available through course reserves at the Halle Library. While your instructor may be somewhat familiar with the topic of your report, be sure to provide sufficient background information within the introduction section to allow any educated reader to understand what you did and why. In the discussion section, be sure to highlight what you have contributed and what experiment(s) could be conducted next to continue the research. The report should be 3-6 double-spaced typewritten pages in length, not including any figures and/or data tables.

Final lab report draft policy: Writing is by nature an iterative process. A typical scientific paper undergoes numerous drafts before publication in a scientific journal. You will have the opportunity to submit a draft of your final lab report, receive comments and suggestions from your instructor, and use the feedback you receive to improve your report. While this portion of the assignment is completely optional, it is highly recommended. Students who complete the draft, and follow the guidelines will be eligible to receive up to **5 extra credit points** based on the quality of the draft & perceived effort invested. There are several conditions that must be met to be eligible for these extra credit points:

- 1) The draft must be submitted as an MS Word document to the “Final lab report drafts” dropbox found in the BIOL306/591 webspace no later than 7 days prior to the actual due date of the final lab report (The earlier, the better! Of course, submissions will be accepted anytime before the draft deadline.).
- 2) An outline of the report must accompany the draft.
- 3) The draft should not be a “rough draft” – while the draft need not be perfect, it should be well on its way toward becoming a final draft in terms of content and organization, and relatively free of grammatical and spelling errors – figures should also be included. Rough drafts will be returned without comments, and extra credit points will not be awarded.
- 4) If you are experiencing problems with particular aspects of the report, list and briefly explain these on the outline page(s) so that your instructor is able to assist with these specific issues.

If you submit a draft, your instructor will try to return it with comments no later than the end of the weekend before the final report is due. Please note that your instructor will not evaluate drafts submitted anytime after the deadline, so if you choose not to submit a draft of the final report via the process outlined above, you will waive the opportunity to receive feedback about your report prior to the due date

The grading guidelines are presented below. Please print off these guidelines and submit them along with your final lab report.

Evaluation Guidelines for Final Lab Report (due at the start of lab on April 16/17/18, 2007)

NAME:	EX	VG	GD	AV	BA	PO	AB
Title: Includes descriptive title that is grammatically correct.	5	4.5	4	3	2	1	0
Abstract: Includes concise summary of the entire paper, including the introduction, materials and methods, results, and conclusions. Stays within a 200 word limit and the number of words in the abstract is noted.	10	9	8	7	6	5	0
Introduction: Includes an explicit purpose and testable hypothesis. Includes sufficient background to understand the field of study and the experiment that was undertaken. Uses a minimum of four references to the primary literature to lay this foundation (the requirement is for four references total in the paper, they do not all have to be used in the introduction).	14	13	11.5	10	8.5	7	0
Materials and Methods: Includes concise narrative description of how the entire experiment was conducted, giving enough detail that the experiment could be repeated by an educated reader. Assumes that the reader knows basic lab techniques and refers to published protocols when appropriate.	14	13	11.5	10	8.5	7	0
Results: Includes narrative summary of all results. Includes figures and tables as appropriate. All figures and tables are labeled and include descriptive legends that allow the reader to interpret the figure without having to read the entire section. Avoids presenting the same information more than once. Avoids presenting raw data.	14	13	11.5	10	8.5	7	0
Discussion/Interpretation: Includes plausible interpretation of all results that places the results in the context of the hypothesis and previous research. Avoids presenting results outside of context. Includes reasonable and justifiable (but not excessive) speculation about discrepancies with previously published work and/or about extensions of the results obtained. Does not dwell on possible sources of experimental error. Summarizes major conclusions at the end of the section, and includes mention of future direction(s).	14	13	11.5	10	8.5	7	0
Literature cited: Includes at least four references to the primary literature. Uses proper parenthetical citation format within the text and includes full reference information at the end of the section. Avoids direct quotes and unreferenced statements that are not common knowledge or original ideas. Highlighted printouts of at least three references are included.	14	13	11.5	10	8.5	7	0
Style, mechanics and overall report quality: Formal tone maintained throughout. Information included in appropriate sections of the paper. Report is reasonably free of errors in spelling, grammar, and punctuation. Sections of the paper “fit together” and care has been taken to provide a high-quality and professional lab report.	15	13.5	12	10.5	9	7.5	0
Total (100 points)							

**CELL AND MOLECULAR BIOLOGY AND GENETICS LABORATORY
BIOL306, WINTER SEMESTER 2007**

Final Group Research Project Presentation

Scientists very frequently give oral presentations about their research and it is important to gain proficiency with this mode of communication. There are several goals of this assignment: 1) to provide an opportunity for students to practice the delivery of a presentation, 2) to share the knowledge gained about mystery proteins with other members of the class, and 3) to work as a team to prepare a presentation. Strong presentation skills are also useful outside of the classroom. They come in very handy when applying for a job, solving problems, applying for grants, gaining entry into graduate/medical/dental/law school, convincing your local legislator to vote on a particular issue, etc.

In addition to providing a useful learning experience, we hope that this presentation will be fun! It is usually much easier to stay focused upon a presentation delivered with enthusiasm, and it is these presentations that spread excitement about a topic. So be enthusiastic, try to engage the audience and pass your enthusiasm to each member. That said, please also treat this presentation seriously, giving it extra effort and energy and being sure to illustrate important concepts clearly. Make sure to dress appropriately, as if you were presenting your work at a scientific meeting. While there is no need to go out and buy a new suit, please leave the ripped jeans at home. We could spend an entire course learning about and practicing effective presentation techniques, but we don't have time! In lieu of such a significant investment of time, some specific guidelines about the presentation follow below, followed by a short but very worthwhile article about delivering effective presentations.

Specific guidelines

The presentations should be 15-20 minutes long. **Each group member should contribute and present a relatively equivalent portion of the talk.** The majority of the grade for the presentation will be a group grade but each group member will receive an individual score as well. Please review the grading guidelines as you are preparing your presentation (see below) and please complete the personal and peer review sheet (also below) before coming to class.

Include most of the elements of your project paper in abbreviated form (e.g. introduction, results with a brief discussion of the experimental techniques used to obtain those results, discussion, and future directions), as well as an opening outline slide and closing conclusion slide(s). Focus on why the topic is interesting to you and why it is broadly important. The other students should walk away from your presentation knowing something about your topic, what you discovered in your project, and why they should care about the area of research. As none of the projects have been completed to the degree that they would be in a true scientific presentation (and since science is perpetually a work in progress...), please be sure to include a description of future directions about how this research could be extended near the conclusion of your presentation.

A computer equipped with MS Powerpoint and a projector will be available for use. Your presentation should be prepared using Powerpoint since this is the standard program used for scientific (and most other) presentations. The presentation should include an outline, background information, graphs, pictures of gels, and other relevant information. Take advantage of Powerpoint to include animation and graphics, these can really breathe life into a presentation if

used effectively. If you need assistance incorporating graphics or other Powerpoint features into your presentation please contact your instructor.

Please structure your talk carefully. Plan to spend about one minute on each slide. Logistically, you should limit your text to no more than 8 lines per slide and use large, easy to read text (Arial is recommended). As with all of your assignments, please proofread carefully to avoid typos. Please do not read your presentation. It is okay to refer to notes occasionally but you should know what you want to say without having to rely on them. An effective strategy to minimize reliance on notes is to build cues into your slides as prompts. Be sure to engage your audience by speaking to them, not the wall or the projected slides.

Remember you will present your research project as a team. Just as a football team practices and doesn't unveil an elaborate new playbook on game day, you should practice your talk before presentation day. It is very difficult to deliver a polished presentation, especially one involving contributions from multiple members, without first practicing it. Aside from the actual content of the presentation there are other things to think about, for instance, how transitions between speakers will be managed, where group members should stand before and after presenting, etc. **The best idea is to practice and time the presentation at least once in front of someone (good-humored roommate, friend, parent...!?!) before you give it.** It is amazing how many bugs it is possible to work out of a presentation by rehearsing it even once before delivery to the class. Having someone else watch your presentation allows an independent observer to point out issues that you may not have identified and let you know if your take home message is coming across clearly. Be prepared to answer questions after your talk. You will not be able to include everything that you know in the talk so there are likely to be questions. During the question and answer session, if you do not know the answer, do not be afraid to say so.

Lastly, try not to be nervous – your presentation will fall upon the ears of a friendly audience of your peers (and one or two mean old instructors). One very common pitfall in giving a presentation is talking too fast. If you find yourself getting nervous and speeding up, stop for a moment to collect yourself and then proceed at a slower pace. If you lose track of your position on a slide, don't panic, pause to take a look at the slide and start over if necessary. Keep in mind that you know a lot more about your topic than anyone else in the class, and everyone else in the class knows that they will have to get up and give a presentation too, so they should be forgiving.

Evaluation guidelines for the Final Project Presentation

Name:	EX	VG	G D	AV	BA	PO	AB S
<p>Organization and Structure The presentation flows clearly from one idea to the next. Introduction outlines presentation, provides useful background information and context, establishes main ideas , and includes hypothesis tested. Body of presentation includes relevant information, including methods used and results obtained, and uses visual aids effectively to demonstrate points. Conclusion recaps main points and leaves the audience with a “take home message.”</p>	20	18	16	14	12	10	0
<p>Information Presented Presentation provides sufficient background for the audience to understand the topic and its relevance & importance. Speakers provide an original and interesting summary of their research into the topic. Speakers answer questions with appropriate detail if answers are known.</p>	20	18	16	14	12	10	0
<p>Visual Aids Presentation demonstrates creativity and effort. Visual aids are effective for demonstrating the importance of the topic, describing complex ideas included in the presentation, and detailing results of project experiment. Visual aids borrowed from the internet or other sources are properly cited.</p>	20	18	16	14	12	10	0
<p>Mechanics (group) Presentation is completed within allotted time but is not too short. Each group member is allotted (relatively equal) portions of the project to present.</p>	15	13.5	12	10.5	9	7.5	0
<p>Mechanics (individual) Each individual makes a substantive contribution to overall presentation. Presentation is delivered with appropriate formality, eye contact and clear speech without heavy reliance on notes.</p>	15	13.5	12	10.5	9	7.5	0
Overall presentation quality	10	9	8	7	6	5	0
Total							

Notes:

**CELL AND MOLECULAR BIOLOGY AND GENETICS LABORATORY
BIOL306, WINTER SEMESTER 2007**

GUIDELINES FOR WRITING A SCIENTIFIC PAPER

I. GENERAL COMMENTS:

Precise scientific thought should be expressed in precise writing. Unfortunately, a glance at almost any scientific journal will reveal that the ideal is not attained often. Indeed, many of the accusations by the non-scientific community of "obscurity" and "elitism" within the scientific community probably originate in the sad fact that many scientists are not capable of expressing their hypotheses and conclusions clearly and simply. Fortunately, much of the confusion can be dissipated if two guidelines are followed: 1) consider writing as part of the methodology of science, and 2) substitute simplicity of expression for flamboyance. The first implies that *as much effort and consideration should be given to the organization of the paper as was given to the execution of the study*. The second implies that the writer should employ short, crisp sentences uncluttered by multiple clauses and prepositional phrases.

Before you accept the following suggestions as dogma, you should be aware that different journals use different styles. The practices outlined here are simply the most common.

The first half of this handout deals with paper organization. The second half discusses common mechanical problems found in scientific writing and offers suggestions for avoiding them.

II. FORMAT:

The scientific paper has the following elements: Title, Abstract, Introduction, Methods, Results, Discussion, and Literature Cited. The actual words "Introduction," "Methods," etc. are used to head the sections of your paper. These words are centered and followed by the text for that section. You do not have to begin a new page for each section. Illustrative tables and figures are placed at the end of the text and before the Literature Cited, which is always last. Tables and graphs must be fully labeled with a descriptive explanation of what is being shown and referred to specifically by number (e.g., Table 1, Fig. 1) in the text. Text should be in the 'first person active' voice. For example, "I (we) removed 50% of surrounding vegetation" not "50% was removed" (supernaturally, evidently). However, there are occasions where passive voicing is appropriate, e.g., "The eggs were incubated at 37°C for 7 days" rather than "I(we) incubated...".

A. TITLE: The title should contain three elements:

- 1) the name of the organism studied;
- 2) the particular aspect or system studied;
- 3) the variable(s) manipulated.

Don't be afraid to be grammatically creative here. These variations on a theme are all appropriate as titles:

THE EFFECT OF TEMPERATURE ON CORN GERMINATION

DOES TEMPERATURE AFFECT CORN GERMINATION?

TEMPERATURE AND CORN GERMINATION: IMPLICATIONS FOR AGRICULTURE

B. ABSTRACT: The abstract (or summary) is a one or two paragraph condensation of the entire work described completely in the article. The abstract should be a self-contained unit capable of being understood without the benefit of the text. It should contain these four elements: 1) the purpose of the study; 2) a brief statement of what was done (Methods); 3) a statement of what was found (Results); 4) a brief statement of what was concluded. The major portion of your abstract should be presentation of results. A well-written abstract is crucial to your paper. For many published papers, this may be all anyone ever reads; if it is poorly written, this is ensured even more.

Tips for writing abstracts:

Purpose: Be sure to clearly state the objective or purpose of the study. Avoid very general beginnings. Remember that other ecologists will be reading your abstract.

Methods: You don't need to provide specific details of sampling methods. Information such as size of quadrats, how many quadrats, how the quadrats were located, etc. is not necessary.

Results: Be as specific as possible in describing results, but try to avoid reporting actual data values. e.g., "Light levels were three times higher in the hardwood forest than in the cedar swamp." is much better than stating the actual light levels in the 2 habitats. Be sure to also mention whether your comparisons were significant or not. The results section of an abstract is the most important and should be the longest. After reading an abstract, the reader should be able to understand the basic findings of a study.

Conclusions: The last part of your abstract should be a short, general conclusion. i.e., What can you conclude about your hypothesis based on the results from your study? Don't mention difficulties or problems with your study. You should discuss the limitations of a study in the discussion section of a paper. Interpretations of your data also belong in the discussion section of a paper, not in an abstract.

General comments: Use past tense. Write concisely. Avoid sentences that are uninformative. e.g., "Our results were not very conclusive, but a few trends were apparent" OR "Our results showed that a number of factors were important", etc.

C. INTRODUCTION: The function of an introduction is to present the question being asked and place it in the context of what is already known about the topic. Background information

that suggests why the topic is of interest and related findings by other scientists are mentioned here. In other words, this section should contain three elements:

1) a description of the nature of the problem and sufficient information to establish our current understanding of this problem. You should put your study into a general ecological context by first providing background information with appropriate literature (references to journal articles). What major findings have been published on the question you are attempting to answer? How does your study fit in? Why is this question interesting?

2) a statement of the purpose, scope, and general method of investigation in your study. The purpose is the question the study is asking. Identify independent and dependent variables.

Examples:

correct: "The purpose of this study was to determine the effect of ambient temperature on the germination rates of corn seedlings."

incorrect: "In this study I observe (or measure) germination rates at different temperatures." (Observations and measurements are the methods, not the purpose, of the investigation.)

3) hypothesis/hypotheses and predictions. An hypothesis is a tentative answer to the question presented in the statement of purpose. It should seem reasonable based on the background information contained in the opening paragraphs. "Because ambient affects soil temperature (Smith 1983), germination rates should be directly proportional to air temperature."

After writing your Introduction, ask yourself:

- 1) Is it informative, concise and complete?
- 2) Is the purpose of the study explicitly stated?
- 3) Are your hypotheses and predictions stated in such a way that they are testable (i.e. quantifiable)? What evidence would support your hypothesis? What evidence would cause you to reject it?

D. METHODS: The function of this section is to explain clearly all of the experimental procedures. Briefly, how are they relevant to your question, i.e. to determine if food was limiting, I sampled..... You may want to add a section on the biology of the organisms if this is important for understanding your results. For field studies, be sure to describe your research site.

If there is more than one part to the experiment, describe your methods and present your results in the same order in each section. This may not be the same order in which the experiments were performed--it is up to you to decide what order of presentation will make the most sense to your reader. Always use past tense to describe methods.

It is also helpful to your reader to explain why each procedure was done, i.e., what variable were you measuring and why?

Example:

not helpful: "First I removed the frog muscle and then I poured Ringers solution on it. Next, I attached it to the kymograph."

helpful: "I removed the frog muscle and poured Ringers solution on it to prevent it from drying out. I then attached the muscle to the kymograph in order to determine the minimum voltage required for contraction."

Mathematical equations and statistical tests are considered mathematical methods and should be described at the end of the Methods section. Mention which statistical tests you used to analyze your data.

After writing your Methods, ask yourself:

- 1) Can the work be repeated on the basis of the methods given?
- 2) Are unwieldy or unfamiliar terms defined?
- 3) Are the methods and organisms used shown to be appropriate for testing the hypotheses?

E. RESULTS: The function of this section is to summarize general trends in the data *without comment, bias, or interpretation*. What was discovered in this investigation? Describe your results in words, referring to tables and figures to support your statements. It is important to remember that tables and figures do not substitute for a written summary of the findings. In short, the text should be able to be understood by someone who has not seen your figures and tables.

Example:

Incorrect: "The results are given in Figure 1."

Correct: "Temperature was directly proportional to metabolic rate (Fig. 1)."

Statistical tests applied to your data are reported in this section although conclusions about your original hypotheses are saved for the discussion section. Statements about results should always be backed up with statistical tests. For example, "Trees were significantly taller in the wet lowland area than in the dry upland area ($t=3.8$, $df=20$, $P<0.05$)".

After writing your Results, ask yourself:

- 1) Are all results presented including those which do not support the hypotheses?
- 2) Do the results contained in the figures and tables support the statements made in the text?

F. DISCUSSION: The function of this section is to analyze the data and relate them to other studies. To "analyze" means to evaluate the meaning of your results in terms of the original question or hypothesis and point out their biological significance. Attempt to integrate your results with the relevant literature to provide an adequate interpretation of the data.

Try to offer explanations of unexpected results and those results that do not conform to your hypothesis and predictions. Compare your results and interpretations with those of other professional investigators. Do your results support or contradict results from other studies? Why or why not? Obviously, this section should include pertinent information from reference books and periodical literature for purposes of comparison. However, remember that your job is to analyze your own results. You should not dedicate whole paragraphs to describing other researcher's studies; their findings should be integrated with your own in order to formulate causal explanations of your results.

In describing what may be concluded from your results, be direct and succinct. These are the ideas that you want your reader to remember. Tell us your major findings first, then add your lesser findings. The discussion section can also mention briefly what problems arose and how they could be avoided in the future, but only after discussing your major results. The discussion section can also include mention of where your study leads us. Speculation is valuable for stimulating further thought but it should not be taken as a result. In its totality, the discussion section should integrate your data with the relevant literature to provide a detailed interpretation of the research data and research question(s).

After writing your Discussion, ask yourself:

- 1) Are the data clearly related to the hypothesis?
- 2) Are ALL the results, including those unexpected or inconsistent, interpreted both in the context of your purpose and in the context of previous findings?
- 3) If the discussion contains any speculation, is it justifiable and consistent with the findings of other studies?
- 4) Are major conclusions succinctly summarized at the end of the paper?

ONCE YOU ARE ABLE TO ANSWER "YES" TO ALL OF THE ABOVE QUESTIONS, REREAD YOUR PAPER AND EXTRACT ALL UNNECESSARY PHRASES AND SENTENCES--ANYTHING THAT SEEMS EXTRANEIOUS OR PERIPHERAL TO YOUR HYPOTHESIS AND PREDICTIONS. EVERY STATEMENT YOU MAKE SHOULD RELATE BACK TO THE PURPOSE OF THE STUDY AS EXPRESSED IN THE INTRODUCTION.

G. FIGURES AND TABLES: Figures (graphs and diagrams) and tables are independent units of information. They must possess descriptive headings that will allow them to be understood by someone who has not yet read the paper. An important recommendation is to present the data visually whenever possible because relationships are much more readily visualized in a figure than as columns of numbers on a table. And remember that some data that cannot be graphed on coordinates can, nevertheless, be expressed in pictorial graphic form in a histogram. There are two types of illustrative material:

1) **Figures**

a. graphs

--use to give a quick visual illustration of significant trends in experimental data. The independent variable is plotted on the x axis and the dependent variable on the y axis. Only connect points on graphs that contain continuous variables.

b. maps and diagrams

--use to illustrate a complex experimental procedure or show the location of study sites if this information is important. Biological processes and models can also be presented this way.

2) **Tables**

--use only when there are so many treatments or variables that plotting them on a graph would result in a big mess (tables are boring).

Graphs, maps, and diagrams are labeled as "figures" (Fig. 1, Fig. 2, etc.) and the descriptive heading is placed **BELOW** the illustration. Tables are labeled as "tables" (Table 1, Table 2, etc.) and the descriptive heading is placed **ABOVE** the table.

H. LITERATURE CITED: This is the last section of a scientific paper. Every paper or book cited in the text of the paper must be listed here. References are listed **alphabetically** by author, as indicated in the following sample list. In the cases of more than two authors, you should use "et al." (Latin for "and others") in the text of your paper (Jones et al. 1983), but in the literature cited sections, all authors must be named. ***No reference is listed in the L.C. unless it was cited in the text somewhere.***

1. Citing references in the Literature Cited: (Note: The format for these references is the Harvard style of citation. The CBE style manual is a valuable source for helping you with citation format. Individual journals may prefer slight variations on this theme).

a) Journal:

Gannon, A. J., C. E. Bach, and G. K. Walker. 1994. Feeding patterns and attachment ability of *Altica subplicata* (Coleoptera: Chrysomelidae) on sand-dune willow. Great Lakes Entomologist 27:89-101.

Tilman, D. 1997. Community invasibility, recruitment limitation, and grassland biodiversity. Ecology 78:81-92.

b) Book:

Howe, H. F. and L. C. Westley. 1988. Ecological relationships of plants and animals. Oxford University Press, New York.

c) Article in a book:

Werner, P. A. 1979. Competition and coexistence of similar species. Pages 287-310 in Solbrig, O. T., S. Jain, G. B. Johnson, and P. Raven, eds. Topics in plant population biology. Columbia University Press, New York.

2. Format for Citing References in the Text (used almost universally):

You must cite another's research whenever you refer to his/her results, conclusions, or methods in your paper. You will probably have occasions to use citations in the Introduction and the Discussion sections only (with a few exceptions--as when using a particular methodology invented by someone else for a specific experiment). **References are made only to the author's name and date of publication (known as Harvard system).** There are 3 ways of doing this:

a) Both the name and date can go inside parentheses if the name is not actually part of your sentence: For example:

"Enzymes are inhibited by cyanide (Grubb 1977)."

"Because enzymes are inhibited by cyanide (Grubb 1977), I expect to find..."

Notice that the parenthetical citation is placed at the end of the sentence or clause containing the reference and the punctuation (period or commas) FOLLOWS the citation.

b) Another way to cite a study is to make the last name of the researcher the subject or object of the sentence or clause and follow it immediately with a parenthetical containing the date of the study. This strategy is especially effective if you wish to emphasize the name of the researcher, i.e., if his/her study is very important to yours:

"Grubb (1977) found that cyanide inhibits enzymes."

"Because Grubb (1977) found that cyanide inhibits enzymes..."

"These data support the conclusions of Grubb (1977)."

c) The only method of citation that is INCORRECT is separating the date of publication from the author's name:

Incorrect: "Grubb found that cyanide inhibits enzyme action (1977)."

d) Finally, if you wish to cite more than one study per reference, i.e., if more than one author has reached the same conclusion or worked on the same problem independently, you may list them together in the same parentheses and separate their names by commas:

"Cyanide has been found to inhibit enzyme action (Grubb 1977, Smith 1980, Taylor 1983)." Conventionally, these citations are listed in chronological order.

A significant amount of the information above was borrowed from Ambrose H.W. and K. P. Ambrose. 1981. A Handbook of Biological Investigation. H. Hunter Textbooks, Winston-Salem, N. C.

III. REFERENCES ON SCIENTIFIC WRITING

Council of Biology Editor's Style Manual (CBE Manual). American Institute of Biological Sciences: Washington, D.C. The book to consult on how to prepare a paper for publication in a scientific journal.

Day, R. A. 1998. How to Write and Publish a Scientific Paper, 5th edition. ISI Press: Philadelphia, PA. 160pp.

Katz, M. J. 1985. Elements of the Scientific Paper: A Step-by-Step Guide for Students and Professionals. Yale University Press, New Haven, CT.

McMillan, V. E. 2001. Writing Papers in the Biological Sciences, 3rd edition. St. Martin's Press, NY.

Miller, C. and K. Swift. 1980. A Handbook of Nonsexist Writing. Barnes and Noble, NY.

Pechenik, J. A. 2001. A Short Guide to Writing about Biology, 4th edition. Little Brown and Company, Boston.

Strunk, W. and E. B. White. 2000. The Element of Style, 4th edition. MacMillan: N.Y. (An excellent book on how to write clearly and concisely)

The Chicago Manual of Style. 13th ed. Univ. of Chicago Press, Chicago.