

Principles of Genetics

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Abstract

Many problems in modern biology are currently being addressed through the use of genetic information. This course provides the fundamentals required to understand the properties of a wide array of genetic markers and the breadth of application found for those markers throughout biology. For example, we will examine the utility of genetic information in the study of genome structure and function, the identification and breeding of economically important traits, the elucidation of basic properties of populations, and the solution of forensics problems. Another important component of the course is the historical perspective. Although the concept of a gene has changed from the breeding experiments of Mendel to the molecular biology of today, there exists a continuity that provides the conceptual basis for the analysis of modern molecular genetics. Finally, the development of both analytical and synthetic skills are emphasized in this course through problem sets and written exams.

General information

Course number Biology 305, Agronomy 305, Animal Science 305, and Horticulture 305

Class time Foster Hall 231 at 1:30–2:20 on Monday, Wednesday, and Friday.

Instructor Dr. Brook Milligan, 302 Foster Hall, 646-7980, brook@nmsu.edu. Office hours: Monday, Wednesday, Friday, 2:30–3:00 or by appointment.

Teaching Assistant Gloricelys Rivera, glorivel@nmsu.edu. Office hours: Tuesday and Thursday 1:30–3:00 (or by appointment) in the Biology Advising Center (Foster Hall 204). Please contact her via email to answer questions, to provide help, or to set up appointments for assistance.

Text The required text for this course is the following:

Brooker, R. J. 2009. *Genetics. Analysis and principles*. McGraw Hill, Boston, Massachusetts, third edition

In-class exams There will be two exams during this course prior to the final exam.

Final exam Monday, 3 May, 1:00–3:00

Additional readings Occasionally there may be required readings beyond those found within the textbook. Announcements of these will be added to the class schedule as appropriate, and instructions for accessing them will be made available here.

Problem sets A number of problems will be assigned throughout the semester. These will be collected periodically as noted on the class schedule. The purpose of working through these problems is to better solidify your understanding of the concepts covered in class. In particular, this should help you synthesize the material and think more critically about it.

Prerequisites Introductory Biology and Introductory Chemistry. Please see the instructor if you do not have these.

Computer resources I will make available to you on the World Wide Web (<http://web.nmsu.edu/~brook/courses/genetics/>) versions of various documents associated with the course. Wherever possible I will make available not only web-browsable versions, but also PostScript (*.ps) and Acrobat (*.pdf) versions. The latter may be more convenient if you wish to download a copy and print it, rather than view it online. These documents will include such things as the most recent version of the complete syllabus, the course schedule, lecture notes, readings, and other supplemental material.

Attendance Because of the importance of active class participation to the learning process, students are expected to attend regularly. Furthermore, students are expected to have prepared the material being covered for each class.

If you are absent from the class, first ask a classmate for a copy of his/her notes and avail yourselves of the readings, review material, and other resources. If you still have questions after studying this material, please make an appointment or come see the instructor and/or T.A.(s) during office hours.

If you believe that an absence should be excused, please notify the instructor in writing as soon as possible prior to the absence so appropriate arrangements may be made. Your notification should include an explanation concerning why the absence is necessary, be accompanied by additional documents as appropriate (e.g., from your parent(s), doctor, advisor, sponsor . . .), and be signed by you. Only those absences deemed appropriate by the instructor will be excused. Any absences for which prior arrangements have not been made will be regarded as unexcused, except under very exceptional circumstances that the instructor deems as appropriate.

Finally, in connection with absentees, I will make no assumptions about your enrollment status in the course. If you wish to drop the course, you must do so yourself or risk receiving a failing grade.

Grading errors or disputes If you detect a miscalculation in the number of points you receive for an exam, homework, or other assignment, please report this matter to the instructor immediately so that a grade adjustment may be considered. If you disagree with your score on any assignment prior to the final exam, you must present your reasons for disagreement in writing within *one week* of the assignment being passed back. Your opportunity to appeal the disputed grade expires after that week has passed.

Exams

Three examinations will be given over the course of the semester; all will be given during the scheduled class or final exam time. No exams will be given at times other than these scheduled times and there will be no make-up examinations **unless arranged in advance**. If you miss one of these exams and have not made *prior* arrangements you will be required to take a zero score for that exam.

Consistent with the objective of developing your communication skills as well as your understanding of genetics, the examinations will require clearly and concisely written answers to questions covering topics studied in the course. The questions will evaluate your comprehension of the material covered, your ability to apply your knowledge to new problems, and your ability to analyze and evaluate experiments and data commonly encountered in the study of genetics. The recommended problem sets will assist you by developing your skills in these areas; therefore, it is especially important that you stay current with them.

You will not need, nor will you be allowed, to use such items as calculators during exams. In the case of quantitative questions, you will be asked to show your work in order to communicate clearly that you understand the *process* of obtaining the correct answers. You will also be required to clearly indicate—for

example, by circling or underlining—your final answer to differentiate it from your general work. Finally, even for quantitative problems, clear answers will include well-written text as one component.

Problem sets

To learn genetics, it is essential that you grapple with some “typical” problems first hand. We will approach this in two ways. First, throughout the semester I will assign homework problems that illustrate the application of concepts discussed in class. Many of these problems will come from the textbook. All are intended to give you a feeling for the types of problems encountered by practicing geneticists, to illustrate some of the types of questions that may appear on examinations, and to crystallize the concepts discussed in class. You will notice that the text includes additional problems; thus, if you seek additional examples of any problems they are readily available. You will also notice that answers are provided for some of the problems, so you can check to see if you are on the right track. *Note, however, that you will learn very little from these problems if you rely heavily on the given answers. Your emphasis should be on understanding how to communicate the process by which you arrive at the correct answer. Be sure you clearly understand the thought process involved in each problem.*

Second, during the semester I will devote class time to illustrate the solution to selected relevant problems. Some of these will be drawn from the recommended problems, with you being asked to suggest the specific problems to illustrate. You will get the greatest benefit from these if you have already attempted the problems and are prepared with specific questions.

As you will see in the class schedule, specific problems are indicated with many specific class periods. These problems relate to the material discussed in that class. Problem sets, composed of all the previous problems are due when indicated in the class schedule by **Previous problems due today**. As mentioned elsewhere, good answers to these problems go beyond simply giving the final result; they include a clear explanation of how you arrived at the result or of your thinking and understanding of the concepts.

Evaluation

The grade you receive in this course will result primarily from your performance on exams. Each of the three exams will be worth 25% of the total grade; the remainder will be divided among the homework problems. Each exam will contain a range of questions, including some that require you to synthesize and reflect on the material covered in class, in the reading, and in the problems. These will be graded with an eye toward how well you are able to communicate your understanding of the material. Thus, rambling or imprecise answers will not benefit you. To excel you must be able to demonstrate your precise understanding in the language of genetics.

The final course grade will be determined based on the following absolute scale: A: 90–100%, B: 80–89%, C: 70–79%, D: 60–69%, F: 0–59%. In the case of S/U grading, the following scale will be used: S: 75–100%, U: 0–74%. Note that this means that you are not competing against anyone else in the course; you must only demonstrate that you know the material.

Grading policy

My grading policy is based on the opinion that a sound college education must be earned and active involvement in your education is the best means of succeeding. As a result, I will be grading you on your performance and ability to communicate clearly the concepts associated with this course. Your grades will represent your performance relative to what I consider to be a reasonable absolute standard; you will not be evaluated relative to your peers in the class. Thus, I regard the grades you receive as directly reflecting

your personal effort and performance in this course. Remember, for each credit received for this course, I expect a minimum of three hours of effective involvement with the class each week. Beware of overloading your schedule.

Most importantly, I consider grades to be something you earn by your activities. During the upcoming semester you will be called upon to make many choices about how you spend your time and energy. Some of those choices may influence (either positively or negatively) your grade in this class. This is fine as long as you are aware at the outset that your choices may have direct consequences. In this regard, I share a philosophy espoused by Wiesenfeld (1996).

I am willing to provide you with learning opportunities and will gladly assist you to identify effective ways of improving your study habits or to understand the material. However, you must provide the initiative and keep me apprised of your status in the course. I cannot help you unless I am aware of problems you may be facing. Please let me know in advance if possible and do not let things slide too far.

Computer resources

I will make available to you on the World Wide Web versions of various documents associated with the course. These documents will include such things as the most recent version of this syllabus (e.g., in case I find errors after printing this copy), review sheets, and/or other supplemental material. In fact, I will not be distributing any of this to you during class time. As a result you will have to print copies on your own. You may access these documents via the following URL:

<http://web.nmsu.edu/~brook/courses/genetics/>

Wherever possible I will make available not only web-browsable versions, but also Postscript (*.ps) and Acrobat (*.pdf) versions. The latter may be more convenient if you wish to download a copy and print it, rather than view it online.

During the course of this semester you may find the need to reference a Web page in your writing. See <http://www.lib.rochester.edu/index.cfm?PAGE=439> for general guidelines and acceptable means of doing so.

Scholastic integrity

The progress of science, indeed of all human knowledge, depends entirely on our ability to trust the workings of others in order to extend their scholarship and creativity into new areas. In the absence of that trust, it is impossible to proceed. Consequently, scholastic integrity is one of the highest values upheld by the academic community. All of us must strive to maintain the highest standards in this area for all work associated with our academic activities, in the classroom, in the laboratory, and at home or with our peers.

You should do all of your own work on all assignments, whether in or out of class. This does not preclude discussion of concepts and ideas with other students; indeed, such interaction is encouraged. However, it does mean that when the time comes to work on an assignment, you must present your own work. Please see the “Student Code of Conduct” in the current *Student Handbook* and pay particular attention to the sections that define Academic Misconduct and Plagiarism.

In the case of evidence of academic misconduct of any type, the instructor of this course will take appropriate action. At minimum all involved will receive no credit for the assignment in question. However, consequences may include immediate and outright failure of the entire course.

Disabilities

Students with Disabilities. If you have or believe you have a disability and would benefit from any accommodations, you may wish to self-identify by contacting the Student Accessibility Services Office located in Room 244 of Corbett Center (646-2420). If you have already registered, please make sure that your instructor receives a copy of the accommodation memorandum from SAS Office within the first two weeks of classes. It is your responsibility to inform either your instructor or SAS representative in a timely manner if services/accommodations provided are not meeting your needs.

If you have a condition which may affect your ability to exit safely from the premises in an emergency or which may cause an emergency during class, you are encouraged to discuss any concerns with the instructor and/or the SAS Coordinator . Feel free to call the EEO/ADA and Employee Relations Director with any questions about the Americans with Disabilities Act (ADA) and/or Section 504 of the Rehabilitation Act of 1973. All medical information will be treated confidentially.

Instructors will receive specific written guidelines for appropriate accommodations for individual students from the SAS office. No student shall be given accommodations for disabilities unless SAS has requested these specific accommodations for her/him.

Student participation

I strongly encourage active student participation in class, and prefer to answer questions concerning the subject matter in class as they arise. There is no such thing as a “dumb question.” If something is not clear to you, others are certainly confused as well, so feel free to ask. I cannot always know what your background is, and may inadvertently use unfamiliar terminology. One of your biggest challenges in this course will be giving concrete meaning to the specialized and precise terminology encountered. In many ways you should treat this as a foreign language course, become actively involved, and participate.

If you feel uncomfortable asking questions in class, jot them in the margins of your notes and ask me immediately following class while your ideas are still fresh.

Courtesy

Please be courteous towards your fellow classmates. If you come to class, stay for the duration; if you must leave early, sit near an exit so that minimal disturbance results when you leave.

Disclaimer

The instructor reserves the right to modify this syllabus during the semester as considered necessary to achieve course objectives, enhance the quality of instruction, or to correct omissions or mistakes. Notification of changes will be made in class; however, the most up-to-date version will always be the one available on the world wide web. You are responsible for being aware of the contents of this syllabus.

References

Brooker, R. J. 2009. *Genetics. Analysis and principles*. McGraw Hill, Boston, Massachusetts, third edition.

Wiesenfeld, K. 17 June 1996. Making the grade. *Newsweek*, page 16.