

UC 12294 135

CBM003 ADD/CHANGE FORM

Undergraduate Council  
 New Course  Course Change  
 Core Category: Life/Phys Sci Effective Fall ~~2013~~ 2014

or

Graduate/Professional Studies Council  
 New Course  Course Change  
 Effective Fall 2013

1. Department: Biol. /Biochem. College: NSM  
 2. Faculty Contact Person: Medrano Telephone: 3-0953 Email: aimedrano@uh.edu

3. Course Information on New/Revised course:  
 • Instructional Area / Course Number / Long Course Title:  
BIOL / 1362 / Introduction to Biological Science  
 • Instructional Area / Course Number / Short Course Title (30 characters max.)  
BIOL / 1362 / Intro to Biological Science  
 • SCH: 3 Level: FR CIP Code:            Lect Hrs: 3 Lab Hrs: 0

RECEIVED APR - 4 2013

4. Justification for adding/changing course: To meet core curriculum requirements

5. Was the proposed/revised course previously offered as a special topics course?  Yes  No  
 If Yes, please complete:

• Instructional Area / Course Number / Long Course Title:  
 \_\_\_ / \_\_\_ / \_\_\_  
 • Course ID: \_\_\_ Effective Date (currently active row): \_\_\_

6. Authorized Degree Program(s): \_\_\_  
 • Does this course affect major/minor requirements in the College/Department?  Yes  No  
 • Does this course affect major/minor requirements in other Colleges/Departments?  Yes  No  
 • Can the course be repeated for credit?  Yes  No (if yes, include in course description)

7. Grade Option: Letter Instruction Type: Lect. (Note: Lect/Lab info. must match item 3, above.)

8. If this form involves a change to an existing course, please obtain the following information from the course inventory: Instructional Area / Course Number / Long Course Title  
 \_\_\_ / \_\_\_ / \_\_\_  
 • Course ID: \_\_\_ Effective Date (currently active row): \_\_\_

9. Proposed Catalog Description: (If there are no prerequisites, type in "none".)  
 Cr. 3. (3-0). (formerly BIOL 1432) Prerequisite: MATH 1310 or equivalent. Credit may not be received for both BIOL 1361:1362 and 1310:1320. Designed for science majors and preprofessional students.

10. Introduction to biological science, including biochemistry, cellular and molecular biology, genetics, physiology, ecology, evolution, and behavior. \_\_\_  
 Print/Type Name: \_\_\_

## REQUEST FOR COURSES IN THE CORE CURRICULUM

Originating Department or College: Department of Biology and Biochemistry

Person Making Request: Ana I. Medrano, Ph.D.

Telephone: 713-743-0953

Email: aimedrano@uh.edu

Dean's Signature: \_\_\_\_\_

Date: 09/24/2012

Course Number and Title: BIOL 1362 Introduction to Biological Science 2.

Please attach in separate documents:

Completed CBM003 Add/Change Form with Catalog Description

Syllabus

List the student learning outcomes for the course (Statements of what students will know and be able to do as a result of taking this course. See appended hints for constructing these statements):

Students will be able to: 1) Describe the different stages of cell division and recognize its relationship with sexual and asexual reproduction, as well as, identify the life cycles that generate the genetic variation which contributes to evolution. 2) Understand and describe the processes involving gene expression at the molecular level. 3) Recognize and list some practical applications of DNA technology, such as cloning and PCR. 4) Use a diverse array of examples to show evolution is supported by scientific evidence. 5) Work with peers to apply content knowledge in problem solving and will also effectively communicate their solutions and reasoning to classmates and the instructors.

Component Area for which the course is being proposed (check one):

**\*Note:** If you check the Component Area Option, you would need to also check a Foundational Component Area.

Communication

American History

Mathematics

Government/Political

Science

Language, Philosophy, & Culture

Social & Behavioral Science

Creative Arts

Component Area Option

Life & Physical Sciences

Competency areas addressed by the course (refer to appended chart for competencies that are required and optional in each component area):

Critical Thinking

Teamwork

Communication Skills

Social Responsibility

Empirical & Quantitative Skills

Personal Responsibility

Because we will be assessing student learning outcomes across multiple core courses, assessments assigned in your course must include assessments of the core competencies. For each competency checked above, indicated the specific course assignment(s) which, when completed by students, will provide evidence of the competency. Provide detailed information, such as copies of the paper or project assignment, copies of individual test items, etc. A single assignment may be used to provide data for multiple competencies.

#### Critical Thinking:

1. Questions that encourage critical thinking will be included in the homework assignments. Homework is assigned through Mastering Biology, an online system. The course is divided into 4 Units – and each unit includes two homework assignments.
2. Critical thinking will also be assessed through exam questions. Examples are provided in the Appendix. (See Appendix questions 1-3; these refer to the interpretation of a DNA fingerprint for determining kinship.
3. In the smaller Honors sections, critical thinking skills will also be evaluated using at least one assignment in which students analyze experiments from the scientific literature.

#### Communication Skills:

1. A few (2 – 5) 1 minute reflection papers will be written by students present in class, at random times, during the semester.
2. Blackboard will be used to generate a discussion topic in which students must participate, as part of their grade.
3. In the smaller Honors sections, at least one assignment will require students to summarize a research article following a specified format. Additional written work may also be used to evaluate communications skills for students in the Honors sections.

#### Empirical & Quantitative Skills:

1. Homework assignments will include problems on population genetics that involve using empirical and quantitative skills.
2. Selected exam questions will also assess empirical and quantitative skills. Examples of salient exam questions illustrate the use of these skills (See Appendix questions 4-6).
3. In the smaller Honors sections, empirical and quantitative skills may also be evaluated through homework assignments in which they analyze experiments from the scientific literature.

#### Teamwork:

1. To increase engagement among students and with the topics seen in class, the active learning approach of Peer Instruction (Think-Pair-Share) will be used in every lecture. Two or three questions will be part of the presentation at each lecture, to reinforce a concept recently covered.

2. In the smaller Honors sections, students will work in groups of 3-5 to create work related to experimental data that they are given. This may involve proposing hypotheses and experiments to test them, or analyzing data from scientific experiments as a group. In either case, the group will present its work to classmates and the instructor, either orally or by posting to the course discussion page on Blackboard.

**Social Responsibility:**

Click here to enter text.

**Personal Responsibility:**

Click here to enter text.

Will the syllabus vary across multiple section of the course?     Yes                       No

If yes, list the assignments that will be constant across sections:

Assignments in Mastering Biology (online system)  
specific exam questions (See appendix for examples).

Inclusion in the core is contingent upon the course being offered and taught at least once every other academic year. Courses will be reviewed for renewal every 5 years.

The department understands that instructors will be expected to provide student work and to participate in university-wide assessments of student work. This could include, but may not be limited to, designing instruments such as rubrics, and scoring work by students in this or other courses. In addition, instructors of core courses may be asked to include brief assessment activities in their course.

Dept. Signature: \_\_\_\_\_

The following courses have been reviewed and approved by the NSM Curriculum Committee to meet the new core requirements. Given the length of the individual submissions I have elected to submit these requests by electronic means only.

**Natural Sciences: Core Courses**

BIOL 1309 - Human Genetics and Society

BIOL 1310 - General Biology

BIOL 1320 - General Biology

BIOL 1361 - Introduction to Biological Science I

~~BIOL 1362 - Introduction to Biological Science II~~

CHEM 1301 - Foundations of Chemistry

CHEM 1331 - Fundamentals of Chemistry I

CHEM 1332 - Fundamentals of Chemistry II

GEOL 1302 - Introduction to Global Climate Change

GEOL 1330 - Physical Geology

GEOL 1340 - Introduction to Earth Systems

GEOL 1350 - Introduction to Meteorology

GEOL 1360 - Introduction to Oceanography

GEOL 1376 - Historical Geology

PHYS 1301 - Introductory General Physics I

PHYS 1302 - Introductory General Physics II

PHYS 1321 - University Physics I

PHYS 1322 - University Physics II

**Mathematics: Core Courses**

MATH 1310 - College Algebra

MATH 1311 - Elementary Mathematical Modeling

**Math/Reasoning: Core Courses**

COSC 1306 - Computer Science and Programming

MATH 1330 - Precalculus

MATH 1431 - Calculus I

MATH 1432 - Calculus II

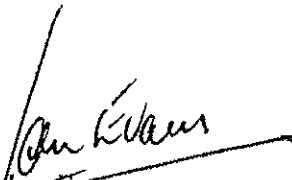
MATH 2311 - Introduction to Probability and Statistics

**Writing in the Disciplines: Core Courses**

BCHS Biochemistry Lab II

BIOL 3311 - Genetics Lab

PHYS 3313 - Advanced Lab I

  
Ian Evans  
Associate Dean

4/4/13

## BIOL 1362 - INTRODUCTION TO BIOLOGICAL SCIENCE - SPRING 2013

**Instructor:** Ana I. Medrano, Ph.D. (aimedrano@uh.edu)  
**Office:** 108 D, Science Teaching Laboratories (STL) Building  
**Office Hours:** 9 – 10 am and 4 – 5 pm Tuesday and Thursday or by appointment.

**Time & Location:** Section 10718 – M/W, 1:00 – 2:30 pm, Science and Engineering Classroom (SEC) room 100

**Text:** *Campbell Biology, 9<sup>th</sup> Edition, Reece et al, with MasteringBiology (required)*. Pearson. Students will also need a TurningPoint® clicker pad that can be acquired at the UH Bookstore.

### **LECTURE SCHEDULE** (This schedule is subject to change; schedule changes will be announced)

WEEK	DATE	TOPIC	CH
1	Jan 14	Introduction; Chromosomes, Mitosis, Meiosis	CH 12
	16	Chromosomes, Mitosis, Meiosis	CH 12, 13
2	21	<b>No Class – MLK Day</b>	
	23	Genetics	CH 14
3	28	Genetics, DNA	CH 15, 16
	30	DNA: molecular structure & DNA replication	CH 16
4	Feb 4	DNA: molecular structure & DNA replication	CH 16
	6 & 7	<b>EXAM 1 (Chapters 12-16) – at CASA</b>	
5	11	Gene Expression – Transcription & Translation	CH 17
	13	Gene Expression – Transcription & Translation, Gene Regulation	CH 17, 18
6	18	Gene Regulation	CH 18
	20	Viruses	CH 19
7	25	Biotechnology	CH 20
	28	Genomes and Their Evolution	CH 21
8	Mar 4	Catch-up day	
	6 & 7	<b>EXAM 2 (Chapters 17-21) – at CASA</b>	
9	11 - 15	<b>NO CLASSES – Spring Break</b>	
10	18	Pre-Darwin view of life, fossils, Darwin & evolution	CH 22, 23
	20	Evolution continued, Population genetics	CH 22, 23
11	25	Evolution continued, Population genetics	CH 22, 23
	27	Speciation, Macroevolution	CH 24, 25
12	Apr 1 <sup>st</sup>	Taxonomy & Phylogeny	CH 26
	3 & 4	<b>EXAM 3 (Chapters 22 – 26) – at CASA</b>	
13	8	Ecology and Biogeography	CH 52
	10	Population Ecology	CH 53
14	15	Community Ecology	CH 54
	17	Ecosystems	CH 55
15	22	Catch-up day	
	24 & 25	<b>EXAM 4 (Chapters 52-55) – at CASA</b>	

### Course Description

BIOL 1362 is the second semester of a two-part **Introduction to Biological Science** course that is required of biology and biochemistry majors. It is a prerequisite for all advanced courses in biology and is often taken as an elective by students majoring in other natural and social sciences. Enrollment in this course requires either credit for, or concurrent enrollment in MATH 1310 or its equivalent. The goal of this course is to introduce students to basic concepts of biology and prepare them for upper level biology and biochemistry course work. BIOL 1361 (first semester) focuses on biochemistry, cell biology, and physiology, while BIOL 1362 (second semester) focuses on genetics, biotechnology, evolution, and ecology.

### Course Objectives

Students will be able to:

- 1) Describe the different stages of cell division and recognize its relationship with sexual and asexual reproduction, as well as, identify the life cycles that generate the genetic variation which contributes to evolution.
- 2) Understand and describe the processes involving gene expression at the molecular level.
- 3) Recognize and list some practical applications of DNA technology, such as cloning and PCR.
- 4) Use a diverse array of examples to show evolution is supported by scientific evidence.
- 5) Work with peers to apply content knowledge in problem solving and will also effectively communicate their solutions and reasoning to classmates and the instructors.

### Laboratory

BIOL 1162 is a 1 credit-hour course consisting of an introductory lecture and laboratory. Concurrent enrollment and attendance in the laboratory course ***is not required*** for the lecture course. BIOL 1162 laboratory starts the FIRST week of school. For further information on BIOL 1162 laboratories contact the laboratory supervisor, Dr. Ana Medrano, using the email account: [introbio@uh.edu](mailto:introbio@uh.edu).

### Exams and Grading Policies

There will be four exams that will cover material presented during lectures, as well as material covered on assigned chapters and homework assignments. The exams consist mainly of multiple choice questions which may also include diagrams/pictures and true/false questions. All exams will be taken at **CASA** – if you have never used their facilities, you need to set up an account with them: <http://casa.uh.edu>.

All exams **MUST** be taken. If you have a valid excuse for missing an exam, a make-up exam will be given.

***Excuses of a purely social nature will not be accepted.***

Please familiarize yourself with the University policies on cheating and academic honesty outlined in the University of Houston Student Handbook. ***Cheating during the exam will not be tolerated.*** Demonstrable incidents of cheating could result in the student receiving a zero for the exam or a grade of "F" for the course.

The **final grade** for this course will be calculated as follows:

1. exam scores are worth 21% each, for a total of **84%**
2. *MasteringBiology* homework assignments given account for **8%**
3. Participation in a Discussion board topic that will be set up by the instructor, account for **2%**
4. A series of 2 - 5 "1 minute reflection papers", assigned in random classes, account for **2%**
5. Consent forms and surveys, given at the beginning and end of the course (this includes: pre&post surveymonkey surveys and pre&post LASSI surveys), account for **4%**
6. Quizzes will also be given prior to each exam, as an opportunity for 5 extra credit points, if the score for the quiz is  $\geq 70\%$ .

Final grades may be adjusted to achieve a fair and reasonable distribution of grades. A **tentative** range for final grades is shown below:

(59.5 to <62.5 D-) (62.5 to <66.5 D) (66.5 to <69.5 D+) (69.5 to <72.5 C-) (72.5 to <76.5 C) (76.5 to <79.5 C+) (79.5 to <82.5 B-) (82.5 to <86.5 B) (86.5 to <89.5 B+) (89.5 to <92.5 A-) (>92.5 A)



**Tutoring**

Tutoring is available through Learning Support Services (713-743-5411); they are located in room N109 Cougar Village (website for schedule of tutoring hours: <http://www.las.uh.edu/lss/tutoring.aspx>). Every student has their own expectations in terms of the final grade they wish to achieve in the course.

**Tips for Success:**

1. **Attend class** and ask questions.
2. **Lecture notes and other class material** will be posted on Blackboard prior to class. Download documents and bring with you to take notes on during class. The assigned chapter(s) should be read **prior** to lecture. This strategy will help you follow the lectures and enhance your ability to master the information and concepts needed to do well on the exams.
3. **Studying for exams:** lecture notes and your own notes taken during class should be your primary study material; use the text as a resource to help you understand material you don't understand from the lecture notes. As you study, make a note of those topics you do not quite understand and see me (or email) for clarification of these concepts.
4. **Keep up with the reading and studying!** If you fall too far behind it may be impossible to catch up since the fundamentals taught early on are integral to the material taught later on in the course. A consistent effort is essential to getting a good grade.
5. The text for this course is supported by the **MasteringBiology website**, which is a great resource for study - it has many useful tools in the *Study Area* such as videos, animations, tutorials, activities, word study tools (key words, flash cards), quizzes and practice tests. There will be homework assignments that will be part of your final grade, as well as quizzes that will give you the opportunity for extra credit points, per exam. Due dates for the assignments will be announced in class.

**General Information**

**Students with disabilities** are accommodated per University rules and regulations. To make the necessary arrangements you should register at Justin Dart Jr. Center for Students with DisABILITIES, CSD Building, Rm 100, or call (713)743-5400 ( [www.uh.edu/csd](http://www.uh.edu/csd) ).

If a student decides to **withdraw** from the course, it is his/hers responsibility to do so online, directly from their own PeopleSoft account. Students who complete only part of the exams and/or other required assignments for the course and do not withdraw will receive a grade of "F".

**Important Dates:**

Tues	01/22/13	Last day to add class online
Wed	01/30/13	Last day to drop the course without receiving a grade
Wed	03/27/13	Last day to withdraw from the course with a "W"

## Spring 2013 – Student Clicker Guide

### Where to Buy TurningPoint Clicker

TurningPoint RF-LCD clickers are available at Barnes & Noble at University Center (UC).

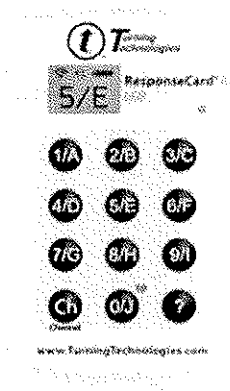
#### Clicker Pricing Information:

- \$40 (including tax and built-in lifetime activation)

For the detailed Clicker purchasing information, please contact Barnes & Noble in the UC.

- Address: 4800 Calhoun Rd., 126 University Center  
Houston, TX 77204
- Phone: 713-748-0923

**NOTE:** If you are getting a book loan, you can use your book loan to buy a clicker through the bookstore.



### IMPORTANT:

There are currently two different clicker models used on campus – RF and RF-LCD. Both clickers work exactly the same; the only difference is that RF-LCD clicker has the LCD panel that displays your answer choices. Beginning Summer 2010, the campus has been transitioning the clicker from the RF to the RF-LCD model. If you purchased an RF clicker in Fall 2009, Spring 2010 or Summer 2010, you can still use your RF clicker in any future classes that require clickers.

### Clicker Problem Report:

Your clicker comes with a one-year warranty starting from the day you purchase your clicker. If your clicker stops working during the warranty period, contact: Jennifer Bernardi ([jbernardi@uh.edu](mailto:jbernardi@uh.edu))

### How to register Clicker via Blackboard

Please follow the steps below to register your clicker:

- 1) Log on to Blackboard at [www.uh.edu/blackboard](http://www.uh.edu/blackboard).
- 2) Select the course you will be using the TurningPoint clicker for.
- 3) On the homepage, click on the “**BIOL 1362 – 10718 Pad Registration**” icon.
- 4) Enter your clicker ID. The ID is available on the back of your clicker – it is a 6-digit combination of numbers or/and letters.

	<p>Response Device ID: <input type="text"/></p> <p>Confirm Response Device ID: <input type="text"/></p> <p><b>NOTE:</b> The ID is not case-sensitive.</p>
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**NOTE:**

If you already registered your clicker for a course in the previous or current semester, you may see the following statement when you try to register your clicker for another course.

Your currently registered Response Device ID is: 000000

Even though it shows that your clicker is already registered, provide your clicker ID again.

- 5) Click Submit.

### How to Use Clicker in Class

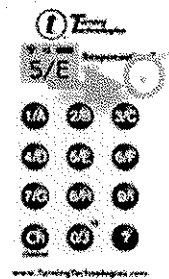
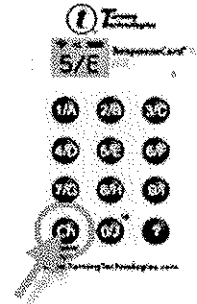
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- 1) If you have a brand-new clicker, remove the plastic flap from the back of your clicker before using it.
- 2) Make sure to set your clicker with a correct channel based on the channel number your instructor uses. At the beginning of each class, your instructor will display a channel number for the class.

To set the channel, press Go (CH) → channel number → Go (CH).

For example, if *Professor A* uses a channel number **65**, press CH and 65 then, press CH again. Once the process is done successfully, you should see the green light on your clicker.

- 3) Whenever you submit an answer, pay attention to the light indicator. When the light shows solid green, it means that your answer has been submitted.



## Spring 2013 – MasteringBiology Guide

In this course you will be using MasteringBiology®, an online tutorial and homework program that accompanies your textbook.

### What You Need:

- ✓ **A valid email address**
- ✓ **A student access code** (Comes in the Student Access Code Card/Kit that may have been packaged with your new textbook or that may be available separately in your school's bookstore. Otherwise, you can purchase access online at [www.masteringbiology.com](http://www.masteringbiology.com).)
- ✓ **The ZIP or other postal code for your school: Use 77004 or 77204** (check that UofH appears in the dropdown menu.)
- ✓ **A Course ID: MBMEDRANO10718**

### 1. Register

- Go to [www.masteringbiology.com](http://www.masteringbiology.com) and click **Students** under **Register**.
- To register using the student access code inside the MasteringBiology Student Access Code Card/Kit, select **Yes, I have an access code**. Click **Continue**.  
–OR– *Purchase access online:* Select **No, I need to purchase access online now**. Select your textbook, whether you want access to the eText, and click **Continue**. Follow the on-screen instructions to purchase access using a credit card. The purchase path includes registration, but the process is a bit different from the steps printed here.
- **License Agreement and Privacy Policy:** Click **I Accept** to indicate that you have read and agree to the license agreement and privacy policy.
- Select the appropriate option under “Do you have a Pearson Education account?” Continue to give the requested information until you complete the process. The **Confirmation & Summary** page confirms your registration. This information will also be emailed to you for your records.
- **Did you receive multiple access codes for MasteringBiology and/or Virtual Biology Labs?** Sometimes new books come with more than one student access code card. If you have more than one code, register using all of your codes BEFORE clicking Log In Now. For each additional code that you have, return to <http://www.masteringbiology.com/> and click the **Students** button under Register again. *Important:* Identify the SAME student account each time you register. To do this, answer **Yes** to “Do you have a Pearson account?” Then enter your existing login name and password.

### 2. Log In

- Go to [www.masteringbiology.com](http://www.masteringbiology.com).
- Enter your Login Name and Password that you specified during registration and click **Log In**.

### 3. Join Your Instructor's Course and/or Open Self-Study Resources

Upon first login, you'll be asked to do one or more of the following:

- **Join a Course** by entering the **MasteringBiology Course ID** provided by your instructor. If you don't have a Course ID now, you can return to join the MasteringBiology course later. When you join a course, you will be asked for a Student ID (follow on-screen instructions).
- **Explore the Study Area** or **Launch Your eText**, if these resources are available for your textbook.

### To Access MasteringBiology Again Later

Simply go to [www.masteringbiology.com](http://www.masteringbiology.com), enter your Login Name and Password, and click **Log In**. *After you have joined a course:* You can open any assignments from the **Assignments Due Soon** area or from the **Assignments** page. For self-study, click **eText** or **Study Area**, if these options are available.

### Support

Access Customer Support at [www.masteringbiology.com/support](http://www.masteringbiology.com/support), where you will find:

- System Requirements
- Answers to Frequently Asked Questions
- Registration Tips & Tricks video
- Additional contact information for Customer Support, including Live Chat.

BIOL 1362 Appendix: Sample Exam Questions

I. Examples of Exam questions that involve Critical thinking:

1) Use Figure 1 to answer the following 3 questions. The DNA profiles (RFLPs) that follow represent four different individuals in a family. Which of the following statements is consistent with the results?

- a) B is the child of A and C.
- b) C is the child of A and B.
- c) D is the child of B and C.
- d) A is the child of B and C.

2) Which of the following statements is most likely true?

- a) D is the child of A and C.
- b) D is the child of A and B.
- c) D is the child of B and C.
- d) A is the child of C and D.

3) Which of the following are probably siblings?

- a) A and B
- b) A and C
- c) C and D
- d) B and D

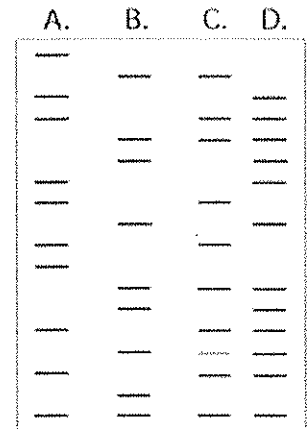


Figure 1

II. Examples of Exam questions that involve Empirical and Quantitative skills:

4) In the formula for determining a population's genotype frequencies (H-W equation:  $p^2 + 2pq + q^2 = 1$ ), the 2 in the term  $2pq$  is necessary because:

- a) the population is diploid.
- b) heterozygotes can come about in two ways.
- c) the population is doubling in number.
- d) heterozygotes have two alleles.

5) Assuming that there are only two alleles at a given locus (i.e. "B" and "b"), if the frequency of one allele is 0.6, what is the frequency of the other allele?

- a) 0
- b) 0.4
- c) 0.6
- d) 1

6) If a population with two alleles (i.e. "A" and "a") is at Hardy-Weinberg equilibrium and the frequency of one allele is 0.7, what is the heterozygote frequency?

- a) 0.7
- b) 0.42
- c) 0.3
- d) 0.21

# Chromosomal Mutations

Chromosomal mutations are changes in the normal structure or number of chromosomes.

- Changes in chromosome structure can result from errors in meiosis or from exposure to radiation or other damaging agents.
- Certain changes in chromosome number can result from nondisjunction during either meiosis or mitosis.

Both structural mutations and nondisjunction can play a role in trisomy 21, commonly known as Down syndrome.

## Part A - Changes in chromosome structure

The diagram below shows two normal chromosomes in a cell. Letters represent major segments of the chromosomes.



The following table illustrates some structural mutations that involve one or both of these chromosomes. Identify the type of mutation that has led to each result shown.

Drag one label into the space to the right of each chromosome or pair of chromosomes. You can use a label once, more than once, or not at all.

You did not open hints for this part.

ANSWER:

Chromosome(s)	Mutation
1. A B C D E F H	
2. I J N K L M N	
3. A B C L M N I J K D E F G H	
4. A E D C B F G H	
5. A B C D D C E F G H	
6. A B C D E K L M N F G H I J	
7. I J M L K N	

translocation

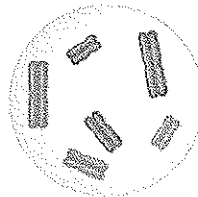
inversion

duplication

deletion

## Part B - Nondisjunction

Suppose a diploid cell with three pairs of homologous chromosomes ( $2n = 6$ ) enters meiosis.

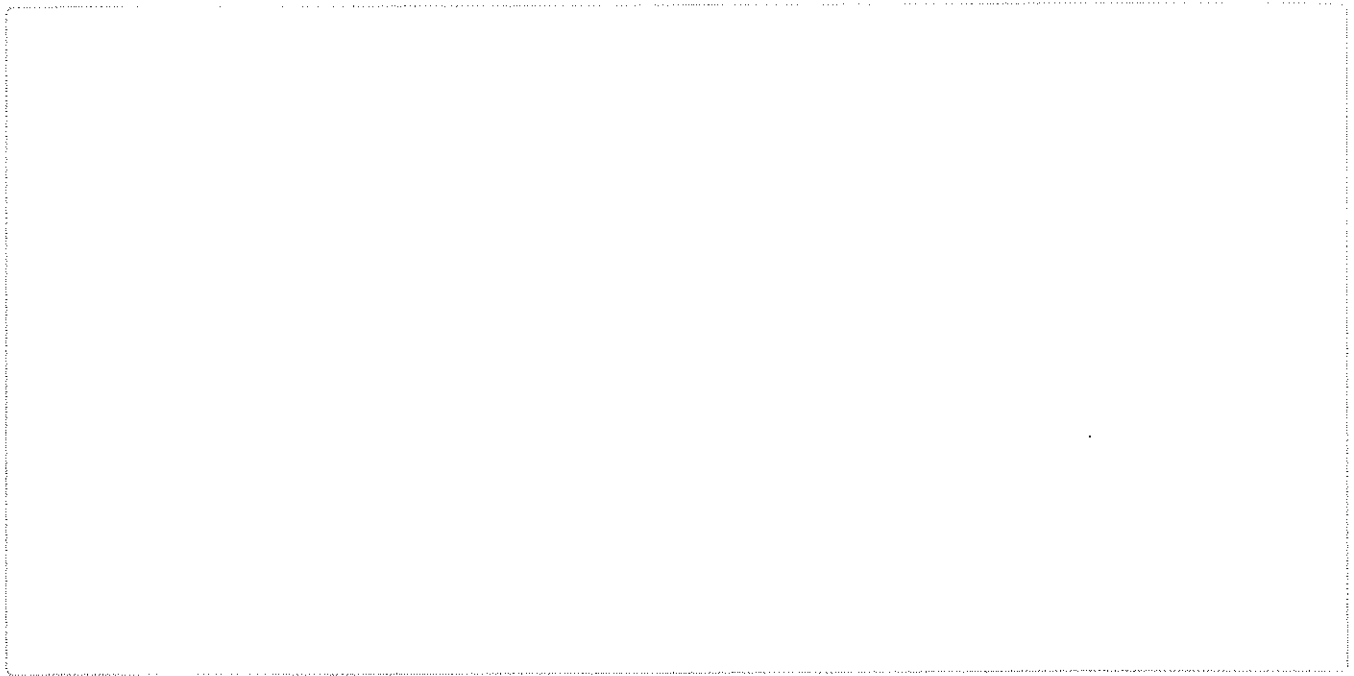


How many chromosomes will the resulting gametes have in each of the following cases?

Drag one label into each space at the right of the table. Labels can be used once, more than once, or not at all.

You did not open hints for this part.

ANSWER:

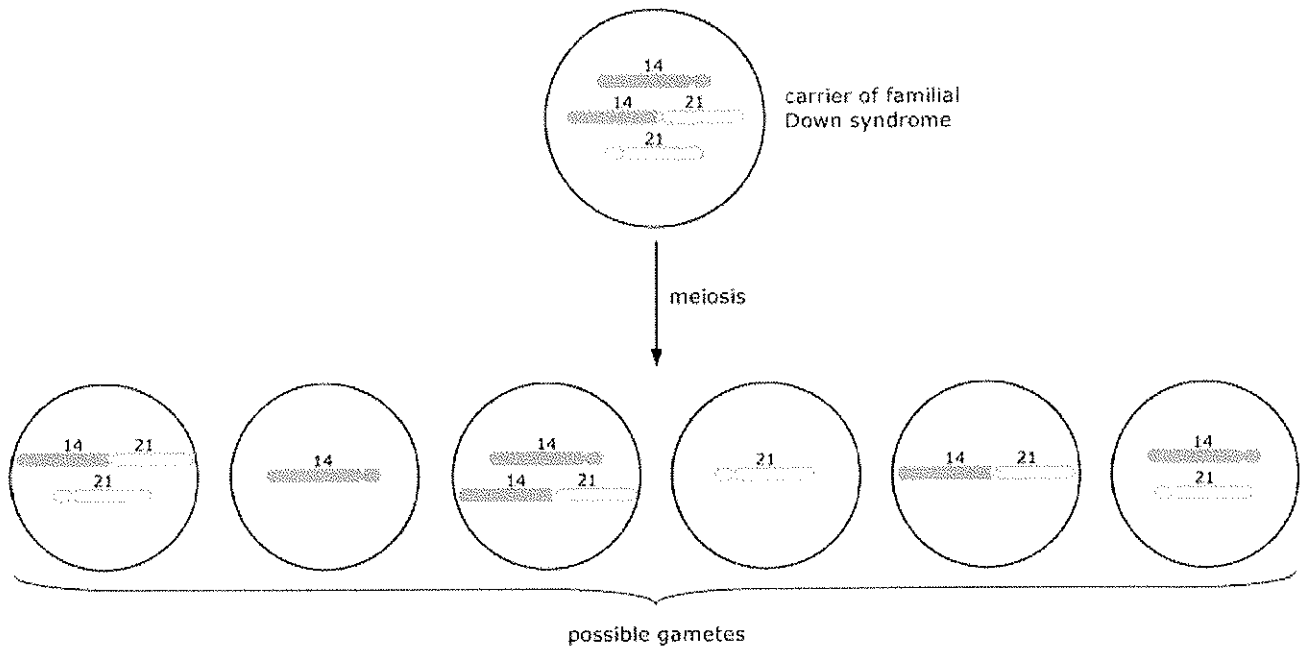


**Part C - Trisomy 21**

Down syndrome is caused by trisomy 21, the presence of three copies of chromosome 21. The extra copy usually results from nondisjunction during meiosis.

In some cases, however, the extra copy results from a translocation of most of chromosome 21 onto chromosome 14. A person who has had such a translocation in his or her gamete-producing cells is a carrier of familial Down syndrome. The carrier is normal because he or she still has two copies of all the essential genes on chromosome 21, despite the translocation. However, the same may not be true for the carrier's offspring.

The diagram shows the six possible gametes that a carrier of familial Down syndrome could produce.

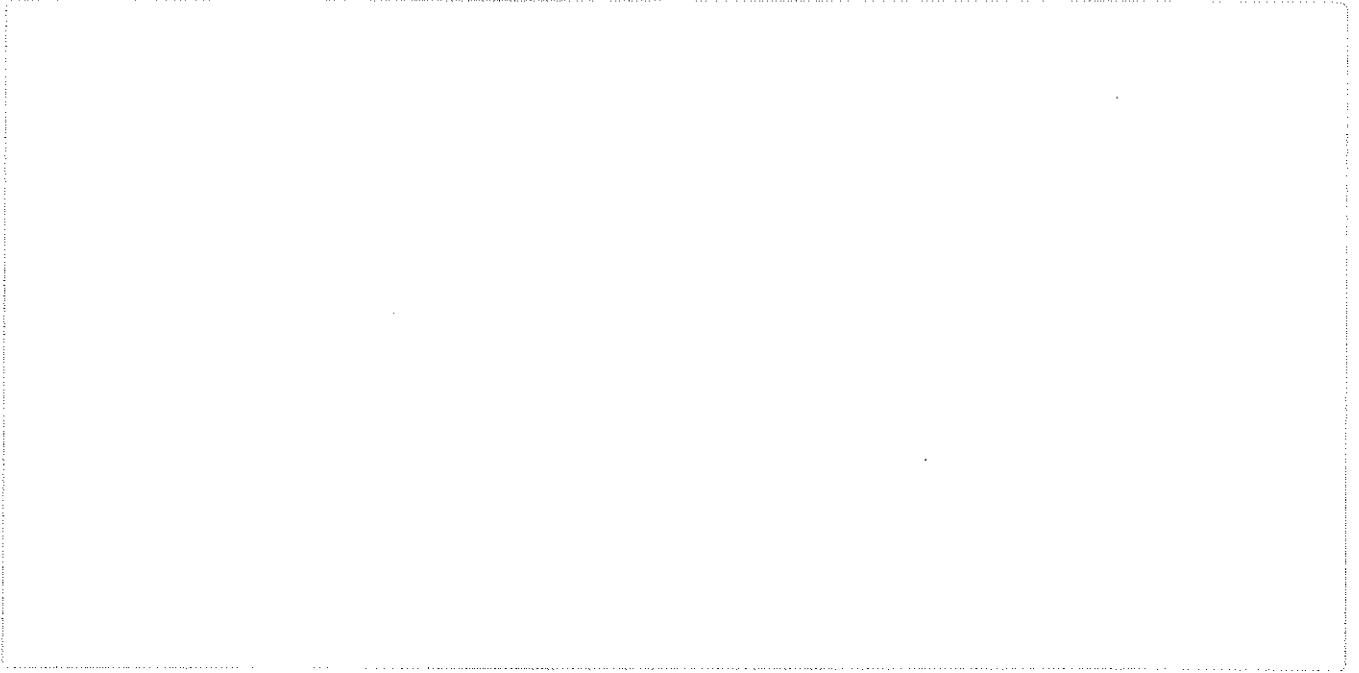


Suppose that a carrier of familial Down syndrome mated with a person with a normal karyotype. Which gamete from the carrier parent could fuse with a gamete from the normal parent to produce a trisomy-21 zygote?

**Drag one of the white cells (representing gametes) to the white target in the diagram. Drag one of the pink cells (representing zygotes) to the pink target.**

You did not open hints for this part.

ANSWER:








## Hardy-Weinberg Principle

The Hardy-Weinberg principle states that, if a population is not evolving, then the frequencies of alleles and genotypes in that population will remain constant from one generation to the next. Further, this principle allows us to predict what the genotype frequencies will be in a non-evolving population. We can conclude that a population *may be* evolving if its genotype frequencies differ from those predicted by the Hardy-Weinberg principle.

### Part A - Analyzing the gene pool of a hypothetical population

A hypothetical population of 200 cats has two alleles,  $T^L$  and  $T^S$ , for a locus that codes for tail length. The table below describes the phenotypes of cats with each possible genotype, as well as the number of individuals in the population with each genotype. Which statements about the population are true?

Genotype	Phenotype (tail length)	Number of individuals in population
$T^L T^L$	long 	60
$T^L T^S$	medium 	40
$T^S T^S$	short 	100

Adapted from *Biology* by Campbell and Reece © 2008 Pearson Education, Inc.

Select the **five** statements that are true.

You did not open hints for this part.

ANSWER:

- Heterozygotes make up 20% of the population.
- Homozygotes make up 80% of the population.
- Homozygotes make up 30% of the population.
- In the entire cat population, 60% of the alleles are  $T^S$ .
- In the entire cat population, the frequency of the  $T^S$  allele is 0.5.
- In the entire cat population, the frequency of the  $T^L$  allele is 0.4.
- Assuming random mating, each gamete has a 50% chance of having a  $T^L$  allele and a 50% chance of having a  $T^S$  allele.
- Assuming random mating, each gamete has a 40% chance of having a  $T^L$  allele and a 60% chance of having a  $T^S$  allele.

### Part B - Determining the expected frequency of each genotype

Considering the same population of cats as in Part A, what is the expected frequency of each genotype ( $T^L T^L$ ,  $T^L T^S$ ,  $T^S T^S$ ) based on the equation for Hardy-Weinberg equilibrium?

Keep in mind that you just learned in Part A that:

- The allele frequency of  $T^L$  is 0.4.
- The allele frequency of  $T^S$  is 0.6.

The equation for Hardy-Weinberg equilibrium states that at a locus with two alleles, as in this cat population, the three genotypes will occur in specific proportions:

$$p^2 + 2pq + q^2 = 1$$

For help applying the Hardy-Weinberg equation to this cat population, see Hints 1 and 2.

Genotype	Phenotype (tail length)	Number of individuals in population
$T^L T^L$	long	60
$T^L T^S$	medium	40
$T^S T^S$	short	100

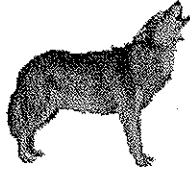


Enter the values for the *expected* frequency of each genotype,  $T^L T^L$ ,  $T^L T^S$ ,  $T^S T^S$ , respectively, separated by commas. Enter your answers numerically (as decimals), not as percentages.

You did not open hints for this part.

ANSWER:

**Part C - Using the Hardy-Weinberg equation to determine if a population appears to be evolving**

A hypothetical population of 300 wolves has two alleles,  $F^B$  and  $F^W$ , for a locus that codes for fur color. The table below describes the phenotype of a wolf with each possible genotype, as well as the number of individuals in the population with each genotype. Which statements accurately describe the population of wolves?

Genotype	Phenotype (fur color)	Number of individuals in population
$F^B F^B$	black 	40
$F^B F^W$	gray 	40
$F^W F^W$	white 	220

Adapted from *Biology* by Campbell and Reece © 2008 Pearson Education, Inc.

Select the *four* statements that are true.

You did not open hints for this part.

ANSWER:

- Based on the equation for Hardy-Weinberg equilibrium, the expected number of wolves with the  $F^B F^B$  genotype is 40.
- Based on the equation for Hardy-Weinberg equilibrium, the expected number of wolves with the  $F^B F^B$  genotype is 12.
- Based on the equation for Hardy-Weinberg equilibrium, the expected number of wolves with the  $F^B F^W$  genotype is 40.
- Based on the equation for Hardy-Weinberg equilibrium, the expected number of wolves with the  $F^B F^W$  genotype is 96.
- The population may be evolving because the actual number of individuals with each genotype differs from the expected number of individuals with each genotype.
- The population is not evolving because it is at Hardy-Weinberg equilibrium.
- The population is not at Hardy-Weinberg equilibrium.