

SAVVAS

PROGRAM
OVERVIEW

Biology

Miller & Levine



Experience It!
IT'S THE SCIENCE OF DOING!



Phenomena

drive student inquiry.

Discover. Explain. Prove. *Miller & Levine Biology* immerses students in phenomena-based lessons through Problem-Based Learning and Case Studies. Send students on a journey of discovery with compelling real-world phenomena.

PROBLEM: For what purposes should humans genetically modify animals?

TO SOLVE THIS PROBLEM, perform these activities as they come up in the unit, and record your findings in your Explorer's Journal.

Problem-Based Learning Projects

Support students' understanding of a relevant and local phenomenon. These student-led research projects encourage student inquiry and discourse.

PROBLEM LAUNCH

INTERACTIVITY

STEM

STEM PROJECT

AUTHENTIC READING

PROBLEM WRAP-UP

Genetics
Genetic Modification of Animals

People have bred animals and plants for hundreds of years. The results include leaner livestock that produced better quality meat, familiar domesticated dogs and cats, and strains of crop plants that are resistant to pests. Today, with the technology of genetic modification, scientists are introducing new genes and traits to both plants and animals, further modifying them from their original form. Scientists and engineers are still exploring the uses of genetic technology. Genetically-modified bacteria and yeasts now produce useful products.

PROBLEM LAUNCH

Genetic Modification of Animals

Choose an animal to research that has been genetically modified.

Timing: Beginning of Unit 4

PROBLEM FOR WHAT PURPOSES SHOULD HUMANS GENETICALLY MODIFY ANIMALS?

1. What problem do researchers hope to solve with their genetic modifications of the animal you chose?

WHAT DO I NEED TO KNOW?

2. What questions do I need to answer to learn more about what researchers intend and the potential outcomes of their plans?

INTERACTIVITY

Evidence of Evolution

What types of evidence of evolution can be observed in different species?

Timing: Chapter 17, Lesson 4

RECORD DATA AND OBSERVATIONS

Part 1

1. Complete the chart listing important characteristics and environmental descriptions about the Emperor Penguin, Galapagos Penguin, and the Common Murre.

Characteristics	Environment
Emperor Penguin	
Galapagos Penguin	
Common Murre	

2. Describe a characteristic differently due to their

STEM PROJECT

Design Evaluation Criteria for Uses of GM Animals

The capabilities of geneticists continues to grow in both animal and plant modifications. However, are there potential drawbacks to genetic modification? A prioritized set of evaluation criteria can help groups of people and organizations decide on whether appropriate constraints are necessary for genetic modification.

Timing: Chapter 16, Lesson 4

DEFINE THE PROBLEM WHAT CRITERIA SHOULD BE USED TO DETERMINE WHETHER AN ANIMAL SHOULD BE GENETICALLY MODIFIED?

1. List your initial thoughts for when it is appropriate to genetically modify an organism.

BRAINSTORM SOLUTIONS

2. In this project, you will work in a group of four to design a proposed set of criteria for evaluating three specific uses of GM animals. Brainstorm the general types of criteria that you believe are most important.

3. Now brainstorm specific ideas about specific ideas for criteria for

- 1) Lab mice in a medicine-related trial
- 2) Inequity for improving public food source (without domesticating wild stock)
- 3) Genetically modified mosquitoes to combat a deadly virus outbreak.

Tiktaalik's internal anatomy explains evolutionary shift from water to land

by John Easton

Timing: Chapter 19, Lesson 2

Newly exposed parts of Tiktaalik roseae—the intermediate fossil between fish and the first animals to walk out of water onto land 375 million years ago—are revealing how this major evolutionary event happened. A new study, published this week in *Nature*, provides a detailed look at the internal head structure of Tiktaalik roseae and reveals a key intermediate step in the transformation of the skull that accompanied the shift to life on land.

A predator, up to 9 feet long, with sharp teeth, a crocodile-like head and a flattened body, Tiktaalik's anatomy and way of life straddle the divide between fish and land-living animals. First described in 2006 and quickly dubbed the "fishapod," it had the fish-like features of a primitive jaw, fins and scales, as well as a skull, neck, ribs and parts of the limbs that are similar to tetrapods (four-legged animals).

The initial 2006 report did not describe the internal anatomy of the head, because those parts of the fossil were buried in rock. In the Thursday, Oct. 16 issue of *Nature*, the researchers describe this region and show how Tiktaalik was gaining structures that could allow it to breathe air and support itself on solid ground.

Individual steps and resolve the relative timing of this complex transition," added Shubin, Professor and Associate Dean of Organismal and Evolutionary Biology, and president of the Field Museum.

"The braincase, palate and gill arch skeleton of Tiktaalik have been revealed in great detail by recent fossil preparation of several



Genetic Disorders: Understanding the Odds

CASE STUDY



Forensics Lab

Guided Inquiry

Using DNA to Identify Species

Time 1 period, ½ block

Purpose In this lab, students will extract DNA from strawberries. Then they will work with another group to model DNA barcoding.

Planning Notes Go online to find the lab worksheet for this lab and an alternative version for struggling students. Both labs are **editable**. Teacher Notes for both labs contain teaching tips, alternative materials suggestions, and answers.

Materials self-sealing plastic freezer bag, funnel, ripe strawberries, medium-sized test tube, detergent solution, test-tube rack, 25-mL graduated cylinder, chilled 95% ethanol, cheesecloth, stirring rod

On the Case Encourage students to think about other kinds of problems DNA barcodes could solve based on the problem they were able to solve in this lab.

Case Studies

- Launch every chapter with an intriguing, open-ended scientific problem or question.
- Connect learning to the Case Study through activities, data analysis, and assessment prompts to create a cohesive storyline.
- Students gather data, cite evidence, and apply scientific reasoning to develop argument-driven discussions with their peers as they Make Their Case.

Make Your Case

New technology allows DNA samples to be sequenced and identified very quickly and inexpensively. In closely related species, some DNA sequences are nearly identical. However, every species has short, unique DNA sequences that act like ID cards, or DNA barcodes. Specimens of fishes—or ferns, or sea turtles—can be classified into the correct species according to these DNA sequences.

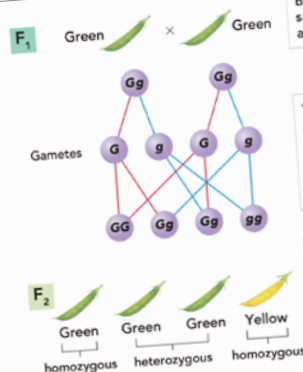
Communicating Information

1. **Conduct Research** Apart from the examples presented in this case study, what other problems do you think DNA barcoding could help solve? Conduct additional research about the technology and its potential uses.
2. **Develop Possible Solutions** Describe a solution that would be useful for addressing the problem.

CASE STUDY

Figure 12-5 Segregation and Probability

In this cross, the GG and Gg allele combinations produced three plants with green pods, while the gg allele combination produced one plant with yellow pods. These quantities follow the laws of probability. **Reason Quantitatively** What is the probability that an offspring from a hybrid cross has the recessive phenotype?



Both F₁ plants have the same set of alleles (Gg) and have green pods.

The probability of each gamete acquiring the green (G) allele is $\frac{1}{2}$. Similarly, the probability of acquiring the yellow (g) is also $\frac{1}{2}$.

When the alleles pair up in the F₂ generation, the probability of offspring with green pods (GG or Gg) is $\frac{1}{4} + \frac{1}{4} + \frac{1}{4}$, or $\frac{3}{4}$. The probability that the offspring will have yellow pods (gg) is $\frac{1}{4}$.

Engage

students in hands-on learning.

Do more inquiry! Throughout each lesson, students are engaged through hands-on labs, STEM activities, and interactivities as they investigate key questions, apply science and engineering practices, and interpret data.



◀ Enhance Learning with Dynamic Resources

- Access animations and interactive media at point of use.
- Meet real scientists at work through career videos.
- Improve data analysis skills with tutorials.

Engaging Virtual Labs ▶

- Give all students access to compelling phenomena with virtual labs.
- Simulate real lab experiences for students with authentic tools and procedures.
- Students conduct quick, multivariable digital investigations that provide instant feedback.



Quick Lab Open-Ended Inquiry

Modeling DNA Replication

1. Cut out small squares of white and black paper to represent phosphate and deoxyribose groups. Label the white squares "phosphate" and the black squares "deoxyribose."
2. Then cut colored paper strips to represent the four nitrogenous bases. Match the colors used in **Figure 13-11**. Label each strip with its nucleotide name. Then tape together a set of five nucleotides.
3. Using your nucleotides, tape together a single strand of DNA. Exchange strands with a partner.
4. Model DNA replication by creating a strand that is complementary to your partner's original strand.

ANALYZE AND INTERPRET DATA

1. **SEP Use Models** The action of what enzyme was modeled by the taping together of the nucleotides?
2. **SEP Evaluate Models** In what ways does this activity accurately model DNA replication? How could you improve the activity to better model the steps of DNA replication?
3. **Defend Your Claim** How can errors during DNA replication lead to genetic variations? Use your model to support your answer.



◀ Quick Labs

- Engage students with hands-on inquiry experiences.
- Students analyze and interpret real data as they model biology concepts.
- Save valuable time with easy setup and cleanup.

Inquiry Labs ▶

- Foster critical thinking and scientific reasoning as students make models and explore scientific concepts.
- Customize and edit on the Savvas Realize® digital platform.
- Differentiate for personalized learning with three versions of each lab: guided, open-ended, or argument-driven.


Modeling Lab
Open-Ended Inquiry

Chapter 12 Lab
A Model of Meiosis

Ask Questions
How does meiosis change a diploid cell into haploid gametes?

Introduction
Almost all the cells of a multicellular organism are produced by mitosis. Mitosis ensures that all the cells have the same set of chromosomes and the same DNA, which is essential for the cells to function properly. However, a different process is needed to produce the gametes of the organism. Gametes, such as sperm and egg cells, are cells that can unite to form the first cell of a new individual. The gametes are haploid (N), meaning they contain half the number of chromosomes of other cells, which are diploid (2N).

The process that produces gametes is called meiosis, and it is summarized in the diagram below. Meiosis involves two cell divisions, called Meiosis I and Meiosis II. Both processes are similar to mitosis, but with important differences. In Meiosis I, the homologous chromosomes align along the metaphase plate. During anaphase, the chromosomes separate from one another. The result is two cells, each with the haploid (N) number of chromosomes.



Modeling Lab Open-Ended Inquiry

A Model of Meiosis

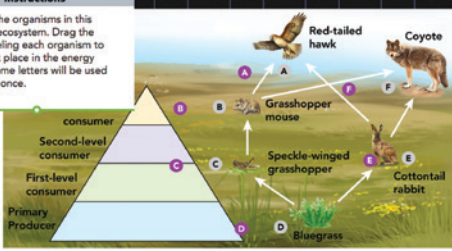
Problem How does meiosis change a diploid cell into haploid gametes?

In this lab, you will plan and develop a model of meiosis. You will choose materials to represent the cell and chromosomes, assemble and manipulate the materials to represent the stages of meiosis, and use the model to explain the process.

You can find this lab in your digital course.

Exit
Interactivity: Ecological Pyramids

Ecological Pyramids
Instructions
Consider the organisms in this grassland ecosystem. Drag the letters labeling each organism to the correct place in the energy pyramid. Some letters will be used more than once.



Go Online to access your digital course.

VIDEO
AUDIO
INTERACTIVITY
ETEXT
ANIMATION
VIRTUAL LAB
ASSESSMENT

◀ Interactive Virtual Simulations

- Students manipulate visuals and interactive content to deepen understanding.
- Learners explore with different types of media, including digital art, drag and drop activities, art review exercises, videos, and vocabulary cards.
- Strategic placement of visuals throughout the narrative enhance explanations.

ACCESSIBLE

biology for all students.

Authors Ken Miller and Joe Levine are active scientists and passionate storytellers who want *Miller & Levine Biology* to inspire students. They combine an engaging narrative with inquiry activities, visual supports, teacher tools, and other reading aids so all students can comprehend and succeed.

Reach All Students

Target your instruction with point-of-use resources and strategies in the Teacher Edition to provide access for all students. Support for:

- English learners
- Special needs students
- Less proficient readers
- Struggling students
- Advanced students

DIFFERENTIATED INSTRUCTION

Share this quote with students: "Viewed from the distance of the moon, the astonishing thing about the earth, catching the breath, is that it is alive Aloft, floating free beneath the moist, gleaming membrane of the bright blue sky, is the

This quote by

otic factors.

sensory descrip-

salt water at the

ENGLISH LANGUAGE DEVELOPMENT

Writing Students work in pairs to explain primary and secondary succession.

Entering Have students draw and add general labels to the illustrations in **Figure 6-8**.

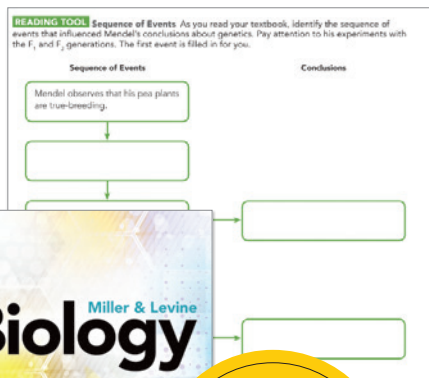
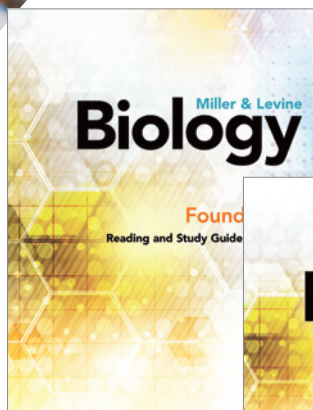
Emerging Have one partner write sentences that combine successive steps in primary succession. The other partner completes the exercise for secondary succession.

Distinguished Have one partner write a one or two sentence precise and clear description of primary succession is. Have the other partner do the same for secondary succession.

Translate the
eText to over
100 languages
using Google
Translate™



Miller & Levine Biología
is available in print and
on Savvas Realize.



Available
in English
and Spanish

Reinforce Learning with the Foundations Reading and Study Guide

- **Reading Tools** target strategies to support reading comprehension.
- **Visual Reading Tools** support difficult concepts with interactive visuals and alternative practice opportunities.
- **Science Vocabulary** graphic organizers spotlight new words and pronunciation to help students learn the language of biology.

3-D Assessment Tasks

Complete Assessment Suite

Pre-Testing

- Diagnostic Test
- Activate Prior Knowledge

Formative Assessments

- Lesson Reviews
- Lesson Quizzes
- Assess on the Spot
- Reading Checks

Summative Assessments

- Chapter Assessments and Tests
- End-of-Course Test Prep
- Unit Benchmark Tests

Performance Tasks

- Performance-Based Assessments
- Make Their Case
- STEM Projects

examview

Assign
and edit
assessments on
Savvas Realize®



Meet the Authors

Active scientists, passionate storytellers



"You don't need a lab coat, degree, or laboratory to be a scientist. What you need is an inquiring mind, the patience to look at nature carefully, and the willingness to figure things out."

– Ken Miller

"We want students to really understand biology—which means more than memorizing facts. We've worked hard to put the information together in ways that will help you understand why that information is important."

– Joe Levine



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SAM: 9781428598058 ADV: 9781428598065

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