

Unit 5

Genetics:

Why are living things different
from one another?

Student Work Pages





Genetics:

Why are living things different from one another?

Student Work Pages

Core Knowledge Science



Creative Commons Licensing

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.



You are free:

to Share—to copy, distribute, and transmit the work

to Remix—to adapt the work

Under the following conditions:

Attribution—You must attribute the work in the following manner:

CKSci 6–8 was originally developed and authored by OpenSciEd, <https://www.openscienced.org>, Copyright 2019. It is licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0). The OpenSciEd 6–8 Science Curriculum is available at:*

<https://www.openscienced.org/access-the-materials/>

Additions to the OpenSciEd 6–8 Science Curriculum are marked as “Core Knowledge Science Literacy”. This additional content is the work of the Core Knowledge® Foundation (www.coreknowledge.org) made available through licensing under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

Noncommercial—You may not use this work for commercial purposes.

Share Alike—If you alter, transform, or build upon this work, you may distribute the resulting work only under the same or similar license to this one.

With the understanding that:

For any reuse or distribution, you must make clear to others the license terms of this work. The best way to do this is with a link to this web page:

<https://creativecommons.org/licenses/by-nc-sa/4.0/>

Copyright © 2022 Core Knowledge Foundation

www.coreknowledge.org

All Rights Reserved.

*Please see full attribution at the back of this book for credited contributors to the development and field testing of the OpenSciEd unit.

Core Knowledge®, Core Knowledge Curriculum Series™, Core Knowledge Science Literacy™, and CKSciLit™ are trademarks of the Core Knowledge Foundation.

Trademarks and trade names are shown in this book strictly for illustrative and educational purposes and are the property of their respective owners. References herein should not be regarded as affecting the validity of said trademarks and trade names.

ISBN: 978-1-68380-767-4

Genetics

Why are living things different from one another?

Table of Contents

Lesson 1: Initial Model	1	Lesson 13: Exit Ticket	41
Lesson 2: Muscle Protein Questions	3	Lesson 13: Giving Feedback to Peers.....	43
Lesson 2: Model Update	5	Lesson 14: Asexual Reproduction Notes.....	45
Lesson 3: Organizer for Obtaining and Evaluating Information	7	Lesson 15: Explaining Environmental Effects	47
Lesson 3: Exit Ticket - Role of Protein and Exercise in Building Muscle	9	Lesson 16: Data Collection: Wheat Kernels... ..	49
Lesson 5: Family Phenotype Graphic Organizer	11	Lesson 16: Arm Span Histogram Instructions	51
Lesson 5: Chromosomes in Sex Cells	13	Lesson 16: Arm Span Reading and Modeling	53
Lesson 5: Karyotype of Lorenc's Muscle Cell..	15	Lesson 17: Questions and Answers from Our DQB	55
Lesson 6: Guiding Questions for Chromosome and Protein Data	17	Science Literacy Exercise Pages	
Lesson 7: Gotta-Have-It Checklist	19	Collection 1 Exercise Page 1	57
Lesson 8: Traditional Pedigree Graphic Organizer	21	Collection 2 Exercise Page 2	59
Lesson 8: Using Pedigrees to Make Predictions	23	Collection 3 Exercise Page 3	61
Lesson 9: Bird Breeder Simulation Results ..	29	Collection 4 Exercise Page 4	63
Lesson 12: Lab v1: Extracting Genetic Material	31	Collection 5 Exercise Page 5	65
Lesson 12: Lab v2: Extracting Genetic Material	33		
Lesson 13: Flower Diagram	37		
Lesson 13: Breeding Tulips	39		

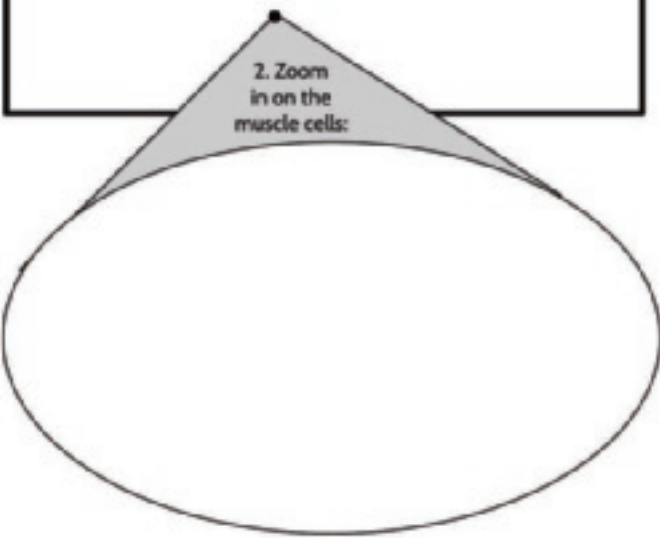
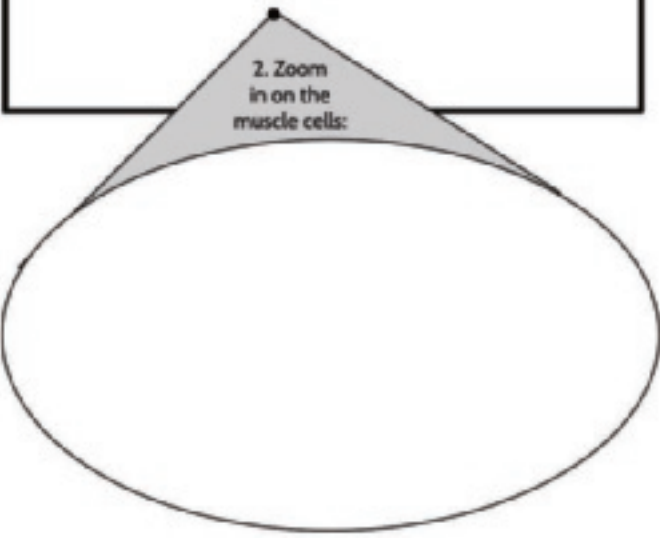
Name: _____

Date: _____

Initial Model

Develop an initial model to explain this question: **What do you think caused this animal to get such big muscles compared to typical animals?**

1. Choose a type of animal we have seen that had an individual with extra-big muscles. Sketch that animal in the top of each box, with typical muscles on the left and with extra-big muscles on the right.
2. If you could view the muscle cells in the muscle tissue from both animals with a microscope, how would they compare? Draw and/or write in the ovals what you would expect to see.
3. On the lines below, explain how you think the animal on the right got those extra-big muscles and the other one did not.

Typical animals	Extra-big muscled animal
1. Sketch of animal:  2. Zoom in on the muscle cells:	1. Sketch of animal:  2. Zoom in on the muscle cells:

4. Explain how the animal on the right got those extra-big muscles but another animal did not.

Name: _____

Date: _____

Muscle Protein Questions

Part 1: Use words and/or drawings to record ideas from the video animation and the written text (with diagrams).

	Video animation	Written text with labeled diagrams
What ideas about muscles do we figure out from this source?		
How does the structure (shape) of the myosin and actin proteins affect their function (how they do their jobs)?		

Part 2: Integrate ideas from both sources to answer these questions.

1. After reading the text, watch the video a second time. Did you notice or understand any part(s) of the video better the second time because of something you read or saw in the text? If yes, what?

2. What new ideas do you have about proteins now?

3. In one or two sentences of your own words, summarize how muscle cells contract (pull together): What is a claim you can make about how muscles contract?

Part 3: Consider how integrating information from both sources helped clarify your understanding of how muscles work.

4. What is an idea you would have missed about muscle cells and how they function if you had used only one source?

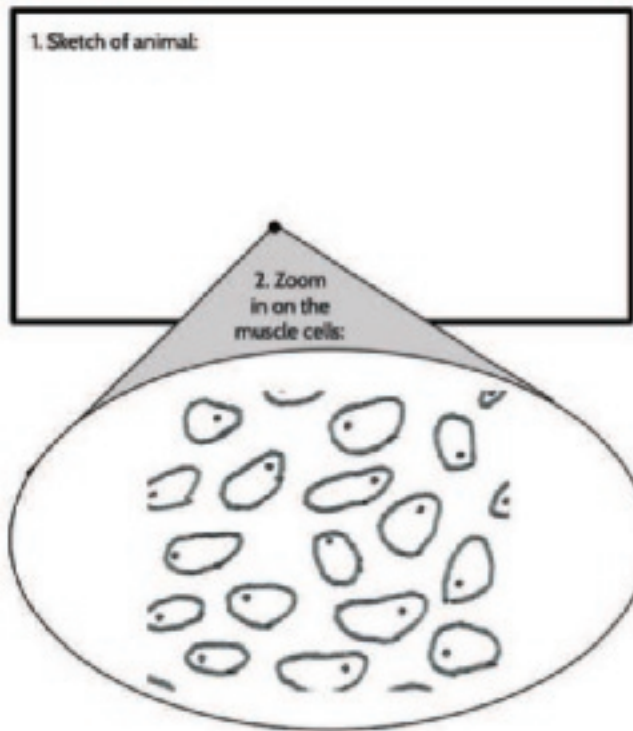
5. Tell one advantage of using multiple sources, both video and text, that helped you deepen your understanding of this information.

Model Update

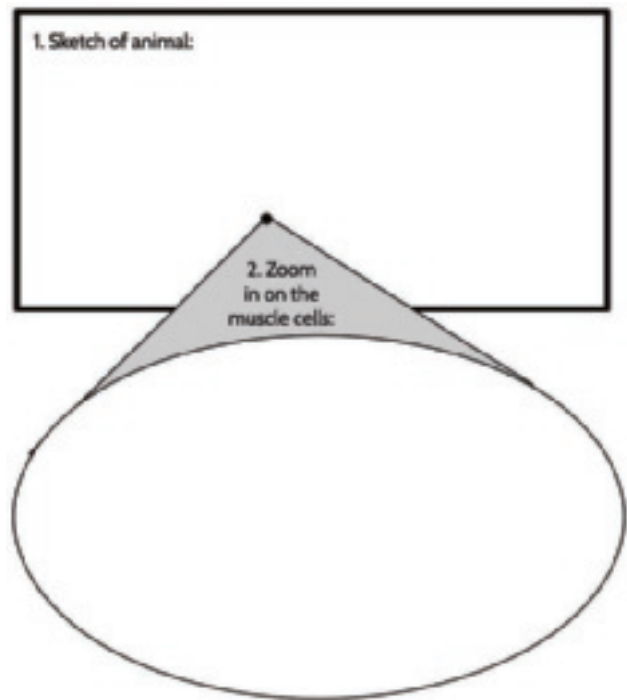
Now that you have figured out how extra-big muscle tissue is different from typical muscle tissue, you can update your initial model. (Your teacher will return this page to you so you can keep it in your science notebook.)

1. For this comparison, like for our initial model, you may decide what animal to consider of those we have observed so far. Sketch that animal with typical muscles on the left and with extra-big muscles on the right.
2. When you zoom in on the muscle cells in the muscle tissue from the extra-big-muscled animal, draw how the cells would compare to the typical animal's cells that are already drawn in for you.

Typical animals



Extra-big muscled animal



3. How do muscles from extra-big-muscled animals compare to typical ones? Check all that are true, based on the evidence you found today

_____ Bigger muscles have bigger cells (they have a greater area) than typical muscles.

_____ Bigger muscles have more cells than typical muscles.

_____ Bigger muscles have more mass than typical muscles.

4. What question(s) are you still wondering about?

Name: _____

Date: _____

Organizer for Obtaining and Evaluating Information

Question to consider while reading	Title:	Title:	Title:
What is the central idea or claim in the article?			
Does the claim make sense with our ideas about muscle growth?			
What evidence is given to support the author’s claim?			
Which sources does the author cite?			
What is the goal of the text?			
What methods did the authors use to study and test their ideas?			

Name: _____

Date: _____

Exit Ticket - Role of Protein and Exercise in Building Muscle

1. How do protein and exercise affect muscle size?

2. What questions do you still have about protein, exercise, and our cattle with extra-big muscles?

Name: _____

Date: _____

Family Phenotype Graphic Organizer

--	--

--	--

--	--

--	--

--	--

--	--

--	--

Chromosomes in Sex Cells

These images of egg and sperm are not to scale, and the size of the nucleus has been enlarged relative to the size of each cell to allow better viewing of the chromosomes.

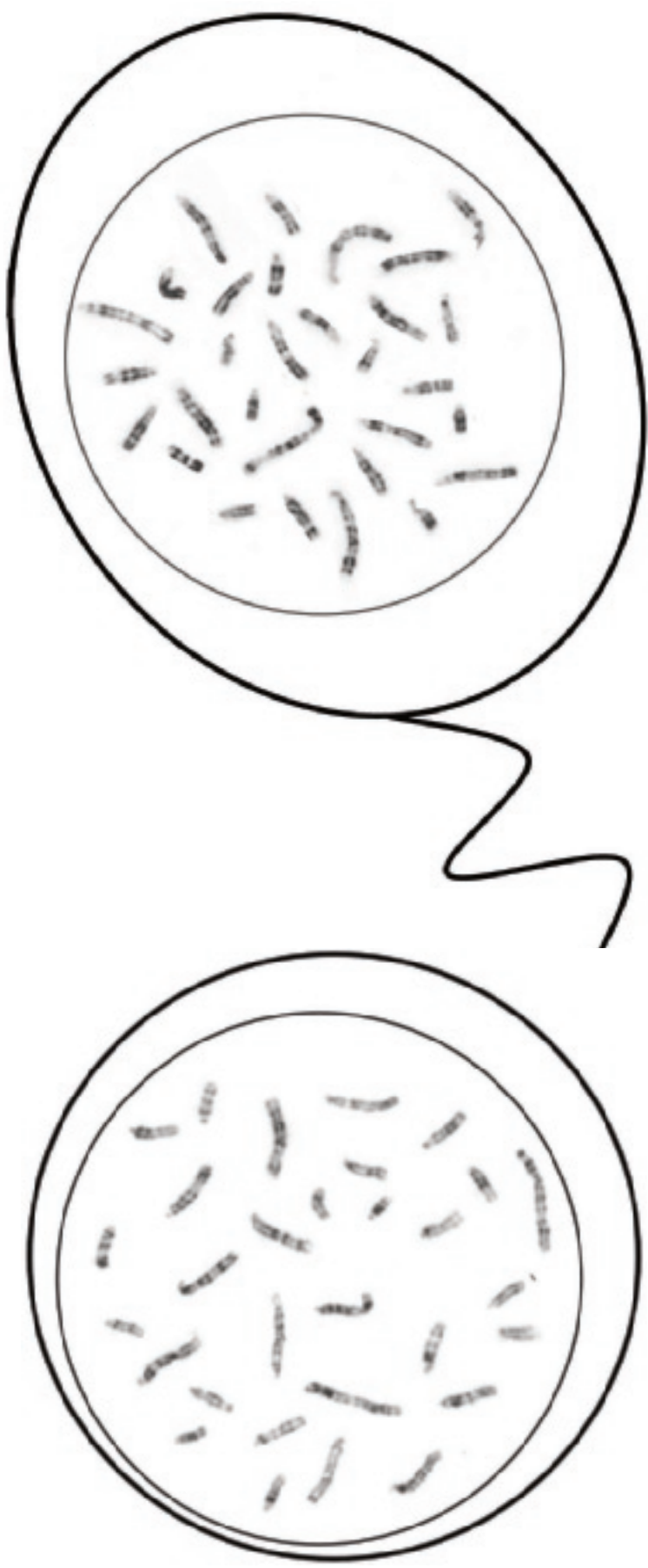


Image credit: G-and-R-banded cattle karyotypes published in J. Hered., 81(1):80-83 (1990)

Karyotype of Lorenc's Muscle Cell

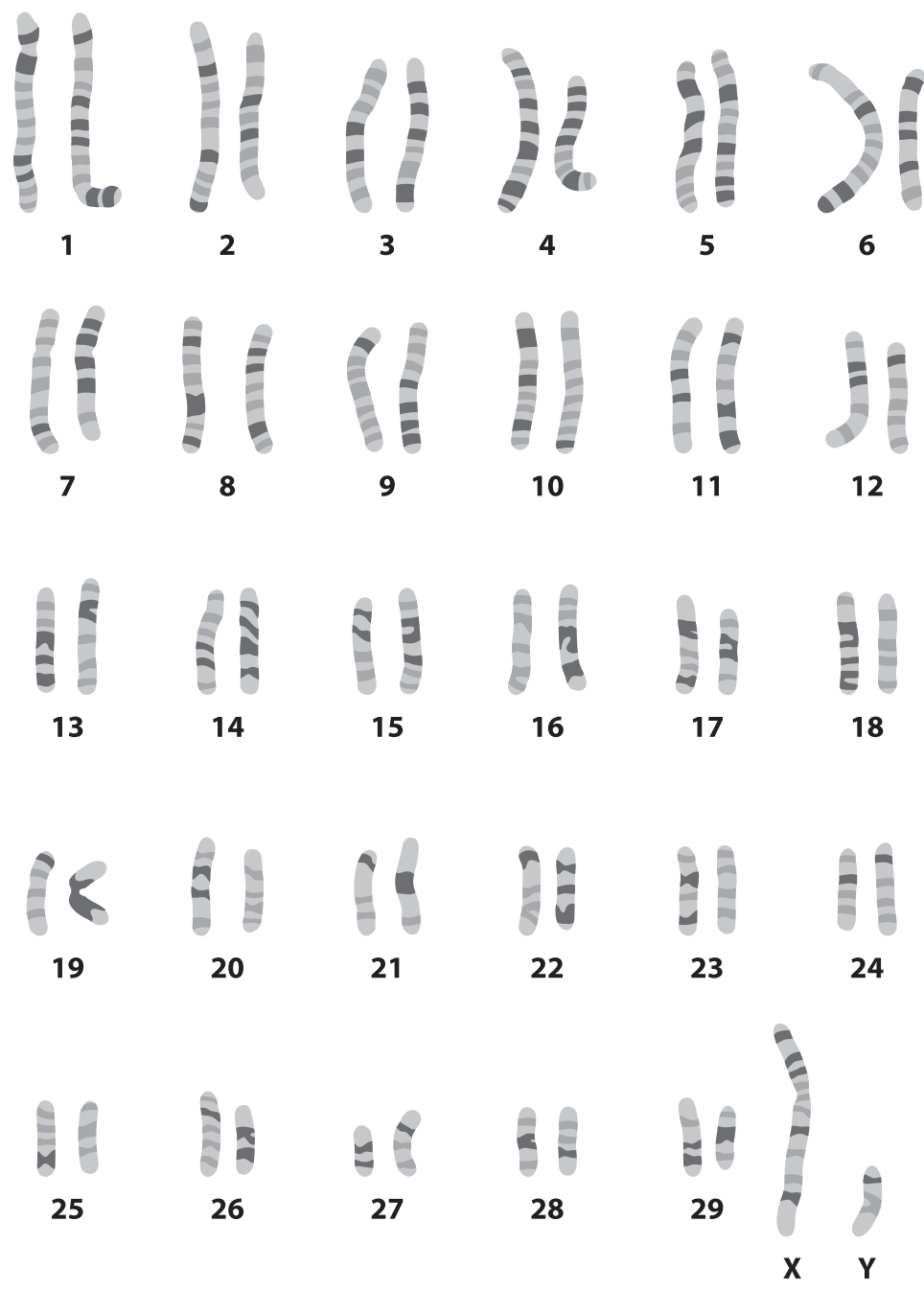


Image credit: G-and-R-banded cattle karyotypes published in J. Hered., 81(1):80-83 (1990)

Name: _____

Date: _____

Guiding Questions for Chromosome and Protein Data

Directions: Complete these questions as you form groups around the classroom to help you find patterns in the cattle photos and chromosome and protein data.

1. What musculature does your animal have? _____
2. What patterns did you find among the colors and shapes of the chromosome symbols from cattle with similar musculature?

3. After rearranging in new groups by versions of myostatin protein, what do you notice about the cattle in your group?

4. What version(s) of the myostatin protein seem(s) to be related to your cattle's musculature?

5. Can you see a pattern between proteins and the chromosome symbols? If so, describe it.

6. Would you say that the relationship among extra-big muscles, chromosomes, and proteins is correlational (simply happening together) or would you say the relationship is causal (one thing is the reason or cause for the other thing)? Why do you think so?

Name: _____

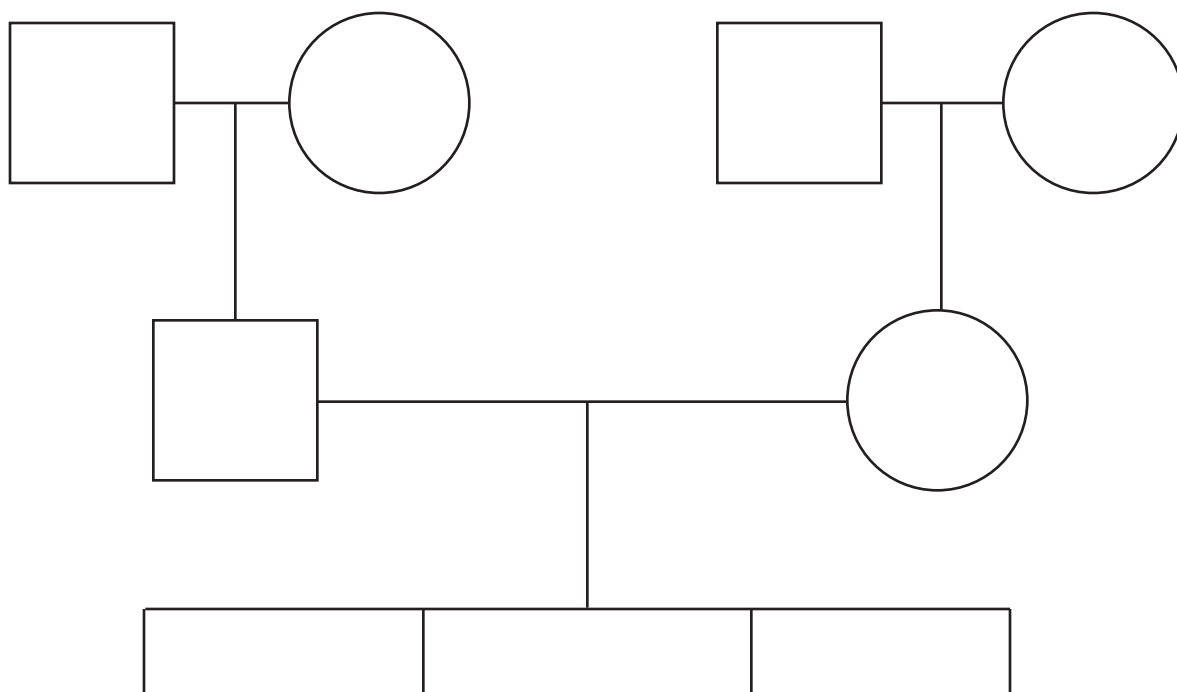
Date: _____

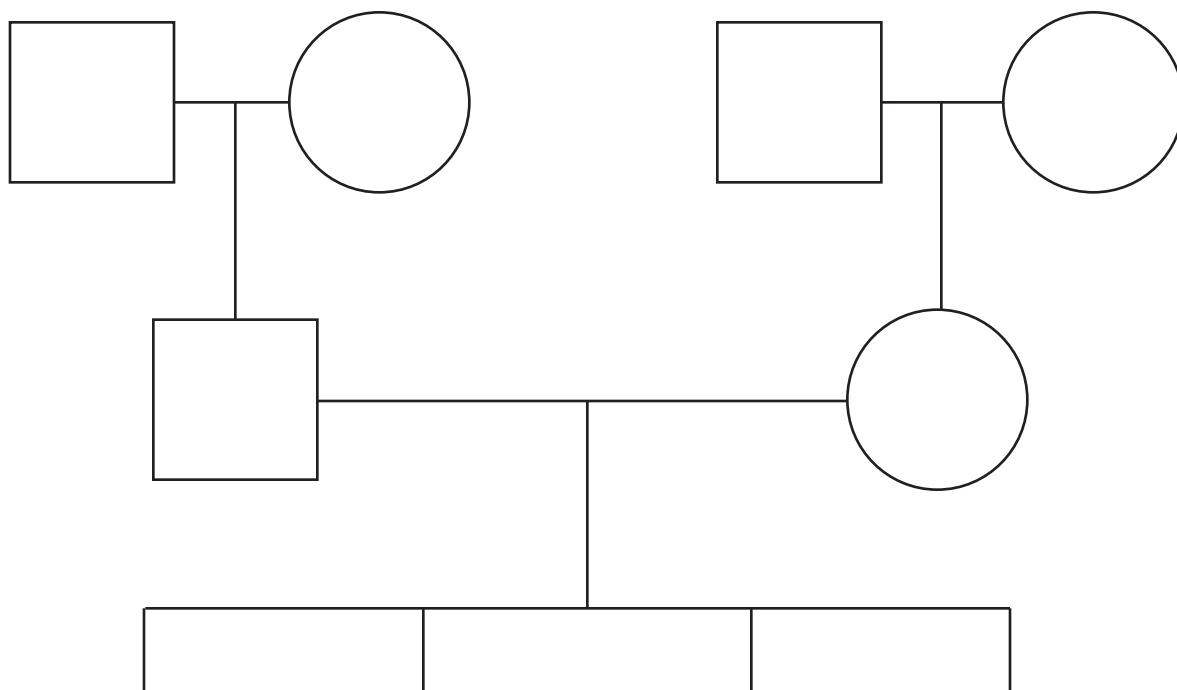
Gotta-Have-It Checklist

Directions: Use our classroom consensus model, your Progress Tracker, and your science notebook to make a checklist of the components and interactions that need to be in our model to explain how an animal’s musculature can be influenced by its genotype. You may or may not use every row.

What our model needs to have in order to answer the question, “How can an animal’s musculature be influenced by its genotype?”	Check off pieces of the model as you use them.	
	used	did not use

Traditional Pedigree Graphic Organizer





Name: _____

Date: _____

Using Pedigrees to Make Predictions

Ranchers noticed that certain bulls and cows reliably had offspring with traits they were interested in (like extra-big muscles or fast growth). This led to the practice of keeping herd books. This is a place where ranchers keep track of which cows are mated to which bulls and all the resulting offspring. When a bull/cow combination gives an exceptional offspring with desirable trait variations, ranchers might pair the same parents multiple times. Both desirable and undesirable variations are recorded. If undesirable trait variations (such as weak legs or feet) result from a match between a cow and bull, they will not continue to cross them. Over time, ranchers are able to create detailed pedigrees documenting family lineages. The most successful ranchers are those that are best at predicting which cow and bull crosses will result in the best combination of desirable characteristics while minimizing the undesirable characteristics. The following are examples of some of these cow/bull offspring records that were organized into pedigrees tracing individual cattle phenotypes with regard to musculature.

Work with your group to count up the total number of offspring for each of the different types of parental crosses and count how many offspring have each of the three different types of musculature phenotypes.

A. Both parents were homozygous for the allele for myostatin that results in big muscles:

Cross: EE x EE Breeding pair(s): _____

Phenotype of offspring	Genotype of offspring	Keep track of how many offspring by making hash marks or writing numbers for each family	Total number
Heavily muscled	EE		
Medium-muscled	Ee		
Typically muscled	ee		
TOTAL of all offspring:			

B. Both parents were homozygous for the allele for myostatin that results in typical muscles:

Cross: ee x ee Breeding pair(s): _____

Phenotype of offspring	Genotype of offspring	Keep track of how many offspring by making hash marks or writing numbers for each family	Total number
Heavily muscled	EE		
Medium-muscled	Ee		
Typically muscled	ee		
TOTAL of all offspring:			

C. One parent was homozygous for the allele for myostatin that results in big muscles, and the other was homozygous for the allele that results in typical muscles:

Cross: EE x ee Breeding pair(s): _____

Phenotype of offspring	Genotype of offspring	Keep track of how many offspring by making hash marks or writing numbers for each family	Total number
Heavily muscled	EE		
Medium-muscled	Ee		
Typically muscled	ee		
TOTAL of all offspring:			

D. One parent was homozygous for the allele for myostatin that results in big muscles, and the other parent was heterozygous:

Cross: EE x Ee Breeding pair(s): _____

Phenotype of offspring	Genotype of offspring	Keep track of how many offspring by making hash marks or writing numbers for each family	Total number
Heavily muscled	EE		
Medium-muscled	Ee		
Typically muscled	ee		
TOTAL of all offspring:			

E. One parent was homozygous for the allele for myostatin that results in typical muscles, and the other parent was heterozygous:

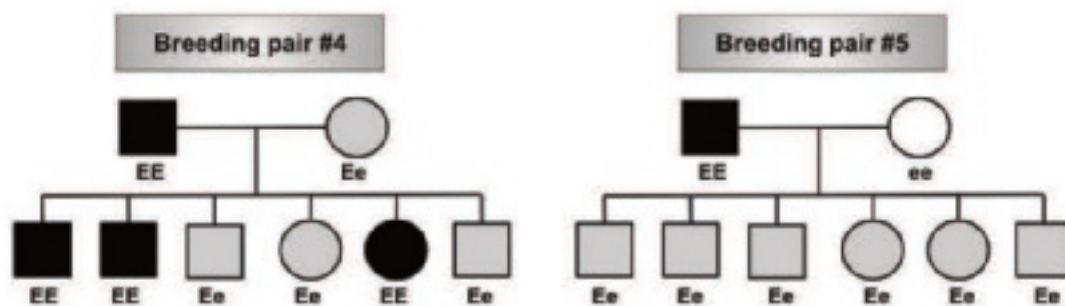
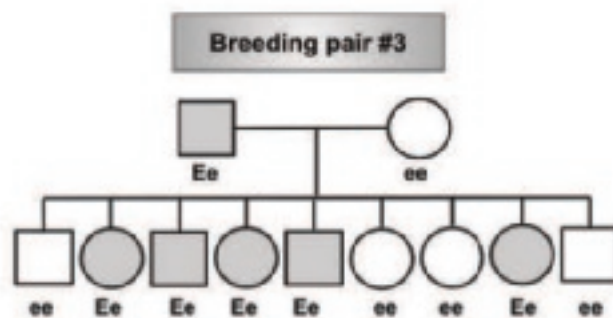
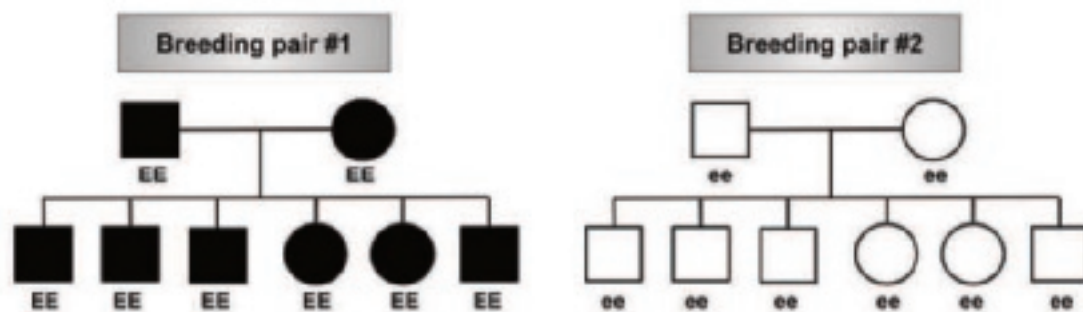
Cross: ee x Ee Breeding pair(s): _____

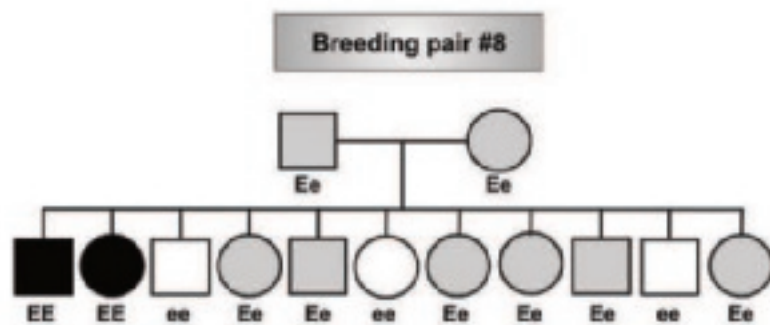
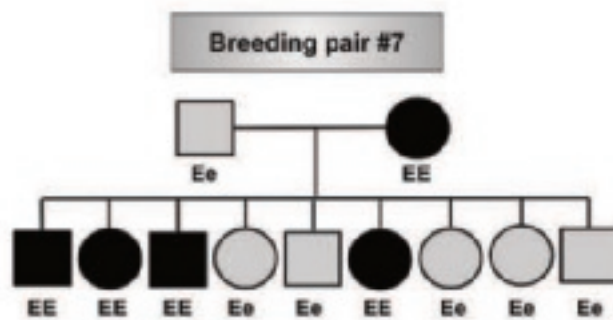
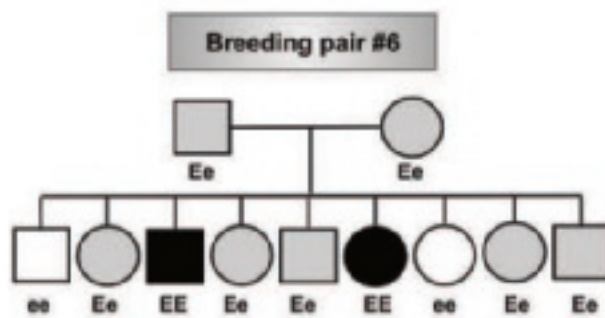
Phenotype of offspring	Genotype of offspring	Keep track of how many offspring by making hash marks or writing numbers for each family	Total number
Heavily muscled	EE		
Medium-muscled	Ee		
Typically muscled	ee		
TOTAL of all offspring:			

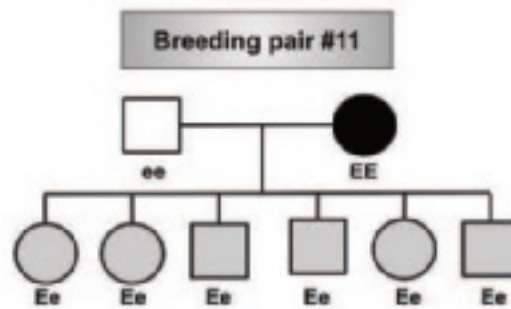
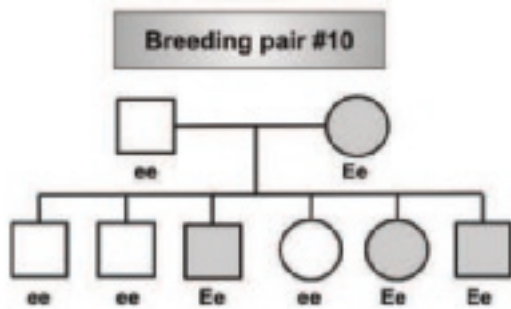
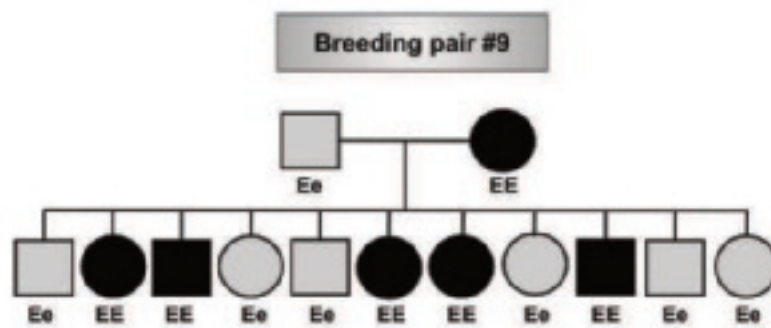
F. Both parents were heterozygous:

Cross: Ee x Ee Breeding pair(s): _____

Phenotype of offspring	Genotype of offspring	Keep track of how many offspring by making hash marks or writing numbers for each family	Total number
Heavily muscled	EE		
Medium-muscled	Ee		
Typically muscled	ee		
TOTAL of all offspring:			







Name: _____

Date: _____

Bird Breeder Simulation Results

Data Collection

		Before selective breeding		After selective breeding	
		# of birds	% of birds	# of birds	% of birds
For all difficulty levels	with no selected for trait variations				
	with one selected for trait variation				
	with two selected for trait variations				
For difficulty level 2 or 3 only	with three selected for trait variations				
For difficulty level 3 only	with four selected for trait variations				
	Total birds		100%		100%

Number of matings	Number of offspring	Number removed

Making Sense

1. By the end of the selective breeding simulation you were able to increase the percentage of birds with trait variations you were trying to select for. What sort of strategies did you use to do this?
2. Use your mathematical models about probability from Lesson 8 to explain why it took so many matings and so many offspring to get to this point.

Name: _____

Date: _____

Lab v1: Extracting Genetic Material

Part 1: Formulate your hypothesis.

A. Write down your question.

B. Make a prediction. Will your sample contain genetic material? Why or why not?

C. Create a hypothesis related to whether plants have genetic material.

Part 2: Prepare for experimentation.

A. Gather materials for your group.

B. Put on indirectly vented chemical-splash goggles, a nonlatex apron, and vinyl or nitrile gloves.

Part 3: Extract genetic material from inside cells.

1. Place the sample you are investigating in the 1 QT heavy-duty ziplock bag. Remove the air and seal the bag.
2. Crush the sample with your hands until there are no chunks. **Be careful to not break the bag while mashing!**
3. Add 20 mL of warm salt water into the bag with the crushed-up sample. Make sure the salt water is not too hot so it does not melt the bag. Remove the air and seal the bag.
4. Gently mix the salt water with the sample in the sealed bag.
5. Add 1 spoonful of dish soap to the bag. Remove the air and seal the bag.
6. Gently but thoroughly mix the soap with the sample. Be careful not to make too many suds!
7. Put a piece of cheesecloth over the top of a 100 mL beaker (or similar container) and secure it with a rubber band. Then gently push down on the top, making a little pocket. You will use this to strain your sample.
8. Slowly pour your sample through the cheesecloth. Be careful not to overfill. You may have to wait while some liquid flows through to pour the entire sample. (Note, you may need to ask your teacher for another piece of cheesecloth if yours gets clogged before it finishes straining.)
9. After the sample has completely flowed through the cheesecloth, remove the rubber band and cheesecloth from the container and discard the cheesecloth into the trash.
10. Add a pinch of meat tenderizer to the solution and stir very gently to mix.



11. Slowly pour 20 mL of ice-cold alcohol into the beaker with the sample. Tilt the beaker slightly and pour down the side of the beaker, being careful *not* to mix the layers.
12. If genetic material is present in the sample, you will see little white strands forming in between the layers of the sample and the alcohol.
13. Gently use a wooden skewer to lift the strands up. You can slowly turn the skewer to spool and collect the genetic material.
14. Clean up your lab station when your group is finished.
15. Record your group's results in the class data table, then answer the making sense questions in part 4.

Part 4: Make sense of your results.

- A. What claim can you make about whether plants have genetic material? What is your evidence? Explain why the evidence does or does not support your claim.

- B. We know that genetic material is much smaller than a cell. We also know the material is inside the cells that we often cannot even see without using a microscope. Given that, how is it possible that we can see the genetic material in this investigation?

Name: _____

Date: _____

Lab v2: Extracting Genetic Material

Part 1: Formulate your hypothesis.

A. Write down your question.

B. Make a prediction. Will your sample contain genetic material? Why or why not?

C. Use the following format to create a hypothesis related to whether plants have genetic material.

If _____, then when we _____, we will observe _____.

(If *explain the claim*, then when we *describe the change (cause)*,
we will observe *describe the expected outcome (effect)*.)

Part 2: Prepare for experimentation.

A. Gather materials for your group.

B. Put on indirectly vented chemical-splash goggles, a nonlatex apron, and vinyl or nitrile gloves.

Part 3: Extract genetic material from inside cells.

1. Place the sample you are investigating in the 1 QT heavy-duty ziplock bag. Remove the air and seal the bag
2. Crush the sample with your hands until there are no chunks. ***Be careful to not break the bag while mashing!***
3. Add 20 mL of warm salt water into the bag with the crushed-up sample. Make sure the salt water is not too hot so it does not melt the bag. Remove the air and seal the bag.
4. Gently mix the salt water with the sample in the sealed bag.
5. Add 1 spoonful of dish soap to the bag. Remove the air and seal the bag.
6. Gently but thoroughly mix the soap with the sample. Be careful not to make too many suds!
7. Put a piece of cheesecloth over the top of a 100 mL beaker (or similar container) and secure it with a rubber band. Then gently push down on the top, making a little pocket. You will use this to strain your sample.
8. Slowly pour your sample through the cheesecloth. Be careful not to overfill. You may have to wait while some liquid flows through to pour the entire sample. (Note, you may need to ask your teacher for another piece of cheesecloth if yours gets clogged before it finishes straining.)
9. After the sample has completely flowed through the cheesecloth, remove the rubber band and cheesecloth from the container and discard the cheesecloth into the trash.
10. Add a pinch of meat tenderizer to the solution and stir very gently to mix.
11. Slowly pour 20 mL of ice-cold alcohol into the beaker with the sample. Tilt the beaker slightly and pour down the side of the beaker, being careful *not* to mix the layers.
12. If genetic material is present in the sample, you will see little white strands forming in between the layers of the sample and the alcohol.
13. Gently use a wooden skewer to lift the strands up. You can slowly turn the skewer to spool and collect the genetic material.
14. Clean up your lab station when your group is finished.
15. Record your group's results in the class data table, then answer the making sense questions in part 4.



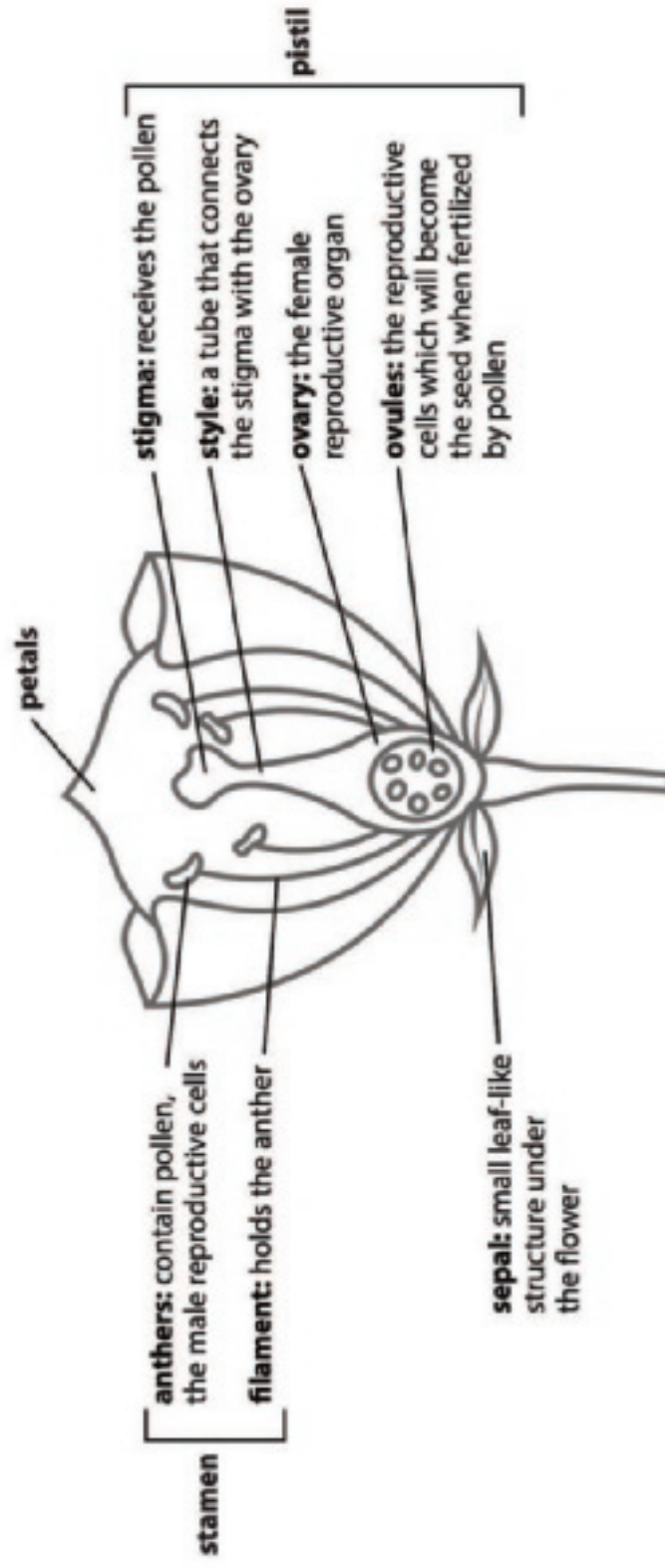
Part 4: Make sense of your results.

A. Use the guidelines below to create a sentence or two that explains whether this investigation supported the claim in your hypothesis.

- **Claim** = explanation/theory. (comes after the "if" clause in the hypothesis)
- **Evidence** = When we changed the independent variable we observed the following pattern in the dependent variable.
- **Reasoning** = Explain why the evidence supports the claim.

B. We know that genetic material is much smaller than a cell. We also know the material is inside the cells that we often cannot even see without using a microscope. Given that, how is it possible that we can see the genetic material in this investigation?

Flower Diagram



Name: _____

Date: _____

Breeding Tulips

Some tulip breeders were interested in developing new variations of tulips to see whether they could breed a variety with a unique petal shape. They hoped a new petal shape would be popular with people who want to plant tulips in their yards.

These breeders already grew tulip plants that they knew had different alleles in one of the genes that affected petal shape, and they hoped to get some unique combinations. The gene has 4 different alleles, each of which makes a protein that functions a little bit differently. The alleles of the shape-affecting (S) gene are designated as follows:

S^A - petals are pointier

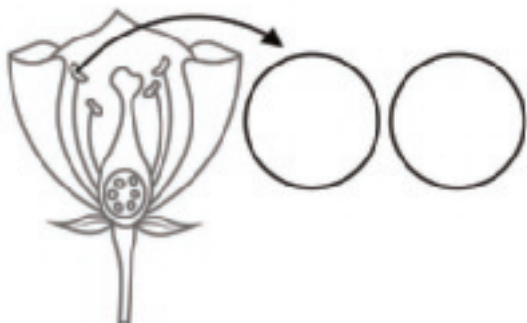
S^B - petals are rounder

S^C - petals have ruffled edges

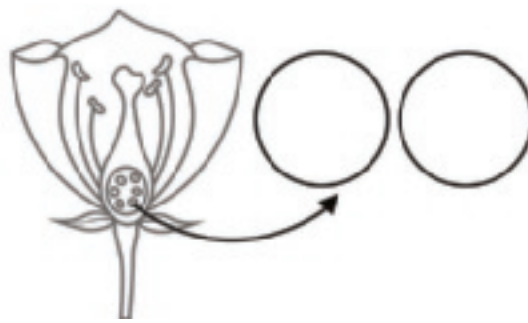
S^D - petals have smoother edges

The breeders manually transferred pollen from a flower having a **S^AS^B** genotype to the female parts of a flower having a **S^BS^C** genotype.

1. Which alleles could be in the pollen from this **S^AS^B** genotype flower?



2. Which alleles could be in the ovules of this **S^BS^C** genotype flower?



After the flowers made seeds, the breeders planted the seeds that were produced. They settled back to wait for 7 years to see what the new flowers would look like.

3. What are the possible genotypes of the offspring plants? And what are the proportions of those offspring genotypes?

4. Even if we know what the possible genotypes of the offspring are, there is no way to tell for sure what the new flowers will look like before the offspring plants bloom (after 7 years of growing from a seed). What would you guess the phenotypes of the offspring might be?

5. If the breeders did produce a new flower that they thought people would like, how would they be able to breed more of that particular variation of flower so they could sell them?

Name: _____

Date: _____

Exit Ticket



Jim Evans, CC BY-SA 4.0



Walter Hood Fitch, PD-US

On the left is a photo of a lily flower. On the right is a drawing of the whole lily plant and some of its parts. Lillies are pollinated by moths.

1. Using labels you add to the pictures, drawings of your own, and/or writing, explain how the lily plant is likely to reproduce and make seeds. Be sure you include
 - the most important structures,
 - the functions of those structures, and
 - an explanation of the process of how sexual reproduction happens in the lily plant.

2. If a gardener liked a particular lily flower that grew in their garden and wanted to make more plants with the same kind of flower, how would you recommend that they do that? Explain why you recommend that way of doing it.

Name: _____

Date: _____

Giving Feedback to Peers

This tool was inspired by the Sticky Note Feedback resource originally developed by Ambitious Science Teaching at <https://ambitiousscience teaching.org/sticky-note-student-feedback/>.

Feedback needs to be specific and actionable.

That means it needs to be related to science ideas and provide your own suggestions for improvement. Nonproductive examples of feedback that do not help other students improve are as follows:

- "I like your drawing."
- "Your poster is really pretty."
- "I agree with everything you said."

How to Give Feedback

Your feedback should give ideas for specific changes or additions the person or group can make. Use the sentence starters below if you need help giving feedback.

- You said _____. I disagree because _____. I think you should change _____.
- I like how you _____. It would be more complete if you added _____.
- We agree that _____. I think you should add more evidence from the _____ investigation.
- I agree/disagree with your claim that _____. However, I do not think the _____ (evidence) you used matches your claim.

Receiving Feedback from Peers

The purpose of feedback is to get ideas from your peers about things you might improve or change to make your work more clear, more accurate, or better supported by evidence you have collected. It can also help you communicate your ideas more effectively to others.

When you receive feedback, you should take these steps:

- Read or listen carefully. Ask for help to understand it, if necessary.
- Decide if you agree or disagree with the feedback and say why you agree or disagree.
- Revise your work to address the feedback.

Name: _____

Date: _____

Asexual Reproduction Notes

Organism	How does it reproduce asexually?	How does the offspring's genetic information compare to the parent's?
spider plants		
potatoes		
aphids		
hydra		
marbled crayfish		
bacteria		
coral		
planaria		
bananas		
echeveria		

Name: _____

Date: _____

Explaining Environmental Effects

Construct an explanation using a model to explain the causes of variation in apple color or flamingo color. Sketch your model in the space here and write your explanation on the lines below that.

What is influencing the range of variation we see?

Name: _____

Date: _____

Data Collection: Wheat Kernels

1. Observe the different colors of kernels of wheat on the cards you received. Sort them based on their color. In the space below, describe them and explain the criteria your group decided to use to sort the kernels.

2. Do you think the wheat color trait is affected by the environment or by its alleles? What about the wheat kernel color makes you think that?

3. Describe an investigation that would help us collect data to confirm your idea about what is causing the wheat kernel color trait.

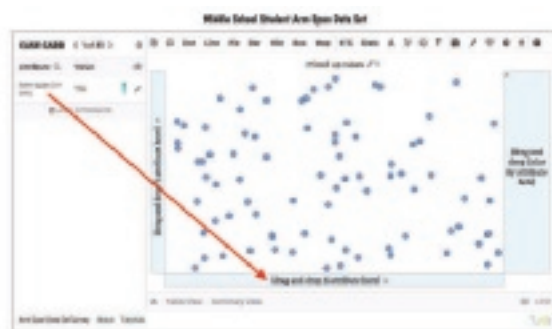
4. If the data we collect support your idea, what do you expect to see as a result of the investigation?

Name: _____

Date: _____

Arm Span Histogram Instructions

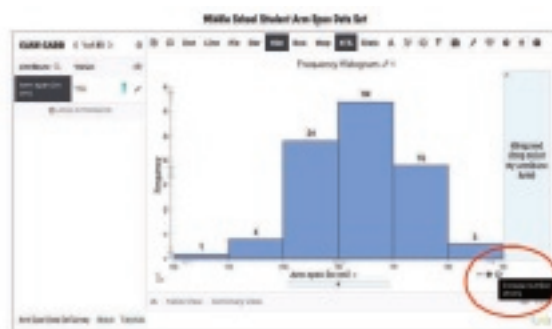
1. When you first open the data set in the online graphing tool, data points will be scattered on the field. Your first step is to drag the "Arm span (in cm)" attribute to the X-axis.



2. The graphing tool will default to organizing data in a dot plot, but we want to use a histogram. So, choose "frequency histogram" from the top toolbar.



3. The histogram will default to 6 bins (the minimum number the tool will allow). You can adjust the number of bins using the gray minus and plus buttons in the lower-right corner of the graph.



4. Explore the other options along the top toolbar.

- Are there statistics that help you communicate about the data set?
- Which other representations of the data help you see the variation in arm span lengths?



Name: _____

Date: _____

Arm Span Reading and Modeling

1. Read *Arm Span Length*.
2. Using a pen or colored pencil, mark evidence in the text that supports the idea that genes impact the development of this trait variation.
3. Using a different-color pen or pencil, mark evidence in the text that supports the idea that environmental factors impact the development of this trait variation.
4. Draw a model in the space below using different-sized arrows to show how much of the trait variation of arm spans you think is influenced by genes and how much by environmental factors.

What causes the trait variations we see in human arm span lengths?

5. Explain in your own words why you chose to make the arrows in your model those sizes.

6. After hearing from everyone in your group, what can you say to summarize how trait variation is influenced by genes and environment?

Name: _____

Date: _____

Questions and Answers from Our DQB

Look through the list of questions from our DQB. Indicate whether you think the class has answered each question by putting one of the following symbols next to it.

- We did not answer this question or any parts of it yet: **○**
- Our class answered some parts of this question, or I think I could answer some parts of this question: **✓**
- Our class answered this question, or using the ideas we have developed, I could now answer this question: **✓ +**

Then pick three questions you marked and write what you think that answer would be. (Record on reverse.)

Questions from our classroom DQB

1.

Pick three questions you marked and write what you think that answer would be.

Question	Answer and supporting evidence

Name: _____

Date: _____

Science Literacy Exercise Page 1

Use with Reading Collection 1

Roadmap for Reading

This week's reading collection focuses on the concept of phenotype. The selections include advertisements for products that the sellers say will change your phenotype and some guidance for how to analyze their claims.

Collection 1: "Muscles and Other Traits" consists of four selections.

- 1 Diversity of Phenotype
- 2 Wellness Wonders Podcast
- 3 Buy Now and Bulk Up!
- 4 Growth in the Family Tree

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, an attempt to persuade, or an attempt to entertain?
- Consider how each part of the reading relates to knowledge you gained from the previous part.
- Consider how data and graphics support the narrative text and how narrative text clarifies the data and graphics.

Written Response

Your writing exercise is to complete an infographic interpreting some of the data related to human phenotypes presented in Collection 1.

- Write on the organizer shown on page 66.
- In the top box, define *phenotype*.
- In each of the remaining boxes, write one sentence about human height supported by the numerical data in the graph.
- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.

Evaluation Guidelines

Content

- ☐ The core vocabulary term *phenotype* is defined accurately.
- ☐ All three graphs are interpreted accurately.

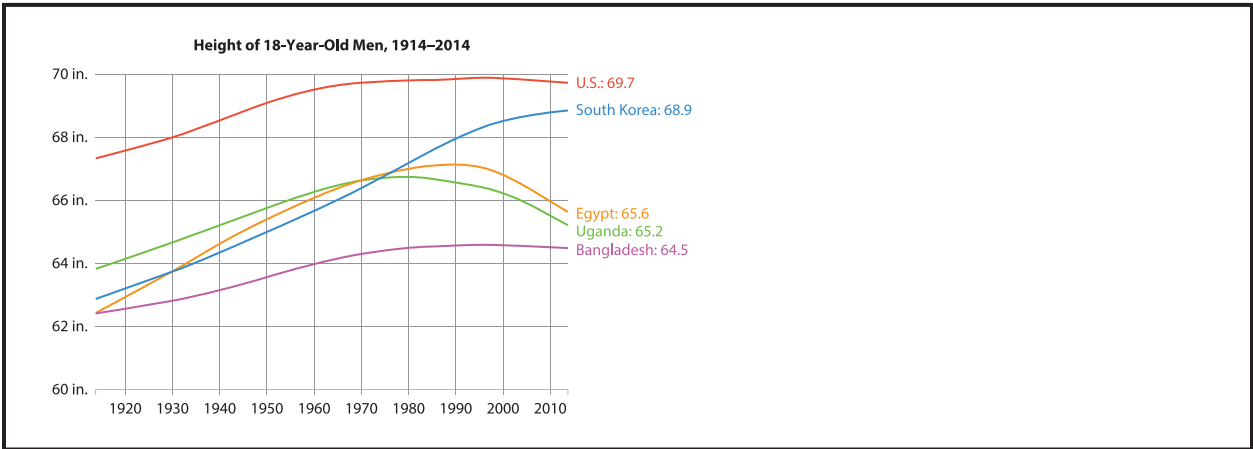
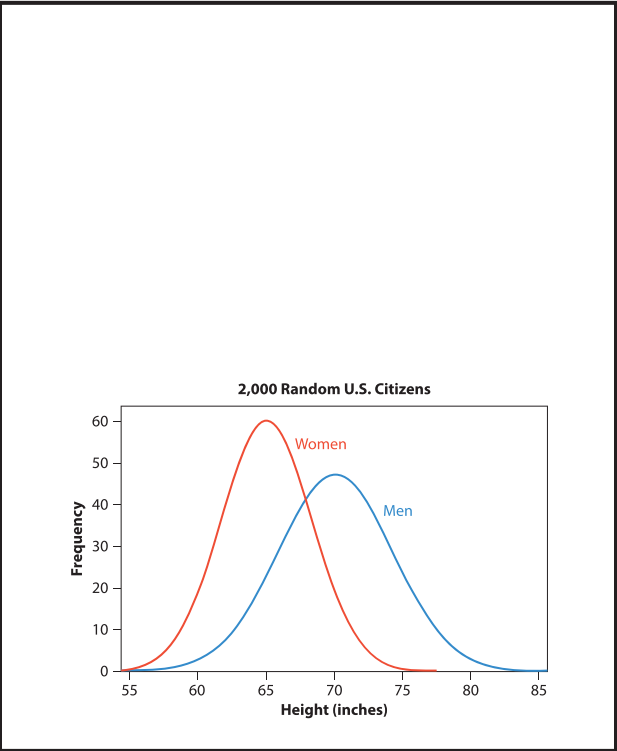
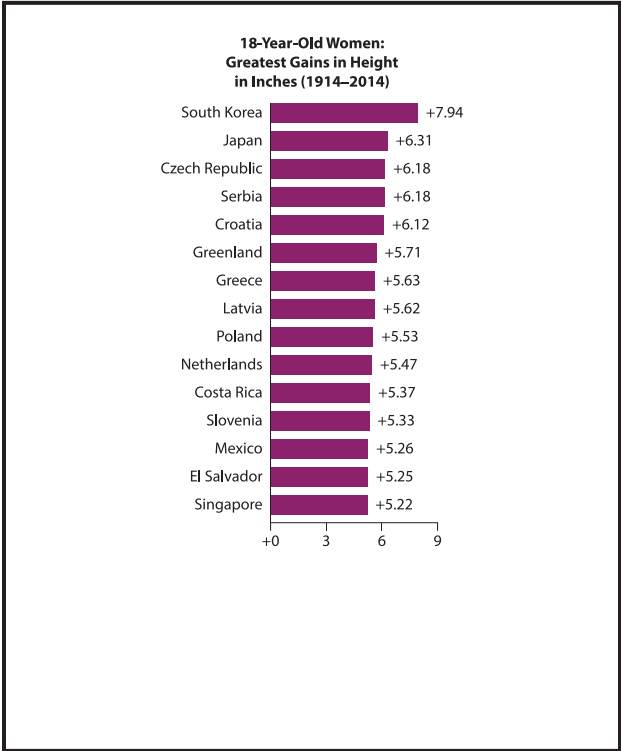
Text

- ☐ The text is clearly worded and easy to read.
- ☐ Spelling, grammar, and punctuation are correct.

Additional Feedback Notes:

Data About Phenotype

Phenotype describes . . .



Science Literacy Exercise Page 2

Use with Reading Collection 2

Roadmap for Reading

This week's reading collection focuses on the roles of heredity and the environment in determining human traits. As you read, you'll apply your mathematical understanding of rates, equations, and exponents to each selection.

Collection 2: "Born or Built" consists of five selections.

- 1 Doing It Right vs. Overdoing It
- 2 Essential Amino Acids and Protein Needs
- 3 Big-Screen Genes
- 4 Coins and Chromosomes
- 5 The Brothers of Bogotá

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how data and graphics support the narrative text and how narrative text clarifies the data and graphics.
- Consider how each part of the reading relates to knowledge you gained from the previous part.

Written Response

After reading this week's collection, your writing exercise is to reflect on Collection 2 by completing a graphic organizer called, "I used to think . . . Now I think."

- Copy the template for the graphic on a separate sheet of paper; attach this page to the front of it when you turn it in.
- As you review the readings, consider how one or more of them changed your thinking.
- Complete the sentence stem above each thought balloon to compare what you thought before you read and what you learned as a result of reading.
- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.

I used to think . . .



Now I think . . .



Evaluation Guidelines

Element	1	2	3	Feedback
Content	The work inadequately shows reflection and how thinking has changed over time; "Now I think" statement is inaccurate.	The work adequately shows reflection and how thinking has changed over time; "Now I think" statement is mostly accurate.	The work clearly shows reflection and how thinking has changed over time; "Now I think" statement accurately summarizes the science in one or more readings.	
Design	Lettering is messy or difficult to read; drawing is carelessly rendered.	Lettering is reasonably clear and readable; drawing is clearly rendered.	Lettering is clear and easy to read; drawing is neatly rendered.	
Grammar and mechanics	Text is missing in one thought balloon or does not complete the sentence begun above. Two or more errors appear in punctuation, capitalization, or spelling.	Text in the thought balloons somewhat completes the sentence begun above. One error appears in punctuation, capitalization, or spelling.	Text in the thought balloons completes the sentence begun above. No errors appear in punctuation, capitalization, or spelling.	

Additional Feedback Notes:

Name: _____

Date: _____

Science Literacy Exercise Page 3

Use with Reading Collection 3

Roadmap for Reading

This week's reading collection focuses on inheritance and reproduction. The selections include a science comic about how male and female wildlife interact before mating. You'll think about cause and effect as you read.

Collection 3: "Picking Parents" consists of four selections.

- 1 The Hazard of Royal Bloodlines
- 2 Inheritance Misconceptions
- 3 Finding Mates
- 4 History of Selective Breeding

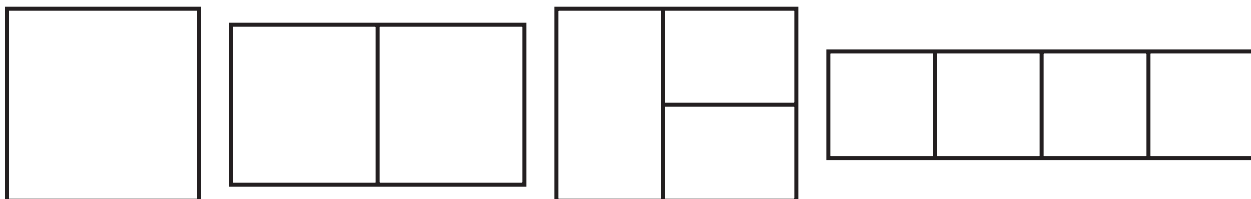
As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how data and graphics support the narrative text and how narrative text clarifies the data and graphics.
- Consider how each part of the collection relates to knowledge you gained from your classroom investigations and discussions.

Written Response

Your writing exercise is to draw a creative and informative cartoon in response to one or more of the readings in Collection 3.

- Draw your comic on a separate sheet of paper; attach this page to the front of it when you turn it in.
- Choose two characters—humans and/or other animals. They should be inspired by one or two selections in this collection.
- Choose the number of panels and layout you will use. Some ideas are shown below.
- Write your dialogue inside the panel, either below the character or above as a word or thought balloon.
- Have your characters talk to one another about either inheriting traits from parents, how wildlife mate, or how humans have selectively bred plants and animals.
- The dialogue you write can be serious or show whimsy, but it must connect to the science related to Collection 3 and show something you learned.
- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.



Evaluation Guidelines

Element	1	2	3	Feedback
Content	Only one character is shown. The dialogue about causes and effects related to inheritance of traits, wildlife mating, or selective breeding has three or more errors.	Two characters are included. The dialogue about causes and effects related to inheritance of traits, wildlife mating, or selective breeding has only one or two minor errors.	Two characters are included. The dialogue about causes and effects related to inheritance of traits, wildlife mating, or selective breeding is accurate.	
Creativity	The work is lacking in creative details that could have contributed to reader enjoyment.	There is at least one creative detail that contributes to reader enjoyment.	Many creative details contribute to reader enjoyment.	
Organization and illustrations	The number of panels is too few or too many for the content. The main characters are not identified. The dialogue is difficult to read.	The number and arrangement of panels is reasonably suited to the content. The main characters are poorly identified. The dialogue is reasonably easy to read.	The number and arrangement of panels is well suited to the content. The main characters are clearly identified. The dialogue is easy to read.	
Grammar and mechanics	More than three errors appear in punctuation, capitalization, or spelling.	One to three errors appear in punctuation, capitalization, or spelling.	No errors appear in punctuation, capitalization, or spelling.	

Additional Feedback Notes:

Science Literacy Exercise Page 4

Use with Reading Collection 4

Roadmap for Reading

This week’s reading collection focuses on plant reproduction and traits. The selections include a photo essay, a blog about a science experiment, and a journal entry about banana farming. All have a strong focus on cause-and-effect relationships.

Collection 4: “Plants and Variation” consists of three selections.

- 1 Flowering Plant Reproduction
- 2 Pollinating Meyer Lemon Trees
- 3 Trouble in the Banana Plantations

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how data and graphics support the narrative text and how narrative text clarifies the data and graphics.
- Consider how each part of the reading relates to knowledge you gained from the previous part.

Written Response

Your writing exercise is to write a television promo script for a magazine-style news show targeted at middle school students. The show will have three stories, one for each of the selections in this collection. You may choose one story to highlight in your promo.

- Compose your script on a separate sheet of paper; attach this page to the front of it when you turn it in.
- Copy the template below, and write your script in it. Include notes on what a viewer will see as well as what they will hear.
- When read aloud, your promo should be about 30 seconds long, or about 70 words.
- Use main ideas or details from the reading, and spark the audience’s interest by connecting to their own lives.
- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.

VIDEO	AUDIO

Evaluation Guidelines

Element	1	2	3	Feedback
Content	Script unclearly presents content unrelated to the selection, with several errors in scientific statements and no references to cause and effect.	Script fairly clearly previews one selection, using mostly accurate science and the theme of cause and effect related to pollination, seed dispersal, or genetic diversity.	Script clearly previews one of the selections, using accurate science and the theme of cause and effect related to pollination, seed dispersal, or genetic diversity.	
Appeal to audience	Script lacks appeal to the needs, wants, or worries of the target audience.	Script somewhat appeals to the needs, wants, or worries of the target audience.	Script strongly appeals to the needs, wants, or worries of the target audience.	
Organization and transitions	Script is not easy to follow due to a lack of a clear opening, call to action, and clear transitions.	Script is missing either a strong opening or closing call to action; at least one transition is unclear; or the audio will take significantly more or less than 30 seconds.	Script has an opening that will capture the attention of audience; has a closing that is a call to action to see the show; has clear transitions; and can be delivered in 30 seconds.	
Grammar and mechanics	Six or more errors are present in punctuation, capitalization, and spelling.	Three to five errors are present in punctuation, capitalization, and spelling.	Fewer than three errors are present in punctuation, capitalization, and spelling.	

Additional Feedback Notes:

Name: _____

Date: _____

Science Literacy Exercise Page 5

Use with Reading Collection 5

Roadmap for Reading

This week's reading collection focuses on the next generation—how species produce offspring and what traits are passed down. The selections include a follow-up on Isaiah and Gabe, the basketball-playing friends you met in the Preface. A graph contains data that reveals their changes in growth and vertical leaping over the two years since they first talked about the VertiCalisthenics app.

Collection 5: "Making New Individuals" consists of four selections.

- 1 Reproduction: A Comparison
- 2 When Is an Offspring Just Part of the Parent?
- 3 A Shark Reproduction Whodunit
- 4 Nature and Nurture: Checking In with the Dunking Duo

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how data and graphics support the narrative text and how narrative text clarifies the data and graphics.
- Identify unfamiliar science terms and other words, find out what they mean, and analyze their importance to your overall understanding.

Written Response

The idea that organisms can clone themselves is woven throughout this collection. Your writing exercise is to complete an informative paragraph that explains what cloning is and discusses some potential costs and benefits if humans were to clone themselves.

- Compose your paragraph on a separate sheet of paper; attach this page to the front of it when you turn it in.
- Include in your paragraph a sentence for each of the following.
 - The topic of the paragraph
 - A description of what a clone is
 - Three kinds of organisms that can clone themselves
 - Why humans might want to clone themselves—some benefits of human cloning
 - Why humans might not want to clone themselves—possible costs of human cloning
- Most of the details in your supporting sentences should come from the reading selections in Collection 5.
- You may also refer to your own life.
- Keep your style formal and objective.
- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.

Evaluation Guidelines

Element	1	2	3	Feedback
Content	The paragraph contains inadequate discussion of the cloning, lacking relevant details from the reading selections and identification of something else to learn about cloning.	The paragraph contains adequate discussion of cloning, citing relevant details from the reading selections and identifying something else to learn about cloning.	The paragraph contains thorough discussion of the topic of cloning, accurately citing relevant details from the reading selections and identifying something else to learn about cloning.	
Supporting sentences (details)	The paragraph contains incomplete sentences, supported by only one reading.	The paragraph contains complete sentences, but too few, supported by only two or three readings.	The paragraph contains at least six complete sentences, including a definition, and details from three or four readings.	
Organization and transitions	The paragraph contains statements with little clear relationship to the topic or each other.	The paragraph contains key supporting details, but transitions are absent or choppy.	The paragraph contains ideas in an order that helps the topic make increasingly more sense.	
Grammar and mechanics	The paragraph contains six or more errors in punctuation, capitalization, and spelling.	The paragraph contains three to five errors in punctuation, capitalization, and spelling.	The paragraph contains fewer than three errors in punctuation, capitalization, and spelling.	

Additional Feedback Notes:



Core Knowledge®

CKSci™

Core Knowledge SCIENCE™

Editorial Director

Daniel H. Franck

Source Material Attribution

The development of the original material in this unit (Copyright © 2022 OpenSciEd) was supported by the Bill & Melinda Gates Foundation, Carnegie Corporation of New York, Charles and Lynn Schusterman Family Foundation, and William and Flora Hewlett Foundation.

The OpenSciEd name is subject to the Creative Commons license and may not be used without the prior and express written consent of OpenSciEd.

This curriculum includes images that are public domain, openly licensed, or used by explicit agreement with their owners. See the attribution information with each image for ownership details and any restrictions on its use. Unless otherwise noted in the image attribution information, all images are licensed for distribution under the terms of the Creative Commons Attribution License (CC BY 4.0) by OpenSciEd or by their respective owners, or they are in the public domain.

The NGSS Badge is only awarded to the version of these materials that was reviewed. The Science Literacy modifications in this version have not been reviewed. If any modifications are made to this unit for your use, the revised version cannot be promoted as earning a badge.

Unit Development Team

Gail Housman, Unit Lead, Northwestern University
Tara McGill, Field Test Unit Lead & Reviewer, Northwestern University
Holly Hereau, Writer, BSCS Science Learning
Natalie Keigher, Writer, Lisle Junior High School
Karin Klein, Writer, Independent Contractor, Northwestern University
Wayne Wright, Writer, BSCS Science Learning
Michael Novak, Simulation Design, Northwestern University
Katie Van Horne, Assessment Specialist, Concolor Research
Ravit Golan Duncan, Advisory Team Chair, Rutgers University
Brian Donovan, Advisor, BSCS Science Learning
Carrie Tzou, Advisor, University of Washington, Bothell
Barbara Hug, Advisor, University of Illinois at Urbana-Champaign
Andrea Poppiti, Field Test Teacher and Advisor, Virginia Beach City Public Schools

Production Team

BSCS Science Learning
Stacey Luce, Copyeditor and Editorial Production Lead
Renée DeVaul, Project Coordinator and Copyeditor
Valerie Maltese, Marketing Specialist & Project Coordinator
Chris Moraine, Multimedia Graphic Designer
Kate Chambers, Multimedia Graphic Designer
David Stockton, Freelance Cinematographer

OpenSciEd

James Ryan, Executive Director
Sarah Delaney, Curriculum Director
Matt Krehbeil, Outreach Director
Theresa Siliezar, Operations Association

Developers Consortium Leadership

Daniel C. Edelson, Director
Audrey Mohan, Associate Director
Professional Learning Center at Boston College
Katherine McNeill, Director
Renee Affolter, Assoc. Director
Instructional Materials Center at BSCS Science Learning
Daniel C. Edelson, Director
Audrey Mohan, Associate Director
Field Test Implementation and Evaluation Center at Charles A. Dana Center, The University of Texas at Austin
Carolyn Landel, Director
Sara Spiegel, Assoc. Director, Implementation
Carol Pazera, Assoc. Director, Evaluation
Field Test Evaluation Center at Digital Promise
Andrew Krumm, Director
William Penuel, University of Colorado, Boulder, Co-Director
Instructional Materials Center at Northwestern University
Brian Reiser, Director
Michael Novak, Associate Director

State Steering Committee

California	Michigan
Kathy DiRanna	Mary Starr
Phil Lafontaine	New Jersey
Jill Grace	Michael Heinz
Iowa	New Mexico
Tami Plein	Yanira Vazquez
Louisiana	Shafiq Chaudhary
Jill Cowart	Oklahoma
Lydia Hill	Tiffany Neill
Breigh Rhodes	Susan Wray
Massachusetts	Rhode Island
Erin Hashimoto-Martell	Kate Schulz
Nicole Scola	Erin Escher
Hillary Metcalf	Washington
	Ellen Ebert

Field Test Teachers

California

Diana Campos
Will Carter
Matt Newcomb
Celina Register
Ali Gubary

Mary Holland
Valery Lyons
Berinda Malden
Nicole Ruttan
Katie Sun
Ron Puerta
Ivette Rubio
Kara Buckley

Michigan

Lisa Beckman
Sarah Bowman
Patsy Curnell
John Lange
Lisa Luke

Michigan, cont.

Julia Maceri
Leslie Buzzy
Scott Wheeler
Shelley Jackson
Michelle Scarborough

Iowa

Abby Richenberger
Kira VanWinkle

Louisiana

Marika Svoboda
Kelly Birdsong
Lyndsey Ewing
Taylor Garrett
Emily Hurst
Belinda Mire
Silvia Pouwels
Mary Reeves

Massachusetts

Rosemary (Tina) Conte
Kris Grymonpre

New Jersey

Thomas Clayton
Jessica Herrera
Andrea Poppiti
Allison Wiesel
Ian Levine
Jacqueline Galella
Laura Ehlers

New Mexico

Heather Farnsworth
Joan Henderson
Dave Layman
Mark Palmer
Naina Panthaki
Sigurd Schmitz
Jason McKinney
Brayden Price

Oklahoma

Sheila Gilbert
Laura Vaughn
Jimmie Wheat

Amanda Williams
Penelope Brickell
Jordan Hill

Rhode Island

Linda Grandchamp
Alisha Iafrate
Stephen Scappaticci
Kellie Sorel Ducharme
Kelsey Hughes

Washington

Jacob Bell
Heidi Fluegel
Margaret Morgan
Joey Reed
Victoria Wells
Phillip Zarelli
Greg Bachmeier
Corey Baerlocher
Nessa Goldman

Special thanks to the following people for their significant contributions to this unit:

Kyle Kehrli and Wilbur Kehrli, American Blue Cattle Breeders, Winthrop, IA
Connie Brooks, MNP Farm, Fair Grove, MO
Jud Parker, Liberty Cattle Company, Fairfield, IA
Penny Heidenreich, Stockton, IL

Illustrations and Photo Credits

Farlap / Alamy Stock Photo: Cover, i

G-and-R-banded cattle karyotypes published in J. Hered., 81(1):80-83 (1990):
13a-b, 15

Jim Evans, CC BY-SA 4.0: 41a

Walter Hood Fitch, PD-US: 41b

Core Knowledge Foundation Science Literacy Development Partner

Six Red Marbles

Carri Walters

Executive Editor

Kimberly Merlino

Writer

CKSci™
Core Knowledge SCIENCE™

A comprehensive program in science, integrating topics from Earth and Space, Life, and Physical Sciences with concepts specified in the ***Core Knowledge Sequence*** (content and skill guidelines for Grades K–8).

Core Knowledge SCIENCE™
units at this level include:

Contact Forces
Sound Waves
Forces at a Distance
Earth in Space
Genetics
Natural Selection and Common Ancestry

www.coreknowledge.org

Core Knowledge Curriculum Series™