

Genetics

Lesson 1b: Passing on the Trait

Grade 6	Length of lesson: 40 minutes	Placement of lesson in unit: 1b of 6 two-part lessons on genetics
Unit central question: Why are individuals of a species different from one another?		Lesson focus questions: Can you predict what offspring will look like by looking at their parents? Why or why not?
Main learning goal: Offspring may exhibit the same trait as one parent or the other rather than a blending of both parents' traits.		
Science content storyline: Individuals within a species are similar to one another in some ways and different from one another in other ways. Some differences—or variations—between individuals are due to the traits offspring inherit from their parents. Offspring may exhibit the same trait as one parent or the other rather than a blending of both parents' traits. A trait that is present in one generation may not show up in the next generation.		
Ideal student response to the focus questions: You can't definitely predict what offspring will look like by looking at the parents. Sometimes all of the offspring will show the same trait as one parent and not the other. For example, all of the dachshund puppies in the activity had short hair like one of the parents, and none of them had long hair like the other parent or medium-length hair (a blend of short hair and long hair).		

Preparation

<p>Materials Needed</p> <ul style="list-style-type: none"> • Science notebooks • Class charts: Our Current Ideas about Inheritance; Our Questions about Inheritance (from lesson 1a) • Chart paper or whiteboard and markers <p>Student Handouts</p> <ul style="list-style-type: none"> • 1.1 Possible Explanations for the Dachshund Results (1 per student) 	<p>Ahead of Time</p> <ul style="list-style-type: none"> • Review the Genetics Content Background Document, especially sections 3 and 6.
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Lesson 1b General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
5 min	Link to previous lesson: The teacher reviews the science ideas and class charts from the previous lesson.	
3 min	Lesson focus questions: The teacher reviews the focus questions from the previous lesson: <i>Can you predict what offspring will look like by looking at their parents? Why or why not?</i>	<ul style="list-style-type: none"> • Trait variations occur among individual offspring.
5 min	Setup for activity: Students review their predictions for what the puppies of a long-haired dachshund and a short-haired dachshund will look like. Then they review their explanations of what could have happened to produce only short-haired puppies.	<ul style="list-style-type: none"> • Some of the differences, or variations, between individuals are due to the traits offspring inherit from their parents.
10 min	Activity: Students analyze three claims about the dachshund results and determine whether the evidence supports these ideas.	<ul style="list-style-type: none"> • All of the dachshund puppies have short hair even though one parent has short hair and one has long hair. None of the puppies have long hair or medium-length hair. There are two possible explanations for these results based on the evidence.
10 min	Follow-up to activity: Students share ideas about the hair-length trait to explain what happened to produce only short-haired puppies. Afterward, new ideas and questions about inheritance are added to the class charts, and inaccurate ideas are crossed out.	<ul style="list-style-type: none"> • Offspring may exhibit the same trait as one parent or the other rather than a blending of both parents' traits. A trait that is present in one generation may not appear in the next generation.
6 min	Synthesize/summarize today's lesson: Students look at examples of trait inheritance in several other organisms and revise their answers to the focus questions based on what they've learned so far. The teacher summarizes key science ideas in the lesson.	<ul style="list-style-type: none"> • You can't definitively predict what offspring will look like by looking at the parents. Sometimes all of the offspring will have the same trait as one of the parents, and none will have the trait of the other parent.
1 min	Link to next lesson: The teacher previews the next lesson and observes that more information is needed to answer the question about what happened to the long-hair trait in the dachshund puppies.	

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5 min	<p>Link to Previous Lesson</p> <p>Synopsis: The teacher reviews the science ideas and class charts from the previous lesson.</p>	Link science ideas to other science ideas.	<p>Show slides 1 and 2.</p> <p>Last time we recorded our ideas and questions about inheritance on chart paper.</p> <p>What does inheritance mean? Who can describe or explain this science idea?</p> <p>So traits are the features or characteristics of organisms that are passed from one generation to the next.</p> <p>In today’s lesson, we’ll continue exploring ideas about the traits offspring inherit from their parents.</p> <p>But first, let’s review the ideas and questions we listed on our charts at the end of the previous lesson</p> <p>NOTE TO TEACHER: <i>Spend a couple of minutes going over the ideas and questions that emerged during the previous lesson.</i></p> <p>We’ll come back to these charts at the end of today’s lesson and see if any of our ideas have changed and whether we</p>	<p><i>Inheritance</i> means “what you get from your parents.”</p> <p><i>Traits.</i> You get traits from your parents.</p>	<p>What do you mean by “what you get”?</p> <p>What would be the scientific word?</p>

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			have new ideas or questions to add.		
3 min	<p>Lesson Focus Questions</p> <p>Synopsis: The teacher reviews the focus questions from the previous lesson: <i>Can you predict what offspring will look like by looking at their parents? Why or why not?</i></p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Trait variations occur among individual offspring. 	Set the purpose with a <u>focus question</u> or goal statement.	<p>Show slide 3.</p> <p>Today, we'll continue exploring the same focus questions from yesterday's lesson: <i>Can you predict what offspring will look like by looking at their parents? Why or why not?</i></p> <p>We'll gather more information about these questions and see whether we can predict what offspring will look like by looking at the parents.</p>		
5 min	<p>Setup for Activity</p> <p>Synopsis: Students review their predictions for what the puppies of a long-haired dachshund and a short-haired dachshund will look like. Then they review their explanations of what could have happened to produce only short-haired puppies.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Some of the differences, or variations, between individuals are due to the traits offspring inherit from their 	Make explicit links between science ideas and activities before the activity.	<p>Show slide 4.</p> <p>Last time, you wrote predictions in your science notebooks about what the dachshund puppies of one long-haired and one short-haired parent would look like.</p> <p>Find those predictions and review what you thought would happen.</p> <p>Student review time (1 min).</p> <p>Now let's have a show of hands. Who predicted that the puppies would have only short hair? Who predicted they would have only long hair?</p> <p>Who thought some of the puppies would</p>		

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	parents.		<p>have short hair and others would have long hair? What about medium-length hair?</p> <p>OK. We had a lot of different ideas, didn't we?</p> <p>Show slide 5.</p> <p>Later in the lesson, we learned that all of the puppies had short hair. That was surprising, wasn't it?</p> <p>Then you wrote a possible explanation in your science notebooks for <i>why</i> all the puppies had short hair.</p> <p>How did you explain this result? What might have caused all the puppies to have short hair?</p> <p>Show slide 6.</p> <p>At the end of the activity, I asked you to share your ideas about the questions, <i>What happened to the long-hair trait? Did it just disappear?</i></p> <p>Let's consider three possible explanations for what happened to the long-hair trait in the puppies. Be prepared to present evidence for why you agree or disagree with each claim.</p>		
10 min	Activity		Show slide 7.		

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	<p>Synopsis: Students analyze three claims about the dachshund results and determine whether the evidence supports these ideas.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> All of the dachshund puppies have short hair even though one parent has short hair and one has long hair. None of the puppies have long hair or medium-length hair. There are two possible explanations for these results based on the evidence. 	<p>Engage students in constructing explanations and arguments.</p>	<p>NOTE TO TEACHER: <i>Distribute handout 1.1, Possible Explanations for the Dachshund Results.</i></p> <p>ELL support: The claims in handout 1.1 introduce new terms: <i>instructions</i> and <i>covered up</i>. Likewise, the word <i>inherit</i> hasn't been explicitly addressed in the materials thus far. ELL students will benefit from understanding the relationship between instructions and inheritance and prior knowledge about genetics (cells, chromosomes) that they gained at the beginning of the unit.</p> <p>Three students, Juan, Celia, and Michael, have different ideas about what happened to the long-hair trait in the first generation of dachshund puppies. Some of their ideas might be similar to yours.</p> <p>Small-group discussion: I'm going to divide the class into small groups so you can talk about these claims. First, read and discuss each claim on the handout and then decide whether you agree or disagree with the idea. Think about whether you have enough information or evidence to support or reject any of the claims.</p> <p>After your group reaches an agreement about each claim, circle your choice on the handout and make sure to include the reasons for your decision.</p>		

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		Engage students in communicating in scientific ways.	<p>ELL support: Rather than asking ELL students whether they have enough evidence (a yes or no question), ask them what evidence they would need to support or reject a claim.</p> <p>NOTE TO TEACHER: <i>You might consider having three volunteers read each of the claims aloud prior to the small-group discussion, or you could have one student in each group read a claim before discussing it. As you walk around the room, listen to students' reasoning and note any ideas you would like students to share with the class during the follow-up.</i></p>		
10 min	<p>Follow-Up to Activity</p> <p>Synopsis: Students share ideas about the hair-length trait to explain what happened to produce only short-haired puppies. Afterward, new ideas and questions about inheritance are added to the class charts, and inaccurate ideas are crossed out.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Offspring may exhibit the same trait as one parent or the other 	Engage students in analyzing and interpreting data and observations.	<p>Show slide 8.</p> <p>Whole-class discussion: So do you agree or disagree with Juan, Celia, and Michael? Which of their claims does the evidence support? Which claims did you reject? Make sure to give your reasons and evidence!</p> <p>NOTE TO TEACHER: <i>Students should recognize that the evidence doesn't support Michael's claim because the puppies don't have medium-length hair. The evidence does, however, fit Juan's and Celia's claims, since the puppies have short hair. The only difference is their ideas about the instructions the puppies inherited.</i></p>	<p>We agreed with Celia's idea.</p> <p>We rejected Michael's idea.</p> <p>We rejected Juan's idea.</p>	<p>How does the evidence support Celia's claim?</p> <p>Why is Michael's idea incorrect?</p> <p>What evidence do you have that Juan's idea isn't correct?</p>

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	rather than a blending of both parents' traits. A trait that is present in one generation may not appear in the next generation.	Engage students in communicating in scientific ways.	<p><i>Encourage students to agree or disagree with Juan, Celia, and/or Michael using these sentence starters: "I agree with Juan because ..." or "I disagree with Michael because" Insist that students give evidence for their responses.</i></p> <p>Show slide 9.</p> <p>Now let's review our chart of current ideas about inheritance. Think about the results with the dachshund puppies and the discussion we just had. What new ideas do you think we should add to the chart? Are there any ideas you think we should cross off our list?</p> <p>NOTE TO TEACHER: <i>Add any new ideas to the chart and draw a line through any ideas students decide to reject. But make sure the wording is still legible in case students decide to reinstate the idea later.</i></p> <p>Show slide 10.</p> <p>Do you think we should add anything to our chart of questions about inheritance?</p>		
6 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: Students look at examples of trait inheritance in several other</p>	Highlight key science ideas and focus question throughout.	<p>Show slide 11.</p> <p>Today's focus questions are <i>Can you predict what offspring will look like by looking at their parents? Why or why not?</i></p>		

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	<p>organisms and revise their answers to the focus questions based on what they've learned so far. The teacher summarizes key science ideas in the lesson.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> You can't definitively predict what offspring will look like by looking at the parents. Sometimes all of the offspring will have the same trait as one of the parents, and none will have the trait of the other parent. 	<p>Engage students in making connections by synthesizing and summarizing key science ideas.</p>	<p>In this lesson we focused on the hair-length trait in dachshunds.</p> <p>Show slide 12.</p> <p>Now let's see if similar results show up when we look at traits in other organisms. Some examples are fur color in guinea pigs, pod shape in peas (regardless of whether they're puffed up), and wing color in butterflies.</p> <p>What do you notice about each of these parents and offspring?</p> <p>Are the results similar to what happened with the dachshund puppies?</p> <p>Show slide 13.</p> <p>Based on what you've learned about trait</p>	<p>The offspring of the guinea pigs has black fur, not white fur.</p> <p>All of the pea pods are puffy, not flat.</p> <p>The butterflies didn't have any black-and-white offspring.</p> <p>Yes, the offspring show the trait from one parent and not the other, just like the dachshund puppies.</p>	

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		Summarize key science ideas.	<p>inheritance so far, how would you answer our focus questions now?</p> <p>Write your response in your science notebooks using either of these sentence starters:</p> <ul style="list-style-type: none"> • I can predict what the dachshund puppies will look like because ... <p>Or</p> <ul style="list-style-type: none"> • I can't predict what the dachshund puppies will look like because ... <p>Student work time.</p> <p>Show slide 14.</p> <p>Today we observed that offspring look similar to their parents in some ways and different from them in other ways.</p> <p>These similarities and differences highlight an important science idea:</p> <ul style="list-style-type: none"> • Offspring may exhibit the same trait as one parent or the other but not a blending of both parents' traits. <p>ELL support: ELL students will benefit from referring to this key science idea throughout the lessons, so post it where it can be seen.</p>		
1 min	<p>Link to Next Lesson</p> <p>Synopsis: The teacher</p>		<p>Show slide 15.</p> <p>So what happened to the long-hair trait</p>		

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	<p>previews the next lesson and observes that more information is needed to answer the question about what happened to the long-hair trait in the dachshund puppies.</p>	<p>Link science to other science ideas.</p>	<p>in the dachshund puppies?</p> <p>Today we reviewed our ideas for why all the puppies have short hair. Then we investigated three possible explanations for this result and determined whether the evidence supported any of these claims.</p> <p>Tomorrow we'll gather more information to help us answer this question.</p>		