

## Genetics

### Lesson 1a: Variations in Parents and Offspring

<b>Grade 6</b>	<b>Length of lesson:</b> 40 minutes	<b>Placement of lesson in unit:</b> 1a of 6 two-part lessons on genetics
<b>Unit central question:</b> Why are individuals of a species different from one another?		<b>Lesson focus questions:</b> Can you predict what offspring will look like by looking at their parents? Why or why not?
<b>Main learning goal:</b> Offspring may exhibit the same trait as one parent or the other rather than a blending of both parents' traits.		
<b>Science content storyline:</b> 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.		
<b>Ideal student response to the focus questions:</b> You can't definitely predict what offspring will look like by looking at the parents. Sometimes all of the offspring will have the same trait as one parent, and none will have the trait of the other parent. 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><b>Materials Needed</b></p> <ul style="list-style-type: none"> <li>• Science notebooks</li> <li>• Chart paper or whiteboard and markers (for creating charts to post in the classroom throughout the lesson series)</li> </ul>	<p><b>Ahead of Time</b></p> <ul style="list-style-type: none"> <li>• Read section 1 (introduction) in the Genetics Content Background Document.</li> <li>• Prior to beginning this unit, make sure your students understand these key science ideas:             <ul style="list-style-type: none"> <li>• Chromosomes are structures found in the nucleus of each cell.</li> <li>• All of the chromosomes for an entire organism are found in every cell.</li> </ul> </li> <li>• <b>ELL support:</b> Identify Tier 2 and 3 words in the lesson plan to review in advance with ELL students. Possible terms include <i>cell</i>, <i>chromosome</i>, <i>organism</i>, <i>species</i>, <i>inherit</i>, <i>inheritance</i>, and <i>trait</i>. Students should already understand the terms <i>cell</i>, <i>chromosome</i>, and <i>organism</i> from previous learning. You may want to have all or some of these words posted in the room where students can see them. You may also want to assign some students a task of creating visual dictionary definitions for each word or have students construct their own key-term dictionaries.</li> </ul>
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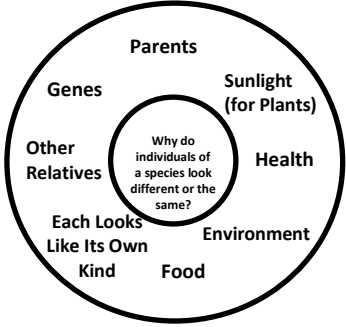
## Lesson 1a General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
3 min	<b>Unit central question:</b> The teacher introduces the unit central question, <i>Why are individuals of a species different from one another?</i>	
10 min	<b>Lesson focus questions:</b> The teacher introduces the focus questions; <i>Can you predict what offspring will look like by looking at their parents? Why or why not?</i> Then the teacher elicits student ideas.	
5 min	<b>Setup for activity:</b> The teacher introduces the idea of <i>traits</i> . Students identify various traits of dachshunds.	<ul style="list-style-type: none"> <li>• Trait variations occur among individual offspring.</li> </ul>
10 min	<b>Activity:</b> Students predict what the puppies of a long-haired dachshund and a short-haired dachshund will look like and why. Then they create class charts of their current ideas and questions about inheritance.	<ul style="list-style-type: none"> <li>• Some of the differences, or variations, between individuals are due to the traits offspring inherit from their parents.</li> </ul>
6 min	<b>Follow-up to activity:</b> The teacher reveals that all of the dachshund puppies (offspring) have short hair. Students propose ideas about the hair-length trait to explain what happened to produce only short-haired puppies. Then the class charts are updated to reflect students' ideas and questions.	<ul style="list-style-type: none"> <li>• 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.</li> </ul>
5 min	<b>Synthesize/summarize today's lesson:</b> Students write a possible answer to the focus questions to synthesize their current ideas about trait inheritance.	
1 min	<b>Link to next lesson:</b> The teacher announces that in the next lesson, students will analyze other students' ideas about what happened with the dachshund puppies and decide whether the evidence supports these claims.	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
3 min	<p><b>Unit Central Question</b></p> <p><b>Synopsis:</b> The teacher introduces the unit central question, <i>Why are individuals of a species different from one another?</i></p>		<p><b>Show slides 1 and 2.</b></p> <p><b>NOTE TO TEACHER:</b> <i>Post the unit central question where students can see and refer to it throughout the lesson series. Do not discuss the question with students at this time.</i></p> <p>Over the next several lessons, we are going to think about this unit central question: <i>Why are individuals of a species different from one another?</i> Write this question in your science notebooks and draw a double-lined box around it.</p> <p><b>ELL support:</b> The term <i>species</i> can be difficult for ELL students to understand because of the level of abstraction in the taxonomic classification. For instance, some common animals are named by their species (lion), while others are not (deer). When introducing the unit central question, ask students to give examples of different species. Create a classroom definition based on examples of animals that represent species (lion), those that don't (birds), and those that may be questionable (deer). You may want to use local animals as examples.</p>		
10 min	<p><b>Lesson Focus Questions</b></p> <p><b>Synopsis:</b> The teacher introduces the focus</p>	Set the purpose with a <u>focus</u>	<p><b>Show slide 3.</b></p> <p>Today's focus questions are <i>Can you predict what offspring will look like by</i></p>		

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	<p>questions; <i>Can you predict what offspring will look like by looking at their parents? Why or why not?</i> Then the teacher elicits student ideas.</p>	<p><u>question</u> or goal statement.</p>	<p><i>looking at their parents? Why or why not?</i></p> <p><i>Offspring</i> is a general word for children. Humans have children, dogs have puppies, cats have kittens, and plants produce seeds that turn into new plants, but all of these baby organisms are considered offspring.</p> <p><b>ELL support:</b> You may want to break down the word <i>offspring</i> to help ELL students understand what it means. In addition to providing examples of the offspring of different species, it may also be beneficial to ask students what the various offspring are called in their native languages and in English. This can be a homework assignment.</p> <p>Write the focus questions for this lesson in your science notebooks and draw a box around them. Leave space under the questions so you can write possible answers at the end of the lesson.</p> <p><b>Show slide 4.</b></p> <p>What do you notice about the parents and offspring on this slide?</p>	<p>Some babies look like one parent, and some look like the other parent.</p> <p>The siblings do not</p>	

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		<p>Ask questions to elicit student ideas and predictions.</p>	<p>That's right! The baby birds, puppies, kittens, and plants look like their parents in some ways but look different in other ways. And some of the offspring look different from each other.</p> <p><b>Small-group discussion (2 min):</b> Why do you think there are similarities and differences between the offspring and their parents and among individual offspring? I would like you to discuss this question in small groups. Be prepared to share your ideas with the class.</p> <p><b>NOTE TO TEACHER:</b> <i>Divide the class into groups of three or four students and circulate among the groups, listening to their ideas and asking probe questions to make their thinking visible.</i></p> <p><b>ELL support:</b> Be prepared to explain the term <i>species</i> if the different taxonomic classifications (species, kingdom, class) confuse your ELL students.</p> <p><b>Whole-class share-out.</b> So what are some of the similarities and differences you came up with?</p> <p><b>Show slide 5.</b></p>	<p>always look alike. Each kitten looks like a different parent.</p>	

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			<p>Now I would like you to draw a circle map in your science notebooks and write down the best ideas you came up with that might help us answer our unit central question.</p> <p><b>NOTE TO TEACHER:</b> Give students 2 or 3 minutes to write their best ideas independently in their notebooks. As you circulate among them, keep track of ideas you want to build on or address in this or future lessons.</p> <p><b>ELL support:</b> ELL students benefit from opportunities to discuss ideas with one another. Instead of having them work independently on the circle map, consider having them share their ideas. If time allows, allow them to amend their ideas after they discuss them.</p> <p><b>NOTE TO TEACHER:</b> Students might come up with ideas like these:</p> 		
5 min	Setup for Activity		Show slide 6.		

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	<p><b>Synopsis:</b> The teacher introduces the idea of <i>traits</i>. Students identify various traits of dachshunds.</p> <p><b>Main science idea(s):</b></p> <ul style="list-style-type: none"> <li>• Trait variations occur among individual offspring.</li> </ul>	<p>Make explicit links between science ideas and activities <b>before</b> the activity.</p>	<p>The features or characteristics of an organism are called <i>traits</i>. Some traits are easy to observe. For example, one observable trait of these dachshunds is a pointed nose.</p> <p>Other traits can't be seen just by looking at a plant or an animal, but they are still traits. For example, a plant's resistance to a particular disease is considered one of its traits even though you can't see it. Another unobservable trait is nearsightedness in a dog. You might not be able to see this trait by looking at the dog, but it's still a trait.</p> <p><b>Whole-class discussion:</b> Besides a pointed nose, what other traits can you observe by looking at these dachshunds?</p> <p><b>NOTE TO TEACHER:</b> <i>There is no need to probe student thinking during this discussion. Simply listen to students' ideas and record them.</i></p>	<p>They both have long bodies.</p> <p>They have short legs.</p> <p>Their ears are kind of long.</p> <p>One of the dogs has short hair, and the other has long hair.</p> <p>One dog has a skinny tail, but I can't see the tail of the other dog. It looks fuzzy.</p>	

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		Highlight key science ideas and focus question throughout.	<p>All of these descriptions about dachshunds are traits. So can anyone tell me what traits are?</p> <p>That's right! Traits are features or characteristics of animals and plants. This is an important science idea, so take a moment to write it in your science notebooks.</p>	They're the features of an organism.	
10 min	<p><b>Activity</b></p> <p><b>Synopsis:</b> Students predict what the puppies of a long-haired dachshund and a short-haired dachshund will look like and why. Then they create class charts of their current ideas and questions about inheritance.</p> <p><b>Main science idea(s):</b></p> <ul style="list-style-type: none"> <li>Some of the differences, or variations, between individuals are due to the traits offspring inherit from their parents.</li> </ul>	<p>Ask questions to elicit student ideas and predictions.</p> <p>Make explicit links between science ideas and activities <b>during</b> the activity.</p>	<p>What is one clear way these two dachshunds look different from each other?</p> <p><b>Show slide 7.</b></p> <p>So if these dachshunds mate, what do you predict their puppies will look like? Do you think they will have short hair or long hair?</p> <p>Before you answer these questions in your science notebooks, look at your circle map and think about the ideas you came up with earlier that might explain why parents and offspring look different from each other.</p> <p><b>Student think time (2 min).</b></p> <p>Now write down your predictions about the dachshund puppies. Which hair-</p>	The male has long hair, and the female has short hair.	



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		Ask questions to elicit student ideas and predictions.	<p>length trait do you think these puppies will exhibit—short hair, long hair, or something in between? Make sure to include the reasons for your predictions!</p> <p><b>NOTE TO TEACHER:</b> <i>Allow a few minutes for students to review their earlier ideas about similarities and differences between parents and offspring and write down their predictions.</i></p> <p><b>ELL support:</b> You may want to have students share their answers with a partner. ELL students benefit from creating and having access to multimodal representations. They may also benefit from drawing a picture in response to the questions.</p> <p><b>Student writing time.</b></p> <p><b>Show slide 8.</b></p> <p><b>Whole-class discussion:</b> So let’s hear some of your ideas and predictions. What do you think these puppies will look like and why?</p> <p>To track our ideas and any questions that come up during our discussion that we want answers for, I’m going to make two charts. As you share your ideas, I’ll write them on a chart titled “Our Current Ideas about Inheritance.” Questions will be</p>	<p>I think all the puppies will have short hair.</p> <p>I think the puppies will be fifty-fifty because they should look like both of their parents.</p>	<p>What are your reasons for this prediction?</p> <p>What do you mean</p>

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		Ask questions to probe student ideas and predictions.	<p>listed on a chart titled “Our Questions about Inheritance.” We’ll come back to these charts frequently during this lesson series.</p> <p><b>NOTE TO TEACHER:</b> <i>Create a chart with the heading “Our Current Ideas about Inheritance” and list student ideas about how hair length is an inherited trait in dachshunds. Make another chart with the heading “Our Questions about Inheritance” and write down any questions that come up during the discussion. Make sure to use complete sentences. Ask several students to share their predictions and reasoning (in complete sentences). Probe for clarification as needed, but don’t give them the answer or disagree with their reasoning at this time.</i></p> <p><b>ELL support:</b> Clarify that these ideas and questions are explicitly about trait inheritance and which traits the dachshund offspring will inherit from their parents. (Make sure students understand that dachshunds are a breed, not a taxonomic classification.)</p>	<p>I think the puppies will have medium-length hair because that’s a mix between the two parents.</p> <p>I think they’ll have long hair like the dad because the dad’s traits are dominant.</p>	<p>by fifty-fifty?</p> <p>What do you mean by “dominant”?</p>
6 min	<p><b>Follow-Up to Activity</b></p> <p><b>Synopsis:</b> The teacher reveals that all of the dachshund puppies (offspring) have short hair. Students propose ideas</p>	Engage students in analyzing and interpreting data and observations.	<p><b>Show slide 9.</b></p> <p>Here are the dachshund puppies that came from the long-haired dad and the short-haired mom. What do you observe about the length of the puppies’ hair? Are you surprised?</p>	They all have short hair.	

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	<p>about the hair-length trait to explain what happened to produce only short-haired puppies. Then the class charts are updated to reflect students' ideas and questions.</p> <p><b>Main science idea(s):</b></p> <ul style="list-style-type: none"> <li>• 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.</li> </ul>	<p>Ask questions to probe student ideas and predictions.</p>	<p><b>ELL support:</b> Asking ELL students a more general question, such as “What do you notice about the puppies?” will give them an opportunity to orally contribute to knowledge building. After students have offered several ideas, you can guide the discussion to hair length.</p> <p>Can you think of a possible explanation for why all of the puppies from a long-haired dad and short-haired mom have short hair?</p> <p>What happened to the long-hair trait? Did it just disappear?</p> <p><b>NOTE TO TEACHER:</b> <i>Invite students to share their ideas and add any new ideas and questions about inheritance to the class charts. Don't correct students' ideas at this point; simply ask probe questions as needed to make student thinking visible. Record their ideas, no matter how wild, on the chart. They'll have opportunities to review and revise them during the next lesson.</i></p> <p><b>ELL support:</b> To support comprehension, give ELL students opportunities to talk in their native languages as well as in English. You may want to have students from the same language group share with one another before they contribute to a class</p>	<p>I didn't expect that to happen!</p>	

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			discussion.		
5 min	<p><b>Synthesize/Summarize Today's Lesson</b></p> <p><b>Synopsis:</b> Students write a possible answer to the focus questions to synthesize their current ideas about trait inheritance.</p>	<p>Summarize key science ideas.</p> <p>Highlight key science ideas and focus question throughout.</p>	<p><b>Show slide 10.</b></p> <p>We have a lot of ideas about inheritance, don't we?</p> <p>To summarize what we have learned so far, let's use the hair-length evidence from the dachshund puppies to come up with a possible answer for today's focus questions, <i>Can you predict what offspring will look like by looking at their parents? Why or why not?</i></p> <p>Make sure to include in your answers the key idea of traits.</p>		
1 min	<p><b>Link to Next Lesson</b></p> <p><b>Synopsis:</b> The teacher announces that in the next lesson, students will analyze other students' ideas about what happened with the dachshund puppies and decide whether the evidence supports these claims.</p>	<p>Link science ideas to other science ideas.</p>	<p><b>Show slide 11.</b></p> <p>Today we saw that all of the dachshund puppies from a long-haired parent and a short-haired parent had short hair. So what happened to the long-hair trait?</p> <p>Tomorrow we will look at some claims other students have made to explain what happened with the puppies and decide whether we agree with those claims based on the evidence we have gathered.</p>		