Lesson 1: Why Do These Organisms Look The Way They Do?

Overview:

Purpose:

The purpose of this activity is to 1) introduce some of the cases that students will study over the course of the unit, and 2) draw out student prior conceptions about what caused dog breeds, wolf sub-species, and wolf-like species to have different traits.

The primary purpose for the teacher is to use this activity as a form of prior conception research on what you students may say or already know in this unit. Students bring in many prior conceptions related to how they think populations change over time, whether humans are always responsible or not, whether individuals evolve or populations evolve, and how organisms are or are not related to one another. It can be very useful to know ahead of time some of the prior conceptions you will be able to build upon, which ones may be more challenging for students to change, and which ones will be productive areas for further investigation.

Performance Expectation

- Ask questions and brainstorm ideas about why domestic dogs, wolves, Maned wolf, coyote, and African wild dog have different many similar traits, but different characteristic variations.

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Scientific Principles (Re)Discovered

- Review of any old scientific principles related to cells, DNA, genes, proteins, traits, and patterns of inheritance that students learned in prior units relevant to this one.

Description of the Lesson

Students predict which photographs of 9 canids are of dogs or wolves and which are not. The teacher introduces the case study board. Students share their prior conceptions about why these organisms look the way they do with each other and then students share these ideas with the class. Students create questions they want to figure out the answer to over the course of the unit and each students shares and posts one question to the case study question board.

Giving time for every student to share out the questions help build stronger ownership (from students) in figuring out the case studies later in the unit, engenders a great sense of mystery about these cases (why they are the way they are), and can help students become dissatisfied with their own explanations as they hear other students ideas.

Lesson Details:

Time 45-60 min. for discussion based launch format

Materials

Per Student

- Introduction to Our Class Case Studies Sheet.
- Index card(s) and marker

For the teacher

- Transparency for cases.pdf found in the zip file for Case Study Introduction handout and printouts.
- Case Study Board (CSB) (built before class and hidden until the last part of the lesson): Use Case Study Board – Full sheet photos pdf or Case Study Board found in the zip file for Case Study Introduction handout and printouts.

Lesson Outline and Timing

Launch

- Display the pictures of the 9 organisms. And have students record their predictions. (3 min).
- Share answers to predictions and introduce class case study board. (2 min.)

Explore

- Explain purpose of page 3 and assign students to work on this individually (10 min).
- Students share their explanation with a group (15 min.)

Summarize

- Students write individual questions down for the case study board (5 min.)
- Students share out questions for case study board (25 min).

Lesson Enactment Details

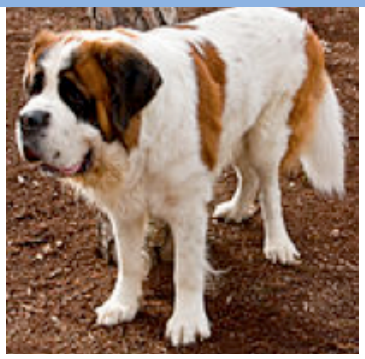
Before the class starts:

Build the Case Study Board (CSB) driving shown below before class starts and keep it covered or hidden until after students make predictions using the pdf of the unsorted pictures of these organisms. To make the case study board, use a large piece of butcher paper, print out color pictures of the 9 cases on full or half sheets of colored paper and stick them to the paper with the labels shown in the example. Note: If you have taught the Populations Dynamics unit in WISE already, you may wish to add a post it to the Great Plains Wolf that indicates it is the sub-species wolf that is found on Isle Royale (the previous case study from that unit). **IMPORTANT SPOILER ALTERT: KEEP THE CSB hidden until after students make their predictions in the launch of the lesson (page 1 of their activity sheets).**

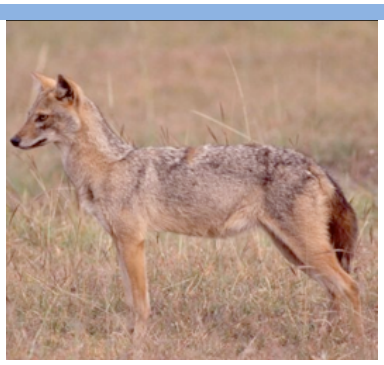
Our Case Study Board: Why Do They Look The Way They Do?

Individuals of the same species (*canis lupus*)


Redbone Coonhound


St. Benard


Basenji


Egyptian Wolf


Great Plains Wolf


Artic Wolf

Individuals of 3 different species


Coyote


Maned wolf


African wild dog

Launch:

Tell students that you would like them to observe some phenomena and make some predictions. Tell them to not share their predictions with other students until you tell them to do so. Project the Transparency for cases (pdf) [in color] as you pass out the Introduction to Our Class Case Studies sheets.

Have students take 1 minutes to make predictions on the first page. Then have them share their predictions with a partner and explain why they made the predictions they did for 2 minutes.

Have students turn the paper to the second page and read through the text on this side together, and have them answer the question on the bottom of the page.

Then tell students, that many common names for wild animals that look like the Kalak or Wildhond use the word dog or wolf, because people thought they shared lots of trait variations in common with wolves and dogs. And though this is true, these animals are different species than wolves or dogs, which means they don't interbreed with dogs or wolves and produce fertile offspring. On the other hand, all the dogs and wolves in the picture can interbreed with each other and produce fertile offspring, even though they have many variation that appear different from each other.

Post the Case Study Board (CSB) and introduce the question for these case studies, "How Come They Look the Way They Do?"

Assign 3rd page for students to complete individually. Give them about 10 minutes to do this. Then have groups of 3 to 4 students share their explanations with one another for about 10 to 15 minutes. Continue with the rest of the directions below if your are enacting option 1 for this lesson.

Once all group members have shared with each other, ask students to share out ideas they wrote or heard from other group members. Accept all ideas. This is an opportunity for you to assess student's prior knowledge. After hearing a dozen or so ideas, have each students write a question they want to try to link to case study board or a new case they want the class be able to explain (page 4). Tell students that they may have cases of other dogs or other animals, such as pets that they want to use as cases (such as types of fish or cats or birds that look similar or different, etc.…) Cases should describe a description of the trait variation between two different individuals. Have students commit to writing either a case or question on an index card.

Tell students that you want them to share and post their questions one at a time next to the Case Study Board. But remind students to think about previously shared questions and try to link their question or case to someone elses, by posting it near that person's card and explaining to class why you think it is linked to their question. The first person who goes will have no other card to link to, so that first person must be someone who can link to a picture or question on the case study board.

Examples of these kind of questions and cases from a classroom of 8th grade students that investigated the question "Why Do I Look The Way I Do?" and started with human traits as their first phenomena, generated the following questions and related cases

Example Questions	Example Cases
	

Notice that the distinction between a question and a case isn't clear cut and there is some overlap between the two. That is ok. The goal is try to provide real world examples as well as personally relevant questions that students want the "science they learn". These questions will end up being ones that they should be able to answer by the end of their unit of study, particularly if you have asked them to link into one another questions and the case study board. This process helps students realize the goal of the unit will be to create a unify framework scientific principles that can be used to account for everyone cases/data and develop explanation/models that can help answer almost any question.

Collect the Introduction to Our Class Case Studies handout, to further evaluate student's prior conceptions on page 3. Use this question to determine if there is any old scientific principles related to cells, DNA, genes, proteins, traits, and patterns of inheritance that students learned in prior units in your classroom relevant to this one that should be reposted/reviewed with class before the next lesson. Below is a list of disciplinary core ideas that students should know coming into the unit.

LS1.A Structure and Function

- All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins.
- Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions (alleles) for forming species' characteristics are carried in DNA. Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual.

LS3.A: Inheritance of Traits

- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.
- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.
- Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits.

LS3.B: Variation of Traits

- In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.
- In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins.

Printable for Case Study Board
From http://en.wikipedia.org/wiki/Redbone_Coonhound

Redbone Coonhound

Printable for Case Study Board
From http://en.wikipedia.org/wiki/St._Bernard_(dog)

St. Bernard

Printable for Case Study Board
Image from http://en.wikipedia.org/wiki/Basenji

Basenji

Printable for Case Study Board

Egyptian Wolf

Printable for Case Study Board

Image from http://www.isleroyale.org

Great Plains Wolf

Printable for Case Study Board

Image from http://upload.wikimedia.org/wikipedia/commons/a/ae/Arctic_wolf_Berlin.JPG

Arctic Wolf

Printable for Case Study Board
Image from http://es.wikipedia.org/wiki/Canis_latrans#mediaviewer/Archivo:Canis_latrans.jpg

Coyote

Printable for Case Study Board
Image from http://en.wikipedia.org/wiki/Maned_wolf#mediaviewer/File:Chrysocyon.brachyurus.jpg

Maned Wolf

Printable for Case Study Board
Image from http://en.wikipedia.org/wiki/African_wild_dog#mediaviewer/File:LycaonPictus.jpg

African Wild Dog