Breeding dragons

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6   Breeding Dragons

In this activity students learn how new pet breeds with desirable traits are developed through artificial selection. Instead of working with real domesticated animals, students work with mythical ones—dragons—which can help to increase student interest and be excellent fun, but can still convey scientific concepts that also apply to real organisms. Students work in pairs to breed a dragon according to their needs. The activity begins with a collection of dragon breeds, each with specific features. Then, students describe a dragon they would like to have and try to breed such a dragon baby by crossing any two of the existing breeds.

6.1   Aims

- To address the mechanism of artificial selection in a playful way.
- To emphasize the importance of having a goal in the process of artificial selection, unlike in natural selection.
- To demonstrate that variation, inheritance, selection, and time are needed for artificial selection to bring the desired results.

6.2   Structure

- Students perform the breeding in pairs (45 min).
- Discussion and presentation of results (45 min).

6.3   Materials

- Cards showing dragon breeds with pictures and descriptions
- Student worksheets
- Coin
- Dragon cut-outs

6.4   Procedure

Introduction:
1. In the initial discussion, the teacher shows the students pictures of dogs, cats and other animals bred and kept by humans as pets, and discusses with them the origin of the variation they can see among the animals. Students should be aware of the human intervention required to produce these pet breeds.
2. The teacher tells the students that now they will have an opportunity to breed their own pet—a dragon—with traits they would wish them to have.
3. Students examine a general dragon picture and the teacher introduces traits that a dragon may or may not have. Any of these traits can be selected for.
4. Students are divided into pairs.
5. Each pair describes a dragon they would like to have and a task they would like such a dragon to perform. The description should contain specific features and explanations of the situations in which these traits would be useful.
6. The teacher introduces the "existing" dragon breeds and explains that different breeds have different combinations of traits. It is important to note that dragon breeds presented belong to a single species, so they can mate with one another and are able to produce viable offspring.
    - Note that the names on the description cards are the subspecies names. The species name is *Draco experimentalis*.
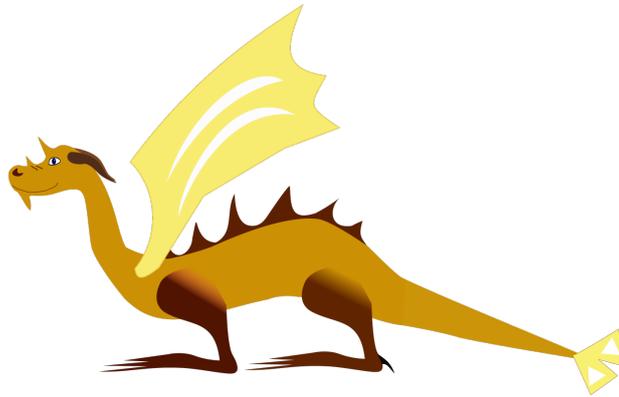
7. Each student pair is given a worksheet. Students should examine the dragon breeds closely and decide which two of them they would breed to try to get a baby dragon with the traits they desire. Students will have to prioritize the features as it is unlikely that two breeds will have the exact combination desired. They should be able to justify their choice of breeds to cross.

8. If the students are not able to get the traits they want after the first crossing, they may use the offspring from the first cross to mate with one of the initial dragon breeds.

9. After breeding a baby dragon, each student pair describes its features and may compile the baby dragons from the dragon cut-outs they were given with the dragon packets. Students evaluate how well the baby dragon meets their expectations.

10. Students complete the analysis section in their worksheets.

11. All newly produced dragon babies are assembled and observed by the whole class.

12. The teacher summarizes the activity, listing the necessary conditions for artificial selection.

References

- Collins, Jenifer Johnson. *Artificially Selecting Dogs.* University of California Museum of Paleontology. [cit. 7.7.2016]
  http://www.ucmp.berkeley.edu/education/lessons/breeding_dogs/

Magneticus graniticus

Magneticus graniticus is a small dragon with shy and friendly nature. Individuals are very intelligent and are fond of humans, as well as tolerant of larger animals and other dragons. This dragon breed usually comes in various hues of brown, however, even bright golden or bronze-colored individuals have been observed. When stressed, Magneticus belches large amounts of sulphur vapour, discouraging any predator from attacking.

Large, membrane-like wings tightly engulf the thin body, the head is equipped with drill-like horns and the neck muscles are extremely strong, enabling individuals to hide in the ground and wait for hours, even days, until a threat disappears. However, the wing muscles are weak and not suitable for flying, only allowing short distances to be crossed. On the ground, individuals are fast and agile, hunting mostly small mammals.
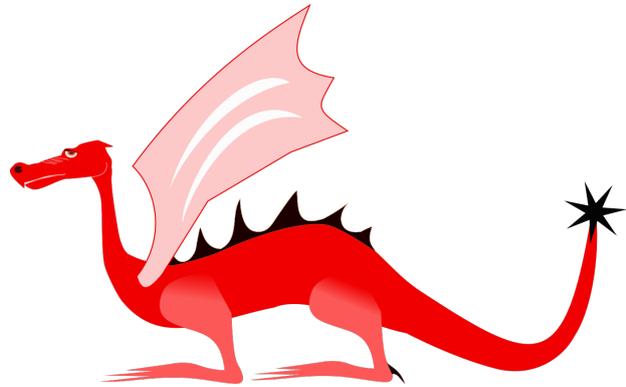
Arcticus glaciaticus

Arcticus glaciaticus is a dragon of larger stature, with a strong body and huge wings, capable of flying long distances. The body is covered with silvery blue-gray scales packed tightly against each other, protecting it from cold weather and icy water. Arcticus likes cold climates and is usually seen above the Arctic Circle, or in lakes in the north of Scotland. Individuals spend most of their time partially submerged below the water surface, being able to last for hours without inhalation. Arcticus is a solitary dragon and does not like a company of other dragons, treating all other animals as prey.

Co-habitation with humans is extremely rare, mainly due to Arcticus' choleric, aggressive nature. Easily disturbed, angered or irritated, individuals spray their prey with an icy shower or fog. This is even the way they hunt: the prey (mostly moose or reindeer) is instantly frozen, and is thus preserved for several months.
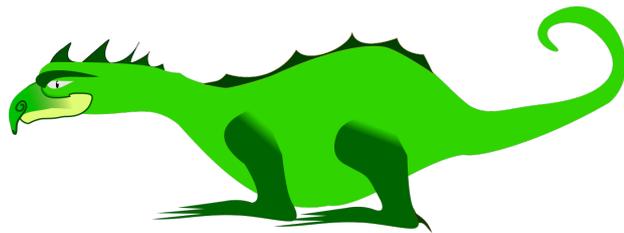
Ignis Antiphon caldus

Ignis Antiphon caldus is a medium-sized dragon with bright red or orange coloring. With their strong wings and slim body, individuals cross long distances quickly and easily. Ignis Antiphon breaths fire, consuming its prey always grilled or cooked, never raw. It is prone to a mutation that causes a non-lethal head duplication and split personality. Two heads (or even three, as the case may be) usually don't get along very well, often quarrel and are jealous of each other. Ignis Antiphon prefers rocky mountains or castles, often forming alliances with humans. In exchange for good meals, Ignis Antiphon is willing to guard female prisoners or expensive objects.

The intelligence of this dragon breed is unknown, as it collaborates with people only according to its own rules. Ignis Antiphon ignores smaller dragons and does not tolerate large ones in its proximity, the few exceptions being individuals of the same breed and the opposite sex.

Draco sempervirens

Draco sempervirens a little green dragon with stout, but lithe body. Sharp claws allow it to climb trees with the help of its strong, flexible tail and small beak. Draco inhabits dark, old forests, where it hunts larger insects and small rodents.

Draco lacks the ability to belch anything dangerous, but can make weird, ear-pleasing sounds. It is very intelligent, curious, friendly and charming, loves to interact with people and is eager to learn new things.

Draco tolerates well and is well tolerated by most of the larger animals. It is even rumoured that, due to its high intelligence, it can manipulate or rule them. Individuals of this breed are often seen in the company of wolves and primates, where it seems that their company is not only tolerated but actively pursued.
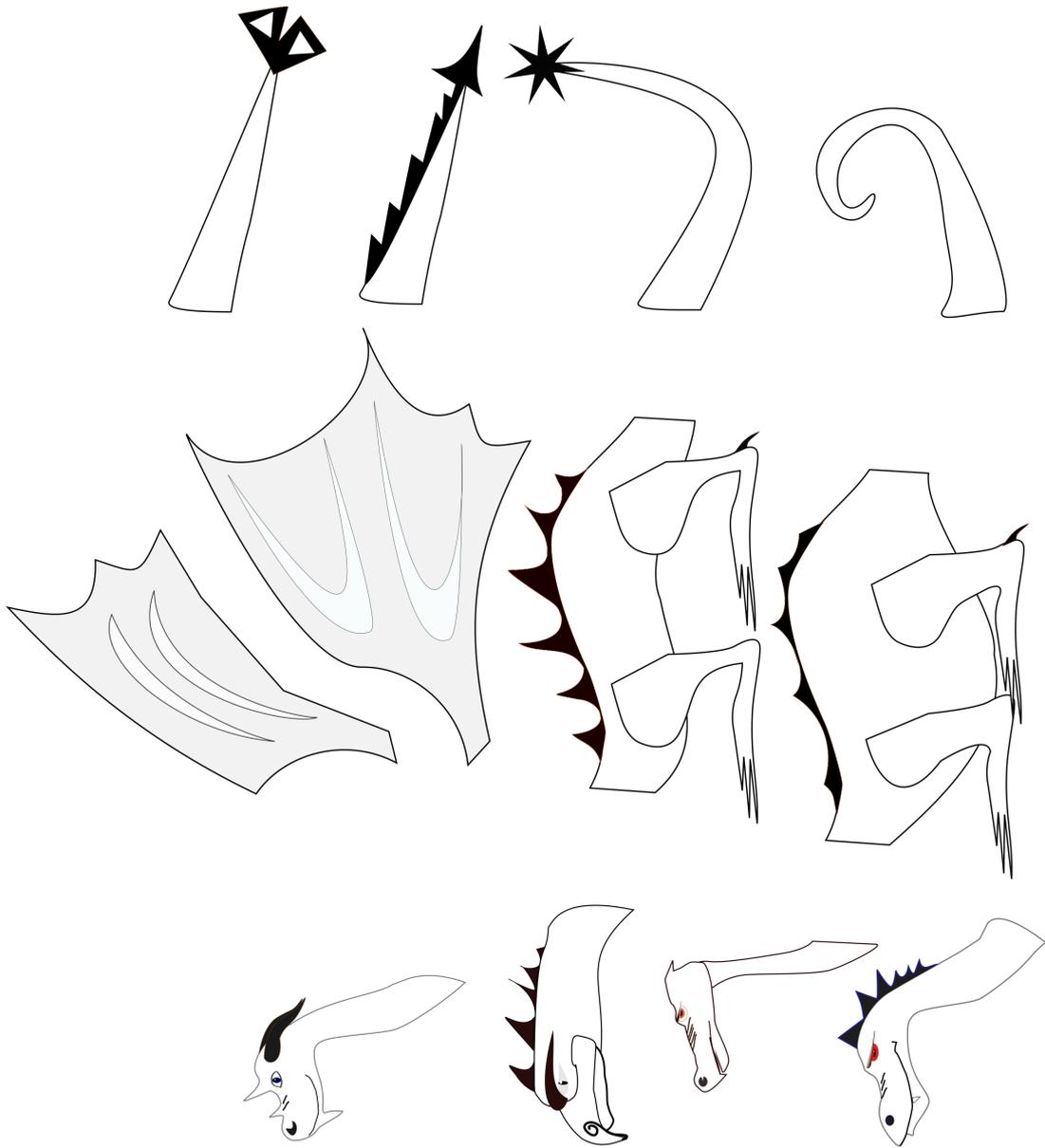
Figure 1: Dragon parts

Breeding dragons

Have you ever wanted a pet? Now is the time to get a very special one: Breed yourself a dragon!

Materials

- List of dragon breeds with pictures and descriptions
- Student worksheets
- Coin
- Dragon cut-outs

Procedure

1. Decide what kind of dragon do you want to have and why. Be specific: List the features you would like your dragon to have and explain why these features are important to you. Suggest a task you would perform with your dragon. It can be anything—be creative!

   Description of your dream dragon:

2. Carefully review the descriptions of the existing dragon breeds.
3. Select two dragon breeds with the features you think most likely to produce a dragon with the traits you desire. If you cannot find a dragon pair that combines all the traits you are looking for, you should prioritize the required traits, or plan to get the desired baby dragon in a second round of breeding.

   Selected dragon breeds:

   _____ x _____
        mother   *father*

4. Each breeding dragon pair will produce three puppies, and each of them may inherit a certain trait either from the mother or from the father. You will determine this by a flip of a coin: Heads = the female's (mother's) feature, tails = the male's (father's) feature. You will flip a coin for each trait to be inherited for each baby dragon separately.
5. Record the results of your coin flips and determine the traits of each baby dragon you get in the table below.
6. Compare the baby dragons. Are they identical? If not, how do they differ? Do any of them have everything you were looking for?
7. You may repeat the breeding process once again, choosing a different dragon pair, or including your newly produced dragons in the breeding.
8. Compile the baby dragon you like best from the dragon cut-outs.

Table 1: Traits and abilities of dragon pups

Pups from: _____ x _____			
trait / ability	first pup	second pup	third pup

Analysis

1. Does your dragon baby meet your expectations?
2. You determined the features of the baby dragon by tossing a coin. What biological process or processes does this action represent?
3. What does the expression "dragon breed" mean? What is the difference between a "dragon breed" and a single dragon?
4. Would the baby dragon you have just produced be able to establish a new dragon breed? Why or why not?