



Innovative Technology in Science Inquiry



Activity: Meiosis

Introduction

In this activity, you will learn how meiosis and fertilization combine to shuffle the alleles that offspring inherit, determining the organism's genotype and hence its phenotype.

Why don't siblings look exactly alike?



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What is meiosis? It is the process by which a diploid cell (with two sets of chromosomes) transforms into four haploid gametes (with one set of chromosomes each).

There are lots of big words in genetics! One way to start thinking about the process of meiosis is to ask yourself some questions.

If two parents are contributing genetic material to their offspring, why don't the genes and chromosomes double in each generation?

If each parent has two sets of genes and chromosomes, why do their offspring receive only one set from each parent?

Standards

NSES Life Science – Reproduction and Heredity

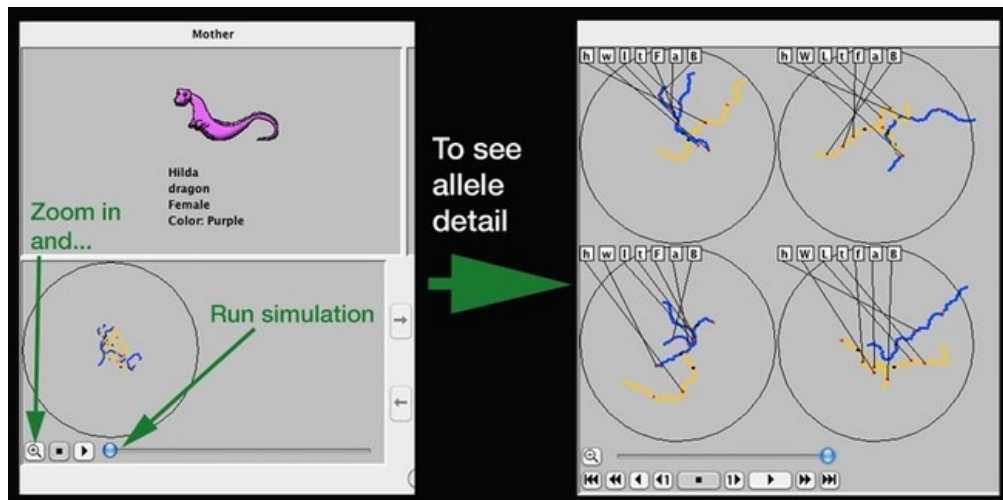
Hereditary information is contained in genes, located in the chromosomes of each cell. Each gene carries a single unit of information. An inherited trait of an individual can be determined by one or by many genes, and a single gene can influence more than one trait.

NSES Life Science – Reproduction and Heredity

The characteristics of an organism can be described in terms of a combination of traits.

Procedure

Meiosis is the type of cell division in which gametes (eggs and sperm) are produced from germ cells. Gametes are haploid; they have only one set of chromosomes instead of two. Therefore, meiosis involves a reduction in the amount of genetic material — each gamete has only half the chromosomes of the original germ cell.



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Meet Hilda, the mother dragon. She is excited because she is about to have a baby! But she will need the help of Landar, the father, and you to make that happen. You will be able to investigate both of their germ cells by clicking on the small magnifying glasses to take a closer look.

Dragons have six different traits, shown by different alleles (varieties of genes): horns (H, h), wings (W, w), number of legs (L, l), fire-breathing (F, f), color 1 (A, a) and color 2 (B, b), and type of tail (T, t).

Collect Data I

Start meiosis on the female side, either by clicking on the Play button or dragging the slider all the way to the right. Do the same for the male side.

Select a gamete on the female side and click the arrow to place the selected gamete into the fertilization chamber in the center. Do the same for the male side.

Run fertilization, either by clicking on the Play button or dragging the slider all the way to the right.

If you want to inspect the chromosomes in the gametes, you can do so by clicking on any of the magnifying glasses.

After you have made a baby dragon, click on the snapshot button, and describe the differences between the parents and the child. Click OK to close the snapshot album. **Do not take more than three snapshots.**

<https://models-resources.concord.org/biologica-ui/itsi-dragon-meiosis-view-1.html>

Take a snapshot and upload it to your Snapshot Album by clicking the "Take a Snapshot" button. To browse your Snapshot Album, click the album icon. A snapshot must be included for the activity to show as completed.

How did the offspring differ from the parents? How were the offspring similar to the parents?

Collect Data II

Now try to make offspring that have no horns. Horns are dominant, so to do this you will have to pick gametes with the “h” allele from both the male and female parents. Remember: you can inspect the chromosomes in the gametes by clicking on the magnifying glass.

Click on the snapshot button and take a picture of the hornless offspring. Click OK to close the snapshot album.

You may end up making a dead dragon! This will happen approximately 25% of the time.

Dead offspring result when female gametes that have “h” on chromosome 1 also have “b” on the X chromosome **and** the male gametes that have “h” on chromosome 1 also have a Y chromosome. This results in male offspring with a lethal “b” allele on its single X chromosome.

If this happens, hit “Reset” and run meiosis again. Meiosis is a random process so chances are that the chromosomes will separate differently each time. Keep trying and you are bound to make viable offspring without horns.

Take **three snapshots** of your various offspring, one of which should be **without horns**. Click OK to close the snapshot album.

<https://models-resources.concord.org/biologica-ui/itsi-dragon-meiosis-view-2.html>

Take a snapshot and upload it to your Snapshot Album by clicking the "*Take a Snapshot*" button. To browse your Snapshot Album, click the album icon. A snapshot must be included for the activity to show as completed.

Is it possible for these two dragons to have an offspring with wings? Can they have an offspring with no wings? Explain.

Collect Data III

All of the offspring so far have either two legs or no legs. Can these dragon parents have offspring with four legs?

Try out different selections of gametes to try to make a dragon with four legs. Take **no more than three snapshots** to document your process. For each, click on the snapshot button and take a picture of the offspring. Click OK to close the snapshot album.

<https://models-resources.concord.org/biologica-ui/itsi-dragon-meiosis-view-2.html>

Take a snapshot and upload it to your Snapshot Album by clicking the "*Take a Snapshot*" button. To browse your Snapshot Album, click the album icon. A snapshot must be included for the activity to show as completed.

Were you able to make and offspring with four legs? Please explain why, or why not.

Analysis

Review your snapshot album, descriptions of images and previous responses to help answer the following questions.

1. How does meiosis increase the diversity of potential offspring? Explain.
2. What do you think causes the different phenotypes of these dragons? How does the phenotype depend on its genes (genotype)?

3. Why does the lethal “b” allele affect more males than females?

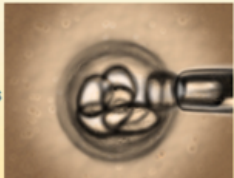
4. How does the genetic code of the offspring differ from its parents?

What process makes children different than their parents?

Conclusion

Why don't siblings look exactly alike?

Concluding Career STEM Question

<p>Stem Cell Researcher</p> <p>Stem cells are specialized undifferentiated embryonic cells that can multiply and become any cell in the body. Stem cell researchers look for ways to use stem cells to cure disease and disabilities.</p> 	<p>Qualifications Minimum: Master's Degree.</p> <p>Salary \$64,000</p> <p>Coursework HS: Biology, Chemistry, mathematics.</p>
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Stem cells do not have any activated or deactivated genetic material. Stem cells are used to make new cells as older cells die.

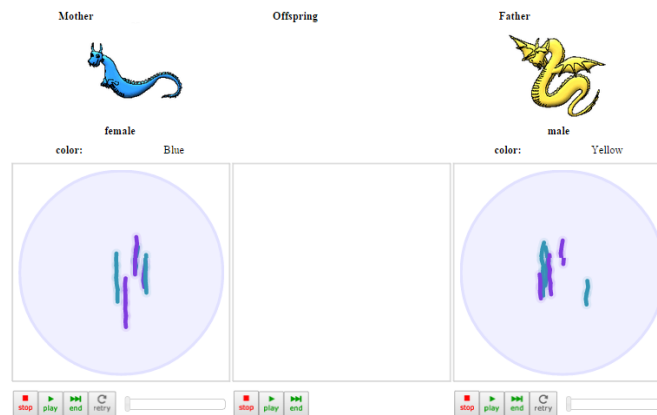
You have stem cells in your body. Where do you think the stem cells are located?

If you were a stem cell researcher, what diseases would you try to find a cure for?

Further Investigation

Is it possible for the dragons below to have offspring that breathes fire? Why or why not?

Make sure to click on the snapshot button and take a picture of the offspring. Click OK to close the snapshot album.



<https://models-resources.concord.org/biologica-ui/itsi-dragon-meiosis-view-2.html>

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