



Today is a very exciting day on the Isle of Gandwar. Two of the dragons there are about to have a baby. Because this happens only about every 500 years, the birth of a dragon is met with great anticipation. The lucky parents are Molthwan and Lucenne, two of the island's most admired inhabitants.



Like all eager parents, Molthwan and Lucenne are anxious to know what their baby will be like. Molthwan is especially interested in knowing whether the baby will have wings and be able to fly. Lucenne is hoping that the baby will be able to breathe fire, something not many dragons on Gandwar are able to do.



Fortunately for the happy couple, dragons on Gandwar have kept meticulous records about dragon births and biology since shortly after the Redawning.

Try some pairings of dragons from the record book to see what types of couples have had babies with wings:





Fire-breathing dragons are less common on Gandwar. Try some pairings of dragons from the record book to see what types of couples have had babies that breathe fire:





Which of these traits is a dominant hereditary trait?

- a.Wings
- b. Fire-breathing
- c. Both
- d. Neither

Why?





You're now looking at a *chromosome view* of a dragon.

Click on a chromosome. Good

Click on a gene. Good.

Change the genes for wings and fire and see what happens.

What combinations of genes will create a dragon with wings? What combinations of genes will create a dragon that breates fire?



Click on a gene of this dragon to be taken to the gene view.



Change the highlighted gene. What happens to the dragon? Click back to the chromosome view and try the gene that controls the tail. Can you change this gene to make the dragon have a fancy tail? **Good.**



The dragons reproduce through the process of meiosis. Click the buttons above to run through the stages of meiosis. As you do, notice what happens to the chromosomes. (Pauses during tetrad and doubling stages -- have student zoom in to observe doubled chromosomes. Do this as a "movie"?)

When chromosomes double in meiosis, are there differences in the copied chromosomes?

Look at the highlighted chromosome in the paused stage of meiosis in the view above. Click on a gene. **Good.** Now find the same gene in the copy of the chromosome and click on it. **Good.** Are these exact copies? How do you know?



Above is the gene view of this chromosome. What do you notice about this view?

Look at the highlighted chromosome. Click on a gene in this chromosome and notice what happens. (Gene view shifts to that gene, highlighted in red.) Click on the same gene on another chromosome. How do the alleles compare? Are they exact copies? How do you know?

Now, let's complete the breeding of our dragon. Run meiosis on both dragons, and choose one of the gametes from each to combine.



Take a look at this combination before you see the dragon that results. What genes does it have for its tail? What should the baby dragon's tail look like? Now click to view the dragon. **You were right!**

Of course, it's not always as straightforward as this. Let's go back to meiosis again...



Run meiosis this time and look closely at the result.



What happened this time? Are the chromosomes all exact copies of each other? How do you know?

Let's go back and run this slowly and see how this happened...



The chromosomes crossed during meiosis in this case, and ended up mixing up with each other. Now the gametes are different from each other. Look at the gametes below, and choose one that could produce a dragon that breathes fire. **Good. You chose a dragon with a recessive fire gene.** Now click on the gametes that could not produce a dragon that breathes fire. **Good.**





Now let's look at the gene views of these chromosomes. Click on the chromosomes to examine the difference between the F and f genes. Can you change the gametes so that all could produce fire-breathing dragons? **Good.**

When genes recombine, the locations of the chromosomes' crossings determine which genes the chromosomes will receive. Here is a cell in the middle of meiosis. Can you arrange it so that two chromosomes cross? **Good.** Now select the chromosomes for the dragon's tail. Can you arrange the chromosomes so that the upper right gamete will end up with an H gene?



Great. In the following example, the upper right gametes will combine to fertilize and produce a baby. Your task is to cross and align the chromosomes from both dragons during the stages of meiosis so that these gametes will be able to produce a fire-breathing dragon.