K20 LEARN

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Dragon Delivery

Biology: Genetic Traits

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Grade Level	9th – 12th Grade	**Time Frame**	4-5 class period(s)
Course	Biology	**Duration**	275 minutes

Essential Question

What makes individuals unique?

Summary

Students will model Mendel's Law of Segregation and Independent Assortment using Popsicle sticks to represent diploid autosomes and sex chromosomes. By the end of this lesson, students will produce unique paper baby dragons.

Snapshot

Engage

Students watch a video or look at a picture and identify all of the similarities and differences of dragons.

Explore

Students explore the Laws of Segregation and Independent Assortment of genes through an activity called Dragon Delivery.

Explain

Students jigsaw and why-light an information packet describing Mendel's Laws, Punnett squares, and various types of traits such as sex-linked, co-dominant, sex-limited, and sex-influenced.

Extend

Students present their dragons to the class along with Punnett Squares for each trait and explain the frequency of their dragon baby's traits expressed as a proportion and percentage.

Evaluate

Students evaluate each other's presentations for accuracy using a rubric. Students independently complete a formative assessment titled "Dogs-Puppies so much more."

Standards

ACT College and Career Readiness Standards - Science (6-12)

IOD301: Select two or more pieces of data from a simple data presentation
IOD505: Analyze presented information when given new, simple information
EMI401: Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text

Next Generation Science Standards (Grades 9, 10, 11, 12)

HS-LS3-1: Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
HS-LS3-3: Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Oklahoma Academic Standards (Biology)

B.LS2.5 : Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
B.LS3.1 : Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

Attachments

- Dragon Delivery Activity—Dragon Delivery - Spanish.docx
- Dragon Delivery Activity—Dragon Delivery - Spanish.pdf
- Dragon Delivery Activity—Dragon Delivery.docx
- Dragon Delivery Activity—Dragon Delivery.pdf
- Dragon Reading—Dragon Delivery - Spanish.docx
- Dragon Reading—Dragon Delivery - Spanish.pdf
- Dragon Reading—Dragon Delivery.docx
- Dragon Reading—Dragon Delivery.pdf
- Lesson Slides—Dragon Delivery.pptx
- Popsicle Sticks Coding—Dragon Delivery - Spanish.docx
- Popsicle Sticks Coding—Dragon Delivery - Spanish.pdf
- Popsicle Sticks Coding—Dragon Delivery.docx
- Popsicle Sticks Coding—Dragon Delivery.pdf
- Poster Rubric—Dragon Delivery.pdf

Materials

- Picture of several dragons from Dreamworks movie "How to Train Your Dragon" (or a short video clip showing several dragons from the movie)
- Multi-colored Popsicle sticks with alleles printed on both sides (each student will need 1 of each color: green, red, orange, yellow, and either pink or blue for female or male).
- Popsicle Sticks Coding (attached; to be printed for popsicle sticks)
- Dragon Delivery Activity handout (attached)
- Dragon Reading (attached; one copy for every student)
- Dragon descriptions for extend/expand
- Poster Rubric (attached)
- Lesson Slides (optional)
- Calculators (optional; one for every pair of students)
- Blank paper
- Highlighters
- Colored pencils, crayons, or markers

Engage

Prior knowledge: Students should be familiar with the terms genes, chromosomes, alleles, dominant, recessive, phenotype, genotype, Punnett squares, diploid, haploid, and gametes. If students do not have this background, then the teacher will want to use these terms in context when helping students with the activity and the reading in the explore and explain phases.

Key Terms for Lesson:

- Mendel's laws:
- Law of Segregation: Each parent has two alleles that contribute to the phenotypes and genotype of offspring. These alleles may be dominant or recessive.
- Law of Independent Assortment: Different pairs of alleles are passed on to the next generation. This allows for many combinations of alleles and explains how offspring may inherit traits not seen by either parent. This also explains why the human inheritance of a particular eye color does not increase or decrease the likelihood of having 6 fingers on each hand because genes for independently assorted traits are located on different chromosomes.
- Punnett squares: This is a simple graphical way of discovering all of the potential combinations of genotypes that can occur in children, given the genotypes of their parents. It also shows us the odds of each of the offspring genotypes occurring.
- Sex-linked traits: Characteristics determined by genes located on sex chromosomes.
- Co-dominant traits: Both alleles (dominant and recessive) are equally expressed.
- Sex-limited traits: A male and a female with the same genotype will express them differently based on their sex, restricted to autosomal traits.
- Sex-influenced traits: Restricted to autosomes and are generally influenced by presence of hormones.
- Relationship between DNA, chromosome, gene, and alleles: Chromosomes contain DNA. DNA contain genes. Genes contain alleles.
- Homozygous: Two alleles are dominant or both recessive.
- Heterozygous: One allele is dominant and one allele is recessive.
- Dominant: Shown with a capital letter, is usually the expressed allele.
- Recessive: Shown with a lowercase letter, and is usually not expressed unless both inherited alleles are recessive or is co-dominant.
- Phenotype: Physical expression of genes – what we see.
- Genotype: Made of two alleles, one from mother and from father. Example of genotypes: GG (homozygous dominant), Gg (heterozygous), gg (homozygous recessive)

Show students the video clip or project the picture of multiple dragons and ask them to list all of the similarities and differences they observe in the dragons. Ask students to share their responses. Their responses will be describing *phenotypes* of dragons. Try to elicit this term through questioning. A sample question might be: *What is the term we use when describing these physical traits?*

Teacher's Note

The site below has 55 short videos from Dreamworks "How to Train Your Dragon."Videos 34-39 are 30-second clips of each of the major dragons; Deadly Nadder, Terrible Terror, Night Fury, Hideous Zippleback, Monstrous Nightmare, and Gronckle. These are nice clips because students get good views of each dragon, and it is easier for them to identify similarities and differences.

http://www.youtube.com/watch?v=Hd23EfCcvI0&list=PLFB513609A0016440&noredirect=1

Sample Student Responses

Size, color, wing size, fighting abilities, strength, speed, phenotypes

Explore

Introduce the activity by telling students they will be surrogate dragon parents. Have students select their partner for the activity; one will need to have the female sex chromosomes (pink/purple Popsicle stick) and one will need to have the male sex chromosomes (blue Popsicle stick).

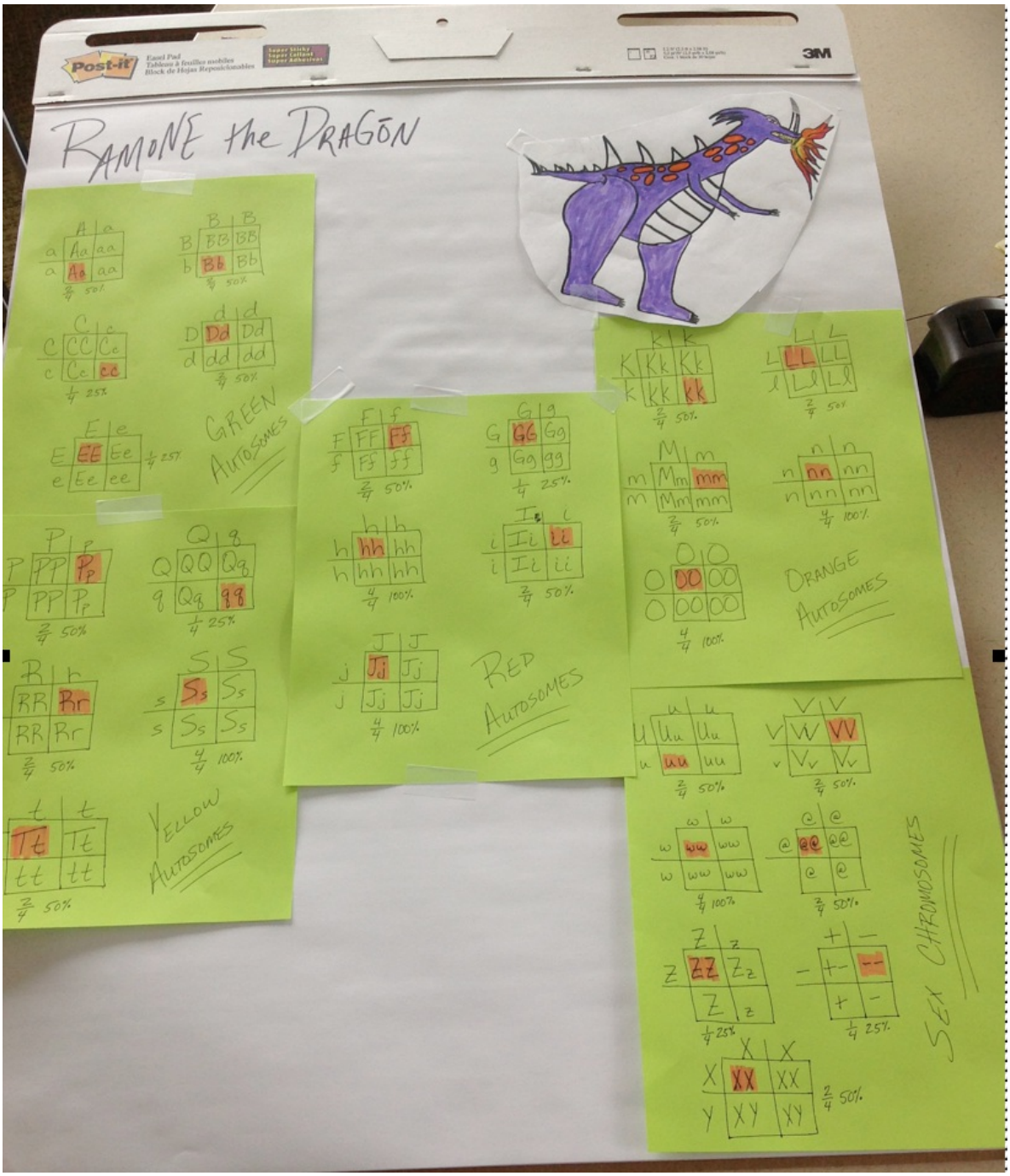
Teacher's Note

You will need to prepare the popsicle sticks ahead of time.

Give each partner set a copy of the attached **Dragon Delivery Activity** and two sets of chromosomes with the attached **Popsicle Sticks Coding** on them (make sure one set has a blue stick and the other set has a pink stick). Ask them to follow the directions carefully and complete the activity.

On separate sheets of paper have students complete Punnett Squares for each trait in the activity. Have them highlight the box that matches their baby dragon's genotype and next to the box write the ratio and percentage of frequency for their baby.

Have students make a poster that includes their baby dragon drawing and their Punnett Squares, ratios, and percentages. Hang the posters around the room. Have students use the attached **Poster Rubric** and evaluate one other poster leaving the rubric with that poster.



Sample Student Dragon Poster

You may have to explain the rubric so the students have a clear idea of what they are expected to do. Allow each group time to examine the rubric left at their poster and modify anything on their poster.

Explain

Give small groups of students (3-4) a copy of the **Dragon Reading**. Explain to them how to use Why-Lighting: students highlight what they think is important and then in the margins of the paper, they write why they highlighted that information. This helps students think about why they selected certain information and identify why the information is important. After the reading, have students work with their Dragon Delivery partner to answer the questions on the last page of their Dragon Delivery Activity handout.

Sample Student Responses

Law of Segregation was demonstrated when we wrote the letters (alleles) for egg and sperm after dropping the sticks. Law of Independent Assortment occurred when we determined the phenotype for the baby dragon, putting together the alleles from the sex cells. Fangs are needed for survival. Just because it is a recessive gene does not mean it is not necessary for survival. Sex of the baby is determined by combination of sex chromosomes: XX = female and XY = male. Sex linked traits are traits associated with an XX gene or an XY gene. Sex linked traits are important because males and females play different roles. For example male dragons may fight more than female dragons so they need a chest plate or more spikes.

Have students swap partners and discuss their answers to the questions. Do this a couple of times before having the original partners come back together. Give students time to change or modify their responses before having a whole class discussion. If you feel the discussions were productive and students developed an understanding, then you may bypass the whole class discussion. If you feel students need the whole class discussion you may want to use the attached **Lesson Slides** provided to help facilitate this process.

Extend

Give each group a description of another dragon. Ask students to write a claim about how this new dragon may be related to their baby dragon. Students need to write a minimum of five evidence statements supporting their claim.

Teacher's Note

Students should use probabilities to help identify possibilities of genetic relations.

Have each group share their responses with one other group and get feedback. Give students time to modify their responses based on feedback. Have each group share their final responses with the class.

Evaluate

Have students write a short summary (5 – 7 minute free-write) answering the essential question: *What makes individuals unique?*

Optional:

- Have students individually complete the formative assessment at the end of the Dragon Delivery Activity.

Resources

- K20 Center. (n.d.). Why-Lighting. Strategies. https://learn.k20center.ou.edu/strategy/128
- Official Clips. (n.d.). How to Train Your Dragon [Video]. https://www.youtube.com/watch?v=-WC9o4Zz-7A&list=PLFB513609A0016440&index=2