Livestock Plans for Raising Red Nosed Reindeer

This lesson about genetics and mutations investigates how red nosed reindeer could be raised in a livestock setting. Students will draw Punnett squares and design livestock plans for reproduction of red nosed reindeer.

General Information

Subject(s): Science
Grade Level(s): 9, 10, 11, 12
Intended Audience: Educators

Instructional Time: 2 Hour(s)

Keywords: Genetics, Mutation, livestock

Instructional Component Type(s): Lesson Plan

Resource Collection: FCR-STEMLearn Diversity and Ecology

Attachment

Punnett_Square_Worksheet.docx

Lesson Content

Lesson Plan Template: General Lesson Plan

Learning Objectives: What should students know and be able to do as a result of this lesson?

The student will know how genetic information:

- is passed from generation to generation by DNA in all organisms, and
- accounts for similarities in related individuals.

The students will also develop a Livestock plan and as a result, connect how the manipulation of DNA in organisms can benefit mankind thorough commercial production of genetically modified organisms.

Summary:

1. Define a mutation.
2. Construct Punnett squares to show possible offspring of the red-nosed reindeer.
3. Predict future patterns of reindeer populations.
4. Analyze reindeer breeding techniques to optimize the production of red-nosed reindeer.

Prior Knowledge: What prior knowledge should students have for this lesson?

Students should have a basic understanding of pedigree, livestock techniques, genetic engineering techniques, and Punnett square statistics.

Guiding Questions: What are the guiding questions for this lesson?

- How could a mutation in a dominant or recessive allele influence the expression of a phenotype?
- How could mutations impact the survival of a species.

Teaching Phase: How will the teacher present the concept or skill to students?

The lesson will be opened by a brief review of a genetic mutation, after reaching class consensus of a definition of a mutation. A class discussion could be held to debate whether or not the red-nose characteristic is a mutation.

A scientist at a local University considered the benefit of red-nosed reindeer. Having a reindeer with a red nose seemed to be a beneficial phenotype. The scientist began a search for a genetic engineering firm to genetically test a reindeer herd and collect genetic data.

Your team has been chosen by the scientist to genetically test the reindeer herd. Develop a plan for testing the herd and plan appropriate livestock techniques for red-nosed reindeer production.

Groups who struggle with livestock techniques could be given the following hints:

1. Cloning.
2. Breed Rudolph with as many does as possible.
3. Isolate the "red-nosed" genetic pattern and genetically engineer zygotes and place in females.

The following genetic testing results can be given to groups to allow statistical analysis in the lesson. Red-nosed reindeer genotype (red) is rr and all other reindeer (natural) are RR for nose color.

Guided Practice: What activities or exercises will the students complete with teacher guidance?

The Punnett Square Worksheet could be given to students for guided practice.

The students will develop a plan for testing the herd and plan appropriate livestock techniques for red nosed reindeer production based on their statistical analysis.

Independent Practice: What activities or exercises will students complete to reinforce the concepts and skills developed in the lesson?

The Punnett Square Worksheet could be given to students for independent practice.

The students could use the following topics as an alternative choice in completing the the Punnett square activity prior to the Live stock group project:

- Hypertrichosis or Werewolf syndrome - for students interested in medicine.
- Strawberry Birth marks (hemangiomas) - for students interested medicine.
- Cloning Livestock - for students who are interested in agriculture.
- http://learn.genetics.utah.edu/content/cloning/whyclone/

Closure: How will the teacher assist students in organizing the knowledge gained in the lesson?

Closure should include:

- A review of mutation.
- A review of Punnett Square Worksheet.
- A sharing of exemplary students livestock plans.

Summative Assessment

Final livestock plans should be submitted as the summative assessment.

Formative Assessment

The students will draft livestock plans and the teacher will review their progress throughout the instructional period.

The livestock plans could include:

1. Cloning.
2. Breed Rudolph with as many does as possible.
3. Isolate the "red nosed" genetic pattern and genetically engineer zygotes and place in females.
4. Breeding plans for Rudolph's offspring if Rudolph remains monogamous.

The student will also reflect periodically on the standards using the learning objectives and guiding questions.

Feedback to Students

- The teacher will provide continuous support to ensure that the students are adhering to the standards by monitoring the group livestock plans.
- The teacher should circulate during the guided practice activity, provide verbal feedback, and encourage peer reviews.
- The teacher should monitor each project for relevance using the topics suggested in the formative assessment section.

Accommodations & Recommendations

Accommodations:

Accommodations can be made for special needs students by arranging students in appropriate groups.

Extensions:

Students can also investigate common genetic anomalies within their own community and use the topics discussed to reason the genotypes from the phenotypes.

Advanced students can read this article of about how the Rudolph's phenotype appeared in the herd:

http://thefinchandpea.com/2012/12/24/the-red-nose-gene/

Advanced students can also investigate hypertrichosis or the Werewolf syndrome:

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3113246/

Special Materials Needed:

None

Further Recommendations:

The lesson can also be modified to be universally applicable to diverse population, including international students by using an comic book/science fiction character such as X-men. A more simple accommodation could be to simply remove any reference to Rudolph and Christmas and use any organism with a desired characteristic achieved through mutation.

To become familiar with agricultural business plans, it's suggested that teachers visit one of the following websites:

- https://www.msu.edu/~steind/2_Buss%20Plan_Farm_mst19pages.doc
- http://www.agf.gov.bc.ca/busmgmt/bus_guides/cow_calf/all.pdf
- http://extension.umd.edu/sites/default/files/_docs/programs/MREDC/HayinBeefAcresFINAL.pdf

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Aligned Standards

Name	Description
SC.912.L.16.2:	Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, codominant, sex-linked, polygenic, and multiple alleles.
SC.912.L.16.4:	Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring.
MAFS.912.S-MD.2.7:	Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). ★