THE GENE SCENE
From
Illinois Biodiversity Basics from Illinois Department of Natural Resources

Performance Standard 12A/11A.G

Students will apply the processes of scientific inquiry to examine macro- and micro-evolution in organisms accordingly:
- *Knowledge*: Understand the concepts and impact of genetic adaptation to environmental changes.
- *Application*: Hypothesize how changes in an environment can cause changes in an organism's adaptations to that environment.
- *Communication*: Explain how the adaptations of organisms help them and their species survive.

Procedures

1. ***In order to know and apply concepts that explain how living things function, adapt, and change (12A), and the concepts, principles and practices of scientific inquiry (11A),*** students should experience sufficient learning opportunities to develop the following:
   - Formulate hypothesis about the genetic basis of biodiversity by generating cause-and-effect premises how changes in form and structure are related to adaptations to changes in the environment (associated with the Illinois white-tailed deer population).
   - Use conceptual, mathematical and physical models to represent population studies.
   - Preview existing research about genetic traits, factors and biodiversity in general populations and specific species.
   - Prepare data-collecting form for simulation activity.
   - Conducting sufficient multiple trials.
   - Recording necessary data and observations objectively.
   - Compare and contrast the genetic functions and adaptations of sample population.
   - Observe trends within population data sets.
   - Analyze observations and data to support or refute inquiry hypothesis.
   - Cite applicable scientific principles.
   - Report and display the process and findings of inquiry investigation.
   - Generate further questions for alternative investigations.

   Note to teacher: This activity relates to knowledge associated with standard 12 A, while addressing the performance descriptors for stage G within standard 11A. Interactions between ecosystem organisms from standard 12B are complementary to the concepts of genetic biodiversity. This activity is summarized from its full curricular setting, available via the website of the Illinois Department of Natural Resources: *http:dnr.state.il.us/lands/education/classrm/classrm.htm* within the Illinois Biodiversity Basics in partnership with Chicago Wilderness and the World Wildlife Fund. It is offered with permission from Illinois Department of Natural Resources.
2. Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.
3. Preliminary foundations for display of genetic traits (ear lobe attachment, curly hair, tongue rolling, etc.) using a Human Genetics Wheel is provided. This introductory activity is followed by another activity for indexing and displaying (modified) genetic traits. Full instructions, materials and background information are provided through this web site. Part III of the activity is the focus of this activity/assessment resource. Provide students with the "All About White-tailed Deer" background Student Page. Familiarize students with this simulation model and its rules and strategies. Follow the directions for setting up the game, determining the genetic number of white-tailed deer and the genetic diversity of each group's population of white-tailed deer. Use the Event Cards randomly as simulations of what really does happen in the wild by natural and human forces. Record population impact for each Event and analyze the results. Multiple scenarios should be tested.
   - Student records of impact and explanations should be submitted; a sample format is offered.
   - In addition, students should discuss as a group and respond individually to questions about the importance of genetic diversity, the relationship between the population and its genetic diversity, the prevention of the loss of genetic diversity and the relative importance of favored or unfavored traits.

- Independently, students should create displays which focus on how people have changed genetic diversity of other species. They should explain how human manipulation of genes might help or hinder biodiversity.
4. Evaluate each student's work using the Science Rubric as follows and add the scores to determine the performance level:
    - *Knowledge*: The concepts and impact of adaptability of genetic traits for physical features and functions are explained accurately.
    - *Application*: The hypothesis for adaptation and observations of simulation models are accurate and complete.
    - *Communication*: Explanations of genetic adaptations and maintenance of biodiversity are complete and thorough.

Examples of Student Work not available

Time Requirements
- 3 class periods for introduction, simulation and individual reflection
- Additional research time for

Resources
Access to IDNR Biodiversity Basics Activity 1-4.
The Gene Scene
(*http:dnr.state.il.us/lands/education/classrm/classrm. htm*)

    for teacher planning:
        pp. 43-60
    for student use:
- All About White-Tailed Deer
- Genetic Wheel
- Deer Cards, Group 1-5
- Deer Fawn Cards
- Event Cards

Observation Record
Reflection Directions
Science Rubric

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OBSERVATION RECORDS:

Scenario #1
- Original population categories and numbers:

- Event circumstances

- Impact on population categories and numbers

Scenario #2
- Original population categories and numbers:

- Event circumstances

- Impact on population categories and numbers

Scenario #3
- Original population categories and numbers:

- Event circumstances

- Impact on population categories and numbers

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REFLECTION DIRECTIONS

1. Why is genetic diversity important?

2. What is the relationshi8p between the size of a population and its genetic diversity?

3. What can be done to prevent the loss of genetic diversity?

4. Did some traits seem to be favored over others? Were there any traits that were favored in one instance but selected against in others? How does this relate to the importance of genetic diversity?

   - Create a display which shows an example of how people have changed the genetic diversity of another species. (This can be a plant or animal species.) Explain how human manipulation of genes can help or hinder biodiversity.