BEEF CATTLE FAMILY GENETICS

Performance Standards 12A/11A.J

Students will apply the process of scientific inquiry to synthesize the principles of genetic studies accordingly:

- *Knowledge:* identify genetic foundations and displays of dominance in beef cattle 'pedigrees.'
- *Application:* make connections to early and current research of agricultural genetics research.
- *Communication:* explain and predict display of genetic traits and project possible applications in future research.

Procedures

1. ***In order to know and apply concepts that explain how living things function, adapt and change (12A) and the concepts, principles and processes of scientific inquiry (11A)***, students should experience sufficient learning opportunities to develop the following:
   - Examine models for applying genetic displays in real-world 'families' with predictable dominance outcomes and probabilities.
   - Review early and current research literature about agricultural genetics and its societal applications.
   - Test simulation genetics models.
   - Evaluate data sets and trends.
   - Report and display process and findings of investigation of genetics models.
   - Generate further questions or issues for consideration.

   This activity relates to knowledge associated with Standard 12A, while addressing Performance Descriptors for Stage J within Standard 11A. Applying the societal implications of this scientific research addresses Performance Descriptions in Standard 13B as an extension. Agriculture students study genetics in various classes. This activity could be a culmination project for an applied genetics curricular unit. This assignment aligns with the Illinois Workplace Skills D1 (Communicating on the Job/Communicate orally with others), D4 (Communicating on the Job/Prepare written communications), M3 (Demonstrating Teamwork/Work with team members), M4 (Demonstrating Teamwork/Complete a team task) and M5 (Demonstrating Teamwork/Evaluate outcomes).
2. Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.
3. The study of genetics is not limited to beef cattle, so this activity could be changed to any other animal or plant. All pairings involve many different traits. The number of possible results increases very rapidly as the number of traits being considered increases. The possibilities can be determined by using the Punnett Square. Research about changes in animal body fat, rate of gain, dressing percentage and fat thickness, etc., will show interesting human societal implications which can be interesting applications for 13B. This activity primarily tests genetic pedigree models. Label index cards equally for male or female gender, as well as traits (whether sex-linked or not) such as birth weight, cow maternal ability, feedlot gain, loin eye area, dressing percent, carcass grade, fat thickness, tenderness, cancer eye susceptibility, calving ease, and hair color. Additional traits could be disease- or mutation-causing traits, not necessarily fatal or common. The listing of these traits may be compiled from genetics research resources. The premise of this issue investigation is the prognosis of beef cattle family pedigrees resulting from random pairings. Two students will pair with each other by random matching and begin a combined research project with their 'mates'; random "breeding" may be added for second-generation offspring. Parameters for the research for group presentation are:
   - Each team member will research the traits they have been assigned.
   - They will determine the possibility and probability of the traits' dominance or appearance.
   - They will research the effect, treatments, cost and any other relevant problems associated with their traits.
   - They will create a pedigree for their generation, their "children" and their "grandchildren."
   - They will make predictions, based on their research, of the potential for improvements in future generations of beef cattle breeds.

   Students will present an oral report with applicable media graphic display. The pedigree should be displayed as a chart incorporated into the report.

4. Evaluate each student's work using the Science Rubric as follows, and add the scores to determine the performance level:
   - *Knowledge:* The genetic foundations and displays of dominance of assigned traits are explained accurately, using scientific terms appropriately and correctly.
   - *Application:* The connections to historic and current research shows the current treatment procedures, possible problems, including side effects, effects on family integrity and possible transmission of the traits accurately and completely.
   - *Communication:* The report should be well organized and well detailed with the explanation of the pedigree and the implications for future research and societal attitudes.

Examples of Student Work

- **Meets**
- **Exceeds**

Time requirements

- One class period to orient students to assessment and assign traits
- At least one week of class time to research and prepare the report (or one week of out-of-class time)

Resources

- Books, journals and magazines related to genetics
- Internet access
- Index cards for random sampling distribution
- Science Rubric

SCIENCE RUBRIC

Exceeds - must receive no more than one 3 and the rest 4s in the other areas of the rubric.
Meets - may receive no more than one 2 and a combination of 3s and 4s in the other areas of the rubric.
Approaches - may receive no more than one 1 and a combination of 2s, 3s or 4s, in the other areas of the rubric.
Begins - must receive at least a 1 in all 3 areas of the rubric.

	KNOWLEDGE Knows and understands scientific terms, facts, concepts, principles, theories and methods.	**APPLICATION** Applies scientific knowledge, skills and methods to manipulate, analyze, synthesize, create and evaluate.	**COMMUNICATION** Communicates scientific knowledge and applications through writing, speech and visual displays.
4	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are complete and correct.	• Applications are thorough, appropriate and accurate.	• Written, oral and/or visual communication is well organized and effective.
3	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are mostly complete and correct.	• Applications are mostly thorough, appropriate and accurate.	• Most of the written, oral and/or visual communication is well organized and effective.
2	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are somewhat complete and correct.	• Applications are somewhat appropriate and accurate.	• Some of the written, oral and/or visual communication is organized and effective.
1	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are minimally present or correct.	• Applications are minimally appropriate and accurate.	• Little of the written, oral and/or visual communication is organized and effective.
0	• All descriptions of scientific terms, facts, concepts, principles, theories and methods are missing and/or incorrect.	• All applications are missing and/or incorrect.	• All of the written, oral or visual communication is missing and/or lacks organization.
Score			