Agricultural Biotechnology

Nebraska Career Development Event
Handbook and Rules 2025-2029

1. PURPOSE

a. The purpose of the agricultural biotechnology career development event is to encourage students to explore the diversity of the Biotechnology Industry, in terms of basic knowledge, skills and applications of biotechnology to the workplace. The areas of agricultural biotechnology have important implications for the animal, plant, food, and pharmaceutical industries.

b. Agriculture Education courses that align with the agricultural biotechnology CDE include: Introduction to Agriculture, Food and Natural Resources; Plant Science; Horticulture; Plant Biology; Natural Resources; Biotechnology; Nursery and Landscape; Food Science; Advanced Food Science; Agronomy; and UNL AGRI 115.

2. OBJECTIVES

a. Team Practicum Objectives:
   i. Research the practicum problem formulated from the annual theme.
   ii. Describe the process of genetic engineering; designing a gene, transformation, breeding, and DNA testing.
   iii. Develop a genetic engineering plan and a breeding plan that solves the practicum problem based around the annual theme.
   iv. Create a Google Slides presentation.
b. Identification Objectives:
   i. Identify equipment and tool(s) utilized in agricultural biotechnology systems.
c. Test Objectives:
   i. Define key concepts related to biotechnology and genetic engineering, such as, but not limited to: cellular makeup, organelle functions, mitosis, plant anatomy, organism reproduction.
   ii. Relate the concepts of biotechnology and genetic engineering to the agriculture industry, such as but not limited to: genetic engineering methods, naturally occurring processes, selective breeding.
   iii. Identify the steps necessary to develop genetically engineered organisms such as the steps outlined in the Journey of a Gene resource materials.

3. ELIGIBILITY

a. The top two teams per district may compete at the state CDE.
b. This event is open to students in grades 9-12.
c. A maximum of four students per team may participate

4. RECOMMENDED ATTIRE

a. Official FFA Dress or other professional attire is strongly recommended for this event.

5. REQUIRED SUPPLIES AND EQUIPMENT

a. Pencils, at least one per student
b. One “clean” clipboard without notes, per student.
c. One laptop computer or tablet per student for use during the practicum.
d. No smartphones will be permitted during the practicum.
e. After arriving on-campus, students should request Guest Wireless Access before the Ag Biotechnology contest begins.

i. Use link to connect to WiFi- https://its.unl.edu/services/wi-fi/

6. EVENT SCHEDULE

a. Teams will be divided into two groups.
   i. Group 1 will start with the Team Practicum, lasting 60 minutes.
   ii. Group 2 will start with the individual components and be subdivided into the individual test and individual identification sections. Each individual section will last 30 minutes before rotating.
   iii. After 60 minutes, teams will rotate to the opposite group.

7. ANNUAL THEME

a. The annual themes will rotate between plants and animals. Specific theme information will be provided by September 15th of each year.
   i. Odd State Event Years - Animal
   ii. Even State Event Years - Plant

8. EVENT FORMAT

a. Individual Written Test
   i. The written test is designed to evaluate participants' knowledge in biological concepts related to the biotechnology industry. The test will consist of 50 multiple choice and/or true/false questions which require the application of biological principles.
   ii. Tests may be presented either on a computer or on a bubble sheet.
   iii. Students must provide a pencil for the written test.
   iv. Scratch paper will be provided.
   v. Students will have 30 minutes to complete this section.
   vi. Contestants will be allowed to work at their own pace.
b. Individual Identification of Materials and Tools
   i. Twenty-five specimens will be selected from the materials and tools listed on the Identification List.
   ii. Specimens will be identified on an individual basis, with 30 minutes.
   iii. Materials and tools to identify will be presented as intact specimens, models, or high quality photographs.
   iv. Each specimen will be designated with a number. Students fill in the answer sheet with the appropriate number in the space next to the specimen's name on the official scorecard.
   v. Two points will be given for each correctly identified specimen.

vi. Under no circumstances is any student allowed to touch or handle the photos or specimens used as part of the event. Any infraction of this policy is sufficient cause to eliminate the individual from the entire contest. Any contestant looking at the identification form of another contestant will be automatically disqualified.

c. Team Activity Practicum
   i. Students are presented with a problem, conduct research with their laptop or tablet about how to solve the problem, and then will create a Google Slides Presentation or to convey their solution to the problem.
   ii. At the conclusion of the team practicum, teams will answer 5 questions (multiple-choice, true/false, or short answer) related to their solution.
   iii. The Google Slides presentation of their solution, as well as the responses to questions is evaluated for the team score.
   iv. Utilize rubric and example in appendix for guidance.

9. SCORING

Individual Event	Score Calculation	Points
Written Examination	(50 questions x 2 points)	100
Identification Practicum	(25 items x 2 points)	50
	Total Individual Score	**150**

Team Event		Team Points
Total of 4 Individual Scores		600
Team Practicum Score		400
	Total Team Score	**1,000**

10. TIEBREAKER

a. Individual
   i. Test Score
   ii. Identification Score
   iii. Team Practicum Score
b. Team
   i. Team Practicum Score
   ii. Combined Individual Test Scores

iii. Combined Individual Identification Scores

11. RESOURCE MATERIALS

a. The Journey of a Gene website (https://ge.unl.edu/journey-of-a-gene), including the 'Test Your Knowledge' section which includes resource materials, quizzes, exams, practicum, identification flashcards, is the best resource to prepare for the event.
b. Relevant resources / websites per the rotating topic will be provided on the CDE website when the annual specific theme is announced.
c. Suggested resources for background knowledge for teaching biotechnology
    - CK12 Biotechnology - Introduction reading
        - https://go.unl.edu/ck12biotech
    - CK12 Biotechnology Advanced - Another reading
        - https://go.unl.edu/ck12biotech-advanced
    - Khan Academy Introduction to Genetic Engineering Lesson
        - https://go.unl.edu/khanacademy-introgeneticengineering
    - Introduction of Genetic Engineering and Its Applications
        - https://go.unl.edu/genetic-engineering
    - Chapter 7 Genetically Engineered Crops - Teacher Resource
        - https://www.nap.edu/read/23395/chapter/10
    - How to Make a GMO - this one has a great diagram
        - https://go.unl.edu/howtomakeagmo
    - Basic Biotechnology Plant and Soil Science eLibrary
        - https://go.unl.edu/basicbiotechplant-soil
    - Segregation of Genes: The Plant Breeder's Method for Predicting the Future
        - https://go.unl.edu/segregationofgenes

12. PAST EXAMS

a. Past exams will not be provided.

13. POST-CDE DEBRIEFING OPPORTUNITY

a. A walk through debriefing is not available.
b. Teams will receive feedback from the Team Practicum after convention.

APPENDIX

List of items in the appendix:

Appendix 1 - Identification List

1. Agar gel
2. Anther
3. Balance Scale
4. Beaker
5. Central Vacuole
6. Centrifuge
7. Chromosomes
8. Corn hybrid production field
9. Cross pollination
10. Detasseling
11. DNA
12. DNA extraction
13. Electrophoresis
14. Electrophoresis casting tray
15. Fertilized egg cell
16. Filament
17. Forceps
18. Frozen male gametes
19. Gene
20. Gene gun
21. Graduated cylinder
22. Hand planter
23. Hotplate
24. Incubator
25. Micro-Centrifuge Tubes
26. Micro-Pipet
27. Microscope
28. Microscope Slides
29. Mortar and pestle
30. Nucleus
31. Ovary
32. Ovule
33. Particle acceleration
34. Petri dish
35. Pipetting a sample
36. Pistil
37. Pollen
38. Protein test strip
39. Punnett Square
40. Sepal
41. Shoot bag
42. Silk
43. Stamen
44. Stigma
45. Style
46. Tassel
47. Tassel bag
48. Thermal cycler
49. Tissue culture
50. Water Bath

Appendix 2 - Identification Form Example

Ag Biotechnology CDE Identification Sheet

Name_____ **Chapter:**_____

Each letter with a blank corresponds to an item in the room. Write the number of the correct word from the word bank on the blank of the letter for the corresponding item.

A _____
B _____
C _____
D _____
E _____
F _____
G _____
H _____
I _____
J _____
K _____
L _____
M _____
N _____
O _____
P _____
Q _____
R _____
S _____
T _____
U _____
V _____
W _____
X _____
Y _____

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Appendix 3 - Team Practicum Poster Rubric

Requirement	Points
Biotechnology company name is unique, creative and prominently displayed.	10
Promote the benefit of this new trait - include consumer and producer benefits connected to trait(s).	30
Genetic Engineering steps have been clearly identified and are specific to the focus organism, and describe how the organism was created.	120
Breeding steps show how to make the desired organism. Show how breeders will achieve the end goal by identifying the parents and offspring, including Punnett squares, and stating the final expected outcome.	140
Describe at least one scientific and one non-scientific (financial or social) challenge or issue related to this genetically engineered organism.	50
Team produced clear, organized and visually attractive poster.	20
Five end of practicum questions answered using information from the team practicum work.	30
Total Points	400