Biotechnology Capstone109934…6050

Course Description

This course equips students with a working knowledge of biotechnology as it is used in Agricultural, Food, Natural Resources, and Health Sciences. Students will diagram how classical processes have influenced trait improvement throughout history. Through application of DNA structure and gene insertion methods, students will demonstrate how genetic engineering has been applied to organism improvement and solving human health issues. Students will apply DNA and protein detection to determine presence of specific traits. Additionally, student will distinguish between scientific and societal biotechnology issues.

Course Code:

Program(s) of Study to which This Course Applies

- Biotechnology (?)

Course Framework	Reference Standards	Academic Crosswalk
Standard 1. Identify classical trait selection processes and their historical and current application in biotechnology.	KS (BS 01.01)	[TBD by NDE]
Benchmark 1.1 Demonstrate how the process of selection is used in developing organisms with desired traits. Sample performance indicators: • Select strains of yeast that have optimal fermenting characteristics. • List characteristics that would be desired in an organism.	KS (BS 03.03.01)	[TBD by NDE]
Benchmark 1.2 Explain the role of classical breeding processes in improving organisms throughout history. Sample performance indicators: • Outline the process breeders would follow starting with a unique behavior or production trait in a parent. • Identify the limits of classical breeding.	KS (BS 03.03.01) KS (BS 01.01.01)	[TBD by NDE]

Benchmark 1.3 Describe how classical breeding and trait selection processes are used in health and agricultural industries. Sample performance indicators: • Identify time efficiency strategies that can improve plant, animal, and bacteria breeding. • Recognize the relative challenge when breeding for complex versus simply controlled traits.	KS (BS 01.01.02)	[TBD by NDE]
Standard 2. Evaluate the application of genetic engineering to solve and improve agricultural and health issues.	KS (BS 03.01)	[TBD by NDE]
Benchmark 2.1 Outline the processes by which organisms are genetically engineered. Sample performance indicators: • Create a plan to produce a transgenic organism containing a desired trait. • Identify the most difficult steps in creating a genetically engineered organism.	KS (BS 03.03.01.b)	[TBD by NDE]
Benchmark 2.2 Identify how gene discovery is critical in genetic engineering. Sample performance indicators: • Propose an organism that naturally contains a gene that would be valuable in genetic engineering project. • Justify why scientists study and identify genes.		[TBD by NDE]
Benchmark 2.3 Employ gene design strategies that will result in desired transgene expression. Sample performance indicators: • Predict how a transgene will be expressed given the transgene design. • Describe the importance of the universal genetic code in genetic engineering.		[TBD by NDE]
Standard 3. Use biotechnology diagnostics to monitor and evaluate procedures performed in industry systems.	KS (BS 03.03)	[TBD by NDE]
Benchmark 3.1 Diagram the relationship of how genes encode proteins and proteins determine traits. Sample performance indicators: • Explain why DNA and protein testing is more reliable than testing for a trait. • Explain why mutations in proteins can result in changes in proteins and how these mutations can be detected.	KS (BS 02.05.02.b)	[TBD by NDE]

Benchmark 3.2 Plan a diagnostic strategy to detect genes or proteins that control important traits. Sample performance indicators: • Identify which molecules are detected with PCR and which are detected with antibodies. • Choose the time and tissue for a diagnostic test on an organism.	KS (BS 03.03.01b)	[TBD by NDE]
Benchmark 3.3 Select the proper laboratory equipment and outline the test for the situation. Sample performance indicators: • Pick the appropriate laboratory equipment from a supply catalog for a diagnostic test. • Arrange procedures in their proper order for a diagnostic test.	KS (BS 02.05.05b)	[TBD by NDE]
Standard 4. Analyze the ethical, legal, scientific, social and cultural issues relating to biotechnology.	KS (03.01)	[TBD by NDE]
Benchmark 4.1 Differentiate between ethical, legal, scientific, social and cultural issues relating to biotechnology. Sample performance indicators: • Identify if a regulatory agency should examine a particular issue. • Determine if there is a valid scientific basis for a biotechnology issue.	KS (01.03.01a)	[TBD by NDE]
Benchmark 4.2 Research, evaluate and articulate the implications of an ethical, legal, scientific, social and cultural biotechnology issue. Sample performance indicators: • Evaluate the benefits and risks associated with biotechnology. • Examine an ethical dilemma associated with biotechnology.	KS (01.03.01c)	[TBD by NDE]

Reference Standards Sources

- KS = Career Clusters Knowledge and Skills Statements. Revised 2008. National Career and Technical Education Foundation, Silver Spring, MD. www.careerclusters.org.
- (additional reference standards listed)

Contributors

Secondary: [Kurt Heideman ï Sutton Public Schools, Cal Williams ï York Public Schools, Kori Jensen ï Mead Public Schools]
Postsecondary: [Dr. Don Lee ï University of Nebraska-Lincoln, Matt Kreifels ï University of Nebraska-Lincoln]

NCE Staff: [Matt Kreifels]
Other: [Seth Derner, Erika Volker]

Other Information

Suggestions for innovative teaching and learning strategies:	• Perform PCR and protein antibody test
Related assessments:	• Supervised Agricultural Experience
Extended learning opportunities:	• Career Development Events • Agricultural and Health industry tours