

BIOTECHNOLOGY

1. **1. DESCRIPTION:** Teams will answer questions, solve problems, analyze data, and interpret figures related to Biotechnology.

A TEAM OF UP TO: 2 **EYE PROTECTION:** #4 **APPROXIMATE TIME:** 50 minutes

1. **2. EVENT PARAMETERS:** Each participant must bring Z87 chemical splash goggles, a writing implement, and a non-programmable, non-graphing calculator.

1. **3. THE COMPETITION:** The event will be run as a series of timed stations. Students will be asked to answer questions regarding the theory, techniques, and applications of modern biotechnology. The test will cover the following aspects of modern biotechnology:

a. a. BASIC MOLECULAR BIOLOGY All levels should know:

- i. i. The structure of nucleotides and how nucleotides join to form the double-helical DNA molecule,
- ii.ii. How DNA sequences are arranged into codons and genes,
- iii. iii. How genes are transcribed into mRNA,
- iv. iv. How mRNA is translated into proteins, including the roles of mRNA, tRNA, and rRNA,
- v. v. How genes are arranged into genomes, and
- vi. vi. The consequences of mutations in the genetic code.

State level only:

- i. i. How genes are arranged into operons, and
- ii. ii. Control of gene expression.

a. b. BIOTECHNOLOGY TOOLS All levels should know:

- i. i. The basic enzymes used during rDNA technology,
- ii.ii. The Polymerase Chain Reaction and its applications,
- iii. iii. Differences between vectors and how they are used, and
- iv. iv. How to construct and screen DNA libraries for genes of interest.
- v. v. How genes of interest, once identified, are used in biotechnology

State level only:

- i. vi. How DNA sequence data is generated,
- ii.vii. How DNA sequence data can be used to study gene structure and activity,
- iii. viii. The human genome project and its applications.

b. c. BIOTECHNOLOGY APPLICATIONS All levels should know:

- i. i. How proteins can be used as products,
- ii.ii. Why *Escherichia coli* is frequently used for protein production,
- iii. iii. The difference between genomics and proteomics and how each is used to solve problems in biotechnology, and
- iv. iv. Applications in medical biotechnology, DNA fingerprinting, and forensic analysis.

State level only:

- i. v. Applications in microbial, animal, and plant biotechnology, and
- ii.vi. The controversy surrounding reproductive cloning and genetically modified crops.

Laboratory skills and knowledge may be examined by demonstrating simple laboratory procedures. Students may analyze and interpret results of molecular biological experiments such as agarose gel electrophoresis and restriction enzyme mapping, and devise approaches for moving genetic information between organisms.

- i. **4. SCORING:** Highest score will determine the winner. Selected questions may be used as tiebreakers.

- i. **5. RESOURCES:** There are many good introductory biotechnology textbooks available (e.g. *Biotechnology Demystified*, Walker; *Introduction to Biotechnology*, Thieman and Palladino; *Biotechnology for Beginners*, Renneberg and Demain; *Basic Laboratory Methods for Biotechnology*, Seidman and Moore) and numerous internet resources.