DESIGNER GENES

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Participants will solve problems and analyze data or diagrams using their knowledge of the basic principles of genetics, molecular genetics and biotechnology.

   A TEAM OF UP TO: 2 **APPROXIMATE TIME:** 50 minutes

2. **EVENT PARAMETERS:**

   Each team may bring one 8.5" x 11" sheet of paper, **which may be in a** sheet protector **sealed by tape** or laminated, that may contain information on both sides in any form and from any source without any annotations or labels affixed along with two stand-alone non-programmable, non-graphing calculators.

3. **THE COMPETITION:**
   a. This event may be run as stations and can include observations, inferences, predictions, data analysis, and calculations. Questions and tasks should be distributed equally so that there is not an over-emphasis on a particular area.
   b. This event will test participants' knowledge of molecular genetics in both bacteria and eukaryotes including the basic principles of genetics as well as the following topics.

Regional and State Tournament Topics		
Mono-, Di-, and Trihybrid crosses	Pedigree construction and analysis	Phylogenetics
Dominant & Recessive Alleles Genotype vs. phenotype	Multiple alleles & Sex-linked traits	DNA fingerprinting and RFLP analysis
Human sex determination	Co-dominance & incomplete dominance	PCR
Gene to protein relationship	Mechanism of gene expression, including roles of enzymes	DNA microarrays
Mitosis, Meiosis and gamete formation	Multifactorial traits and Epistasis	Gene therapy, CRISPR-Cas technology
Human karyotypes analysis	Molecular consequences of mutations	Sanger sequencing
Prokaryotic and eukaryotic promoter structure	DNA structure & mechanism of replication	Plasmid cloning, selection, and isolation
Components of a gene	Transcription & Translation	Organelle DNA
National Tournament Topics (Regional & State topics + the following)		
Epigenetics	DNA repair	RNA-Seq, Tn-Seq, and their uses
Random vs. targeted mutagenesis	Post-transcriptional RNA processing and regulation	Comparison of Next Generation Sequencing Platforms

4. **SAMPLE QUESTIONS:**
   a. Given a gel electrophoresis set up and running, or photographs showing results of a gel, with the lanes labeled: mother, child, male 1 and male 2.
      i. Identify the apparatus or process (gel electrophoresis).
      ii. According to the results, who is the possible father of the child?
      iii. Why do the bands of DNA in the photograph end up at different locations within their lanes?
      iv. What is the size of fragment 3 in Lane 3?
   b. Given a sequence of coding strand DNA,
      i. What is the sequence of the corresponding RNA?
      ii. Using the genetic code, what would be the sequence of amino acids made from this RNA?
   c. What would be the consequence of mutating the -10 region of a prokaryotic promoter?

5. **SCORING:**
   a. Highest number of correct solutions will determine the winner.
   b. Selected questions may be used as tiebreakers.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Genetics CD and Bio/Earth Science CD; other resources are on the event page at soinc.org.

This event is sponsored by Corteva Agriscience