# 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 that may contain information on both sides in any form and from any source along with two **stand-alone** non-programmable, non-graphing calculators.

3. **THE COMPETITION:**
   a. This event may be run as stations and could include observations, inferences, predictions, data analysis, and calculations. **Questions/tasks will be equally allocated to not overemphasize a particular topic.**
   b. **This event will test participants' knowledge of molecular genetics in both bacteria and eukaryotes including basic principles of genetics as well as the following topics**:

| **Regional & State Tournament Topics** | | **National Tournament Topics** (all Regional & State topics + the following) |
|---|---|---|
| Monohybrid cross | Dihybrid cross | Pedigree construction &analysis |
| Dominant & recessive alleles | Sex-linked traits | Production of gametes with Abnormal #'s of chromosomes |
| Genotype vs. phenotype | Pedigree analysis | Trihybrid cross (probability analysis) |
| Human sex determination | Multiple alleles | Analysis of karyotypes for deletion, addition, translocation |
| Gene - Protein relationship | DNA structure & replication | **Mutations** |
| Mitosis, Meiosis & gamete formation | Transcription & translation | Multifactorial traits &Epistasis |
| Human karyotypes analysis for nondisjunction disorders | Co-dominance & incomplete dominance | **PCR** |
| **Components of a gene** | Sanger sequencing | **Random vs. targeted mutagenesis** |
| **Mechanism of** DNA replication, including roles of enzymes | DNA fingerprinting & **RFLP analysis** | **Post-transcriptional RNA processing & regulation** |
| Mechanism of gene expression, including roles of enzymes | Gene therapy, **CRISPR-Cas technology** | RNA-Seq, **Tn-Seq, & their uses** |
| Promoter **structure** | DNA microarrays | DNA repair |
| **Molecular consequences of** mutations | **Plasmid cloning, selection, & isolation** | Comparison of Next Generation Sequencing Platforms |
| Organelle DNA | Phylogenetics | Epigenetics |

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. According to the results, who is the possible father of the child?
      ii. Why do the bands of DNA in the photograph end up at different locations within their lanes?
      iii. What is the size of fragment 3 in Lane 3?
   b. Given a sequence of coding strand DNA, what is the sequence of the corresponding RNA?
   c. Using the genetic code, what would be the sequence of amino acids made from this RNA?
   d. 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 **updated** Genetics CD and Bio/Earth Science CD; other resources are on the event page at soinc.org.

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