

2020 DESIGNER GENES-OVERVIEW

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DISCLAIMER - This presentation was prepared using draft rules. There may be some changes in the final copy of the rules. The rules which will be in your Coaches Manual and Student Manuals will be the official rules.

- **BE SURE TO CHECK THE 2020 EVENT RULES** for EVENT PARAMETERS and TOPICS FOR EACH COMPETITION LEVEL

TRAINING MATERIALS:

- **Training Power Point** presents an overview of material in the training handout
- **4 Training Handouts** - overview, classical genetics, molecular genetics, and biotechnology principles
- **2 Practice Activities** on molecular genetics and biotechnology that have sample problems and lab evaluations with key
- **Sample Tournament** has sample problems with key
- **Event Supervisor Guide** has event preparation tips, setup needs and scoring tips
- **Internet Resource & Training Materials** are available on the Science Olympiad website at www.soinc.org under Event Information.
- **A Biology-Earth Science CD, a Genetics CD** as well as the **Division B and Division C Test Packets** are available from SO store at www.soinc.org

Students will solve problems using their knowledge of **Molecular Genetics, Biotechnology, and Population Genetics**. This event may be run as stations but it need not be. It is a very different event when run as paper and pencil. The best competition is still as stations using process skills and problem solving.

1. At the various levels, possible areas to be tested are limited **to the basic principles of genetics** (see Heredity-B event training materials on SO website) plus the following topics:

Regional and State Tournament Topics		National Tournament Topics (Regional & State topics + the following)
Components of a gene	Sanger sequencing	Random vs. targeted mutagenesis
Mechanism of DNA replication, including roles of enzymes	DNA fingerprinting and RFLP analysis	Post-transcriptional RNA processing and regulation
Mechanism of gene expression, including roles of enzymes	Phylogenetics	RNA-Seq, Tn-Seq, and their uses
Promoter structure	DNA microarrays	DNA repair
Molecular consequences of mutations	Plasmid cloning, selection, and isolation	Epigenetics
Organelle DNA	Gene therapy, CRISPR-Cas technology	Comparison of Next Generation Sequencing Platforms

Every attempt should be made to avoid over-emphasis on a particular area.

Note: Regions or States may decide to cover all of the topics so check with your local tournament director for specifics.

2. Process skills may include observations, inferences, predictions, data analysis, and calculations.

Note: It is a good idea to review the **Heredity training materials** that are in the Heredity Event in Division B – they are very relevant to what Designer Genes covers.

SAMPLE STATION PROBLEMS

- Monohybrid crosses with dominant/recessive, incomplete dominance, test crosses, and codominance as blood types
- Crosses with two traits illustrating homozygous/heterozygous dominant/recessive, incomplete dominance, epistasis, sex linkage, and lethal gene
- Genotype and phenotype ratios or probabilities based upon stated crosses
- Common genetic disorders and the types of genes that cause them
- Karyotype analysis
- Pedigree analysis
- Mitosis and/or meiosis stages to identify, analyze and compare
- Analyzing blood chemistry, blood typing and blood cell genetic information
- Problems involving Epistasis
- Problems involving Multifactorial Inheritance
- Data on time or number of individuals in each phase of mitosis for data analysis
- DNA Structure and Replication
- Differences between Prokaryotic and Eukaryotic Gene Expression
- Production of RNA from a coding strand of DNA - & post transcription modification of M-RNA
- Gene Expression (Transcription and Translation) with controls
- Control and Detection of Gene Expression
- Chromosome map units problems
- Cross over frequencies
- DNA cloning, storing, identifying, sequencing and analyzing
- Restriction enzyme analysis – Making a restriction map of a plasmid or DNA segment.
- Interpreting data from DNA fingerprinting studies
- Forensic Uses of Biotechnology
- Interpreting DNA analysis data + comparing RFLP and PCR forensic testing and analysis
- Analyzing and interpreting chromosome maps
- Understanding and interpreting the uses of restriction enzymes