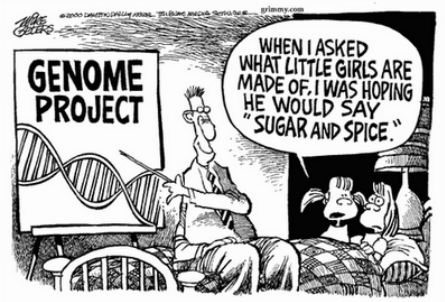
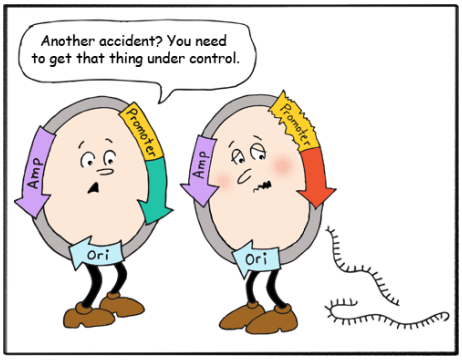
**Key Terms:**

Anti-parallel
Anticodon
Biotechnology
cAMP
Chromosome
Cloning
Codon (triplet)
Co-repressor
DNA
DNA methylation
DNA polymerase
DNA replication
Double helix
Electrophoresis
Euchromatin
Exon
Frameshift mutation
Gene expression
Genetic engineering
Guanine cap (5')
Heterochromatin
Helicase
Histone protein
Histone Acetylation
Intron
Inducer
Lagging strand
Leading strand
Ligase
Missense mutation
mRNA
Mutation
Nucleotides
rRNA
RNase
RNAi
Okazaki fragments
Operon
Operator




## Key Concepts

-DNA controls the behavior of cells. In most cases, information flows from DNA to RNA to protein.
-DNA is a self-replicating molecule constructed according to strict base-pairing rules.
- The genetic code, through transcription and translation, contains the information to construct proteins.
- Mutations are changes to the DNA sequence. They may be positive, negative or neutral in their effect.
- Transcription factors regulate gene expression.
-There are key difference in gene expression in prokaryotic and eukaryotic cells.

**Essential Knowledge:**
**Blueprint of Life (3.A.1, 4.A.1)**

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□ Recall the structure of **nucleotides** and nucleic acids. Describe the Watson-Crick **double-helix** model of **DNA** structure, including reference to the **anti-parallel** nature of DNA, the **base-pairing** rule, and **hydrogen bonding**.
□ Describe the structure and function of **mRNA, tRNA, rRNA**. Explain the role of **RNAi**. Contrast the structure and function of RNA and DNA.
□ Describe the **semi-conservative** replication of DNA. Demonstrate the **base-pairing** rule for creating a **complementary strand** from a single strand of DNA.
□ Describe the many proteins that work together in DNA replication and repair.
□ Describe how a **chromosome** consists of DNA packed together with proteins and the important features of a eukaryotic chromosome.

**Gene Expression (3.A.1, 4.A.1)**

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□ Describe and explain the main features of the **genetic code**.
□ Identify the two stages of **gene expression** as **transcription** and **translation**. Explain how these processes differ in prokaryotes.
□ Describe **transcription**, including **post-transcriptional modifications** of mRNA in eukaryotic cells. Explain the significance of **introns** and **exons** with respect to the production of a functional **mRNA** molecule.
□ Recall the structure of amino acids and how they form the **primary structure** of proteins (polypeptides).
□ Describe and explain **translation**, including the role of **tRNA** molecules, **ribosomes**, **start codons**, and **stop codons**.
□ Explain how the activities of proteins determine phenotype (ie: sickle cell disease).

**Key Terms:**

Primer
Plasmid
Point mutation
Poly-A tail (3')
Polymerase Chain Reaction
Recombinant DNA
Replication fork
Repressor
Regulatory gene
Restriction enzymes
Ribosome
RNA polymerase
Semi-conservative
Silent Mutation
Spliceosome
Start Codon
Stop Codon
Sticky ends
Transformation
Transgenic
tRNA
Transcription
Translation
Telomeres
Topoisomerase

**Changes in Genotype (3.C.1, 4.C.1)**

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□ Describe, in a general way, how **mutation** can lead to changes in **phenotype**.
□ Distinguish between beneficial (positive), harmful (negative), and silent mutations and describe examples.

**Regulation of Gene Expression (3.B.1, 3.B.2)**

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□ Explain how bacteria respond to environmental changes by regulating transcription (**operons**).
□ Know and describe the difference between **inducible** and **repressible** operons.
□ Know that eukaryotic **gene expression** is regulated at many stages. Recall the differences in gene regulation in regards to eukaryotic transcription and translation.

**Biotechnology (3.A.1)**

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□ Explain how the heritable information of DNA (sometimes RNA) can be manipulated with **genetic engineering** techniques. You should understand:
- How **restriction enzymes** are used to manipulate and analyze DNA
- The role of gel **electrophoresis** in identifying DNA fragments
- The role of **polymerase chain reaction (PCR)** in DNA amplification

□ Describe some outcomes of DNA manipulation, including any of the following:
- Production of a genetically engineered food, such as golden rice.
- Production of transgenic animals, eg: for expression of a specific trait.
- Production of pharmaceuticals, eg: human insulin.

□ Understand that **cloning** organisms may lead to production of **stem cells** for research and other applications.