Essential Vocabulary

- **Allele:** an alternate form of a gene; for example, a gene for human hair color may have alleles that cause red or brown hair
- **Chromosome**: a cell structure that contains genetic information along strands of DNA
- **DNA fingerprint:** pattern of DNA fragments obtained by examining a person's unique sequence of DNA base pairs (also called DNA profiling)
- **Electrophoresis:** a method of separating molecules, such as DNA, according to their size and electrical charge using an electric current passed through a gel containing the samples
- **Gene:** segment of DNA in a chromosome that contains information used to produce a protein or an RNA molecule

Q: What is DNA Evidence?

- Because each human is unique, DNA evidence from a crime scene or from an unidentified body can be traced back to one and only one person.
  - Except for identical twins, **no two people on earth have the same DNA** (deoxyribonucleic acid).
- DNA evidence can be used to:
  - Link a suspect to a crime or to eliminate a suspect.
  - Identify a victim, even when no body can be found.
  - Identify human remains of victims of large-scale disasters, such as plane crashes, tsunamis, and hurricanes.

Q: What is the history of DNA Evidence?

- Many scientists worked to determine the source of heredity
  - **Heredity:** the passing of traits from parent to offspring

- How are these traits passed on?
  - **First** scientists determined that chromosomes controlled heredity and are made of DNA and proteins
  - **Then** scientists determined that DNA was the chemical that controlled characteristics (traits) of the organisms
  - **Then** the race was on to reveal the chemical structure of the DNA molecule

Q: What is the history of DNA Evidence?

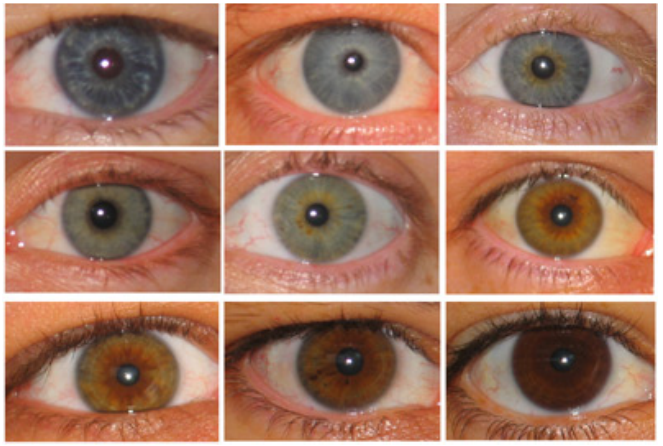
- Several types of biological evidence, such as skin, blood, saliva, urine, semen, and hair, are used in forensics for identification purposes.
- Biological evidence is examined for the presence of inherited traits, such as blood type or enzyme variants.
  - The analysis of chromosomes = **karyotyping**.
  - Blood-typing techniques = common in forensics.

Q: What is the history of DNA Evidence?

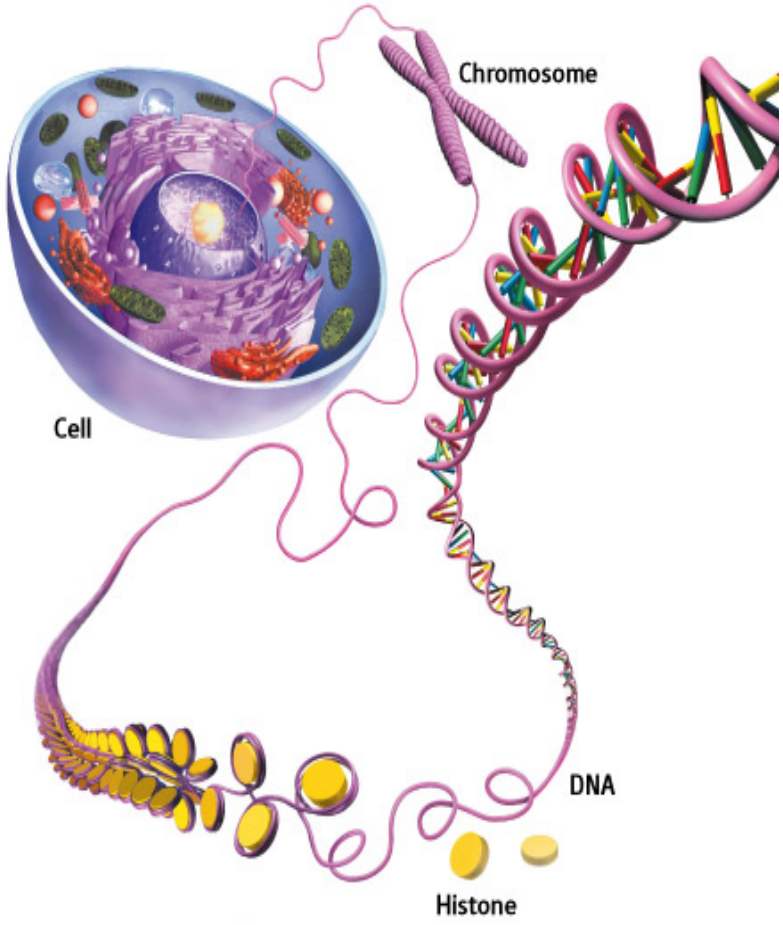
- **DNA fingerprinting =** DNA profiling
  - Used in criminal and legal cases to determine identity or parentage.
  - DNA can be extracted from relatively small amounts of biological evidence, such as a drop of blood or a single hair follicle.
  - When DNA fingerprinting is performed and interpreted by qualified forensic scientists, the results can very accurately predict whether an individual can be linked to a crime scene or excluded as a suspect.

Q: How does DNA Work?

- DNA stands for deoxyribonucleic acid
- DNA is the blueprint of life. It codes for making proteins which determine traits.
  - DNA contains the instructions for making the proteins (called **pigments**) which give your eyes color.



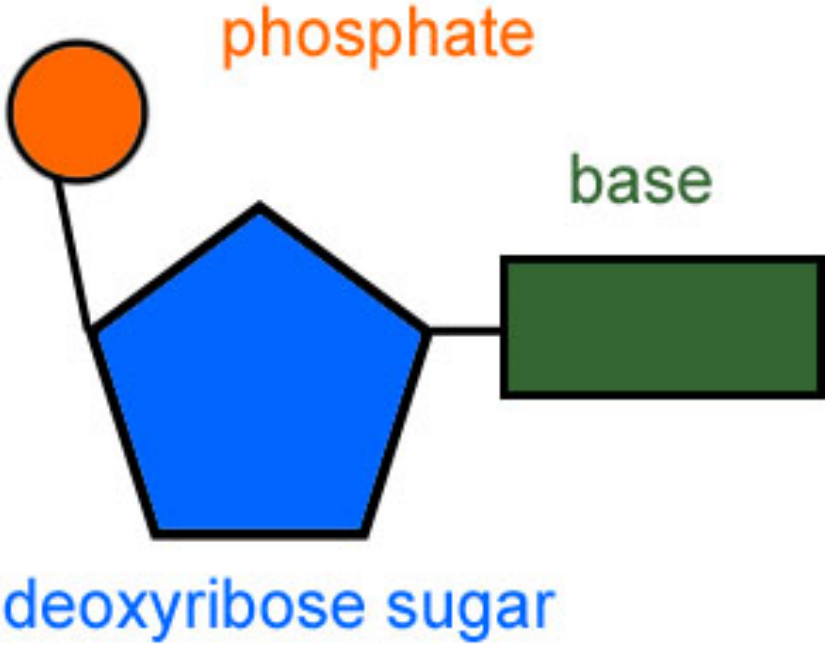
Q: How does DNA Work?



- DNA is packaged into chromosomes
  - Found in the nucleus of eukaryotic cells
  - Composed of two strands of DNA wrapped around proteins and coiled tightly
    - The Double Helix or Twisted Ladder

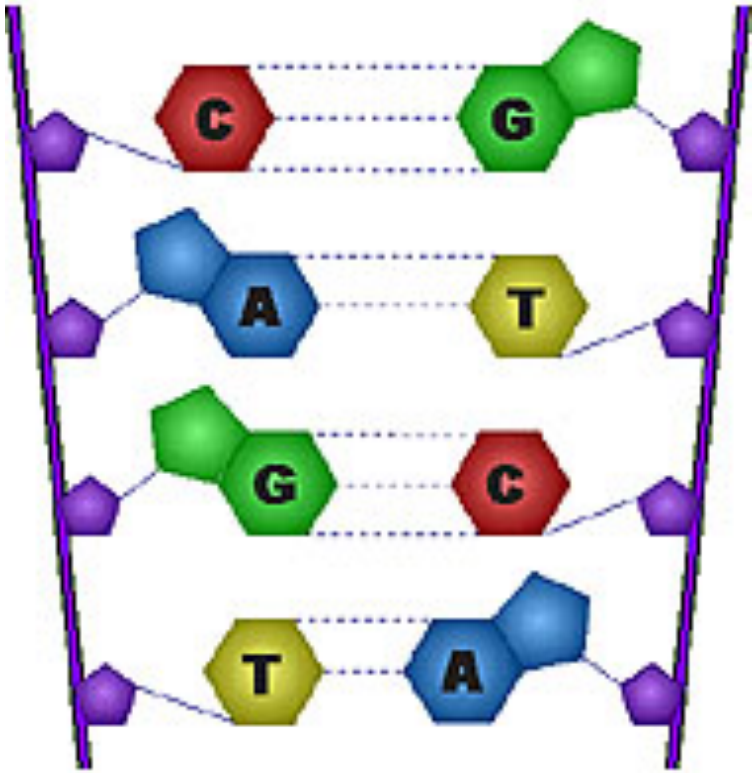
Q: How does DNA Work?

- The building blocks of DNA are called nucleotides. A nucleotide consists of three parts:
  - A sugar (named deoxyribose)
  - A phosphate group.
  - A nitrogen base



Q: How does DNA Work?

- The sides of the ladder are made of **sugar and phosphate**. The rungs of the ladder are the **nitrogen base pairs**.
- The nucleotides are arranged into two strands that are held together by **weak hydrogen bonds** between the nitrogen bases.
- The nitrogen bases bond in a specific way
  - Adenine – Thymine (A-T)
  - Guanine – Cytosine (G-C)
  - This pattern is called **complementary base pairing**



Q: How does DNA Work?

- **Complementary base pairing**
  - If the order of the bases in a section of one strand of DNA is CGTCTA, then the order of bases in the complementary section of DNA in the other strand is GCAGAT

Try transcribing this DNA strand:

TAGACTTAATG

ATCTGAATTAC

Q: What else should we know…?

- There are **23 pairs (46 total) chromosomes in the nucleus of most human body cells**
  - Exception = human gamete (sex) cells
- One chromosome in each pair is inherited from the mother; one from the father
  - This means that half of an individuals nuclear genetic information comes from each parent

Q: What else should we know…?

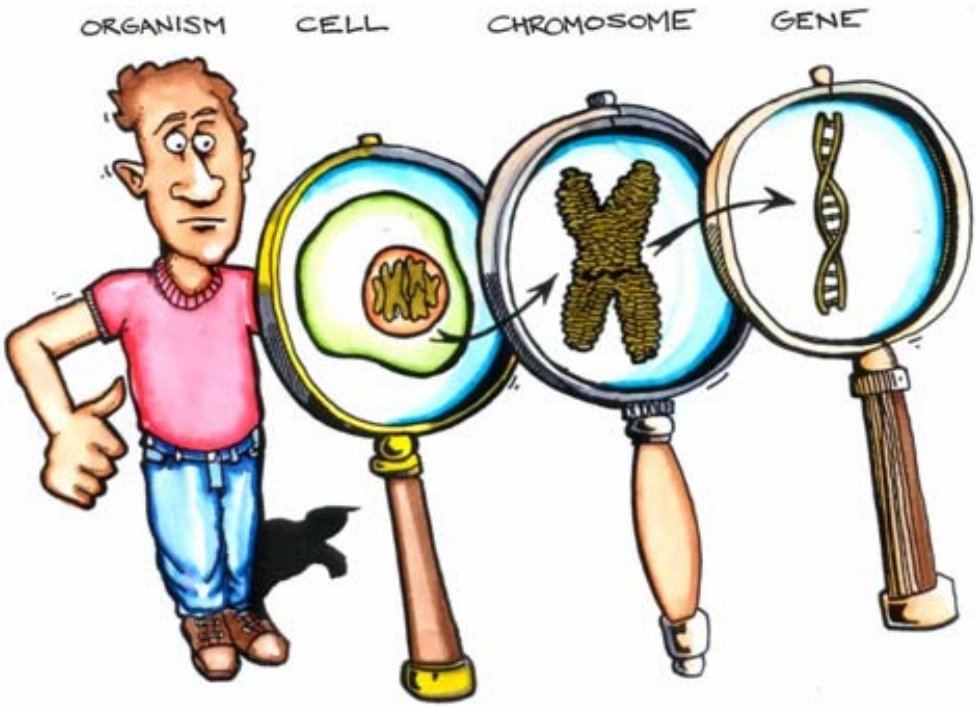
- **DNA in chromosomes = nuclear DNA**
  - Virtually identical to all cells of the human body
  - Codes for most proteins made by the cell and responsible for the inheritance of physical traits and genetic disorders
    - I.e., hair color, dimples, sickle cell anemia, Tay-Sachs disease

Q: What else should we know…?

- **Locus:** the specific location of a gene or DNA sequence on a chromosome
- **Genes**: DNA sequences that have instructions that determine our inherited traits (i.e., blood type)
  - Make another type of nucleic acid called RNA
- **Allele:** a variant of a DNA sequence at a given locus; determines someone's genotype (genetic make-up)
  - **Example:** one allele of a gene might code for normal hemoglobin while another allele code for abnormal hemoglobin
  - One allele comes from mom; the other comes from dad

Q: What else should we know…?

- Each chromosome contains many genes.
  - **Genes** are DNA sequences that have instructions that det tics or traits, such as



Q: What else should we know…?

- An **allele** is one of two or more alternative forms of a gene
  - One allele comes from the mother, and the other allele comes from the father.