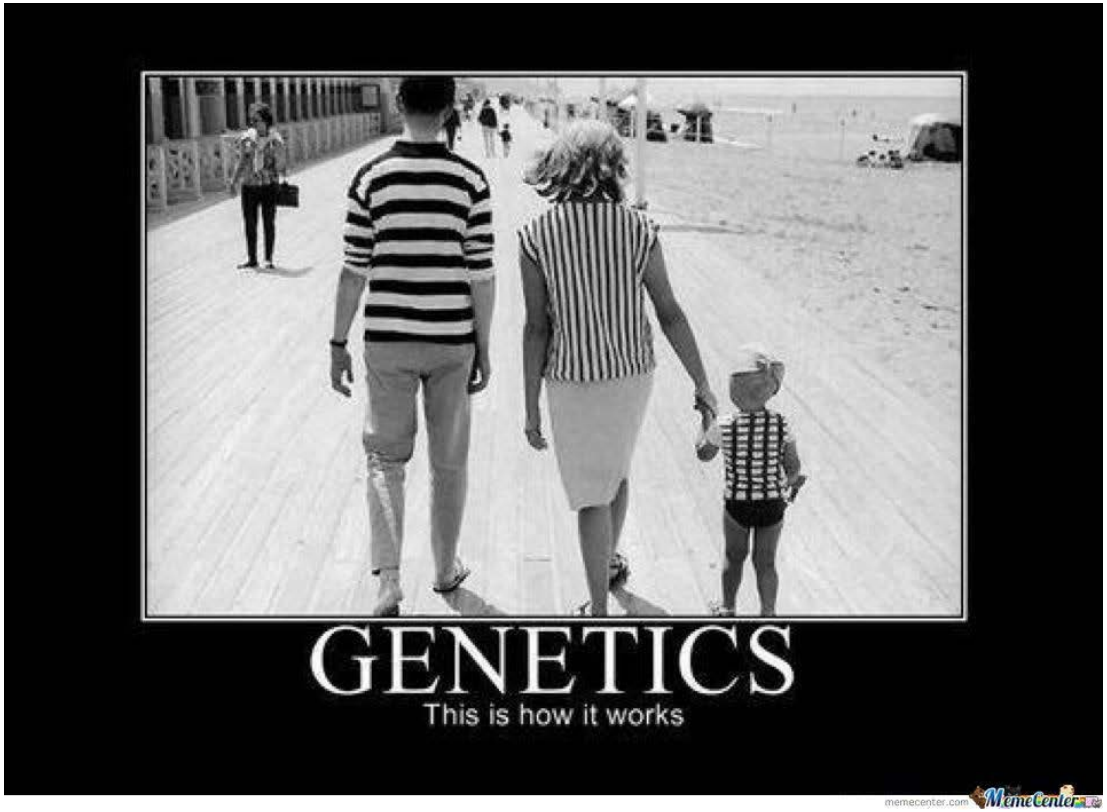
# Genetics: The Science of Heredity



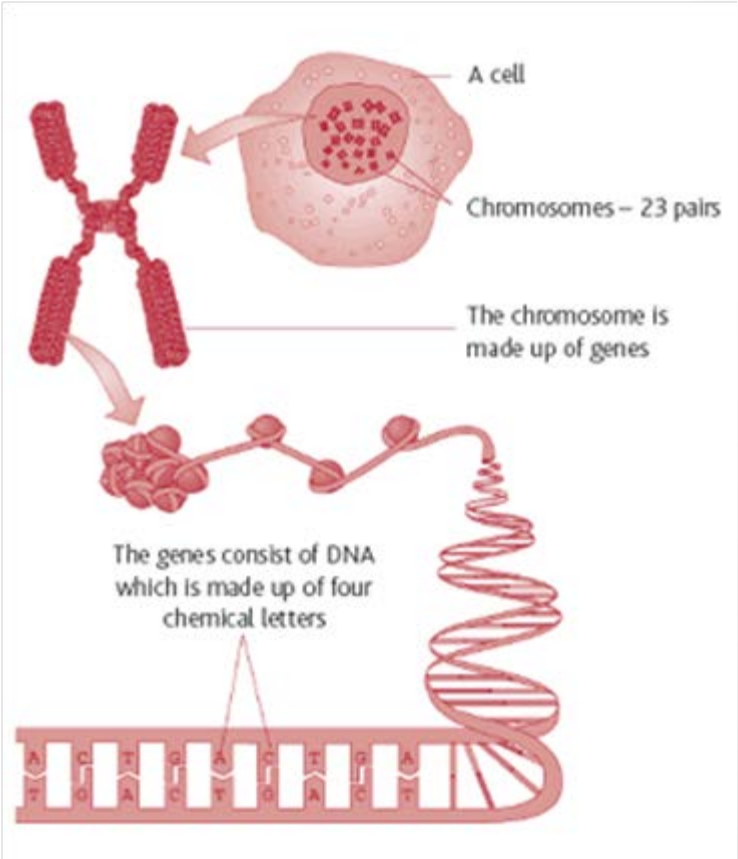

S1-1-12 Differentiate between dominant and recessive genes. Include: genotype, phenotype

S1-1-13 Describe the relationship among DNA, chromosomes, genes, and the expression of traits. Include: genetic similarity among all humans

# Genetics: The Science of Heredity…

A **GENETICIST** is a scientist that is concerned with **HEREDITY**. They analyze how we **INHERIT** our **PHYSICAL TRAITS**. **Gregor Mendel** was one of the first, he looked at the **HEREDITY** of **PEA PLANTS**.

We know that **TRAITS** we inherit depend on the **GENES** we receive from our **PARENTS**. (i.e. **BLOOD TYPE**, **HAIR COLOUR**, **EYE COLOUR**, etc.)



# Genetics: The Science of Heredity…

Geneticists use two terms to describe these ideas:

**PHENOTYPE:**

- The **PHYSICAL APPEARANCE** of a **TRAIT**. Its what you actually see.
- Example, **PEAKED HAIRLINE** (like **DRACULA**), or smooth hairline (George Costanza)

**GENOTYPE:**

- Is the **ACTUAL GENE COMBINATION** responsible for a specific **TRAIT**.
- **DRACULA** inherited a **PAIR** of **GENES** for his **HAIRLINE**.

# Genetics: The Science of Heredity…

Let's say that **DRACULA** got a gene for a **PEAKED HAIRLINE** from his **MOTHER**, and a **SMOOTH HAIRLINE** from his **FATHER** → **GENOTYPE** is called "**PEAKED** – **SMOOTH**".

→ ***Why is his hairline peaked and not smooth?***

The gene for **PEAKED** hair is **EXPRESSED** over the gene for **SMOOTH** hair

→ Therefore, a **PEAKED HAIRLINE** must be **DOMINANT** over a **SMOOTH HAIRLINE**.

# Genetics: The Science of Heredity…

**DOMINANT GENE:**

- The gene that **FUNCTIONS** (is **DISPLAYED**) even when **PAIRED** with an **OPPOSITE GENE**.
- We use a **CAPITOL LETTER** to symbolize **DOMINANT GENES**.
  Ex. **P = PEAKED HAIRLINE**

**RECESSIVE GENE:**

- The gene that is only **EXPRESSED** when paired with the **SAME TYPE** of gene.
- We use **LOWER CASE** letters to symbolize **RECESSIVE GENES**.
  Ex. **p = PEAKED HAIRLINE**

# Genetics: The Science of Heredity…

| Trait | Dominant | Recessive |
|---|---|---|
| Tongue rolling | yes | no |
| Earlobe attachment | free | attached |
| Pinky shape | bent (crooked) | straight |
| Arm folding | right on top | left on top |
| Cheek dimple | dimple | no dimple |
| Cleft chin | cleft | no cleft |
| Hitchhiker thumb | straight | hooked |
| Toe length | 2nd toe longer | 1st toe longer |
| Widow's peak | peak | no peak |

# Key Terms in Heredity…

**GREGOR MENDEL:**

- First person to study **INHERITANCE** in a species.

**VARIATION:**

- **DIFFERENCES** between plants or animals of a species.

**TRAIT:**

- Refers to any **CHARACTERISTIC** of an organism.

**HEREDITY:**

- The **PASSING** of **TRAITS** from one **GENERATION** to the **NEXT**.

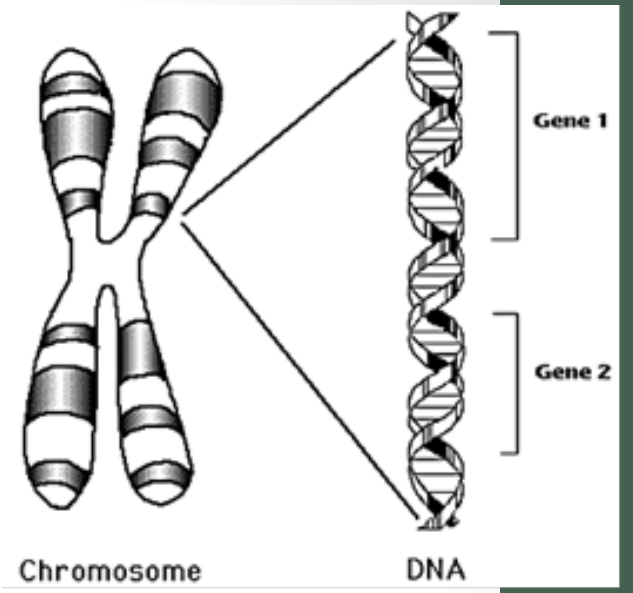
**CHROMOSOME:**

- Made of **GENES**. They pair up with other **CHROMOSOMES** that **CODE** for the same traits (**HOMOLOGOUS PAIRS**).

# Key Terms in Heredity…

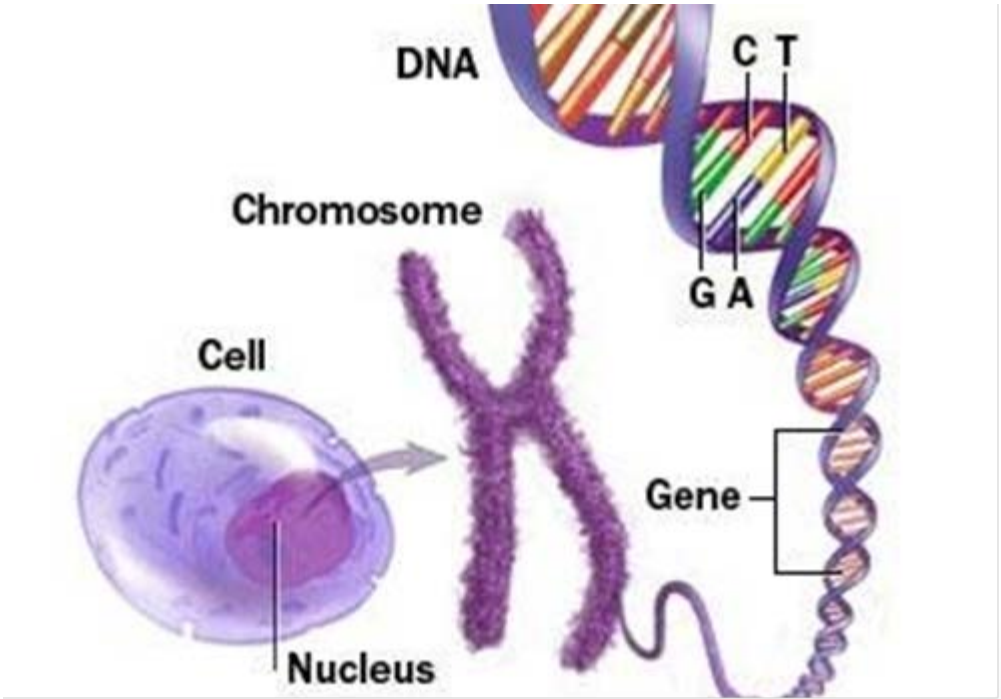
**GENE:**

- A **PORTION** of a **CHROMOSOME** that **CODES** for a specific **TRAIT**, made of **DNA**.




**DNA:**

- The **CODE** in which all **GENETIC INFORMATION** is stored



# Key Terms in Heredity…

**PHENOTYPE:**

- The **APPEARANCE** of a **TRAIT**. What it **LOOKS LIKE**. (**DARK HAIR**)

**GENOTYPE:**

- The **GENETIC CODE** (**GENE PAIR**) for a **TRAIT**. (**Dd or DD**)

**DOMINANT GENE:**

- The gene that will "**TAKE OVER**" and **DISPLAY** it's **TRAIT**. (**D**)

**RECESSIVE GENE:**

- Only shows when **PAIRED** with another gene **JUST LIKE IT**. (**d**)

**HOMOZYGOUS:**

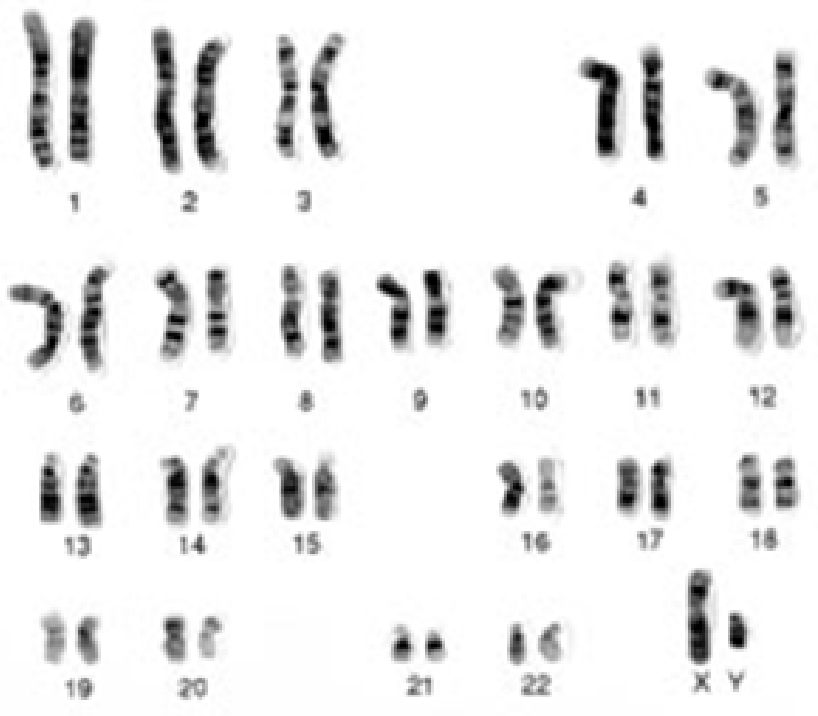
- Having two **IDENTICAL GENES** for the same trait (**DD** or **dd**).

**HETEROZYGOUS:**

- Having two **DIFFERENT GENES** for the **SAME TRAIT** (**Dd**)
- Also called **HYBRID**

# Karyotypes…

Humans have 23 pairs of chromosomes in total. A picture of these chromosomes is called a **KARYOTYPE**:

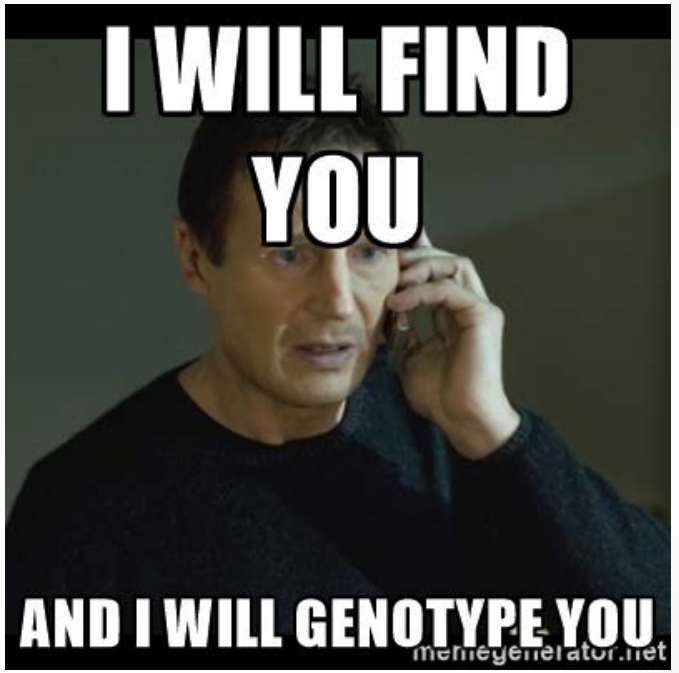



**22** of these chromosome pairs code for **EVERYTHING** except **SEX**. The **23RD PAIR** codes for **SEXUAL CHARACTERISTICS**, **X AND Y** chromosomes.

Girls: **XX** Boys: **XY**

# Genotype/Phenotype Example: Hair Colour

Having **DARK** hair is a **DOMINANT TRAIT**, and having **LIGHT** hair is a **RECESSIVE TRAIT**. We will use the letter "**D**" for a dominant gene, and "**d**" for the recessive gene.




**A person with:**

1. **HOMOZYGOUS DARK HAIR:**
   - **GENOTYPE:** "**DD**"
   - **PHENOTYPE:** "**DARK HAIR**"
   - Also called "**PURE**" **DARK HAIR**.

2. **HOMOZYGOUS LIGHT HAIR:**
   - **GENOTYPE:** "**dd**"
   - **PHENOTYPE:** "**LIGHT HAIR**"
   - Also called "**PURE**" **LIGHT HAIR**.

3. **HETEROZYGOUS GENES:**
   - Will have **GENOTYPE** "**Dd**" and **PHENOTYPE** "**DARK HAIR**"
   - The **DOMINANT** gene is what's **DISPLAYED**.