



Population Genetics



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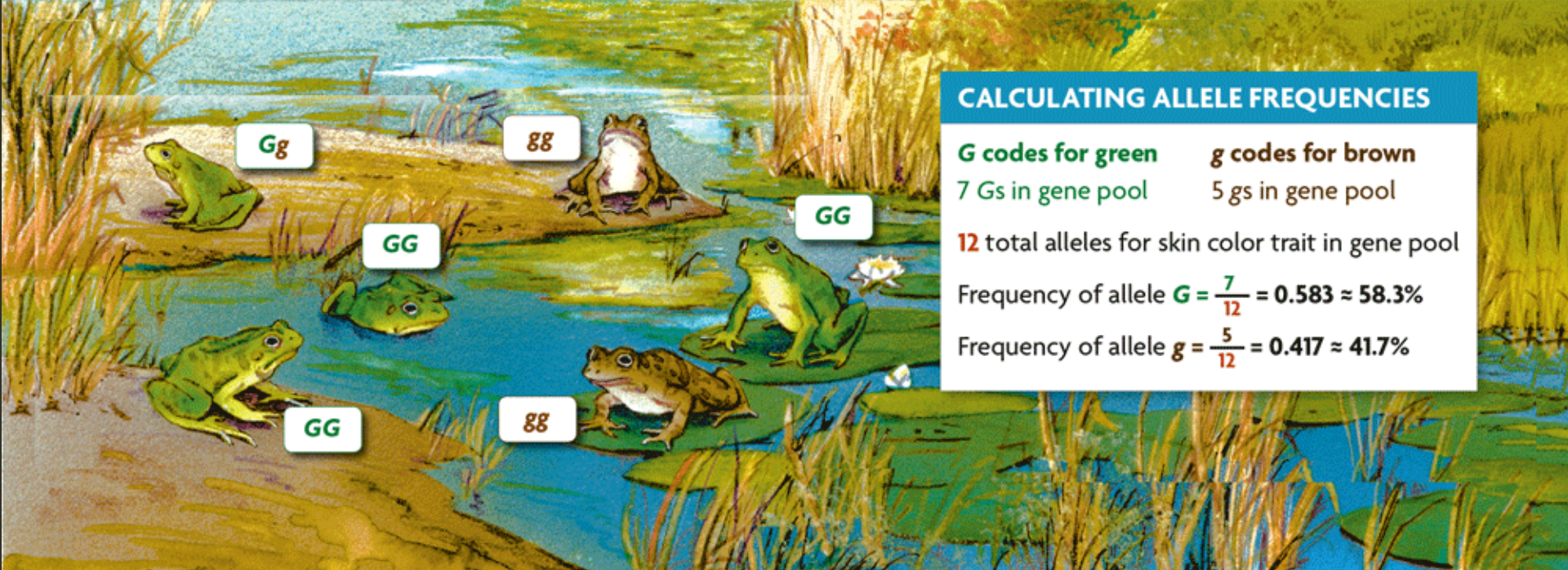


Mutations can form **new alleles** and can be passed on to the offspring if it occurs **in reproductive cells**.

If a new allele is formed... **a new phenotype is formed**.

Population Genetics

- Genotypic variation leads to **phenotypic variation**.
- **Genotypic variation** is stored in a population's gene pool.
 - Made up of all **alleles** in a population
 - Allele combinations form **when organisms have offspring**.



CALCULATING ALLELE FREQUENCIES

G codes for green

7 Gs in gene pool

g codes for brown

5 gs in gene pool

12 total alleles for skin color trait in gene pool

Frequency of allele **G** = $\frac{7}{12} = 0.583 \approx 58.3\%$

Frequency of allele **g** = $\frac{5}{12} = 0.417 \approx 41.7\%$

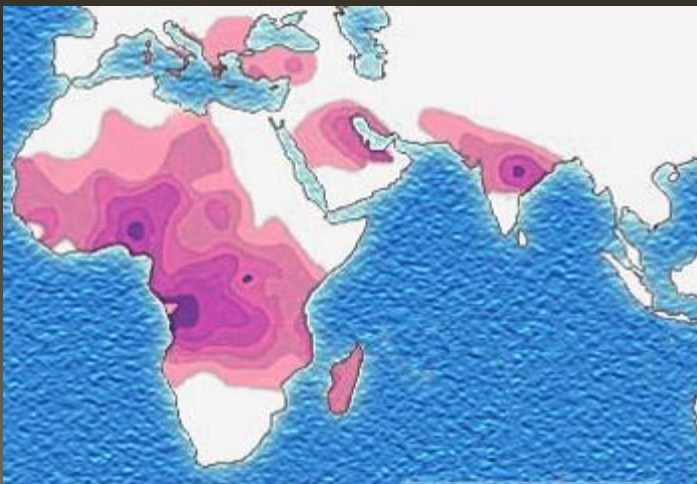
- If an allele doesn't disadvantage an organism in anyway, it may stick around in the population.
- If the allele gives the organism some advantage in its environment over others in its population, the allele may become more common and eventually incorporate itself as a trait of the species.
- This is how mutations can eventually lead to the formation of new species.

Population Genetics

Some mutations that stick around may be **harmful** but also give a **benefit**.

Like Sickle Cell Anemia.

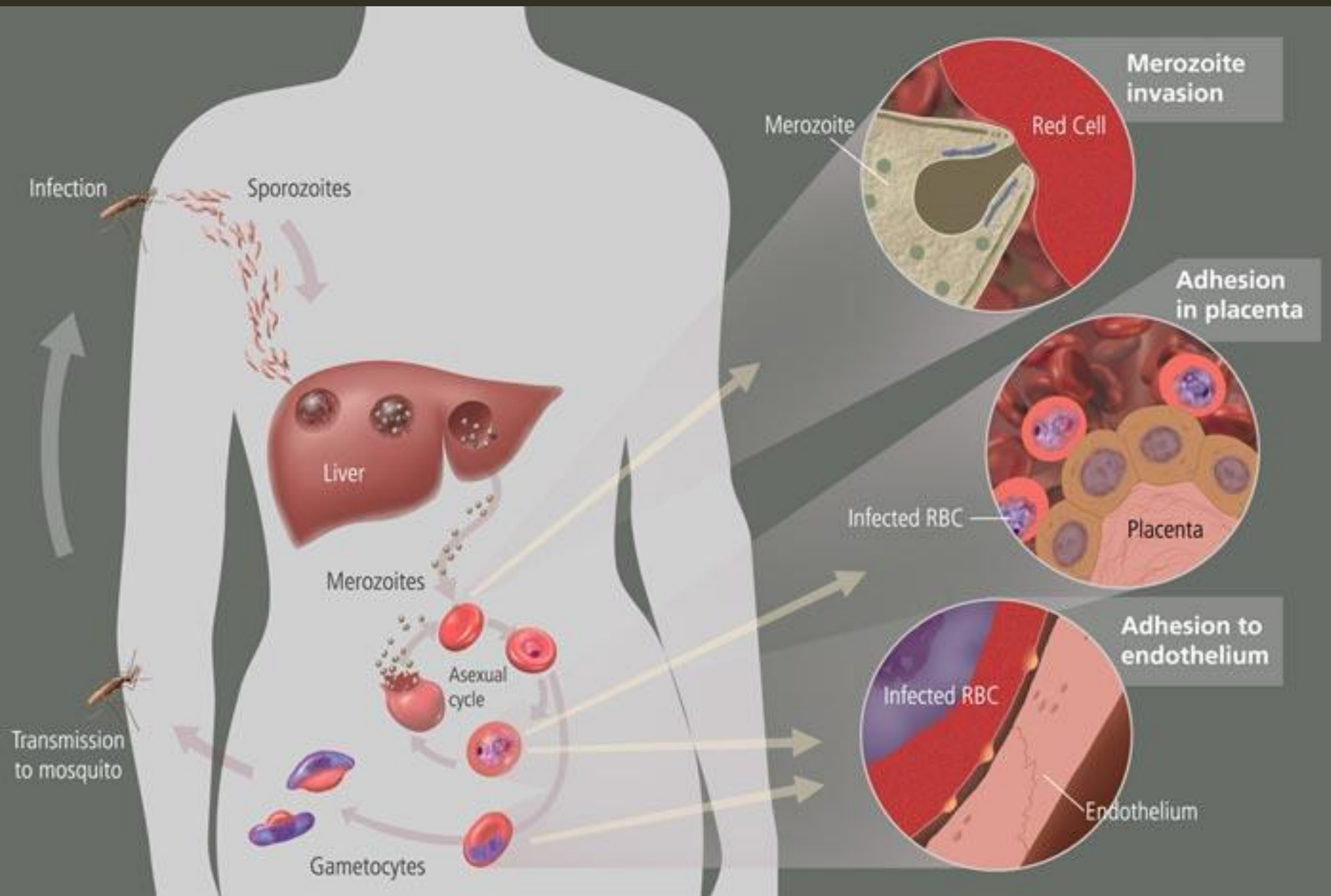
Sickle Cell Individuals are immune to **Malaria**.



Sickle-Cell Distribution



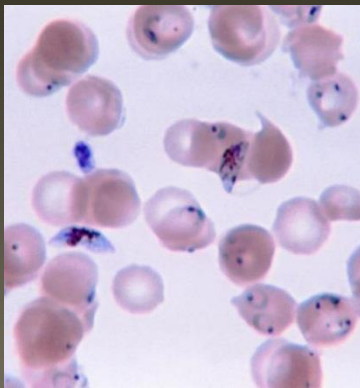
Malaria Distribution



Population Genetics

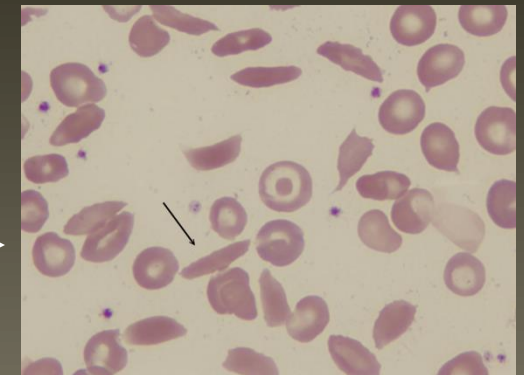


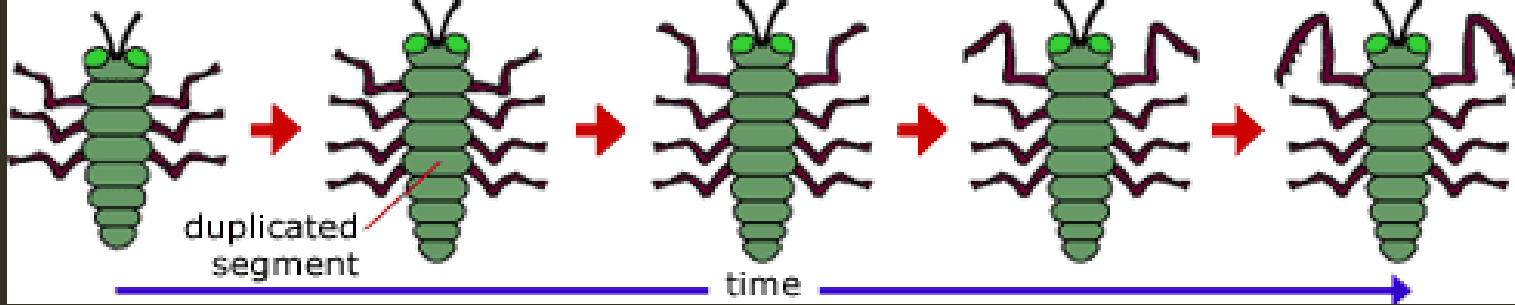
- Individuals with two **mutated alleles** have true Sickle Cell Disease and die relatively young.
- **Heterozygotes** with one mutated allele and one normal have Sickle Cell Trait and are typically normal, but still resistant to Malaria.
- Sickle-Cell then can be passed on through the **“Heterozygote Advantage”**



← Malaria Plasmodium

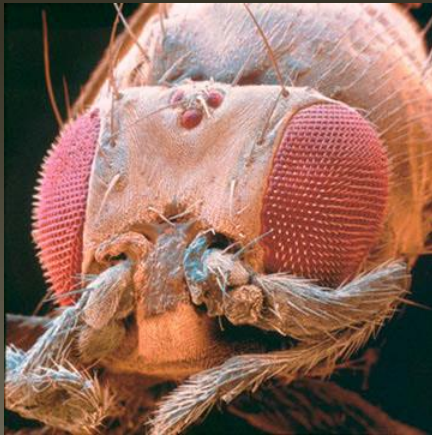
Sickle-Cell →





Big Changes

- Mutations can cause **big phenotypic changes**, if certain development genes are **mutated**.
- This can lead to parts that are duplicated, or in the wrong place.
- If they have an advantage (they rarely do), that's a big phenotypic change in a **short amount of time!**



Fly with legs instead of antennae

Amazingly, mammals, insects and even fungi all have similar genes that plan out our development from embryo to adult.



Fly with two pairs of wings