

## PATTERNS OF SELECTION

### SICKLE CELL ANEMIA

- Serious blood disorder which provides a good example of how mutation, genetic variation and environmental conditions results in different patterns of natural selection.
- Single base pair mutation (point mutation) leading to single amino acid change in hemoglobin molecule
- RBCs are sickle shaped, cannot hold oxygen well
- Suffer from fatigue, malaise, jaundice, other minor problems
- Major problem is the sickle shaped RBCs are more prone to clogging blood vessels which can be fatal.
- Heterozygous individuals are only mildly affected by the disorder since it is codominant, both normal and sickle RBCs are made.
- Benefit: more resistant to malaria, since the malaria causing protist cannot infect sickle RBCs and there are not enough normal RBCs
- Disadvantage in regions where malaria is uncommon (ie. North America)
- Advantage where malaria is common (ie. Sub-Saharan Africa); heterozygous individuals are strongly favoured, **heterozygote advantage**; they are more likely to survive than either homozygous group.

### MUTATIONS and EVOLUTION

- The environment selects for the best adapted phenotype. The sickle cell allele is only common where it will provide an advantage.
- Important relationship between mutations and evolution:
  1. Harmful mutations occur frequently but they are selected against and these mutations remain extremely rare.
  2. Beneficial mutations are rare, but they are selected for and therefore will become more common over time.
- Although genes provide the source of variation, natural selection acts on individuals and their phenotypes.
- As a result, particular alleles are most successful and passed on when they enhance the phenotype of the individual and thereby contribute to their reproductive success.

### TYPES OF SELECTION

#### Stabilizing Selection

- Once well adapted to environment, selection pressures tend to prevent them from changing
- Occurs when most common phenotype the most favoured by environment
- ex. baby weights (3kg)

#### Directional Selection

- The environment favours individuals with more extreme variations of a trait.
- Occurs when organism moves to a new environment
- ex. gill nets and salmon fishing in 50s and 60s

#### Disruptive Selection

- Favours individuals with variations at opposite extremes of a trait over individuals with intermediate variations

#### Sexual Selection

- Favours the trait that influences mating success
- Include sexual dimorphism (physical differences between males and females).
- Usually based on female choice and/or male vs. male competition
  - ex. widow bird, runaway selection.