Red Queen Hypothesis

Red Queen stated to Alice….

"It takes all the running you can do, to keep in the same place"

Evolution wise –
what does this mean?

- For an evolutionary system, continuing development is needed just in order to maintain its fitness relative to the system it is co-evolving with.

Explains 2 phenomena:

1. the advantage of sex at the level of individuals
2. constant evolutionary arms race between competing species

- The basis for the entire theory is also known as ‘the evolutionary arms race’, where prey and predator constantly evolve together to reach some sort of uneasy balance

- EXAMPLE: plants that evolve toxins to kill off predators such as caterpillars.
- If the plant, under predation selection pressure, evolved a new type of toxin to which the caterpillar had no immunity, most of the caterpillars would die off and the tree would flourish. This victory would be short lived, if only a few caterpillars undergo a mutation and are immune to the toxin. These would breed rapidly, and once again the tree would be under attack
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- EXAMPLE: Peppered Moth and Industrial Revolution
- Genetic fluctuations rely on probability and numbers. A large population is much more able, by chance, to throw up random mutations, whilst a small population is less likely.

- Predator/prey relationships are not the only factors in the Red Queen Hypothesis. If many species are competing for the same resources, mutations are sometimes needed to prevent a species from being out-competed. This is possibly one of the reasons why sexual reproduction occurs in higher species. If no random mixing occurred, then a bacteria or parasite may quickly evolve into a lethal form which would wipe out a species.
- Sexual reproduction means that in a large population, there would be enough individuals with resistance to breed, pass the trait on and continue the species.
- In a strange way, this benefits both host and parasite because, if a parasite or bacteria was so effective that it killed the host species, then it too is guaranteed extinction.
- This process of sexual selection may explain why the vast majority of genes in vertebrates are dormant and do nothing (often called ‘junk DNA’) as they are preserving possible mutations that might suddenly be needed in the future if the environment or parasite pressure changes.
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