DNA and Mutations :

The effects of mutations

Since all cells in our body contain DNA, there are lots of places for mutations to occur; however, some mutations cannot be passed on to offspring and do not matter for evolution. Somatic mutations occur in non-reproductive cells and won't be passed onto offspring. For example, the golden color on half of this Red Delicious apple was caused by a somatic mutation. Its seeds will not carry the mutation.

The only mutations that matter to large-scale evolution are those that can be passed on to offspring. These occur in reproductive cells like eggs and sperm and are called germ line mutations.

Effects of germ line mutations

A single germ line mutation can have a range of effects:

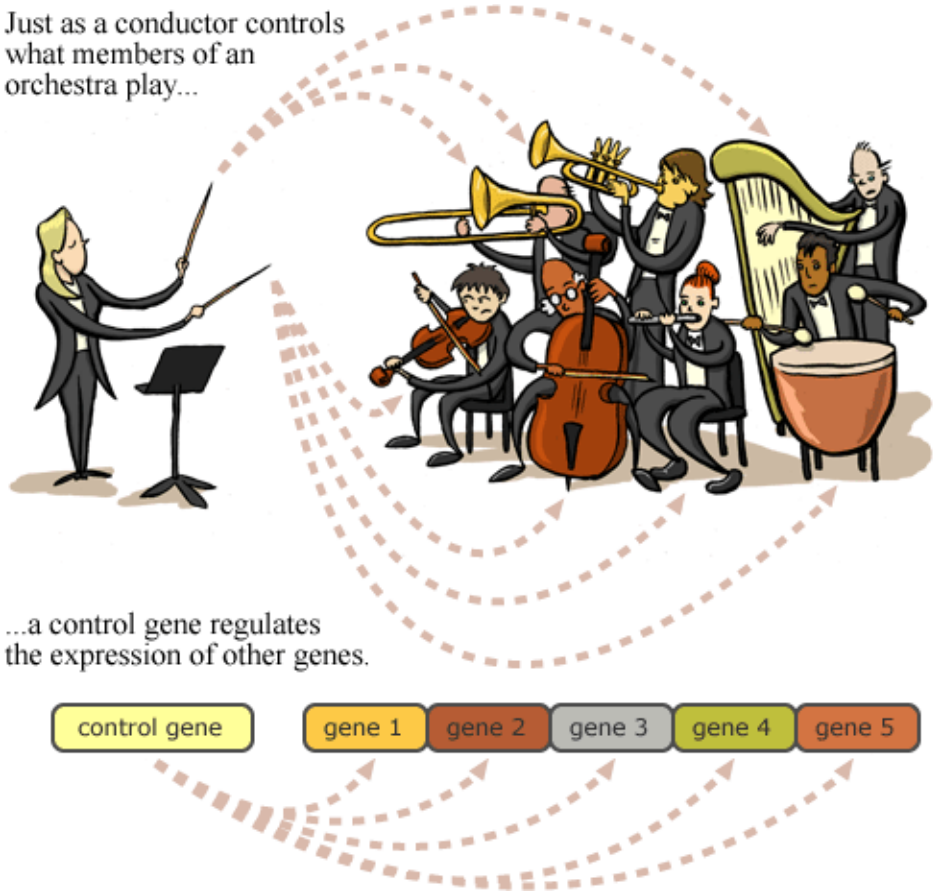
1. **No change occurs in phenotype.**
   Some mutations don't have any noticeable effect on the phenotype of an organism. This can happen in many situations: perhaps the mutation occurs in a stretch of DNA with no function, or perhaps the mutation occurs in a protein-coding region, but ends up not affecting the amino acid sequence of the protein.
2. **Small change occurs in phenotype.**
   A single mutation caused this cat's ears to curl backwards slightly.
3. **Big change occurs in phenotype.**
   Some really important phenotypic changes, like DDT resistance in insects are sometimes caused by single mutations. A single mutation can also have strong negative effects for the organism. Mutations that cause the death of an organism are called lethals — and it doesn't get more negative than that.

Little mutations with big effects: Mutations to control genes

Mutations are often the victims of bad press — unfairly stereotyped as unimportant or as a cause of genetic disease. While many mutations do indeed have small or negative effects, another sort of mutation gets less airtime. Mutations to control genes can have major (and sometimes positive) effects.

Some regions of DNA control other genes, determining when and where other genes are turned "on". Mutations in these parts of the genome can substantially change the way the organism is built. The difference between a mutation to a control gene and a mutation to a less powerful gene is a bit like the difference between whispering an instruction to the trumpet player in an orchestra versus whispering it to the orchestra's conductor. The impact of changing the conductor's behavior is much bigger and more coordinated than changing the behavior of an individual orchestra

member. Similarly, a mutation in a gene "conductor" can cause a cascade of effects in the behavior of genes under its control.



Many organisms have powerful control genes that determine how the body is laid out. For example, *Hox* genes are found in many animals (including flies and humans) and designate where the head goes and which regions of the body grow appendages. Such master control genes help direct the building of body "units," such as segments, limbs, and eyes. So evolving a major change in basic body layout may not be so unlikely; it may simply require a change in a Hox gene and the favor of natural selection.

WEIRD FACT

Mutations to control genes can transform one body part into another. Scientists have studied flies carrying *Hox* mutations that sprout legs on their foreheads instead of antennae!