

# Genomics Lite: Evolution and Proteins in Focus

## *Learning Resources*



These resources are designed to support and further attendees understanding of evolution of proteins and genes, and are aimed at students in upper secondary years (e.g. year 10 and higher).

For further resources, visit [yourgenome.org](http://yourgenome.org)

### How do genes and proteins evolve?

The Central Dogma in biology describes the flow of genetic information from DNA (in the form of genes), to RNA, to proteins. Because of this, changes (mutations) at the DNA level can have large impacts on the protein product's function.

<https://www.yourgenome.org/facts/what-is-the-central-dogma><https://www.yourgenome.org/facts/what-is-a-mutation>

There are two main ways that changes in the DNA can create a new gene and a new protein - duplication and recombination.

If a gene gets duplicated, one version of the gene might mutate enough to be functionally different from the original (known as diverging). This is called duplication and divergence.

<https://www.genome.gov/genetics-glossary/Duplication>

Recombination involves an exchange of stretches of DNA between different chromosomes, or different parts of the same chromosome. This most commonly occurs during meiosis.

<https://www.yourgenome.org/facts/what-is-meiosis>

Scientists have recently discovered a third way for new genes and proteins to evolve, called 'de novo' (or 'new') genes. Unlike the other ways, this creates new genes from previously non-coding regions of DNA.

<https://www.nature.com/articles/d41586-019-03061-x>

### How can we study the evolution of proteins?

Comparative genomics uses genome sequencing techniques to compare the genomes of different species, genes or proteins.

<https://www.genome.gov/about-genomics/fact-sheets/Comparative-Genomics-Fact-Sheet>

Comparative genomics can help scientists identify homologous genes - genes that have a shared ancestor. These genes might be paralogs - genes that have been duplicated and often diverged from each other - or orthologs - genes found in different species following speciation.

<https://sciencing.com/difference-between-orthologous-paralogous-genes-18612.html>

Bioinformatics tools - like BLAST - can help scientists compare genes and proteins between species to look for similarities. Use this Function Finders: BLAST! Activity to try out the tool.

<https://www.yourgenome.org/activities/function-finders-blast>