

# Importance of molecular genetics

Melaku Getachew\*

---

Getachew M. Importance of molecular genetics. J of Genet Disord and Genet Med. 2021;5(1):5.

---

Molecular genetics is a sub-speciality of biology that marks how variation in the structures or expression of DNA molecules indication as variation among organisms. By using mutagenesis screen molecular genetics frequently applies an “investigative approach” to determine the structure or function of genes in an organism’s genome. The field of study is based on the consolidation of several sub-fields in biology: classical Mendelian inheritance, cellular biology, molecular biology, biochemistry, and biotechnology. Molecular genetics is a robust methodology for linking mutations to genetic conditions that may support the search for treatments/cures for various genetic diseases.

## Forward genetics

Forward genetics is one of the molecular genetics technique used to recognize genes or genetic mutations that produce a certain phenotype. In a genetic screen, irregular mutations are generated with mutagens (chemicals or transposons) and individuals are screened for the specific phenotype. Usually, a secondary assay may follow mutagenesis where the desired phenotype is hard to observe, for example in bacteria or cell cultures. The cells may be modified using a gene for antibiotic resistance or a fluorescent reporter so that the mutants with the desired phenotype are selected from the non-mutants.

Mutants indicating the phenotype of interest are isolated and a complement test may be performed to determine if the phenotype results from more than one gene. The mutant genes are then characterized as dominant, recessive (showing a loss of function), or epistatic (the mutant gene masks the phenotype of another gene). Finally, the location and specific nature of the mutation is mapped through sequencing. Forward genetics is an impartial approach and often leads to many unexpected discoveries, but it may be expensive and time consuming. Model organisms like the nematode worm *Caenorhabditis elegans*, the fruit fly *Drosophila melanogaster* have been successfully used to study phenotypes resulting from gene mutations

## Reverse genetics

Reverse genetics is the term for molecular genetics techniques used to determine the phenotype resulting from a deliberate mutation in a gene of interest. The phenotype is used to conclude the function of the un-mutated version of the gene. Mutations may be irregular or intentional changes to the gene of interest. Mutations may be a mis-sense mutation caused by nucleotide substitution, To induce a frameshift mutation a nucleotide addition or deletion, or a complete addition/deletion of a gene or gene segment. The deletion of a particular gene generates a gene knockout where the gene is not expressed and results in loss of function. Mis-sense mutations may cause partial loss of function or total loss of function, known as a knockdown. Knockdown may also be achieved by RNA interference. Alternatively, genes may be substituted into an organism’s genome which is also known as a transgene to create a gene knock-in. Although these techniques have some innate bias regarding the decision to link a phenotype to a particular function, As the gene of interest is already known it is much faster in terms of production than forward genetics

Molecular genetics employ the laboratory tools of molecular biology to concern changes in the structure and sequence of human genes to functional changes in protein function, and ultimately to health and disease. The use of molecular genetics in selection programmes depends on the ability to determine the genotype of individuals for causal mutations or indirect markers using DNA analysis.

---

Department of Molecular Genetics, Open University of Sudan, Khartoum, Sudan

**Correspondence:** Melaku Getachew, Department of Molecular Genetics, Open University of Sudan, Khartoum, Sudan, E-mail: melakug044@gmail.com

---

**Received:** February 04, 2021, **Accepted:** February 18, 2021, **Published:** February 25, 2021



This open-access article is distributed under the terms of the Creative Commons Attribution Non-Commercial License (CC BY-NC) (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits reuse, distribution and reproduction of the article, provided that the original work is properly cited and the reuse is restricted to noncommercial purposes. For commercial reuse, contact [reprints@pulsus.com](mailto:reprints@pulsus.com)