General biology 2

2nd stage

Introduction to Molecular Genetics

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Techniques of Molecular Genetics

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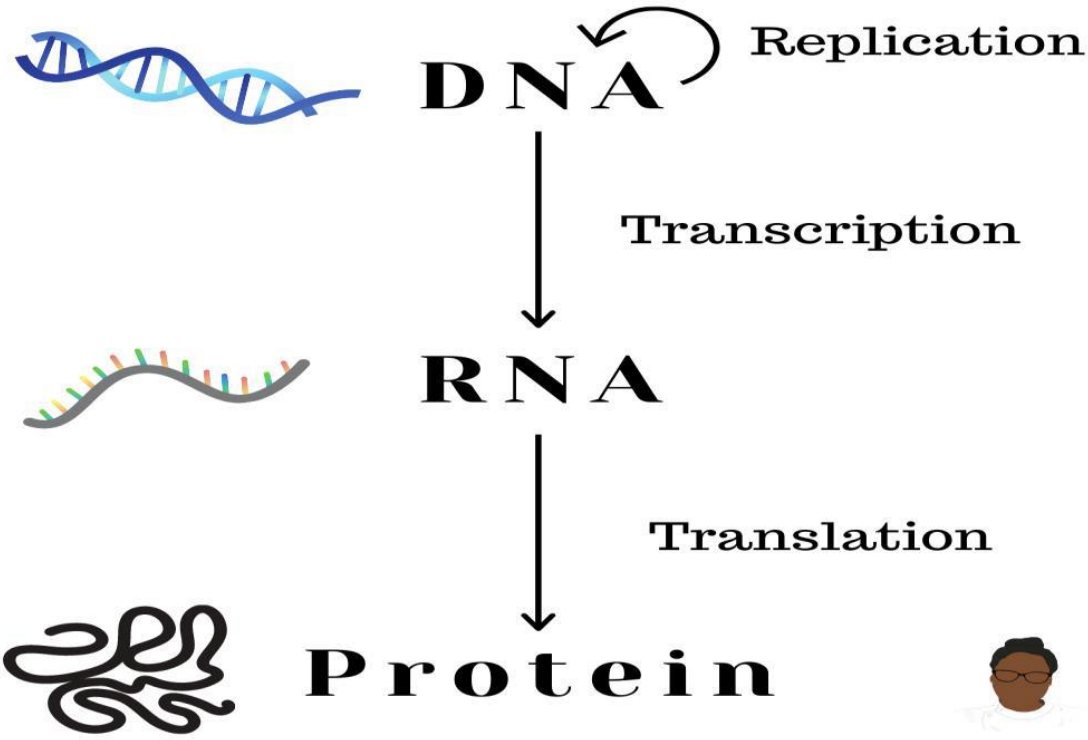
Introduction to Molecular Genetics

Molecular genetics is a sub-field of biology that investigates how differences in the structures or expression of DNA molecules manifest as variation among organisms. It is a powerful methodology for linking mutations to genetic conditions, which may aid the search for treatments and cures for various genetic diseases. The field of study is based on the merging of several sub-fields in biology, including classical Mendelian inheritance, cellular biology, molecular biology, biochemistry, and biotechnology.

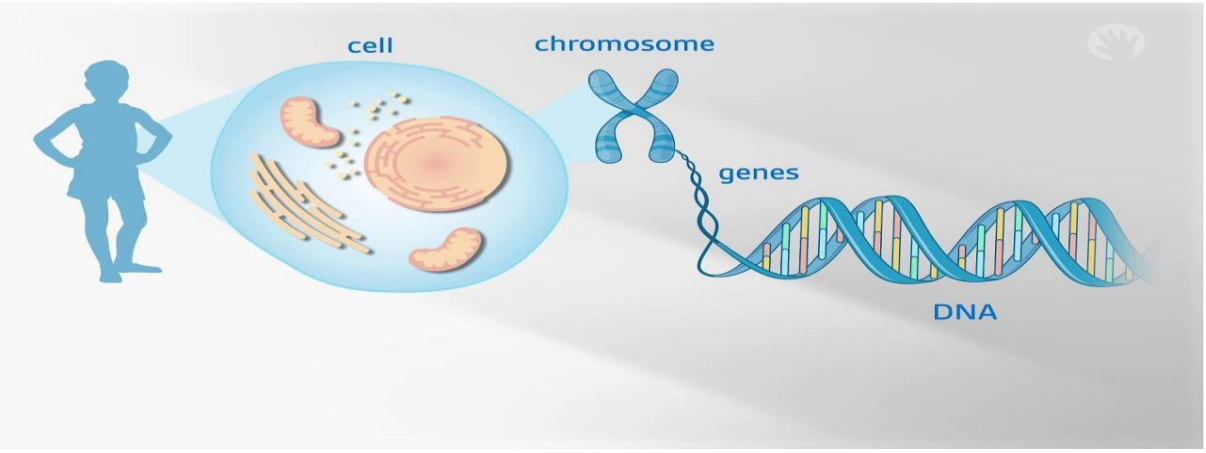
Molecular genetics often applies an "investigative approach" to determine the structure and/or function of genes in an organism's genome using genetic screens. Researchers search for mutations in a gene or induce mutations in a gene to link a gene sequence to a specific phenotype.



Molecular genetics

A branch of genetics that deal with the structure and function of genes at a molecular level Genetics is a basically a study in heredity, particularly the mechanisms of hereditary

transmission, and the variation of inherited characteristics among similar or related organisms. Some of the branches of genetics include behavioural genetics, classical genetics, cytogenetics, molecular genetics, developmental genetics, and population genetics. Molecular genetics, in particular, is a study of heredity and variation at the molecular level. It is focused on the flow and regulation of genetic information between DNA, RNA, and proteins. Its sub-fields are genomics (i.e. the study of all the nucleotide sequences, including structural genes, regulatory sequences, and noncoding DNA segments, in the chromosomes of an organism) and proteomics (i.e. the study of proteins from DNA replication). The different techniques employed in molecular genetics include amplification, polymerase chain reaction, DNA cloning, DNA isolation, mRNA isolation, and so on. Molecular genetics is essential in understanding and treating genetic disorders. It is regarded as the most advanced field of genetics. The Human Genome Project was a large scientific research endeavor in molecular genetics. It began in 1990s and finished in 2003 with the intent of identifying the genes and the sequences of chemical base pairs in human DNA



Techniques of Molecular Genetics

● Molecular biology involves the isolation and analysis of DNA and other macromolecules

● Isolation of total genomic DNA involves separating DNA from protein and other cellular componentsfor example by ethanol precipitation of DNA.

• PCR can be used as part of a sensitive method to detect the presence of a particular DNA sequence

• PCR can also be used as part of a method to isolate and prepare large quantities of a particular DNA sequence

• Restriction enzymes are natural endonucleases used in molecular biology to cut DNA sequences at specific sites.

● DNA fragments with compatible ends can be joined together through ligationIf the ligation produces a sequence not found in nature, the molecule is said to be recombinant

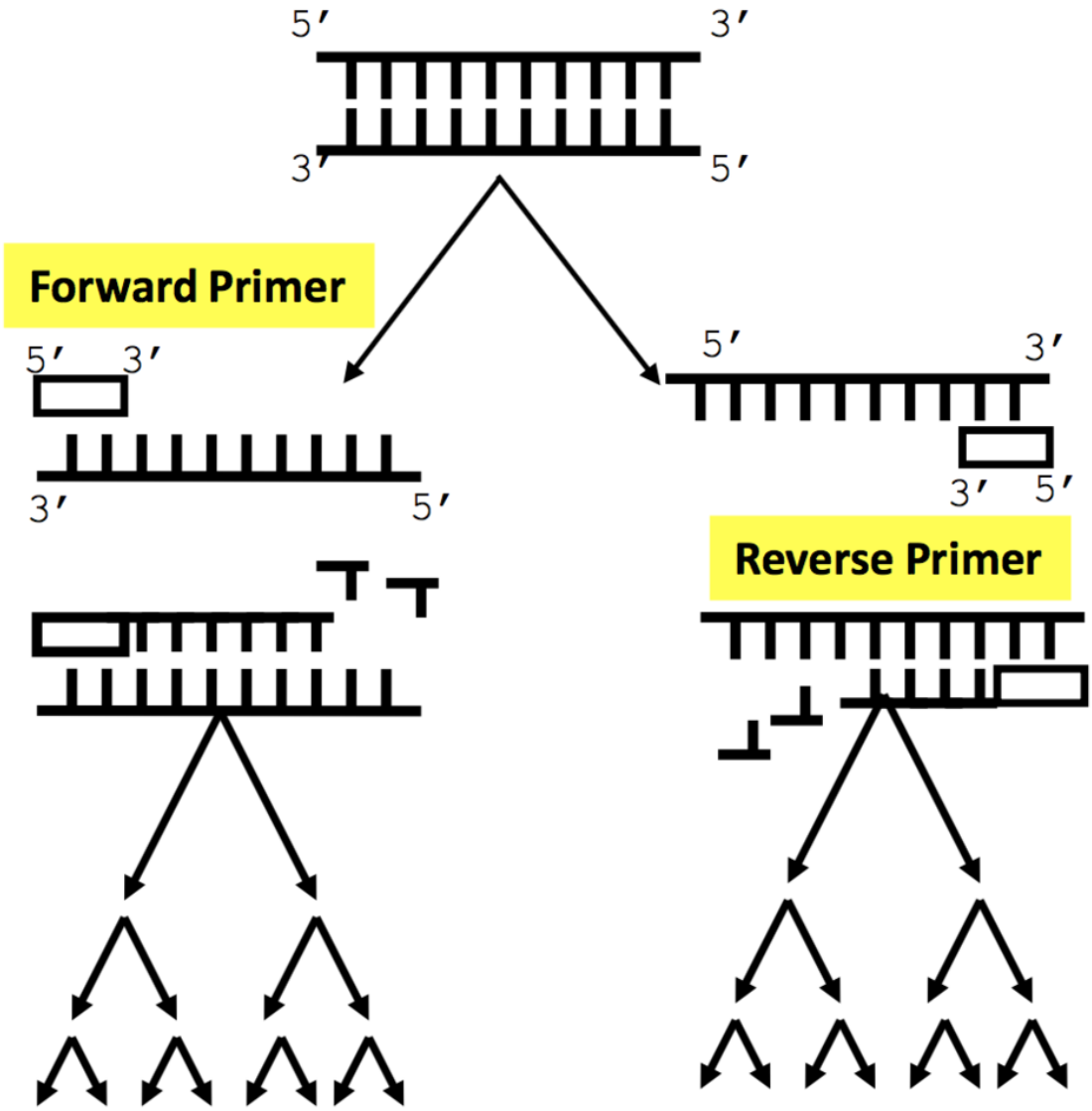
• Transformation is the introduction of DNA (usually recombinant plasmids) into bacteria.

● Cloning of genes in E. coli is a common technique in molecular biology, since it allows large quantities of a DNA for gene to made, which allows further analysis or manipulation.

● Cloning can also be used to produce useful proteins, such as insulin, in microbes

• Southern blotting can be used to detect the presence of any sequence that matches a probe, within a mixture of DNA (such as total genomic DNA).

- The stringency of hybridization in blotting and in PCR is dependent on physical parameters such as temperature and washing.



Forward primer

In molecular biology, a forward primer is one of the two types of primers used in the polymerase chain reaction (PCR) to amplify a specific part of a DNA strand . Forward primers anneal to the antisense strand of the double-stranded DNA, which runs from 3′ to

5′ direction. They are complementary to the antisense strand and are used to amplify the antisense strands during PCR.

Reverse primer

In molecular biology, a reverse primer is the other type of primer used in the polymerase chain reaction (PCR) to amplify a specific part of a DNA strand. Reverse primers anneal to the sense strand of the double-stranded DNA, which runs from 5′ to 3′ direction. They are complementary to the sense strand and are used to amplify the sense strands during PCR

Molecular genetics techniques

are a set of methods used to study DNA and other macromolecules that have been isolated from an organism. These techniques play a crucial role in understanding and treating genetic disorders. Here are some commonly used molecular genetics techniques:

1. Amplification: This technique allows researchers to make multiple copies of a specific DNA sequence using the polymerase chain reaction (PCR).

2. DNA Cloning: DNA cloning involves the creation of identical copies of a DNA fragment, which can then be studied or manipulated.

3. DNA Isolation: DNA isolation is the process of extracting DNA from cells or tissues for further analysis.

4. mRNA Isolation: mRNA isolation is the process of isolating messenger RNA (mRNA) molecules from cells or tissues, which can provide insights into gene expression patterns.

5. Polymerase Chain Reaction (PCR): PCR is a technique used to amplify a specific DNA sequence, allowing researchers to study and analyze it in detail.

6. Restriction Digests and DNA Ligation: Restriction digests involve cutting DNA at specific locations using restriction enzymes, while DNA ligation involves joining DNA fragments together.

7. Mapping With Three-Point Crosses: This technique is used to map the relative positions of genes on a chromosome by analyzing the inheritance patterns of three or more genes .