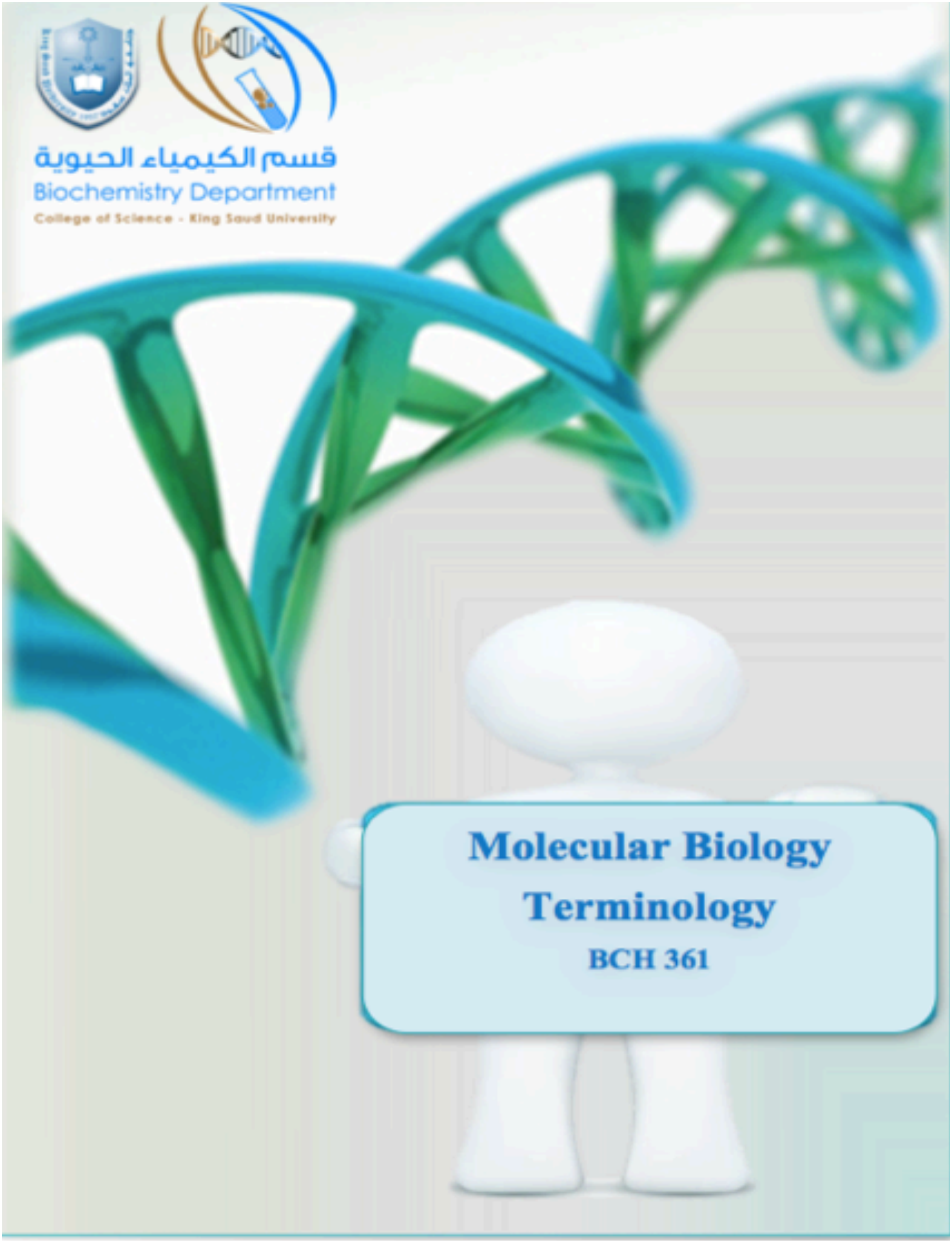
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Biochemistry Department
College of Science - King Saud University
Molecular Biology
Terminology
BCH 361

MOLECULER BIOLOGY TIMELINE

Gregor Mendel's (1865) Three Laws of Inheritance

Friedrich Miescher (1869) identified DNA & called it nuclein

Thomas H. Morgan (1910) discovered genes on chromosomes

Beadle & Tatum (1941) One gene-one enzyme

Avery, Mcleod & McCarty (1944)
DNA is genetic material

Edwin Chargaff (1950)
Found that C complements G and A complements T

Watson, Crick, Franklin &Wilkins (1953)
Structure of DNA

Brenner, Jacob & Meseleson (1961)
Discovery of mRNA

CONTINUE

1956 — Central Dogma; Crick & Gamov

1966 — Finished unraveling the code; Nirenberg & Khorana

1972 — Recombinant DNA made in vitro; P. Berg

1973 — DNA cloned on a plasmid; H. Boyer & S. Cohen

1973 — Discovery of reverse transcriptase; H. Temin

1977 — Rapid DNA sequencing; F. Sanger & W. Gilbert

1977 — Discovery of split genes; Sharp, Roberts et al.

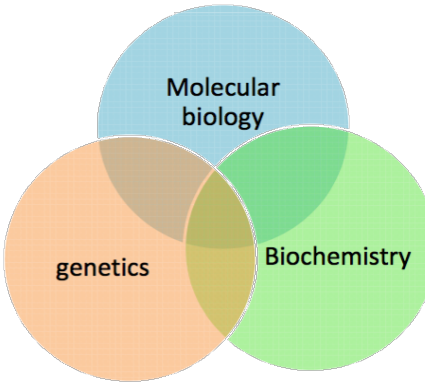
1982 — Discovery of ribozymes; T. Cech & S. Altman

1986 — Creation of PCR; K. Mullis et al.

2001 — Human Genome Project; Venter, Collins and others

TERMINOLOGY

Molecular biology is the branch of biology that deals with the molecular basis of biological activity. It concerns itself with understanding the interactions between the different types of DNA, RNA and protein biosynthesis as well as learning how these interactions is regulated.

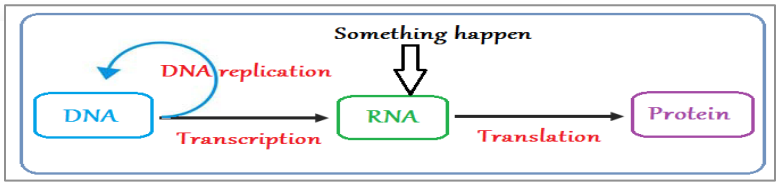


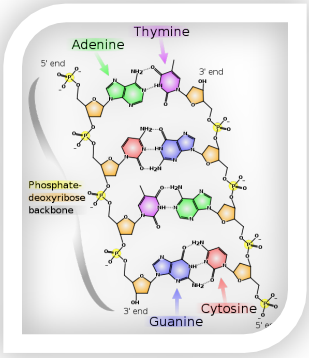
This field overlaps with other areas of biology, genetics and biochemistry.

Genetics is the study of inherited phenotypes.

Biochemistry is the study of the chemistry of living organisms and/or cells.

The Central Dogma is the Flow of Information: DNA → RNA → Protein.





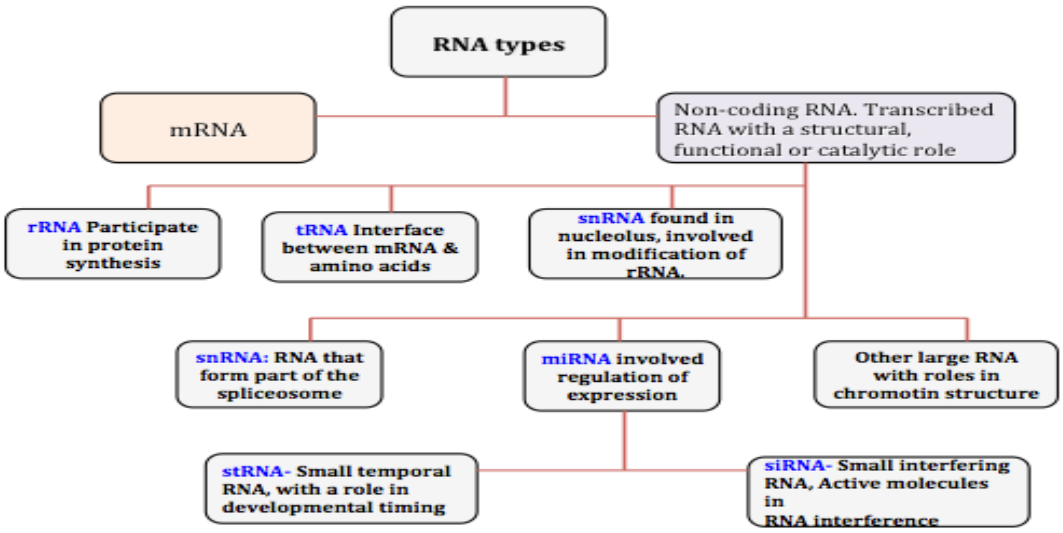
Deoxyribonucleic acid (DNA) is a nucleic acid containing the genetic instructions used in the development and functioning of all known living organisms. It consists of two long polymers of simple units called nucleotides, each composed of deoxyribose, phosphate group and a nitrogenous base (adenine, thymine, cytosine and guanine). Phosphodiester bonds link these successive nucleotides.

Ribonucleic acid (RNA) chemical structure is very similar to that of DNA, but differ in three main ways:

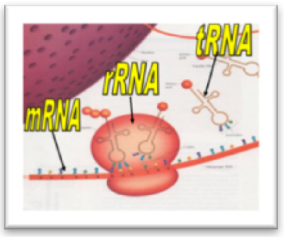
⇒ Unlike double-stranded DNA, RNA is a single-stranded molecule in many of its biological roles and has a much shorter chain of nucleotides.

⇒ While DNA contains deoxyribose, RNA contains ribose.

⇒ The complementary base to adenine is not thymine, as it is in DNA, but rather uracil, which is an unmethylated form of thymine.



Messenger RNA (mRNA) is the RNA that carries information from DNA (transcription) to the ribosome, the sites of protein synthesis (translation) in the cell.

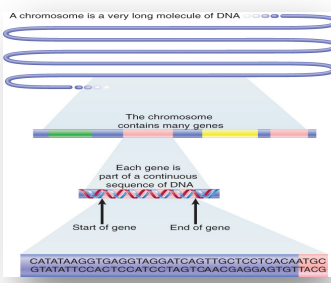


Transfer RNA (tRNA) is the form of RNA used to shuttle successive amino acids to the growing polypeptide chain.

Ribosomal RNA (rRNA), occurs in two sizes, 28S and 18S together they form the basic core of the eukaryotic ribosome involved in protein synthesis.

Genome

It is a large sequence of DNA that provides the complete set of hereditary information carried by the organism.



Gene

It is the molecular unit of heredity of a living organism. Genes hold the information to build and maintain an organism's cells and pass genetic traits to offspring.

Gene family

It is a set of several similar genes, formed by duplication of a single original gene, and generally with similar biochemical functions.
One such family is the genes for human hemoglobin subunits; the ten genes are in two clusters on different chromosomes, called the α-globin and β-globin.

Gene cluster

A group of adjacent genes that is identical or related.

Pseudogenes

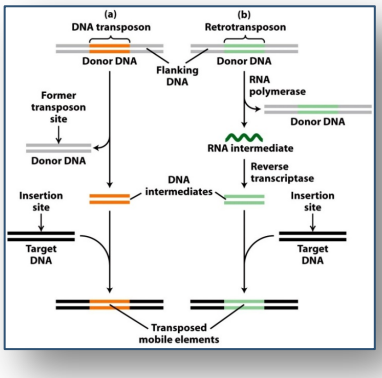
They are genes related to functional genes but are no longer capable of being transcribed or translated.

Transposons

They are mobile DNA elements that move directly as DNA via a "cut-and-paste" mechanism.

Retrotransposons

They are mobile DNA elements that move via an RNA intermediate and a "copy-and-paste" mechanism, wherein the original copy of the transposon is preserved.

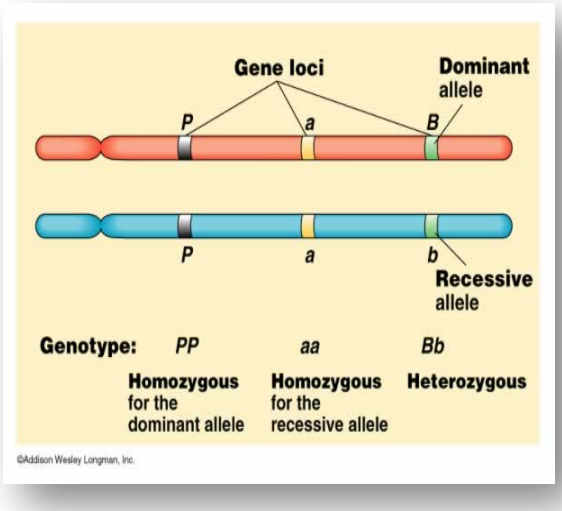


Locus

It is the location of gene on a chromosome

Alleles

They are different forms or variants of a gene.



Homozygous

When a cell contain identical alleles of a gene.

Heterozygous

When a cell contain two different alleles of a gene.

Genotype

It is the genetic makeup of an organism.

Phenotype

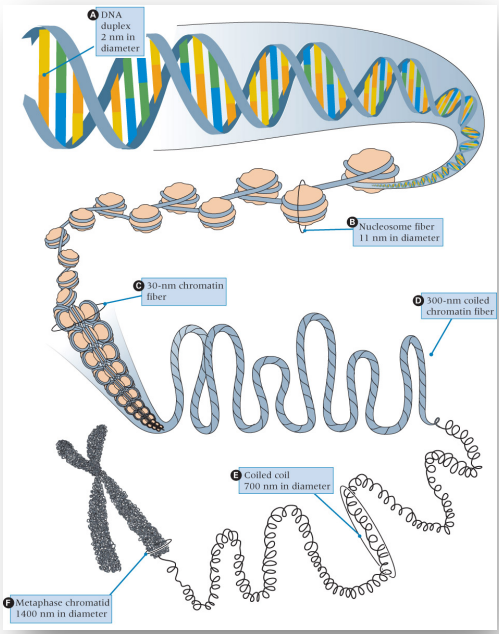
It is the observable expression of the genotype.

Chromatin

It is the combination of DNA and proteins that make up the contents of the nucleus of a cell.

It is found in two varieties: euchromatin and heterochromatin. Originally, the two forms were distinguished cytologically by how intensely they stained .

Euchromatin is less intense, while heterochromatin stains intensely, indicating tighter packing.



Chromosome

It is a discrete unit of the genome carrying many genes

Centromere

It is the attachment point for mitotic spindle, which is essential for the equal and orderly distribution of chromosome, sets to daughter cells during mitosis.

Telomere

A repeating structure found at the end of chromosomes, serving to prevent recombination with free-ended DNA. Telomeres of sufficient length are required to maintain genetic integrity, and they are maintained by telomerase.

Transcription

Transcription is the act of generating a primary **RNA** molecule from the double-stranded **DNA** gene.
The enzyme **RNA** polymerase is the key feature of the system, which acts to generate the **RNA** copy of the gene in combination with a number of important proteins.

Codon

Three successive nucleotides on an **mRNA** that encode a specific amino acid in the polypeptide.

Sixty-one codons encode the 20 amino acids and three codons signal termination of polypeptide synthesis.

Downstream and Upstream

Downstream is the region towards the 3' end of the strand (**5' --> 3'**). While the **upstream** direction is (**3' --> 5'**)

Enhancer

It is a segment of **DNA** that lies either upstream, within, or downstream of a structural gene that serves to increase transcription initiation from that gene.

Silencer

These elements are very similar to enhancers except that they have the function of binding proteins and inhibiting transcription.

Promoter

A specific short sequence on DNA at which RNA polymerase attaches and initiates transcription at the beginning of the transcription unit.

Terminator

A specific short sequence on DNA at which RNA transcription ends (the end of the gene).

Transcription factor

A protein that can recognize the promoter region, especially a TATA box, and bind to it, then, RNA polymerase attach to it in order to start transcription.

Exons

These are the regions of the primary RNA transcript that, following splicing forms the mature mRNA species, which encodes polypeptide sequence.

Introns

These are the regions of the primary RNA transcript that are eliminated during splicing. Their precise function is uncertain. However, several transcriptional regulatory regions have been mapped to introns.

Splicing

It is a process that brings the exons together while introns are removed from the primary RNA transcript.

Polyadenylation

Following transcription of a gene, a specific signal near the 3' end of the primary transcript (AATAAA) signals that a polyadenine tail be added to the newly formed transcript.

It plays a role in stability of the mRNA and perhaps in its metabolism through the nuclear membrane to the ribosome.

Protein translation

This term is applied to the assembly of a polypeptide sequence from mRNA.

Initiation codon

The ATG triplet is used to begin polypeptide

Open Reading Frame (ORF)

The term given to any stretch of a chromosome that could encode a polypeptide sequence