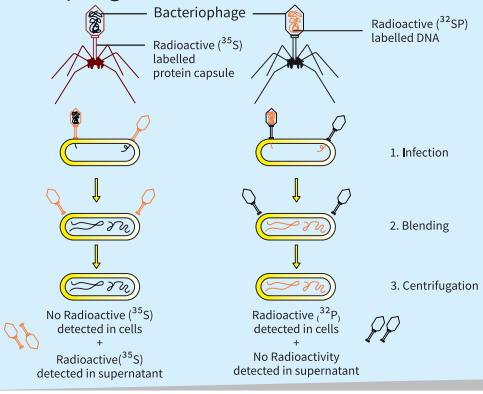
SEARCH FOR GENETIC MATERIAL

Transforming Principle: Fredrick Griffith (1928) experimented on mice and *Streptococcus pneumoniae*.

Biochemical Nature of Transforming Principle: Oswald Avery, Colin MacLeod and Maclyn McCarty (1933-44) worked to determine the biochemical nature of 'transforming principle' in Griffith's experiment.

Hershey – Chase Experiment: The unequivocal proof that DNA is the genetic material came from the experiments of Alfred Hershey and Martha Chase (1952). They worked with viruses that infect bacteria called bacteriophages.



5. MOLECULAR BASIS OF INHERITANCE

GENETIC CODE

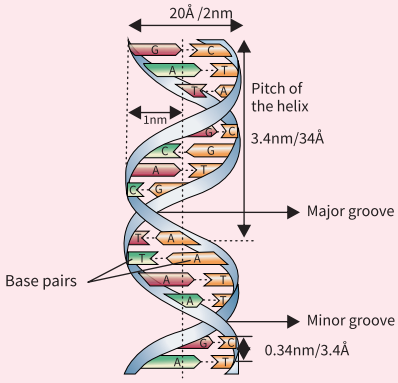
First position	Second position U	Second position C	Second position A	Second position G	Third position
U	UUU Phe	UCU Ser	UAU Tyr	UGU Cys	U
	UUC Phe	UCC Ser	UAC Tyr	UGC Cys	C
	UUA Leu	UCA Ser	UAA Stop	UGA Stop	A
	UUG Leu	UCG Ser	UAG Stop	UGG Trp	G
C	CUU Leu	CCU Pro	CAU His	CGU Arg	U
	CUC Leu	CCC Pro	CAC His	CGC Arg	C
	CUA Leu	CCA Pro	CAA Gln	CGA Arg	A
	CUG Leu	CCG Pro	CAG Gln	CGG Arg	G
A	AUU Ile	ACU Thr	AAU Asn	AGU Ser	U
	AUC Ile	ACC Thr	AAC Asn	AGC Ser	C
	AUA Ile	ACA Thr	AAA Lys	AGA Arg	A
	AUG Met	ACG Thr	AAG Lys	AGG Arg	G
G	GUU Val	GCU Ala	GAU Asp	GGU Gly	U
	GUC Val	GCC Ala	GAC Asp	GGC Gly	C
	GUA Val	GCA Ala	GAA Glu	GGA Gly	A
	GUG Val	GCG Ala	GAG Glu	GGG Gly	G

Salient features

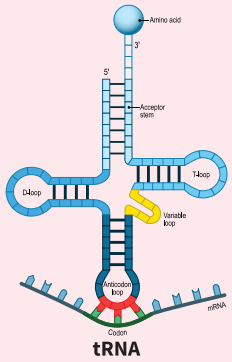
- Triplet in nature
- Code is degenerate
- Contiguous in manner
- Universal, Unambiguous
- Initiator codon (AUG)
- Stop/ Terminator codons (UAA, UAG, UGA)

STRUCTURE

DNA

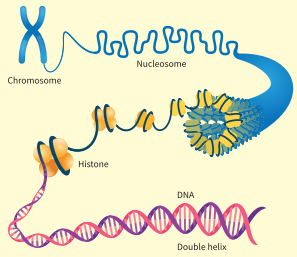


RNA



A molecule that can act as a genetic material must fulfill the following criteria:
(i) It should be able to generate its replica (Replication).
(ii) It should be stable chemically and structurally.
(iii) It should provide the scope for slow changes (mutation) that are required for evolution.
(iv) It should be able to express itself in the form of 'Mendelian Characters'.

PACKAGING OF DNA HELIX



Histones are organised to form a unit of eight molecules called histone octamer. The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome. A typical nucleosome contains 200 bp of DNA helix.

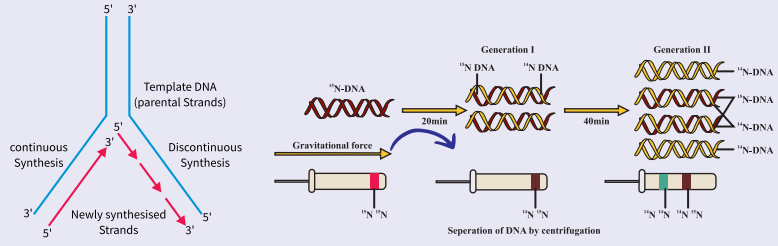
Central Dogma of Molecular Biology

Replication

DNA → **Transcription** → **mRNA** → **Translation** → **Protein**

REPLICATION

Replication is the copying of DNA from parent DNA



DNA dependent DNA polymerase - Initiates DNA Synthesis

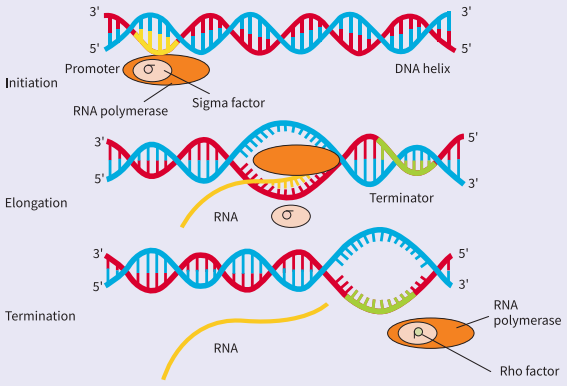
Primase - Aids the formation of primers

DNA ligases - Join fragments of lagging strand

Helicase - To unwind DNA helix

Topoisomerases - Relieve stress on DNA due to unwinding

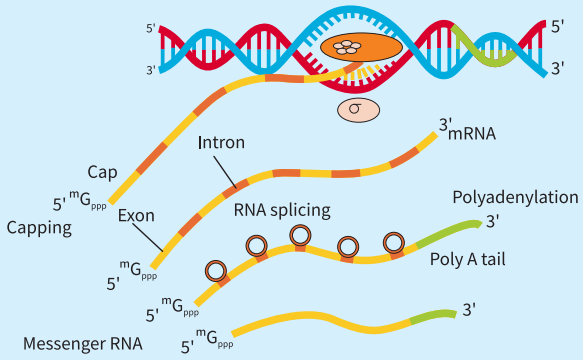
Transcription in Prokaryotes



- No division of labour.
- No processing.

5'end (up stream) - Promoter (Transcription start site)
Between Promoter and terminator - Structural gene
3'end (down stream) - Terminator (Transcription stop site)

Transcription in Eukaryotes

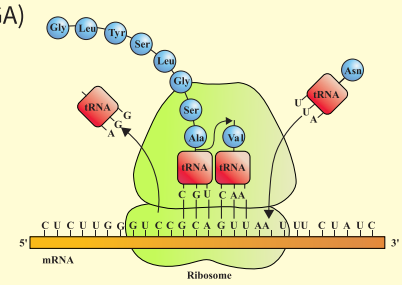


In eukaryotes, there are two additional complexities –

- There is a clear cut division of labour.
- Processing of hnRNA involves - Splicing, capping and tailing

TRANSLATION

1) Charging of tRNA: (aminoacylation) Aminoacyl tRNA synthetase catalyze aminoacylation
2) Initiation: Binding site (A – site), Peptidyl site (P – site)
3) Elongation: Amino acids linked by peptidyl transferase
4) Termination: Release Factor recognise STOP codons (UAA, UAG/UGA)

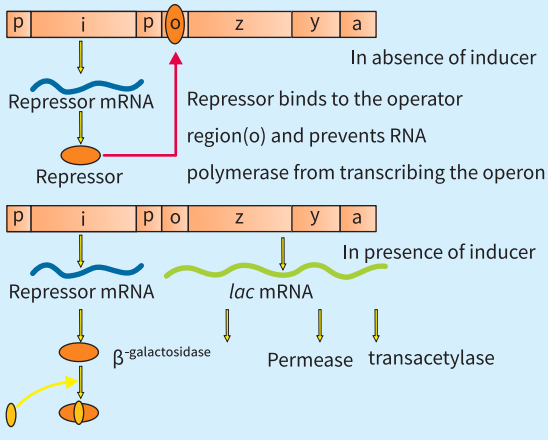


HUMAN GENOME PROJECT (HGP)

The Human Genome Project was a 13-year project coordinated by the U.S. Department of Energy and the National Institute of Health. It is conducted to identify all the estimated genes in human to determine 3 billion chemical base pairs. Introduction to tools for data analysis and storage.

Regulation of Gene Expression - LAC OPERON

Proposed by a geneticist, Francois Jacob and a biochemist, Jacque Monod



DNA FINGERPRINTING

Alec Jeffreys used a satellite DNA as probe that shows very high degree of polymorphism. It was called as Variable Number of Tandem Repeats (VNTR). The technique, as used earlier, involved Southern blot hybridisation using radiolabelled VNTR as a probe. It included
(i) isolation of DNA,
(ii) digestion of DNA by restriction endonucleases,
(iii) separation of DNA fragments by electrophoresis,
(iv) transferring (blotting) of separated DNA fragments to synthetic
membranes, such as nitrocellulose or nylon,
(v) hybridisation using labelled VNTR probe, and
(vi) detection of hybridised DNA fragments by autoradiography. A schematic representation of DNA fingerprinting is shown in Figure.