

Molecular Basis of Inheritance: Revision Sheet

CBSE Class 12 Biology · Genetics and Evolution unit · useful for NEET

DNA at a glance

Fact	Value / rule
Strands	Two, antiparallel (5'→3' and 3'→5')
Base pairing	A=T (2 H-bonds); G≡C (3 H-bonds); Chargaff: A = T, G = C
Distance between base pairs	0.34 nm
Base pairs per turn / pitch	~10 bp / 3.4 nm
Packaging	DNA + histone octamer = nucleosome; euchromatin (active), heterochromatin (inactive)
Why DNA, not RNA	RNA's 2'-OH is reactive; thymine adds stability; DNA is better for storage

Key experiments (method → result → conclusion)

Experiment	Key method	Conclusion
Griffith (1928)	Heat-killed S + live R Streptococcus pneumoniae in mice	Transforming principle exists
Avery, MacLeod, McCarty (1944)	Enzymes destroying protein, RNA or DNA	DNA is the transforming principle
Hershey & Chase (1952)	Phages labelled with ³² P (DNA) or ³⁵ S (protein)	DNA is the genetic material
Meselson & Stahl (1958)	E. coli in ¹⁵ N then ¹⁴ N; density separation	Replication is semi-conservative

Replication vs transcription vs translation

	Replication	Transcription	Translation
Makes	DNA	RNA	Polypeptide
Template	Both DNA strands	One strand (3'→5')	mRNA
Machinery	DNA polymerase, ligase	RNA polymerase	Ribosome, tRNA
Scope	Whole genome	One gene	One mRNA
Where (eukaryotes)	Nucleus	Nucleus	Cytoplasm

Transcription details

Item	Key point
Transcription unit	Promoter (upstream) – structural gene – terminator
Bacteria	One RNA polymerase; σ factor (start), ρ factor (stop)
RNA polymerase I	rRNAs: 28S, 18S, 5.8S
RNA polymerase II	hnRNA (precursor of mRNA)
RNA polymerase III	tRNA, 5S rRNA, snRNAs
Processing	Splicing (introns out), capping (5'), tailing (poly-A at 3')

Genetic code and translation

Feature	Detail
Codons	64 triplets: 61 code amino acids; 3 stop (UAA, UAG, UGA)
Start	AUG — also codes methionine
Properties	Unambiguous, degenerate, comma-less, nearly universal
tRNA	Adapter; clover leaf (2D), inverted L (3D); charged by aminoacylation
Peptide bond	Catalysed by 23S rRNA in bacteria (ribozyme)
Termination	Release factor binds the stop codon

Lac operon (E. coli; Jacob and Monod)

Gene / part	Role
i	Codes for the repressor
Operator	Repressor binds here to block transcription
z, y, a	β -galactosidase, permease, transacetylase
No lactose	Repressor on operator → genes OFF
Lactose present	Lactose (inducer) binds repressor → genes ON
Type	Negative regulation

HGP and DNA fingerprinting

HGP (1990-2003): ~3 billion bp; less than 2% codes for proteins; 99.9% of bases identical between people; differences include SNPs. **DNA fingerprinting:** VNTRs → isolate DNA → restriction digest → gel electrophoresis → Southern blotting → labelled probe → autoradiography. Uses: forensics, paternity.