

CH. MOLECULAR BASIS OF INHERITANCE

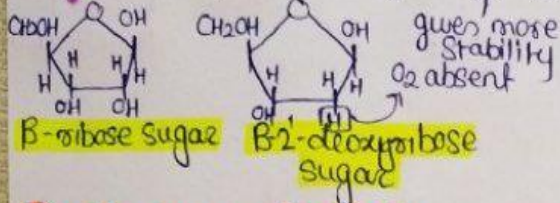
Deoxyribonucleic acid (DNA): Nitrogenous Bases:

- acidic, -ve charge, genetic material

Sugar **Base** **phosphate**
nucleoside nucleotide

Pyrimidine (1 ring) Purines (2 ring)
Cytosine uracil Thymine Adenine Guanine (RNA)

Sugar: 5C pentose sugar: genetic material



Packaging of DNA:

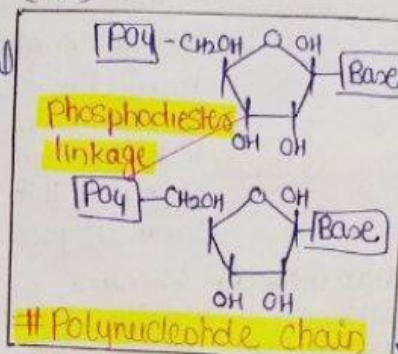
- DNA 2.2m long
- wrapped with basic AA lysine & Arginine

H₁ protein - linked b/w two nucleosome

Beads on String = chromatin
Non-histone chromosomal protein = stability of packaging

Euchromatin	Heterochromatin
loosely packed	tightly packed
active transcription	inactive / can not transcribe
lightly stained	dark stain

Watson & Crick Model



Chargaff Rule:

Purines = pyrimidines
 $A + G = T + C$

- DNA is double stranded
- Both strands antiparallel & joined through H bond
- dist. b/w two bp 0.34nm
- pitch of DNA 3.4nm

Search for genetic material:

1. **Griffith**: Transforming Principle

Bacteria → St. pneumonia → Rough - Non-virulent
Smooth - virulent

S live	R live	heat killed S	heat killed S + R strain
mouse pneumonia death	mouse live	mouse live	mouse pneumonia death

@Gargigauke

II. Biochemical Analysis:

Avery, McCleod, McCarty

Protein	Lipid	RNA	DNA	Carbohydrate
+ live R	+ live R	+ live R	+ live R	+ live R
Survive	Survive	Survive	DIE	Survive

Character of genetic material:

- Chemically more stable
- Can self replicate
- Should be prone to errors
- Should express itself in mendelian characters

RNA world Hypothesis suggest that RNA would have arrived first
RNA = Genetic material + Ribozymes

III. Hershey - chase Expt

- Blender's Expt:
- Bacteriophage → Transduction
- Radioactive Isotopes
DNA → ³²P; Capsid → ³⁵S



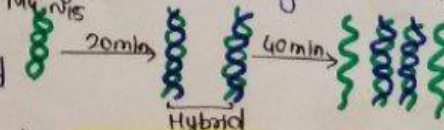
- DNA with ³²P was transferred from virus into bacteria
- proven DNA is genetic material

Meselson - Stahl Expt:

Replication is Semiconservative

- E. coli. Cultured on N¹⁵ (heavy isotope)

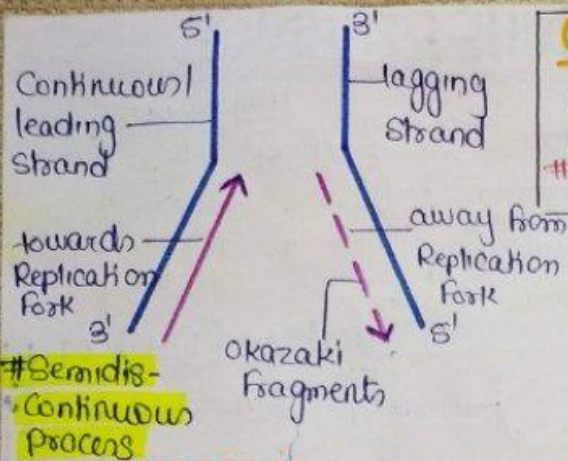
after 20 min Hybrid DNA



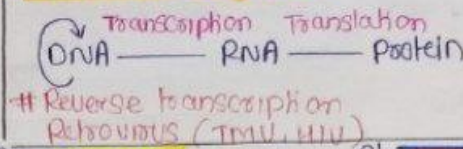
To obtain density strand CsCl₂

Replication in Prokaryote

- Topoisomerase (Gyrase) open super coils
- Helicase enzyme break H bond
- to avoid Complementary bonding of both strand single stranded binding protein stabilize DNA
- addⁿ of deoxynucleotide triphosphate in 5'-3'OH
- Primase = DNA dependent RNA Polymerase synthesize oligonucleotide seq.

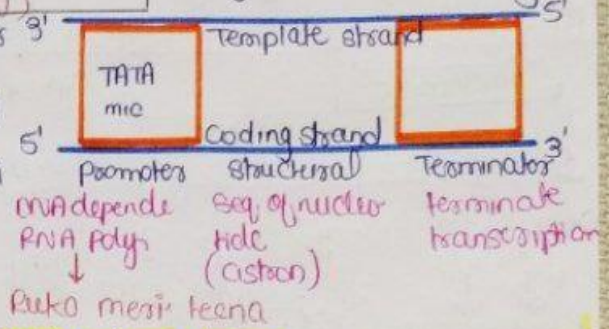


Central Dogma:



Transcription:

- monocistronic = Eukaryote
- polycistronic = Prokaryote



Genetic Code: George Gamow

3 nucleotide → 1 codon
20 AA $4^3 = 64$

Nirenberg & Matthaei: poly U mRNA

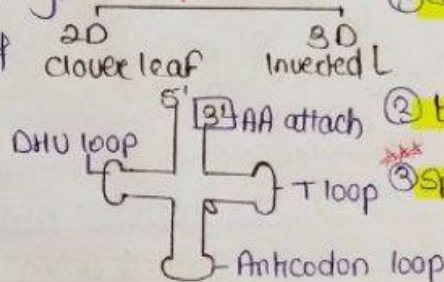
Har Gobind Khorana: alternative tail of C/U → our genetic code is triplet

Properties of Genetic Code:

- Commaless, Unambiguous
- non-overlapping, Redundant
- Degenerate
- Universal Except Virus & mitochondrial DNA
- Start Codon AUG, methionine
- Stop codon UAA, UAG, UGA

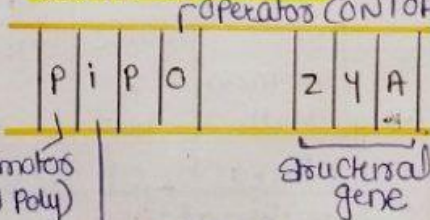
t-RNA:

> Transfer RNA Adapter / Soluble



Lac Operon:

Jacob and Monod



Lac Z = β galactosidase

Lac Y = permease ↑ permeability of galactoside

Lac A = transacetylase
transfers acetyl group on β galactosidase

@Ganggaikar

Translation:

Activation of Amino acid:

ATP + Enzyme + tRNA → charged tRNA

- ① Initiation: Smaller subunit attaches with mRNA, larger unit = 3 sites [APE]
- ② Elongation: aminoacyl site shifts to A → P → E
- ③ Termination: stop codon terminate process.

Human Genome Project:

- haploid content of nucleus 3×10^9 bp
- 1990-2003 (13 yrs)
- 9 billion dollars

Goals of HGP:

- ① Identify 20,000-25,000 genes
- ② Store this info. into databases
- ③ Address ethical, legal, social issues, genetic disorders.

Methodology:

- (Expressed seq. tag)
 - Approach directly starts with parts of DNA which express in mRNA
- (Seq. annotation)
 - Sequencing entire genome

DNA Fingerprinting:

Alec Jefferys

Bulk DNA

99.9%

Satellite DNA

0.1%

Repetitive Seq of Nucleotide

Variable no. tandem repeats

Short tandem repeats

- ① AT:GC Ratio
- ② length
- ③ no. of repetition