MBI [Molecular Basis of Inheritance]

Parents → Progeny → Cells (cells)

Reseem. → Parents → inheritance → Progeny

Mendel → factor → chromosomes → (DNA + Protein)

Nucleic Acid ?? ??

A —Z^α→ B

A —X→ B

Topic Covered :→ (Biomolecule)**

1. Nucleic Acid (DNA and RNA)
2. Search of Genetic Material
3. RNA World + central Dogma
4. DNA Replication (Duplication)
5. Transcription (DNA → RNA)
6. Genetic code
7. Translation (RNA → Protein)
8. Regulation of Gene Expression
9. HGP (Human Genome Project)
10. DNA fingerprinting.

Introduction :→

* In chapter genetics we have studied → Pattern of Inheritance / Genetic basis of Inheritance
* At the time of Mendel, the (Biochemical)** nature of those "factors" controlling the pattern of inheritance was not clear**
* over Next 100 → we finally came to Know that DNA is genetic material in most** of organisms. (* Not all organisms)

(1) Nucleic acid :→

* There are two type of nucleic acid found in living system. → DNA (Deoxyribonucleic acid), RNA (Ribonucleic acid)
* DNA is act as genetic material in most of the organism. RNA act as genetic material in some viruses.
* RNA also → mostly function as messenger RNA; other
  - Adapter molecule (t-RNA)
  - Structural molecule
  - In few case Catalytic molecule.

"Ribozyme" → "Act as Enzymes" (Ribosomes)

"All Enzy are Protein" => False

Almost all Enzymes are protein = True

Nucleotide (monomeric unit of Nucleic acid) → (Polymer)

Nucleotide → Nucleoside, H_3PO_4

Nucleoside → Nitrogen base, Sugar (Pentose) "5c"

Sugar → Deoxyribose (in DNA), Ribose (in RNA)

"2-deoxy-D-ribose" — removed

β-D-ribose

(OH) above the plane of ring on anomeric Carbon [β]

(OH) below the plane of ring [α]

Nucleic acid (Polymer) → Nucleotide (monomeric) → Nitrogenous Base, (5c) Pentose Sugar, H_3PO_4

Nitrogenous Base (Heterocyclic Aromatic comp) → Single ring (Pyrimidine), Double ring (Purine)

Pentose Sugar → Ribose (+nt) → RNA; Deoxy ribose (+nt) → DNA

Purine (double ring) (4N+5C) → smaller

Pyrimidine (single ring) → Hetero cyclic (4C+2N)

imadazole, Pyrimidine → Numbering

Purine → 9N, Pyrimidine → 1N

Pyrimidine: * Cytosine, * uracil, * Thymine → RNA; Cytosine, Thymine → DNA; Purine: * Adenine, * Guanine

Adenine (A) => 6-amino purine (6-NH_2)

(A&G) → metabolism → (uric acid)**

Guanine (G) => 2-amino-6-oxypurine

Cytosine (C) => 2-oxy-4-amino pyrimidine

Uracil (U) => 2,4-dioxypyrimidine (methylation) → (Thymine)

Thymine (T) => 2,4-dioxy-5-methylpyrimidine = (5-methyl uracil) [Methylated uracil]

✓ DNA → A, T, G, C

✓ RNA → A, U, G, C

Uracil + 5' CH_3 → (Thymine)

when Sugar + Nitrogen base = Nucleoside

1'-1-N, 1'-9-N → glycosidic Bond

1'-C-OH, 1-N-H

(β-N-glycosidic Bond) (Linkage)

Ribose

β-N-glycosidic bond → syn, Anti form (Anti conformers predominates**) → Steric Repulsion

syn, Anti

1' one prime

Ribose: 1' → β; (D) 4 → orientation; (5C) Ribo-; (5memb) furan; Sugar → ose (Suffix); (cyclic) → 5c/6c; Aldol Sugar → 1C anomeric; Ketose sugar → 2C anomeric

RNA → Ribose; 'O' is removed from 2nd carbon → β-D-Ribofuranose

✓ 2-deoxy ribose → (DNA)

N-methyl methamine

(Adenosine diphosphate)

Adenosine triphosphate → "ATP" → Energy Currency. → Ribose

(Adenosine monophosphate)

(High energy bond)

A.A. — A.A. → A. anhydride

✓ ATP → ADP + iP

✓ ADP → AMP + iP

dephosphorylation

(Digestion) ✓ AMP → Nucleoside + iP; Nucleoside → N_2-Base + Sugar

→ ATP → dATP; → GTP → dGTP; → UTP → dTTP; → CTP → dCTP → NTPs

(Ribose) Nucleoside Triphosphates

(deoxy) dNTPs

deoxy nucleoside Triphosphates

N_2-Base		Sugar	Nucleoside	Phosphate	Nucleotide
Purine -	Adenine +	Ribose	Adenosine	+	* (Adenylic acid) * Adenosine 5-monophosphate
Purine -	Guanine +	Ribose	Guanosine	+	Guanylic acid
Pyrimidine -	Cytosine +	Ribose	Cytidine	+	cytidylic acid
-	Uracil +	Ribose	Uridine	+	Uridylic acid
DNA →	Adenine +	deoxyribose	deoxyadenosine	+	(deoxyadenylic acid) deoxy adenosine monophosphate
→	Guanine +	— " —	deoxyguanosine	+	
→	Cytosine +	— " —	deoxycytidine	+	
→	Thymine +	— " —	deoxythymidine / Thymidine	+	

(RNA)

ester bond, anhydride acid, formation, glycosidic

"Phosphodiester linkage" → (always formed between two nucleotide)

(3'-5' phosphodiester linkage)

5' → PO_4^{2-} (moiety)

3' OH → (moiety) (more reactive end)

RNA → Ribose; DNA → deoxyribose