NUCLEOTIDE METABOLISM

2nd stage

Lec 3

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A. Barrington Brown/Science Source

Watson and Crick with their model of the DNA molecule.

Nucleic acids
are polymers of nucleotides, linked by phosphodiester bond.

The nucleic acids are of two main types:

Deoxyribonucleic acid (DNA)
Ribonucleic acid (RNA)

Nitrogenous Bases

Two classes of **nitrogenous bases** namely:
purines and **pyrimidines**

- **Purine Bases**

Adenine (A)
Guanine (G).

- **Pyrimidine Bases**

Cytosine (C)
Uracil (U)
Thymine (T).

Pentose Sugars

- DNA contains D-2-deoxyribose
- RNA contains D-ribose.

Nucleotides

A nucleotide = Base + Sugar + Phosphate

A nucleic acid = A chain of nucleotides

The nucleotides are of two types:

1. **Deoxyribonucleotides**: are monomeric units of **DNA** .
2. **Ribonucleotides**: are monomeric units of **RNA**.

- Ribonucleotides (RNA) contain Uracil
- Deoxyribonucleotides (DNA) contain Thymine

Examples

- Adenosine monophosphate (**AMP**)
- Guanosine monophosphate (**GMP**)
- Uridine monophosphate (**UMP**)
- Cytidine monophosphate (**CMP**)

METABOLISM OF PURINE AND PYRIMIDINE NUCLEOTIDES

PURINE METABOLISM

Biosynthesis of purine nucleotides:

Purines are synthesized by most of the tissues ,

- ✓ **the major site is liver**
- ✓ ***Subcellular site* cytoplasm**
- ✓ **Synthesis of AMP and GMP**

1. Denovo synthesis: Major pathway

Synthesis of purine nucleotides from various small molecules (many metabolic pathways in the body).

2. Salvage pathway: Minor pathway

The purines can also be converted to corresponding nucleotides.

DEGREDATION OF PURINE NUCLEOTIDES

- **The end product of purine DEGREDATION in humans is uric acid.**

Xanthine oxidase is an important enzyme that converts hypoxanthine to xanthine, & xanthine to uric acid.

DISORDERS OF PURINE METABOLISM

HYPERURICEMIA AND GOUT

- ✓ **Uric acid is the end product of purine metabolism in humans.**
- ✓ **The normal concentration of uric acid in the serum of adults is in the range of 3-7 mg / dl.**

- ✓ **Hyperuricemia; an elevation in the serum uric acid concentration.**
- ✓ **GOUT is metabolic disease associated with overproduction of uric acid. Uric acid crystals precipitate into joints (Gouty Arthritis), kidneys, ureters (stones)**

PYRIMIDINE METABOLISM

BIOSYNTHESIS OF PYRIMIDINE NUCLEOTIDES

1. Synthesis: aspartate, glutamine and CO_2 lead to formation of pyrimidine ring.

2. Salvage pathway

Degradation of pyrimidine nucleotides

- ✓ **degraded to highlyl soluble products**

β-alanine and β-aminoisobutyrate.

Disorders of pyrimidine metabolism:

OROTIC ACIDURIA:

- ✓ deficiency of Orotatephosphoribosyl transferase and OMP – decarboxylase.
- ✓ are inherited as **autosomal recessive** disorders.

Features

- ✓ anemia
- ✓ Retarded growth
- ✓ Crystals excreted in urine causing urinary obstruction