

SNS COLLEGE OF ALLIED HEALTH SCIENCE
Affiliated to The Tamil Nadu Dr M.G.R Medical University, Chennai



DEPARTMENT OF OPERATION THEATRE AND ANAESTHESIA

TECHNOLOGY

COURSE NAME: BIOCHEMISTRY

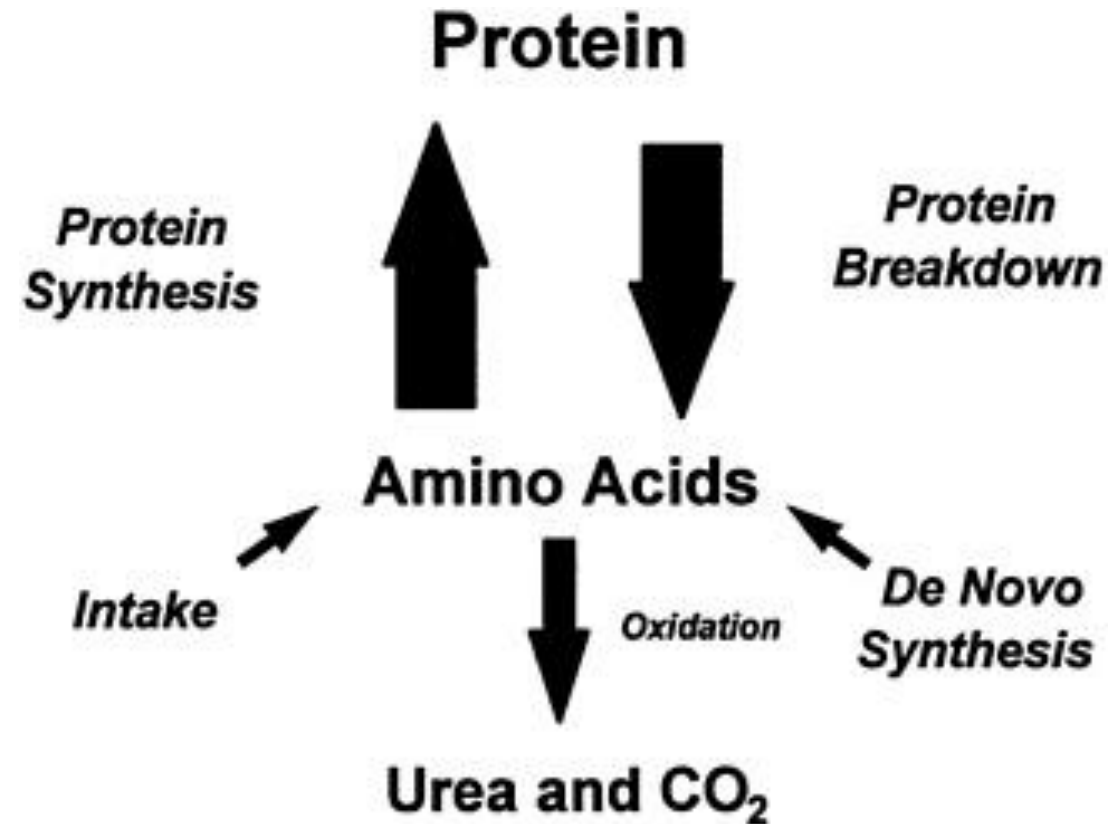
UNIT : 3

TOPIC : PROTEINS – METABOLISM

FACULTY NAME: MITHRA V

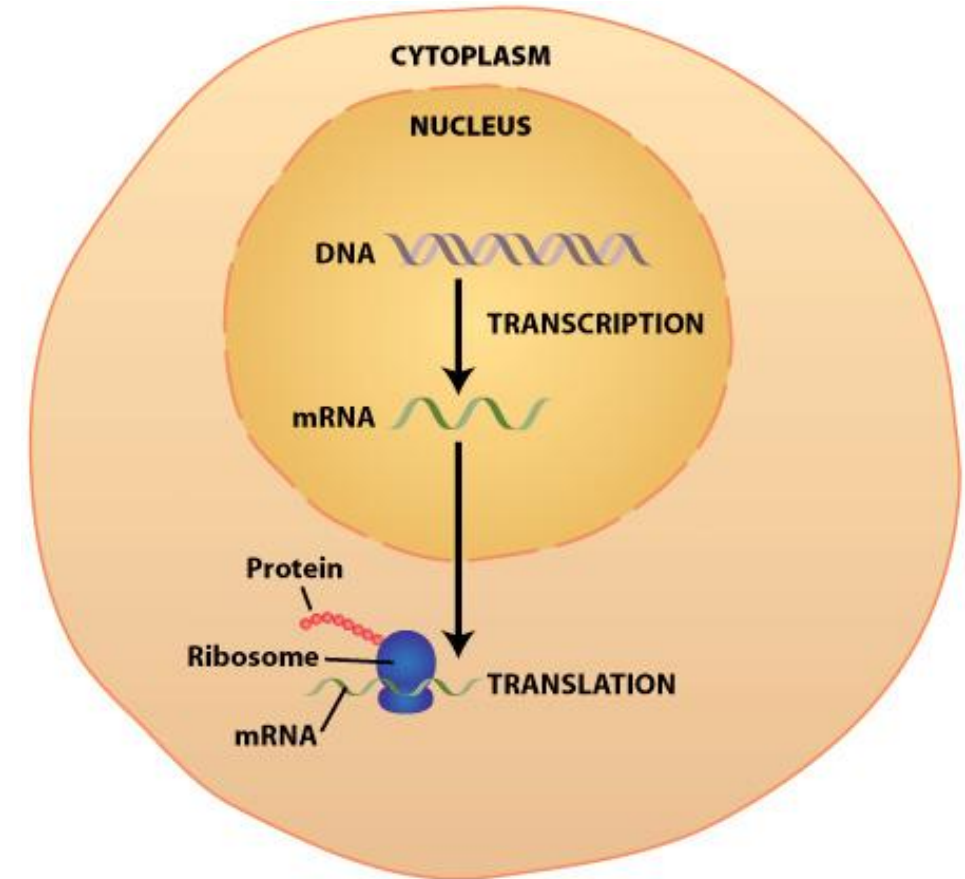
PROTEIN METABOLISM

- **2 Process** - **Protein synthesis** (**Anabolism**) and **Protein breakdown** (**Catabolism**).
- Vital for structural support, enzymatic catalysis, immune defense, signaling, transport, growth, repair and energy.
- Regulated by hormones (e.g., **insulin**, **glucagon**, **cortisol**) and affected by diet, physiological state (**growth**, **fasting**) and diseases.



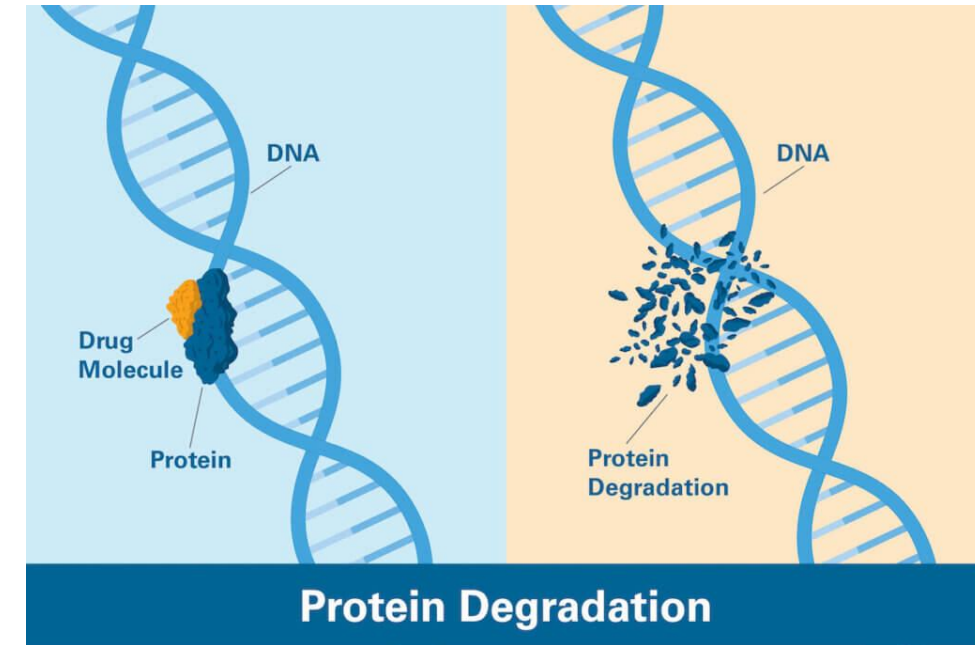
PROTEIN SYNTHESIS (ANABOLISM)

- Assembly of amino acids into polypeptide chains.
- Occurs in ribosomes via **translation**.
- **Transcription:** DNA → mRNA.
- **Translation:** mRNA → polypeptide chain.
- **Post-translational modifications:** Folding and modifications to **form functional protein**.
- **Examples:** Synthesis of muscle proteins or enzymes.



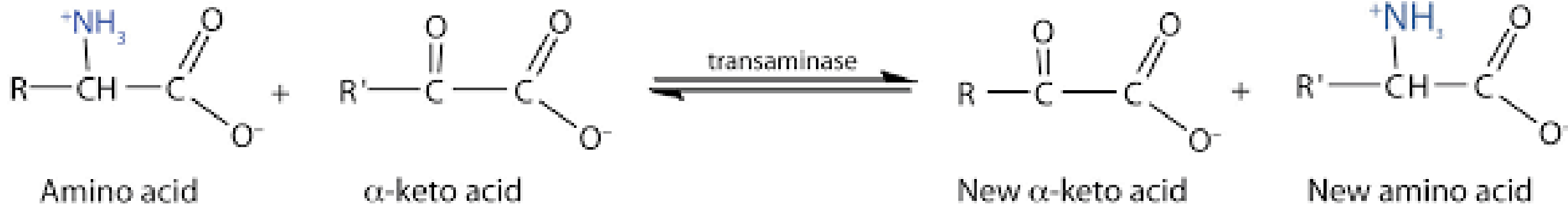
PROTEIN DEGRADATION (CATABOLISM)

- **Breakdown of proteins** into amino acids via proteolysis.
- **Purpose:** Remove damaged proteins, provide energy (e.g., during **starvation**, muscle breakdown in fasting).
- **Digestion:** Proteins → amino acids in stomach and small intestine.
- Used for **new protein synthesis**, energy (via citric acid cycle), gluconeogenesis.
- **Excess nitrogen** → excreted as **urea** (urea cycle).



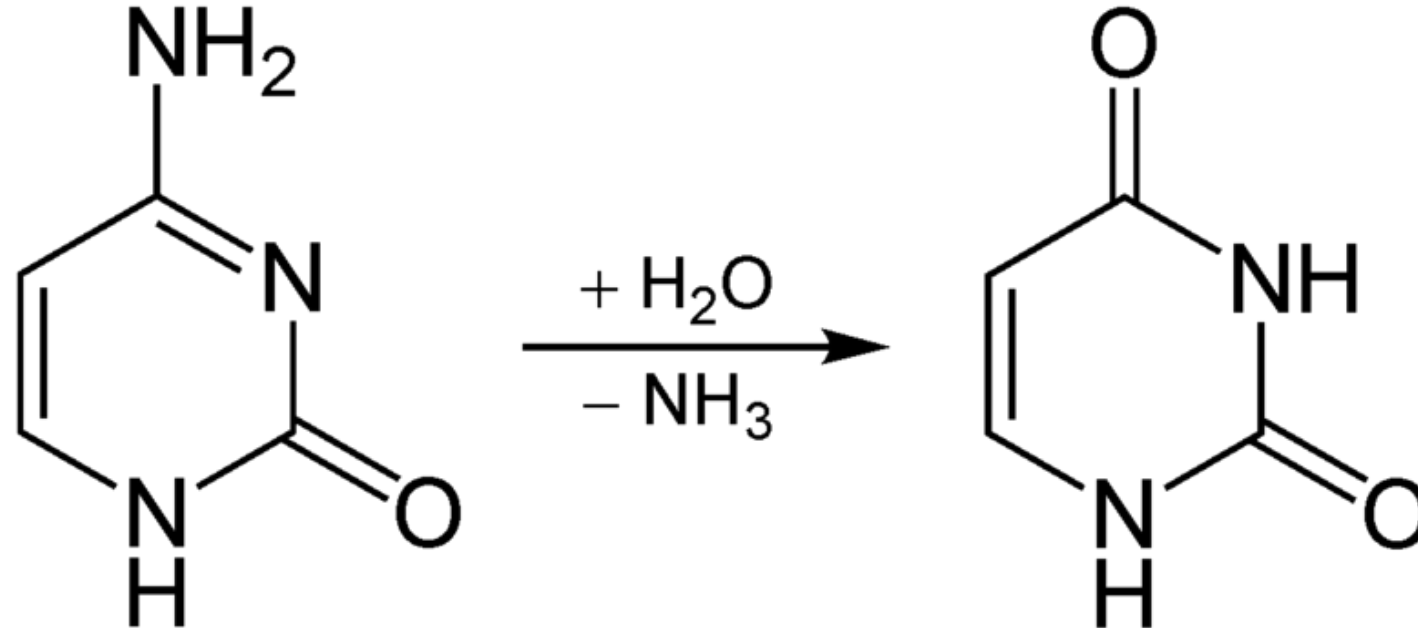
PROTEIN CATABOLISM (BREAKDOWN)

- **Transamination**: Transfer of an amino group from one amino acid to a keto acid, forming a new amino acid and a new keto acid



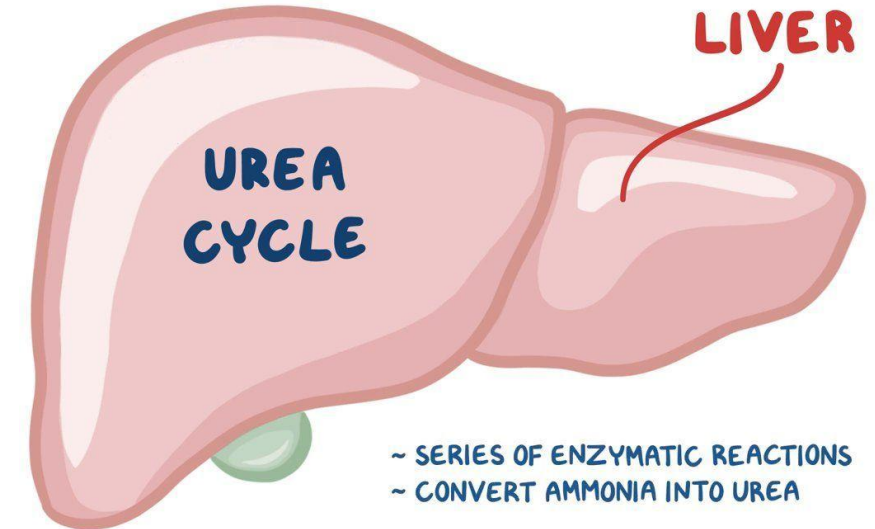
PROTEIN CATABOLISM (BREAKDOWN)

- **Deamination**: Removal of the amino group (-NH₂) from an amino acid, typically as ammonia (NH₃) leaving a keto acid.



UREA CYCLE (AMMONIA DETOXIFICATION)

- Metabolic pathway that converts **toxic ammonia** and carbon dioxide **into urea**.
- Also called as **ornithine cycle**.
- **Location:** Liver (**mitochondria and cytoplasm of liver cells**) (**hepatocytes**).
- **Purpose:** **To detoxify ammonia**, a byproduct of amino acid breakdown, highly toxic (CNS)



Process: Protein Breakdown -----> Amino acids -----> Ammonia -----> Toxic

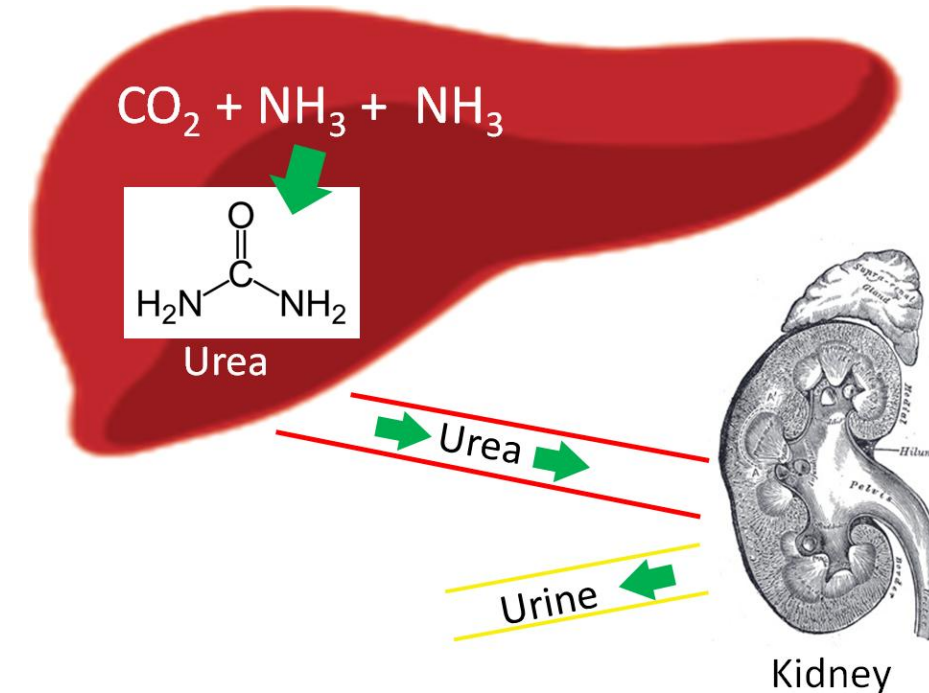
- **ENZYMES:**

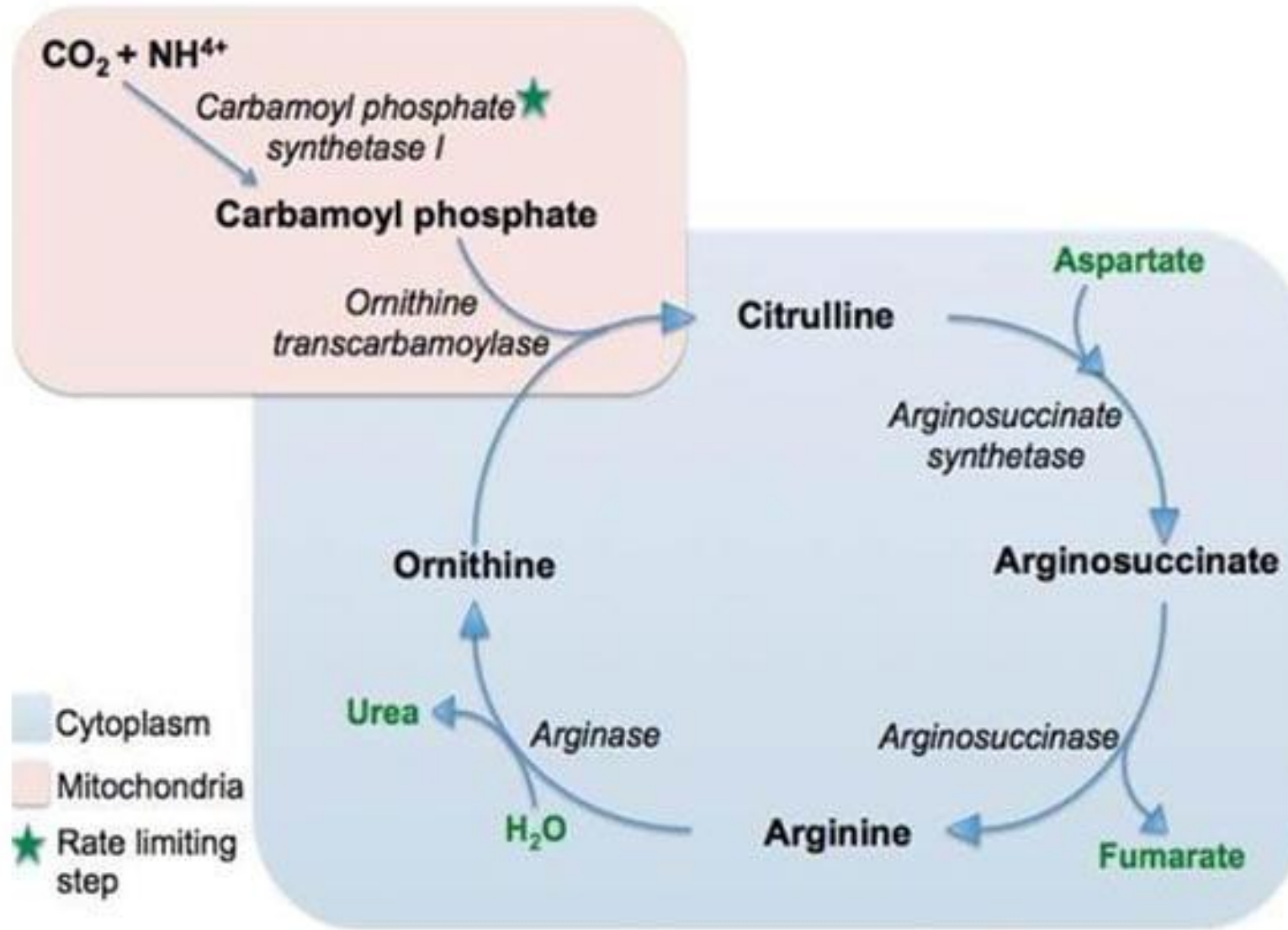
- Carbamoyl phosphate synthetase (CPS1),
- Ornithine transcarbamylase (OTC),
- Argininosuccinate synthetase (ASS),
- Argininosuccinate lyase (ASL) and
- Arginase.

- **EXCRETION:**

- Urea (End Product – Soluble -----> Kidney -----> Urine

NET REACTION:



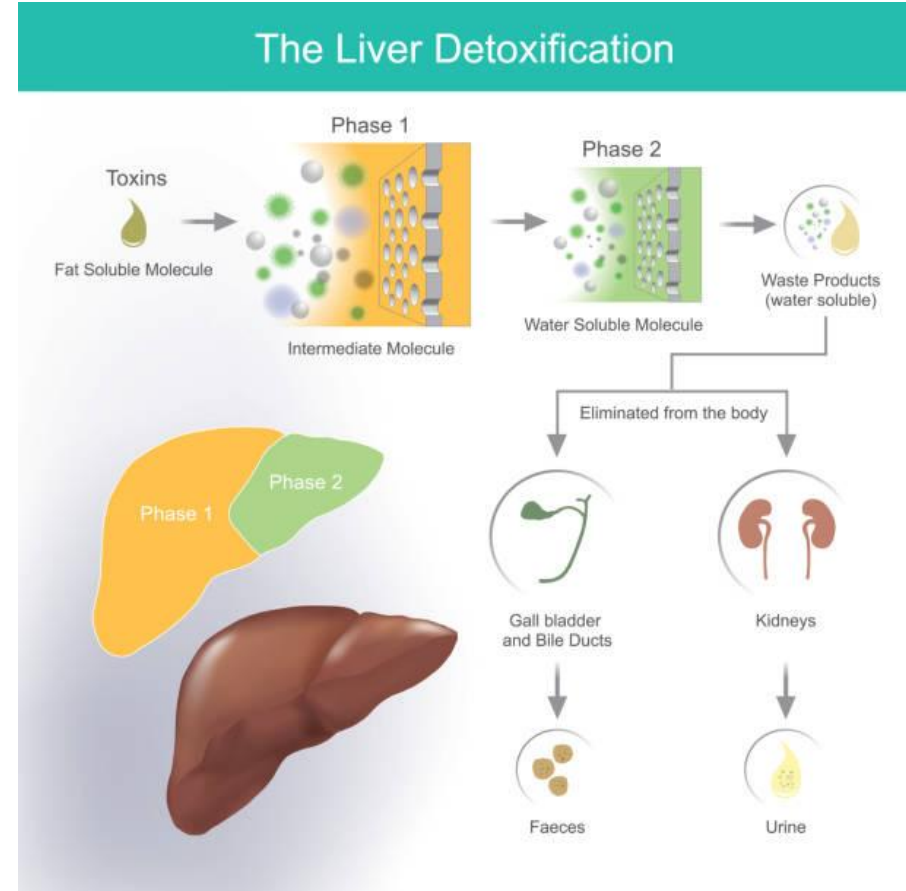
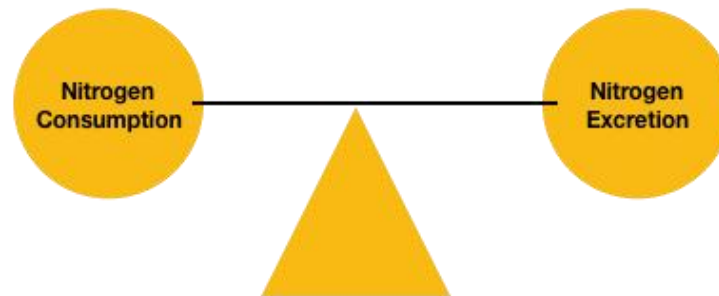


UREA CYCLE - SIGNIFICANCE

- **Nitrogen Excretion:**
- Essential for **nitrogen balance**, Remove excess nitrogen from protein breakdown
- **Detoxification:**
- Converts **toxic ammonia into urea**.

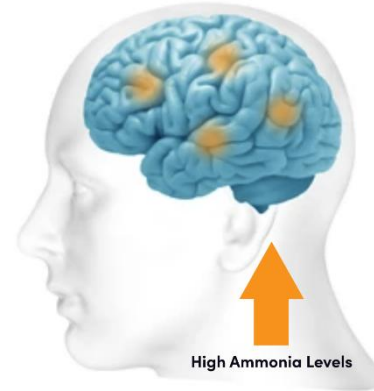


Nitrogen Consumption = Nitrogen Excretion



UREA CYCLE - DISORDERS

- **Hyperammonemia :**
- Buildup of ammonia in the blood, causing insufficient removal of NH_4^+ .
- **Ammonia intoxication:**
- Leads to CNS deterioration.
- Cause lethargy, vomiting, neurological problems, mental retardation, seizures, coma, and death.

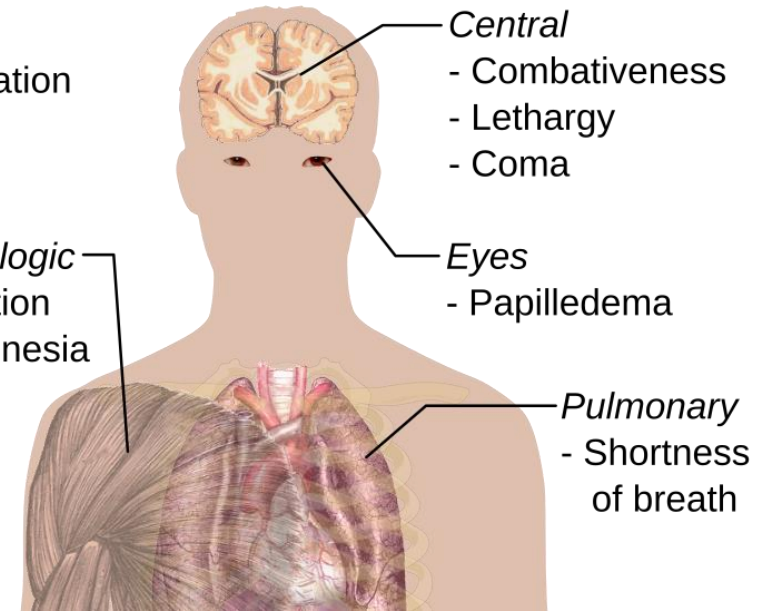


General

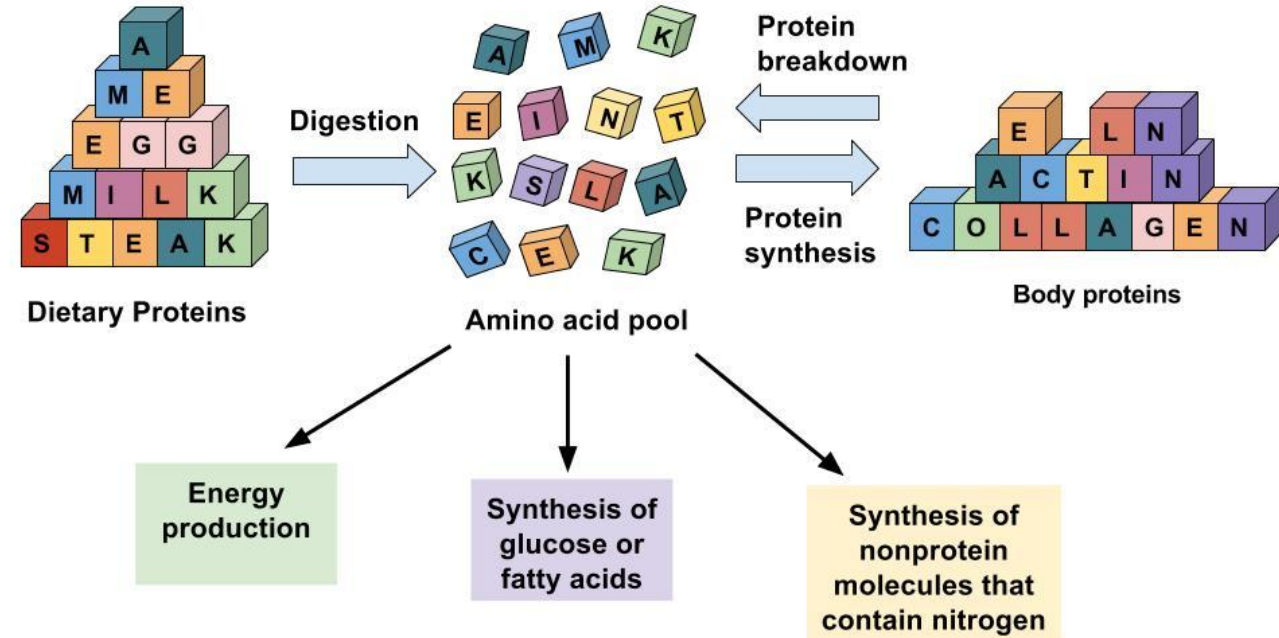
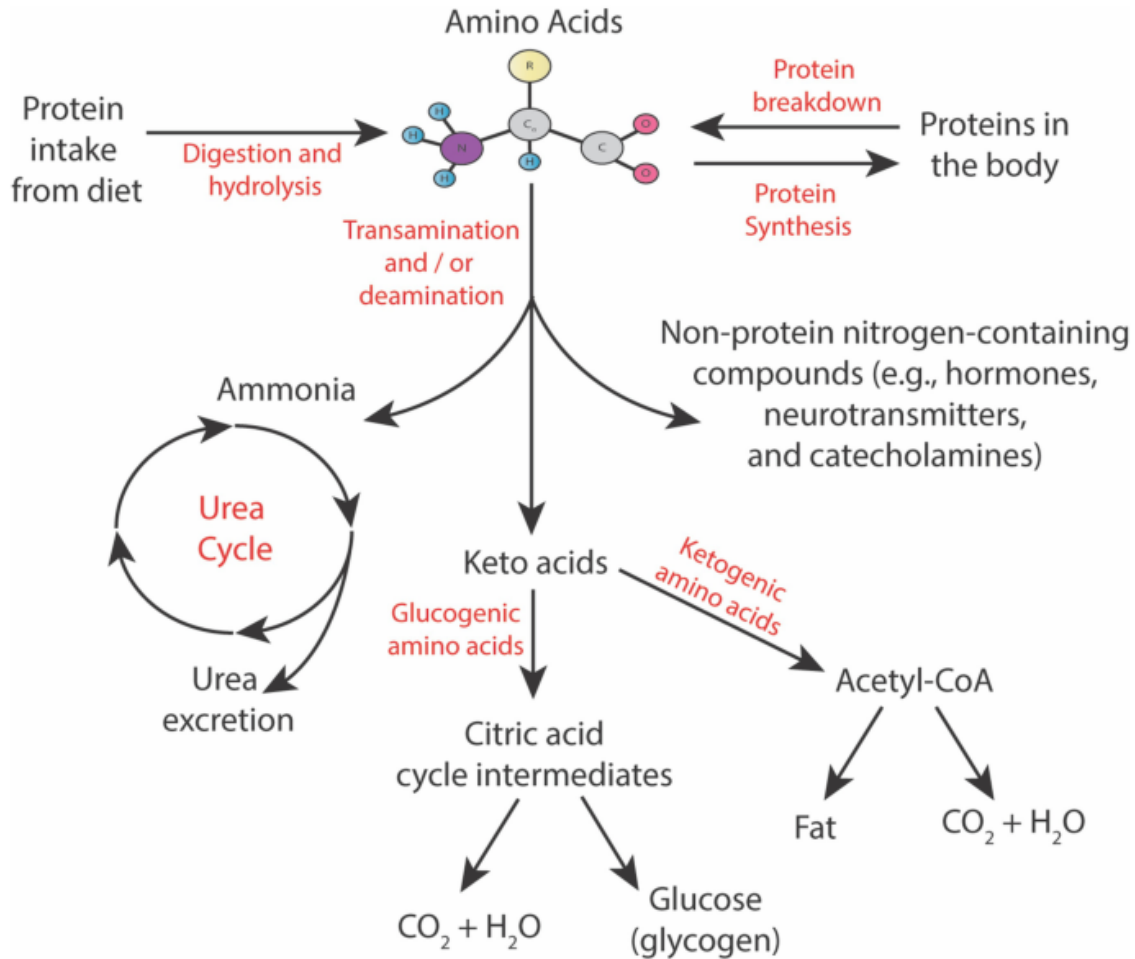
- Growth retardation
- Hypothermia

Muscular/Neurologic

- Poor coordination
- Dysdiadochokinesia
- Hypotonia or hypertonia
- Ataxia
- Tremor
- Seizures



SUMMARY



REFERENCES



- **Lehninger Principles of Biochemistry** - David L. Nelson, Michael M. Cox, Aaron A. Hoskins Edition: 8th Edition (2021)
- **Harper's Illustrated Biochemistry** - Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil Edition: 32nd Edition (2023)
- **Textbook of Biochemistry for Medical Students** - DM Vasudevan, Sreekumari S, Kannan Vaidyanathan Edition: 10th Edition (2023)
- <https://teachmephysiology.com/gastrointestinal-system/liver/protein-and-ammonia-metabolism-in-the-liver/>
- https://www.osmosis.org/notes/Protein_Metabolism

THANK YOU