Chapter 24: Nutrition, Metabolism & Body Temperature Regulation

Food energy measured in kcals. One kcal = energy to heat 1 kg water 1°C.

(A) Diet & Nutrition

Nutrients required for growth, maintenance, repair.

Major = **macronutrients**: Carbohydrates, Proteins, Lipids. Water.

**Micronutrients** = vitamins & minerals.

Recommendations depicted with pyramids.

**Essential** nutrients required in diet; non-essential can be created in body. 45-65% kcal should come from carbohydrates, 10-25% from proteins.

**Vitamins** - water or fat soluble. Many in coenzymes. Some ingested as precursors. Antioxidants fight free radicals.

**Minerals** with specific functions.

(B) Metabolism Overview


**Cellular respiration**: ATP production (from ADP) using oxygen. Coenzymes reduced to temporarily store energy. ATP production is phosphorylation.

(C) Nutrient Metabolism

-1- Carbohydrates

Stored form = glycogen. Creation is **glycogenesis**, breakdown = **glycogenolysis**. Carbohydrate loading promotes glycogen storage.

Amino acids can be used for **gluconeogenesis**.

**-2- Lipids:** triglycerides yield glycerol and acetyl CoA via **beta oxidation**. Breakdown accumulates **ketone bodies** (acidic). **Lipogenesis** vs. **lipolysis**.

**-3- Proteins:**

a) amino acids can be deaminated to produce pyruvate, acetyl CoA, accumulates **ketone bodies**.

The amino group $\rightarrow$ ammonia $\rightarrow$ urea.

Protein synthesis genetically controlled.

(C) **Metabolic States**

alternation between catabolism & anabolism.

**-1- Absorptive State:** anabolism > catabolism.
Glucose the main fuel.
Insulin the influential hormone.

**-2- Postabsorptive State:** catabolism > anabolism.

Glycogenolysis in liver and muscle; lipolysis; protein breakdown.
Glucagon, epinephrine thyroxine influential.

(D) **Role of Liver**

Cholesterol metabolism and transport.
VLDLs made in liver, release fat, enter peripheral circulation as LDLs (bad cholesterol).
HDLs (good cholesterol) travel back to liver for processing.
(E) **Energy Balance** responsible for maintenance of body weight.

**BMI** a common measure.

Food intake regulated by hypothalamus.

Hormones involved, e.g. CCK and leptin inhibit appetite, ghrelin stimulates. Psychological involvement also.

Metabolism generates heat.

**BMR** effected by gender, age, surface area, thyroxine concentrations and more...

Core temperatures regulated.

Heat transferred via radiation, conduction, convection and evaporation.

Insensible vs. sensible (controlled) sweat. Hypothalamic control.

Body temperature regulation—
   involves dermal blood vessels, sweat, muscular contractions, thyroid hormones.

Hyperthermia leads to heat exhaustion → heat stroke.

Fever due to cytokines (pyrogens).

Hypothermia slows metabolism.

Many genetic disorders of metabolism, e.g. PKU, Cystic Fibrosis