SNS COLLEGE OF TECHNOLOGY

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Coimbatore – 35

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DEPARTMENT OF AGRICULTURE ENGINEERING

19AGE307 – ERGONOMICS OF FARM MACHINERY AND IMPLEMENTS

III – YEAR VI SEMESTER

UNIT 1 – INTRODUCTION

TOPIC – ASSESSMENT OF ENERGY EXPENDITURE

Energy Liberation in Human Body

- In the context of human physiology and ergonomics, energy liberation primarily involves the metabolic processes that produce the energy needed for daily activities.
- The primary source of energy for the human body is derived from the breakdown of macronutrients—carbohydrates, fats, and proteins—through processes like glycolysis, the citric acid cycle, and oxidative phosphorylation.
- In the field of ergonomics, the study of energy metabolism is crucial for assessing the physiological demands of work tasks, designing workstations, and optimizing job performance.

Energy Liberation in Human Body

Processes crucial for energy liberation in human body:

- ❖ Glycolysis
- ❖ ATP Production
- ❖ Cellular Respiration
- ❖ Citric Acid Cycle (Krebs Cycle)
- ❖ Oxidative Phosphorylation

Assessment of Energy Expenditure

- Assessing energy expenditure is a critical aspect of ergonomics, as it helps evaluate the physical demands placed on individuals during various tasks or activities.

- The assessment of energy expenditure in ergonomics involves measuring the amount of energy expended by the human body while performing work.

There are two methods for measuring the heat expenditure:

- Direct Calorimetry
- Indirect Calorimetry

Assessment of Energy Expenditure

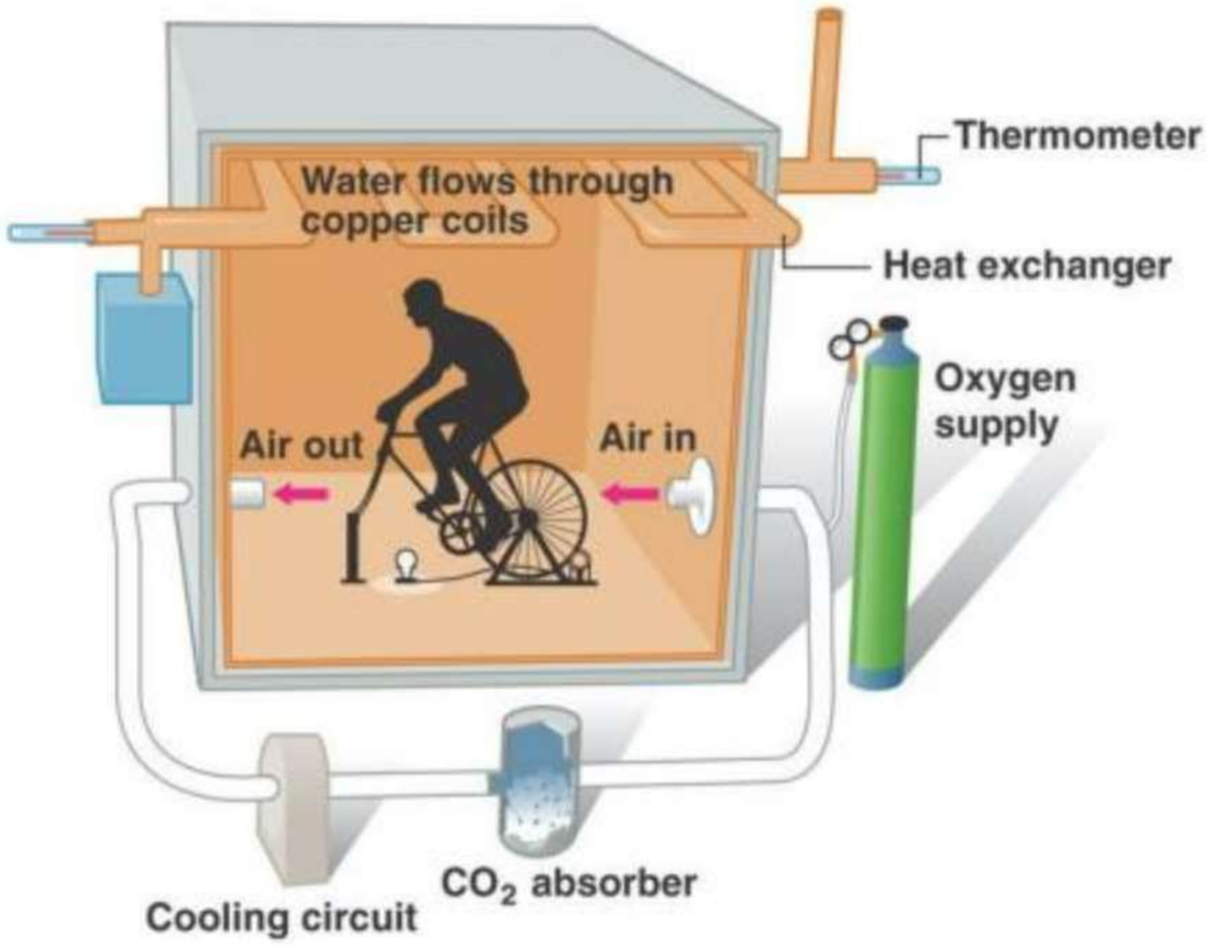
Units of Energy

- Calorie
  - One calorie expresses the quantity of heat necessary to raise the temperature of 1 g of water by 1° Celsius.
- Kilocalorie (kCal)
  - One calorie expresses the quantity of heat necessary to raise the temperature of 1 kg (1 L) of water by 1° Celsius.

Direct Calorimetry

- Directly measures energy expenditure
- Human calorimeter
  - Airtight chamber
  - A person lives or works in the chamber for an extended period of time.
- Changes in water temperature relate directly to an individual's energy metabolism.

Direct Calorimetry



Direct Calorimetry

- Airflow calorimeter
  - Temperature change in air that flows through an insulated space × air's mass and specific heat
- Water flow calorimeter
  - Change in temperature flowing through coils embedded in an environmentally self-contained suit

Direct Calorimetry

- Gradient layer calorimetry
  - Measures heat flowing from the subject through a sheet of insulating materials with piping and cooler water on outside
- Storage calorimetry
  - Subject sits in a known mass of water at a constant temperature. Changes in water temperature are measured.

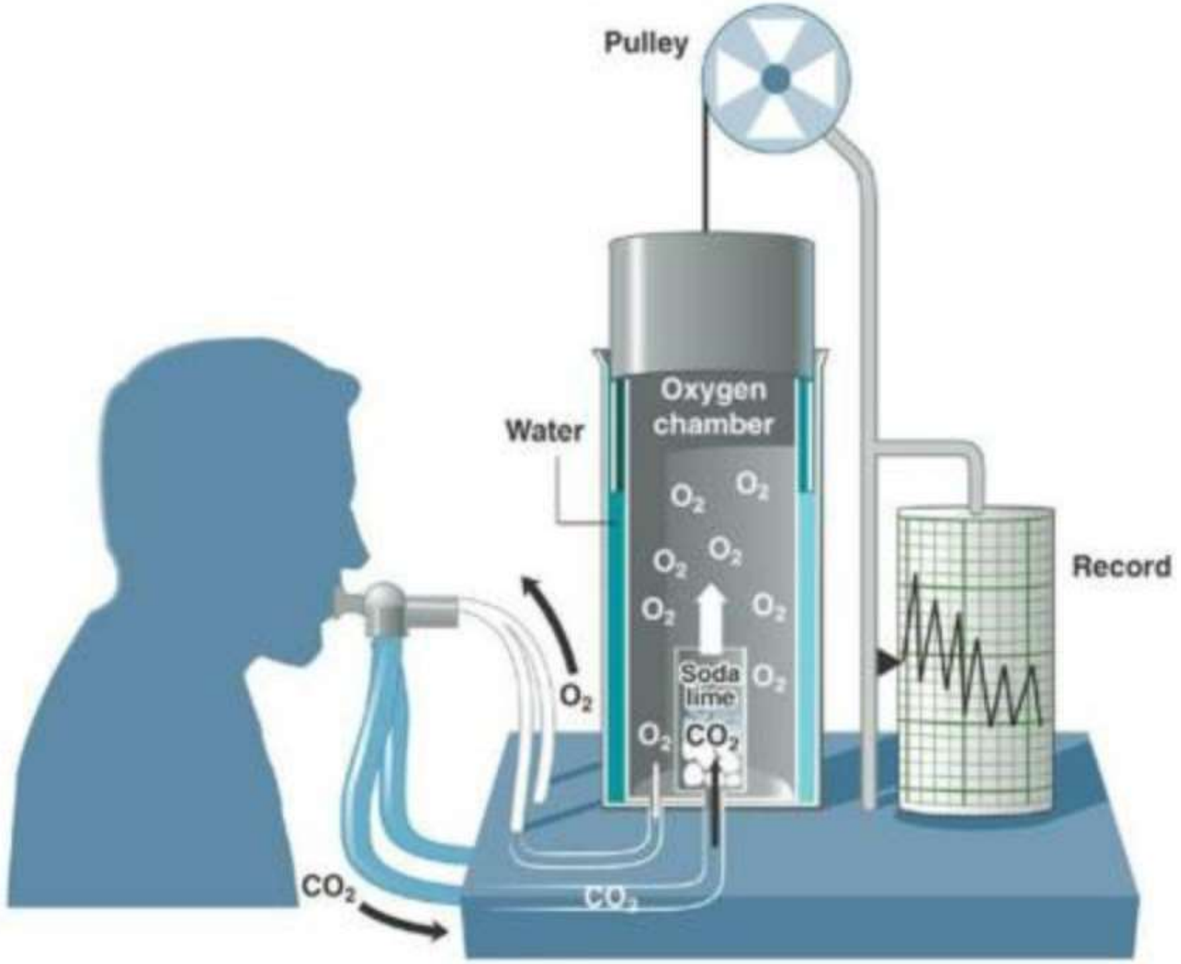
Indirect Calorimetry

- Energy expenditure
  - Measurements of oxygen uptake and carbon dioxide production using:
  - Closed-circuit spirometry
  - Open-circuit spirometry

Indirect Calorimetry

- Closed-circuit
  - Subject breathes 100% oxygen from a prefilled container.
  - A canister of soda lime absorbs the carbon dioxide in exhaled air.
- Open-circuit
  - Subject inhales ambient air
  - Indirectly reflects energy metabolism

Closed or Open Circuit Spirometry



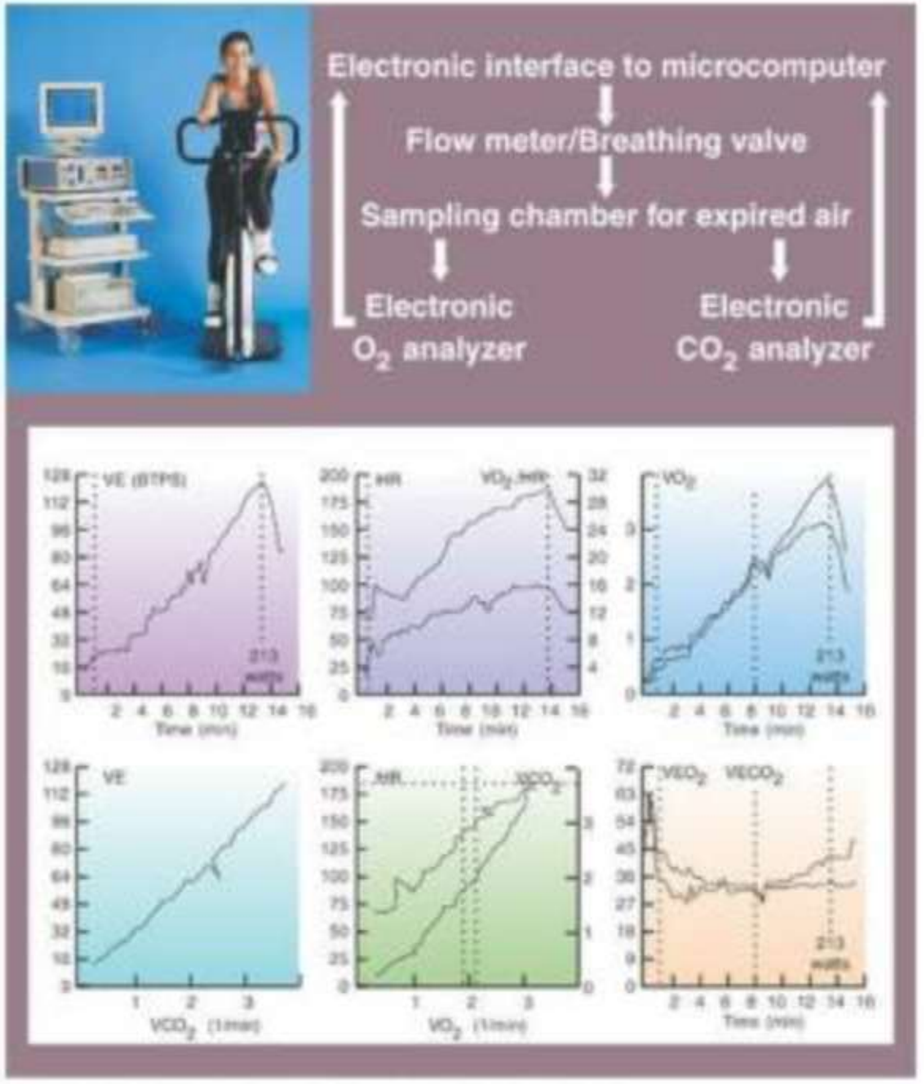
Indirect Calorimetry

- Open-circuit spirometry
  - Portable spirometry
    - Spirometer is small and is carried in a pack.
    - Air volume is metered.
    - Sample is collected to measure concentrations of gases.

Indirect Calorimetry

- Computerized instrumentation
  - Air flow is measured for volume.
  - Gas analyzers measure concentrations of oxygen and carbon dioxide.

Computerized Instrumentation




Thank You!