

Body energy, Metabolic Rate, and Regulation of Food Intake



**FATS, OILS, & SWEETS
USE SPARINGLY**

Key:

- Fat (naturally occurring and added)
- ▼ Sugars (added)

These symbols show fat and added sugars in foods. They come mostly from the fats, oils, and sweets group. But foods in other groups—such as cheese or ice cream from the milk group or french fries from the vegetable group—can also provide fat and added sugars.

MILK, YOGURT, & CHEESE GROUP

Examples:

- 1 cup milk or yogurt
- 1.5 oz natural cheese



2-3 servings



2-3 servings

**MEAT, POULTRY, FISH, DRY BEANS, EGGS,
& NUTS GROUP**

Examples:

- 2-3 oz cooked, lean meat, chicken, or fish
(Count 1/2 cup cooked dry beans, 1 egg, or, 2 tablespoons peanut butter as 1 oz lean meat)

VEGETABLE GROUP

Examples:

- 1 cup raw leafy vegetables
- 1/2 cup other vegetables
- 3/4 cup vegetable juice



3-5 servings



3-5 servings

FRUIT GROUP

Examples:

- 1 medium banana, apple, or orange
- 3/4 cup fruit juice
- 1 melon wedge
- 1/4 cup dried fruit



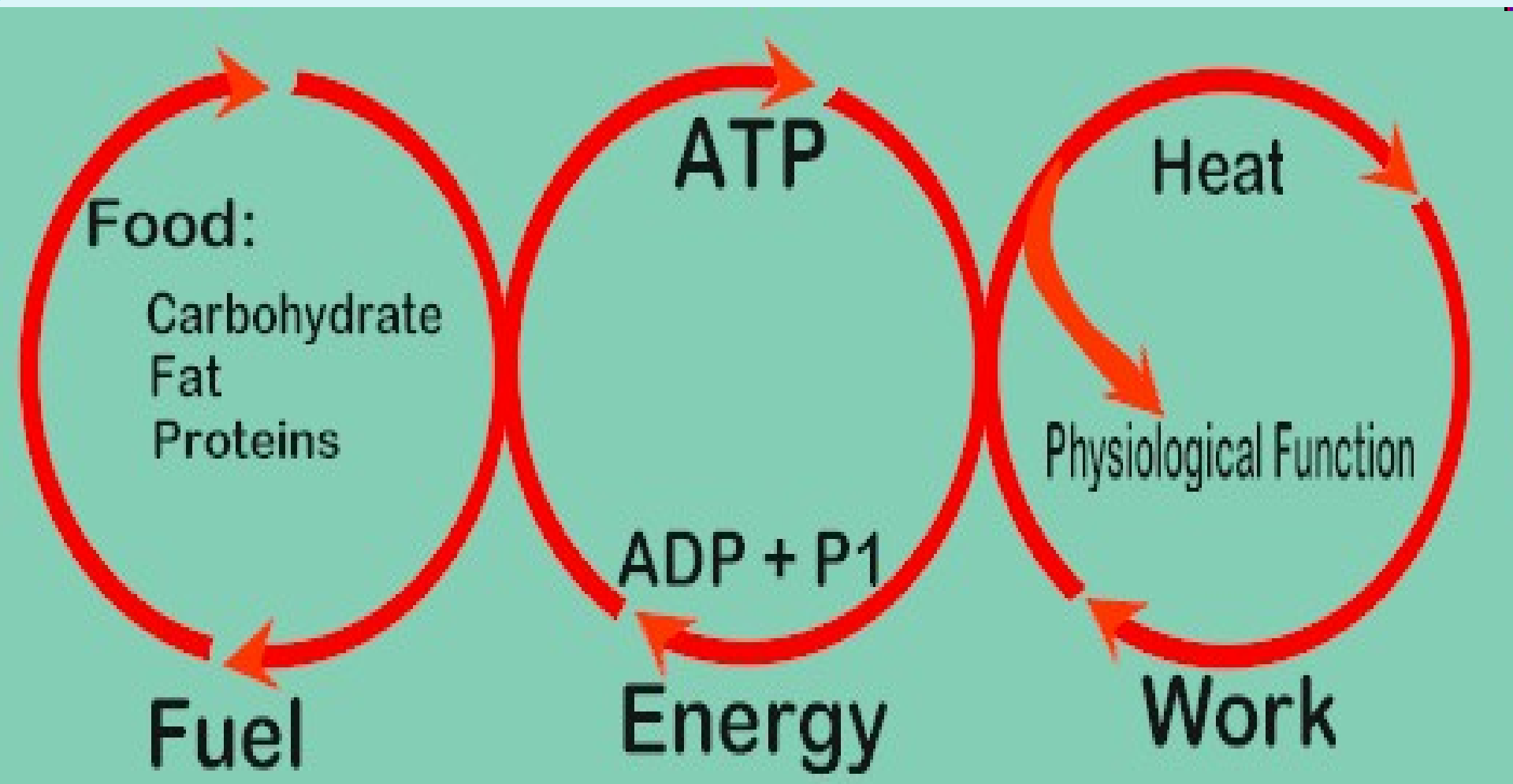
6-11 servings

**BREAD, CEREAL, RICE,
& PASTA GROUP**

Examples:

- 1 oz ready-to-eat cereal
- 1/2 cup cooked cereal, pasta or rice
- 1 slice bread





Types of Work

Chemical works: building of cellular components, secretions, etc

Mechanical works: muscle contractions, heart pumping, etc

Electrical works: nerve conduction, resting potential (by maintaining the activity of Na^+/K^+ pumps and other pumps)



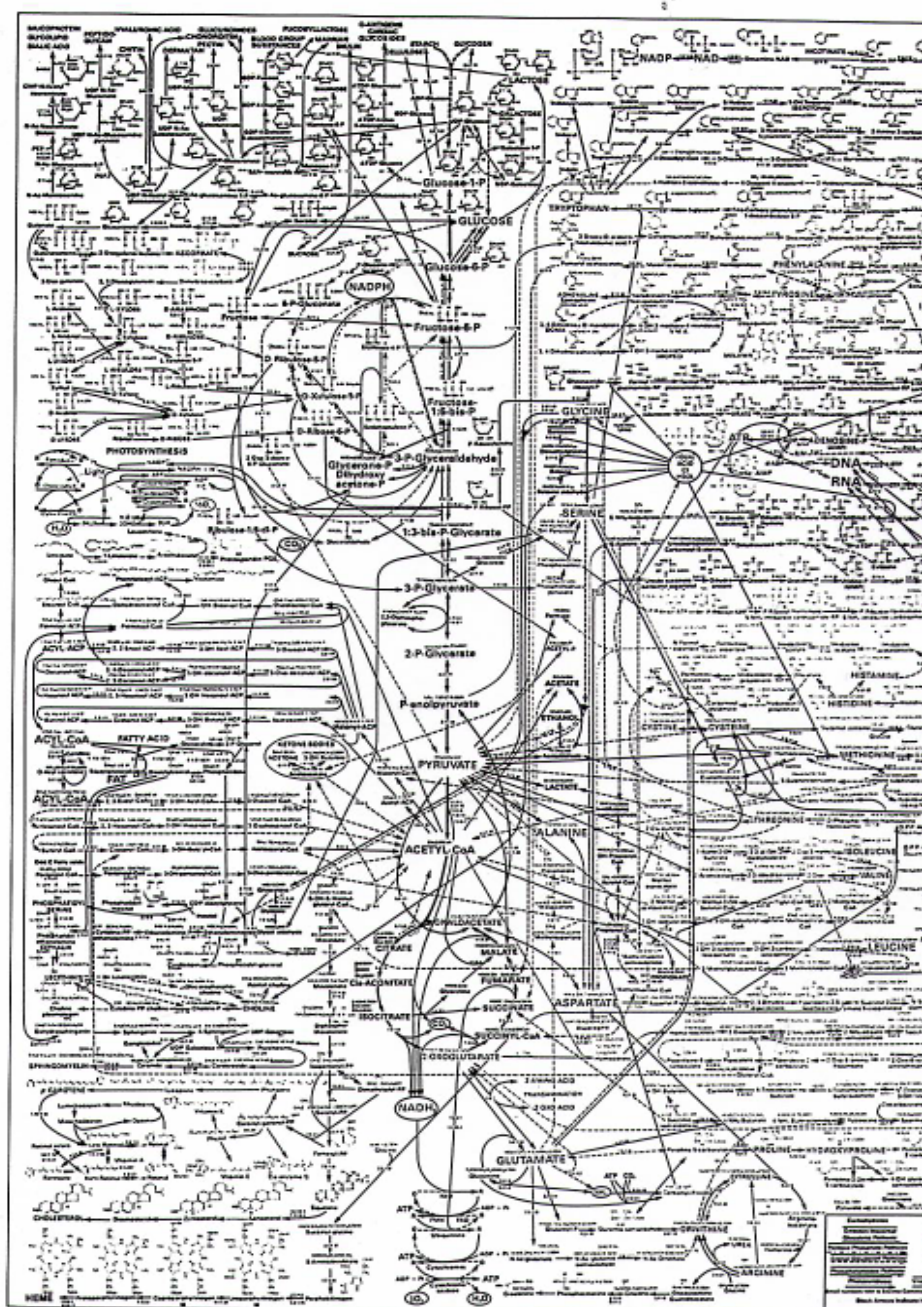
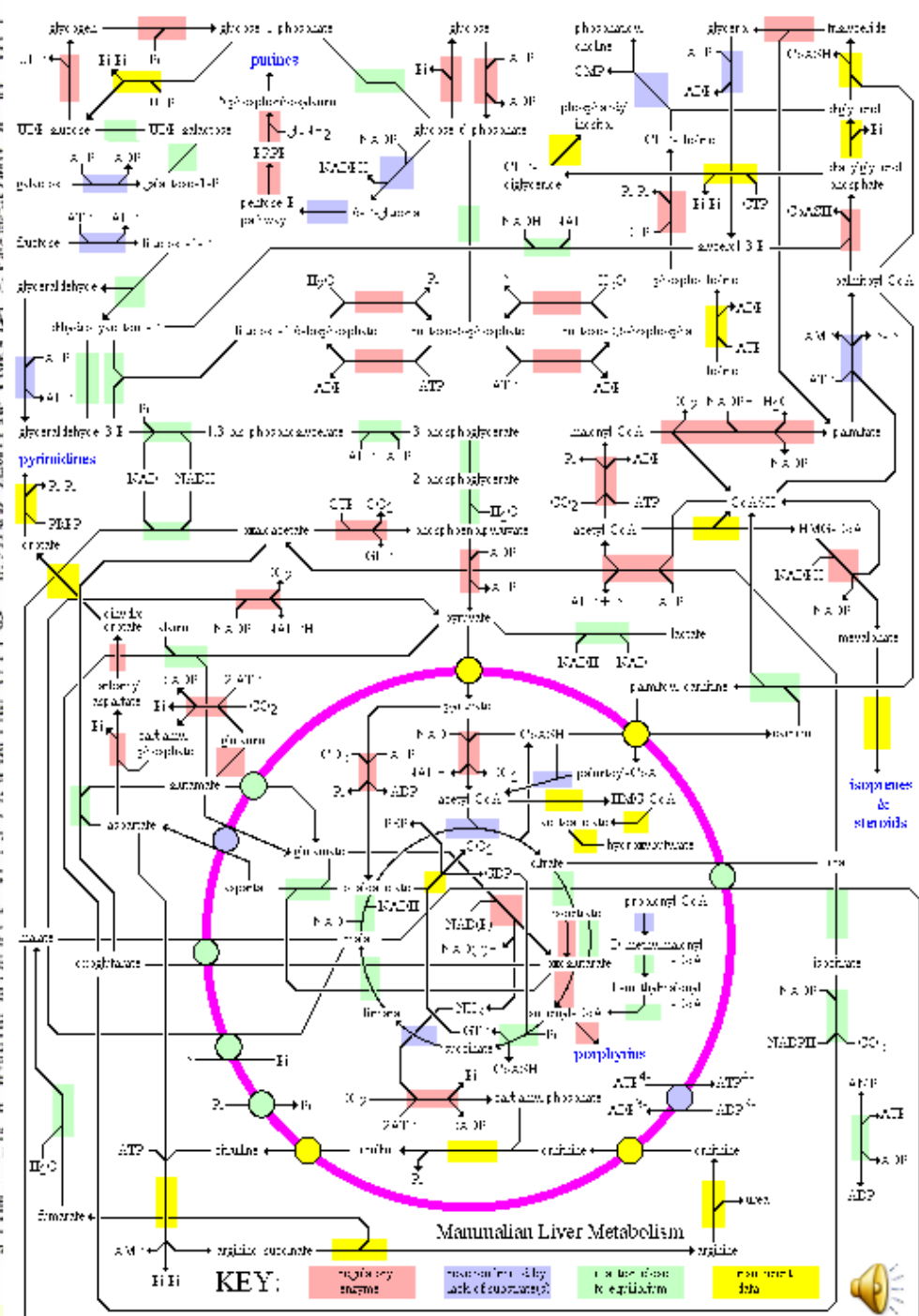
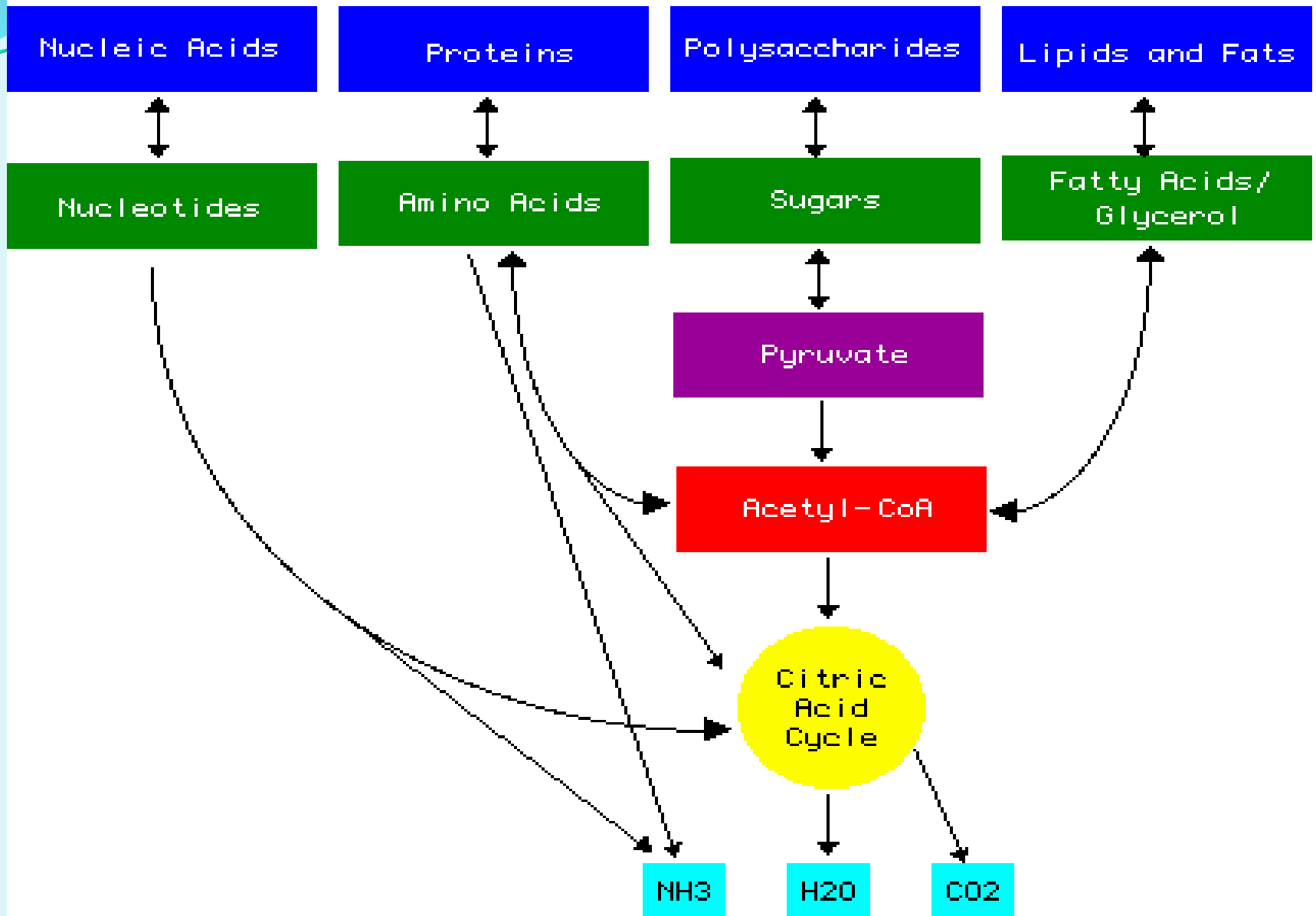


Figure 17.1 A metabolic map, indicating the reactions of intermediary metabolism and the enzymes that catalyze different chemical intermediates, or metabolites, and a greater number of enzymes are represented here. (Courtesy of D. E. Nicholson, University of Leeds, U.K., and the Sigma Chemical Co.)





Fat

Carbohydrate

Protein

Triglycerides

Glucose

Amino Acids

Glycerol + Free Fatty Acids (FFA)

Glycolysis

Deamination Transamination

Pyruvic Acid

Keto Acids

Beta Oxidation

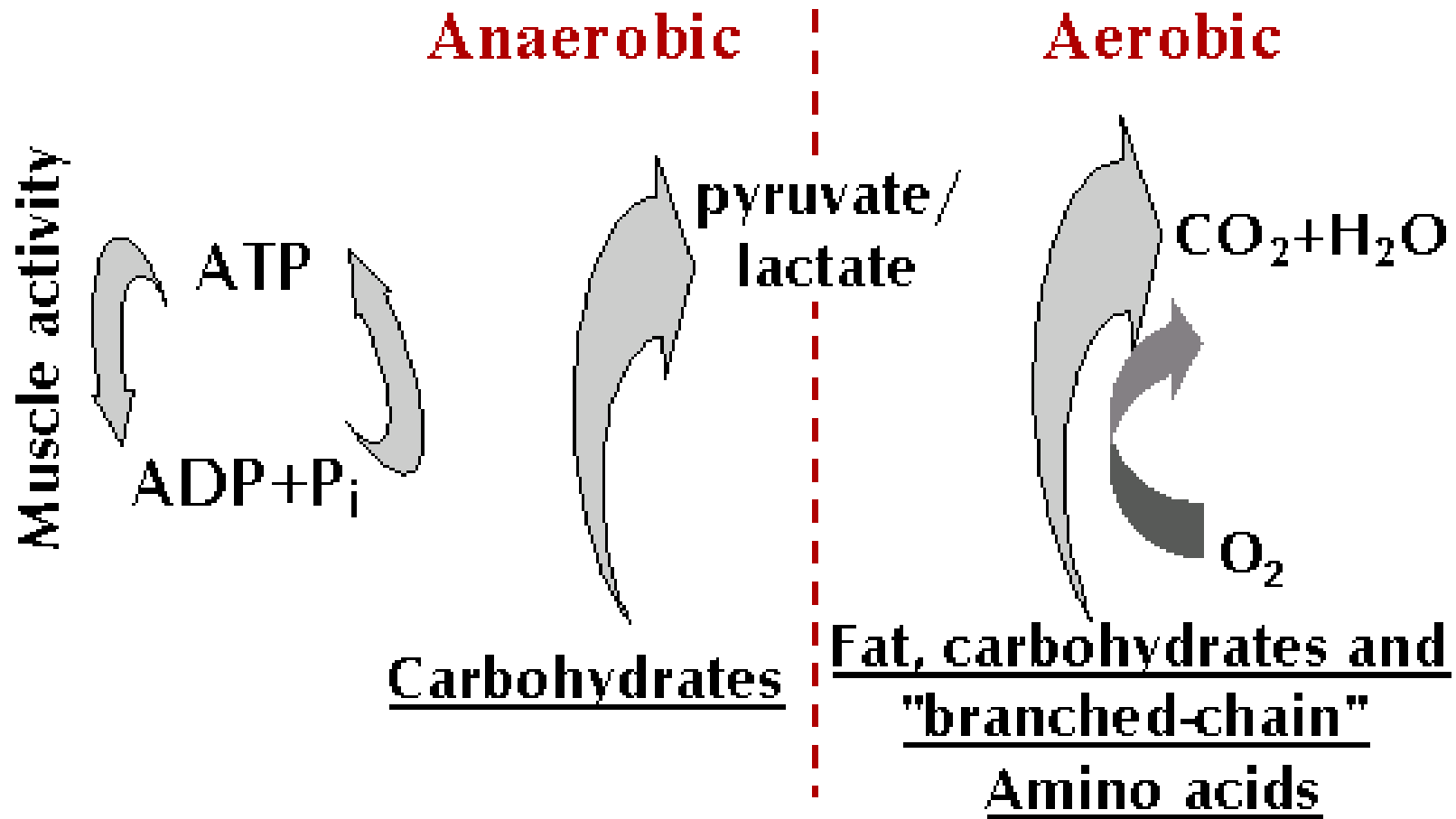
Acetyl CoA

Krebs Cycle

Electron Transport and Oxidative Phosphorylation



Muscle work and Energy



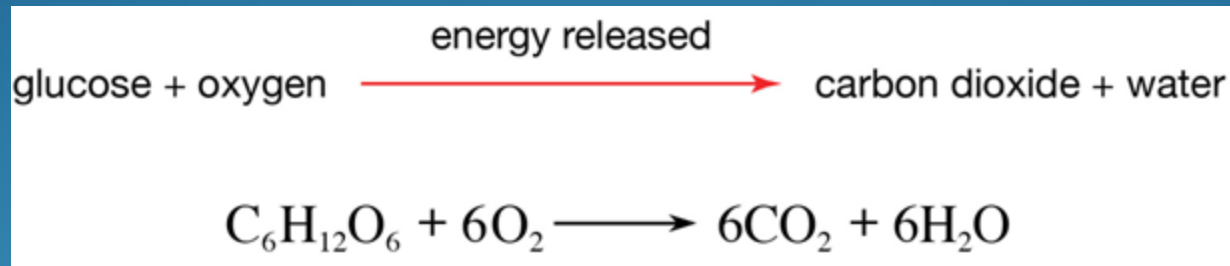
Respiratory Quotient (RQ)

$$\text{Respiratory Quotient} = \frac{\text{volume of carbon dioxide per unit time}}{\text{volume of oxygen per unit time}}$$



Respiratory Quotient (RQ)

By calculating **RQ** = We can get an estimate about **the main fuel of food stuff for our body energy**



By using Carbohydrates as Fuel: RQ is = 1

Fat as Fuel: RQ = 0.7

Proteins as Fuel: RQ = 0.82



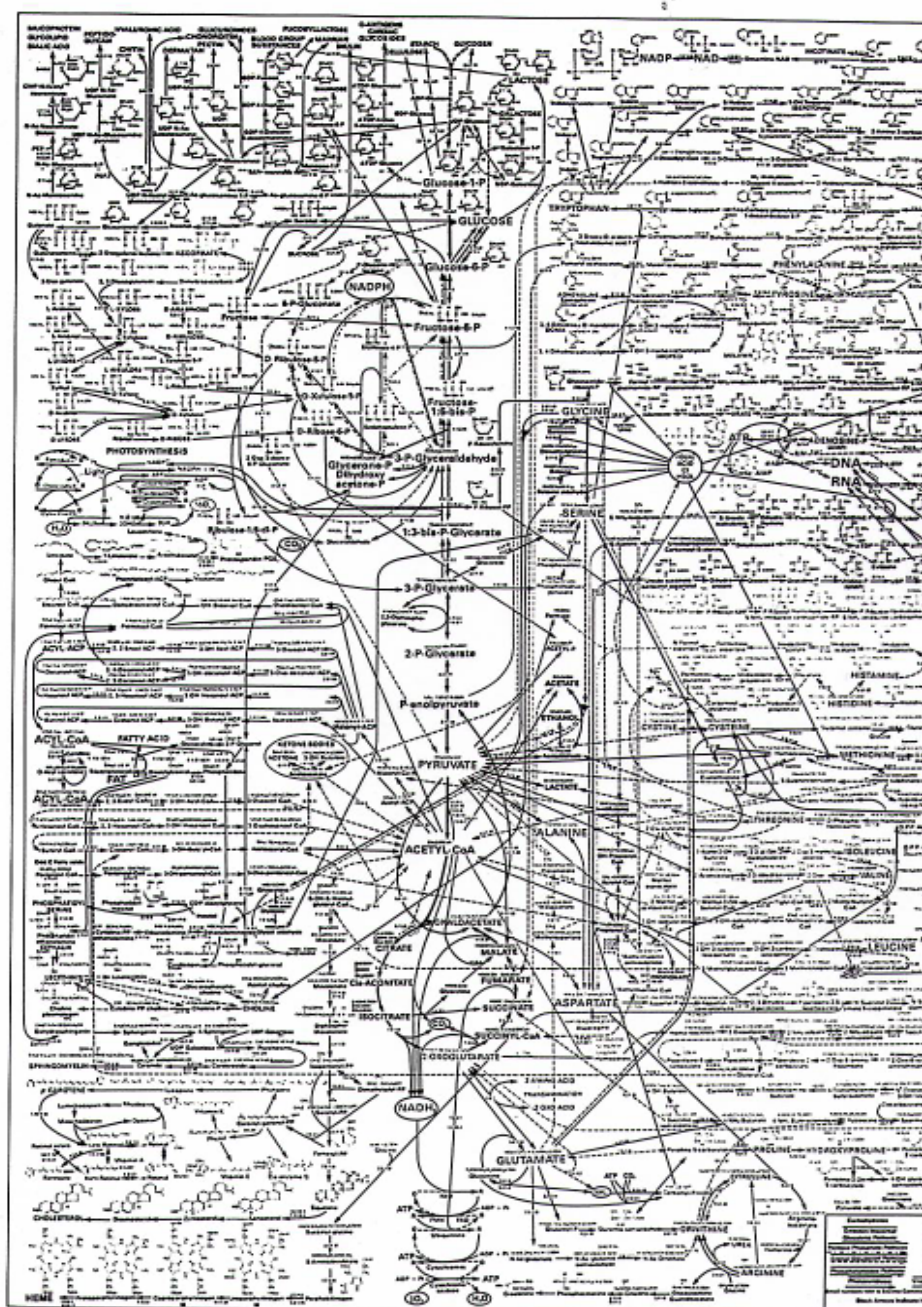
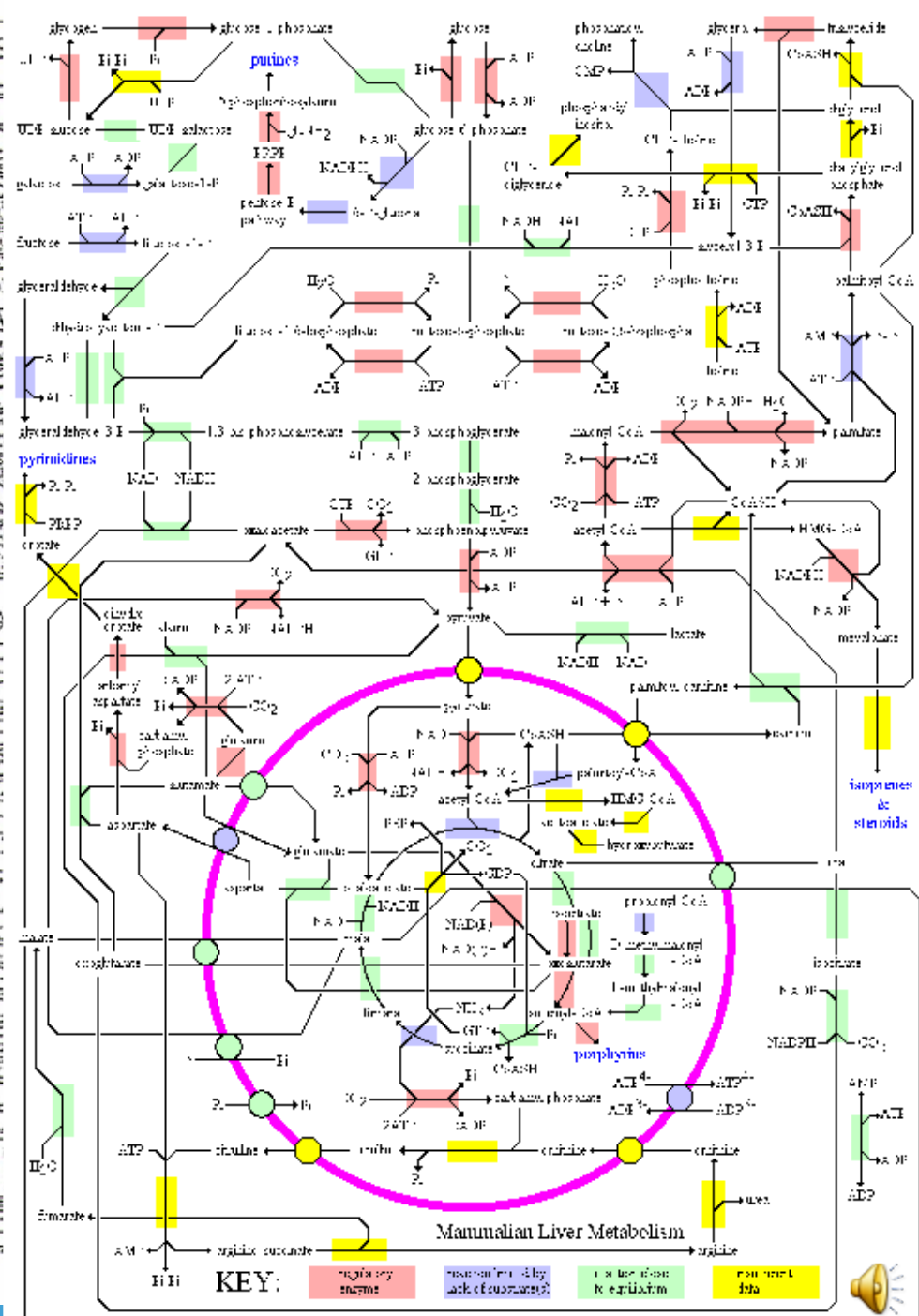


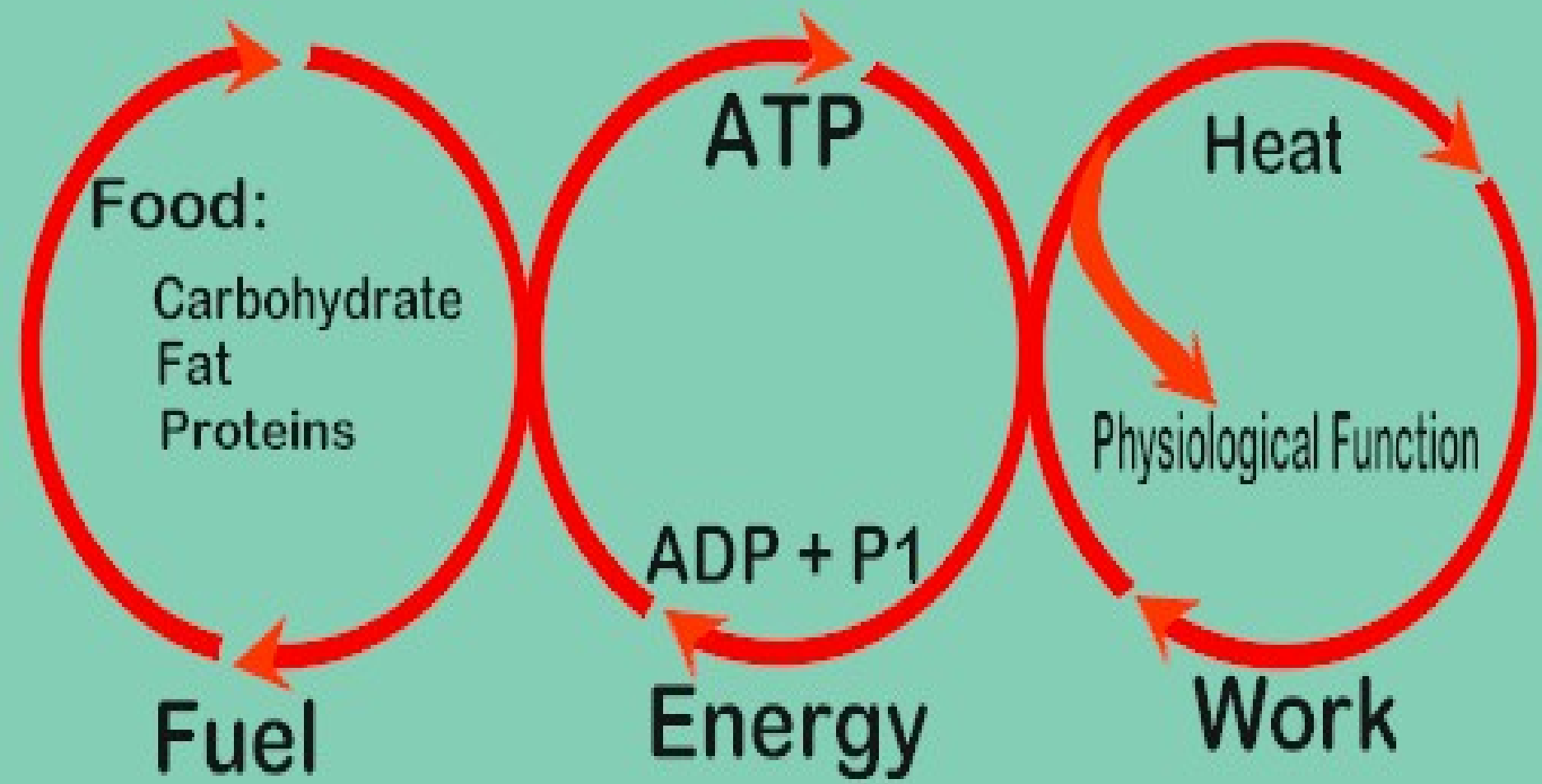
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Metabolic Rate

Metabolic activity / Unit time





Metabolic Rate

Cal/Hour

- **Measurements:**

- **Direct Calorimetry**

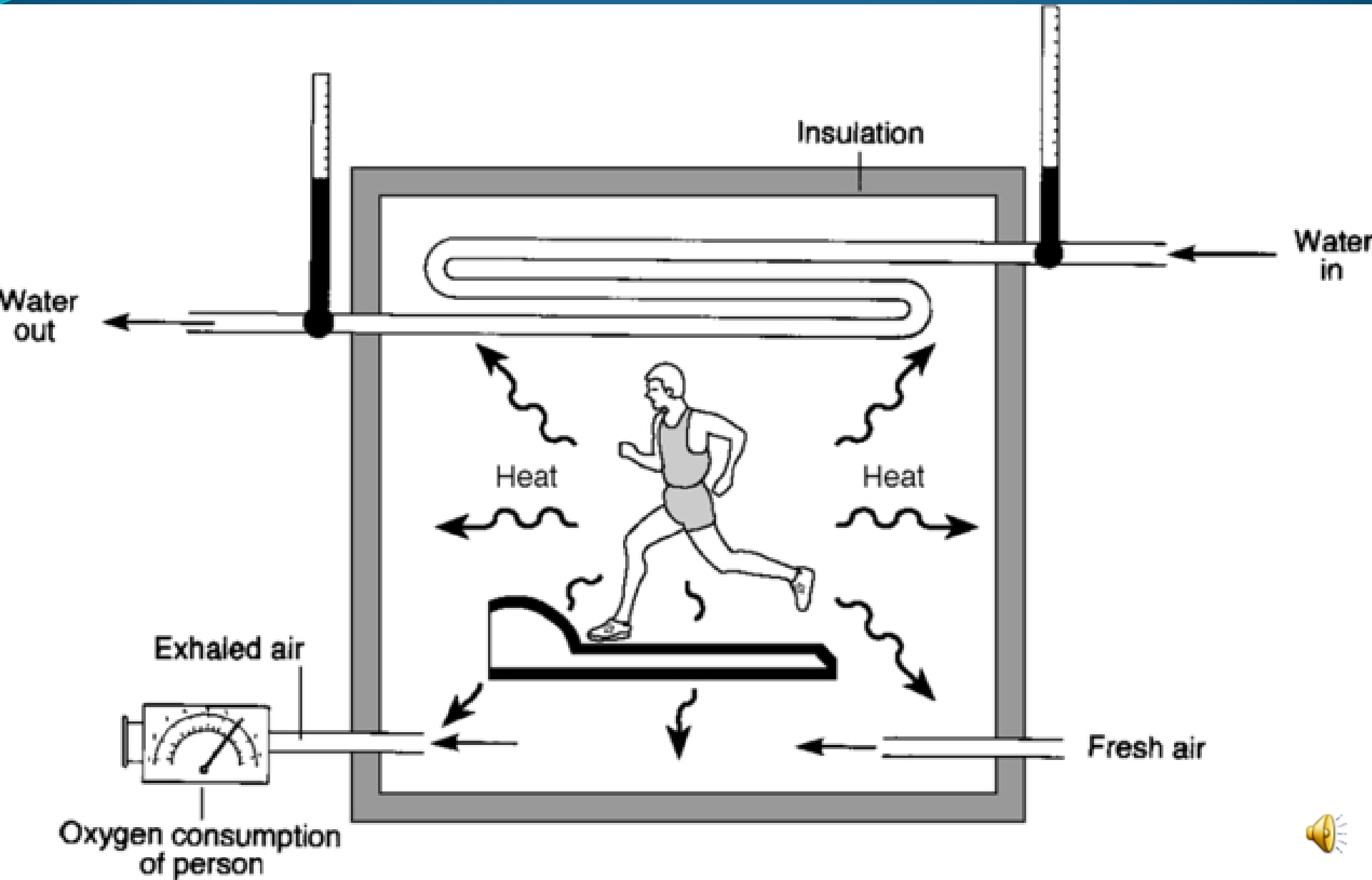
- Indirect Calorimetry

 - (O₂ consumption)

 - Closed method

 - Opened method





Metabolic Rate

Cal/Hour

- **Measurements:**
 - Direct Calorimetry
 - **Indirect Calorimetry**
(O₂ consumption)
 - Closed method
 - Opened method



Rate of Oxygen consumption per unit time

:Energy Equivalent of OXYGEN

,Cal/1liter of Oxygen Consumption 4.8

Example of calculation:

liter of Oxygen Consumption/5minutes □ 12 liters/hour 1

Metabolic rate will be: $12 \times 4.8 = 57.6$ Cal/Hour



Metabolic Rate

Cal/Hour

- **Measurements:**

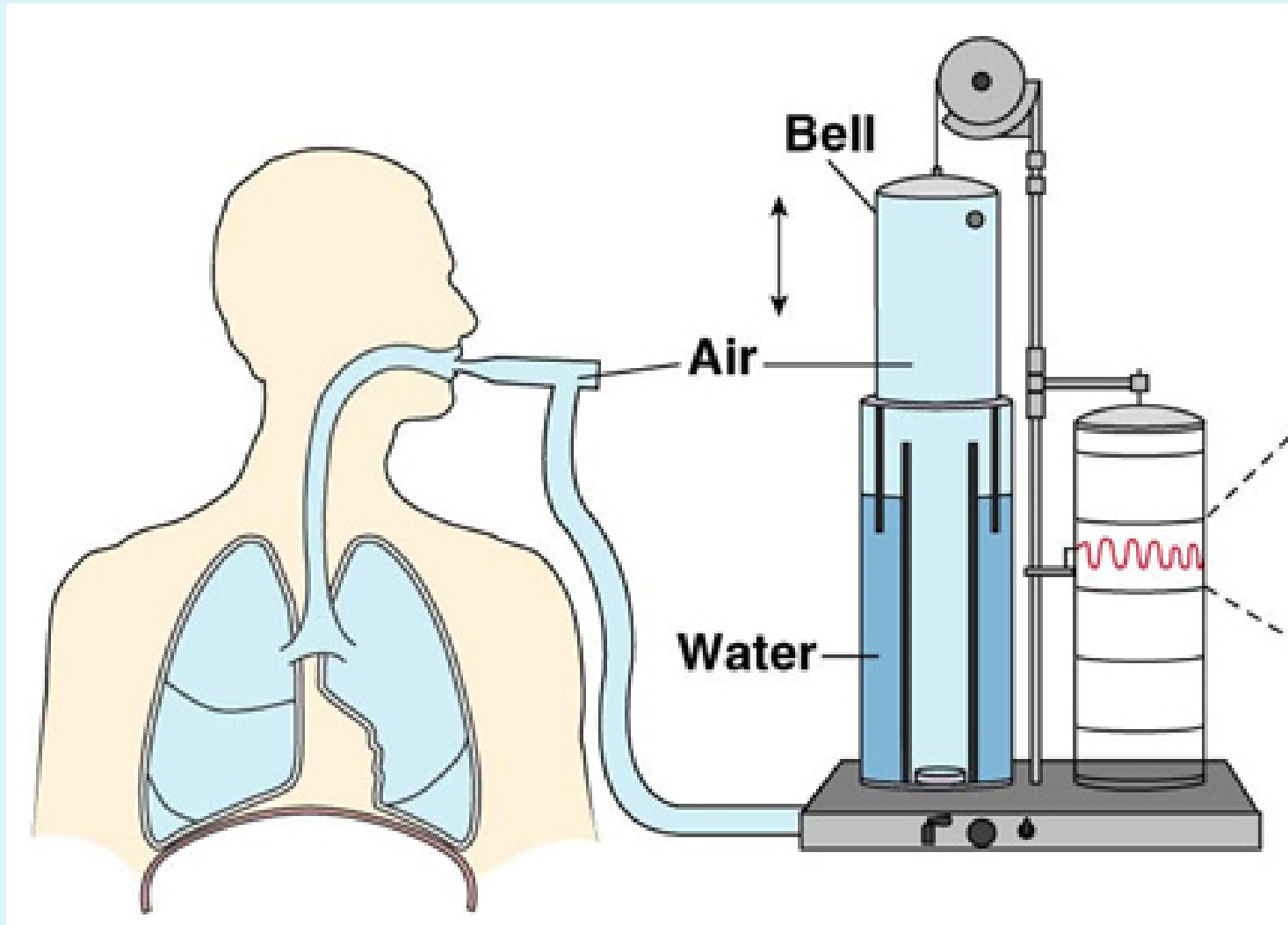
- O₂ consumption:**

- **Closed method**
 - Opened method



Spirometer

)measurement of O₂ consumption(



Metabolic Rate

Cal/Hour

- **Measurements:**

- O₂ consumption:**

- Closed method
 - **Opened method**





Standardization of Measurement

Relating Metabolic Rate to **1 Meter square-Surface area of the body.**

Cal/hour/m² (**Cal.h⁻¹.m⁻²**) 36 = 57.6/1.6

Measurement under basal Conditions-



Basal Metabolic Rate (BMR)

measurement under basal
conditions



Basal Conditions

- .No eaten food for at least 12 hours -
- .Measurement after a night of restful sleep -
- .No exercise in the hour prior to the test -
- Elimination of all factors that may cause -
 - .excitement
- Comfortable temperature during -
 - .measurement



Factors affecting metabolic rate

Exercise: increases-

Daily activities-

:Age-

:Sleep-

:Climate-

:Fever-

;Malnutrition-

:Specific dynamic action-

:Effect of hormones-

:Thyroid hormones

.Male sex hormones increase 10-15%

Growth hormones: Increase 15-20%

Effect of sympathetic stimulation: increases metabolic-
.rate



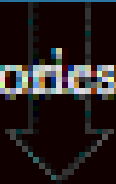
Regulation of food intake



Food intake = Energy expenditure

- **Neutral Balance**

Calories In



Energy Intake
"Calories in"

Weight Stable



Energy Expenditure
"Calories out"

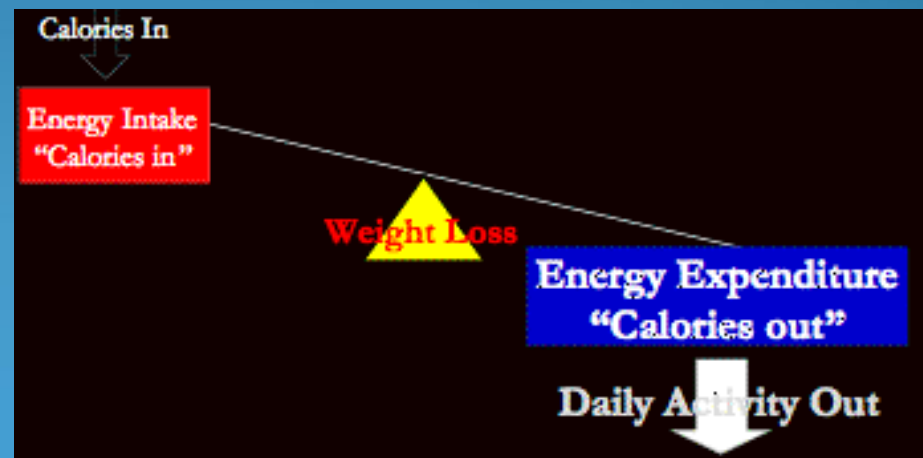
Daily Activity Out



- **Positive balance**



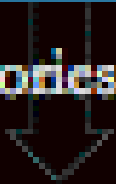
- **Negative balance**



Food intake = Energy expenditure

- **Neutral Balance**

Calories In



Energy Intake
"Calories in"

Weight Stable



Energy Expenditure
"Calories out"

Daily Activity Out



Hypothalamic control of food intake

..**Feeding center**: lateral nuclei

Satiety center: ventromedial nuclei

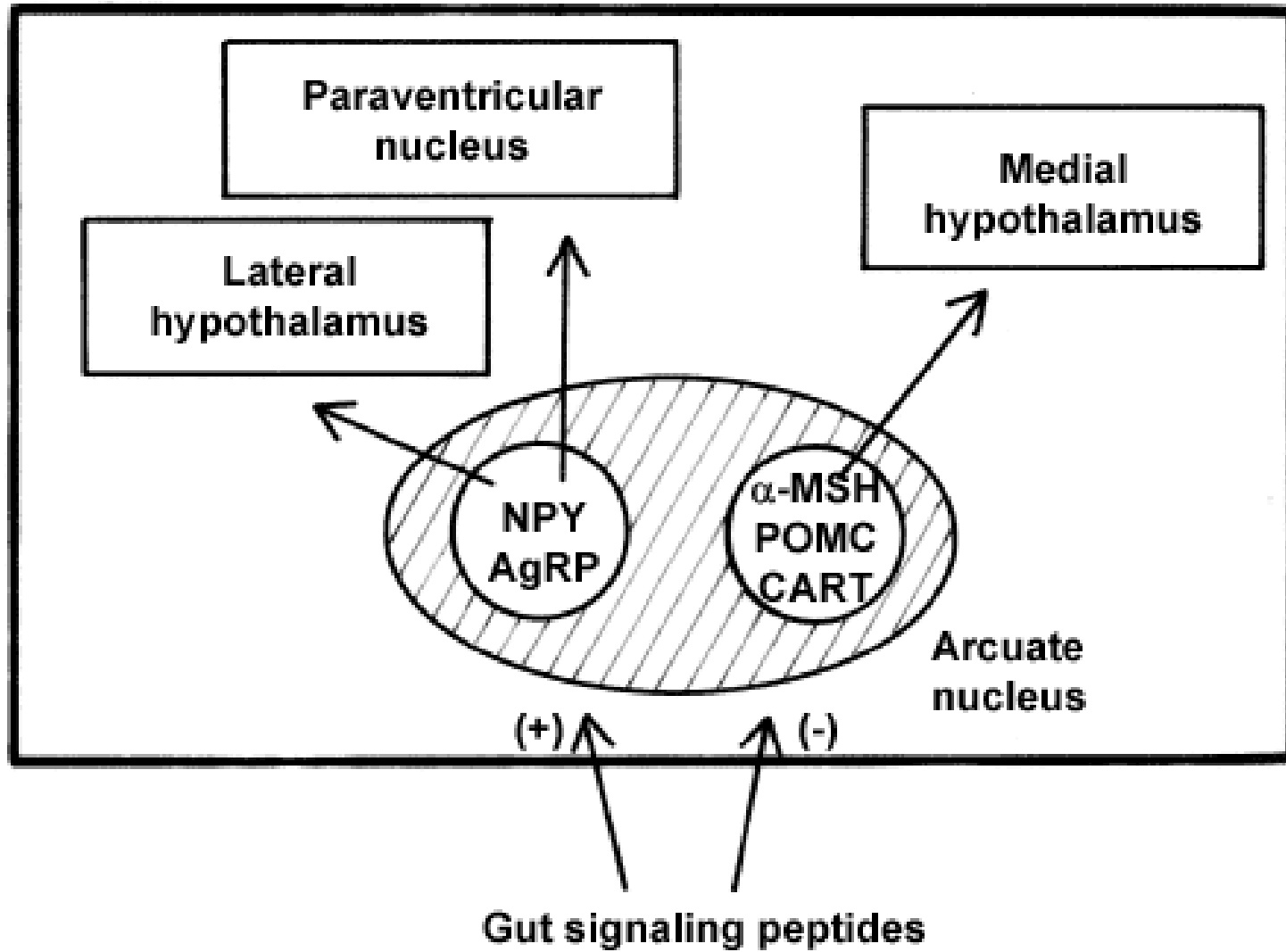
Amygdala (destruction \square psychic blindness)

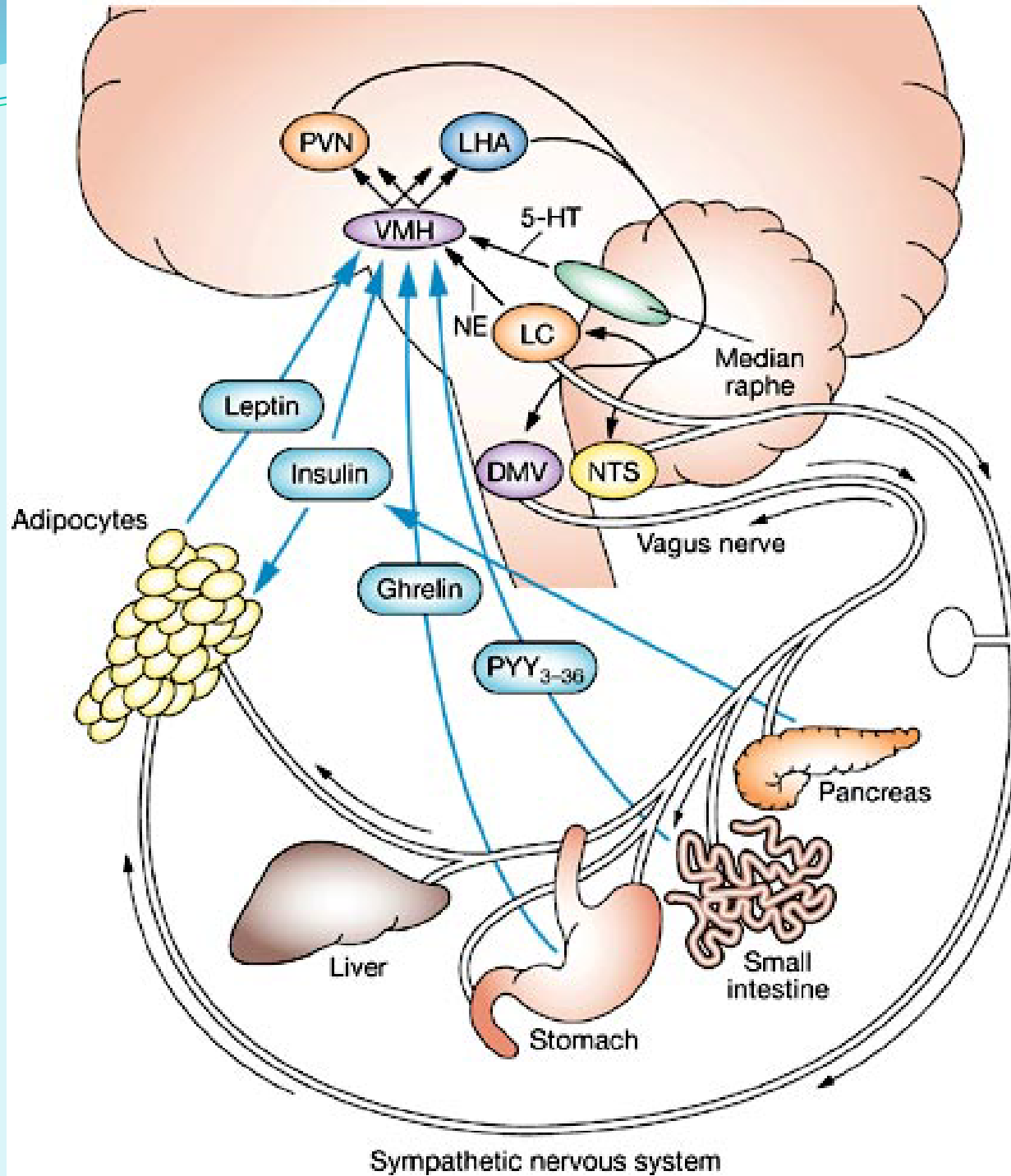
:prefrontal cortex



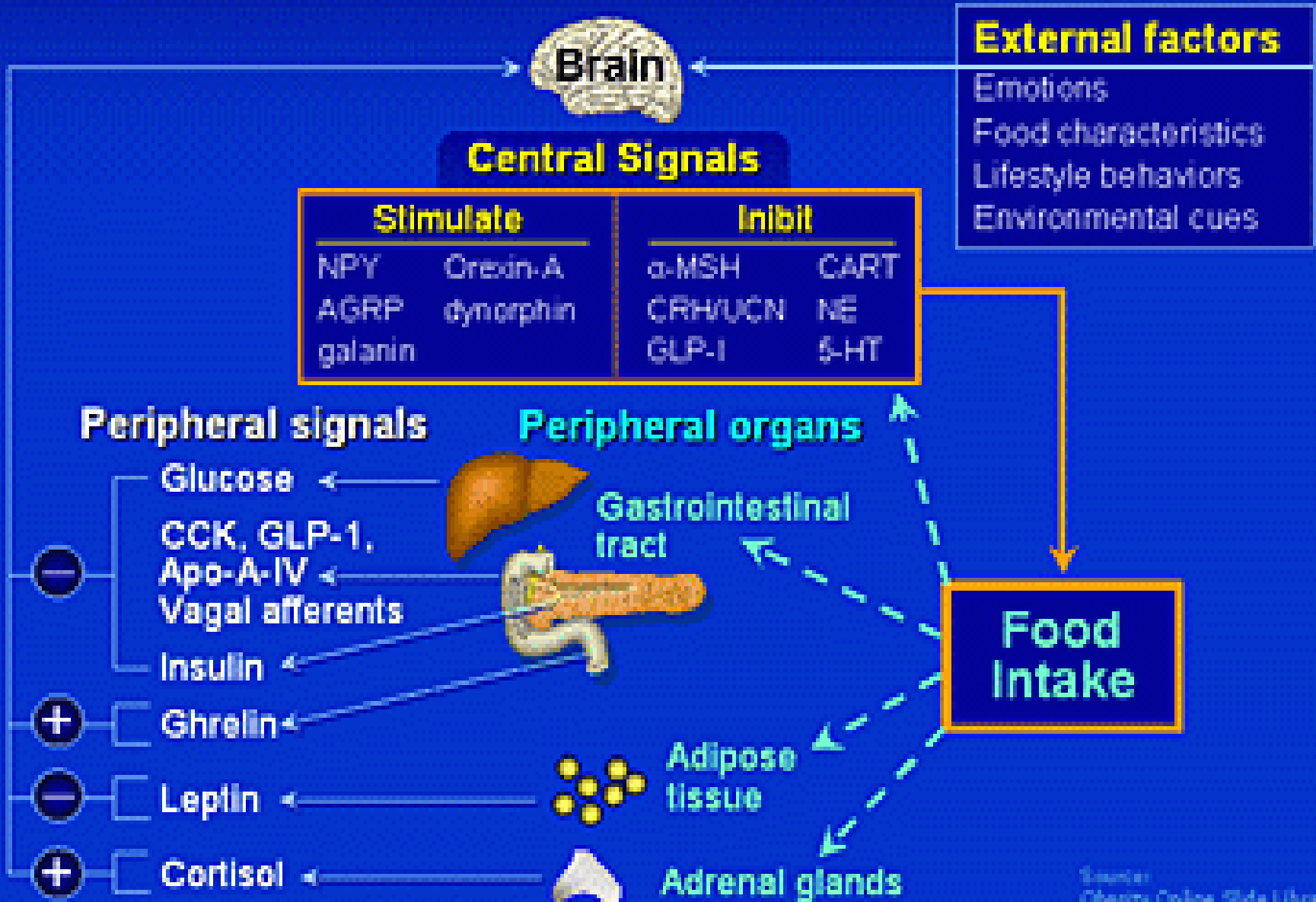
Hunger center

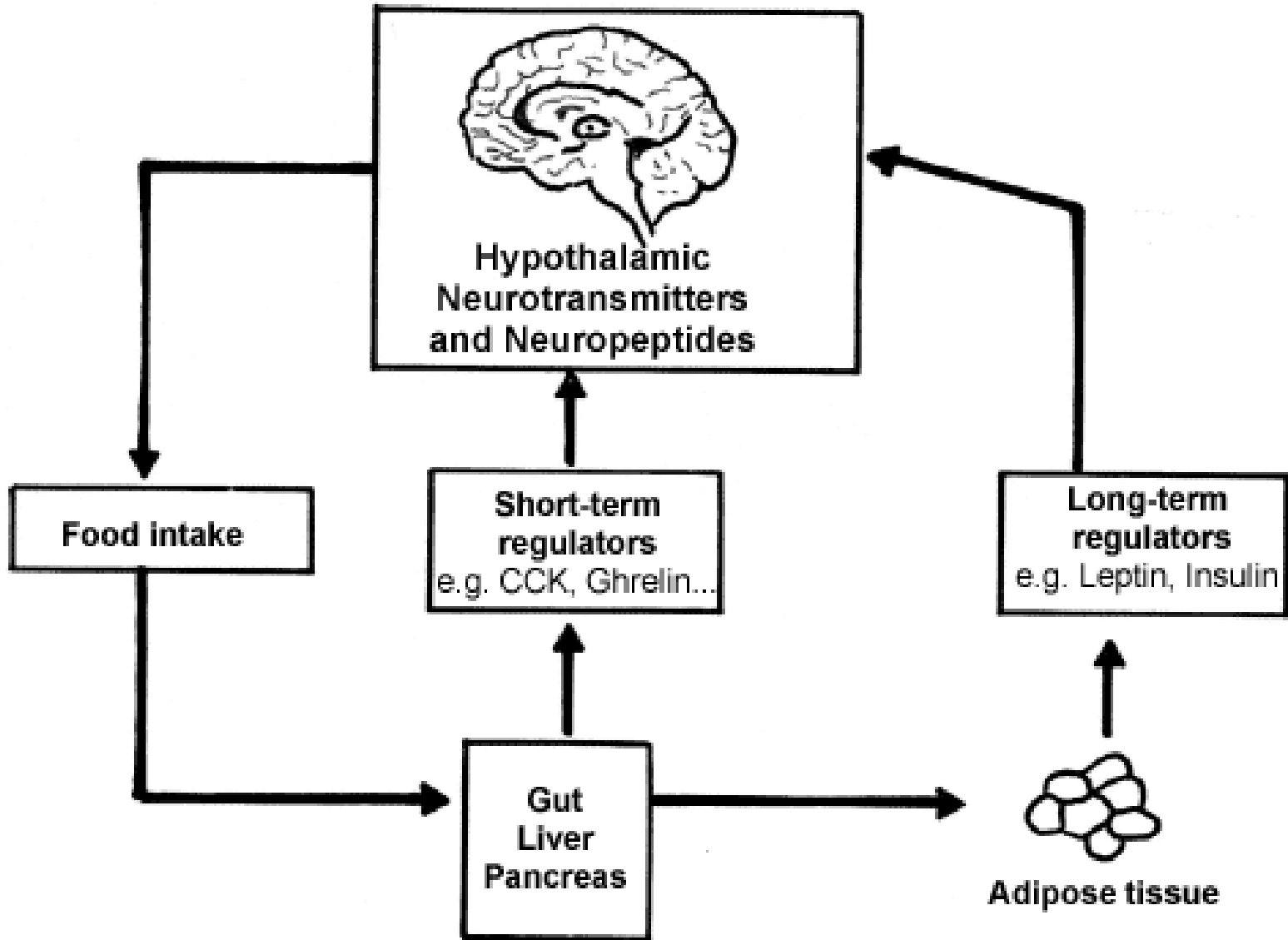
Satiety center





Regulation of Food Intake





Regulation of food intake

Long term regulations

Glucostatic theory of hunger and
:feeding regulation

Lipostatic theory: Leptin

Aminostatic theory

**Body temperature and its relation
to food intake: thermoregulatory
and feeding centers**

:Psychosocial factors



Regulation of food intake

Long term regulations

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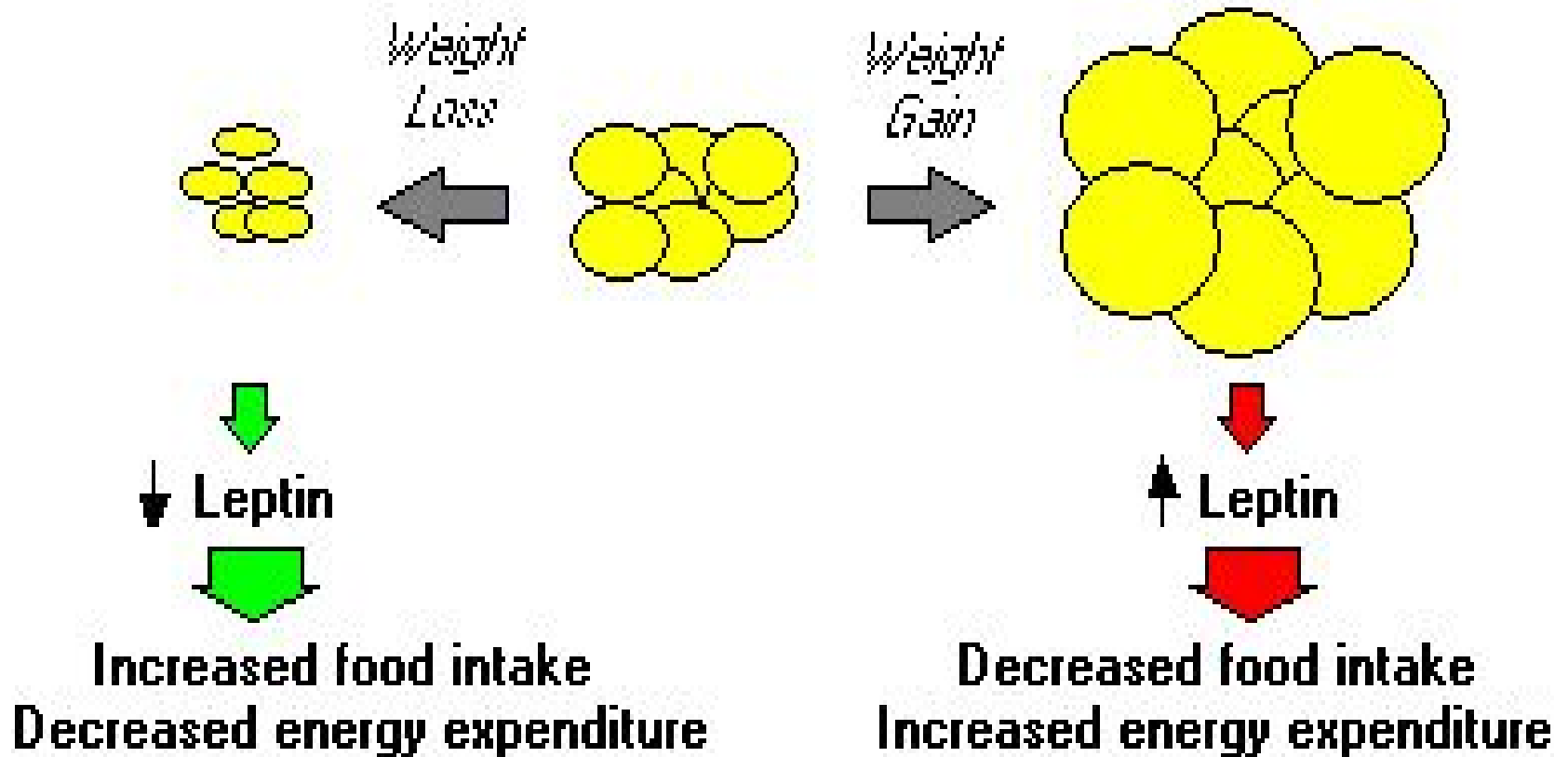
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Regulation of food intake

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:**Psychosocial factors**



Short term regulation of food intake

These are rapid signals that affect
.feeding

:Gastrointestinal filling

:Hormonal factors

:Suppression by oral receptors



Obesity

- Positive balance



OBESITY

Causes of obesity

:Neurogenic abnormalities

:Genetic factors

:Psychosocial factor

:Childhood overnutrition

:Other causes of obesity

Disorders of the endocrine system

.(hypothyroidism) and lack of physical exercise



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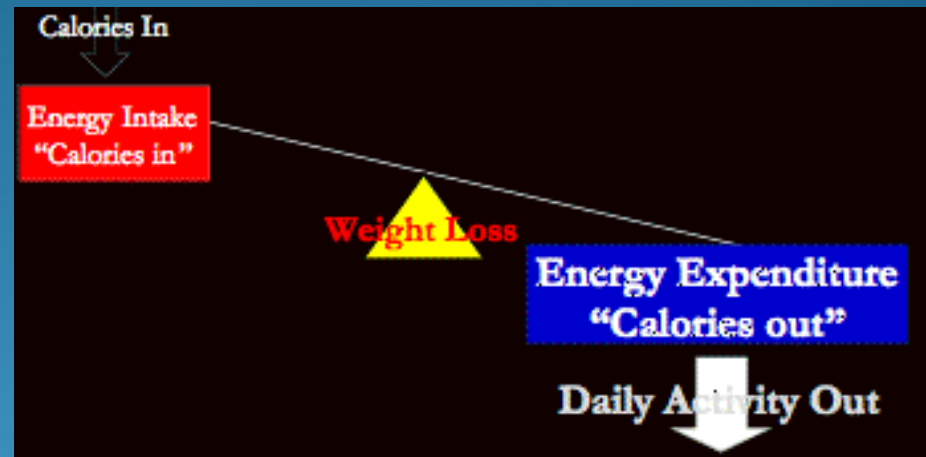
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Inanition

- **Negative balance**

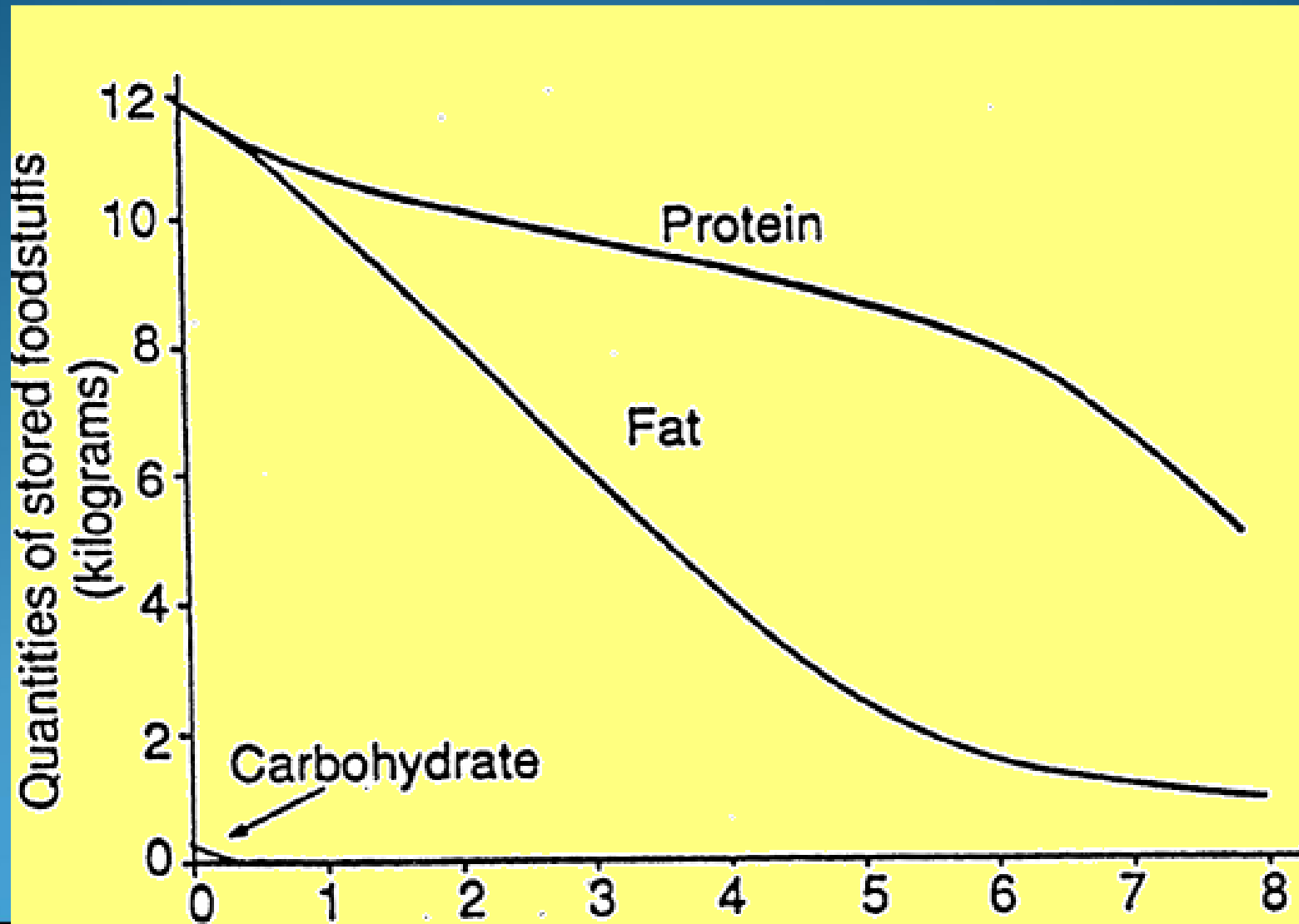


Causes:

psychogenic (anorexia nervosa) or hypothalamic abnormalities



Starvation and depletion of stores in the body



GOOD LUCK

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