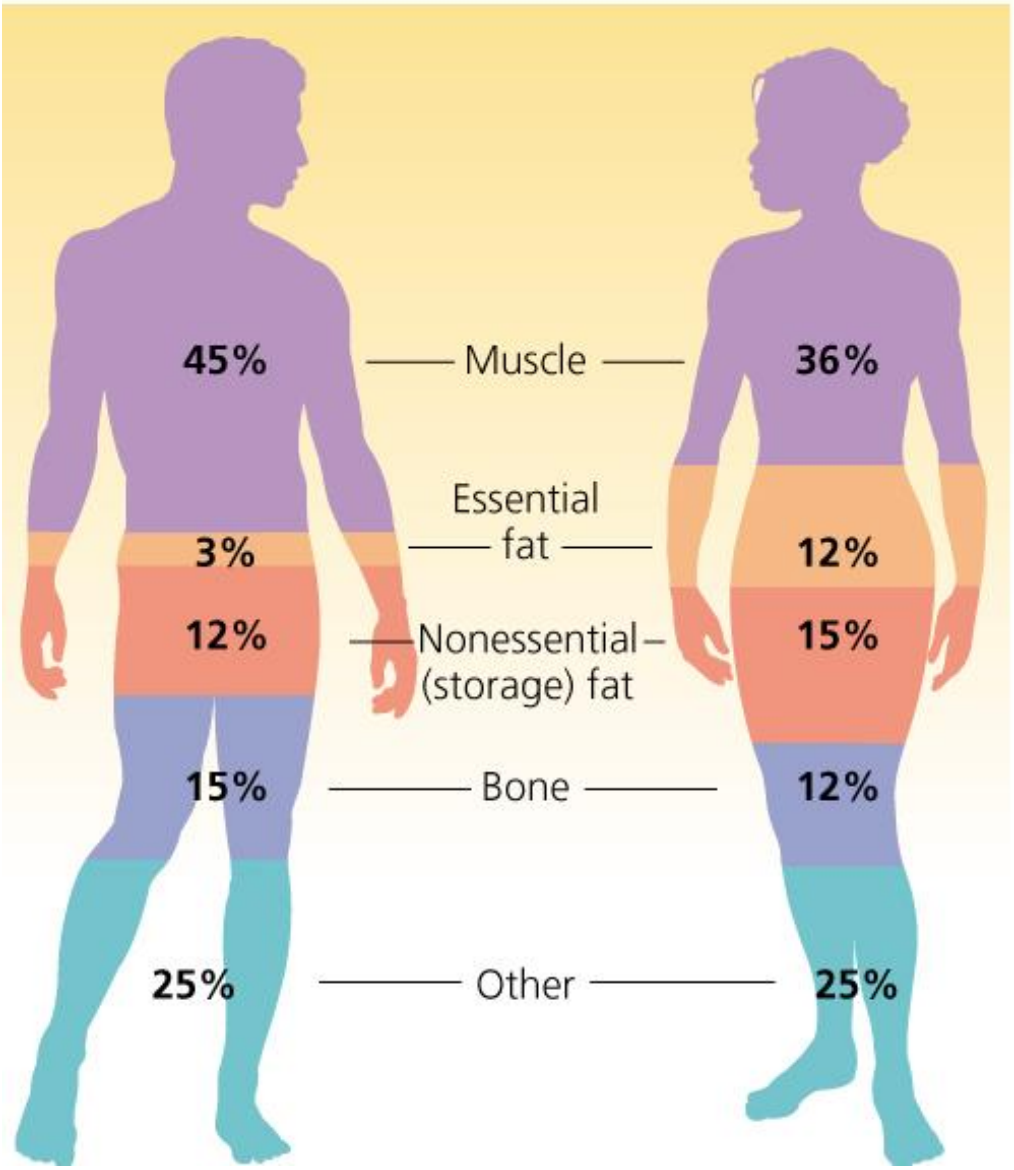
Methods of assessing Body Composition

Body Composition

- Body composition: The body's relative amounts of fat mass and fat-free mass (bone, water, muscle, connective and organ tissues, teeth)
- Essential fat: crucial for normal body functioning
  - 3–5% of total body weight in males
  - 8–12% of total body weight in females
- Nonessential fat: Adipose tissue

Typical Body Composition



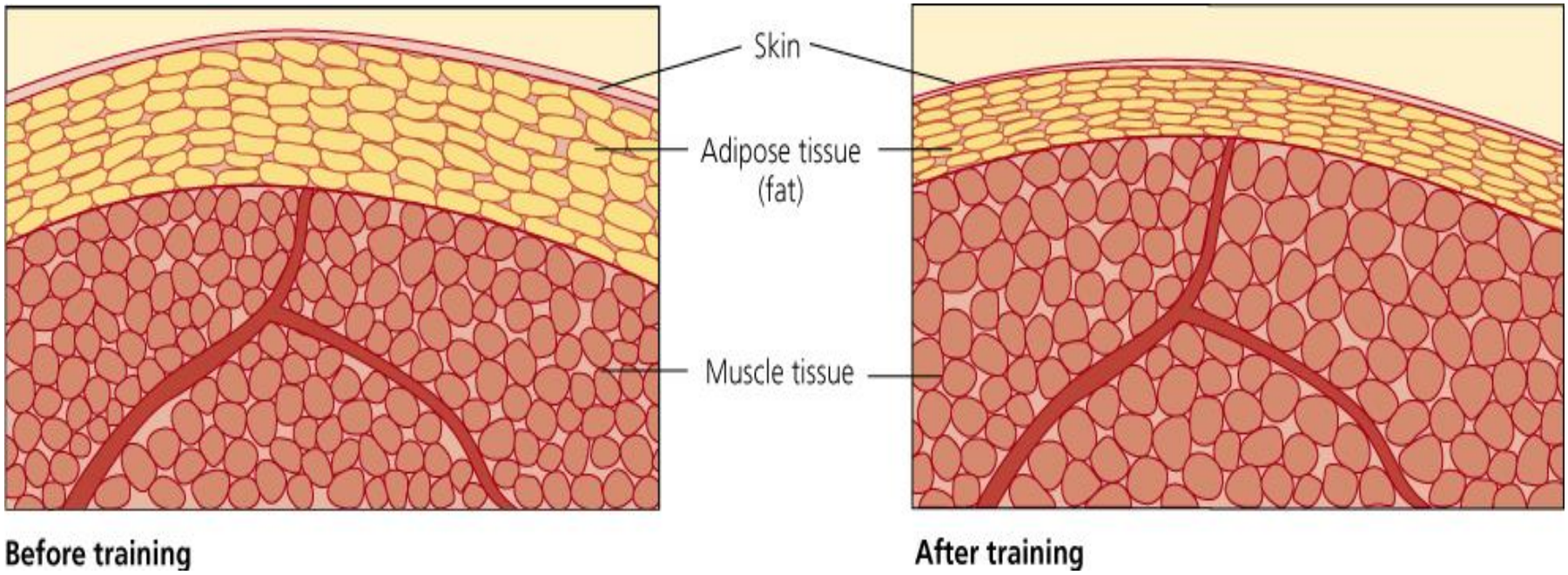
What is Essential Fat?

- **Consists of fat stored in major organs, muscles, and central nervous system**

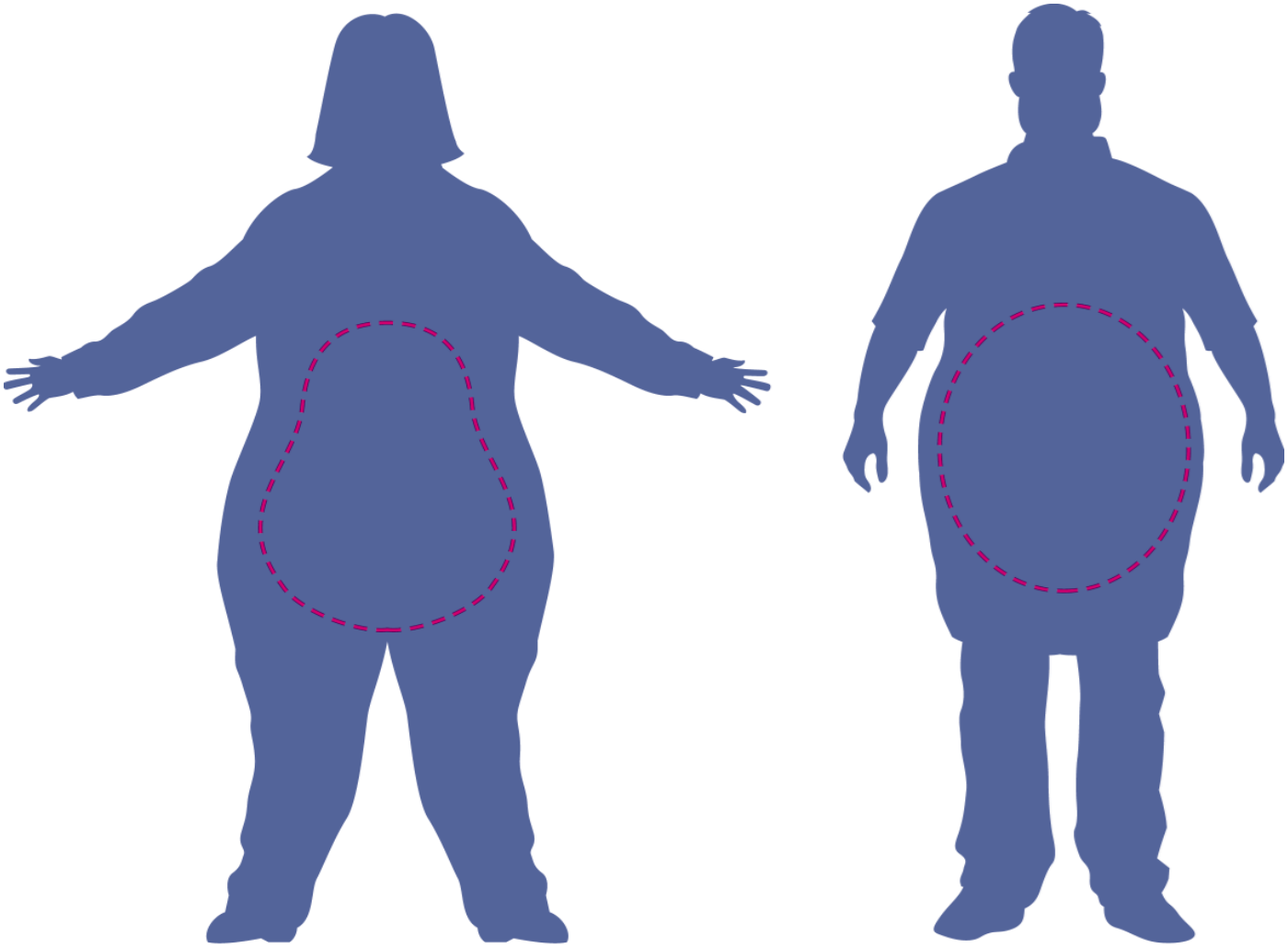
- Important for childbearing and hormone-related functions
- Required for normal physiological functioning

Making Changes in Body Composition

- Lifestyle should focus on:
  - Regular physical activity, endurance exercise, and strength training



Regional Fat Deposition



PEAR
Fat stores around hips predominate

APPLE
Fat stores around waist predominate

Lab Methods of Body Composition Assessment

Dual-Energy X-ray Absorptiometry (DEXA)

Under Water Weighing (Hydrodensitometry)

Air-displacement plethysmography (Bod Pod)

Field Methods of Body Composition Assessment

Bioelectrical Impedance (BIA)

Anthropometric Measures : Circumference, Diameters, Height, Weight

Skinfold method

Dual energy X-ray absorptiometry (DEXA)

- This methods is considered as one of the standard technique for body composition assessment
- Low dose beams of X-ray uses
- It measures fat mass, fat distribution pattern, and bone density

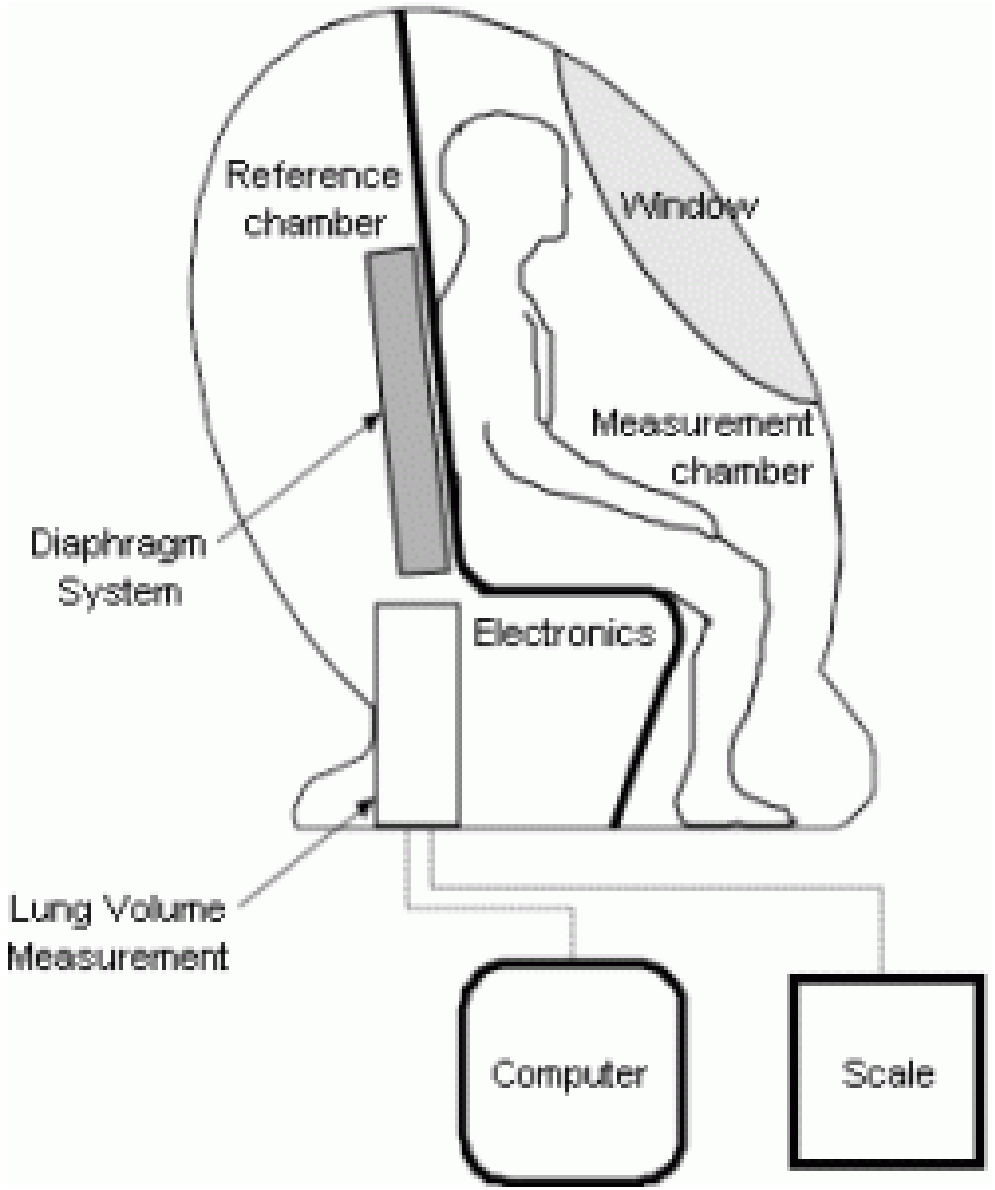
Dual Energy X ray Absorptiometry

A DXA scanner is a machine that produces two X-ray beams, each with different energy levels. One beam is high energy while the other is low energy. The amount of X-rays that pass through the bone is measured for each beam. This will vary depending on the thickness of the bone. Based on the difference between the two beams, the bone density can be measured.

Underwater Weighing

- This is the most common technique used for decades
- A person's "regular" weight is compared with underwater weight using Archimede's principle
- Fat is more buoyant than lean tissue.
- Almost all other indirect techniques have been validated against hydrostatic weighing

Air Displacement Method using BOD POD



The BOD POD consists of two chambers.

The front, or **Test Chamber**, is where the subject sits and is comprised of a seat that forms a common wall separating it from the rear, or **Reference Chamber**.

During the brief data collection period of the volume measurement, the chamber door is secured by a series of electromagnets and a gasket.

A Diaphragm is mounted on the common wall, which oscillates during testing.

This causes small changes in volume inside the chamber, of which the pressure response to these small volume changes is measured.

This is done by measuring the interior volume of the empty BOD POD chamber, then measuring it again when the subject is seated inside.

By subtraction, the subject's body volume is obtained.

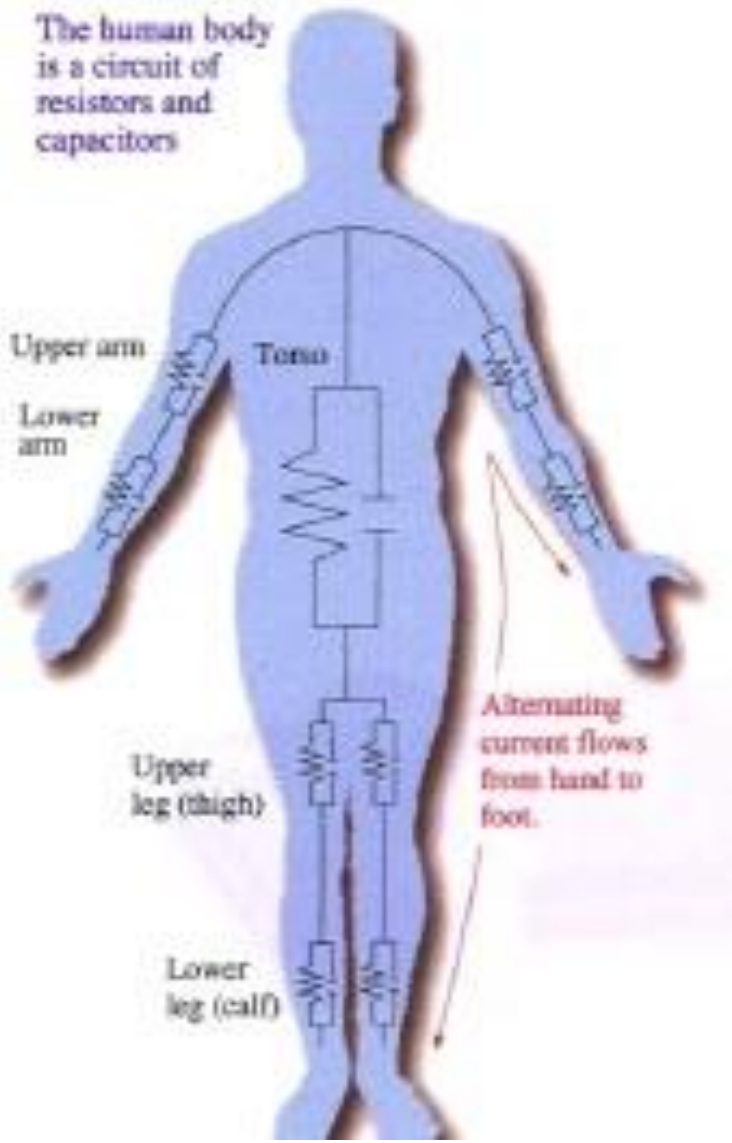
For example, if the interior air volume of the empty chamber is 400 litres, and the volume of the chamber is reduced to 350 litres with the subject inside, the body volume of the subject would be 50 litres.

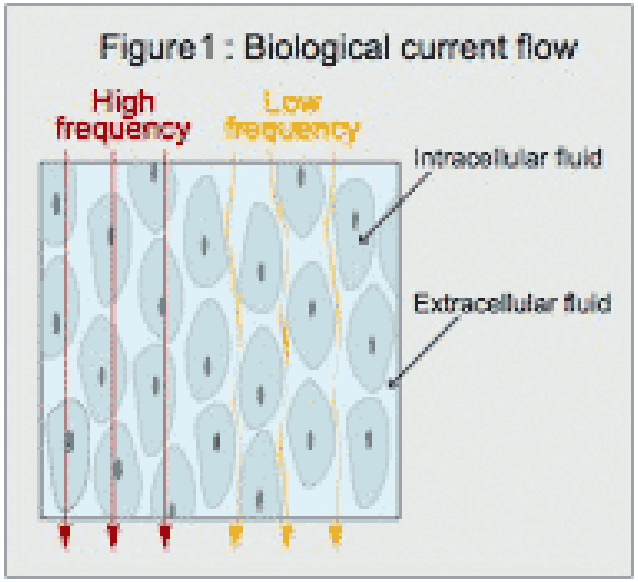
The BOD POD is an Air Displacement Plethysmograph (ADP) that uses whole-body densitometry to determine body composition (fat vs. lean). Similar in principle to underwater weighing, the BOD POD measures body mass (weight) using a very precise scale, (accurate within a gram) and volume by sitting inside the BOD POD for two fifty second increments of air measurement. Body density can then be calculated.

Bioelectrical Impedance

- It is simpler to administer, but standardization with gold standards should be required.
- Sensors are applied to the skin and a weak electrical current is run through the body to estimate body fat, lean body mass, and body water
- Based on the principle that fatty tissue is a less-efficient conductor of an electrical current
- The easier the conductance, the leaner the individual
- Body weight scales with special sensors on the surface has been used to perform this technique.

Bioelectric Impedance Analysis





Body Composition Analyzer

Anthropometry

- Skinfold measurements
- Waist to Hip ratio
- Waist to height ratio
- Waist circumference
- Body Mass Index
- Circumferences
- Diameters