

# Growth and Development



## Chapter 15

# Learning Objectives:

- Identify the stages of growth & development
- Describe factors affecting growth & development
- Understand the necessity of physical activity for optimal growth & development
- Recognize and understand gender and individual differences in growth & development



# Early Stimulation





# Introduction

- One must consider a few important influences that affect individual growth & development, including:
  - Early Exposure to Physical Activities
  - Critical Periods
  - Readiness



# Early Exposure to Physical Activities

- Encouragement to participate in various physical activities from a young age
- Early development of balance, coordination, strength, flexibility, and endurance
- Positive experiences when engaged in physical activities

# Early Exposure to Physical Activities

- The benefits of early exposure to physical activity has motivated many parents to involve children in education programs for many sports at a young age





# Critical Periods

- Times of particular sensitivity to environmental stimuli
- Potential for *optimal* development is affected by the presence or absence of appropriate stimuli at this critical period
- This critical period is quite *early* in development

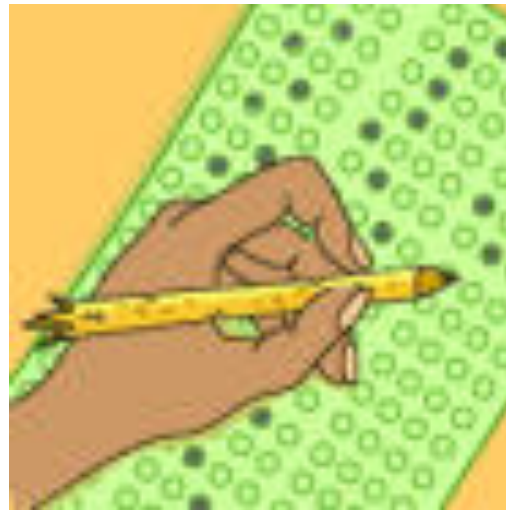


# Readiness

- Implies that the individual is prepared, or ready, to acquire a particular behaviour or skill
- Performance requires:
  - Desire to perform
  - Information
  - Ability
  - Acquisition of physical characteristics



# Knowledge Check





# True or False?

- The adolescent growth spurt occurs approximately two years earlier in girls than in boys.

**TRUE**

# True or False?

- There is a significant difference between female and male physique prior to puberty.

**FALSE**

# True or False?

- Within each of the life stages, there is individuality and variability in growth and development among people

**TRUE**

# Stages of Growth & Development





# Stages of Growth & Development

1. Infancy
2. Childhood
3. Adolescence

# Infancy

- BIRTH → ONE YEAR (1)
- Period of rapid growth
- Males are usually heavier and taller than females at birth





# Childhood

- ONE YEAR (1) → ELEVEN YEARS (11)
- Consists of:
  - Early childhood
  - Mid-Childhood
  - Late Childhood



# Early Childhood

- One year to six years of age
- Gradual loss of “baby fat”
- Girls lose less fat than boys
- Rapid growth but not as rapid as infancy
- Quite flexible
- Muscle development while at play



# Mid-Childhood

- Six to ten years of age
- Slower, more constant growth
- Improved coordination and motor functioning





# Late Childhood

- Ten to sixteen years of age
- Increased rate of growth
- Fat deposition just prior to adolescent growth spurt
  - 9-10 years of age in girls
  - 11-12 years of age in boys
- Individual differences in maturation

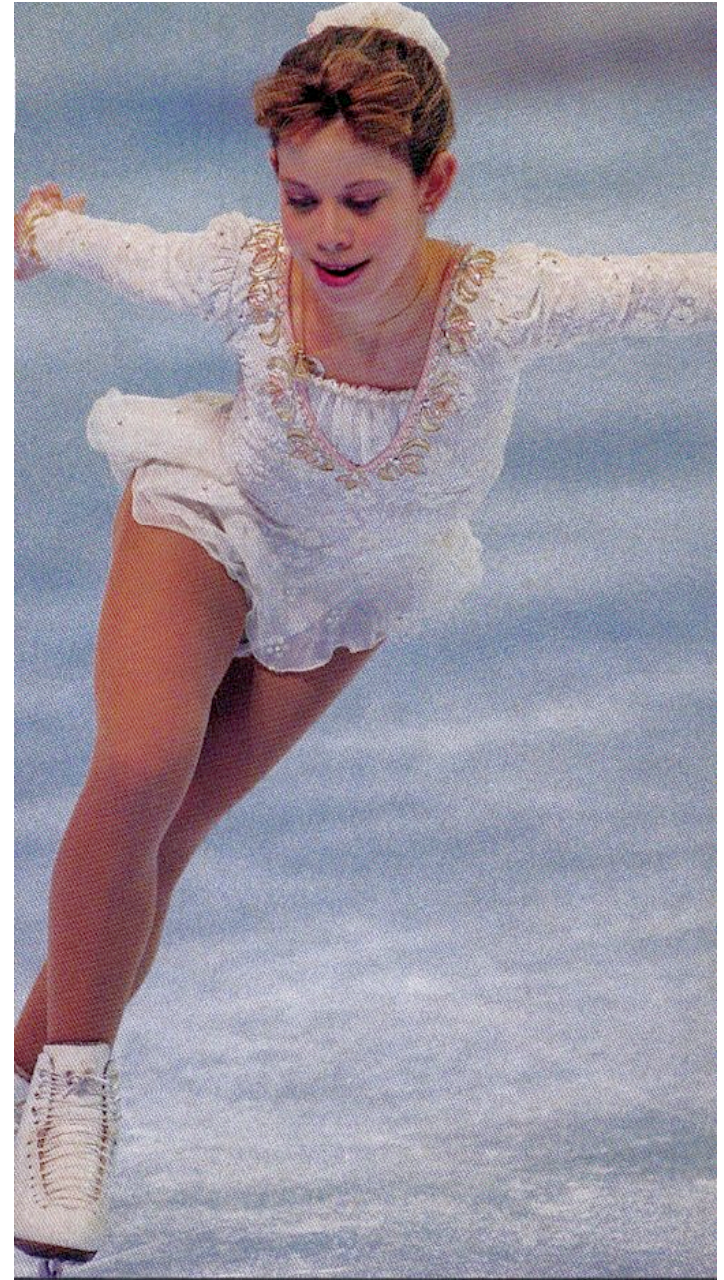


# Late Childhood

- Development of the reproductive system
- Appearance of secondary sex characteristics
  - Breasts
  - Pubic Hair
- Redistribution of body weight
  - Boys - ↑muscle tissue, ↓body fat
  - Girls - slight ↑body fat

# Late Childhood

- Earlier onset of maturation in females may account for their ability to achieve world-class status across many sports
- For example, Tara Lipinski, is the youngest US ladies' figure skating champion



# Adolescence

- Fourteen to twenty years of age
- Following puberty
- Ends with onset of adulthood
- Obvious differences in physical growth cease with the end of adolescence





# Adolescence

- The variability of body types (somatotypes) become more evident
  - Ectomorph
  - Mesomorph
  - Endomorph
- Usually individuals are a combination of these body types

# Somatotypes





# Ectomorph

- Linear shape
- Delicate bone structure
- Little fat
- Long limbs relative to the body

# Ectomorph



# Mesomorph

- Well-muscled
- Little body fat
- Broad shoulders
- Narrow waist

# Mesomorph



# Endomorph

- Rounded appearance
- Heavy bone structure
- Little bone and muscle definition

# Endomorph

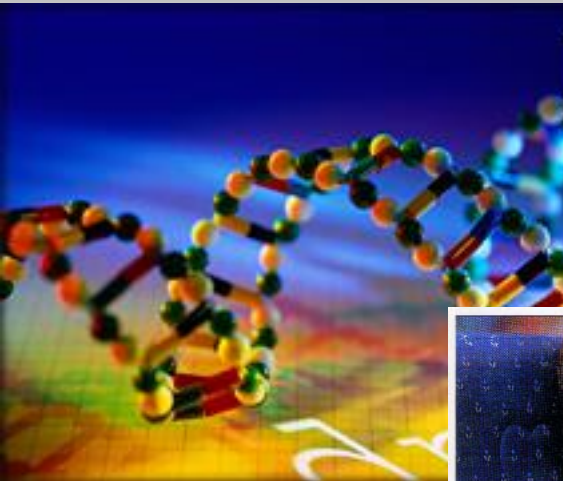


# Adolescence



- External social pressures for the “ideal” body type
- Combined with many physical, hormonal, and psychological changes that occur at this time

# Factors Affecting Growth & Development







# Factors Affecting Growth & Development

- Large variation among individuals
- A number of factors affect growth and development, including:
  - Heredity
  - Nutrition
  - Socioeconomic status
  - Exercise

# Heredity

- Genetic information that is passed on from generation to generation
- These genes are also affected by environmental factors
- For example, malnutrition may prevent an individual from growing to their maximum potential height



# Nutrition

- Adequate nutrients are essential for growth & development
- Carbohydrates and fats are primarily used for energy
- Proteins contribute to the growth and repair of body tissues, including muscle
- Vitamins, minerals and water are also essential for various functions and reactions that occur in the body



# Nutrition

- Undernourishment or malnutrition can delay growth
- Undernourishment exists even in countries with abundant food supplies
- Overeating is also a problem in these countries and can lead to obesity when combined with a sedentary lifestyle



# Socioeconomic Status

- Body size is positively related to socioeconomic status and may be related to nutrition
- That is, socioeconomic status affects
  - Income (money to spend on food)
  - Education (knowledge about healthy food)
  - Time (food selection and preparation time)
  - Availability (access to stores with healthy food choices)





# Socioeconomic Status

- Other factors may contribute to the differences observed in growth & development among individuals, such as
  - Lower levels of stress;
  - Better sleeping patterns; and
  - Regular exercise
- These factors are easier to ensure when the basic necessities are met



# Exercise & Bone Development

- Regular exercise tends to increase the diameter and density of bone
- Increased strength and durability
- Increased length of non-weight bearing bones such as the arms
- Overuse injuries can be incurred by young children who over-train
- Too much strain on a bone during a period of growth can lead to “osteochondrosis,” or the de-arrangement of the normal process of bone growth

# Exercise & Body Composition

- Active children and teenagers show:
  - An increase in lean body mass
  - A decrease in percent body fat
  - Muscle hypertrophy with exercise







# Exercise & Social Development

- Team sports that stress positive interaction and cooperation facilitate social development in children and teens
- Pressure by parents and coaches can hinder the development of an active lifestyle and cause stress

# Perceptual Motor Development Across the Growth & Development Cycle





# Perceptual Motor Development Across the Growth & Development Cycle

- The importance of physical education as an integral part of the school curriculum is often overlooked
- Some parents discourage physical education and emphasize academics
- Other parents encourage physical activity pursuits by enrolling their children in organized physical activity programs



# Perceptual Motor Development Across the Growth & Development Cycle

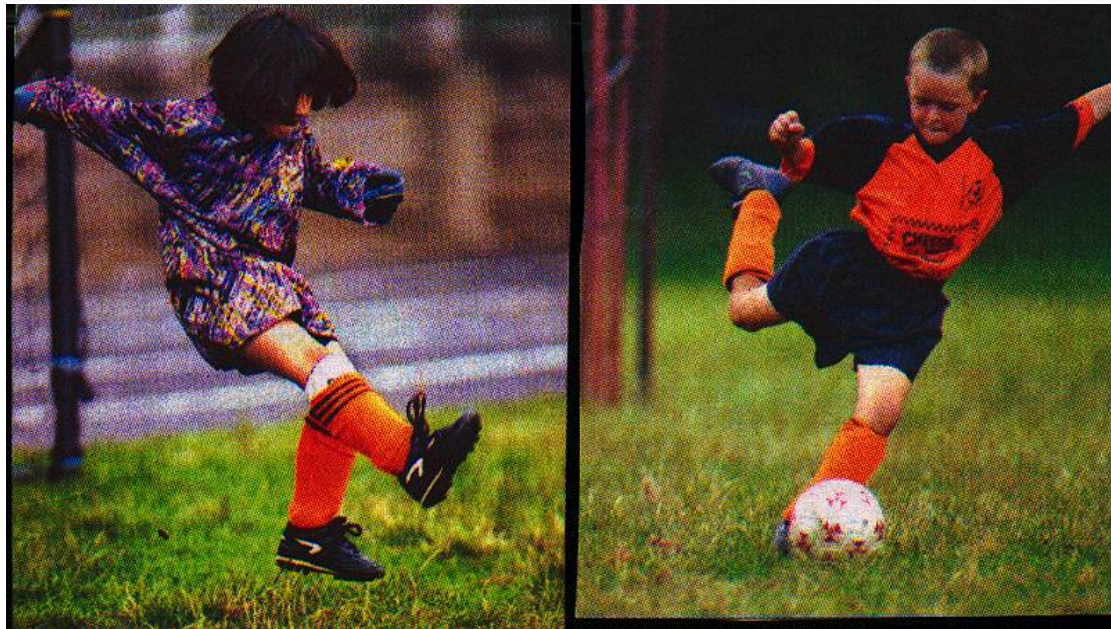
- “Perceptual Motor Development”:  
The use of movement activities to enhance academic or intellectual performance
- Theory developed by Kephart over 30 years ago



# Kephart's Theory of Perceptual-Motor Development

- Believed that learning deficiencies resulted from the *inability* to properly *integrate* present stimuli with the *stored information* concerning past stimuli
- Suggests that participation in basic forms of movement may improve reading and writing skills

# Gender Body Structure Differences Across the Growth & Development Cycle





# Stature

- Refers to a person's standing height
- The distance between the floor and the highest point on the skull
- Body length is measured in infants while the child is supine



# Stature

- Little difference in average length between males and females at birth  
50.5 cm (boys) vs. 49.9 cm (girls)
- By the end of the first year, boys are longer on average  
75 cm (boys) vs. 73.1 cm (girls)
- After 2 years, stature increases more slowly, until adolescence





# Stature

- The age of onset of the adolescent growth spurt can vary by 3+ years
- Usually occurs at 10 or 11 years in girls and at 12 or 13 years in boys
  - Boys grow 10cm/year on average
  - Girls grow 8cm/year on average



# Stature

- Due to hormonal changes that trigger growth to a peak height by adulthood
  - Peak height achieved by 18 years in boys, on average
  - Peak height achieved by 16.5 years in girls, on average
- Usually no change in stature after age 30
- Sometime after age 45, height begins to decrease due to a degeneration of vertebral disks



# Weight

- Little difference in body weight exists between boys and girls from birth until adolescence
- Rapid weight gain occurs from birth to 6 months, such that by 5 months, an infant can double its weight since birth (20g/day)
- Weight gain decelerates during the second year of life



# Weight

- Weight gain continues for the next 3 years (approximately 2kg/year or 4.5lbs/year)
- Slight increase in rate of weight gain per year from 6 years to adolescence (approximately 3kg/year or 6.5lbs/year)
- Sharp increase in body weight at adolescence
  - Boys gain 20kg (45lbs) on average
  - Girls gain 16kg (35lbs) on average
- This adolescent weight gain can be attributed to increases in height and changes in body composition

# Gender Fitness Differences Across the Growth & Development Cycle





WHO  
IS  
MORE  
FIT???



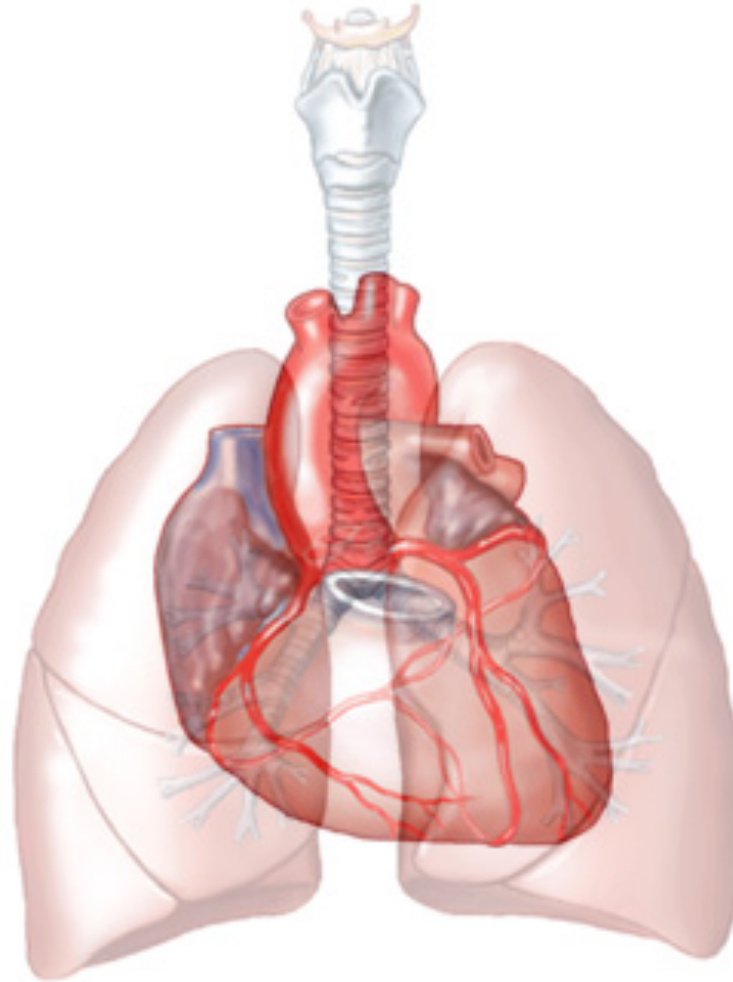


# Four Components of Fitness

“Fitness” is **NOT** synonymous with leanness.  
There are four components to fitness, including:

- Cardiovascular Endurance
- Body Composition
- Flexibility
- Muscular Strength

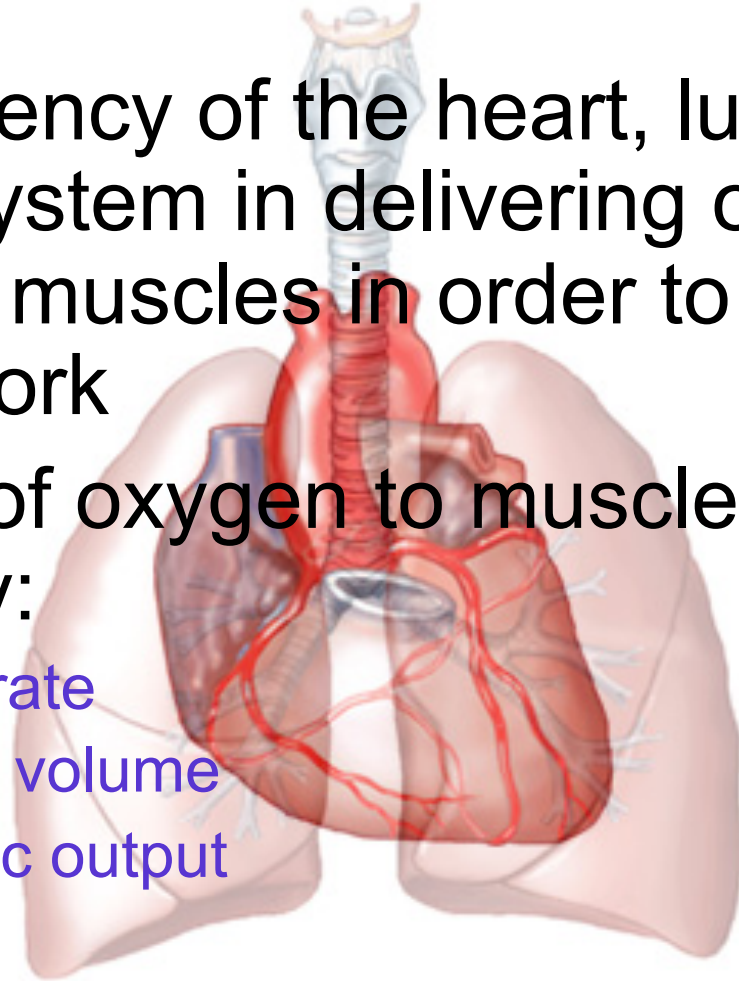
# Cardiovascular Fitness





# Cardiovascular Fitness

- The efficiency of the heart, lungs, and vascular system in delivering oxygen to working muscles in order to maintain physical work
- Delivery of oxygen to muscles is affected by:
  - Heart rate
  - Stroke volume
  - Cardiac output

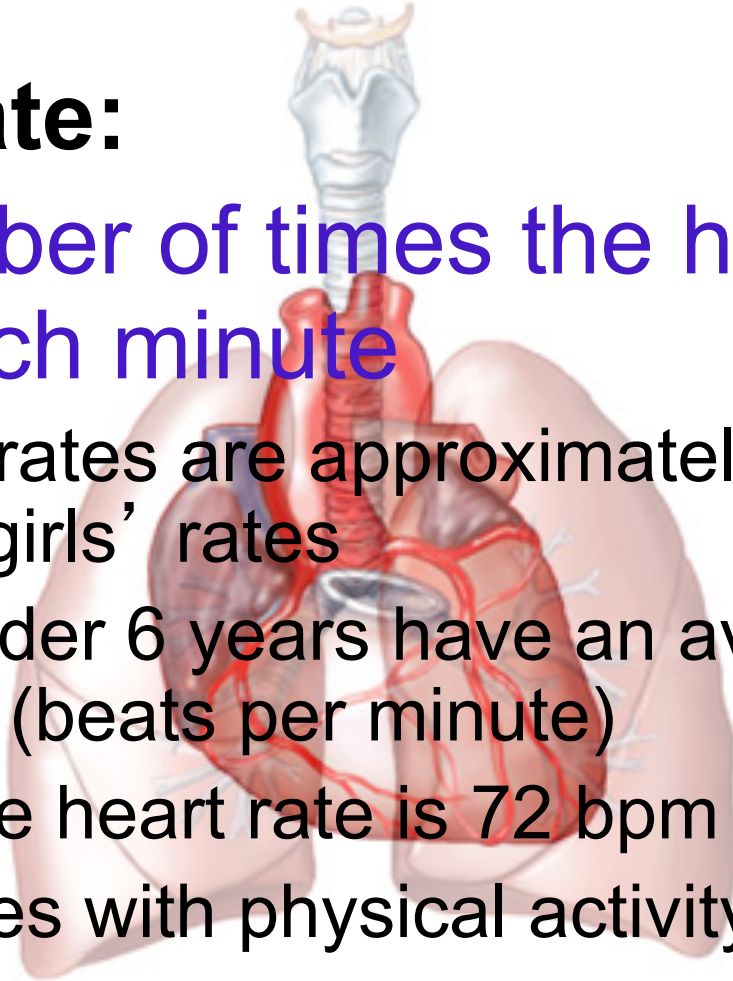


# Cardiovascular Fitness

## ■ Heart Rate:

The number of times the heart beats each minute

- Boys heart rates are approximately 10% lower than girls' rates
- Children under 6 years have an average HR of 100 bpm (beats per minute)
- The average heart rate is 72 bpm
- HR increases with physical activity

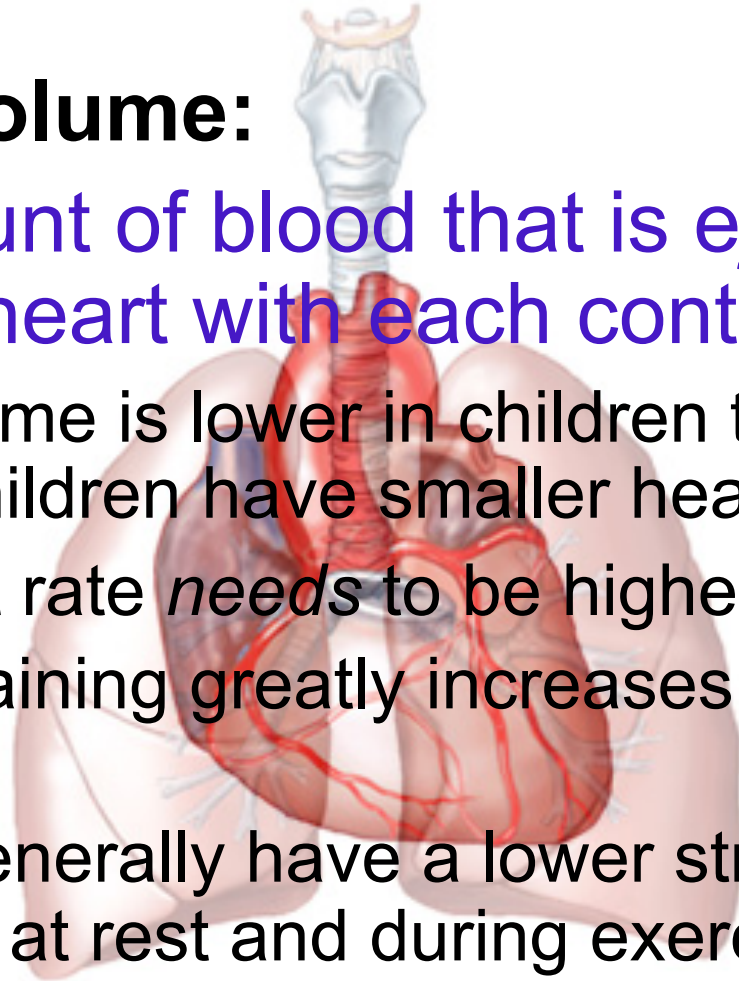


# Cardiovascular Fitness

## ■ Stroke Volume:

The amount of blood that is ejected from the heart with each contraction

- Stroke volume is lower in children than in adults because children have smaller hearts
- Thus, heart rate *needs* to be higher in children
- Exercise training greatly increases stroke volume
- Females generally have a lower stroke volume than males at rest and during exercise



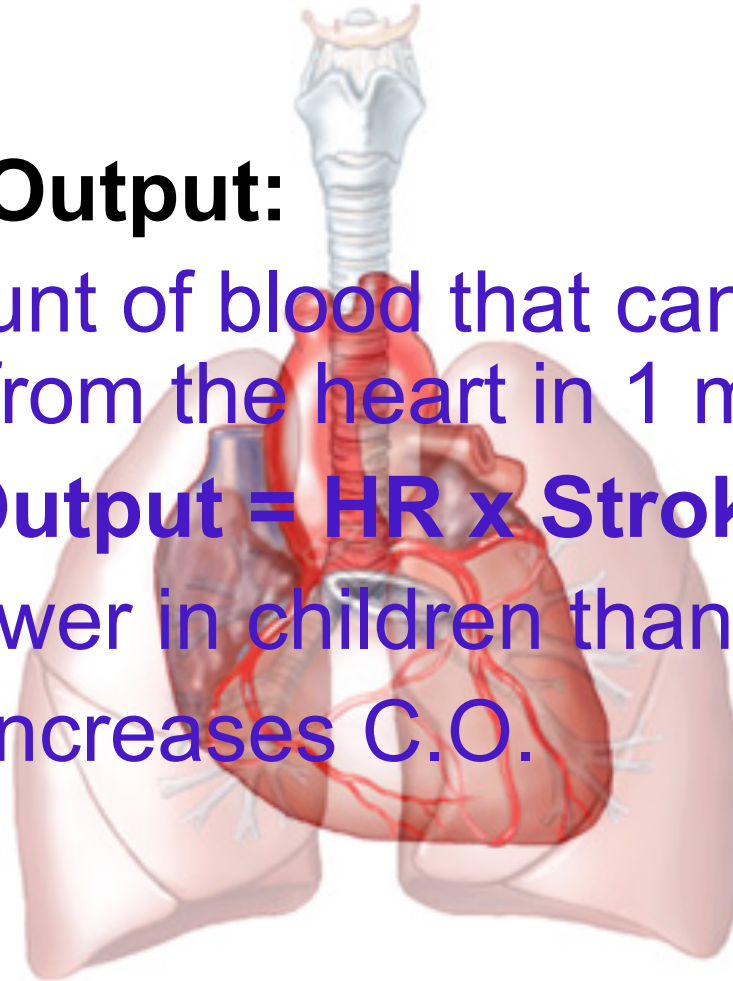
# Cardiovascular Fitness

- **Cardiac Output:**

The amount of blood that can be pumped from the heart in 1 minute

$$\text{Cardiac Output} = \text{HR} \times \text{Stroke Volume}$$

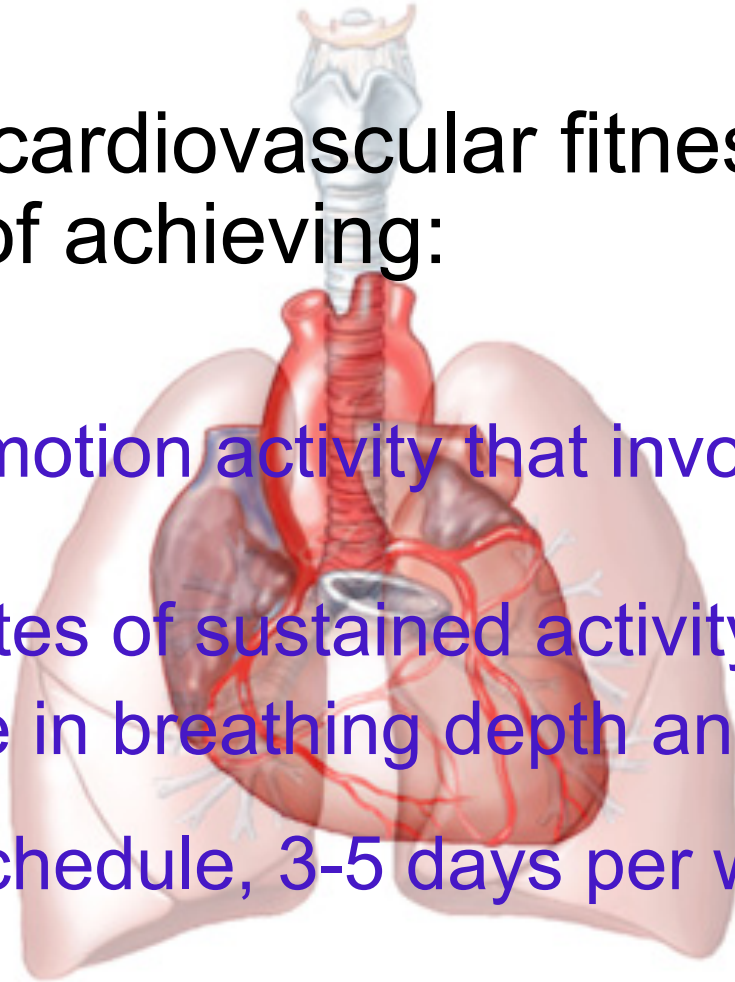
- C.O. is lower in children than adults
- Training increases C.O.



# Cardiovascular Fitness

To improve cardiovascular fitness, get into the habit of achieving:

- Repetitive motion activity that involves large muscles
- 20-30 minutes of sustained activity
- An increase in breathing depth and frequency
- A regular schedule, 3-5 days per week

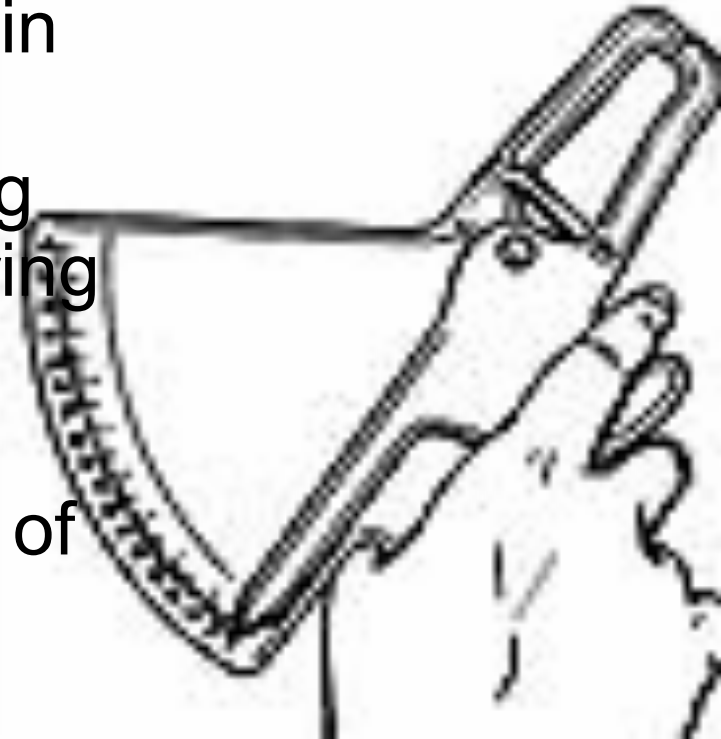


# Body Composition



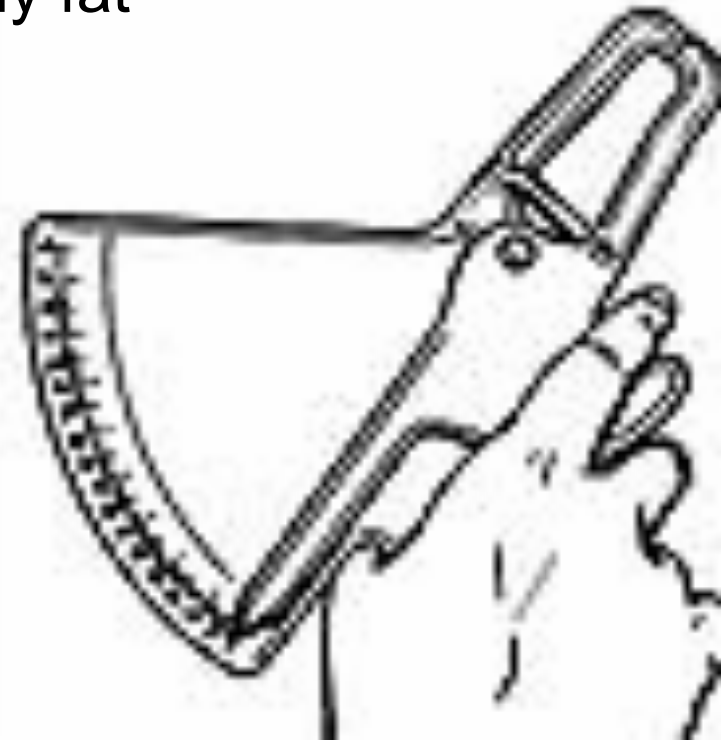
# Body Composition

- Refers to the amount of lean body tissue (muscle and bone) and fat in the body
- Fat is stored fat cells called *adipocytes*
- The number of adipocytes in the body increases during childhood, especially during the first year of life and during puberty
- After puberty, girls usually have a greater percentage of fat than boys



# Body Composition

- Fat is necessary for many functions, including:
  - Insulation
  - Protection of internal organs
  - Energy reserve for the body
- Healthy and recommended body fat content:
  - Males
    - Healthy: 10-22%
    - Minimal: 3-7%
    - Recommended: 15%
  - Females
    - Healthy: 20-32%
    - Minimal: 10-20%
    - Recommended: 25%





# Body Composition



- Calipers are the instruments used to determine body fat
- There is a gradual increase in body fat with age

# Body Composition

- Women generally accumulate more fat than men; distributed evenly over the body
- Men tend to collect fat around the trunk

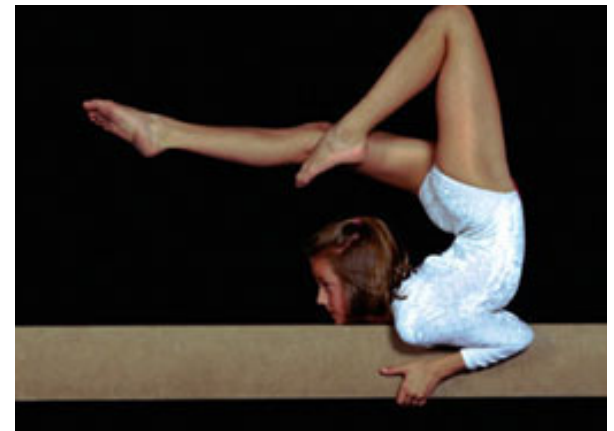


# Flexibility



# Flexibility

- The range of motion about a joint or series of joints
- Factors affecting flexibility:
  - Anatomical structure of joint (bony structure, muscles, ligaments, tendons)
  - Exercise habits
  - Stretching habits
  - Age (natural decrease with age)
  - Gender (women are generally more flexible)



# Flexibility

- The “stretch reflex” protects stretched muscles from injury
- Muscle spindles signal an increase in length of the muscle when stretched
- When the stretch reflex is invoked, the muscle contracts in order to prevent over-stretching and potential injury
- Slow, gentle stretches will prevent the stretch reflex by activating Golgi tendon organs that act in opposition to the stretch reflex



# Flexibility

- Stretches that are held allow the muscle to relax and lengthen
- Stretches should cause tension but not pain within the muscle
- Warm-up prior to stretching
- Hold the stretched position for 15-20 seconds



# Muscular Strength



# Muscular Strength

- The maximum tension or force a muscle can exert in a single contraction
- Muscular strength is important because muscle contraction allows movement to occur
- Without muscular strength, a sedentary life often results





# Muscular Strength



- A hand grip dynamometer is commonly used to measure muscular strength or grip strength
- The instrument is used to measure the force exerted when a hand squeezes as hard as possible



# Muscular Strength

- Strength gains in adolescence are rapid for both males and females
- In females, strength begins to peak by the late teens
- In males, strength begins to peak during the twenties
- Difference in muscle strength in males versus females becomes apparent after puberty
- Testosterone is responsible for increases in muscularity and exists in smaller amounts in women compared to men
- Thus, women tend to develop less muscle and more body fat as adults
- Strength peaks between 20-30 years of age and then slowly declines with age in both sexes

# Muscular Strength & Strength Training

- Resistance training with weights increases muscular strength
- Significant strength gains can be achieved in prepubescent individuals with *resistance training*
- *Weight-lifting* is NOT recommended for prepubescent children
- Regular strength training can slow the decline in strength seen with age in both men and women
- Strength training practiced regularly throughout adulthood can increase mobility and independence when elderly



# Social and Psychological Factors Across the Growth & Development Cycle

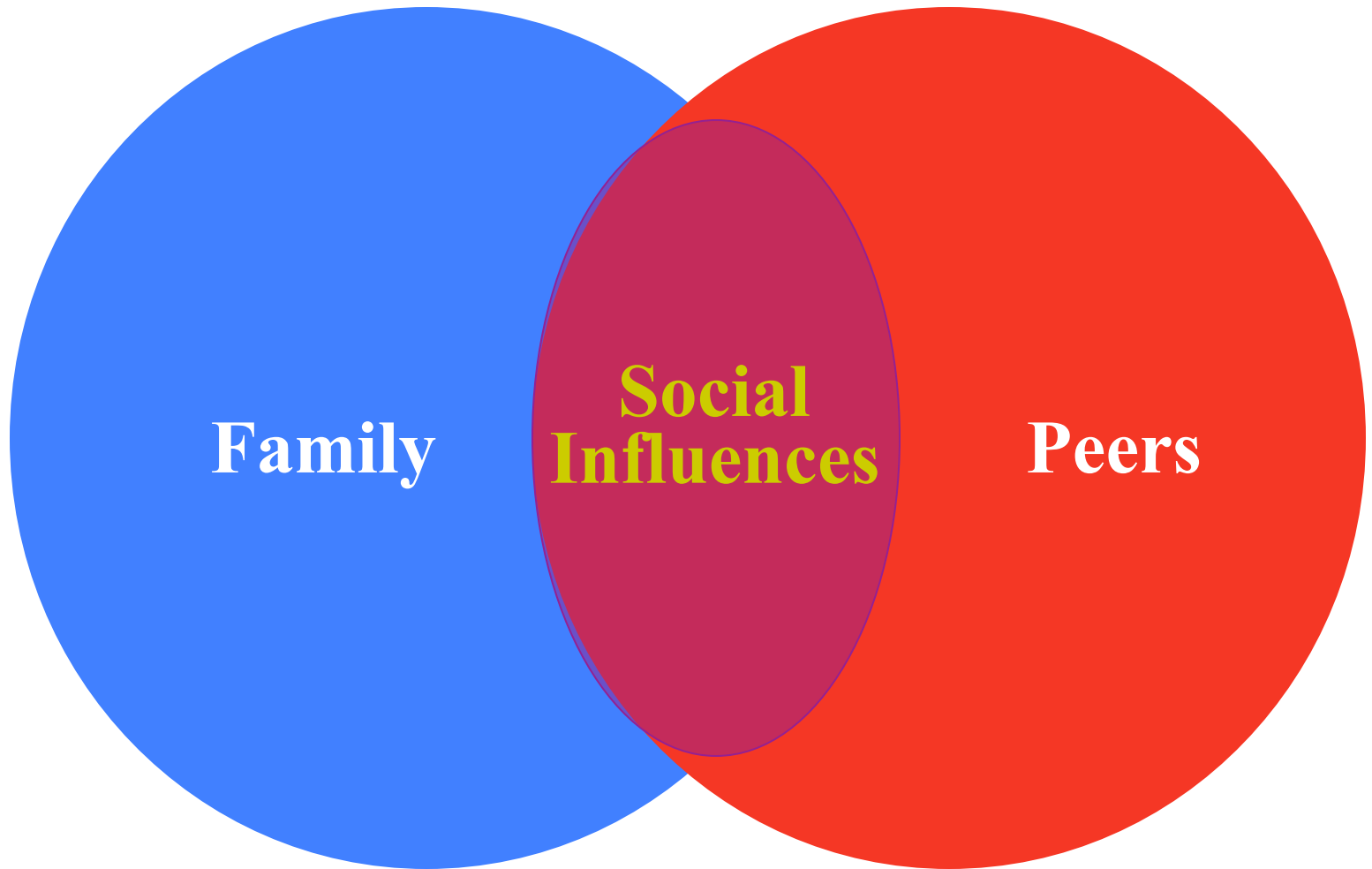




# Self-Esteem and Self-Concept

- Self-Esteem: the value we place on ourselves as persons
- Self-Concept: the perception that we have of ourselves
- Athletic Competence: a perceived level of success in competitive sporting activities
- Involvement in physical activity has been shown to enhance self-esteem and self-concept
- Athletic competence is not necessary to achieve the self-esteem benefits of physical activity
- Though athletic competence can have a positive effect on self-esteem in itself

# Social Influences



# Family

- Family influences children's choice to participate in physical activities and the success attained
- Parents' approval or disapproval of physical activity impacts the child's future involvement in sports
- The family's views concerning physical activity are instilled at a young age



# Peers

- As adolescence approaches, the family's influence diminishes
- The peer group becomes an important social force
- The need for peer approval can affect decisions concerning participation in physical activity positively or negatively





# Youth Sports





# Why Children Participate in Sports

Children have cited many reasons for sport participation. Of these, which is the most important to them?

- To improve skills
- To have fun
- To be with friends
- To be part of a team
- To experience excitement
- To receive awards
- To win
- To become more physically fit

# Why Children Drop Out of Sports

- Interpersonal problems (disliking the coach or peers)
- To pursue other leisure activity interests
- To become involved in a different sport activity
- Excessive stress
- ★ It is more common for children to drop out due to interpersonal problems than due to excessive stress.



# Youth Sport Coaching

- It is important to offer youth sport programs that are led by competent coaches
- Too often, coaches are volunteers or parents and have little formal training
- Coaches should be encouraged to become certified *prior* to coaching
- Children's first experiences in organized sport should be positive in order to develop healthy attitudes towards sports and physical activity

