

Growth & Maturation

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Introduction

- Physical activity/exercise with young people – must consider growth and maturation of individuals
 - Morphological parameters and physiological functions (e.g., heart volume, lung function, aerobic power and muscular strength) develop with increasing age and body size
 - Physical fitness parameters (e.g., muscular, motor and cardiorespiratory) develop with increasing age and body size
- Principles of childhood growth and maturation – Auxology
- Growth & maturity – maintained by genes, hormones, energy, and nutrients
 - Interact between themselves and with the environment.

Growth

- Changes in the size of an individual
 - Taller, heavier, increase lean and fat tissues, organs increase in size
- Changes in size are result of 3 cellular processes:
 - Increase in cell number (hyperplasia)
 - Increase in cell size (hypertrophy)
 - Increase in intercellular substances (accretion)
- All 3 occur but predominance of one process over another varies with chronological age and the tissue involved

Maturation

- Progressive achievement of adult status
- Comprises a subset of developmental changes:
 - Morphology, function & complexity
- 2 components of maturation process:
 - Timing (when specific maturational events occur)
 - Tempo (rate at which maturation progresses)
- Children of similar chronological ages can differ significantly in their degree of maturation
 - Early, average or late maturers

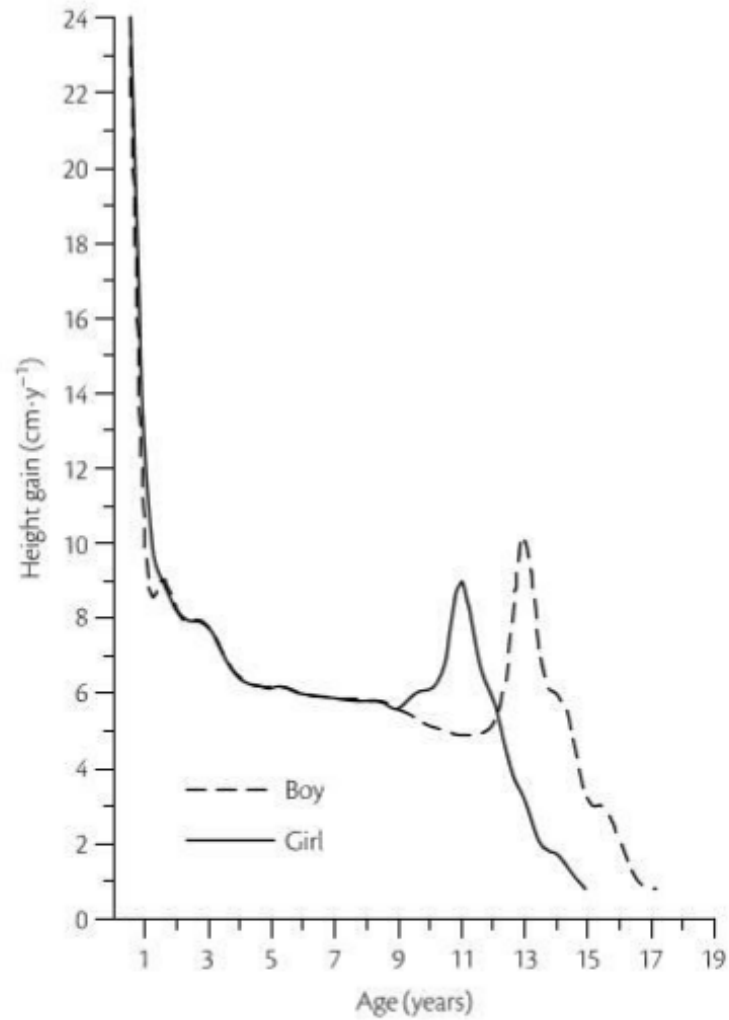
Stages of life leading up to Maturity

- Pre Natal
- Post Natal
 - Childhood
 - Adolescence

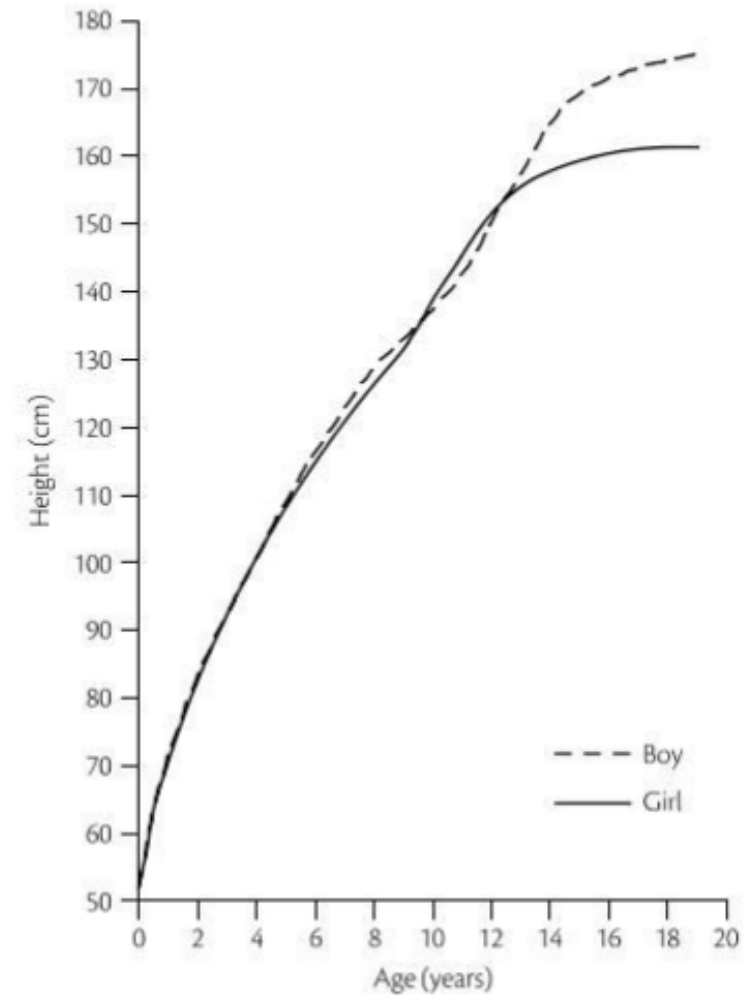
Growth, Development, and Maturation *(continued)*

- Infancy: first year of life
- Childhood: first birthday to puberty
- Puberty: secondary sex characteristics develop
- Adolescence: puberty to growth completion

(continued)



Typical individual height velocity curves for boys and girls, representing the velocity of the typical boys and girls at a given instance (Malina *et al.*, 2004 In Baxter-Jones, 2008)



Typical individual distance curves for boys and girls (Malina *et al.*, 2004 In Baxter-Jones, 2008)

Growth, Development, and Maturation *(continued)*

- Rates of change in height and weight
 - Birth to 2 years: fast
 - 2 years to just before puberty: slow
 - Puberty onset: fast
 - Midpuberty to late teens: slow
- Height and weight change not synchronized
 - Height change fastest at 12 years (girls), 14 years (boys)
 - Weight change fastest at 12.5 years (girls), 14.5 years (boys)

(continued)

Gender Differences

- Adolescent growth spurt varies in magnitude and timing between sexes
 - Males enter growth spurt almost 2 years later than females and have a slightly greater magnitude of height gain
- Extra 2 years of growth before adolescence, in combination with a greater magnitude of growth during adolescence explain part of the increased final adult height observed in males.
- Also other skeletal changes occur that result in gender differences in adulthood:
 - Wider shoulders in males & wider hips in females
 - Males = rapid increase in muscle mass whilst females accumulate greater amounts of fat.

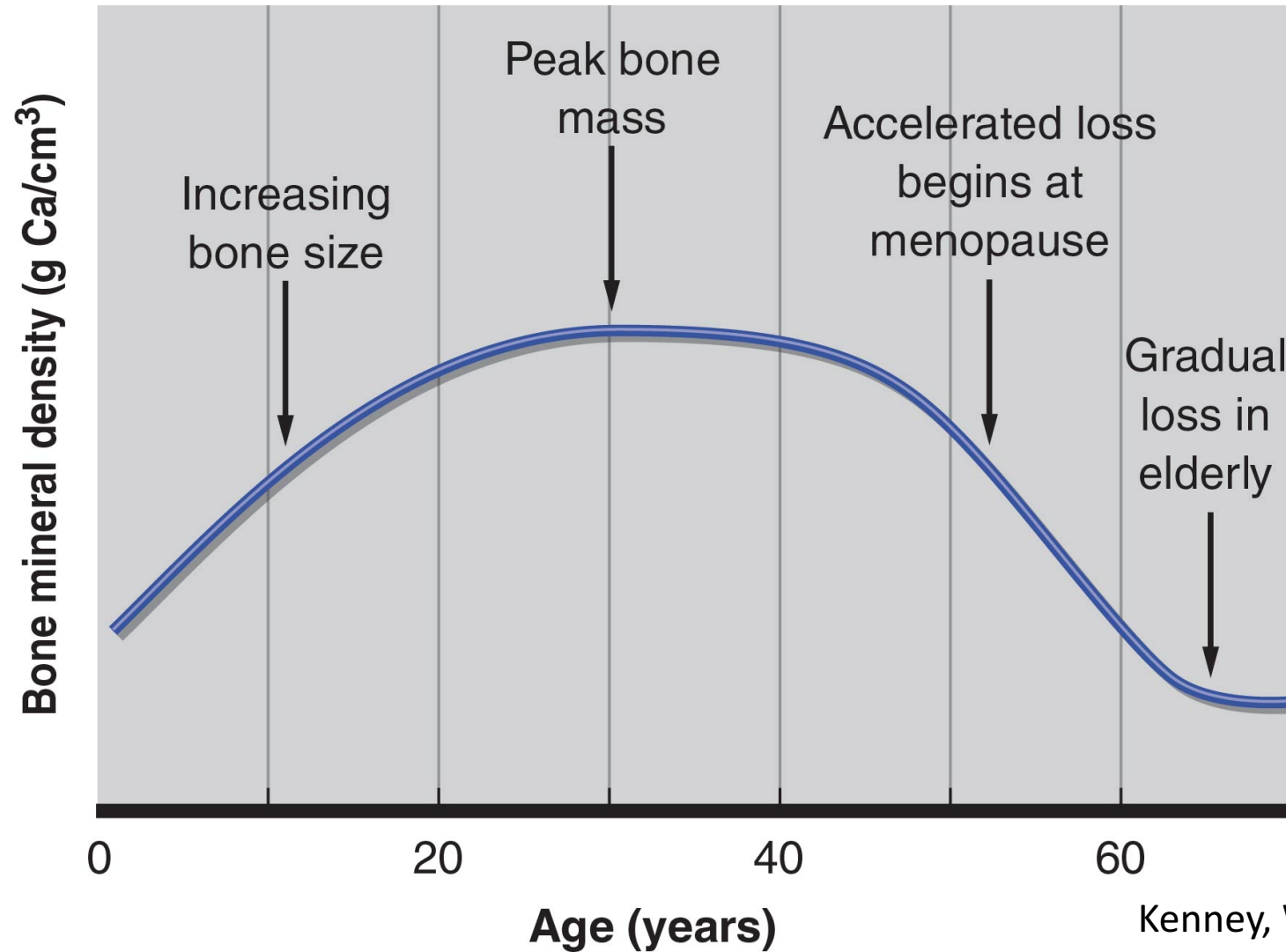
Growth, Development, and Maturation *(continued)*

- Bone ossification from fetus to adulthood
 - Growth plate: cartilage line in bone
 - Growth plate closure = ossification completed
- Estrogen stimulates plate closure
 - Girls achieve full bone maturity faster
 - Midteens versus later teens/early 20s for boys
- Calcium essential for bone health
 - Bone mineral density (BMD)
 - Osteoporosis later in life

(continued)

Kenney, Wilmore & Costill (2015)

Figure 17.2



Kenney, Wilmore & Costill (2015)

Growth, Development, and Maturation *(continued)*

- Muscle mass steadily increases with weight
 - 25% of body weight at birth
 - 30 to 35% of body weight in young women (estrogen)
 - 40 to 45% of body weight in young men (testosterone)
 - Peaks at 16 to 20 years (girls), 18 to 25 years (boys)
- Fiber hypertrophy → ↑ muscle mass
- More/longer sarcomeres → ↑ muscle length

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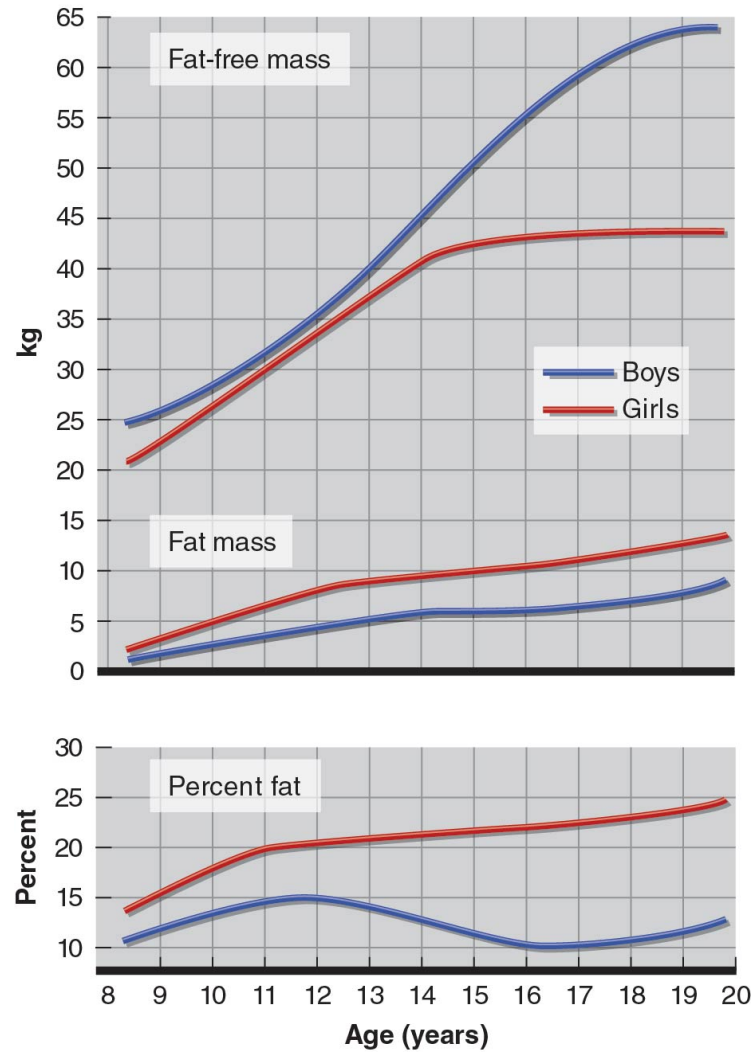
Growth, Development, and Maturation *(continued)*

- Fat deposits form in fetus and throughout life
- Amount of fat affected by
 - Diet (changeable)
 - Exercise habits (changeable)
 - Heredity (not changeable)
- Percent body fat changes with age
 - Birth: 10 to 12%
 - At physical maturity—women: 25%, men: 15%

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Kenney, Wilmore & Costill (2015)

Figure 17.3



Kenney, Wilmore & Costill (2015)

Growth, Development, and Maturation *(continued)*

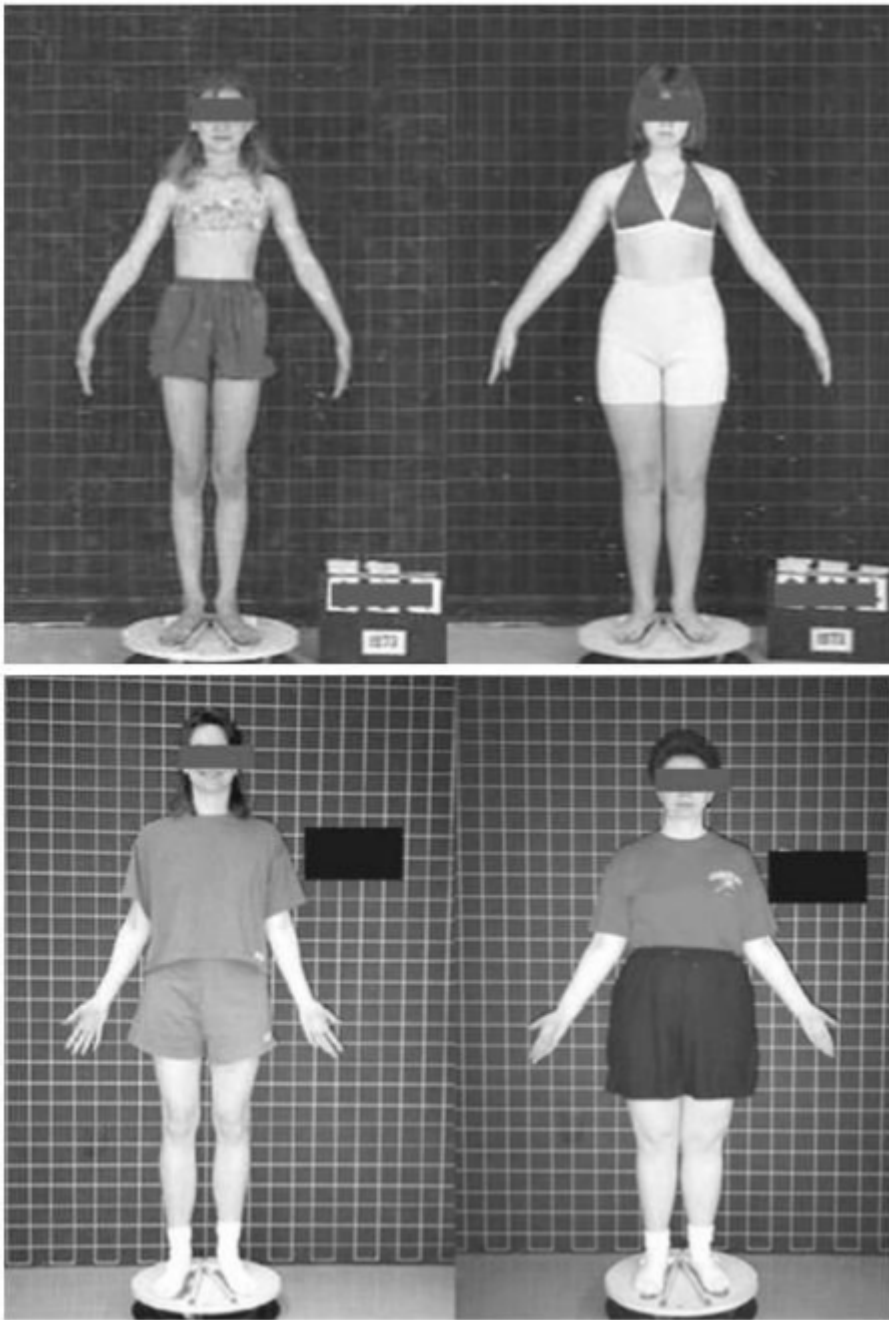
- Neurological development in childhood
 - Better balance, agility, coordination
 - Due to ongoing myelination of nerves, brain
- Myelination also influences strength

Puberty

- Time period that sees the onset of adult reproductive capacity.
- Dramatic period involving rapid transformation of anatomy, physiology, and behaviour

Biological Maturity

- Whilst every individual passes through the same stages of maturity they do so at differing rates.



Two girls photographed at the same chronological ages (11 and 35 years). At 11 years of age the girl on the left has 25.2cm of growth in stature remaining and the girl on the right 6.5 cm of statural growth remaining. Data taken from two individuals who participated in the Saskatchewan Growth and Development Study (1964-1998) Cited in Baxter-Jones (2008)

Baxter-Jones, A.D.G. (2008). Growth and Maturation In Paediatric Exercise Science and Medicine (2nd Ed.) Armstrong, N. and Van Mechelen, W. Oxford: Oxford University Press.

Gallahue, D., Ozmun, J. C. & Goodway, J. D. (2012) Understanding Motor Development (7th ed.). New York :McGrawHill

Kenney, W. L., Wilmore, J. H. & Costill, D. L. (2015). Physiology of Sport & Exercise (6th ed.). Human Kinetics: Champaign, IL.

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