



**MEDICAL UNIVERSITY - PLEVEN
FACULTY OF MEDICINE**

Department of Pediatrics

Lecture № 7

**GROWTH AND DEVELOPMENT.
PSYCHOMOTOR DEVELOPMENT**

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GROWTH AND DEVELOPMENT



INTRODUCTION

- Physical growth is **biological process** from birth till maturity
- Influenced by **genetic, sexual, endocrine, environmental and disease factors**
- This is combination of two processes:
 - **Growth** – an increase in cell number or cell size
 - **Development** – progressive change of body function or structure toward its mature state
- Growth assessment requires **standards** (a range of normal values) in relation of **age and sex**
- Standards – as a **growth charts or tables** (for height, weight, rate of growth)

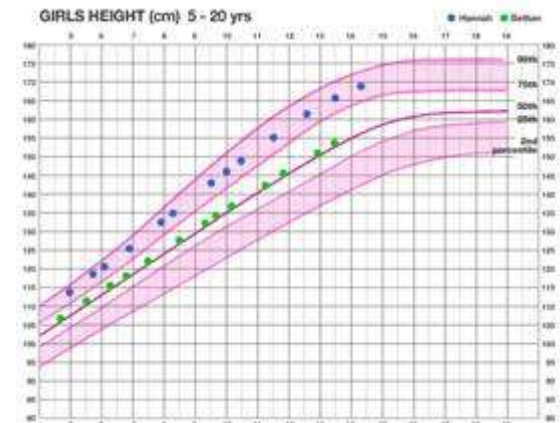
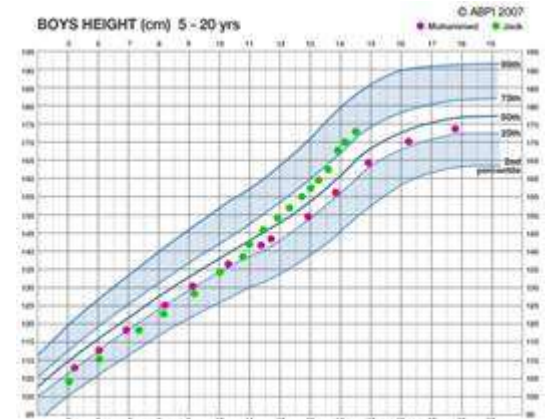
PERIODS OF GROWTH

- Rapid growth – during infancy until 3-rd year
- Slow growth – from 3-rd until puberty
- Adolescent growth spurt
- Decrease in the rate of growth until maturity



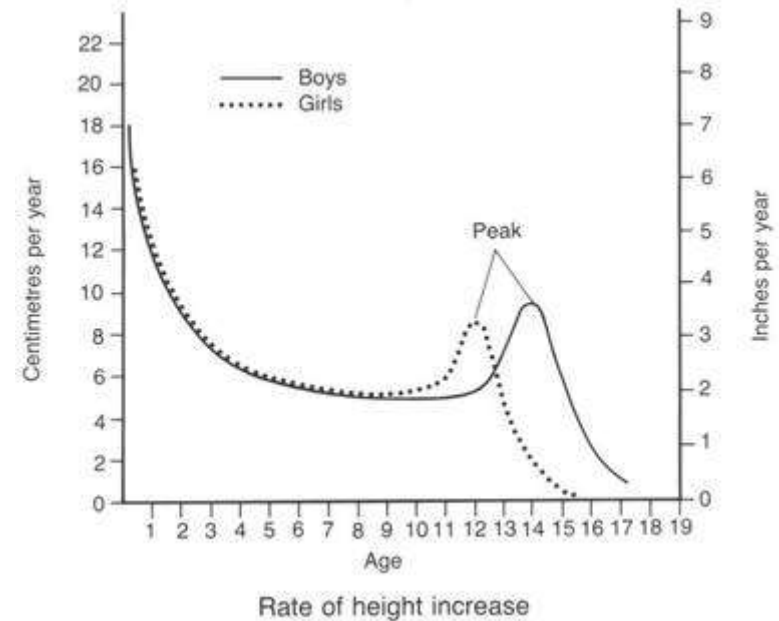
FACTORS INFLUENCING GROWTH AND DEVELOPMENT

- 1. **Heredity**
 - The inherited genes are modified by various exogenous influences
- 2. **Sex**
 - Girls are usually slightly shorter and weigh less than boys



FACTORS INFLUENCING GROWTH AND DEVELOPMENT

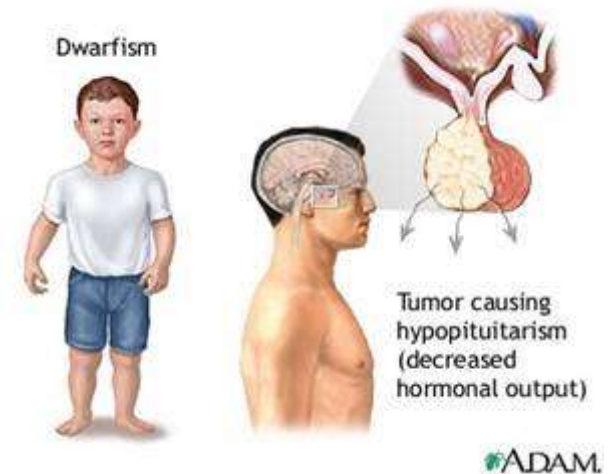
- Girls usually begin puberty 2 years earlier than boys and between 11-14 years of age they are taller than boys
- Adolescent growth of boys completes 3 years later than girls



FACTORS INFLUENCING GROWTH AND DEVELOPMENT

3. Endocrine system

- The Pituitary gland (**Growth hormone**):
 - Stimulates the transport of amino acid across cell membranes and the **synthesis of protein**
 - Stimulates **cartilage growth**
 - Increases **fatty acid catabolism**
 - Increases the metabolism of **carbohydrates**
 - Its effect is mediated by **somatomedins** (**insulin-like growth factors**) synthesized in the liver and kidneys



3. Endocrine system

- The Thyroid gland (Thyroid hormones)
 - Influence fetal and neonatal growth
 - Promote body growth and development
 - Promote skeletal growth and development
 - Promote sexual maturation
 - Influence brain growth and mental development



- Increase metabolic rate
- Influence cutaneous and hair growth

3. Endocrine system

The **Gonads** are activated during the puberty

- Boys (**Testosteron**):
 - Increases **muscular** development
 - Stimulates bone maturation and **epiphyseal closure**
 - Stimulates **sexual** maturation (enlargement of scrotum, penis, prostate and spermatogenesis)
- Girls (**Estrogens**):
 - Accelerate skeletal maturation and **fusion closure** of epiphyses
 - Stimulate differentiation of the genitalia and secondary **sex characteristics**

3. Endocrine system

- The Pancreas (**Insulin**) – complements the action of GH
- The Adrenal glands (adrenal cortex):
 - Influence **water and electrolyte** balance (**Aldosteron**)
 - Influence **carbohydrate and protein** balance (**Corticoids**)
 - Influence **masculinization and skeletal maturation** (**Androgens**)

4. Environmental factors

Prenatal factors

- Maternal **infections**
- Maternal **disorders** (Diabetes mellitus)
- Maternal **nutritional** status
- Exposure to **drugs and chemicals**
- **Intrauterine conditions**

4. Environmental factors

Postnatal factors

- Poor nutrition (**malnutrition**) or overfeeding (**Obesity**)
- **Chronic illness** - cause growth failure (Cystic fibrosis, renal and heart disorders, intestinal malabsorption, anemia)
- Inadequate **medical care**
- Poor **social state** and sanitation
- Non-supportive **psychological interactions**
- Rate of growth may be accelerated during the period of remission (**Catch up growth**)

MEASUREMENT OF PHYSICAL GROWTH

Body weight (BW)

- At birth – 2 500 – 4 500 g
(the median: boys 3 400 g, girls 3 100 g).
- SGA – fullterm less than 2 500 g
- Premature – preterm newborn
- 1 – 3 month – 700 – 750 g/month (20-25 g/24h)
- 4 – 6 month – 600 g/month
- 7 – 9 month – 500 g/month (15 g/24h)
- 10 – 12 month – 360 g/month
- Doubled birth weight – between 4 – 6 month
- Tripled birth weight – at 1 year age
- Between 1 year and puberty – 2 - 3 kg/year
- Formula: $BW = 1\text{-year BW} + (\text{number of years of age} \times 2)$

MEASUREMENT OF PHYSICAL GROWTH

2. Body height (BH)

- Newborns – **49 – 53 cm**
(the median **50 cm**)
- Length increases by **24-25 cm** during the 1-sth year:
 - 1-3 month - **3 cm/month**
 - 4-6 month - **2 cm/month**
 - 7-9 month - **2 cm/month**
 - 10-12 month - **1 cm/month**
- During the 2-d year – by **12 – 14 cm/year**
- Between 3-rd year and puberty – **by 5 cm/year**
- Puberty growth spurt (duration 2 year):
 - Boys (at 13-14 years) - **20 cm**, 10 cm/year
 - Girls (at 11-12 years) – **16 cm**, 8 cm/year
- Formula: $BH = 1\text{-year BH} + (\text{number of years of age} \times 5)$



3. Head circumference (Indicator of brain growth)

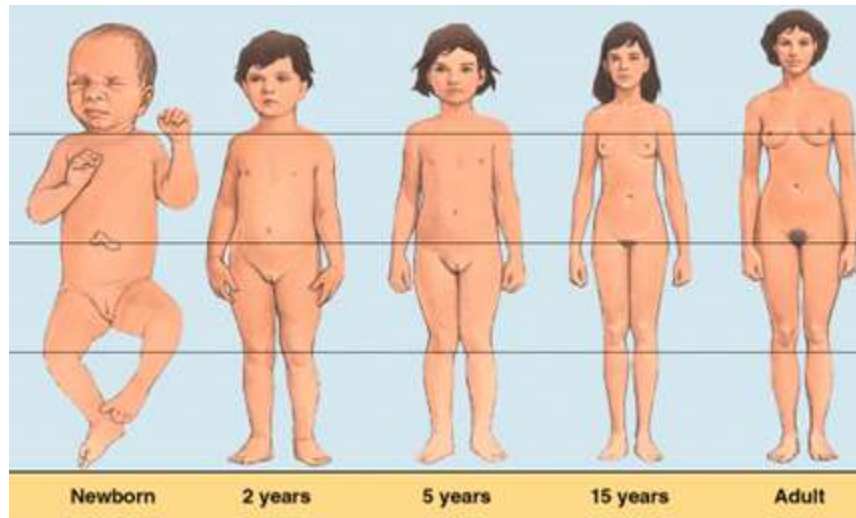
- At birth – **34 cm**
- During the 1-sth year increases by **12 cm**
- Between the 1-sth year and puberty the rate decreases to **1 cm/year**
- **The fontanel:**
 - **posterior** is closed at birth
 - **anterior** is open (closures between **9-18-th month**)



MEASUREMENT OF PHYSICAL GROWTH

4. Body proportions

- Chest circumference:
 - 32 cm at birth (smaller than head circumference)
 - after the 4-th month is getting bigger than head circumference
- Upper/lower segment ratio – $\frac{2}{3}$ in newborn, $\frac{1}{2}$ after 2-year and adults



MEASUREMENT OF PHYSICAL GROWTH

5. Skinfold thickness (for assessment of nutrition status)

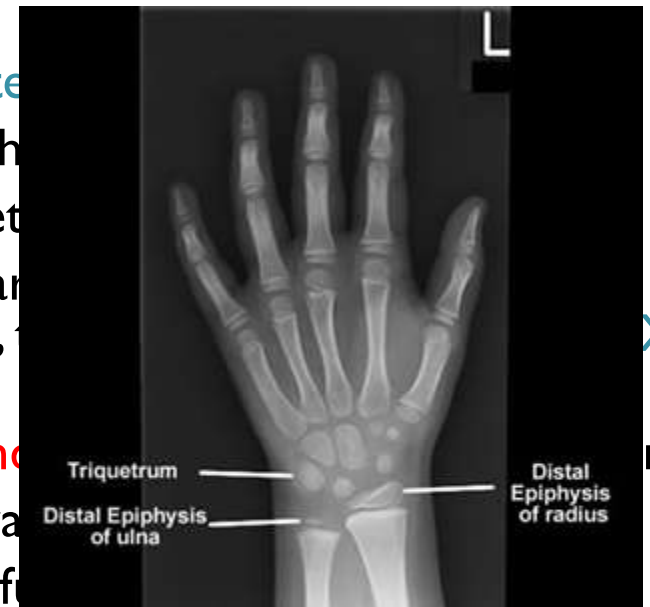
- Measurement by **skinfold calipers**
- Sites of measurement – **the triceps and subscapular region**
- There correlation between skin thickness and **body fat content**



ASSESSMENT OF THE DEVELOPMENT

1. Bone age

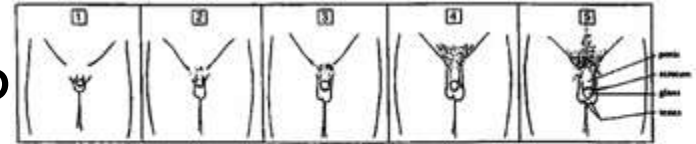
- Assessment by ossification centers
- Radiograph (the wrist) – after the
- Comparing with a standards (set)
- At birth: 5 ossification centers are visible: the distal femur, proximal end of the tibia, the distal humerus, the distal radius and the distal ulna
- At 5-6 months – the capitate and the distal radius and ulna
- Girls, as a rule, have a more advanced bone age
- The end of growth – when the epiphyses are completely ossified



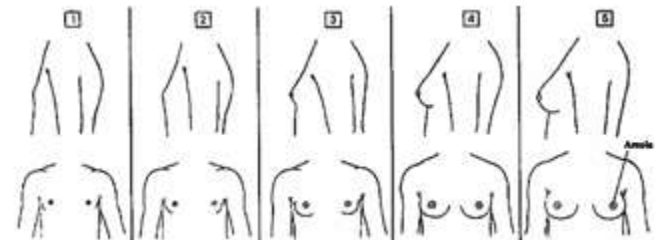
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2. Sexual maturation

- Marks the beginning of p



- Puberty begins with
 - Girls – breast development
 - Boys – genital development



- Assessment by **Tanner Sexual Development Stages:**
| – 5 stages

- for breast development
- for genital development in boys
- for pubic hair in both sexes

3. Dentition

- Eruption of the first tooth usually begins at about **6 months**
- There is a order and age of eruption for every tooth
- Deciduous teeth are **20** (completion by the age of 2 years)
- The first permanent tooth erupts at **6 years** of age
- Formula for number of infant teeth = number of months of age - 6



PSYCHOMOTOR DEVELOPMENT



INTRODUCTION

- Indicator of **nervous system** maturity
- Assessment by **standards** (complex of normal skills for different age)

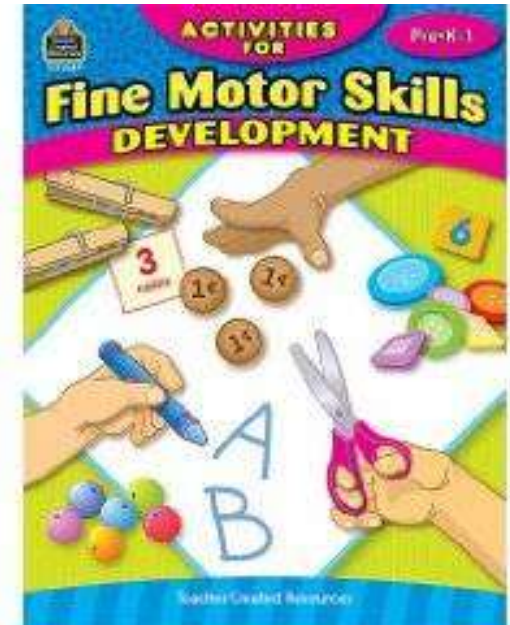


CONTRIBUTING FACTORS

- Normal CNS status
- Normal analyzers (sight and hearing)
- Genetics (intelligence level of the parents)
- Environment (social factors, cultural factors, family or orphanage)

CRITERIA FOR ASSESSMENT

- **Motor skills** (gross and fine) – progress in cephalocaudal direction
- **Adaptive skills**
- **Personal-social contact**
- **Language**
- **Games**



CRITERIA FOR ASSESSMENT

- Formula:

- $\text{PsD ratio (\%)} = \left(\frac{\text{observed PsD in weeks}}{\text{PsD reference in weeks}} \right) \times 100$

- Normal 90 – 110 %
- Delayed <70%
- Advanced >110%
- Borderland 90-70%

IQ ASSESSMENT

- In children older than **3 years** of age
- Assessment by special **tests and standards**



DEVELOPMENT OF INFANT SKILLS

MOTOR

- Newborn – slow neck and hand asymmetric movements
- At 1 month – head lifted for a short time when prone
- At 2 months – head lifted for a long time when prone
- At 3 months – head lifted steady when prone, support of the feet
- At 4 month – turns over on its back
- At 5 months – turns over on its stomach
- At 6 months – sits briefly

DEVELOPMENT OF INFANT SKILLS

MOTOR

- At 7 months – creeps and sits for a long time
- At 8-9 months – supports body in standing
- At 10 months – stands up with 1 hand help
- At 11-12 months – walks 1-2 step alone
- At 15 months – toddles independently
- At 18 months – walks well
- At 2 years – runs well, walks up and down stairs
- At 3 years – jumps, climbs, rides tricycle

ADAPTIVE

- Newborn – sleeps the most time
- At 1 month – regards bright color toy
- At 3 months – regards and hears well, moves the head to noise direction
- At 4 months – eye-hand coordination
- At 7-10 months – shakes rattle, matches 2 objects in hands
- At 12 months – rings bell alone
- At 2 years – begins toilet training

PERSONAL-SOCIAL

- Newborn – only **basic needs** (food, pain)
- At 1 month – first **smiling**
- At 3-4 months – strong relationship between **infant and its mother**
- At 5 months – infant can **separate its mother** from others
- At 6-7 months – **afraid** of strangers
- At 10 months – makes **“bye-bye”**
- At 12 months – cooperates **in dressing**
- At 2 years – fears of **dogs and dark**

LANGUAGE

- Newborn – only **crying**
- At 1 month – **throaty noises**
- At 2-3 months – begins **cooing**
- At 4-5 months – speech **sounds**
- At 6 months – begins to make **syllables**
- At 8 months – the **meaning of words**
- At 10-12 months – the first **3-5 words**
- At 12 months – begins to associate **action with words**
- At 15-18 months – the speech production, **300-400 words**
- At 3 years – starts asking **questions**, uses **1 200 words**

GAMES

- Help infant to **communicate** with other children
- At 12 months – **shows pictures** in the book
- At 2 years – talks to doll
- At 3 years – **draws** on a sheet of paper





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