Growth II: Factors Affecting Growth

Objectives
- Understand how the nervous and hormonal systems regulate growth
- Understand difference between trophic and non-trophic hormones
- Know the hormones important for growth
- Understand the relationship between diet and disease
- Understand the factors affecting growth

Growth
- Nervous system
- Hormonal system

Hypothalamus
- 7 hypothalamic hormones that affect the release of the pituitary gland hormones

Pituitary gland
- Master gland

Pituitary Hormones
- Regulate reproduction:
  - Gonadotropins: stimulate gamete formation and production of sex hormones, which include
    - Follicle-stimulating hormone (FSH)
    - Luteinizing hormone (LH)
  - Prolactin: near the end of pregnancy and prepares the breasts for milk production

Other
- Thyroid-stimulating hormone (TSH) - metabolism
- Growth hormone (GH) - skeletal growth and protein synthesis
Endocrine System

**Hormones**

**Trophic**

**Non-trophic**

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### Trophic Hormones

E.g.

- **Thyroxine Stimulating Hormone (TSH)**
  - produced by pituitary gland
  - low levels of TSH triggers hypothalamus to release TSH-Releasing Hormone (TRH)
  - TSH stimulates production of thyroid hormone, or thyroxine

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### Non-trophic Hormones

- **Growth Hormone (GH) or somatotrophic hormone**
- **GH-Releasing Hormone** produced by the hypothalamus
- hypertrophy – when cells under the action of GH increase in size
- hyperplasia – when cells under the action of GH increase in number
Sex Hormones

During adolescence replacement of cartilage by bone, halting further bone growth even though GH is still present.

Growth Hormone

Gigantism - too much of GH before skeletal maturity
Acromegaly (gross thickening of bone) - too much of GH after skeletal maturity
Dwarfism - too little of GH

Hormones important to human growth

1) Thyroid hormone: thyroxine promotes general body growth and development and promotes skeletal, dental and sexual maturation. Thyroid deficiencies are linked to Cretinism
2) Insulin – produced by islets of Langerhans of Pancreas
   diffusion of glucose
   protein synthesis
3) Androgens (e.g., testosterone) responsible for secondary sexual characteristics at puberty and for epiphyseal bone closure
4) Estrogen
   female sex hormones
Diseases and Nutritional Inadequacies

thalamidomide – drug administered to pregnant women in 1st trimester in UK; resulted in babies lacking limbs

pre-natal growth period - most often due to maternal undernutrition or to placental exchange problems

post-natal growth

Basic components of the diet

- protein - growth and the maintenance of structures
- carbohydrates - primary fuel for energy yielding reactions
- lipids (fat cells) - are for fuel storage
- vitamins
- minerals

Protein-Calorie Malnutrition (PCM)

Undernutrition - an inadequate calories
Malnutrition - inadequacy of some key element
Kwashiorkor - Ghanaian word meaning “second child disease”
- diet low in protein, especially animal protein
- symptoms include fat and distended bellies
Marasmus
diet is low in both protein and calories and
the result is starvation

Factors Affecting Growth

Secular trends
- decline in age of menarche
- increase in height
- socioeconomic
- males reaching maturity earlier

Population variability
- population differences with regard to child and adult stature,
  body weight, body proportions, and rate of maturation

Seasonal Factors: growth in height is fastest in the spring and growth
  in weight is fastest in the autumn

Psychological disturbances
Widdowson (1951) study of nations in orphanage

Socio-economic Differences
Upper class are always more advanced along the course to maturity
Size of Family
Height, weight, auditory and visual acuity, and mental ability all had
lower values in children of 3-sib and larger families

Study Guide – Exam I

- When: October 2 at 9 AM (arrive before 9 AM for early start)
- What: ~75 multiple choice questions
- Bonus question (5 pts.)
- Covers: Chapter 1-4 & 14-16 and PPT
  lecture material
- Bring hand calculator
- Study sessions