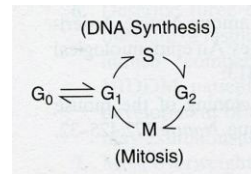


Chapter 12: Growth Hormones

Lecture 14

Growth: increase in size

- 1) hypertrophic: cells enlarge
- 2) hyperplastic: cells increase #s
- 3) extracellular matrix: production of intercellular substance



Growth Hormone (GH)

source: anterior pituitary

polypeptide: 191 aa $C_{990}H_{1532}N_{262}O_{300}S_7$

growth & cell reproduction: availability of materials

binds to cell receptors

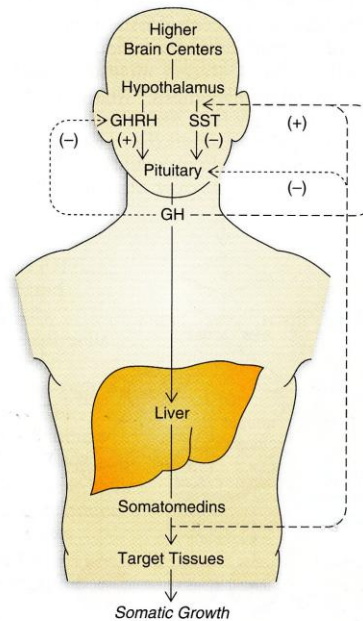
↑ height & growth of all organs except brain

Ca⁺⁺ retention

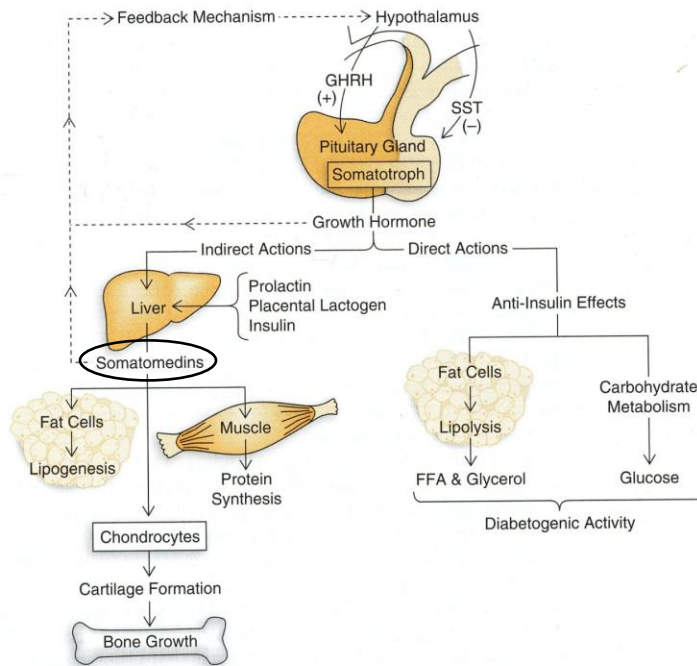
strengthens & ↑ bone mineralization

↑ muscle mass: ↑ new muscle cells ↑ protein synthesis

↑ lipolysis: ↓ adipose tissue (body fat)



SST= somatostatin



Somatomedins

GH: growth of epiphyseal regions of long bones → incorporation of sulfur

Indirect effects on bone through sulfation factor

Somatomedin hypothesis:

under control of GH somatomedin promote incorporation of sulfate into cartilage

Somatomedins

plasma: insulin-like growth factors I & II (IGF – I & IGF – II)

source: liver

Peptides: similar to proinsulin

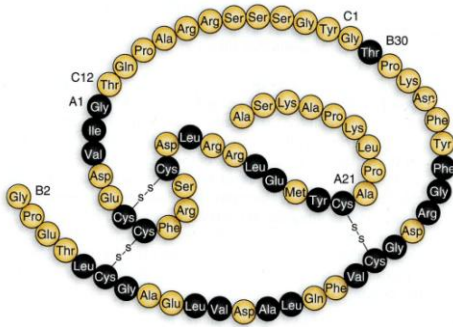
affinity to insulin receptors

↑↑ insulin → binds to IGF receptors

insulin > IGF → metabolic effects

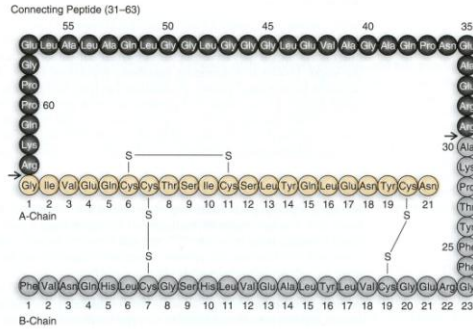
IGF > insulin → cell proliferation

Structure of IGF-1

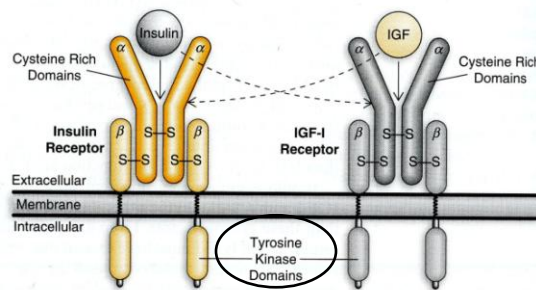


Black aa indicate identical positions as human insulin

Human Insulin



Structure of insulin & IGF receptors



Structurally related heterotetrameric glycoproteins

two α subunits & two β subunits

α subunits entirely extracellular with cysteine –rich domains

β subunits transmembrane joined by disulfide bonds with tyrosine kinase domains

85% aa similarity in tyrosine kinase domains

Pathophysiology

Congenital hyposecretion → dwarfism

Children

hypersecretion → gigantism
growth failure & short stature

Adult

- ↓ strength
- ↓ energy
- ↓ bone mass
- ↑ cardiovascular risk

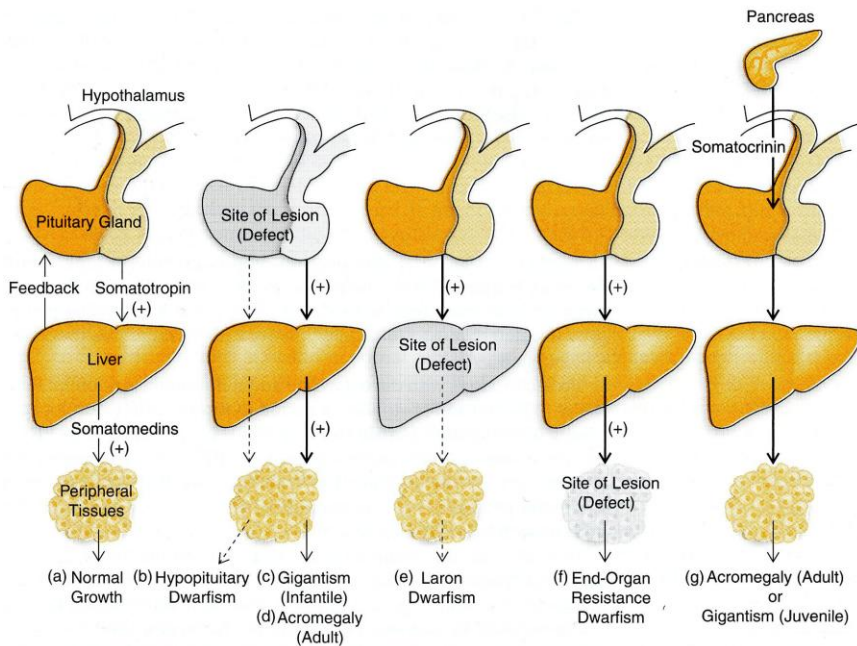
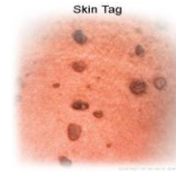
Adult: benign tumor of pituitary gland → adenoma

hypersecretion: diagnosis middle age adults → acromegaly

- 1) abnormal growth of hands & feet
- 2) facial bone growth
 - protrusion of brow & jaw
 - nasal growth of hands & feet
 - teeth space out
- 3) arthritis
 - overgrowth of bone & cartilage
- 4) carpal tunnel syndrome
 - tissue thickens
- 5) body organ enlargement (heart)

Other acromegaly symptoms

- 6) joint aches
- 7) thick, coarse, oily skin
- 8) skin tags (benign skin growth)
- 9) enlarged lips, nose & tongue
- 10) deepening of voice: enlarged sinuses & vocal cords
- 11) sleep apnea—breaks in breathing during sleep due to obstruction of airway
- 12) excessive sweating and skin odor
- 13) fatigue & weakness
- 14) headaches
- 15) impaired vision
- 16) abnormalities of menstrual cycle & sometimes breast discharge in women
- 17) erectile dysfunction in men
- 18) decreased libido



GH receptor deficiency inbred Ecuadorian family



#8: 16 years old
#9: 21 years old
#10: 6.5 years old