Pituitary Hormones

- Groupings
- Chemical
  - GH and PRL are proteins
  - ACTH, LPH, and MSH are peptides
  - FSH, LH and TSH are Glycoproteins
  - Oxytocin and Vasopressin are peptides
- these hormones have isoforms

Pituitary Hormones

- GH overview
  - All vertebrates
  - Species specific
  - Large, protein, single chain, 190 AA, 20,000
  - Big, intermediate and small forms
  - Active core (60%)
  - Bioassay

Pituitary Hormones

- GH function
  - Metabolic regulator
  - Protects lean mass and nervous tissue
  - fat metabolism (produces fatty acids)
  - Abundant during fasting
  - Targets all tissues except nervous tissue
  - Effects occur through IGF one and 2

Pituitary Hormones

- GH function
  - Function of GH varies with the life cycle of the organism
    - Immature animals – responsible for growth
    - Adults – too much can cause overgrowth
      » i.e. “Frankenstein effect”
  - Effects carbohydrate metabolism
    - Reduces tissue uptake of sugar and as a result increases the blood sugar levels
    - Increases sugar output from liver
  - Effects on fat metabolism
    - Breaks down fatty acids for use as energy
    - Diabetogenic hormone?
- Effects on protein metabolism
  - Increases cellular AA uptake
  - Stimulates protein synthesis in cells

**Pituitary Hormones**

- GH regulation
  - Neural
    - Stress increases it
    - Sleep/wake cycle alters it
    - Higher CNS responses alter it
  - Chemical
    - Somatostatin/somatocrinin
    - Metabolic – low blood sugar, fasting, drop in AA’s
  - Chronotropic
    - Elevated at night, reduced during the day

**Pituitary Hormones**

- PRL overview (lactogenic hormone, leuteotropin)
  - All vertebrates
  - Species specific
  - Large, protein, single chain, 198 AA,

**Pituitary Hormones**

- PRL function
  - Regulates reproductive and parental care
  - Effects on the integument
  - Osmoregulation
  - Growth
  - Metabolism

**Pituitary Hormones**

- GH regulation
  - Neural
    - Controlled from higher nervous centers (stress)
  - Chemical
    - Prolactin inhibiting factor (PIF),
    - prolactin releasing factor (PRF)
    - PIF the major control in mammals
    - Short loop and ultrashort loop feedback
• Long loop feedback from estrogen and progesterone
  – Biphasic effects of estrogen

Start here

Pituitary Hormones

• ACTH, MSH, LPH overview
  – Grouped because of common function
  – Similar chemistry, there are long sequences that are similar
    (heptapeptides)

Pituitary Hormones

• ACTH overview
  – Single, peptide, 39 AA’s, produced in anterior pituitary
  – 1st 24 AA’s required for biological action
  – Residues 25-34 used for receptor recognition
  – ACTH 1-24 not species specific

Pituitary Hormones

• ACTH function
  – Stimulates the adrenal cortex
  – Quick acting to cause release of glucocorticoids

Pituitary Hormones

• ACTH regulation
  – Neural
    • #1 stress hormone
  – Chemical
    • Corticotropin releasing factor (CRF) from the hypothalamus
    • Short loop, ultra short loop feedback on the pituitary and hypothalamus
    • Long loop feedback from glucocorticoids to the anterior pituitary

Pituitary Hormones

• MSH overview
  – Melanotropin, melanostimulating hormone, intermedin
  – Produced in the Pars Intermedia or Pars Distalis
  – Function not clear in higher vertebrates
  – 3 types
• Alpha – 13 AA’s, Beta 18 AA’s, Gamma 22 AA’s
  – Smallest hormone produced in pituitary
  – Alpha has the greatest biological activity of the 3 forms

**Pituitary Hormones**

• MSH function
  – Color adaptation in lower vertebrates
  – Stimulates melanin synthesis and storage in higher vertebrates
  – Camouflage, sexual behavior, thermoregulation

**Pituitary Hormones**

• MSH function
  – Disperses melanin in melanophores

**Pituitary Hormones**

• MSH regulation
  – Neural
    • Neural inputs from the Pars intermedia
      – Catecholamines – inhibitory
      – Adrenergic - stimulatory
  – Chemical
    • MIF melanotropin inhibiting factor
      – Tonic inhibition from this hypothalamic factor keeps MSH down

**Pituitary Hormones**

• LPH overview
  – Lipotropin
  – Overall function is to break down fat
  – The most important precursors of brain peptides and psychoactive drugs
  – 2 types
    • Beta 91 AA’s, Gamma 58 AA’s
• LPH synthesis
  – Formed from the prehormone POMC

Pituitary Hormones

• POMC
  • Provides 7-10 potent brain peptides
    – Endorphins
      • Alpha, beta, gamma
        – Pain relief
    – Enkephalins
      – Pleasure, pain, memory, learning