I. Lab 5 Review: Safety & Techniques Q?

II. Introduction to Endocrinology LS ch 17, DC Module 13, SI Fox+
A. Endocrine vignette: Cushing's syndrome LS fig17-20 p 521-2
B. Endocrine system DC p 103 fig 13-1, LS fig 17-1, tab 17-1
C. What’s an endocrine? + classes ~ LS pp 495 – 6
D. Hypothalamus (Master) – Pituitary (subcontroller)
   DC pp 104-6 + LS pp 499-506
E. Posterior pituitary + hormones DC p 108, LS fig 17-4 p 502
F. Anterior pituitary + hormones DC pp 105-7, LS pp 502-6
H. Peripheral endocrine organs DC pp 109-13, LS pp 513-36
   1. Pancreas (insulin, glucagon, diabetes) 2. Thyroid 3. Adrenals

III. Nervous System & Excitable Cell Connections LS ch 5, 4, 7
A. How is the nervous system organized? fig 5-1 p 108
B. Neurons? What kind? fig 5-2 p 109
C. Brain structure & function fig 5-7, 5-8 pp 116 - 7
D. Protect your head with a helmet! Bicycle head injury statistics, NHTSA & BHSI
No food, drink or gum in lab today! Thanks sincerely!

...Healthy, tasty & fresh, but not in lab!!
PREPARATION

1. WASH & DRY

2. ALCOHOL

3. WASH & DRY
SAMPLE + TESTS

1. Obtain μ-sample

2. Blood glucose

3. Blood typing
Glucose: Sugar in Blood

Normal: 70-99
Pre-Diabetes: 100-125
Diabetes: ≥ 126 mg/dL
BLOOD TYPING

ADD ANTISERA

MIX W/TOOTHPICKS

READ & RECORD!!
CLEAN-UP!

1. FOLD DIAPER
2. BLOOD PRODUCTS
3. REWASH!!
Blood Chem Lab Q?
Cushing’s Syndrome = Hypersecretion of Cortisol: Hypothalamic (CRH), Pituitary (ACTH), or Adrenal (Cortisol)
ANP = Atrial Natriuretic Polypeptide
Hormone/Endocrine Classifications

**Exogenous**

**Endogenous**

![Hormone diagrams](image)
Hypothalamus & Pituitary: Intimate Relationship
Good Things Come in Small Packages!

Hypothalamus < 1% of Brain Mass
Hormone Master Controller +100s of Functions!

Kreiger & Hughes 1980
Nervous Connection!!

Neurosecretory neurons

Hypothalamic-posterior pituitary stalk

Anterior pituitary

Hypothalamus

Systemic arterial inflow

Systemic venous outflow

= Vasopressin

= Oxytocin
Hypothalamus-Anterior Pituitary Vascular Connection!

- Neurosecretory neuron
- Systemic arterial inflow
- Hypothalamic-hypophyseal portal system
- Anterior pituitary

- = Hypophysiotropic hormones
- = Anterior pituitary hormone
Pituitary Nourishing or Growth Hormones

Neurosecretory neuron

Systemic arterial inflow

Hypothalamic-hypophyseal portal system

Hypothalamus

Systemic venous outflow

RH + or RIH -

Releasing or Release-Inhibiting Hormones

- Hypophysiotropic hormones

- Anterior pituitary hormone

Hypophysis = Pituitary

LS 2007
Capillary-Venule-Capillary Intimate Circulation

Krieger & Hughes 1980
Paraventricular nucleus
Supraoptic nucleus
Median eminence
Portal system
Infundibulum
Hypothalamus
Anterior pituitary
Posterior pituitary

TSH
Prolactin
ACTH
Gonadotropins
FSH
LH

Mammary gland
Thyroid
Adrenal cortex
Ovary
Testis

Bone
Muscle
Adipose tissue
fig 17-10
Progression & Development of Acromegaly

Age 13

Age 21

Age 35
Growth Hormone = Somatotrophic Hormone
Body Builder’s Dream?
GH/STH Effects: Insulin Resistance/Type II Diabetes?

↑ Amino Acid uptake & Protein synthesis

↑ Lipolysis & Fatty Acid mobilization

↓ Glucose uptake
   (skeletal muscle & adipocytes)

↑ Glucose production
   (liver glycogenolysis)

↑ Insulin secretion
Increase GH naturally with exercise & sleep!!

![Graph showing growth hormone (GH) levels during sleep and wakefulness. There are peaks in GH levels during sleep and lower levels during wakefulness, with an arrow indicating a peak after strenuous exercise. The y-axis represents growth hormone levels in ng/ml plasma, and the x-axis represents time of day.]

ng/ml = nanograms per milliliter
Endocrine Pancreas: Insulin (I) & Glucagon (G)  
See-Saw Hormones in Regulating Blood Glucose

- **Duodenum**
- **Stomach**
- **Bile duct from liver**
- Endocrine portion of pancreas (Islets of Langerhans)
- Exocrine portion of pancreas (Acinar and duct cells)
- Duct cells secrete aqueous NaHCO₃ solution
- Acinar cells secrete digestive enzymes

The glandular portions of the pancreas are grossly exaggerated.
NB: Diabetics have problems either here or here.

Cellular uptake and utilization of glucose

Fox 1987
Times of Need!

Blood

Glucose

A cells

Glucagon

Insulin

Cellular uptake of glucose

Glycogenolysis

Mobilize!!
### Table 4-7: Warning Signs of Diabetes

These signs appear reliably in type 1 diabetes and, often, in the later stages of type 2 diabetes.

- Excessive urination and thirst
- Glucose in the urine
- Weight loss with nausea, easy tiring, weakness, or irritability
- Cravings for food, especially for sweets
- Frequent infections of the skin, gums, vagina, or urinary tract
- Vision disturbances; blurred vision
- Pain in the legs, feet, or fingers
- Slow healing of cuts and bruises
- Itching
- Drowsiness
- Abnormally high glucose in the blood
Diabetics must constantly juggle diet, exercise & medication to control blood glucose!
Like others, diabetics benefit from whole grains, vegetables, fruits, legumes & non-/low-fat milk products!
FIGURE 13-12
Adrenal Gland  The adrenal glands sit atop the kidney and consist of an outer zone of cells, the adrenal cortex, which produces a variety of steroid hormones, and an inner zone, the adrenal medulla. The adrenal medulla produces adrenalin and noradrenalin.
Epinephrine 80%
Norepinephrine 20%

**Figure 77-1**
Secretion of adrenocortical hormones by the different zones of the adrenal cortex.
Nervous System

CNS

PNS

input

output
Central nervous system (CNS)

Input to CNS from periphery

Brain and spinal cord

Output from CNS to periphery

Peripheral nervous system (PNS)

Afferent division

Sensory stimuli

Visceral stimuli

Efferent division

Somatic nervous system

Motor neurons

Skeletal muscles

Smooth muscle
Cardiac muscle
Exocrine glands
Some endocrine glands

Autonomic nervous system

Sympathetic nervous system

Parasympathetic nervous system

Enteric nervous system

Stimuli in digestive tract

Enteric organs only

Effector organs
(made up of muscle and gland tissue)
~99% of all neurons in humans! CNS ~100 billion interneurons!!
Motor

M. Supplementary motor area (on inner surface—not visible; programming of complex movements)

M. Premotor cortex (coordination of complex movements)

M. Primary motor cortex (voluntary movement)

S. Primary sensory cortex (sensation)

Central sulcus

Sensory

Key

M. Motor cortex
A. Association cortex
S. Sensory cortex

A. Posterior parietal cortex (integration of somatosensory and visual input; important for complex movements)

A. Wernicke's area (speech understanding)

A. Parietal-temporal-occipital association cortex (integration of all sensory input; important in language)

S. Primary visual cortex surrounded by higher-order visual cortex (sight)

A. Limbic association cortex (mostly on inner and bottom surface of temporal lobe; motivation and emotion; memory)

A. Prefrontal association cortex (planning for voluntary activity; decision making; personality traits)

M. Broca's area (speech formation)

S. Primary auditory cortex surrounded by higher-order auditory cortex (hearing)

LS 2006, cf: LS 2012 fig 5-8a
~ 500,000 bicyclists/yr visit emergency rooms

As of 2014, the population estimate of
State of Wyoming  584,153
Albany OR  51,980
Corvallis OR  54,953
Springfield OR  60,263

~ 26,000 traumatic brain injuries
743 of ~900 cyclist deaths, 2013 ≡ ~ 2% of all traffic fatalities
13% of deaths children ≤ 14 yr, 87% σ
11% involved wrong-way riding!

Bicycle crashes & injuries are under reported, since majority not serious enough for ER visits.

Helmets may reduce head & brain injury risk by 85%!

~$2.3 billion/yr = indirect injury costs from not using helmets!
The "typical" bicyclist killed on our roads is a sober male over 16 riding without a helmet. He's hit by a car on a major road between intersections in an urban area on a summer evening. Please wear a helmet – it can make the difference between life and death.
Hey, I’m alive because I wore a helmet!!
Stories, Discussion, Questions or Comments!