I. **Announcements** *Blood Chemistry Lab today!* Fun!! Personal data!!! If you haven't already done so, please review Lab 5 in LM & in e-mail. Thanks! Q from last t?

II. **Safety & Techniques Review for Blood Chem Lab** Q?

III. **Endocrine Connections** Peripheral endocrine organs
   DC pp 109-13, LS pp 513-36
   A. Pancreas (insulin – glucagon see-saw!)
   B. Thyroid
   C. Adrenals

IV. **Introduction to the Nervous System** LS ch 5, DC Module 9
   A. Organization? LS fig 5-1 DC p 67
   C. Myelin? How does it help? DC fig 9-3, LS pp 83-5
   D. Brain structure & function DC fig 9-6 thru 9-10 pp 71-5+
   E. **Protect your head with a helmet!** Bicycle head injury statistics *NHTSA & BHSI, 2013 & 2014*
No food, drink or gum in lab today! Thanks sincerely!

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

1. WASH & DRY

2. ALCOHOL

3.
OBTAINE μSAMPLE

BLOOD GLUCOSE

BLOOD TYPING
Glucose: Sugar in Blood

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

NB: Read & Record!

https://doihaveprediabetes.org/
BLOOD TYPING

1. ADD ANTISERA

2. MIX W/TOOTHPICKS

3. READ & RECORD!!
10 Q? Clumping in Any Wells?

Type AB+

Source: S Wong, BI 121 Lab, 2016
CLEAN-UP!

1. FOLD DIAPER

2. BLOOD PRODUCTS

3. REWASH!!
Blood Chem Lab Q?
Endocrine Pancreas: Insulin (I) & Glucagon (G)
See-Saw Hormones in Regulating Blood Glucose

Duodenum

Bile duct from liver

Stomach

Hormones (insulin, glucagon)

Blood

Duct cells secrete aqueous NaHCO₃ solution
Acinar cells secrete digestive enzymes

Exocrine portion of pancreas (Acinar and duct cells)

Endocrine portion of pancreas (Islets of Langerhans)

The glandular portions of the pancreas are grossly exaggerated.
Insulin Stores Sugar, Glucagon Mobilizes Sugar!

~ 4-6 hr of Stored Glucose

Benjamin Cummings 2001

https://www.youtube.com/watch?v=y9Bdi4dnSlg
https://www.fuseschool.org
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.
Adrenals/Suprarenals

- Adrenal medulla
  - Mineralocorticoids (aldosterone)
  - Glucocorticoids (cortisol) and sex hormones (dehydroepiandrosterone)
  - Catecholamines (epinephrine and norepinephrine)

- Adrenal cortex
  - Zona glomerulosa
  - Zona fasciculata
  - Zona reticularis

- Connective tissue capsule

LS 2012 fig 17-18
Stress Promotes Cortisol Secretion

Metabolic fuels and building blocks available to help resist stress:

- Blood glucose (by stimulating gluconeogenesis and inhibiting glucose uptake)
- Blood amino acids (by stimulating protein degradation)
- Blood fatty acids (by stimulating lipolysis)
Epinephrine 80%
Norepinephrine 20%

Guyton & Hall 2000

FIGURE 77-1
Secretion of adrenocortical hormones by the different zones of the adrenal cortex.

Zona glomerulosa
secretes aldosterone

Zona fasciculata

Zona reticularis

Cortisol
and androgens

Medulla

Cortex

Magnified section
Questions + Discussion
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

<table>
<thead>
<tr>
<th>KEY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central nervous system</td>
</tr>
<tr>
<td>Peripheral nervous system</td>
</tr>
<tr>
<td>Afferent division of PNS*</td>
</tr>
<tr>
<td>Efferent division of PNS</td>
</tr>
<tr>
<td>Somatic nervous system</td>
</tr>
<tr>
<td>Motor neurons</td>
</tr>
<tr>
<td>Sympathetic nervous system</td>
</tr>
<tr>
<td>Parasympathetic nervous system</td>
</tr>
<tr>
<td>Autonomic nervous system</td>
</tr>
<tr>
<td>Enteric nervous system*</td>
</tr>
</tbody>
</table>

Effector organs

(made up of muscle and gland tissue)

Stimuli in digestive tract

Enteric organs only

Digestive organs only

Skeletal muscles

Smooth muscle
Cardiac muscle
Exocrine glands
Some endocrine glands
~99% of all neurons in humans! CNS ~100 billion interneurons!!
~90% of Cells w/in CNS are not neurons but glial cells = neuroglia or nerve glue!
Neuron 1

Input
Dendrites ≡ Antennae

Controller
Soma ≡ NCB

Output
Axon

Neuron 2

Neuron 3

H. Howard 1980
A single nerve cell may have as many as 200,000 inputs!
Nerve cell with multiple axons grown by adding a mitogen/neurogen ≡ nerve growth factor!
Sensory nerves especially, come in all shapes & sizes!

Figure 46-1

Several types of somatic sensory nerve endings.
Nerve Extremes: Far ends of the Continuum

**A** = Large to medium myelinated, up to 120 m/sec

**C** = Small unmyelinated, < 0.25 m/sec

α, β, γ, δ

IV
What is myelin? Why is it important?

Lipid insulative coat

↑ $\bar{v}$, conserves ions & ATP
A large myelinated "survival" nerve can conduct impulses the length of football field in < 1 second!
Saltatory/Leaping Conduction! Crucial Sensory & Motor Nerves

Cell body
Myelin sheath
Node of Ranvier
Nerve impulse
Axon

L. saltare to hop or leap! Fr. salt, sautier, sauté, leap, high air, vault

DC 2003
**Motor**

- Supplementary motor area (on inner surface—not visible; programming of complex movements)
- Premotor cortex (coordination of complex movements)

**Sensory**

- Primary motor cortex (voluntary movement)
- Central sulcus
- Primary sensory cortex (sensation)

**Key**

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

- Posterior parietal cortex (integration of somatosensory and visual input; important for complex movements)
- Wernicke’s area (speech understanding)
- Parietal-temporal-occipital association cortex (integration of all sensory input; important in language)
- Primary visual cortex surrounded by higher-order visual cortex (sight)

- Prefrontal association cortex (planning for voluntary activity; decision making; personality traits)
- Broca’s area (speech formation)
- Primary auditory cortex surrounded by higher-order auditory cortex (hearing)
- Limbic association cortex (mostly on inner and bottom surface of temporal lobe; motivation and emotion; memory)

LS 2006, cf: LS 2012 fig 5-8a
300 million axons enable R & L hemisphere cross-talk!!
MRI 061307
Lumbar spine
Lateral view

L5
S1
L1
L2
L3
L4

Disc herniation
Discs bulging

Oregon Imaging
Helmets Cheap, Brains Expensive!!
Use Your Head, Get a Helmet!!

http://www.bhsi.org/stats.htm

~ 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% ↙
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!!