I. **Announcements** To make Lab 5 educational, fun & safe for all, please read pp 5-1 thru 5-6 in LM twice before Thursday! Remaining exams & notebooks returned > lecture. Key posted in glass box in Huestis near 120 HUE? Estimate grade? Q?

II. **Blood Chemistry Review** LS ch 11 + 17, DC Module 5, Q?

III. **Blood Glucose, Insulin Diabetes Connections** DC Module 13+…

IV. **Endocrinology Overview** LS ch 17, DC Module 13, SI Fox+
   A. Vignette: Cushing's syndrome LS fig 17-20 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 see-saw!) 2. Thyroid 3. Adrenals...This Thursday more fun & data about me! Heck yeah!!
Students who succeed are usually those who:

1. **Attend** class regularly
2. **Ask** questions
3. **Come** to office hours & problem-solving sessions
4. **Study** outside class both alone & in study groups
5. **Seek** to understand methods & overarching principles/concepts rather than specific answers
6. **Teach** or tutor others &
7. **Discuss** concepts informally with fellow students.

Q? What do I need on Exam II, if I want to get…?

A? You can actually calculate given assumptions…
e.g., 62 for Exam I & desire ≥ B- (assume ≥ 80)

Assume 100% for lecture (20% of grade)  
+ lab attendance & participation (20% of grade!)

Hope for? | Exam I | Lecture | Lab
---|---|---|---
X = [80 - ((0.3 x 62) + (0.2 x 100) + (0.2 x 100))]/0.3

X = [80 - [(18.6) + (20) + (20)]]/0.3

X = [21.4]/0.3 = 71.3

...Fortunately, the lab buffers the grade!

Need this on Exam II for B- for course!
Today & next time we’ll cover blood chemistry to ensure for adequate lab prep time & incubation.
No food, drink or gum in lab!
Thanks sincerely!
PREPARATION

1. WASH & DRY
2. ALCOHOL
OBTAIN $\mu$SAMPLE

BLOOD GLUCOSE

BLOOD TYPING
Glucose: Sugar in Blood

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

*NB*: Read & Record!
ADD ANTISERA

MIX W/TOOTHPICKS

READ & RECORD!!
1° 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?
Universal Blood
All like Type O!

Key
- Fucose
- Galactose
- Glucose
- N-acetylgalactosamine
Diabetic & Normal Response to Glucose Load

Ingest Glucola or eat meal

Guyton & Hall 2000
**Proinsulin with C-Connecting Peptide**

**FIG. 10-4.** Amino acid sequence of a mammalian proinsulin molecule. Note how the insulin molecule can be formed by cleaving this polypeptide chain at two locations to liberate the C peptide.
Endocrine Pancreas: Insulin (I) & Glucagon (G)
See-Saw Hormones in Regulating Blood Glucose

Hormones (insulin, glucagon)

The glandular portions of the pancreas are grossly exaggerated.
Times of Plenty!!

NB: Diabetics have problems either here or here.

Fox 1987

https://www.youtube.com/watch?v=8dgoeYPoE-0
1994 Diabetes Prevalence in the US by State

Source: Centers for Disease Control, Division of Diabetes Translation, [http://www.cdc.gov/diabetes/statistics](http://www.cdc.gov/diabetes/statistics), S&W 2014 fig 4-15 p139A.
2010 Diabetes Prevalence in the US by State

Key:
- <4.5%
- 4.5%–5.9%
- 6.0%–7.4%
- 7.5%–8.9%
- ≥9%

<table>
<thead>
<tr>
<th></th>
<th>Type 1</th>
<th>Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of cases</td>
<td>5–10%</td>
<td>90–95%</td>
</tr>
<tr>
<td>Age of onset</td>
<td>&lt;30 years</td>
<td>&gt;40 years&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Associated characteristics</td>
<td>Autoimmune diseases, viral infections, inherited factors</td>
<td>Obesity, aging, inherited factors</td>
</tr>
<tr>
<td>Primary problems</td>
<td>Destruction of pancreatic beta cells; insulin deficiency</td>
<td>Insulin resistance, insulin deficiency (relative to needs)</td>
</tr>
<tr>
<td>Insulin secretion</td>
<td>Little or none</td>
<td>Varies; may be normal, increased, or decreased</td>
</tr>
<tr>
<td>Requires insulin</td>
<td>Always</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Older names</td>
<td>Juvenile-onset diabetes</td>
<td>Adult-onset diabetes</td>
</tr>
<tr>
<td></td>
<td>Insulin-dependent diabetes mellitus (IDDM)</td>
<td>Noninsulin-dependent diabetes mellitus (NIDDM)</td>
</tr>
<tr>
<td>Table 4–9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warning Signs of Diabetes</td>
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</tbody>
</table>

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!
Exercise is a must based on its insulin-like effect!
Cushing’s Syndrome = Hypersecretion of Cortisol: Hypothalamic (CRH), Pituitary (ACTH), or Adrenal (Cortisol)
ANP = Atrial Natriuretic Polypeptide

https://www.youtube.com/watch?v=lRJE8c3ghRE
https://www.hopkinsallchildrens.org/Patients-Families/Health-Library/HealthDocNew/Movie-Endocrine-System
Hormone/Endocrine Classifications?

Exogenous

Endogenous

Amino Acid/PP/Protein

Thyroid

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

Good Things Come in Small Packages!

Kreiger & Hughes 1980
Hypothalamus-Anterior Pituitary Vascular Connection!

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

- = Hypophysiotropic hormones
- = Anterior pituitary hormone

LS 2007
Pituitary Nourishing or Growth Hormones

Hypothalamus = Pituitary

RH + or RIH -

Releasing or Release-Inhibiting Hormones

Systemic arterial inflow

Systemic venous outflow

Neurosecretory neuron

Hypothalamic-hypophyseal portal system

= Hypophysiotropic hormones

= Anterior pituitary hormone

LS 2007
Often, more than simply 1 feedback loop!
Progression & Development of Acromegaly
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

Mismatch!!
Increase GH naturally with exercise & sleep!!

ng/ml = nanograms per milliliter