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 Connections** LS ch 11 p 303, ch 17 pp 525-36 Erythroblastosis fetalis, diabetes, insulin, glucagon

III. **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
WOW!  SUPER 🤗
~ TOP 5 - 10 ~

EXCELLENT!!
~ TOP 15 ~

GREAT EFFORT
~ TOP 20 - 25 ~
## Class Frequency Distribution Report for BI 121 Midterm F16, Multiple Choice, Part II

Mean Score: 71.50%

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percent Score</th>
<th>Raw Score</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>90.00 - 100.00</td>
<td>36.00 - 40.00</td>
<td>14</td>
<td>8.00</td>
</tr>
<tr>
<td>B</td>
<td>80.00 - 89.99</td>
<td>32.00 - 35.99</td>
<td>37</td>
<td>21.14</td>
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<tr>
<td>C</td>
<td>70.00 - 79.99</td>
<td>28.00 - 31.99</td>
<td>56</td>
<td>32.00</td>
</tr>
<tr>
<td>D</td>
<td>60.00 - 69.99</td>
<td>24.00 - 27.99</td>
<td>38</td>
<td>21.71</td>
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<tr>
<td>F</td>
<td>0.00 - 59.99</td>
<td>0.00 - 23.99</td>
<td>30</td>
<td>17.14</td>
</tr>
</tbody>
</table>

Overall SA + MC:

70.4 ± 13.4

X ± SD

⇒ 2/3 Scores

~57-84
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 the final, 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!
Erythroblastosis Fetalis?

e.g., Rh- mom
Rh+ baby

Erythroblastosis Fetalis or Hemolytic Disease of the Unborn/Newborn

Throw Blanket Over This Step!
Inject Mom with RhoGam ≤ 48-72 hr > each Rh+ Pregnancy

The Blanket is RhoGam → Masks the Mom’s Immune System!
1994 Diabetes Prevalence in the US by State

Diabetic & Normal Response to Glucose Load

Blood glucose level (mg/100 ml)

Hours

Guyton & Hall 2000
Glucose: Sugar in Blood

Normal: 70-99
Pre-Diabetes: 100-125
Diabetes: ≥ 126 mg/dL
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.
NB: Diabetics have problems either here or here.

Cellular uptake and utilization of glucose

Fox 1987
Times of Need!

Blood

Glucose

Islets

A cells

Glucagon

B cells

Insulin

Cellular uptake of glucose

Glycogenolysis

Glucose

Mobilize!!

Fox 1987
# Table 4–8
Type 1 and Type 2 Diabetes Compared

<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, Insulin-dependent diabetes mellitus (IDDM)</td>
<td>Adult-onset diabetes, 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>
<td></td>
<td></td>
</tr>
</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)

T = 0, near normal

T = 4 months later
ANP = Atrial Natriuretic Polypeptide
Hormone/Endocrine Classifications?

**Exogenous**

**Endogenous**

- Amino Acid/PP/Protein
- Steroid
- Thyroid

**Diagram Explanation**

- **Thyroid**
  - T4 and T3 structures are shown.
  - T4: 3,5,3′-Triiodothyronine
  - T3: 3-Iodothyronine

- **Steroid**
  - ALTERED FUNCTIONAL RESPONSE
  - PROTEIN SYNTHESIS
  - SPECIFIC RECEPTOR COMPLEX
  - HORMONAL RECEPTOR COMPLEX
  - DNA
  - mRNA

**Images**

- Cartoon of pigs and cows eating cucumbers.
- Humulin N bottle and box.
Hypothalamus & Pituitary: Intimate Relationship
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

Posterior pituitary

Systemic arterial inflow

Systemic venous outflow

= Vasopressin

= Oxytocin
Hypothalamus-Anterior Pituitary Vascular Connection!

Neurosecretory neuron

Hypothalamic-hypophyseal portal system

Anterior pituitary

Posterior pituitary

Systemic arterial inflow

Systemic venous outflow

• • = Hypophysiotropic hormones

• = Anterior pituitary hormone

LS 2007
Pituitary Nourishing or Growth Hormones

RH + or RIH -

Releasing or Release-Inhibiting Hormones

Hypophysis = Pituitary

Systemic arterial inflow

Systemic venous outflow

Hypothalamic-hypophyseal portal system

Neurosecretory neuron
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!!

Growth hormone (ng/ml plasma)

Time of day

Sleep

ng/ml = nanograms per milliliter