I. **Blood Cell Connections** Q?

II. **Lab 5 Review: Safety & Techniques** Q?

III. **Blood Glucose & Insulin** LS pp 530-2, DC pp 110-2

IV. **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 2. Thyroid 3. Adrenals
NEUTROPHILS

EOSINOPHILS

BASOPHILS

LYMMPHOCYTES

MONOCYTES

PLATELETS

ERYTHROCYTES

SI Fox 2009 fig 10-2
Megakaryocyte

Clusters of platelets about to shed off

Developing leukocyte

Cluster of developing erythrocytes
No food, drink or gum in lab today! Thanks sincerely!

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

1. WASH & DRY

2. ALCOHOL

3.
SAMPLE + TESTS

1. Obtain sample

2. Blood glucose

3. Blood typing

BLOOD GLUCOSE

BLOOD TYPING
Glucose: Sugar in Blood

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

NB: Read & Record!
BLOOD TYPING

1. ADD ANTISERA
2. MIX W/TOOTHPICKS
3. READ & RECORD!!
1° Q? Clumping in Any Wells?

Here?

Type AB+

Here?

Here?

Here?

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

1. FOLD DIAPER

2. BLOOD PRODUCTS

3. REWASH!!
Blood Chem Lab Q?
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

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)

Blood

Hormones (insulin, glucagon)

Duodenum

Bile duct from liver

Stomach

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
**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!
Discussion/Questions/Break!
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 & Pituitary: Intimate Relationship
Hypothalamus
< 1% of Brain Mass
Hormone Master Controller
+100s of Functions!

Good Things Come in Small Packages!

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

Systemic arterial inflow

Hypothalamic-hypophyseal portal system

Anterior pituitary

Systemic venous outflow

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

RH + or RIH -

Releasing or Release-Inhibiting Hormones

Hypophysis = Pituitary

- = Hypophysiotropic hormones
- = Anterior pituitary hormone

LS 2007
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!!

- Strenuous exercise
- Sleep

Growth hormone (ng/ml plasma)

Time of day

ng/ml = nanograms per milliliter
Insulin Stores Sugar, Glucagon Mobilizes Sugar!

~ 4-6 hr of Stored Glucose

Peripheral Endocrine & Digestive Organ

Benjamin Cummings 2001

https://www.youtube.com/watch?v=y9Bdi4dnSlg
https://www.fuseschool.org
Thyroid → metabolism highly vascularized

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.

Guyton & Hall 2000
Adrenals/Suprarenals

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

Connective tissue capsule
- Zona glomerulosa
- Zona fasciculata
- Zona reticularis

Medulla

Cortex
Stress Promotes Cortisol Secretion

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)
Questions + Discussion