BI 121 Lecture 10

...This Thursday more fun & data about me! Heck yeah!!

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**
G. **GH: Body builder's dream? Fountain of youth?** **LS pp 506-11**
H. **Peripheral endocrine organs** **DC pp 109-13, LS pp 513-36**
1. Pancreas (insulin – glucagon see-saw!) 2. Thyroid 3. Adrenals

☞☺...I ♡ U of O!

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.

Science Teaching Reconsidered, National Academy Press, 1997.

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!)

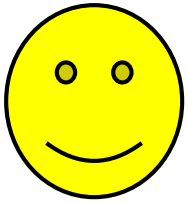
Hope for? Exam I Lecture Lab

$$X = [80 - ((0.3 \times 62) + (0.2 \times 100) + (0.2 \times 100))]/0.3$$

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

$$X = [21.4]/0.3 = 71.3$$

Need this on Exam II for *B*- for course!

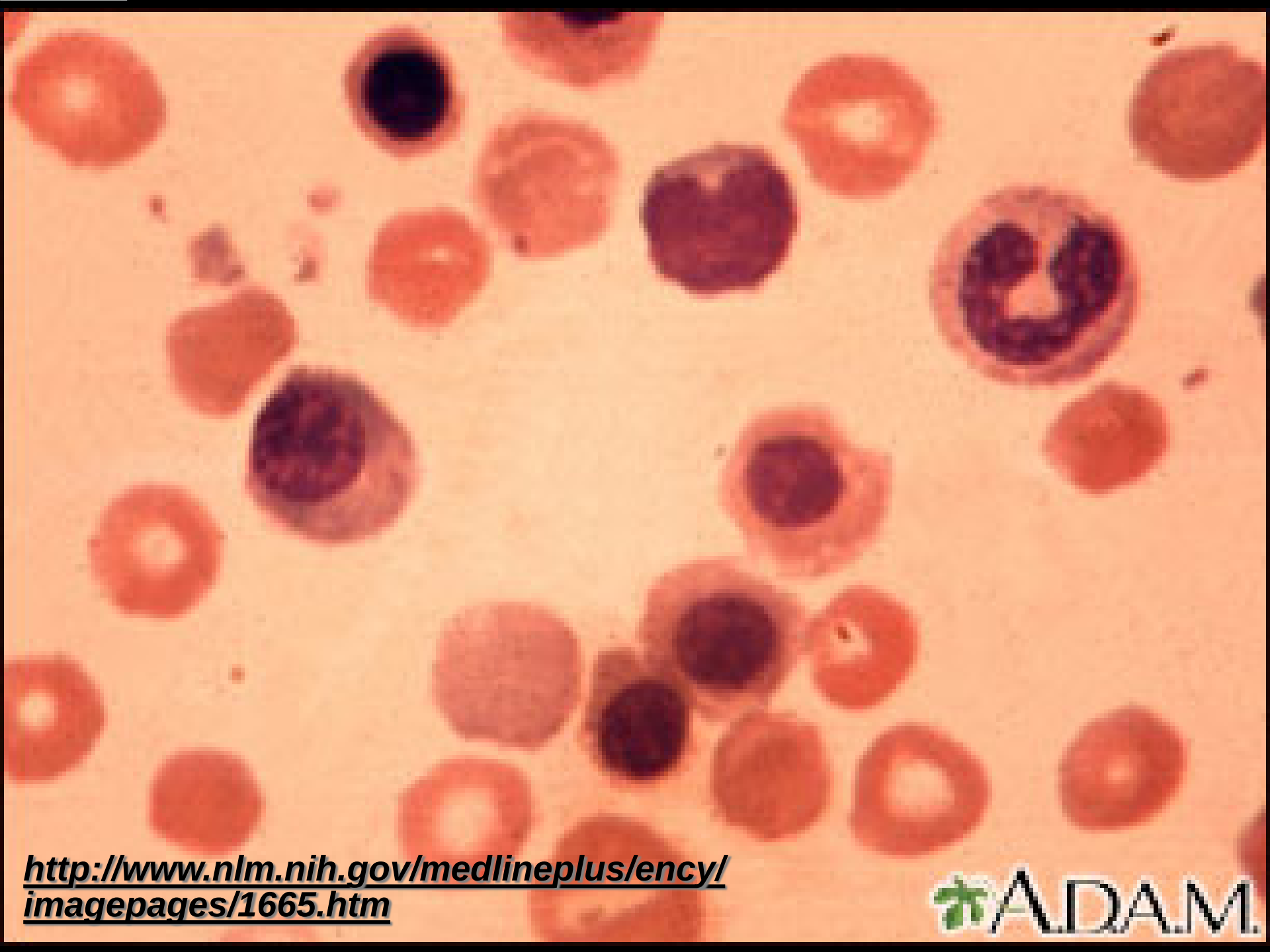


…Fortunately, the lab buffers the grade!

Erythroblastosis Fetalis?

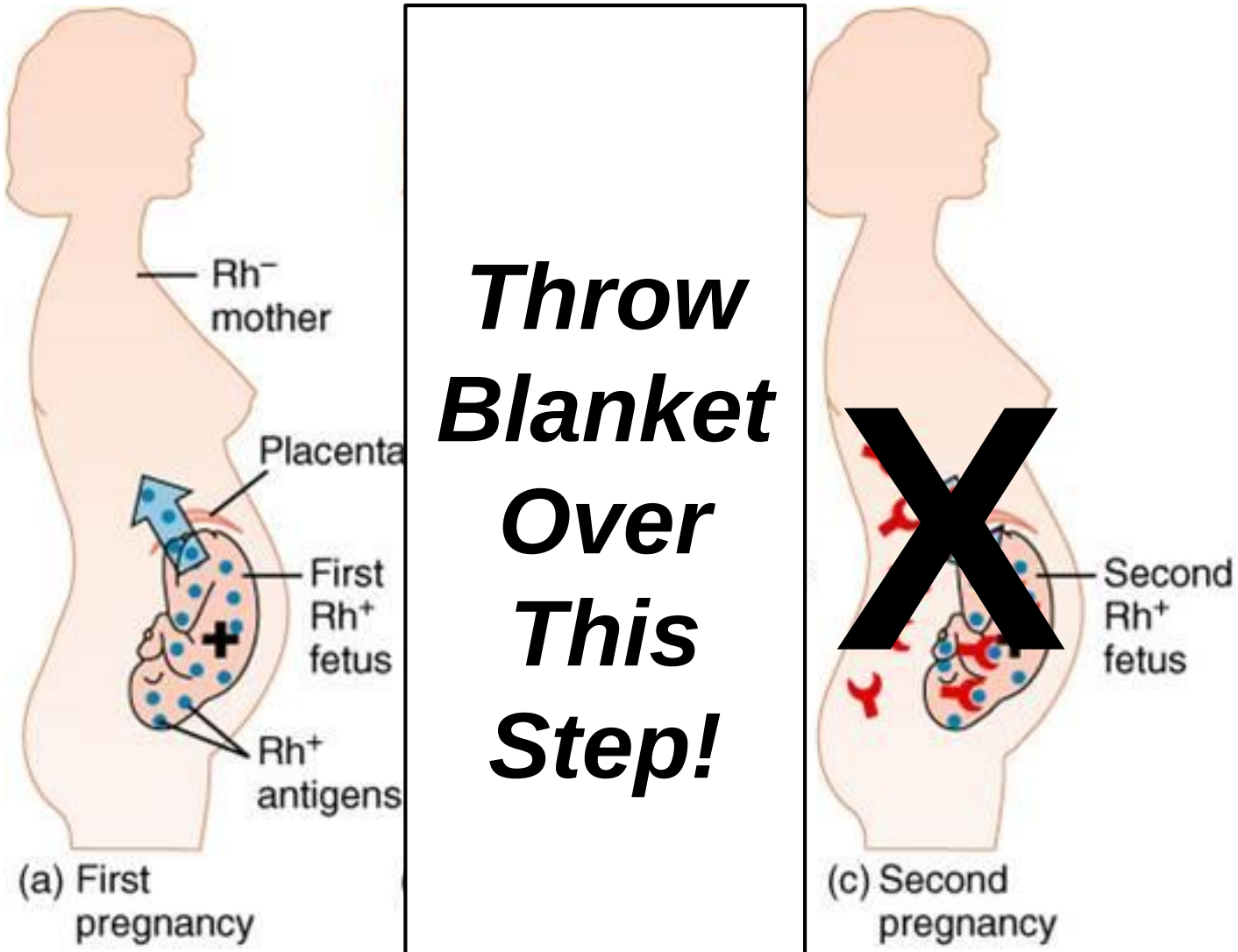
e.g., **Rh- mom**
Rh+ baby

https://www.nlm.nih.gov/medlineplus/rhincompatibility.html



http://www.nlm.nih.gov/medlineplus/ency/imagepages/1665.htm

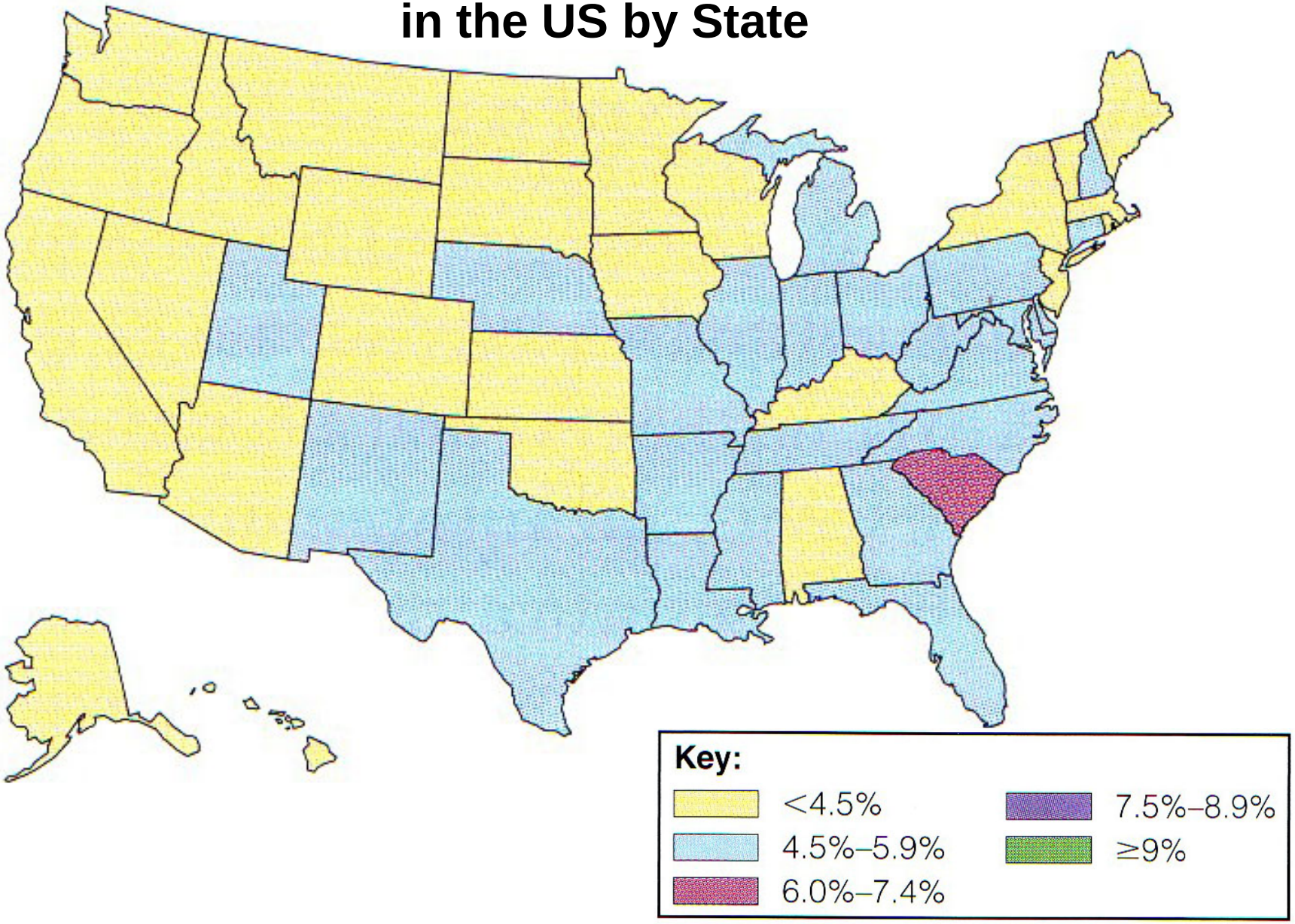
Erythroblastosis Fetalis or Hemolytic Disease of the Unborn/Newborn



Inject Mom with RhoGam < 48-72 hr > each Rh+ Pregnancy

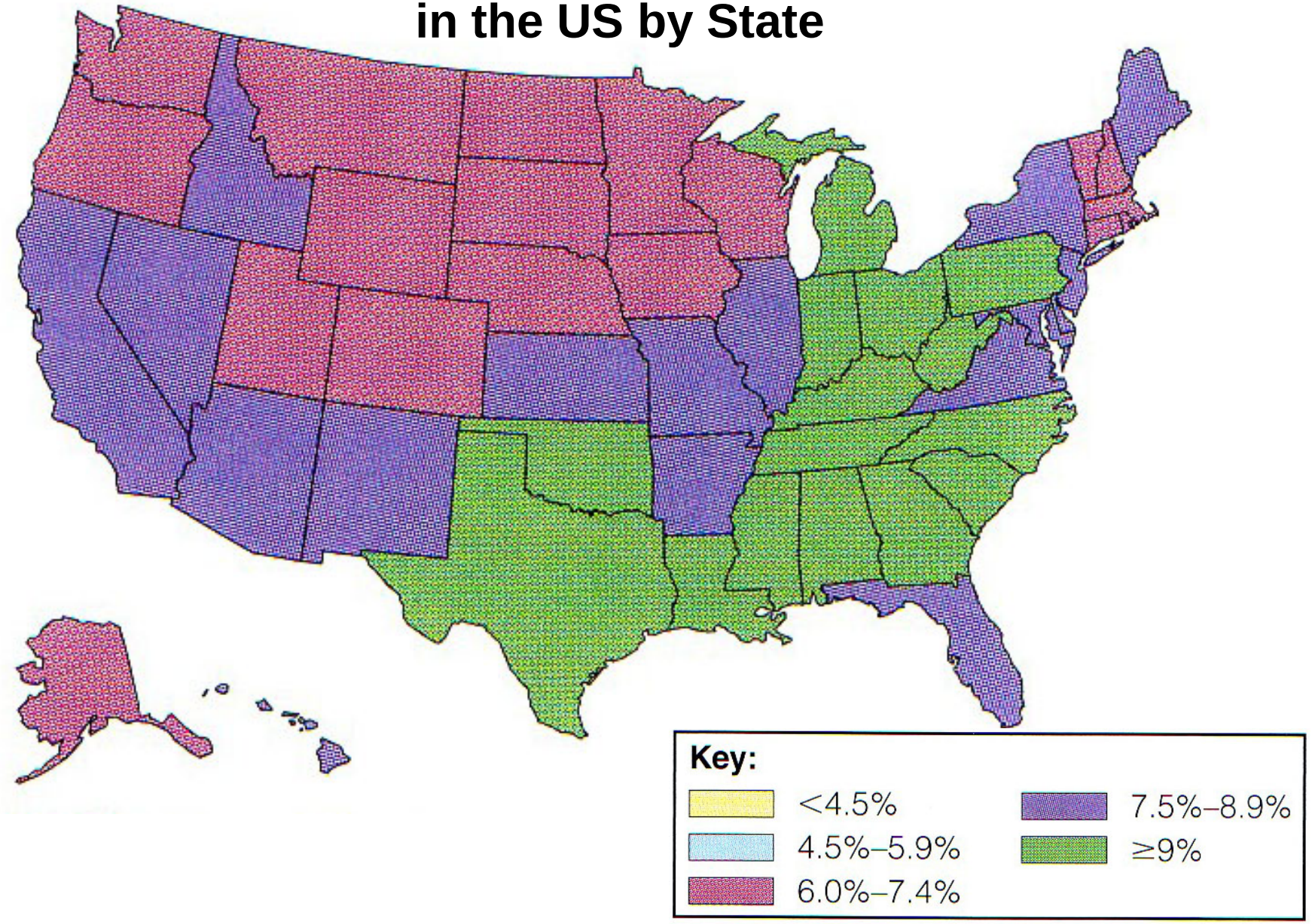
The Blanket is RhoGam → Masks the Mom's Immune System!

1994 Diabetes Prevalence in the US by State



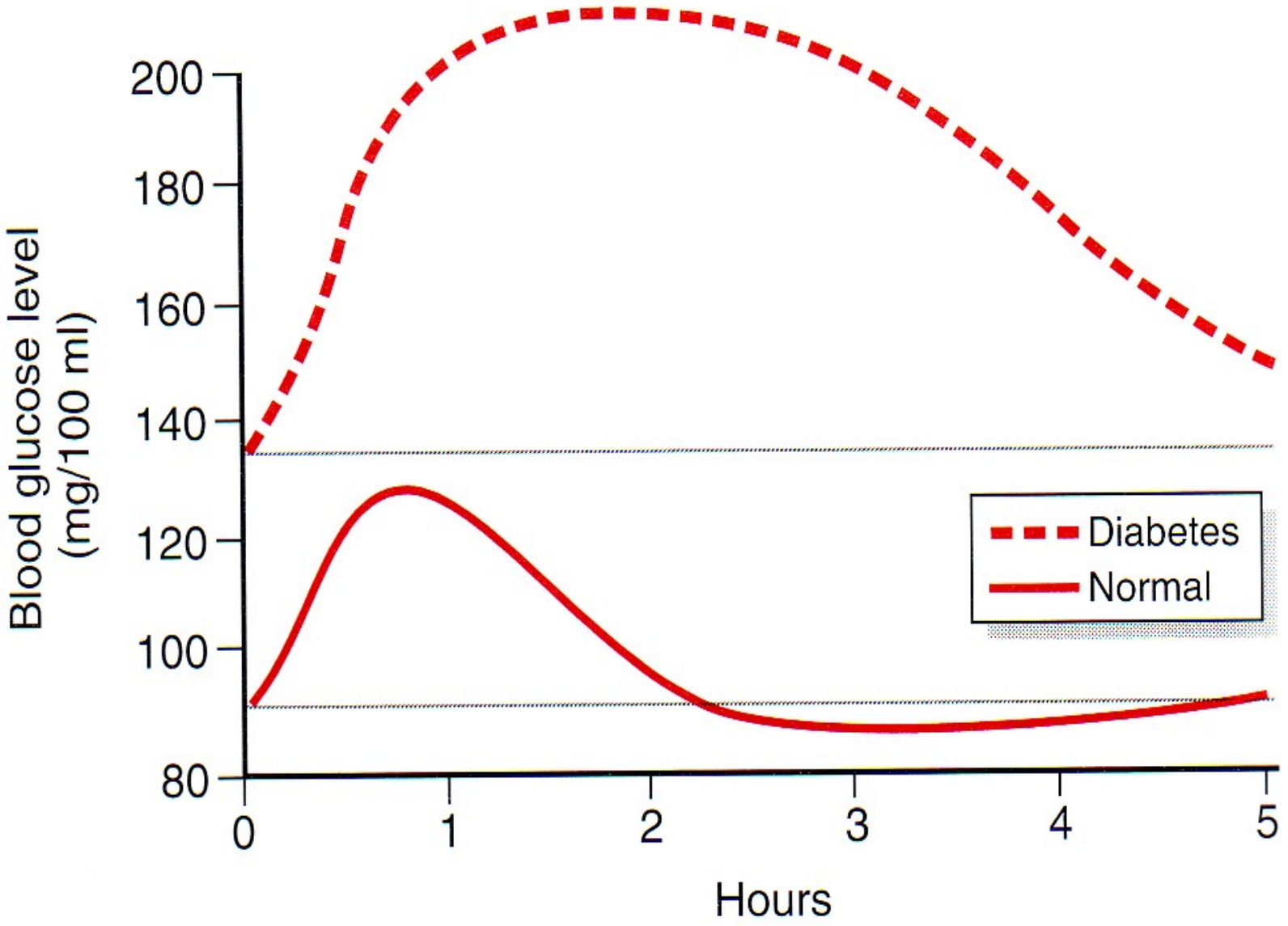
Source: Centers for Disease Control, Division of Diabetes Translation, *http://www.cdc.gov/diabetes/statistics*, S&W 2014 fig 4-15 p139A.

2010 Diabetes Prevalence in the US by State



Source: Centers for Disease Control, Division of Diabetes Translation, *http://www.cdc.gov/diabetes/statistics*, S&W 2014 fig 4-15 p139B.

Diabetic & Normal Response to Glucose Load



Guyton & Hall 2000

Glucose:
Sugar in Blood

Normal: 70-99

Pre-Diabetes: 100-125

Diabetes: ≥ 126 mg/dL

Proinsulin with C-Connecting Peptide

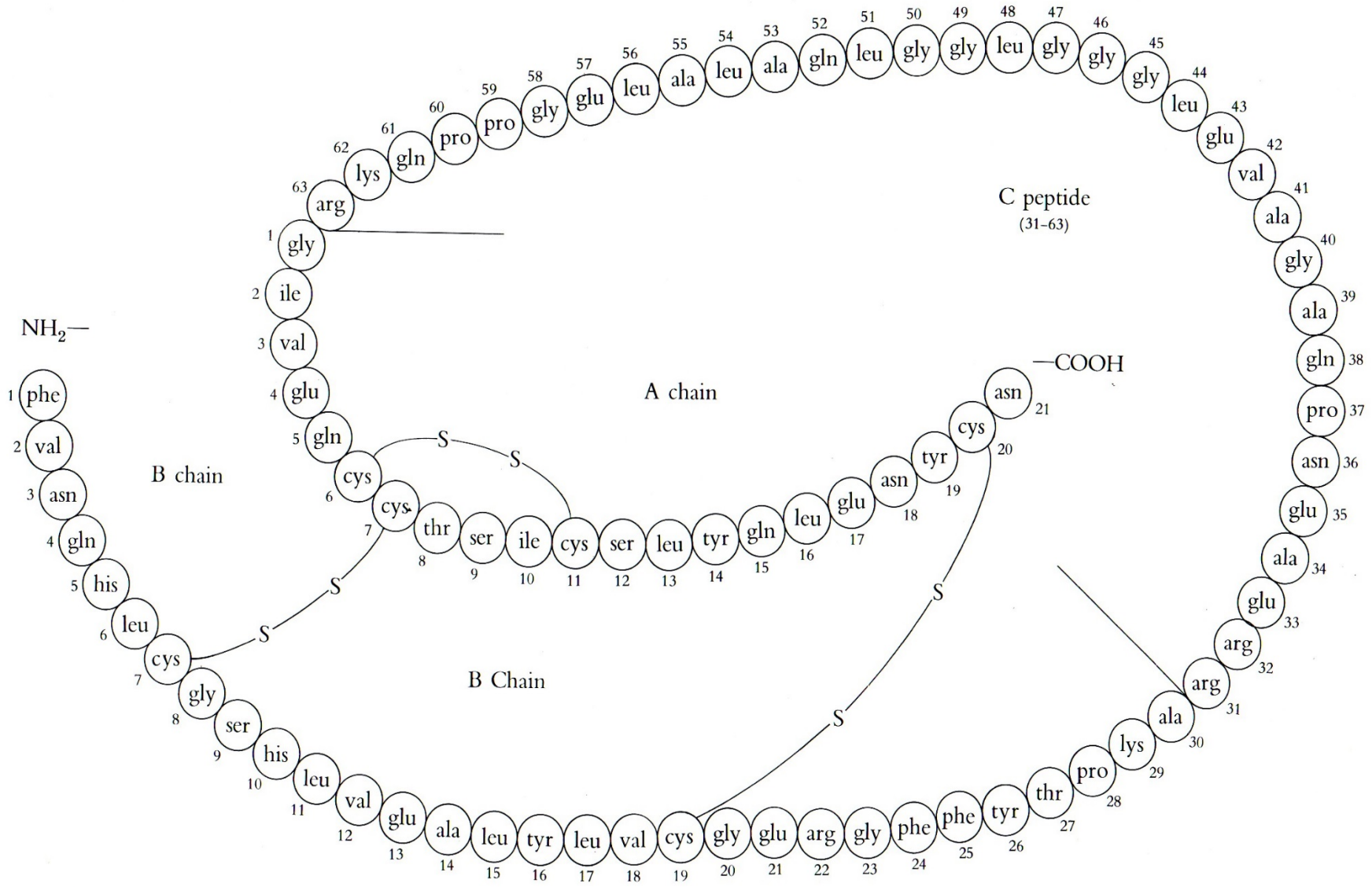
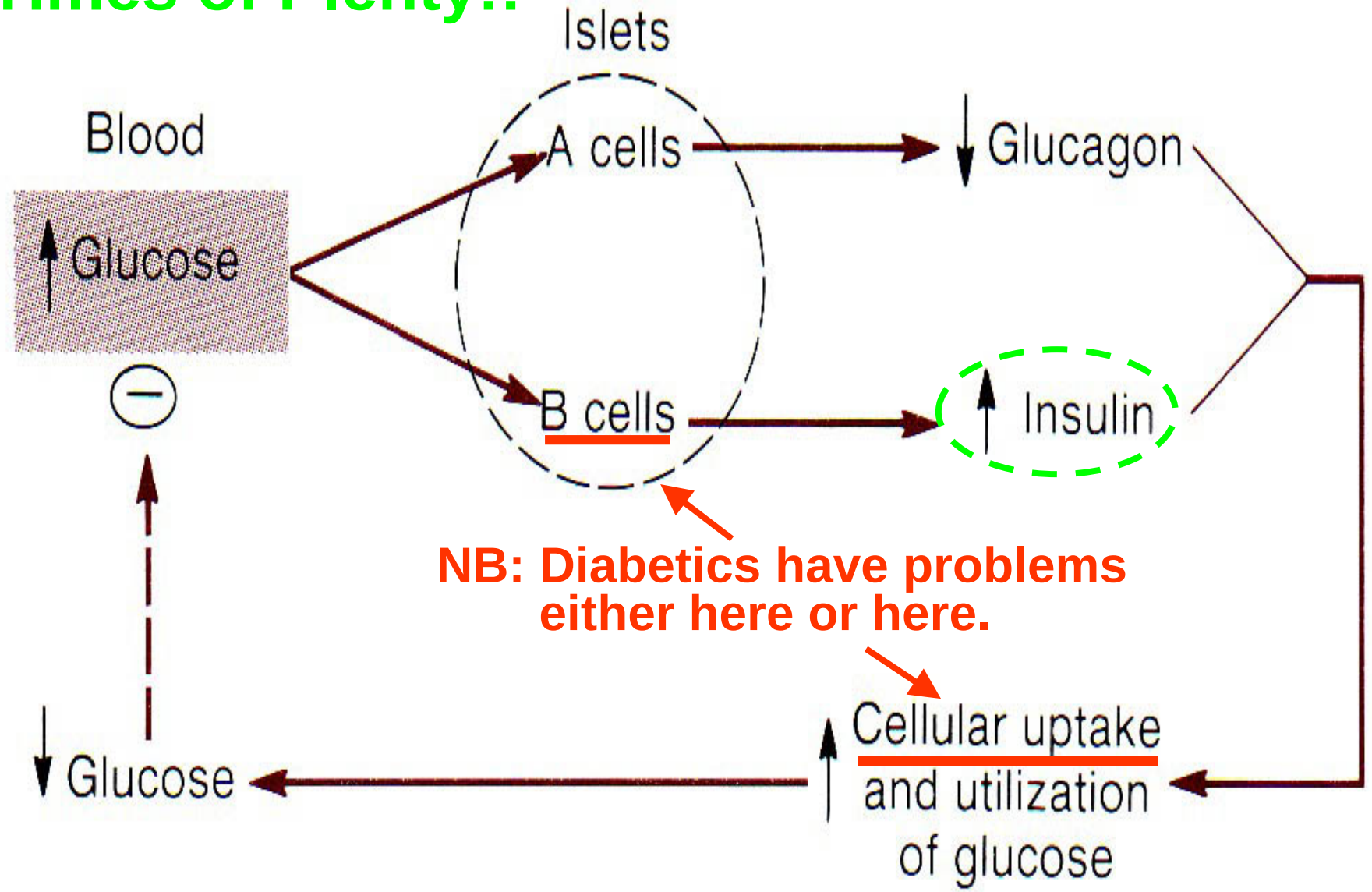


FIG. 10-4. Amino acid sequence of a mammalian proinsulin molecule. Note how the insulin molecule can be formed by cleaving this polypeptide chain at two locations to liberate the C peptide.

DO Norris 1980

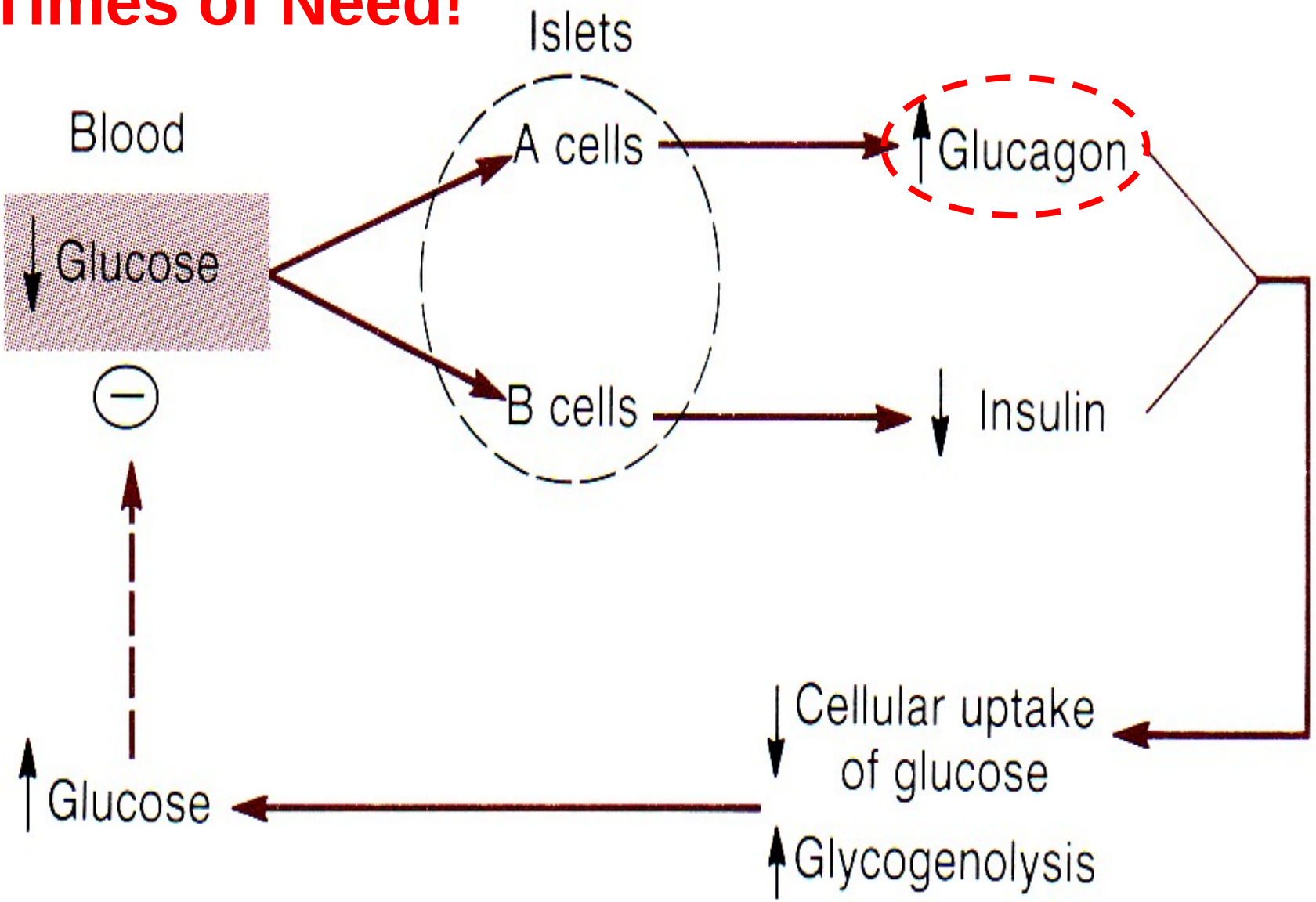
Times of Plenty!!



Fox 1987

Store!

Times of Need!



Fox 1987

Mobilize!!

Table 4–8

Type 1 and Type 2 Diabetes Compared

	Type 1	Type 2
Percentage of cases	5–10%	90–95%
Age of onset	<30 years	>40 years[a]
Associated characteristics	Autoimmune diseases, viral infections, inherited factors	Obesity, aging, inherited factors
Primary problems	Destruction of pancreatic beta cells; insulin deficiency	Insulin resistance, insulin deficiency (relative to needs)
Insulin secretion	Little or none	Varies; may be normal, increased, or decreased
Requires insulin	Always	Sometimes
Older names	Juvenile-onset diabetes Insulin-dependent diabetes mellitus (IDDM)	Adult-onset diabetes Noninsulin-dependent diabetes mellitus (NIDDM)

S&W 2014 tab 4-8 p 139

Table 4–9

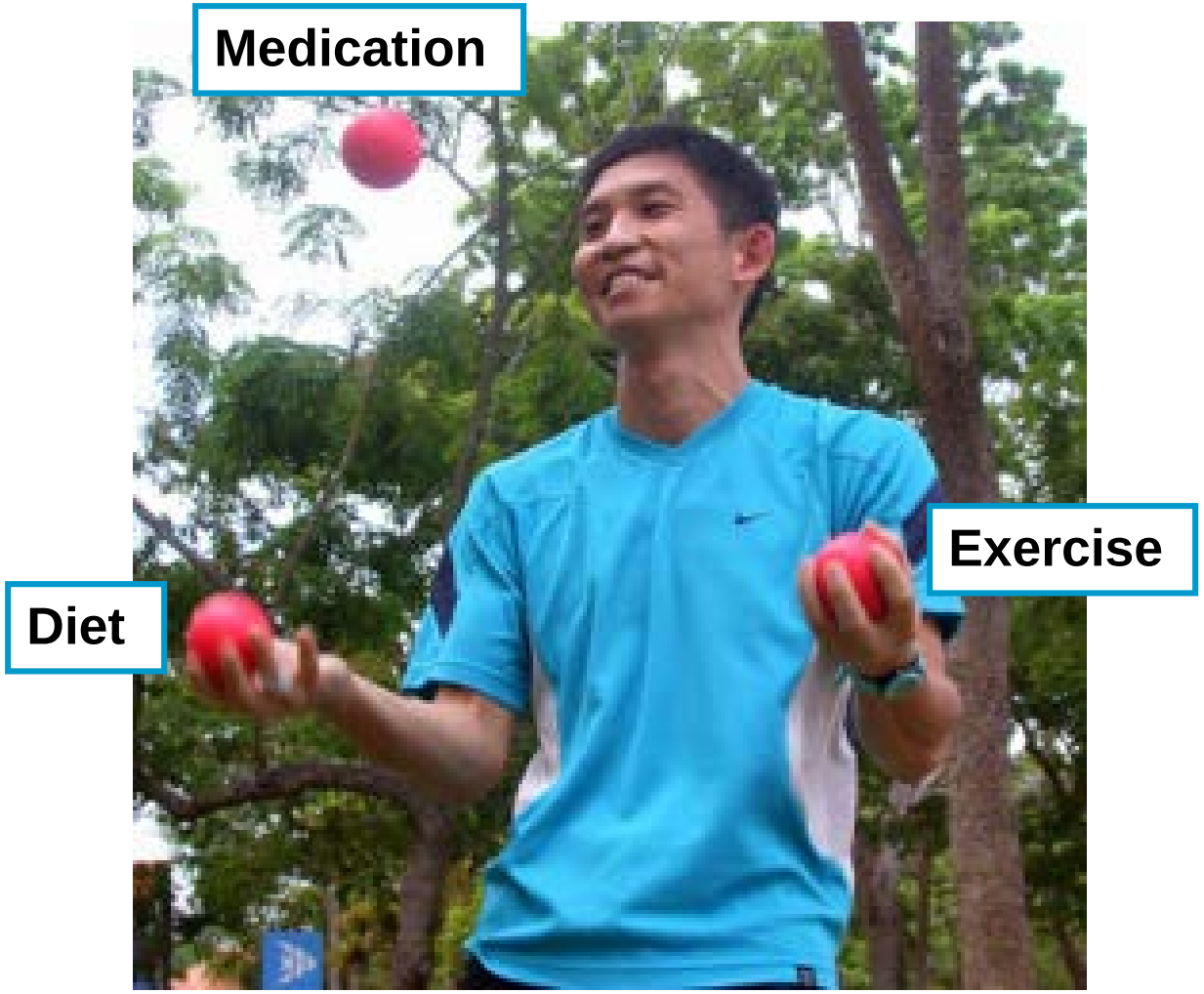
Warning Signs of Diabetes

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

S&W 2014 tab 4-9 p 140

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!

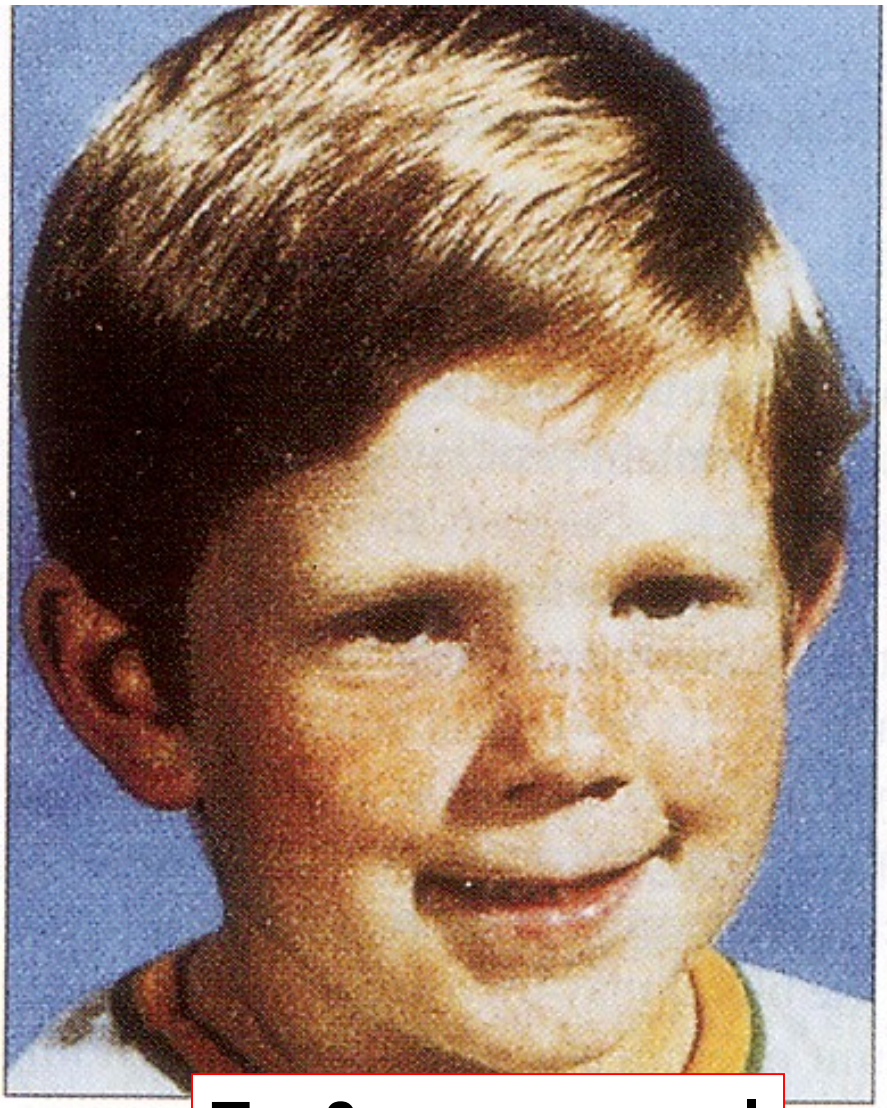
S&W 2011 p 133

Exercise is a must based on its insulin-like effect!

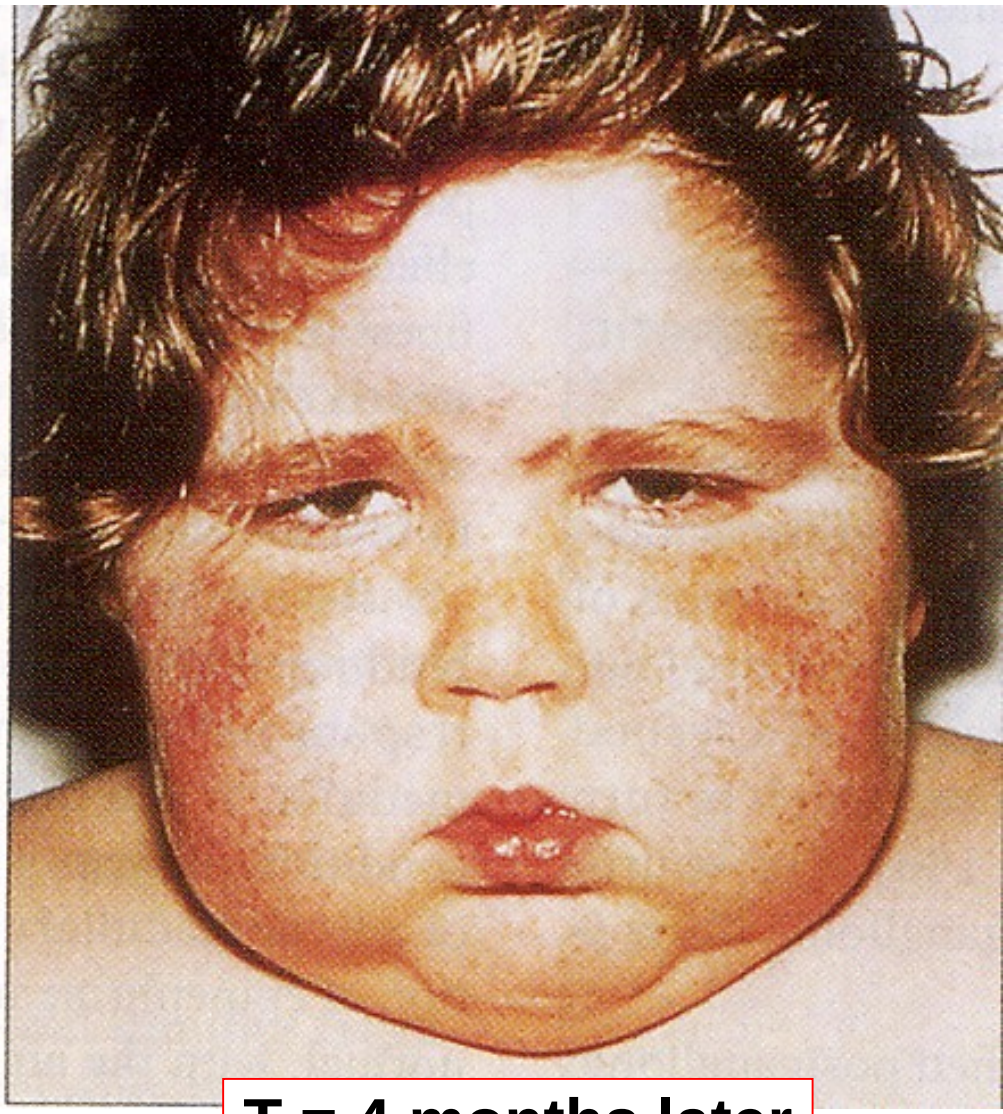
S&W 2011 p 135

TIME OUT

Cushing's Syndrome = Hypersecretion of Cortisol: Hypothalamic (CRH), Pituitary (ACTH), or Adrenal (Cortisol)



T = 0, near normal

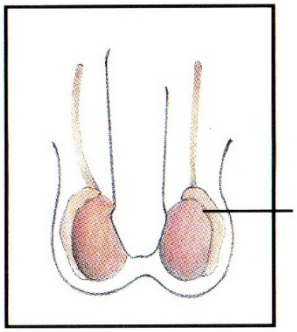


T = 4 months later

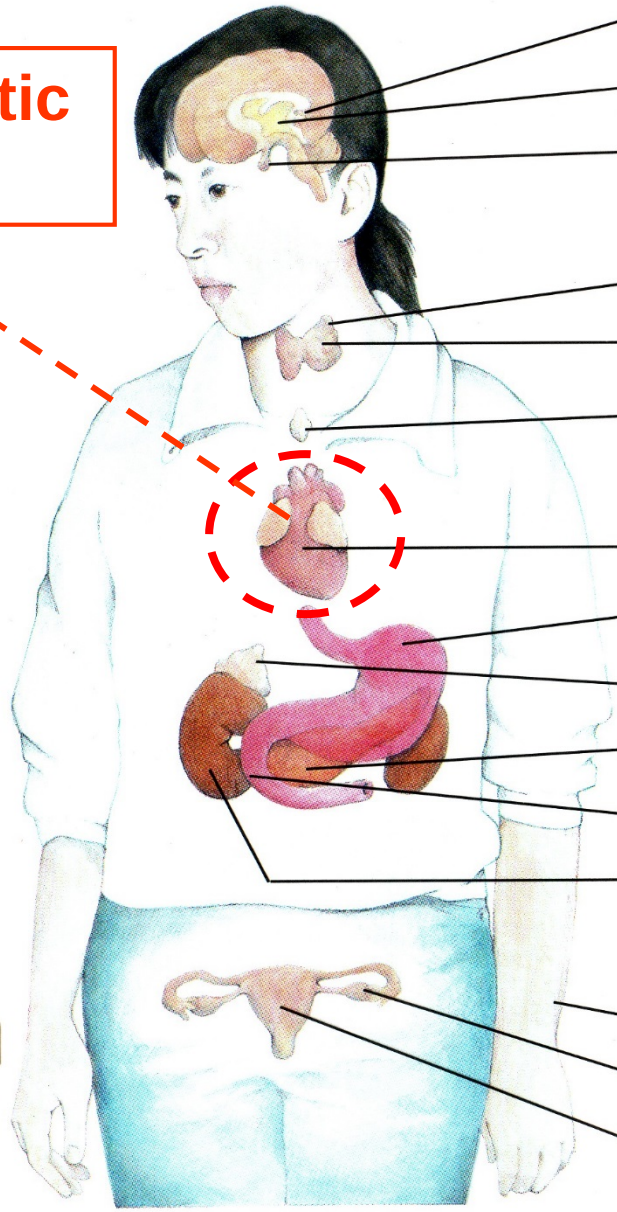
Endocrine System

ANP = Atrial Natriuretic Polypeptide

- Solely endocrine function
- Mixed function
- Complete function uncertain



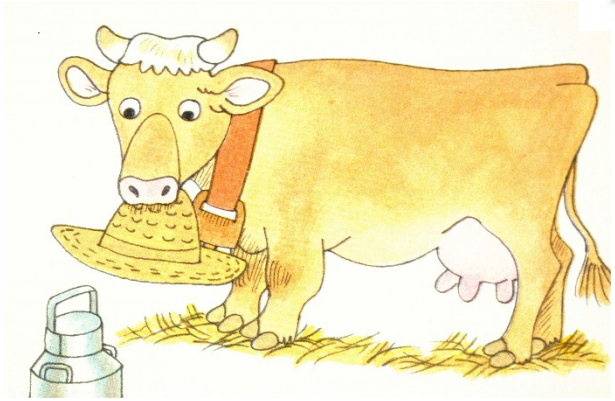
Testes in male



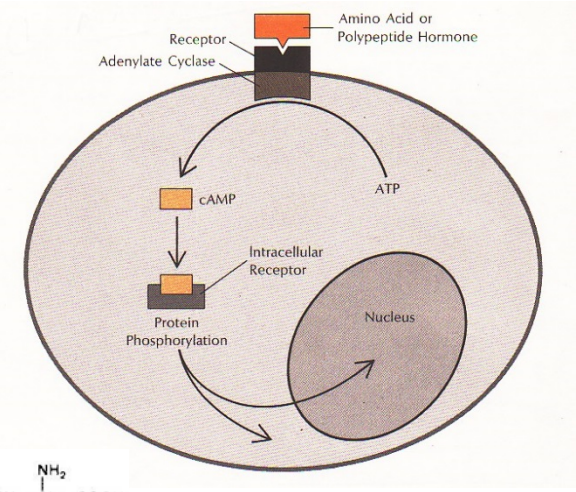
- Pineal
- Hypothalamus
- Pituitary
- Parathyroid
- Thyroid
- Thymus
- Heart
- Stomach
- Adrenal gland
- Pancreas
- Duodenum
- Kidney
- Skin
- Ovaries in female
- Placenta in pregnant female

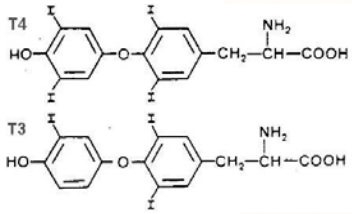
Hormone/Endocrine Classifications

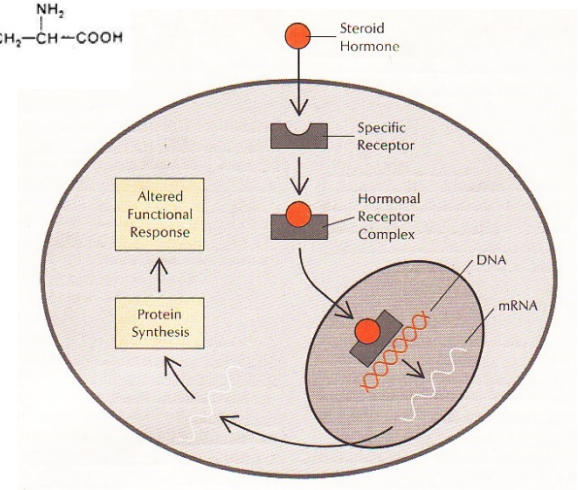
Exogenous



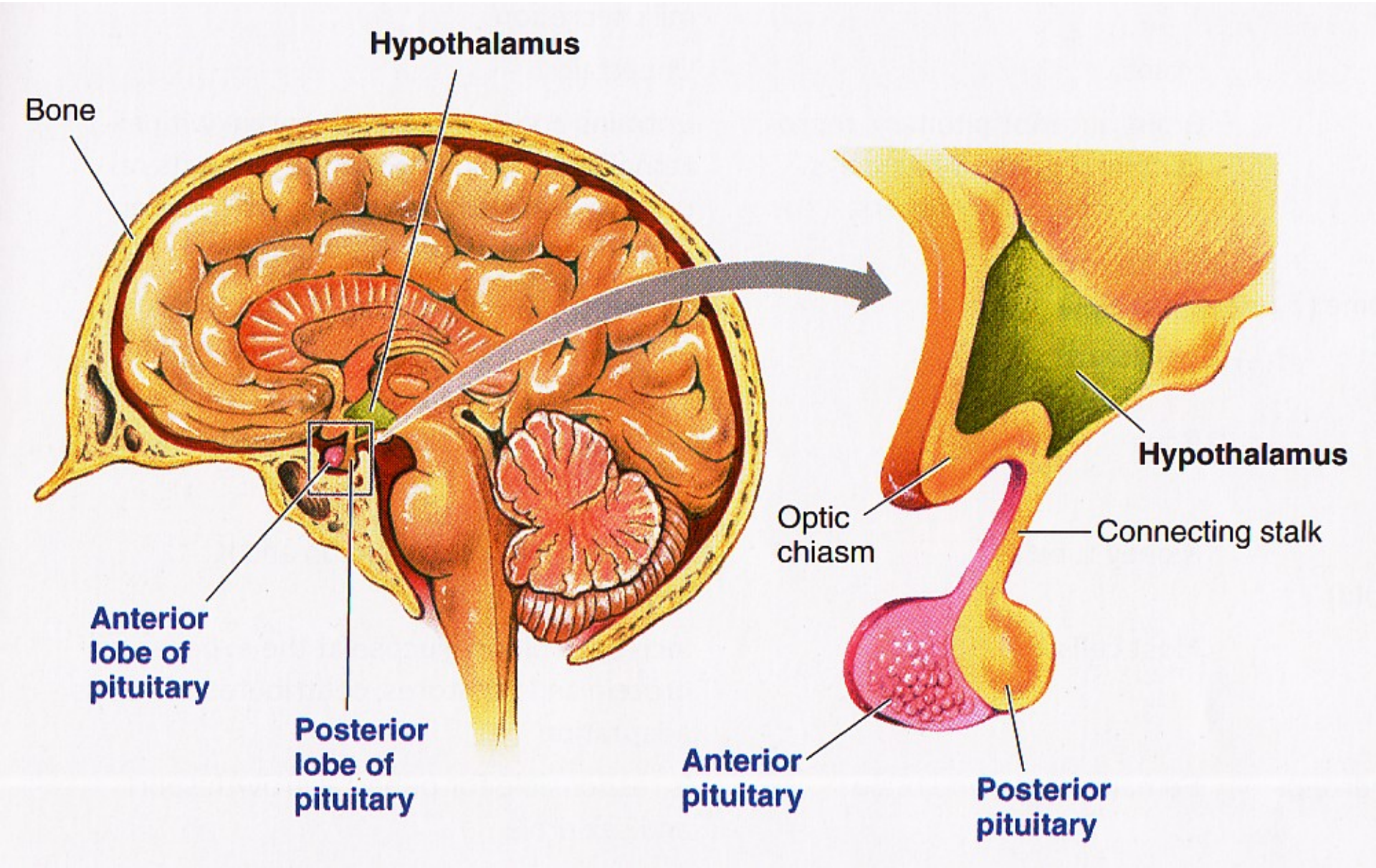
Endogenous





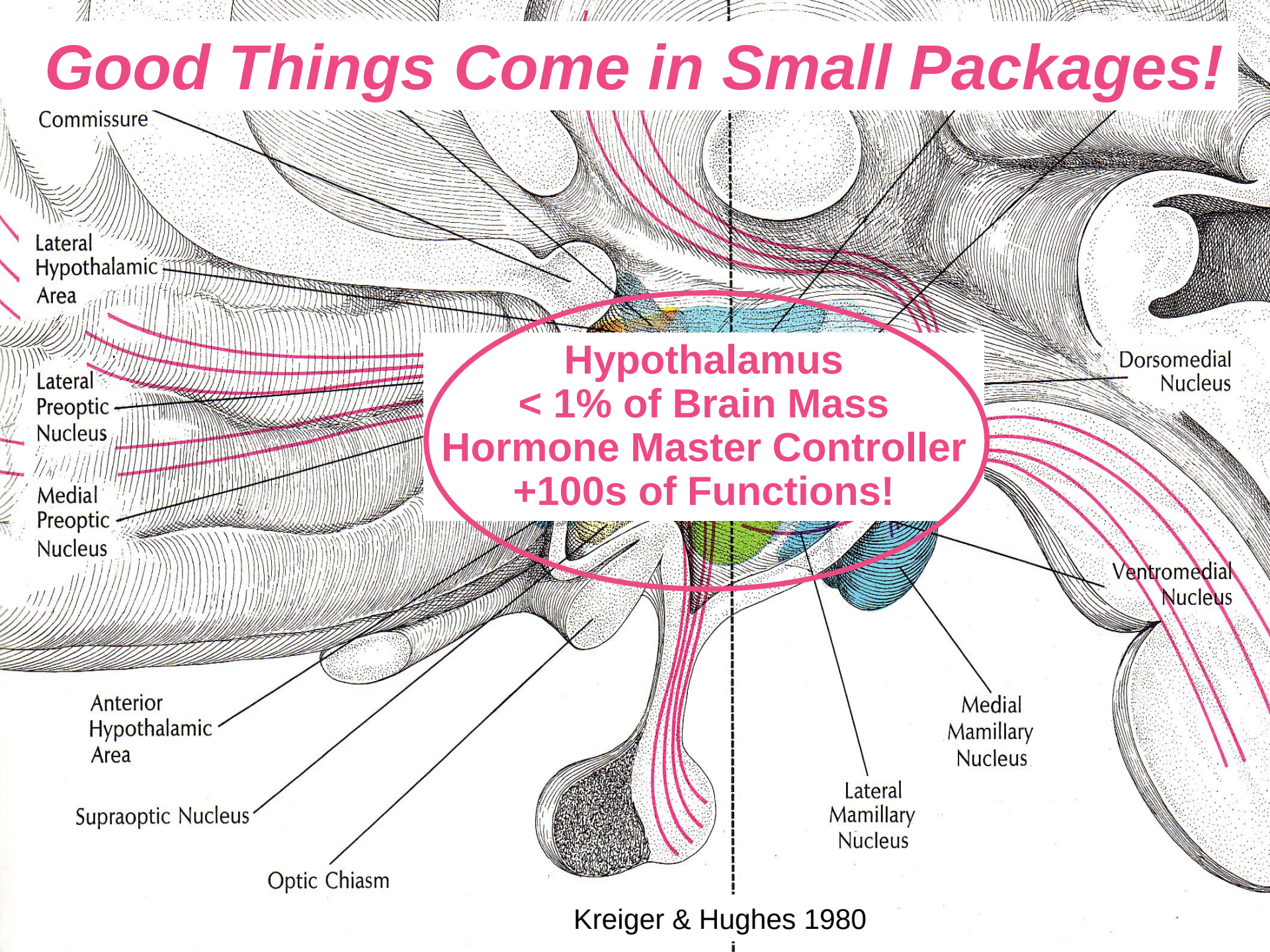


Hypothalamus & Pituitary: Intimate Relationship

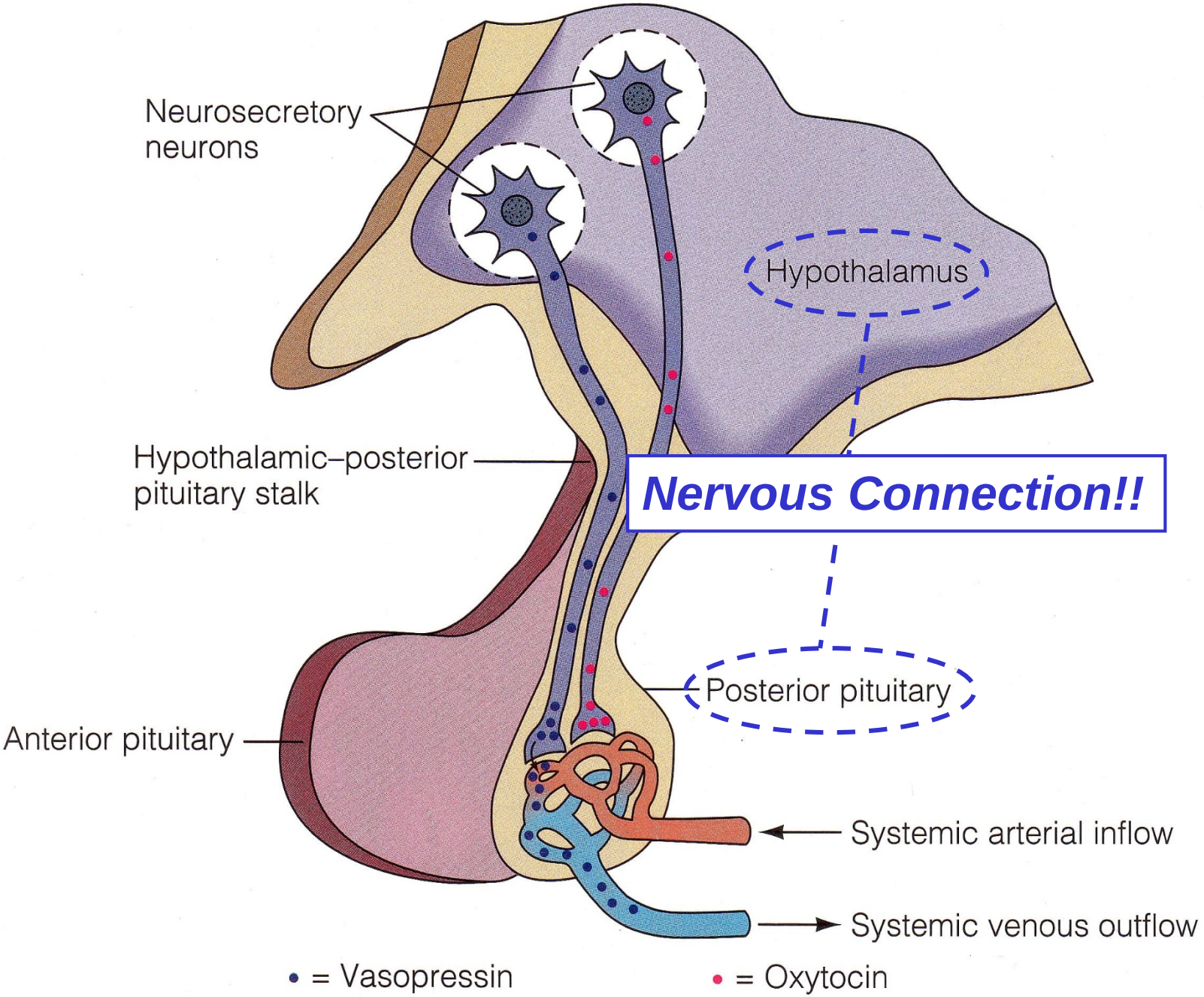


LS 2012 fig 17-3

Good Things Come in Small Packages!

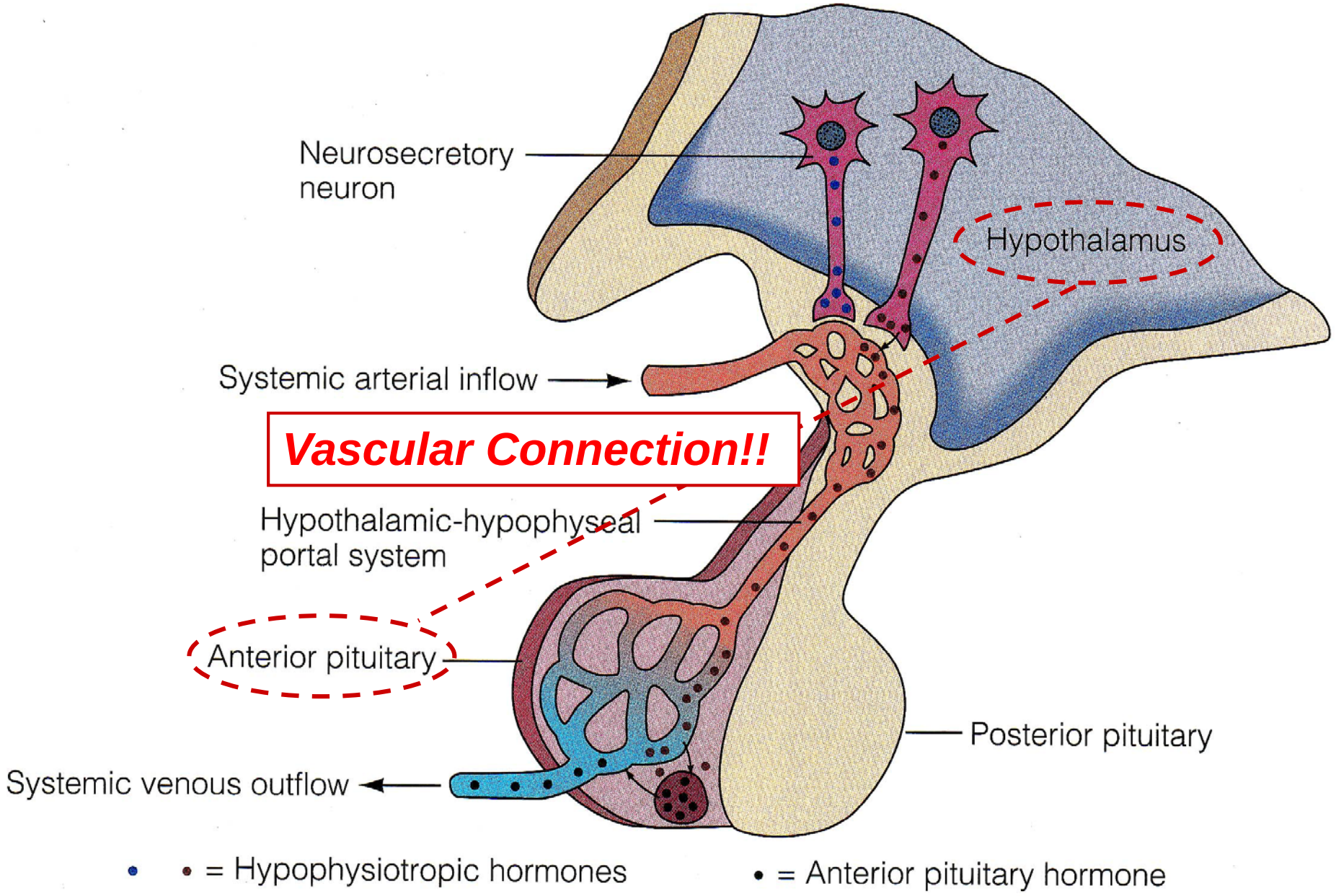


Kreiger & Hughes 1980

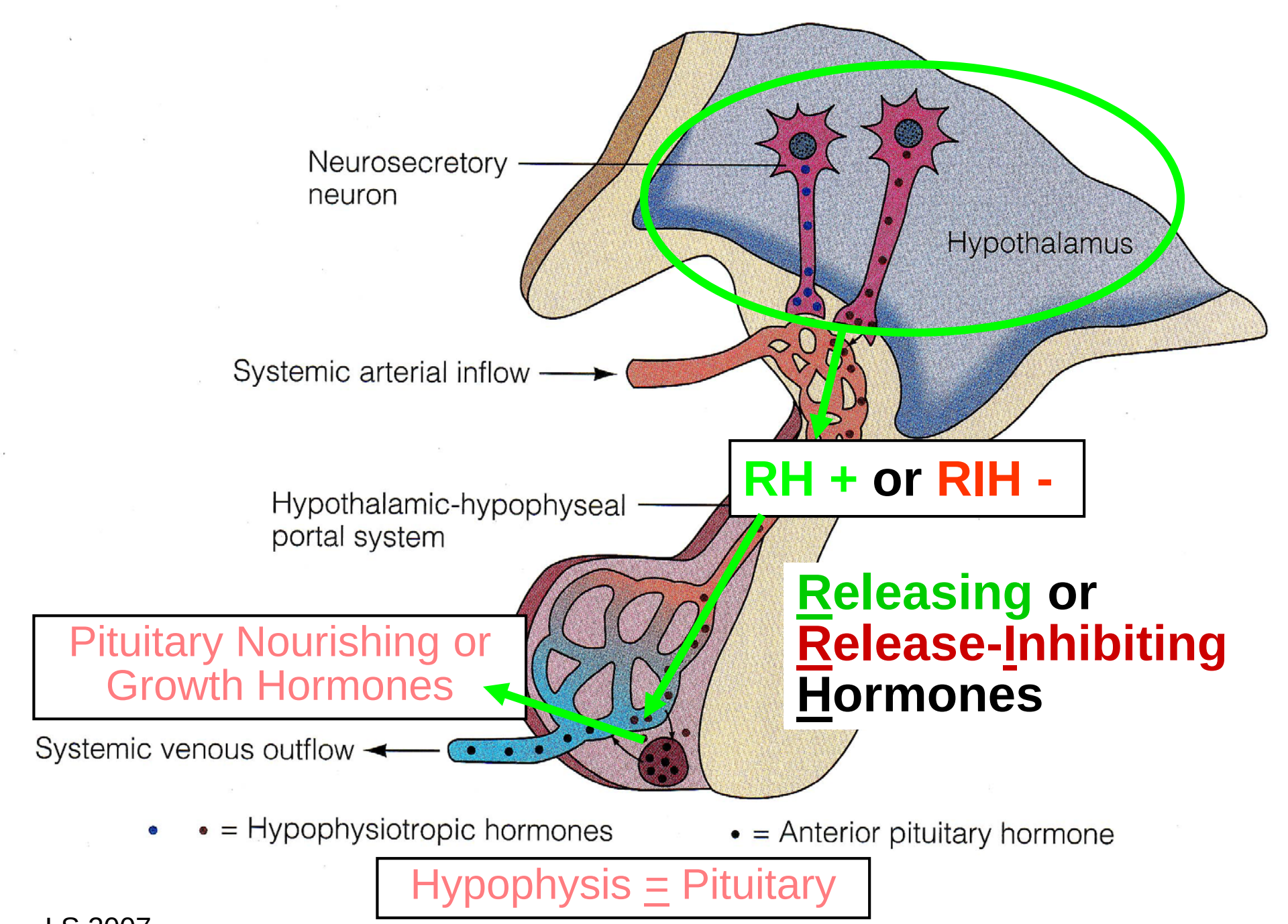

Neurosecretory neurons
Hypothalamus
Hypothalamic–posterior pituitary stalk
Nervous Connection!!
Posterior pituitary
Anterior pituitary
Systemic arterial inflow
Systemic venous outflow
• = Vasopressin
• = Oxytocin

LS 2007

Hypothalamus-Anterior Pituitary Vascular Connection!

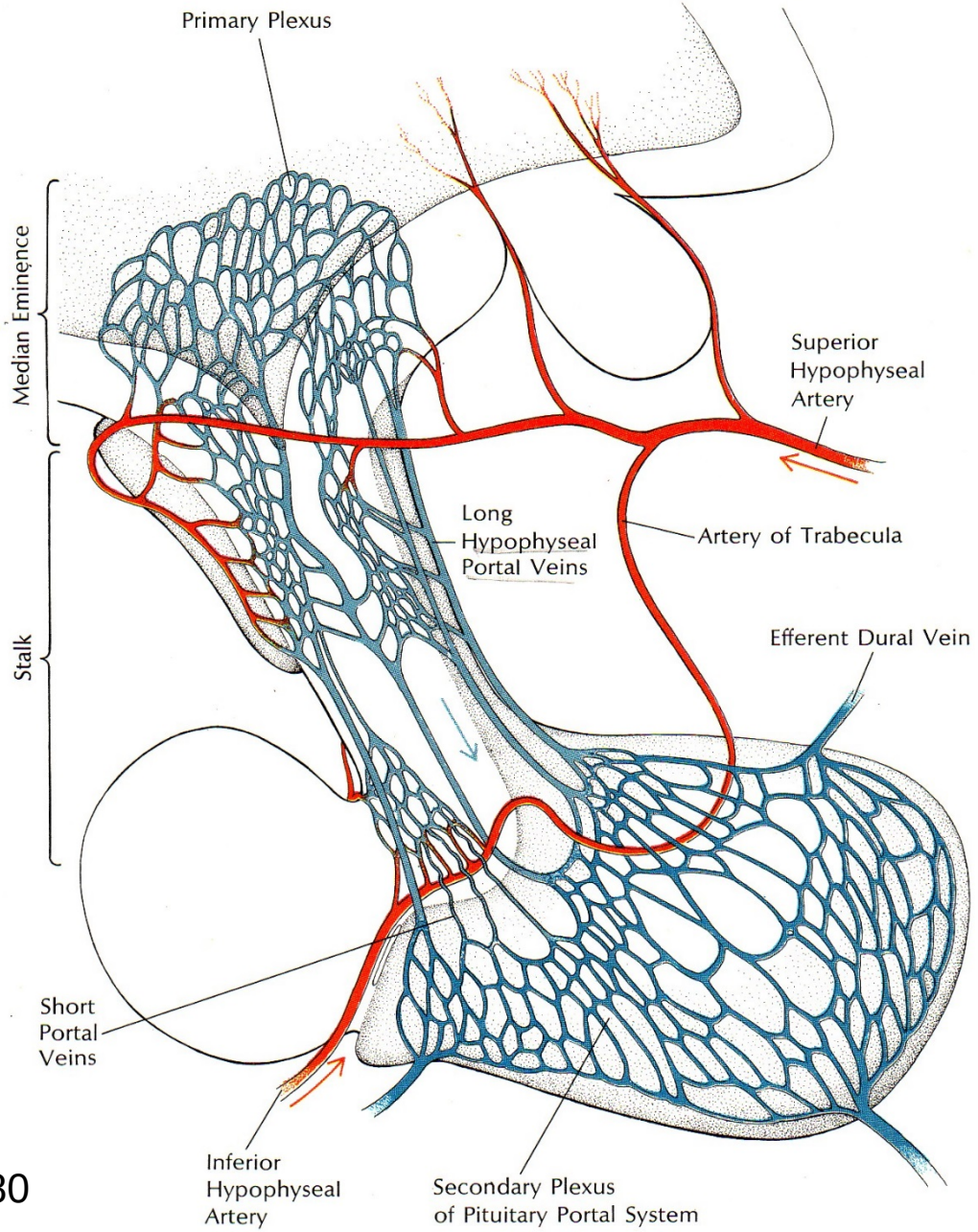


LS 2007

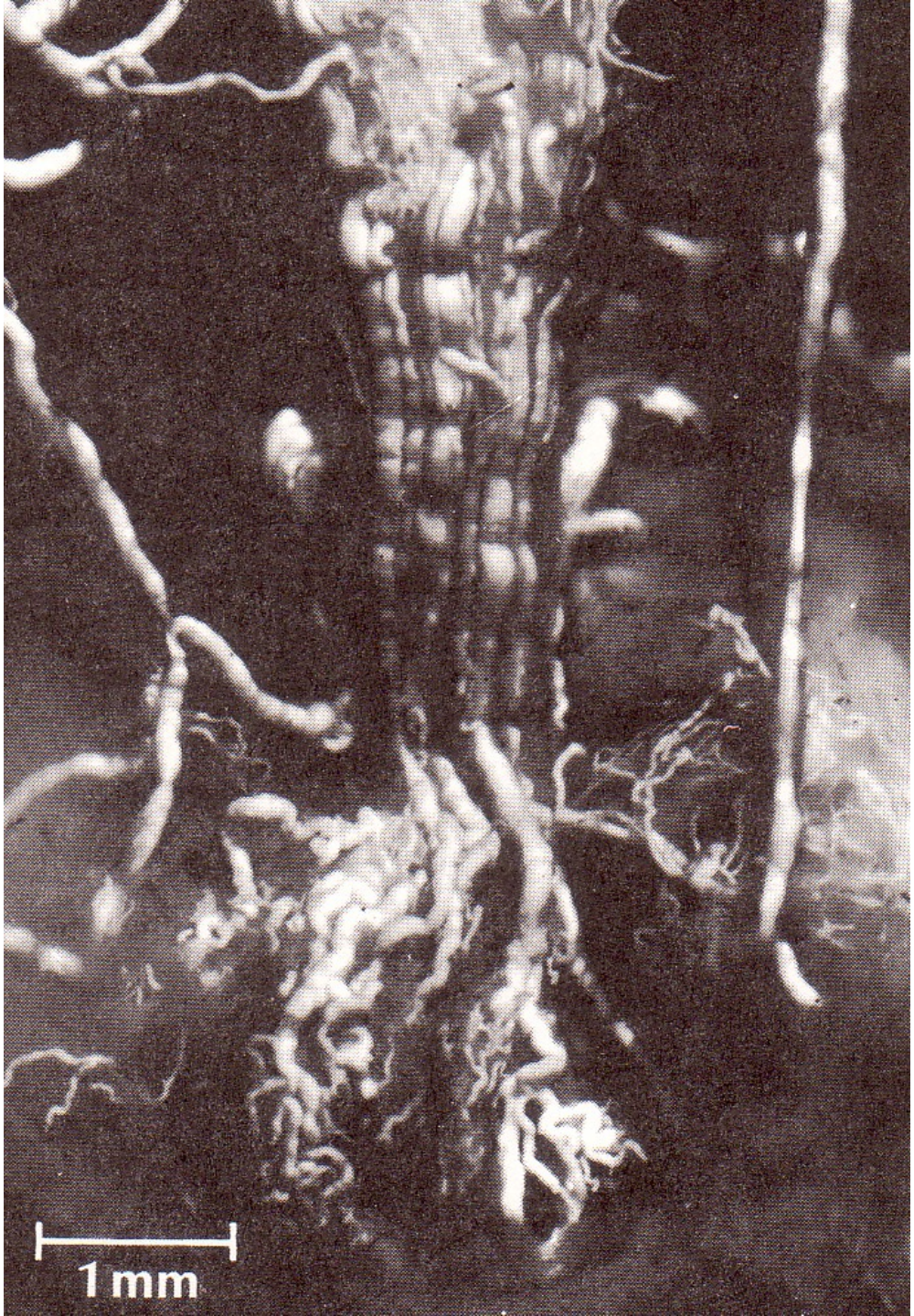

Neurosecretory neuron
Hypothalamus
Systemic arterial inflow
RH + or RIH -
Hypothalamic-hypophyseal portal system
Releasing or Release-Inhibiting Hormones
Pituitary Nourishing or Growth Hormones
Systemic venous outflow
• = Hypophysiotropic hormones
• = Anterior pituitary hormone
Hypophysis ≡ Pituitary

LS 2007

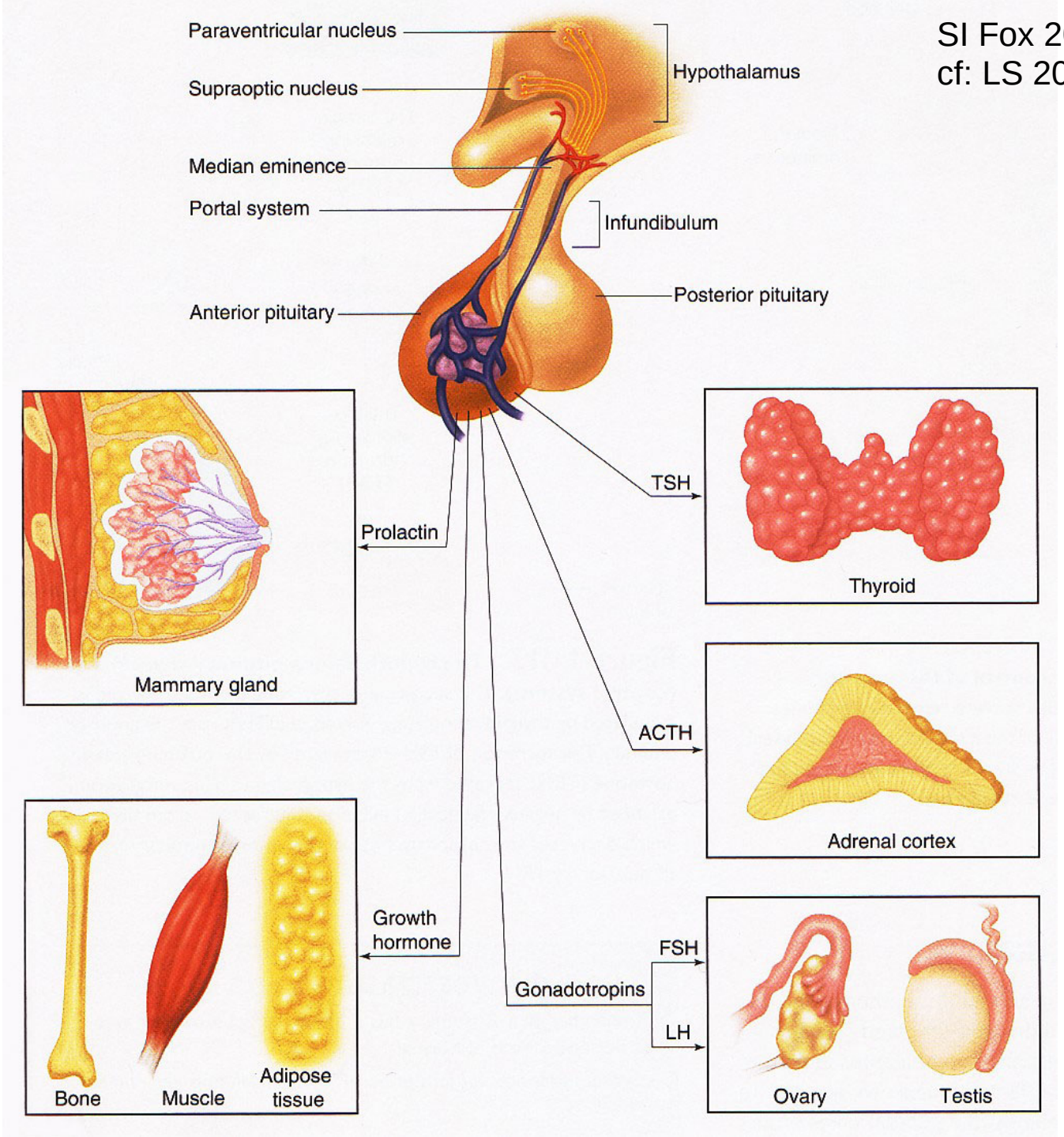
Capillary-Venule-Capillary Intimate Circulation

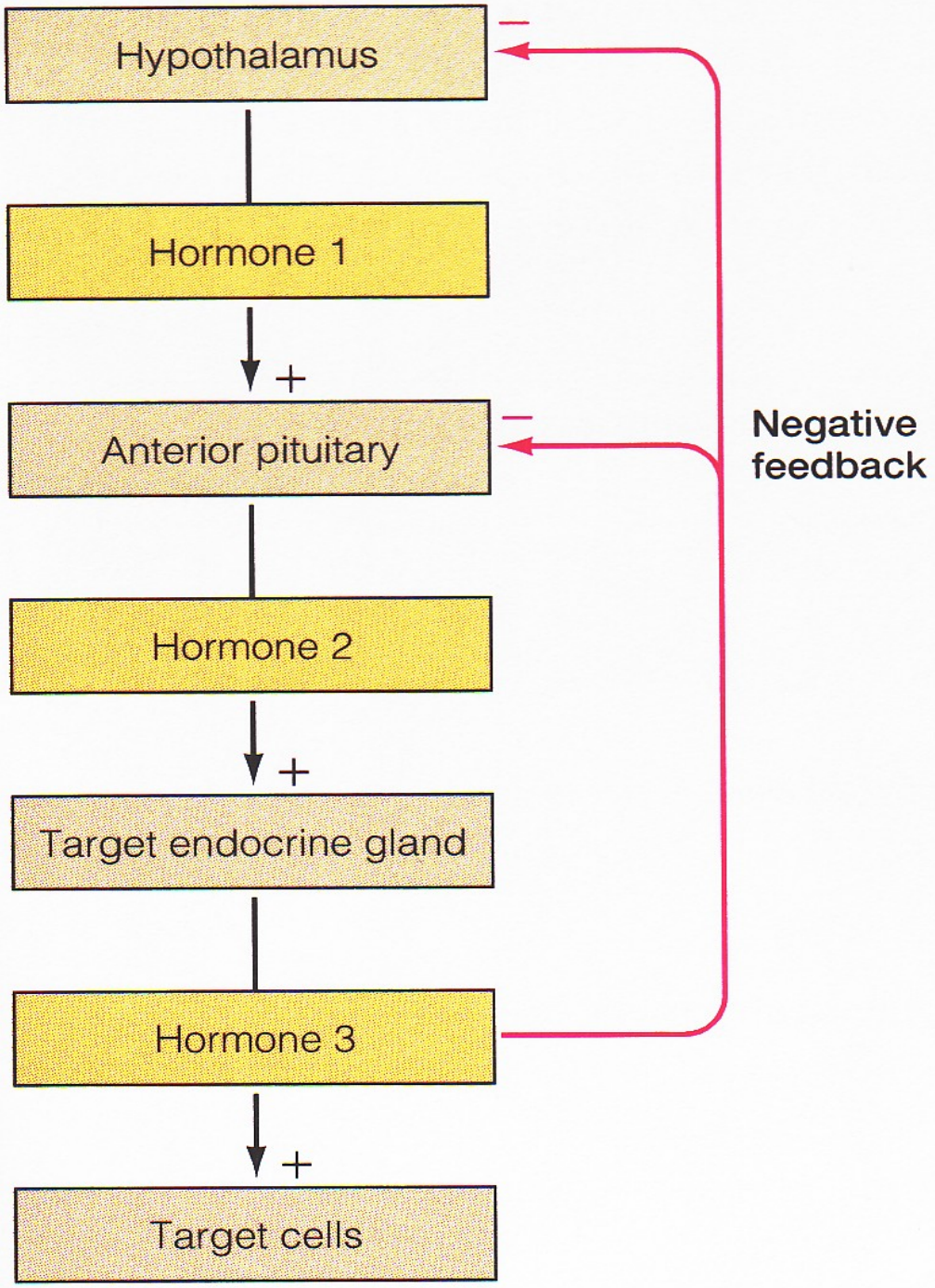


Krieger & Hughes 1980


1 mm

SI Fox 2008
cf: LS 2012 fig 17-5

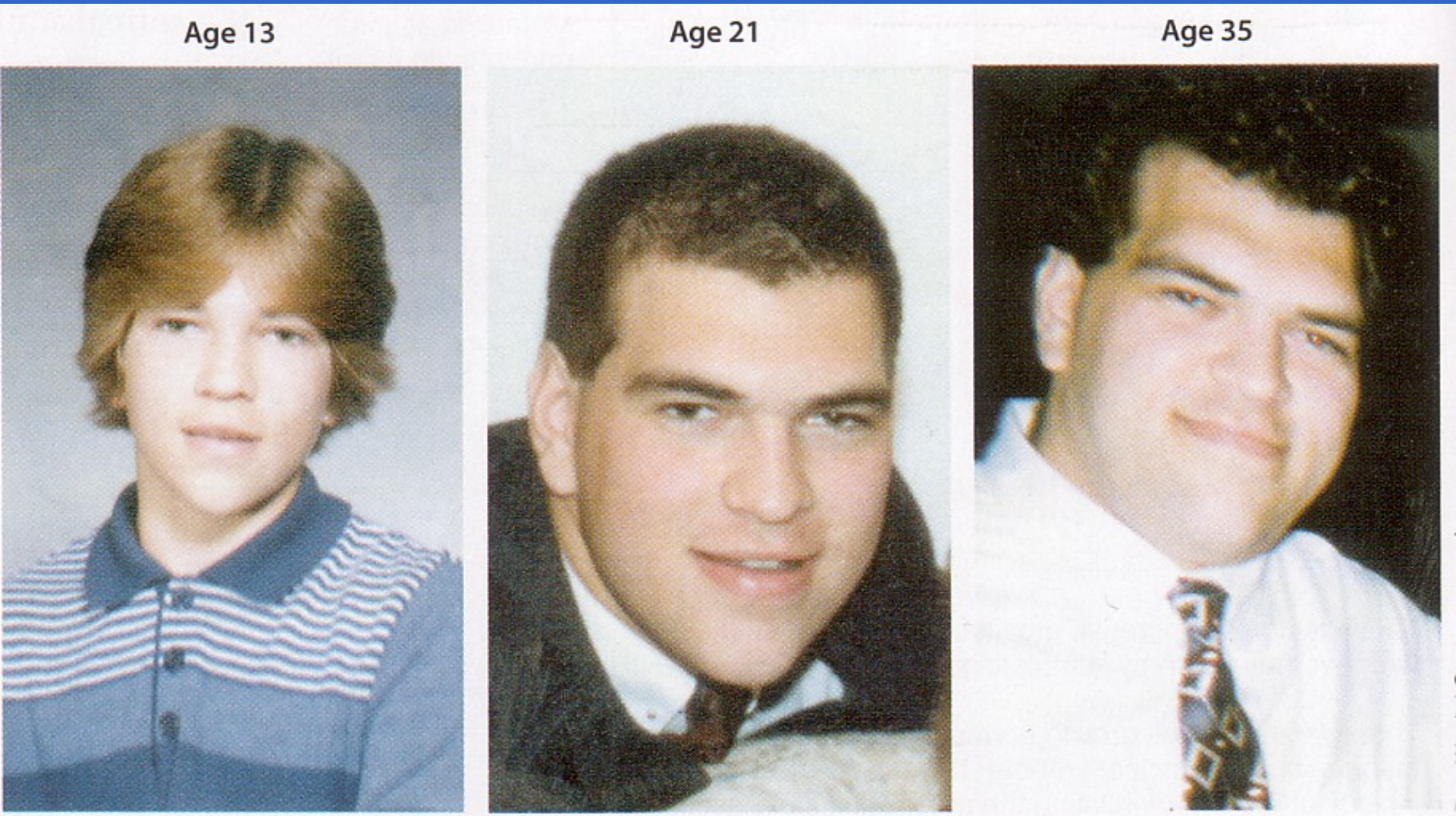



Hypothalamus
Hormone 1
+
Anterior pituitary
Hormone 2
+
Target endocrine gland
Hormone 3
+
Target cells
−
−
Negative feedback

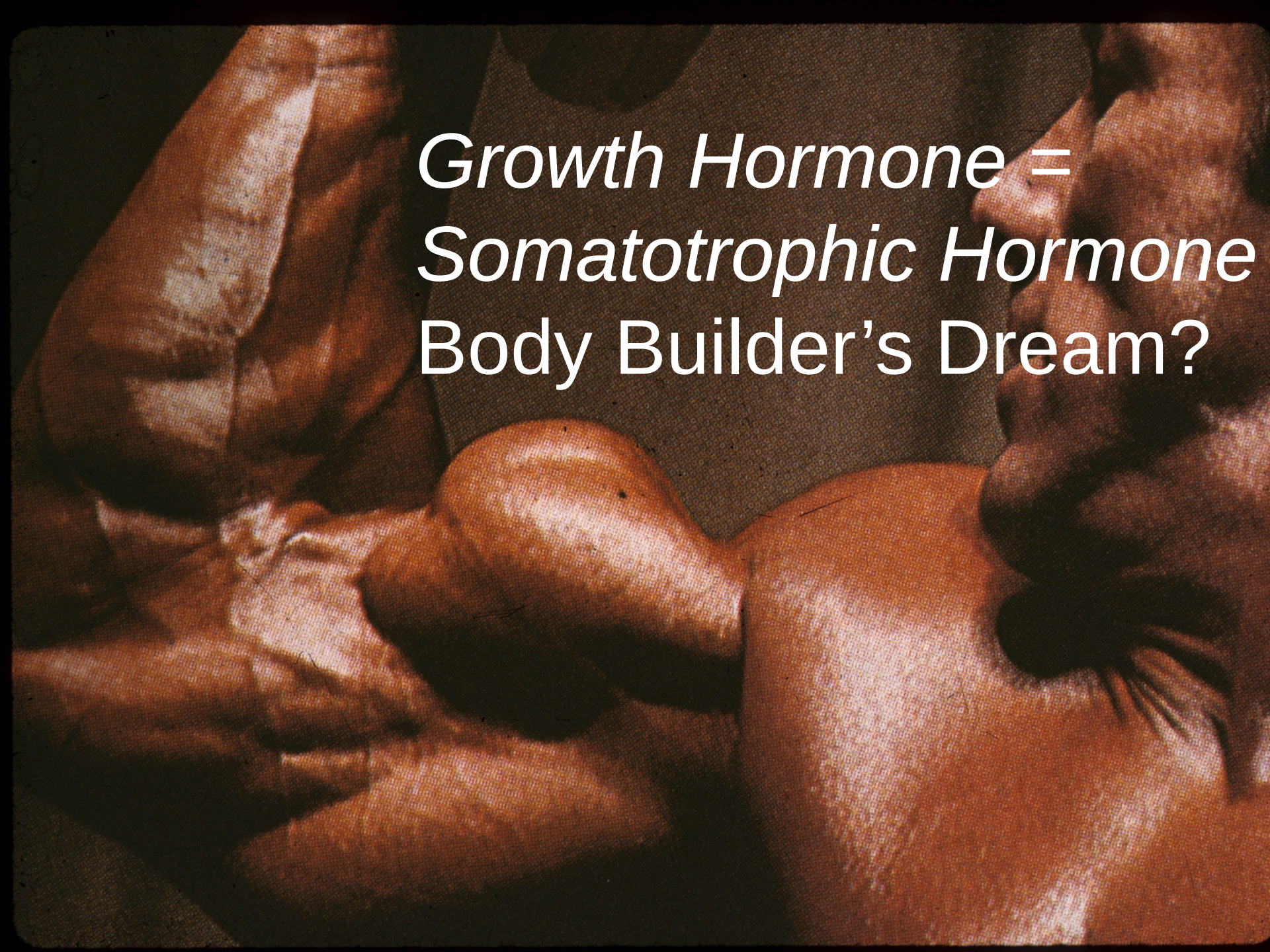
LS 1991

LS 2006, cf: LS 2012
fig 17-10

Progression & Development of Acromegaly



LS 2012 fig 17-11


Growth Hormone =
Somatotrophic Hormone
Body Builder's Dream?

GH/STH Effects: Insulin Resistance/Type II Diabetes?

↑ Amino Acid uptake & Protein synthesis

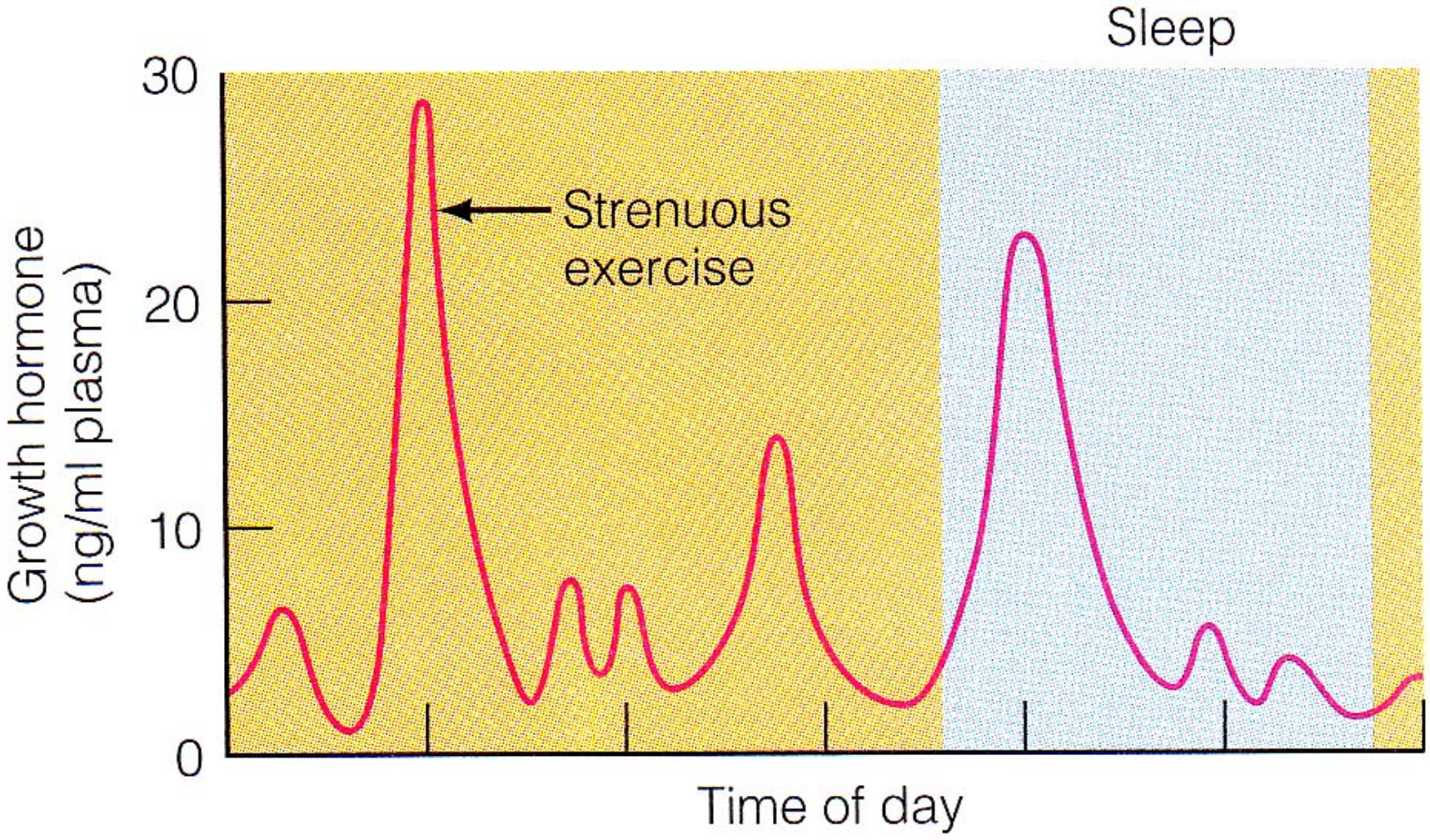
↑ Lipolysis & Fatty Acid mobilization

↓ Glucose uptake
(skeletal muscle & adipocytes)

↑ Glucose production
(liver glycogenolysis)

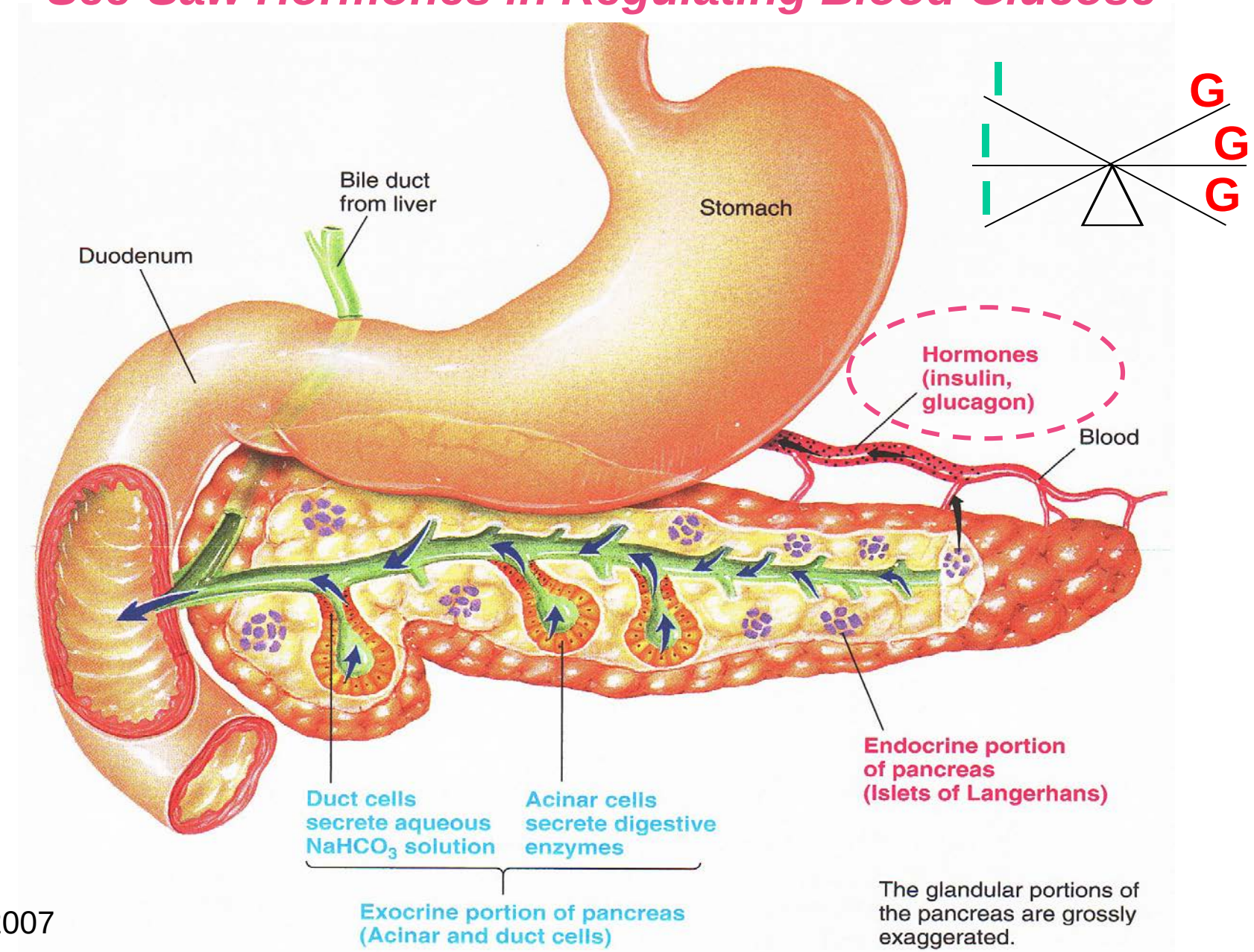
↑ Insulin secretion

Increase GH naturally with exercise & sleep!!

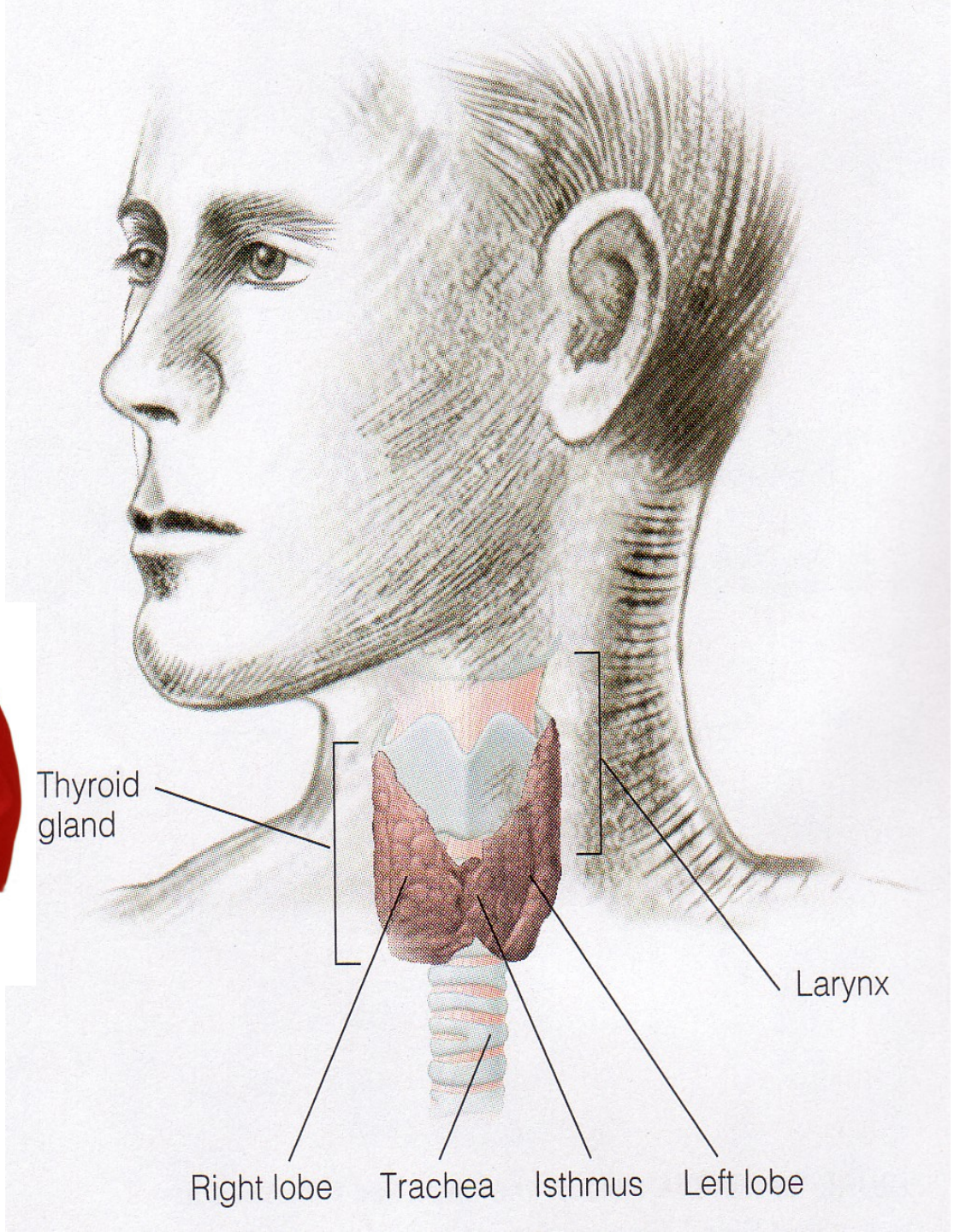


ng/ml = nanograms per mililiter

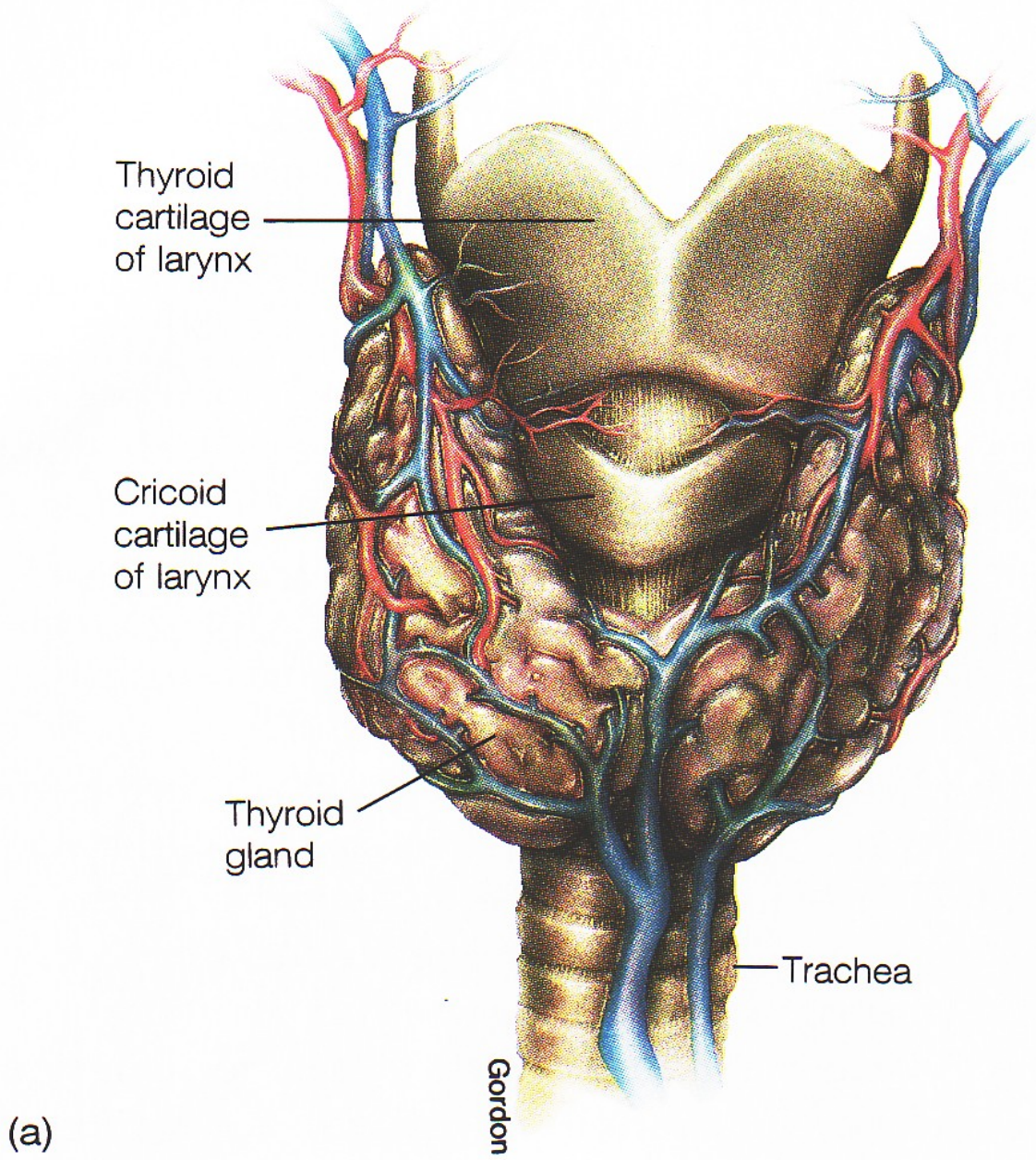
Endocrine Pancreas: Insulin (I) & Glucagon (G) See-Saw Hormones in Regulating Blood Glucose



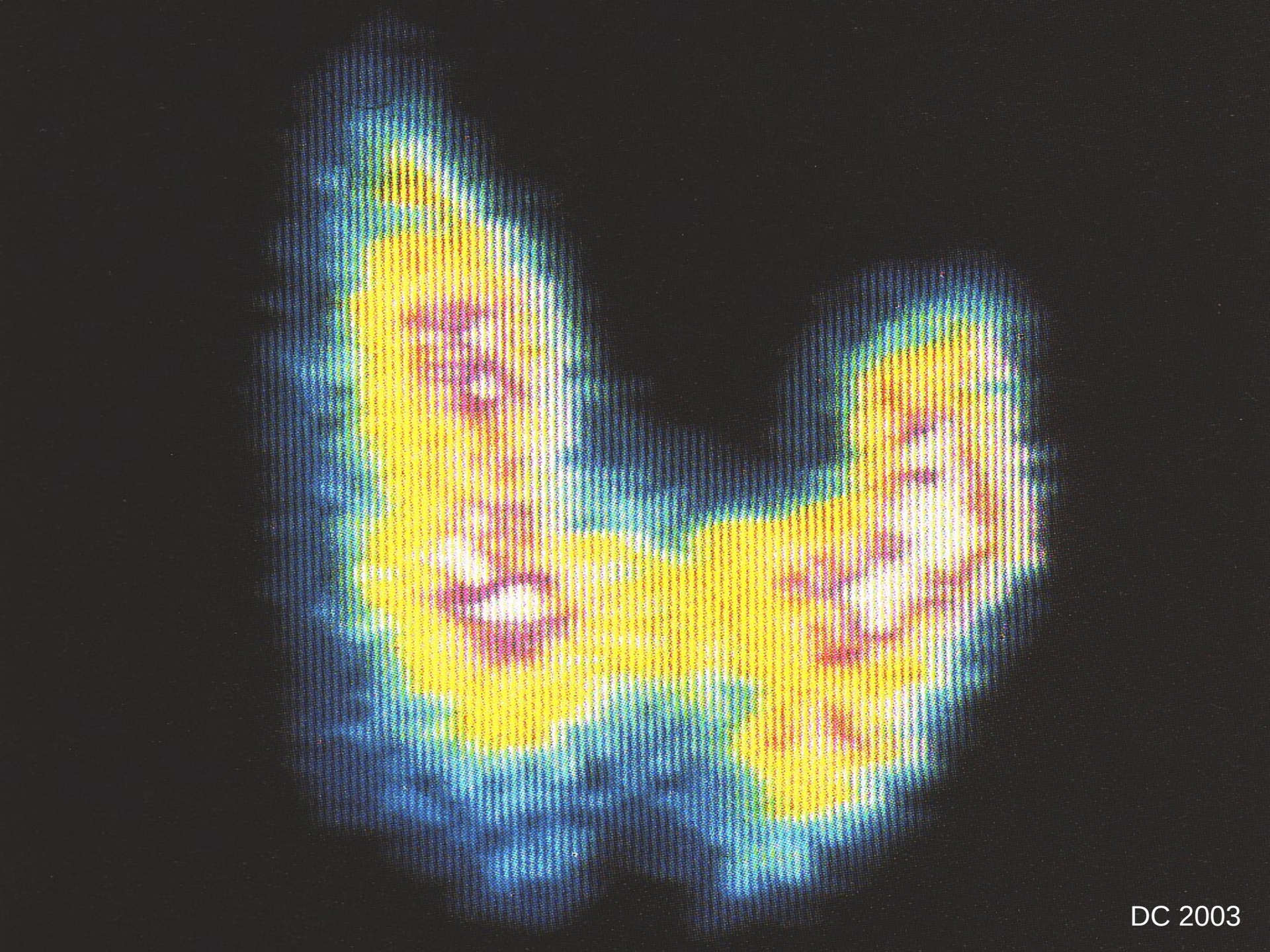
LS 2007



DC 2003


Thyroid cartilage of larynx
Cricoid cartilage of larynx
Thyroid gland
Trachea
Gordon
(a)

DC 2003


DC 2003

LS 2012 fig 17-16

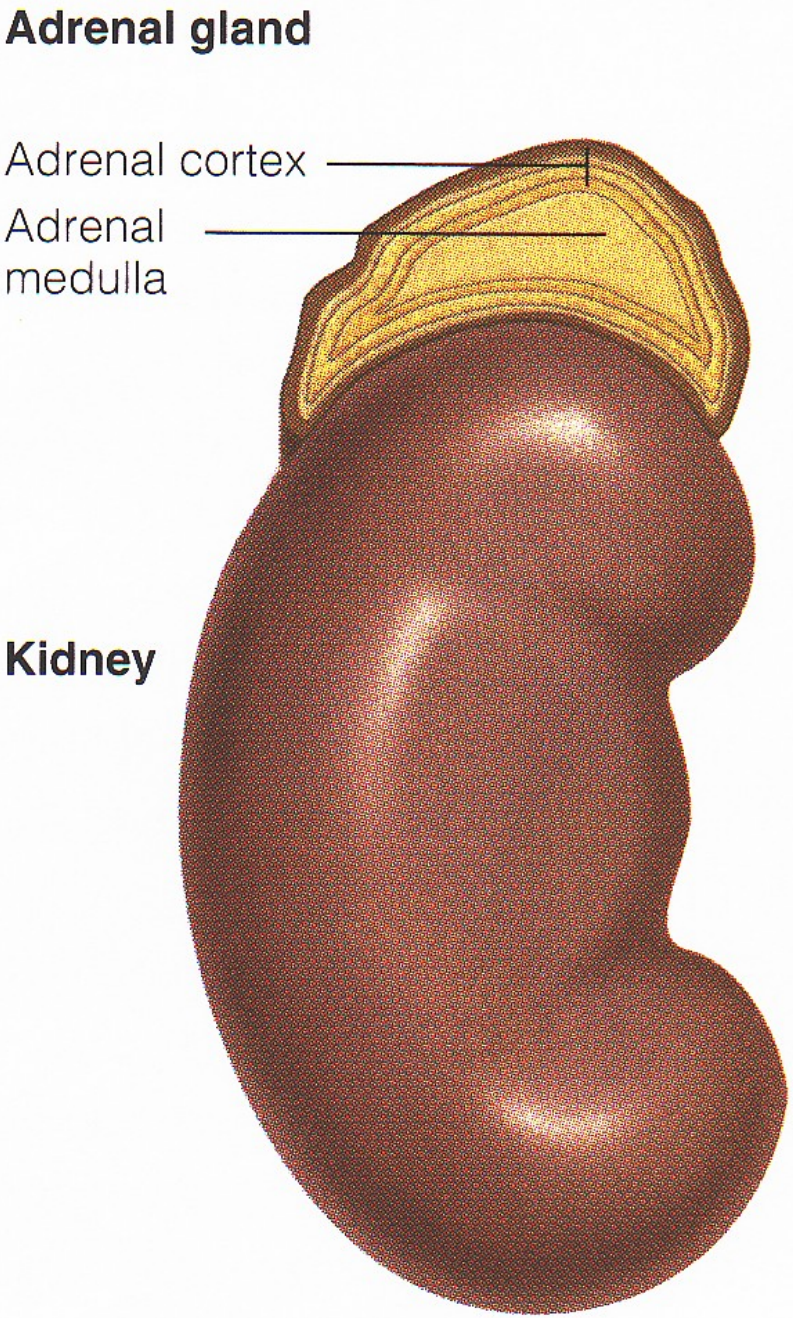
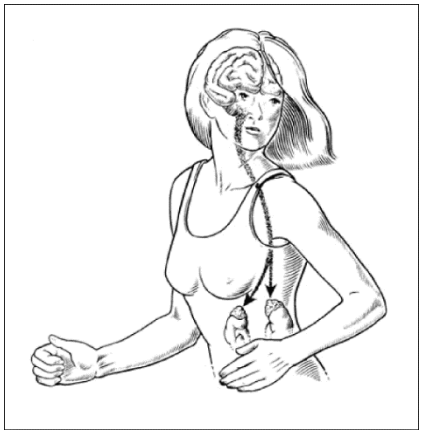


FIGURE 13-12
Adrenal Gland The adrenal glands sit atop the kidney and consist of an outer zone of cells, the adrenal cortex, which produces a variety of steroid hormones, and an inner zone, the adrenal medulla. The adrenal medulla produces adrenalin and noradrenalin.

Epinephrine 80%
Norepinephrine 20%



Guyton & Hall 2000

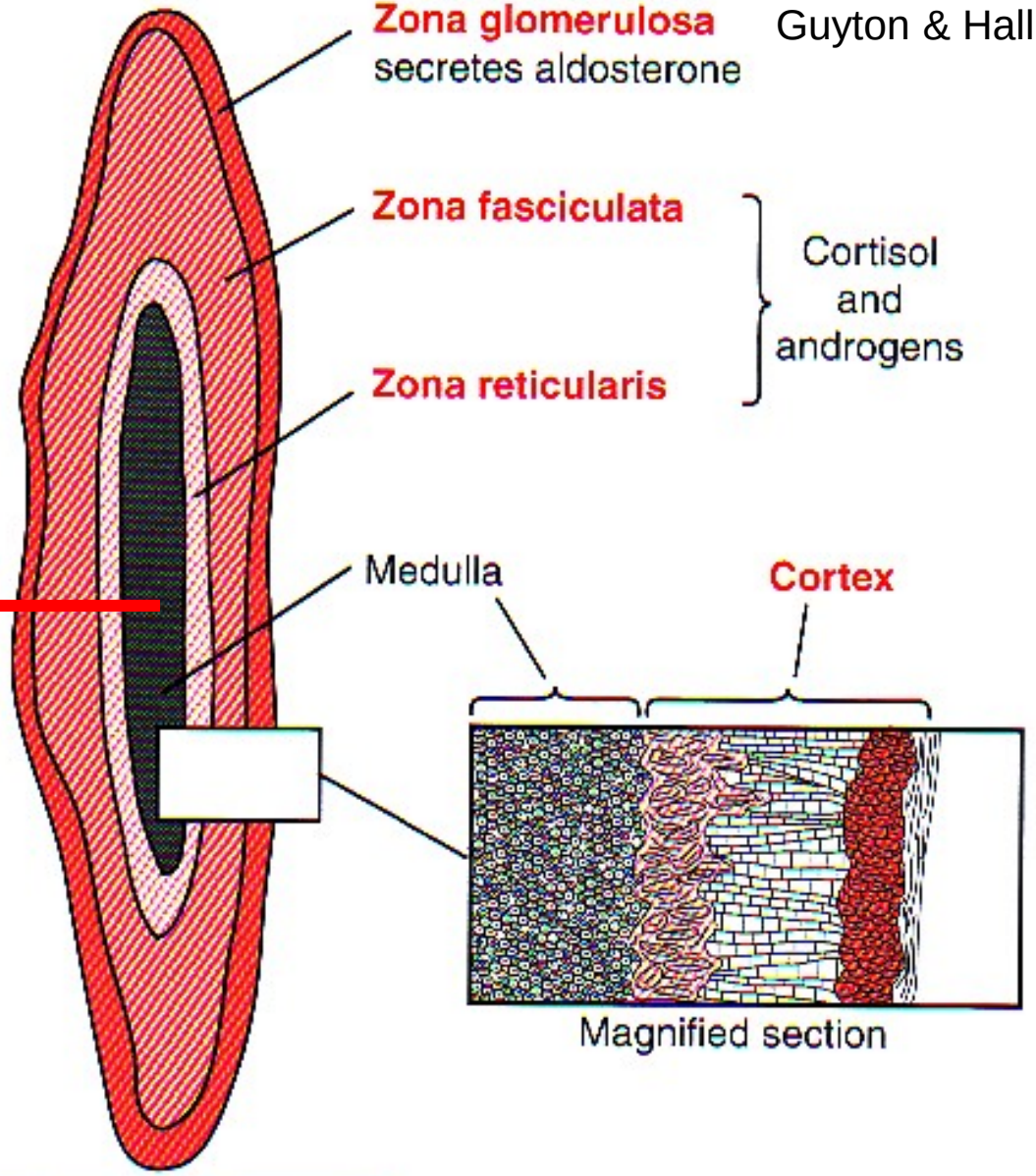


FIGURE 77–1

Secretion of adrenocortical hormones by the different zones of the adrenal cortex.