

Endocrine Topics

- 1) **Hormones**
- 2) **Hormonal Mech.**
- 3) **Hormonal Glands**
- 4) **Hormonal Homeostasis**
- 5) **Diseases**

Hormone

What is a hormone?

hormone:

**chemical produced by a specialized gland,
which is delivered by the blood,
to target cells to initiate metabolic activities**

other chemical signals:

- 1) prostaglandins: affect nearby cells, pain & inflam.**
- 2) growth factors: cell division & mitosis**
- 3) pheromones: attract mates, mark territory**
 - male: calms tension in women**
 - female: synchronizes menstrual cycle of nearby women**

Peptide Hormone Assignment

Gland	Hormone	Target	Function
1) pituitary	a) ADH b) oxytocin c) GH	kidney	water reabsorp.
2) pancreas	a) insulin b) glucagon		
3) adrenal medulla	a) epinephr.		
4) parathyroid	a) PTH		

Steroid Hormone Assignment

Gland	Hormone	Target	Function
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1) adrenal cortex

- a) cortisol**
- b) aldosterone**
- c) sex hormones**

2) gonads (ovary, testis)

- a) testosterone**
- b) estrogen & progesterone**

3) thyroid

- a) T3 & T4**
- b) calcitonin**

Hormonal Mech.

1) peptide hormones

- enzymatic reaction in cytoplasm**
- faster acting (sec-min)**
- aka 2nd messenger mech.**

2) steroid hormones

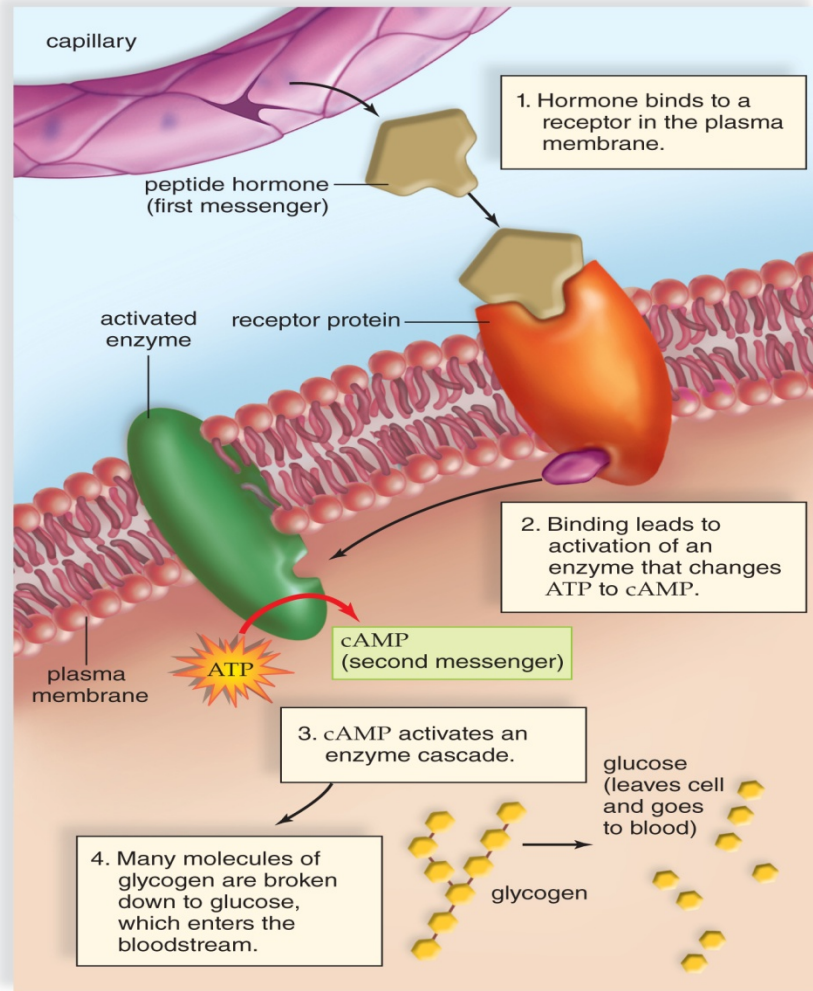
- 2 parts:**
 - a) chromosome activation in nucleus**
 - b) protein synthesis in cytoplasm**
- slower acting, incl. gene activation (min-hr)**
- aka gene activation mech.**

Hormonal Mech & Glands

<u>hormone group</u>	<u>mechanism</u>	<u>Producing Gland</u>
1) peptide	2nd messenger	1) pituitary 2) pancreas 3) adrenal medulla 4) parathyroid
2) steroid	gene activation	1) adrenal cortex 2) gonads (ovary, testis) 3) thyroid

Peptide Hormone Mech.

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- aka
2nd
messenger
mechanism

epinephrine:
(adrenaline)
energized due
to glucose
release into
bloodstream

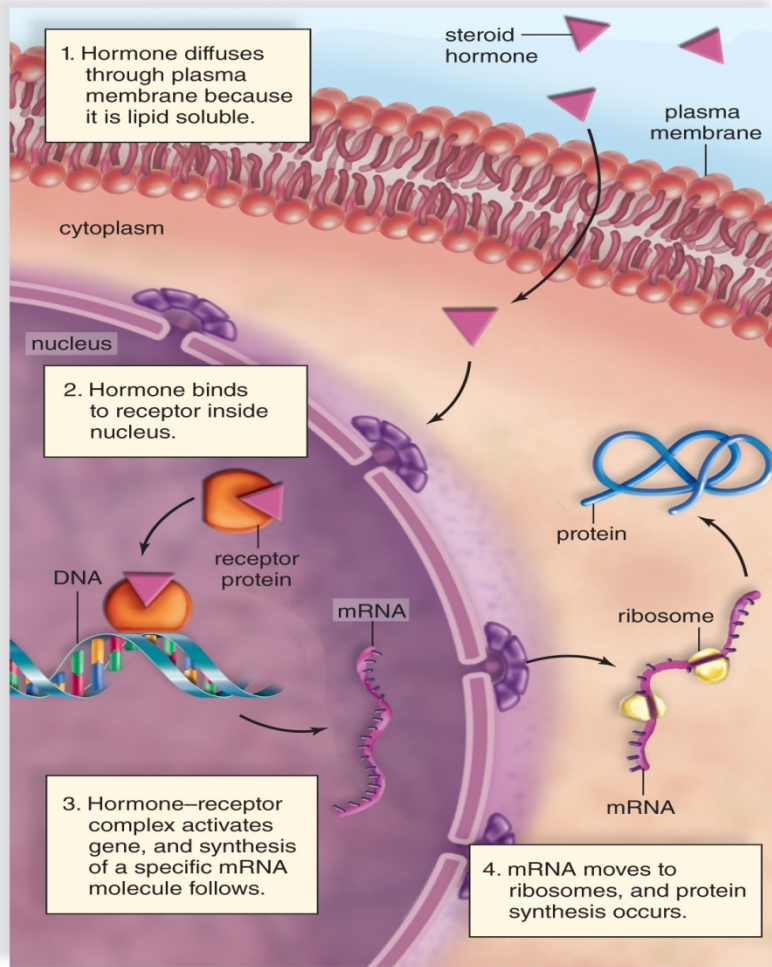
Peptide Hormone Steps

Step	Location	Hormonal Action
1.	cell memb.	hormone binds to receptor
2.	"	cAMP produced
3	cytoplasm	enzyme reaction
4.	"	glucose produced
5.	"	hormonal effect

**effect of adrenaline:
energized due to glucose release into blood**

Steroid Hormone Mech.

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**- aka
gene
activation
mechanism**

**testosterone:
grow more
muscle mass
due to DNA
activation**

Steroid Mech. Steps

Step	Location	Hormonal Action
1.	cell membrane	hormone enters cell
2.	nucleus	hormone binds to receptor
3.	nucleus	hormone activates specific gene
4.	cytoplasm	protein synthesis
5.	cytoplasm	hormonal effect

effect of testosterone: more muscle mass

Pituitary & Hypothalamus

both organs

- **master glands, reg. other glands**
- **tight neural & hormonal connection**

1) pituitary

- **prod. 8+ hormones which reg. growth, maturation, response to environment**

2) hypothalamus

- **autonomic center**
eg. sleep, thirst, biological clocks

Thyroid & Parathyroid

thyroid

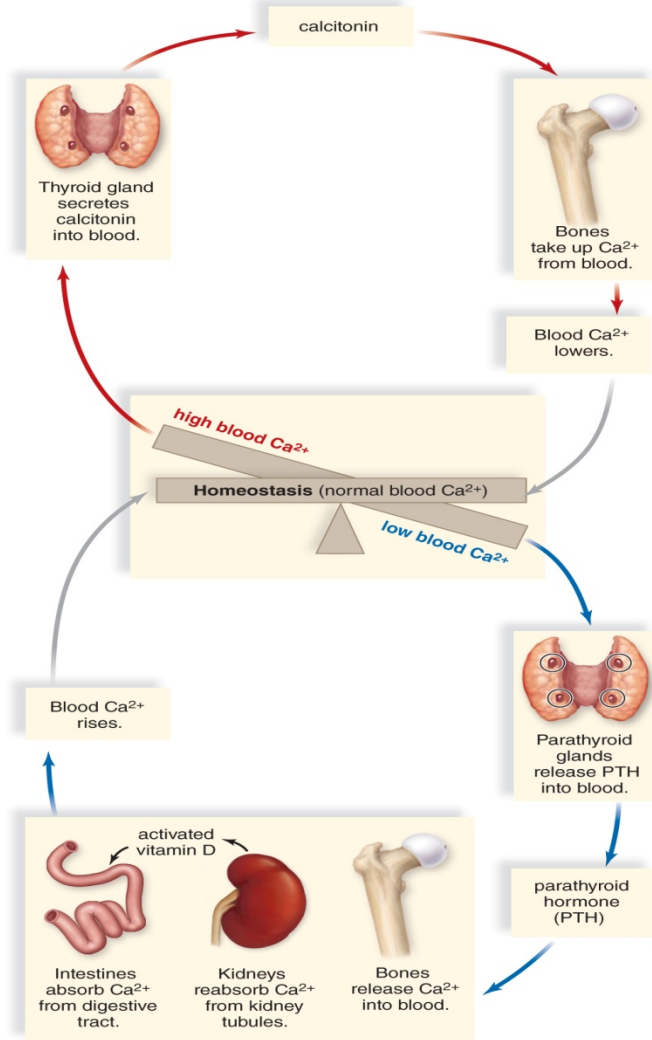
- 1) **thyroid hormones (TH): T3 & T4**
 - **increases metabolism, energy and growth**
 - **BMR**
 - **reg. by TSH (pituitary)**
- 2) **calcitonin**
 - **regulates high blood calcium levels**

parathyroid

- 1) **parathyroid hormone (PTH)**
 - **regulates low blood calcium level**

Calcitonin & PTH: Blood Ca Balance

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calcium: essential for nerves and muscle contractions

↓ blood Ca → PTH

- 1) bone release Ca**
 - 2) intestines absorb Ca**
 - 3) kidney absorb Ca**
- ↑ blood Ca**

↑ blood Ca → calcitonin

- 1) bone absorbs Ca**
- ↓ blood Ca**

Adrenal

1) cortex (outer)

a) glucocorticoids (cortisol): stress, tissue repairs

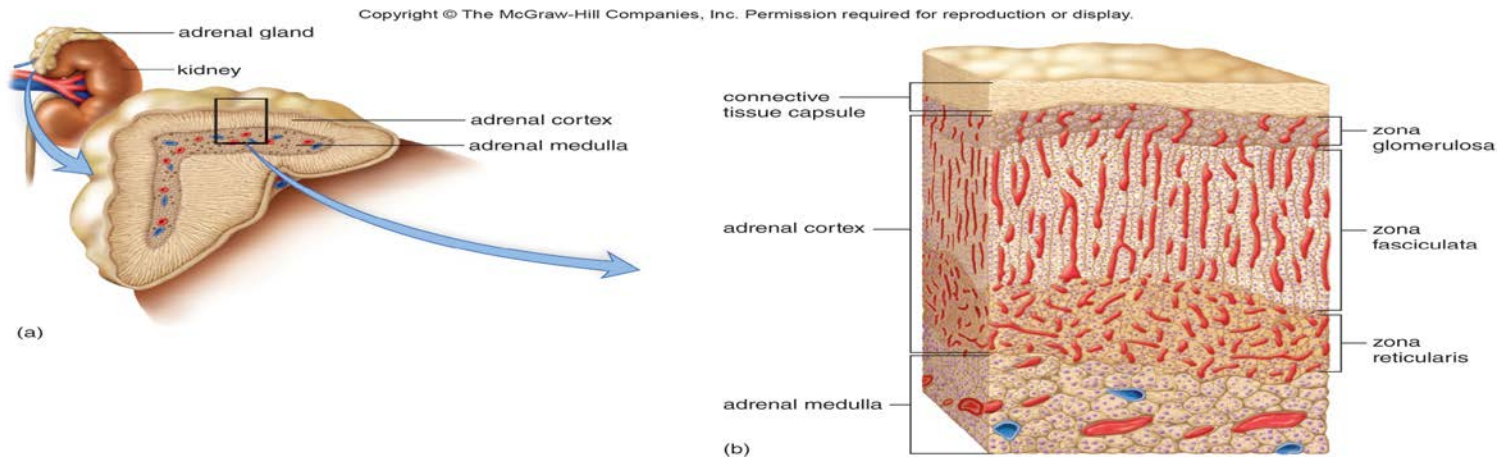
b) mineralcorticoids (aldosterone): ion balance

- reg water, Na, K

2) medulla (inner)

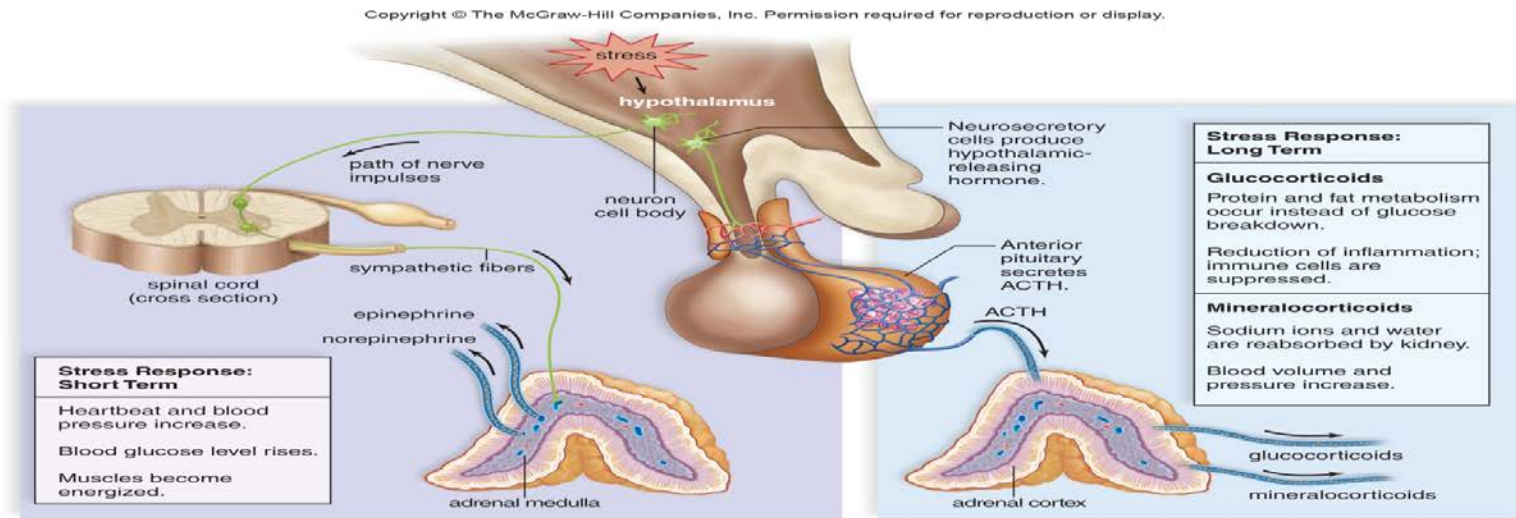
- epinephrine & nor-epinephrine

- ↑ HR, BV, BR, blood sugar,



Stress Response

- 1) short term stress (adrenal medula: nor & epinephrine)
→ ↑ HR, BP, glucose → energize muscles → fight or flight resp.
- 2) long term stress (adr. cortex: gluco- & mineral-corticoids)
use protein & fat → ↓ inflam. & immune response (get sick)
reabsorb salt & water → ↑ BV & BP (retain fluids)



Cortisol Imbalance

cortisone (gluco-corticoid) shots:

+: ↓ inflam. → ↓ pain & swelling → ↑ sport playing ability -
: ↑injury & infection (↓ pain or injury)

Addison's Disease: ↓ cortisol
- bronze skin color

Cushings: ↑ cortisol
- skin fat

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a.



b. a: © Custom Medical Stock Photo, b: © NMSB/Custom Medical Stock Photo

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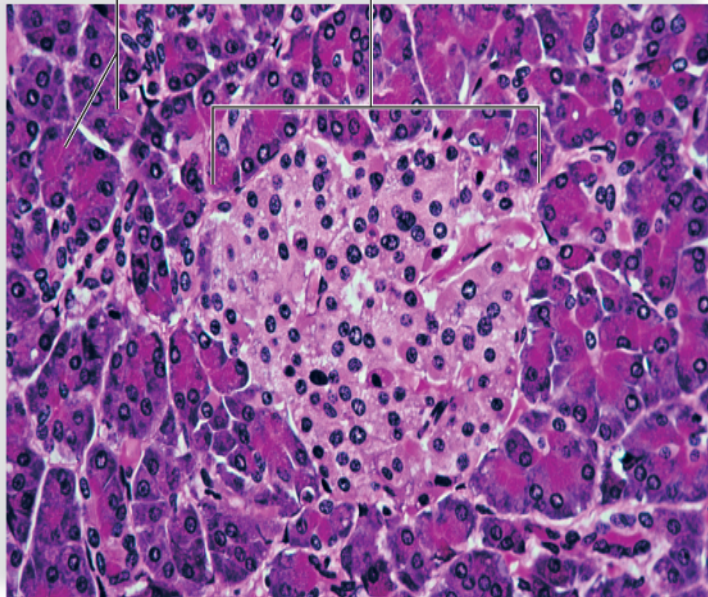
(both): Courtesy Shannon Halverson

Pancreas

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Exocrine tissue produces digestive juice.

Pancreatic islet (islet of Langerhans)
Endocrine tissue produces insulin.



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100x

2 hormones

1) glucagon

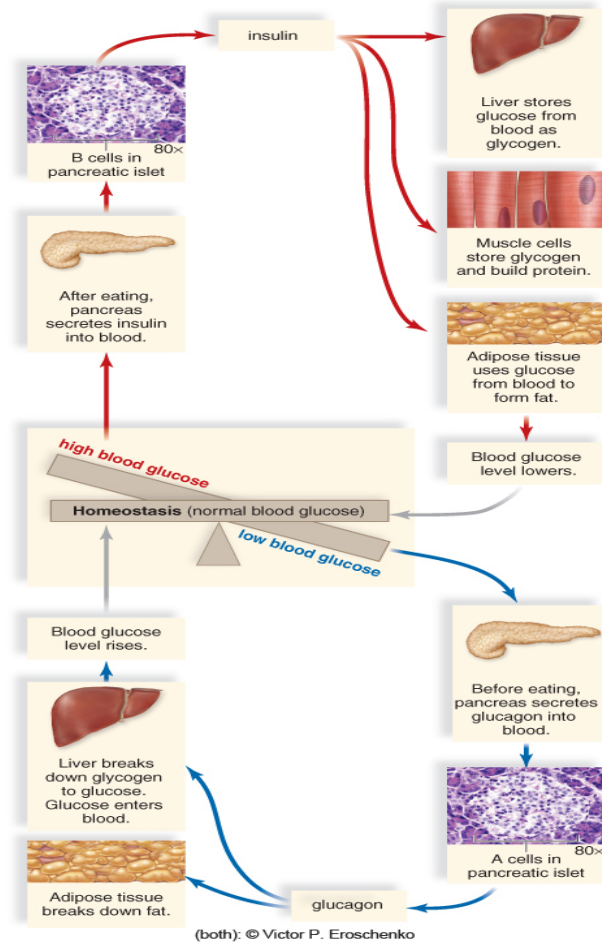
- during famine times,
↑ low blood sugar levels
by ↑ glycogen breakdown
into glucose

2 insulin

- during feast times,
↓ high blood sugar levels
by ↑ glucose uptake by cell

Blood Glucose Homeostasis

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low blood sugar

glucagon makes glucose

- 1) liver - glycogen breaks down
- 2) fat cells break down

high blood sugar

insulin stores glucose

- 1) increase cell glucose uptake
- 2) increase muscle glycogen
- 3) increase fat tissue

Diabetes

= **diabetes mellitus (honey)**

- **↓ sugar uptake by cell → ↑ blood sugar**
 - **↑ urine sugar → sugar-starved cells**
 - **fatigue, thirst, hunger, weight loss, vision loss, kidney failure, hard to heal from infections, nerve damage, stroke**

a) Type I (10%) - insuff. insulin prod.
- juvenile, treat: insulin injection

b) Type II (90%) - insulin resistance
- adult, treat: ↓ fat & sugar, ↑ exercise

Synthetic Insulin

1920 - Banting & best, pancreas extract, on dogs

1922 - insulin for humans, pig & cattle pancreas extract

1923 - Banting & Macleod, Nobel Prize Medicine

1953 - amino acid sequence

today - bacteria, E. Coli, recombinant insulin, Genentech

**- human DNA inserted into bacteria,
to make human insulin**

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Sexual Characteristics

sexual char

**a) primary: female: breasts & female genitalia
male: male genitalia**

**b) second.: female: high voice, smaller body, less hair
male: lower voice, larger body, more hair**

hormones:

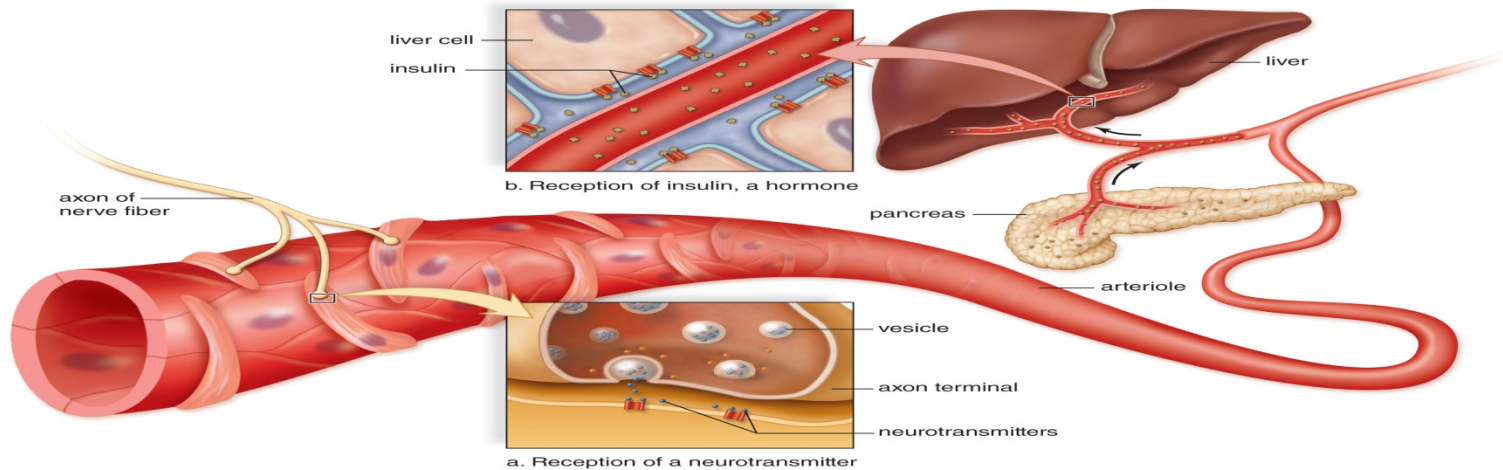
1) male: testosterone, FSH, LH

2) female: estrogen, progesterone, FSH, LH

Neural vs Hormonal

Feature	Neural	Hormonal
1) chem. compd.	neurotransmitters	hormones
2) speed	fast (ms)	slow (sec-yrs)
3) delivery	neurons	blood
4) target cells	muscles	all tissues
5) mechanism	AP - 4 phases	1) 2nd mess. 2) gene activ.

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Endocrine Diseases

Describe the cause and effects of:

- 1) diabetes mellitus -
 - a) Type I (10%)**
 - b) Type II (90%)****
- 2) hypothyroidism**
- 3) hyperthyroidism - (Grave's Disease)**
- 4) Addison's Disease**
- 5) Cushing's Syndrome**