Western

UNIVERSITY · CANADA

Tutorial 7
Sections 009/010

TA: Greydon Gilmore

Physiology 2130

Oct 22nd, 2019

Western

Your TA reminding you…

- **1st Quiz** (1%)
  - Opens: Oct 21st @ 4pm
  - Closes: Oct 22nd @ 4pm
- **1st Midterm** - Oct 25th @ 6pm-7pm (15%)
- **Midterm Review session**
  - When: Wednesday, Oct 23rd from 6:00-8:00pm
  - Where: Auditorium C, University Hospital, 3rd floor

Today

- No group work!
- Learning Catalytics Question
- Basal ganglia
- Anterior pituitary and thyroid
- Thyroid Gland and Adrenal Gland

Question from email/anonymous suggestion box…

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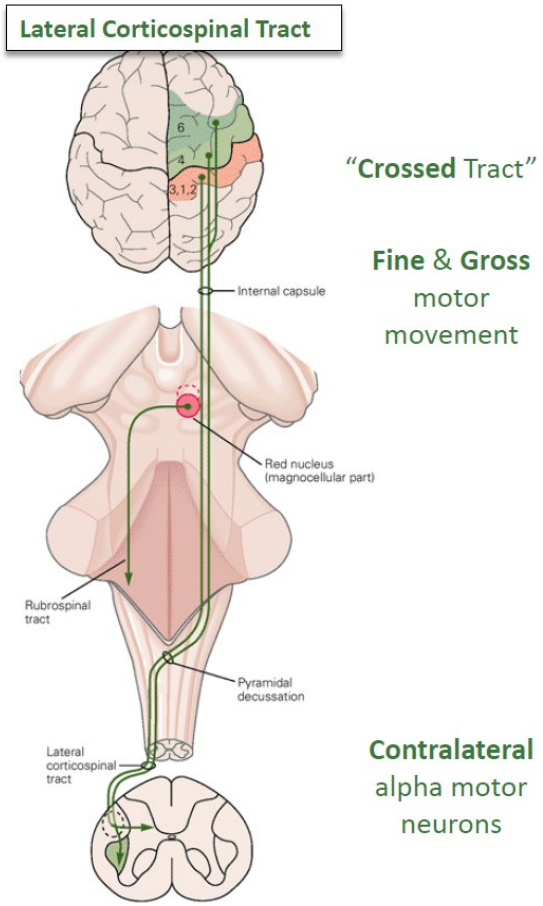
Lateral vs. Ventral Corticospinal Tracts



Dorsal Lateral Corticospinal tract

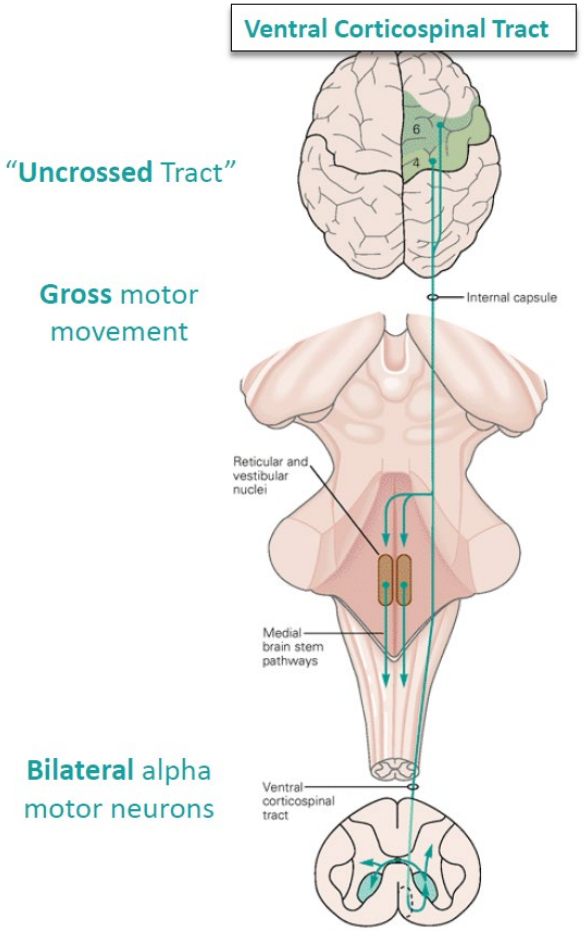
Contralateral

- Crosses at the pyramids of the medulla
- 80-90% of this pathway
- Fine gross motor movements

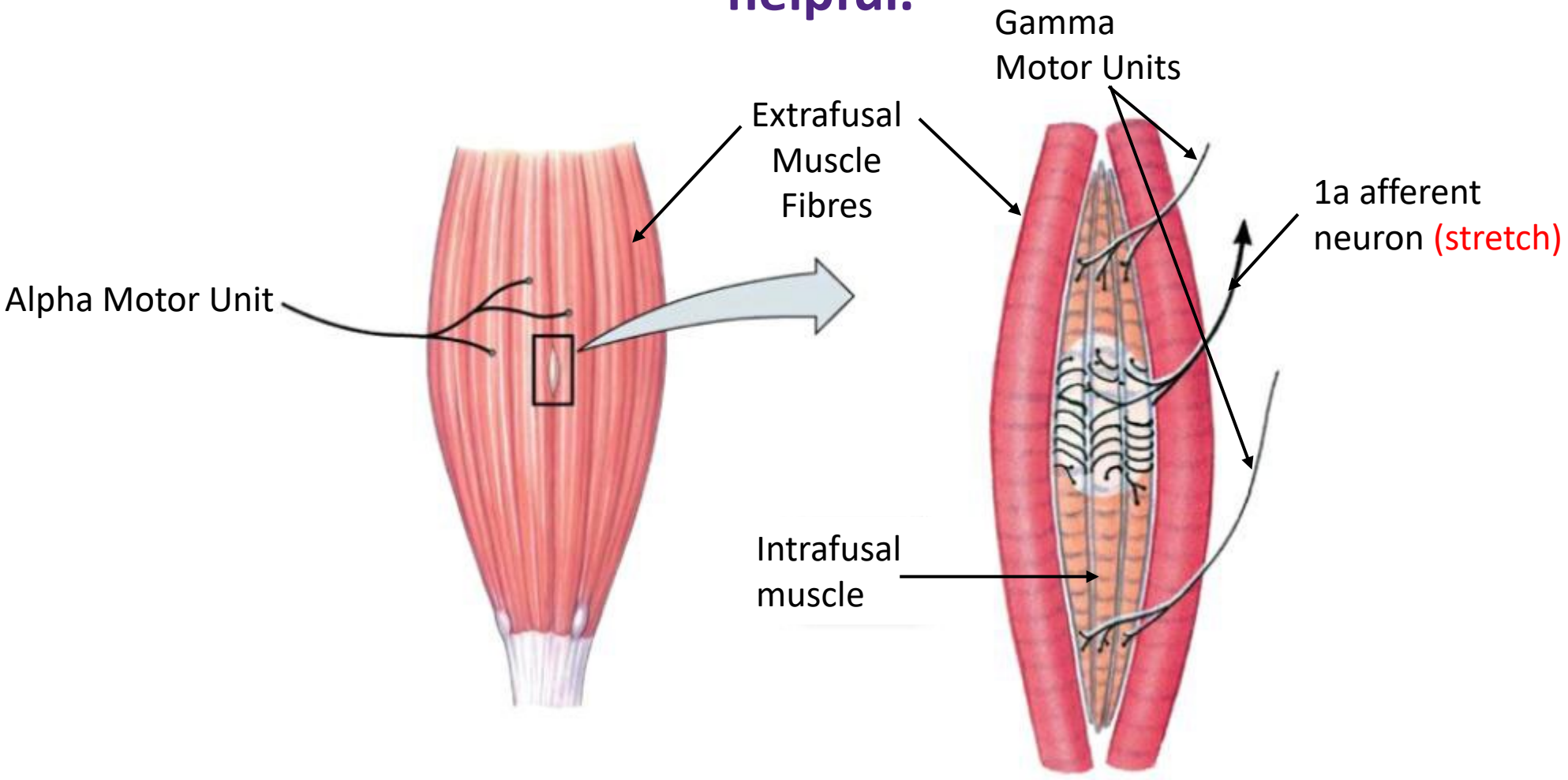
Ventral Medial Corticospinal tract

Ipsilateral

- Crosses at the spinal cord
- Gross motor movements
- Affects motor neurons on both sides of the body



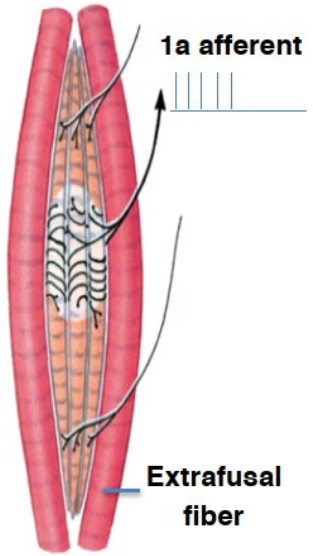
I really don't get the concept of gamma motor neurons and 1a and 1b afferent neurons so if you can just revise these it would be really helpful.



I really don't get the concept of gamma motor neurons and 1a and 1b afferent neurons so if you can just revise these it would be really helpful.

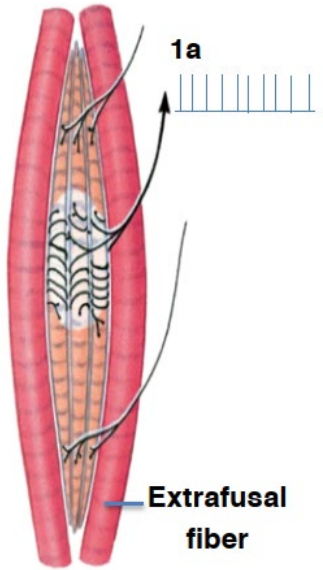
Alpha motor neuron without gamma motor neuron would lead to loss of 1a firing

- If gamma not contracting intrafusal, stretch of muscle will not be able to be detected (dangerous)



Alpha motor neuron with gamma motor neuron would maintain 1a firing

- With gamma contracting intrafusal, stretch of the muscle can still be detected

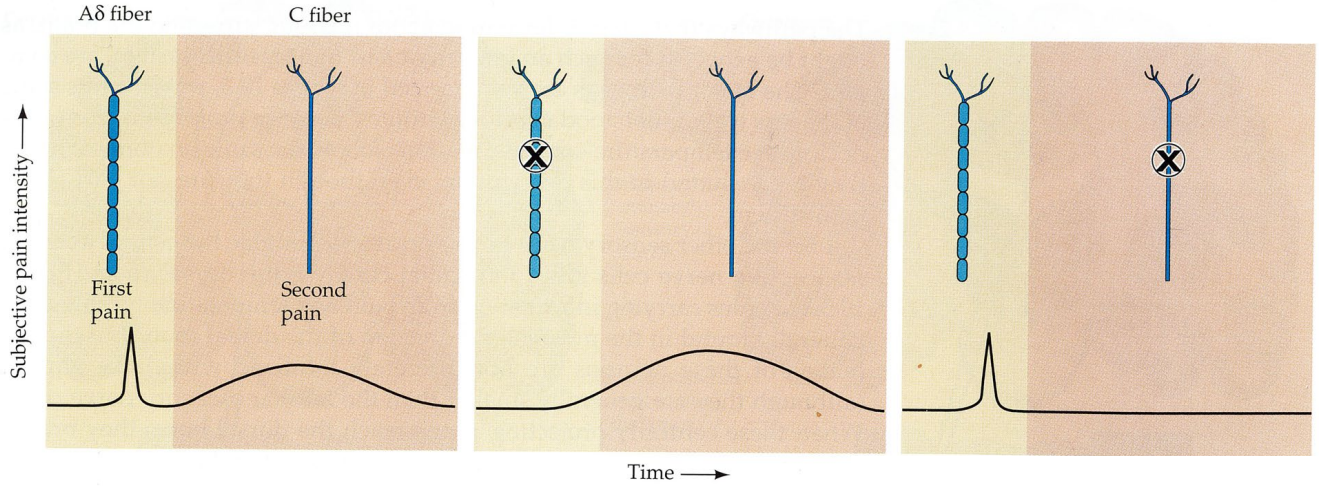


Would you be able to go over the cerebellum and basal ganglia in more detail, particularly the cerebellar circuit. I'm not sure I fully understand the concepts

- Will be covered in todays lecture slides

Where were type C fibers mentioned?
Dr. Everling, Lecture 2, Slide 23

Fiber Type	Fiber characteristics	Associated stimuli
Aβ (beta)	Large, myelinated	Mechanical stimuli (touch)
Aδ (delta)	Small, myelinated	Intense mechanical or mechanothermal stimuli, fast pain
C	Small, unmyelinated	Heat, cold, slow pain



Learning Catalytic Question

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Motor Physiology: The Cerebellum and Basal Ganglia

Chapter 3: Dr. Everling

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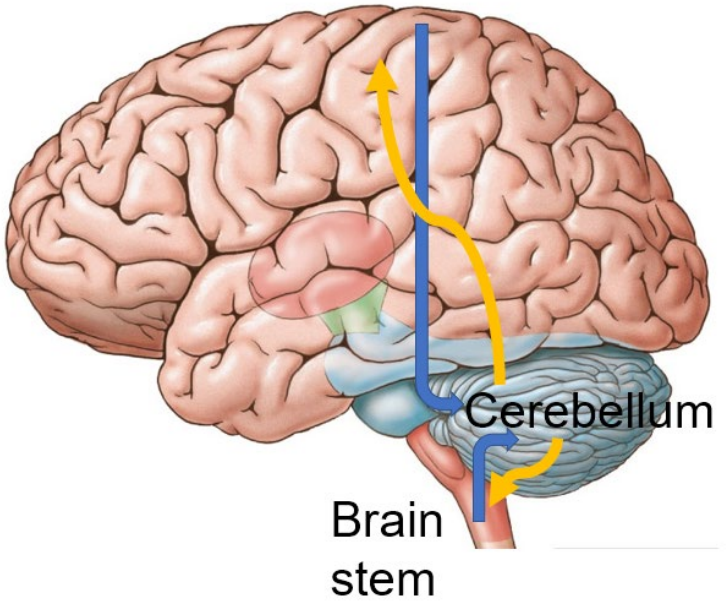
The Cerebellum

- Function: evaluates difference between intended and actual movement action
- Cortex, brain stem and spinal cord send signals TOWARDS
- Cerebellum sends signals BACK, however these can be modified for motor learning

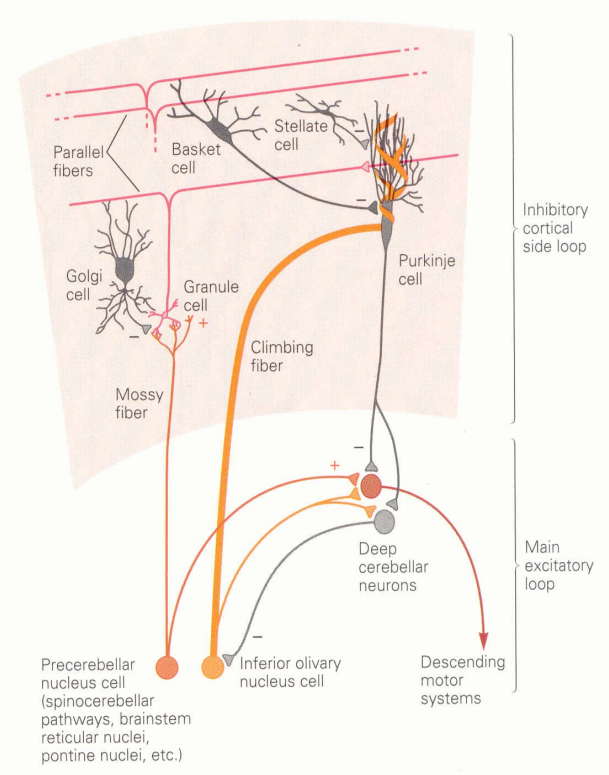


The Cerebellum Circuit

Two inputs:

- Mossy fibers: Synapse on granule cells.
  - Axons of granule cells form parallel fibers which synapse on Purkinje cells
- Climbing fibers: Synapse directly on Purkinje cells.

- Mossy and climbing fibers excite Purkinjie cells, which provide cerebellum output through inhibition

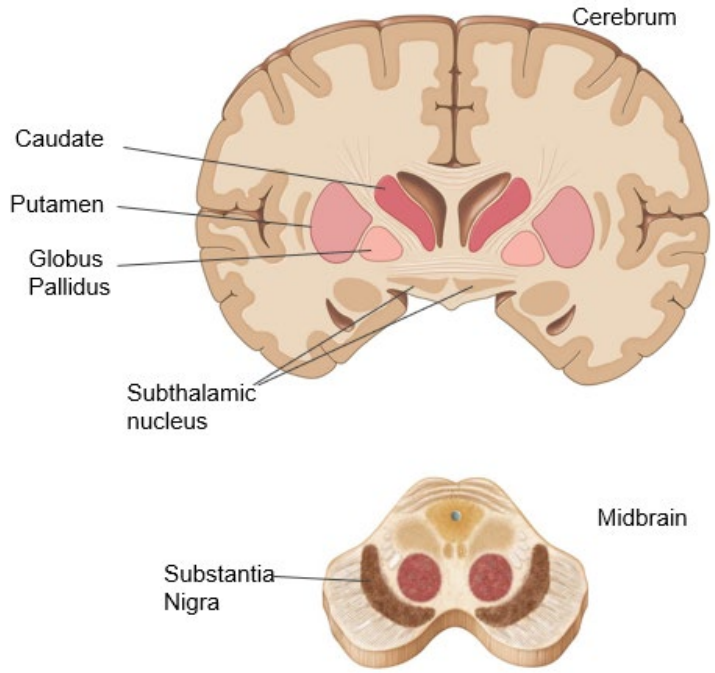


The Basal Ganglia

- Function: regulating and planning movements
- Cortex send signals TOWARDS
- Basal ganglia sends signals BACK through the thalamus

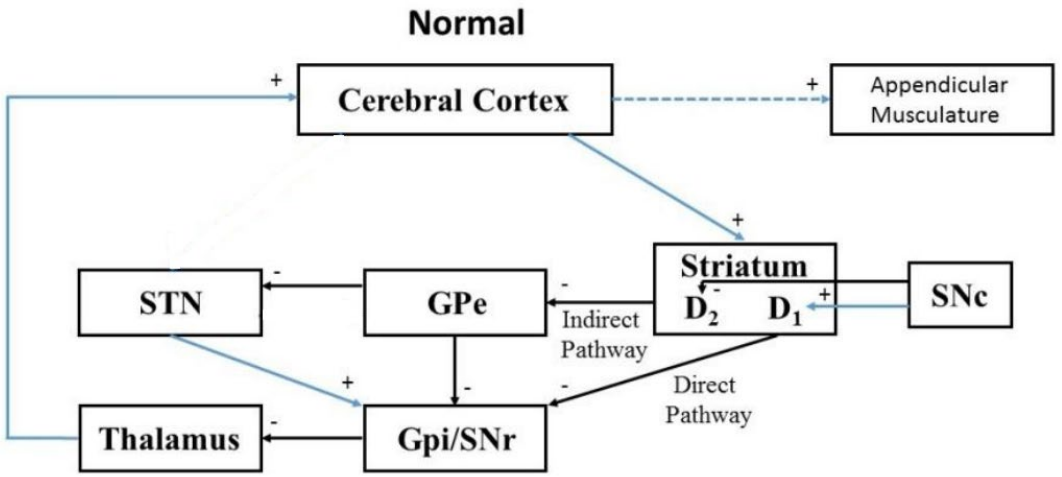
Two main functions

1. Production of movement – direct pathway
2. Inhibition of movement – indirect pathway



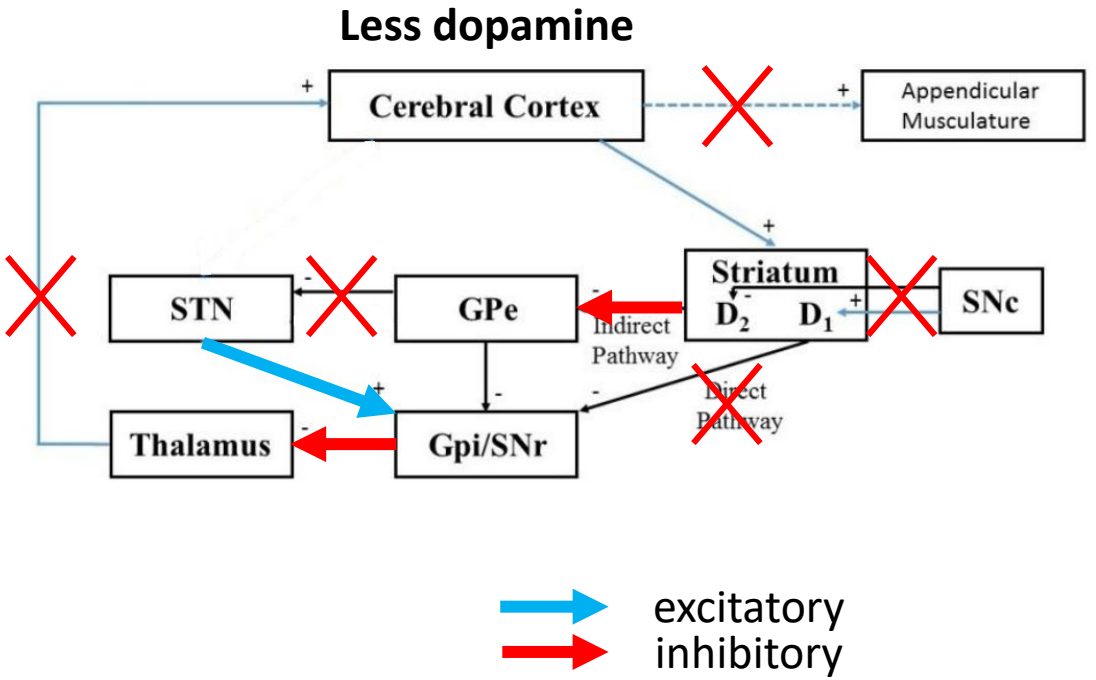
Basal Ganglia Circuit

- Cerebral cortex sends excitatory signals to striatum (caudate + putamen)
- Direct pathway (movement):
  - striatum inhibitory projections to globus pallidus internal
  - globus pallidus inhibitory projections to thalamus
- Indirect pathway (Inhibit movement):
  - striatum inhibitory projections to globus pallidus external
  - globus pallidus external inhibitory projections to subthalamic nucleus
  - subthalmic nucleus excitatory projections to globus pallidus internal
- globus pallidus internal inhibitory projections to thalamus
- thalamus excitatory projections to cortex



Less Dopamine

- Less dopamine from substantia nigra pars compacta
- Direct pathway DE-ACTIVATED:
  - striatum will not inhibit the globus pallidus internal
- Indirect pathway ACTIVATED:
  - striatum will inhibit globus pallidus external
  - globus pallidus external will no longer inhibit the subthalamic nucleus
  - subthalmic nucleus will cause excitation of globus pallidus internal
- globus pallidus internal inhibits the thalamus
- thalamus will no longer excite the cortex
- Movement inhibited



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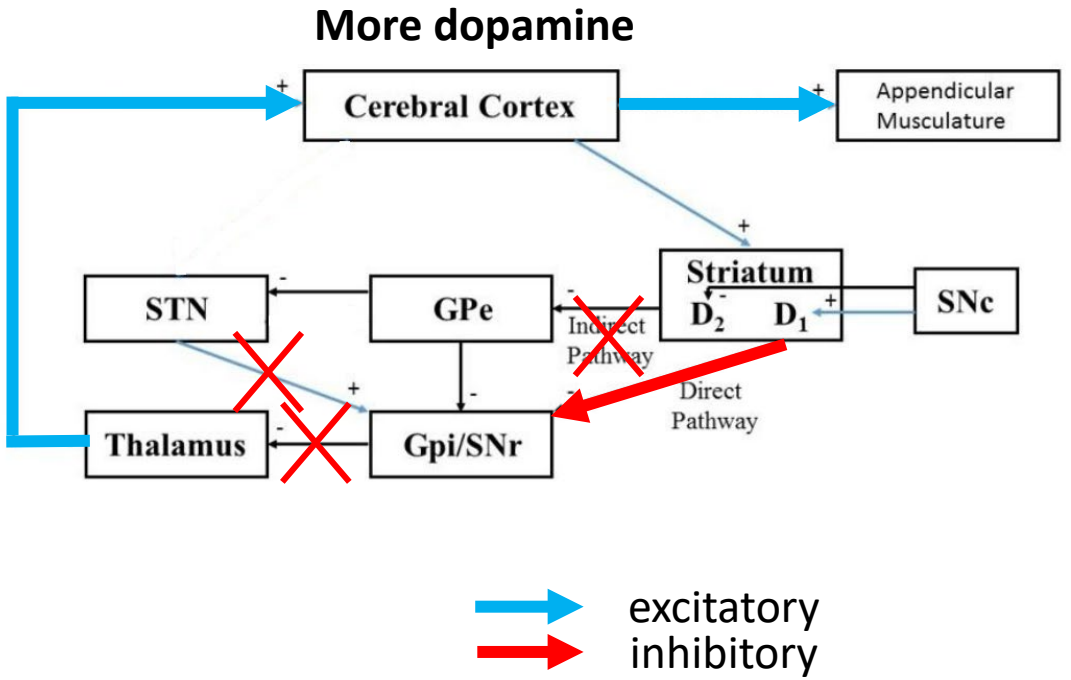
- globus pallidus internal no longer inhibits the thalamus
- thalamus will excite the cortex
- Movement initiated



Parkinson Disease

- Loss of neurons in substantia nigra pars compacta
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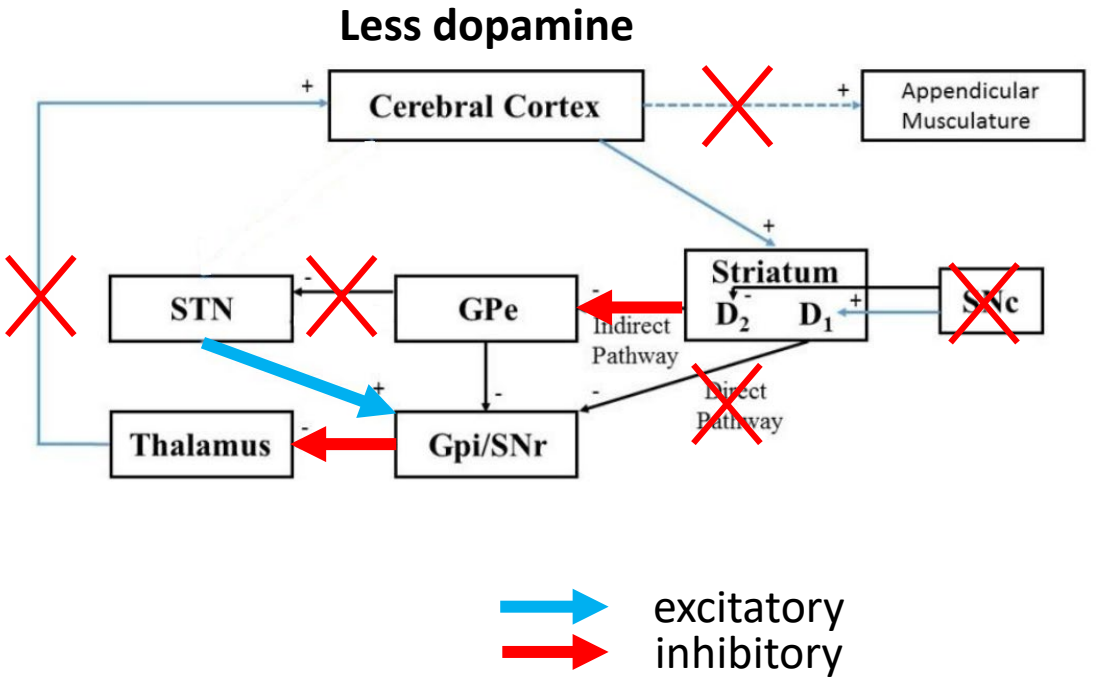
- Movement inhibited



Endocrine: Anterior pituitary and thyroid

Chapter 3: Dr. Beye

Western

Where are the neurohormones released by the posterior pituitary produced?

A) by neuroglia located at the end of the posterior pituitary
B) in the neuronal cell bodies found in the hypothalamus
C) by the endocrine cells located within the posterior pituitary
D) in the axon terminal of the neurons that project from the hypothalamus through to the infundibulum

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What is true of oxytocin?

A) It is made by the posterior pituitary
B) It acts on an intracellular receptor
C) It dissolves in the blood
D) It mediates a slow response

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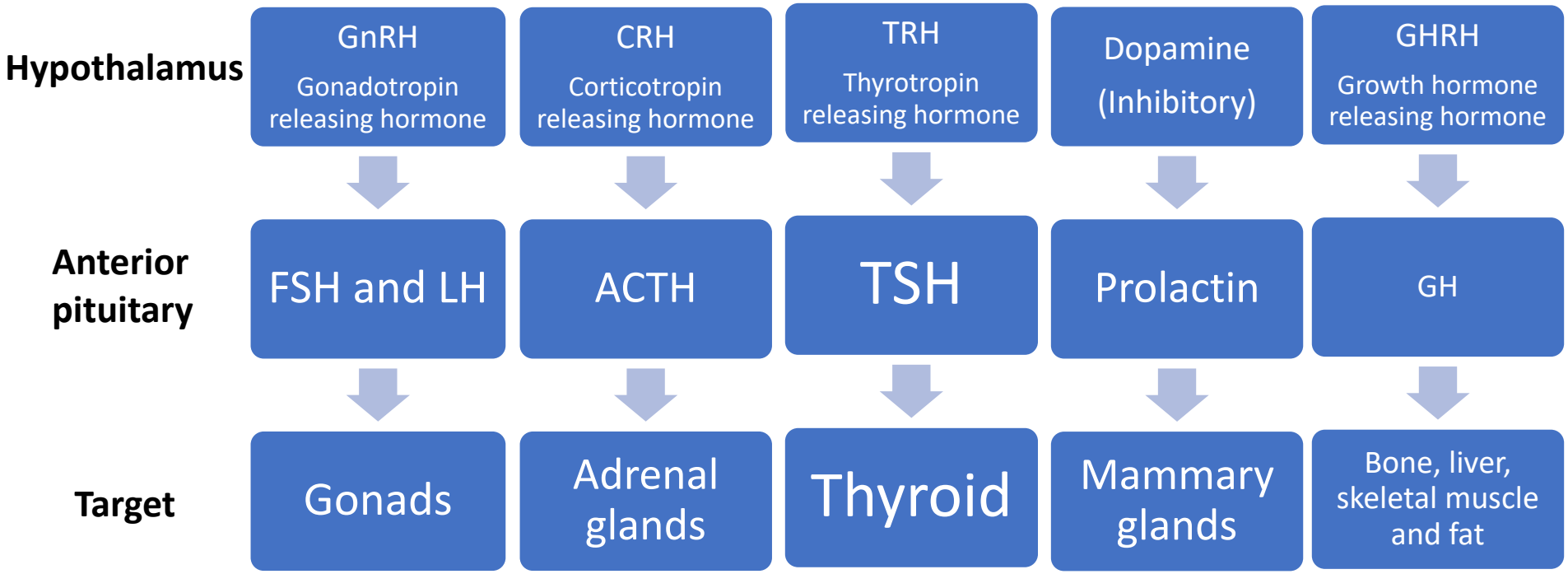
Hypothalamus-Anterior Pituitary



1. Hypothalamus makes and releases hormone into portal system
2. Hormone travels through hypothalamic hypophyseal portal system to ant pit
3. Hormone acts on ant pit to make and release a hormone into general circulation
4. Hormone travels through general circulation to target tissue

If the hypothalamic-hypophyseal portal system was destroyed…

A) Prolactin would not be circulating
B) GnRH would not be circulating
C) Thyroid hormone would be circulating
D) No hormones would be circulating

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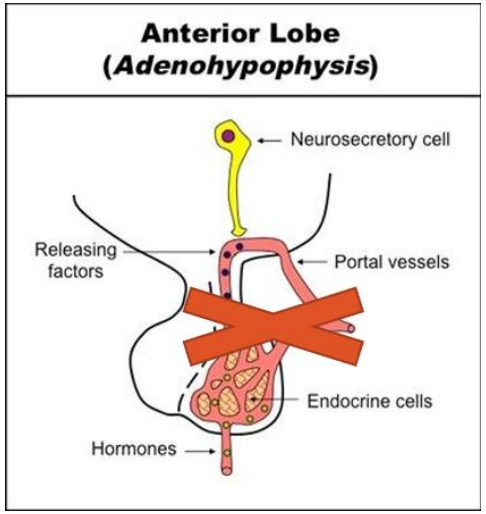


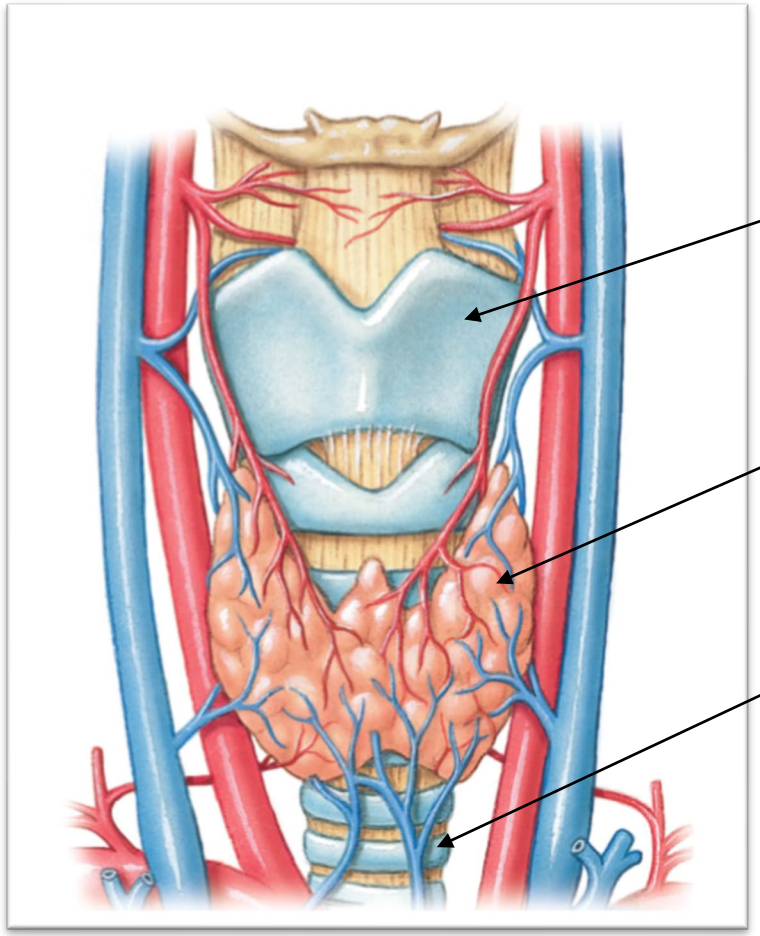
GnRH

Gonadotropin releasing hormone

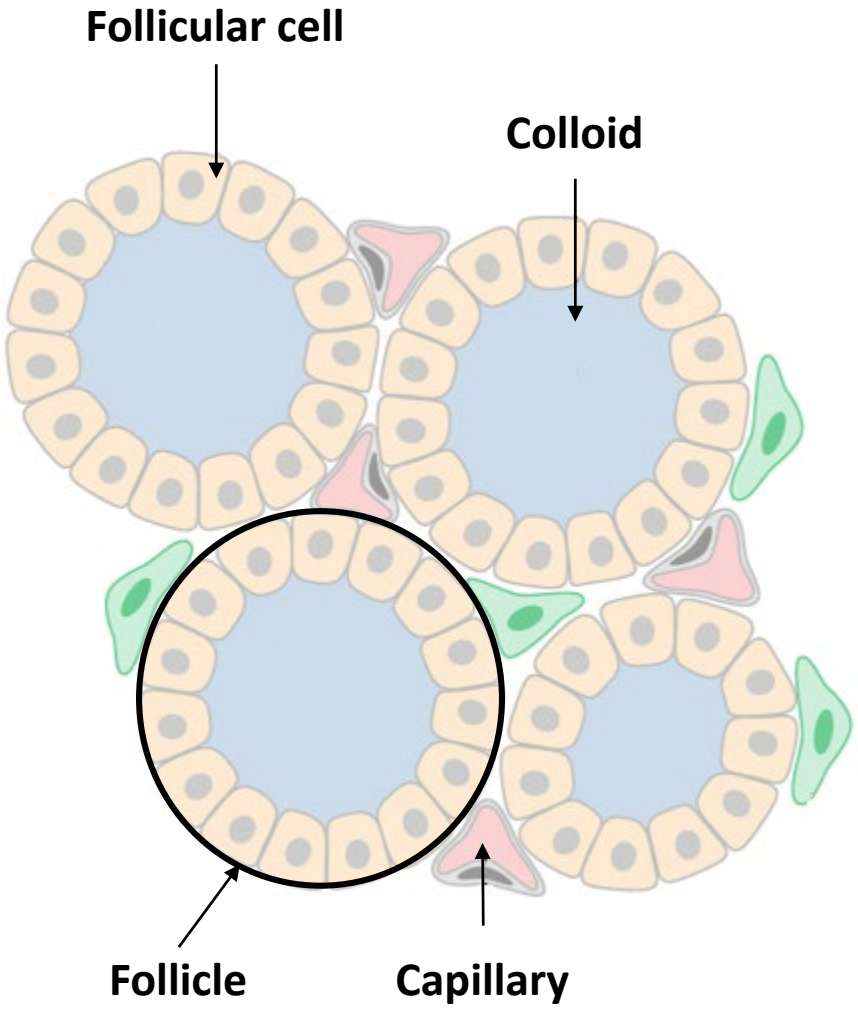
FSH and LH

Gonads

Thyroid Gland



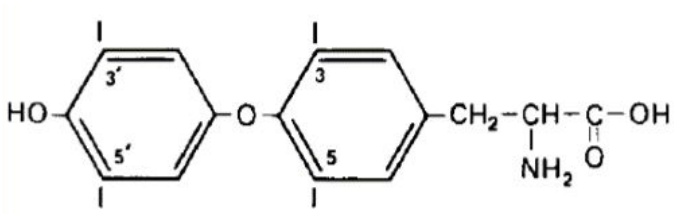
Thyroid Gland



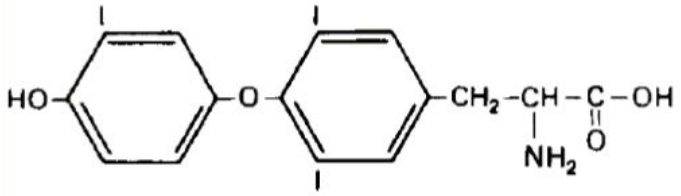
1. Capillary: TH transport
2. Follicle: functional unit where TH is made
3. Colloid: TH is made and stored here
4. Follicular cells: acquire and produce TH building blocks

Thyroid Hormone Overview

- TH is an amine hormone with properties similar to steroid hormone
- Function: increase basal metabolic rate; acts on nearly every cell of body
- 2 key components: tyrosine and iodide



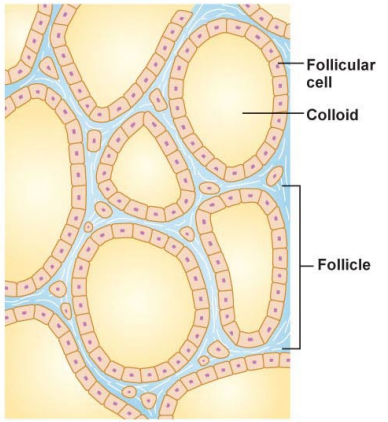
3,5,3′,5′-Tetraiodothyronine (thyroxine, T_4)

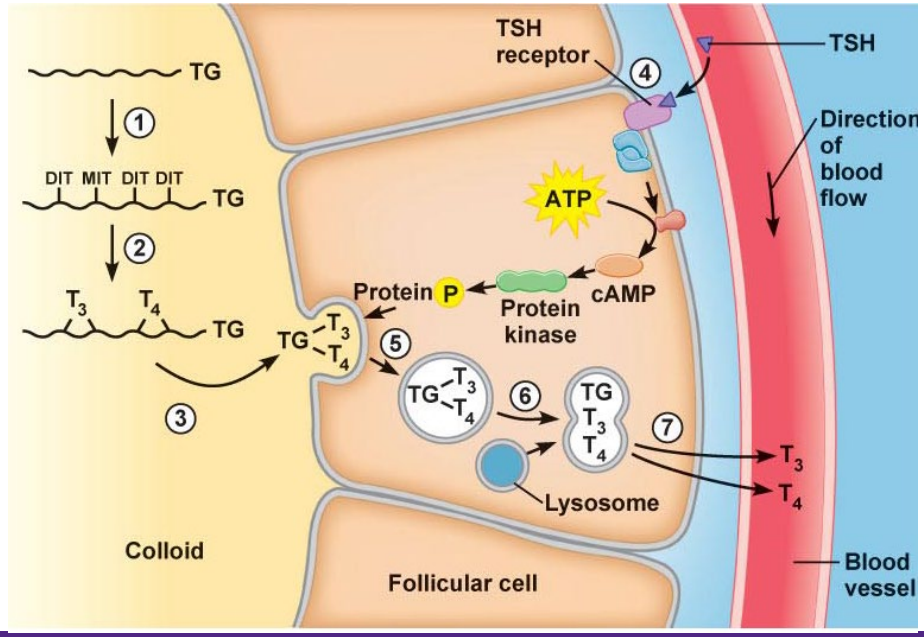


3,5,3′-Triiodothyronine (T_3)

Thyroid Hormone Synthesis

1. Tyrosine residues of thyroglobulin iodinated
2. Two iodinated residues join by covalent bond
3. Thyroid hormones stored in colloid
4. TSH binds receptor and activates thyroid hormone synthesis
5. Follicular cells take in thyroglobulin by endocytosis
6. Endosome fuses with lysosome
7. Lysosomal enzymes cause release of T3 and T4
8. T3 and T4 diffuse into bloodstream





Which of these hormones have the same target tissues or cells?

A) TRH and T4
B) ADH and CRH
C) Prolactin and Vasopressin
D) TSH and GHRH

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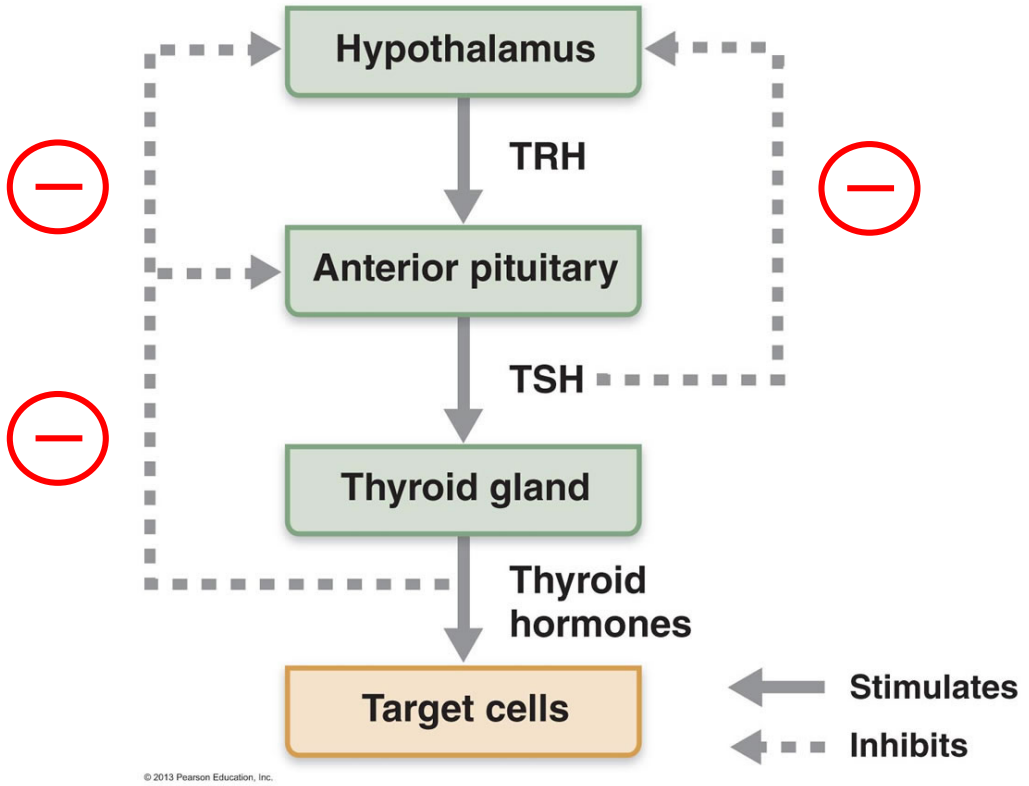
Thyroid Hormone Modulation



Thyroid Gland and Adrenal Gland

Chapter 3: Dr. Beye

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Thyroid Gland Disorders

	Hyperthyroidism	Hypothyroidism
Symptoms	Weight loss Increase HR Sensitive to heat Fidgety, hyperactive, irritable	Weight gain Decrease HR Sensitive to cold Fatigue, depression
Causes	⬆ TRH or ⬆ TSH (leads to Goiter) Grave's disease: Ab to TSH receptor	⬇ TRH ⬇ TSH Poor diet/iodide deficiency (leads to Goiter) Can also result in atrophy: Autoimmune destruction of thyroid gland

Adrenal Gland: Layers
(Not on midterm)

	Layers	Categories of Hormones	Example	Stimulus	Effect
Cortex	Zona glomerulosa	Mineralocorticoids	Aldosterone	RAAS pathway (@ low BP)	Increase Na^+ reabsoprtion
Cortex	Zona fasciculata	Glucocorticoids	Cortisol	ACTH	-
Cortex	Zona reticularis	Androgens	DHEA	-	-
Medulla	Medulla	Catecholamines	Epinephrine	Sympathetic Nervous System	SNS response

Three classes of steroids: Mineralocorticoids, Glucocorticoids and Androgens

Next Tutorial (Oct 29th)

- Endocrinology

What Questions Do You Have?

You can ask in the **Owl forums** as well!

Also anonymously ask questions in the **online dropbox**!!

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