Endocrine

434 Physiology team
presents to you:

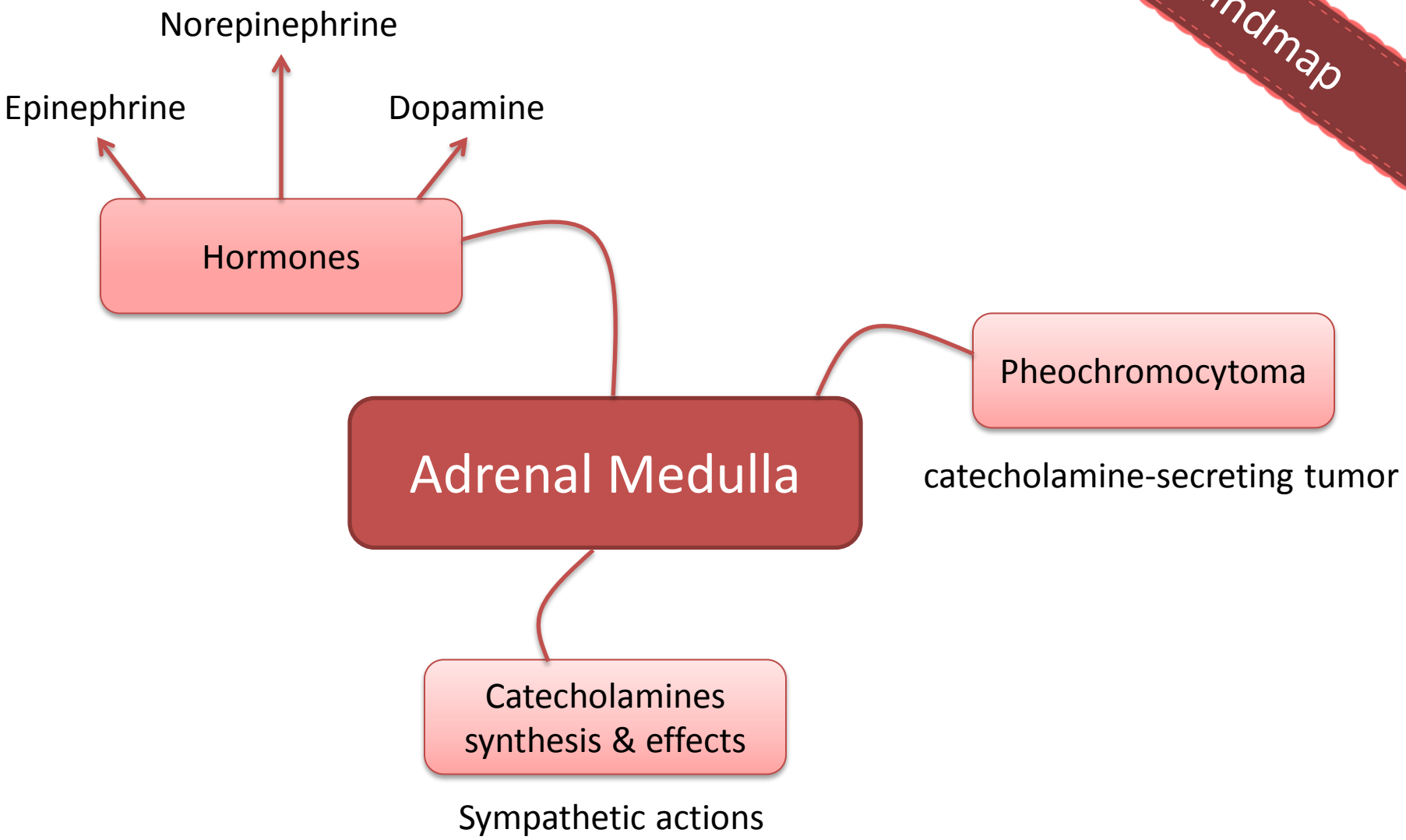
Adrenal Medulla

- Important
- Further explanation

Contents

Please check out this link before viewing the file to know if there are any additions/changes or corrections. The same link will be used for all of our work [Physiology Edit]

Mindmap


Norepinephrine
Epinephrine
Dopamine
Hormones
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Pheochromocytoma
catecholamine-secreting tumor
Catecholamines
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Sympathetic actions

Adrenal Medulla Hormones

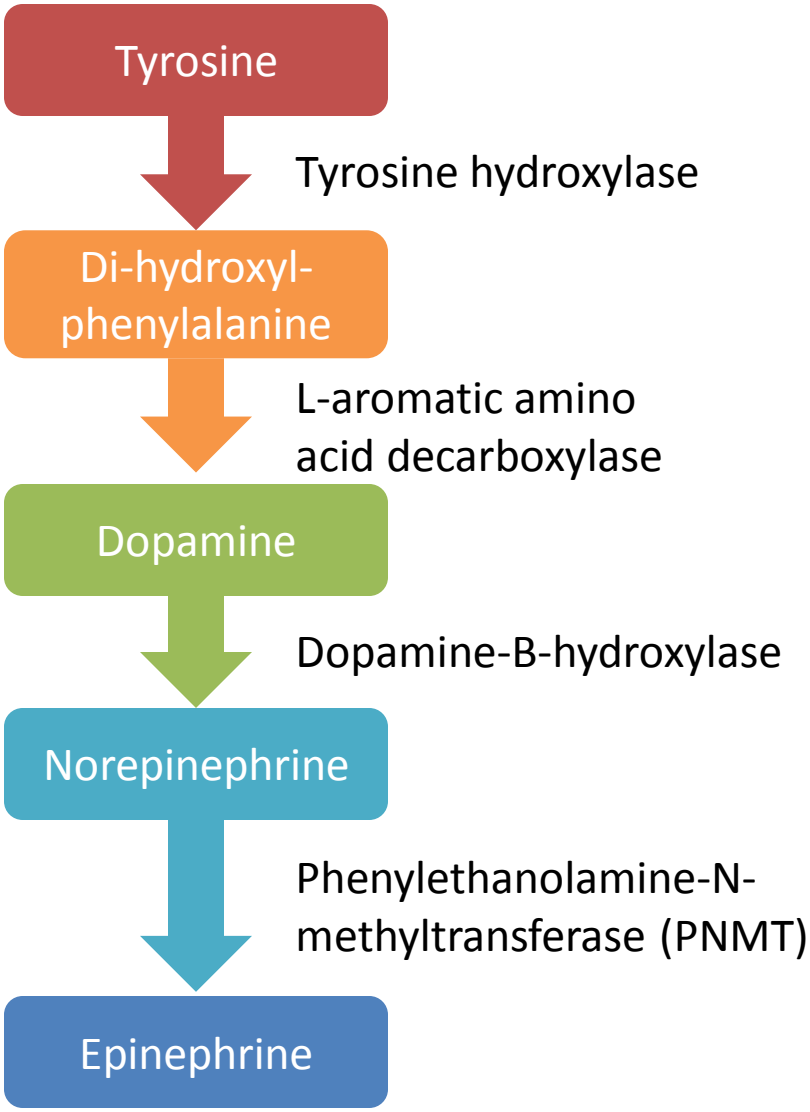
- ✓ The adrenal medulla constitutes the **inner part** of the suprarenal gland , and comprises 20% of the gland.
- ✓ The adrenal medulla is actually a modified sympathetic ganglion, since its origin is the **embryonic neural crest** (i.e. its cells are actually neurons)
- ✓ It is made of Chromaffin cells that secrete catecholamines

Epinephrine	Norepinephrine	Dopamine
(Adrenaline) around 80% of released catecholamines	(Noradrenaline) around 20% of released catecholamines	Small amount

Released in response to stimulation by preganglionic sympathetic nerves

Catecholamines Synthesis

- ✓ PNMT is present in the adrenal medulla, but NOT present in postganglionic sympathetic nerves. Therefore, **ALL** blood adrenaline comes **ONLY** from adrenal medulla
- ✓ BUT blood noradrenaline comes from **both** adrenal medulla AND postganglionic sympathetic fibers .



Mechanism of action

Receptor	α	β
Norepinephrine	+++++	++
Epinephrine	++++	++++

- Receptor mediated – adrenergic receptors.
- Peripheral effects are dependent upon the type and ratio of receptors in target tissues.
- NE → mainly on α receptors
- Epinephrine → on both α and β

Catecholamines Effects

- ✓ **Epinephrine** is more potent than norepinephrine in terms of **cardiac stimulation** leading to greater cardiac output (β stimulation) and in terms of **increasing metabolism**
- ✓ **Norepinephrine** is more potent than epinephrine in terms of **constriction of blood vessels** – leading to increased peripheral resistance – increased arterial pressure.

Cardiovascular

↑ Heart rate

↑ cardiac contractility

↑ BP

Metabolism

- Glycogenolysis in liver and skeletal muscle
- Mobilization of free fatty acids
- Increase metabolic rate.
- Increases O2 consumption.

Respiration

↑ Oxygen consumption & respiratory rate

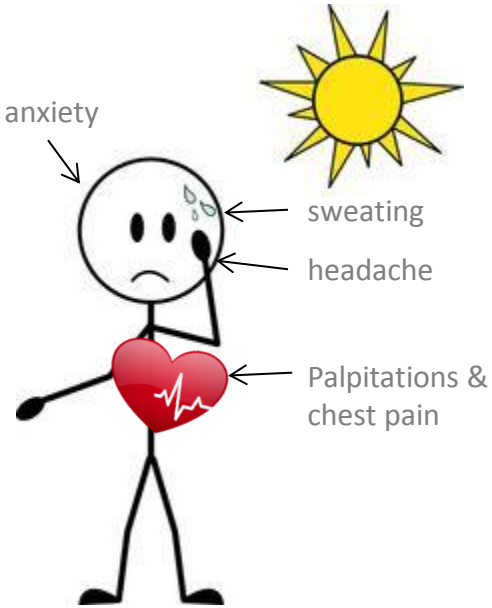
And all other fight or flight actions..

Pheochromocytoma

- ✓ A catecholamine-secreting tumor of chromaffin cells of the adrenal medulla.
- ✓ It can be life threatening if not recognized & not treated.
- ✓ It can develop at any age, but most often occurs in middle age.
- ✓ It has two types:
  - adrenal pheochromocytoma (90%).
  - Extra-adrenal pheochromocytoma.

Signs and Symptoms

1. resistant hypertension (95%)
2. Sudden bouts of headache (most common symptom)
3. sweating
4. palpitations
5. chest pain
6. anxiety
7. glucose intolerance
8. increased metabolic rate



Diagnosis and treatment

- High plasma catecholamine.
- ↑ metabolites [VMA]* in urine
- Treatment is surgical resection

1, 2, & 3 are the classical triad

*Norepinephrine (Noradrenaline) is metabolized into normetanephrine and Vanillyl mandelic acid (VMA)

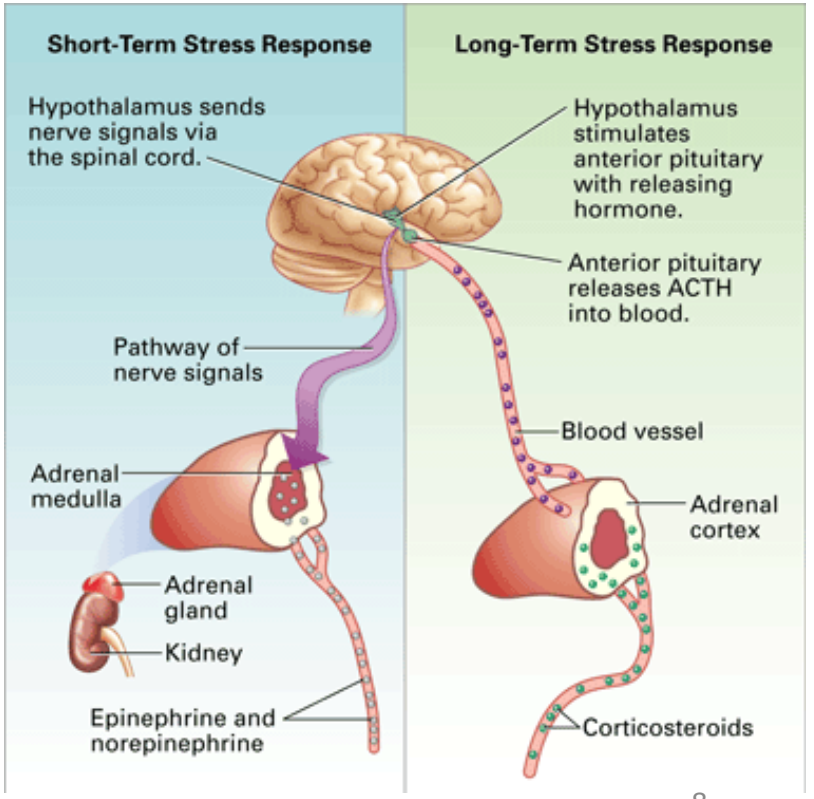
Remember..

Summary

Epinephrine & NE effects

Eye	pupil dilation
Skin	Increase sweating
GIT & Bladder	• Sphincter contraction & wall relaxation • Decrease GI secretion & motility
Kidney	Renin secretion
Heart	increased heart rate & force of contraction → increased cardiac output & BP
Total peripheral Resistance	Arteriolar constriction (→ raised BP. norepinephrene is causing more effect)
Bronchioles	Bronchiolar dilation
Liver	glycogenolysis, gluconeogenesis
Skeletal muscle	Glycogenolysis (increased blood glucose)
Metabolic rate	increased

Adrenal Gland



Answer key: 1:C 2:B 3:A 4:D 5:B 6:D 7:A

MCQs

1-What stimulates the release of catecholamines?
A. Preganglionic parasympathetic nerves
B. Postganglionic parasympathetic nerves
C. Preganglionic sympathetic nerves
D. Postganglionic sympathetic nerves

2-What is the most released catecholamine?
A. Acetylcholine
B. Epinephrine
C. Norepinephrine
D. Dopamine

3-Norepinephrine acts mainly on:
A. α receptors
B. both α and β
C. β receptors
D. D_1 receptors

4-Which enzyme converts Di-hydroxyl-phenylalanine to dopamine?
A. Tyrosine hydroxylase
B. Phenylethanolamine-N-methyltransferase
C. Dopamine-B-hydroxylase
D. L-aromatic amino acid decarboxylase

5-Norepinephrine is more potent than epinephrine in terms of:
A. Cardiac stimulation
B. Constriction of blood vessels
C. Increasing metabolism
D. None of the above

6-Which of the following is not an effect of catecholamines?
A. Increasing heart rate
B. Increasing oxygen consumption
C. Pupil dilation
D. Increasing GI secretion & motility

7-Which of the following is not a sign of pheochromocytoma?
A. Resistant hypotension
B. Glucose intolerance
C. Sweating
D. Anxiety

SAQs

Q1: What is the cascade of catecholamines synthesis?

Tyrosine → Di-hydroxyl-phenylalanine → Dopamine → Norepinephrine → Epinephrine

Q2: Where does blood noradrenaline come from?

Both adrenal medulla AND postganglionic sympathetic fibers

Q3: What is a diagnostic test for pheochromocytoma?

High urine Vanillyl mandelic acid

Q4: What are the classical three symptoms for pheochromocytoma?

Resistant hypertension, Headache, and sweating

Q5: Rollie Hendrix, a 35-year-old husband and father of three children, has been experiencing headaches and palpitations of increasing frequency and severity over the past six months. In addition, he has had periods of intense anxiety and panic attacks. What's the most likely diagnosis?

Pheochromocytoma

Thanks for checking our work

Good Luck

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Can you spot the hidden panda amongst these snowmen?