

Zona granulosa and Fasciculata

Dr. arwa rawashdeh

Adrenal gland

- Top of the kidney (suprarenal gland)

- Pyramid gland

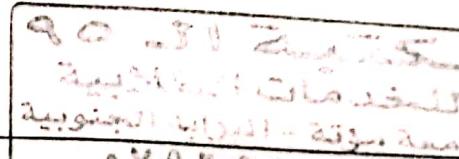
*consist
of 2 parts
① cortex ^{have} _{Layers:} every layer secret a specific hormone.

1- granulosa

2- fasciculata (biggest Layer)

3- Reticularis

- ② Adrenal medulla (neural tissue) \Rightarrow At the center of the Gland.



Mechanism of secretion of Zona granulosa

* factors that stimulate the secretion of adrenal hormones :-

- Low blood pressure ①

(Aldosterone)
secretion

+ due to Low BP, Kidney secret Renin.

In the kidney, Renin (Juxtaglomerular cells)

Liver plasma protein enzyme (angiotensinogen)

Renin (enzyme) convert angiotensinogen,
angiotensin one into

Lung angiotensin converted enzyme (A.C.E),
angiotensin one into two

* converts angiotensin 1
into angiotensin 2.

* Angiotensin 2 is the strong stimulus.

- Angiotensin two, G receptor coupled protein, G stimulatory protein, convert GDP into GTP, adenylate cyclase, ATP into cAMP, Protein kinase P.K.A (the strongest stimulus)
 - bind to
 - when angiotensin bind to receptor
 - it's responsible of phosphorylation of enzymes participate in synthesis of aldosterone.

- (CRH)
- Paraventricular nucleus corticotropin releasing hormone, anterior pituitary (adrenocorticotrophic hormone) (weakest stimuli in stress conditions), the same pathway of angiotensin two

Steroid hormone synthesis

Cholesterol, pregnenolone, progesterone by 21-hydroxylase, 11-deoxy corticosterone, corticosterone, Aldosterone (the second stimulus)

convert to
convert
then
convert
then

Kinase?

- P.K.A phosphorylating each enzyme in each step
- ③ Low sodium (hyponatremia) or ④ high potassium (hyperkalemia) level in the blood

Inhibitors

- Blood pressure high

Atrial natriuretic peptide (strongest), G inhibitory pathway, K efflux (hyperpolarization), alter the enzymatic activity

stimulate
(outside the cell)

Effect of aldosterone

→ It's secreted
from Granulosa

Bind to Trans cortin (corticosteroid binding
globulin) or albumin, distal convoluted tubules,
Inside the cell activate gene sequence,
transcription mRNA, translation proteins
that act as
apum ps

Overall effect

Plug three different types of protein into the cell membrane → (pump)

- ① Sodium potassium pump establish gradient
- ② More pumps for sodium in the luminal membrane from the filtrates into the blood
- ③ Potassium from the blood secreted through distal convoluted tubules excreted

effect

Increase blood volume (caused by increased osmolarity → increase water absorption).
Increase blood pressure

then

Mechanism of secretion of cortisol

in hypothalamus

[From Fasiculata]

- Paraventricular nucleus, corticotropin releasing hormone, hypophyseal system, anterior pituitary gland, adrenocorticotropic hormone (strongest stimulator)
- G protein coupled receptors, G stimulatory protein, GTP, Adenylate cyclase, ATP to c. AMP, protein kinase A P.K.A (phosphorylating different kinds of protein)

Steroid hormones

- Cholesterol is the basic unit to make steroid hormones not DNA or mRNA or proteins
- Cholesterol, pregnenolone, progesterone, 17-hydroxy progesterone by 21-Hydroxylase into 11-deoxy cortisol, cortisol

P.K.A phosphorylating different enzymes involved within enzymatic reaction

Effect of cortisol

- 25% of cortisol bind to albumin
- 75% bind to corticosteroid binding globulin (trans Courtin)

Muscle and bone (Protein catabolism) ①

Binds intracellular receptors

Proteases break the peptide bond

Releasing Amino acids into blood

→ Amino acids to liver

* deficiency in protein does not affect the synthesis of hormone but affect their secretion.

لack of protein does not affect the synthesis of hormone but affect their secretion.

Adipocyte ② degradation into

Triglycerides(glycerol to liver, Fatty acid chains utilized by muscles or redistributed in different part of the body) → for energy

→ Liver (hyperglycemia)

① Gluconeogenesis Glycerol, amino acids, lactic acids, fatty acids and converted to glucose

② Glycogenesis (converting glucose into glycogen)

Direct effect

③ Glycogenolysis (breaking glycogen into glucose) by stimulating (adrenergic receptors) in the liver
indirect effect ↓ epinephrin or NE

Tunica media of Smooth muscle (vasoconstriction and increase blood pressure) ③

Sensitivity of adrenergic receptors amplify the effect of norepinephrine

④ Inhibit Immune system → by indirect effect

Basophiles (^{secret} histamine, leukotriene, prostaglandins)

Lymphocytes (^{secret} interleukins, cytokines)

Monocytes (^{secret} interleukins, Cytokines)

* cortisol inhibit the releasing of these chemicals.

* what causes the secretion of cortisol :-

Secretion of cortisol

① Hypoglycemia → ^{the effect of cortisol} :

Glycogenolysis (indirectly) ①

Gluconeogenesis ② (direct)

Glycogenesis (direct) ③

② Long term stress (chronic stress)

(Trauma or starvation or emotional) * ^{the effect of cortisol} :-

Vasoconstriction (increase blood pressure) ③

Protein catabolism ②

Depression of immune system ①

* Regulation of Cortisol *

High cortisol ↘

Negative feedback effect on hypothalamus
(CRH) ↙ inhibit

Negative feedback effect on anterior pituitary gland (ACTH) ↙ inhibit

Low cortisol ↗

High CRH and ACTH