Zona granulosa and Fasciculata
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Adrenal gland

- Top of the kidney (suprarenal gland)
- Pyramid gland
- cortex → have Layers: (every layer secret aspecific hormone.) *consist of ①
  1- granulosa
  2- fasciculata (biggest Layer)
  3- Reticularis
② Adrenal medulla (neural tissue) ⇒ At the center of the Glanel.

Mechanism of secretion of Zona granulosa (Aldosterone)

* Factors that stimulate the secretion of adrenal hormones:-

- **Low blood pressure** (1)

* due to Low BP, Kidney secret Renin.

In the kidney, Renin (Juxtaglomerular cells) (secret) (secreted from:)

Liver plasma protein enzyme (angiotensinogen)

Renin (enzyme) convert angiotensinogen, angiotensin one (into)

then → 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 (bind to), G receptor coupled protein, G stimulatory protein, (convert GDP into GTP,) adenlytae cyclase, ATP into cAmp, Protein kinase P.K.A (the strongest stimulus)

when angiotensin bind to receptor

ATP (convert)

* it's responsible of phosphorylation of enzymes participate in synthesis of aldosterone.

(2) (stress affect) Paraventricular nucleus (secret) corticotropic releasing hormone (affect), anterior pituitary (secret (ACTH)) ((adrenocorticotropic hormone)) (weakest stimuli in stress conditions), the same pathway of angiotensin two

(CRH)

Steroid hormone synthesis

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

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

Effect of aldosterone

→ It's secreted from Granulosa

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

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~~ excreted through distal convoluted tubules

effect

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

then

Increase blood pressure

Mechanism of secretion of cortisol

[from fasiculata]

in hypothalamus

- Paraventricular nucleus, corticotropin releasing hormone (secret), hypophyseal system,
- anterior pituitary gland (secret), adrenocorticotropic hormone (strongest stimulator)

bind

- 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
- 11- deoxy cortisol, cortisol

into

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

synthesis of ↓ Proteases break the peptide bond

Releasing Amino acids into blood

Amino acids to liver

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

لأنه يأثر على نقل الهرمونات خلال الدم.

Adipocyte (2) degradation into

Triglycerides(glycerol (1) to liver, Fatty acid (2) chains utilized by muscles or redistributed in different part of the body) ⟹ for energy

⟹ Liver (causes hyperglycemia)

1. Gluconeogenesis from Glycerol (1), amino acids (2), lactic acids (3), fatty acids (4) 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 ↳ epinephrin or NE

indirect effect

Tunica media of Smooth muscle (vasocontraction and increase blood pressure) (3) → by indirect effect

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 :o

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 :-

Vasocontraction (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