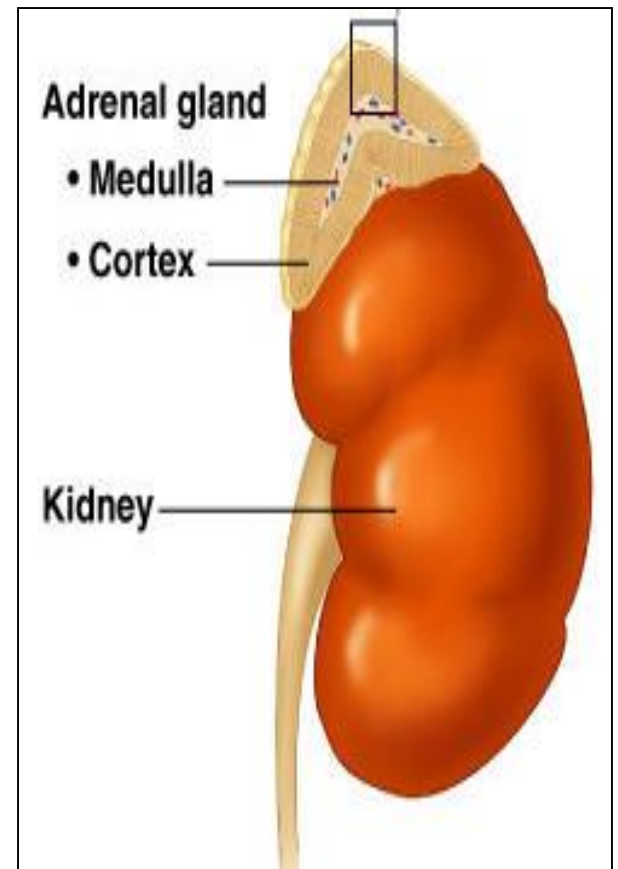


Adrenal Gland

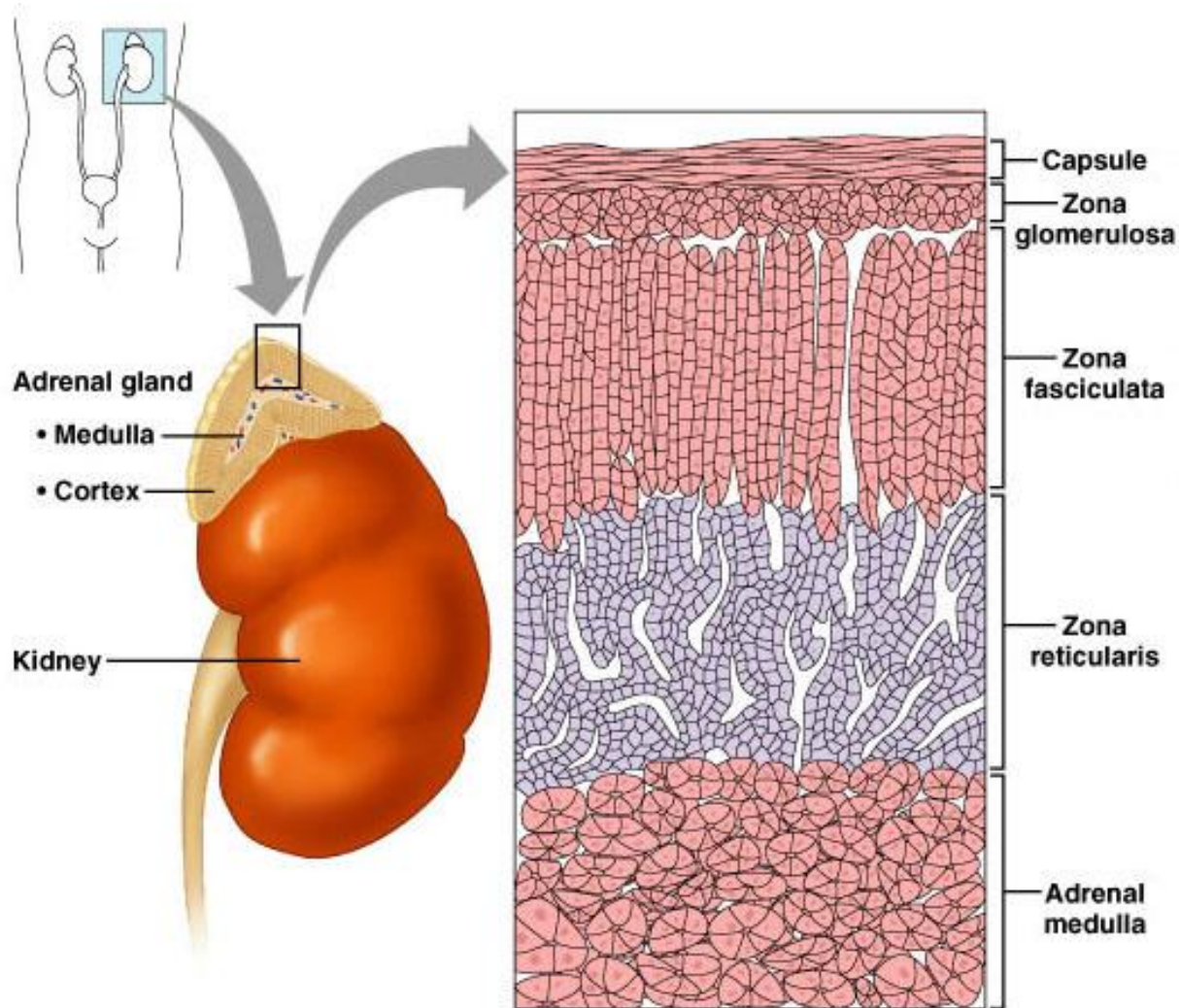
**Dr Awadh Alqahtani MD,MSc,
FRCSC(Surgery)FRCSC(Oncology),FICS
Laparoscopic Bariatric Surgeon and
Surgical Oncologist.**

Adrenal Glands

- Divided into two parts; each with separate functions
- Adrenal Cortex
- Adrenal Medulla

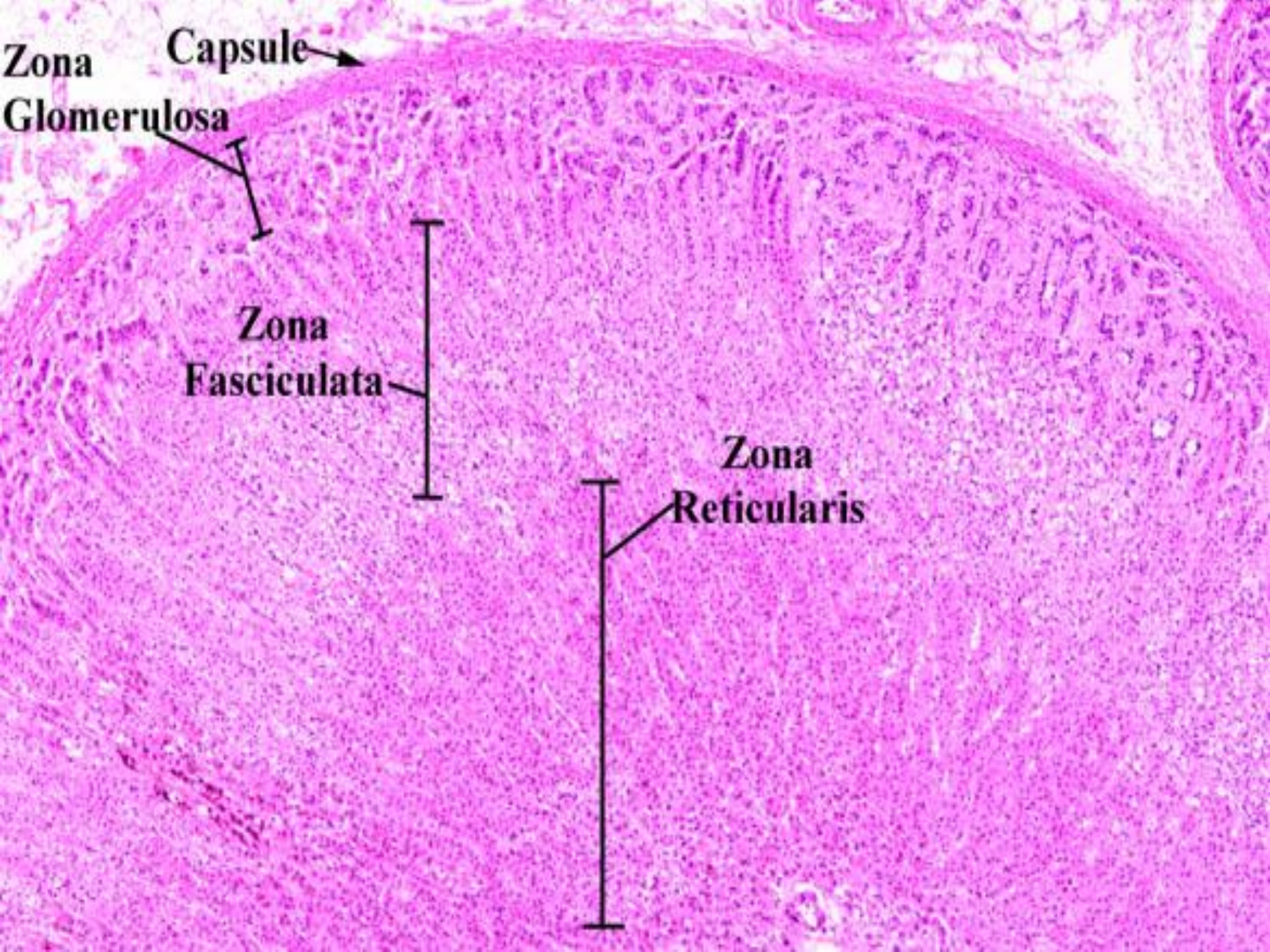


The Adrenal Cortex



(a)

Figure 25.9a



Zona Capsule
Glomerulosa

Zona Fasciculata

Zona Reticularis

C. The Adrenal Glands

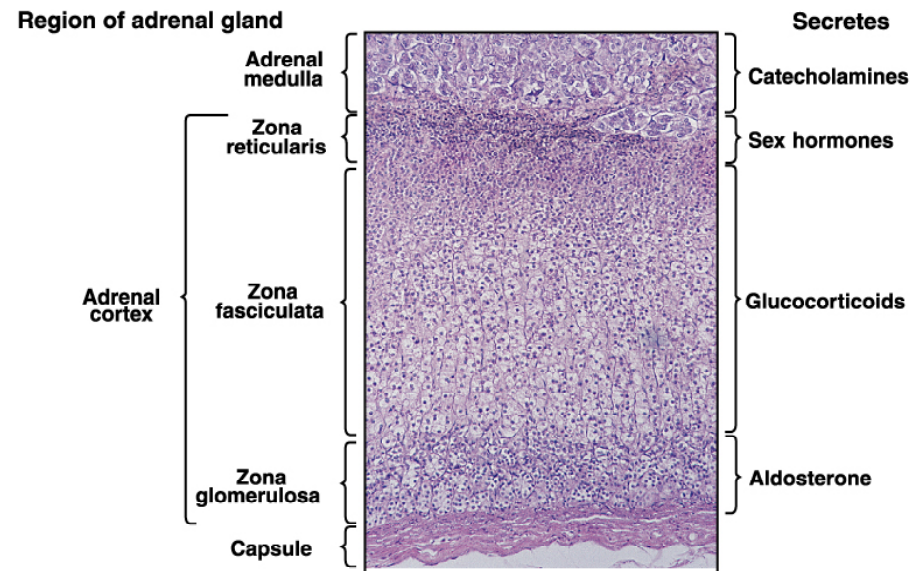
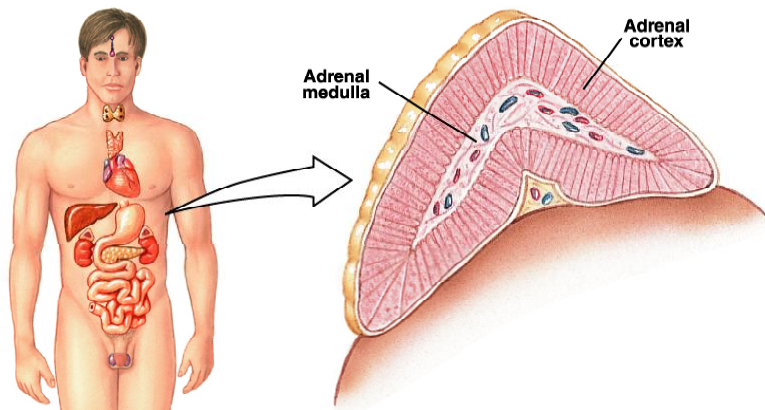
- Adrenal medulla
- Adrenal cortex

Three specific zones and each produces a specific class of steroid hormone

Zona glomerulosa – mineralocorticoids (Aldosterone)

Zona fasciculata – glucocorticoids (Cortisole)

Zona reticularis - androgens



Hormones of the Adrenal Cortex

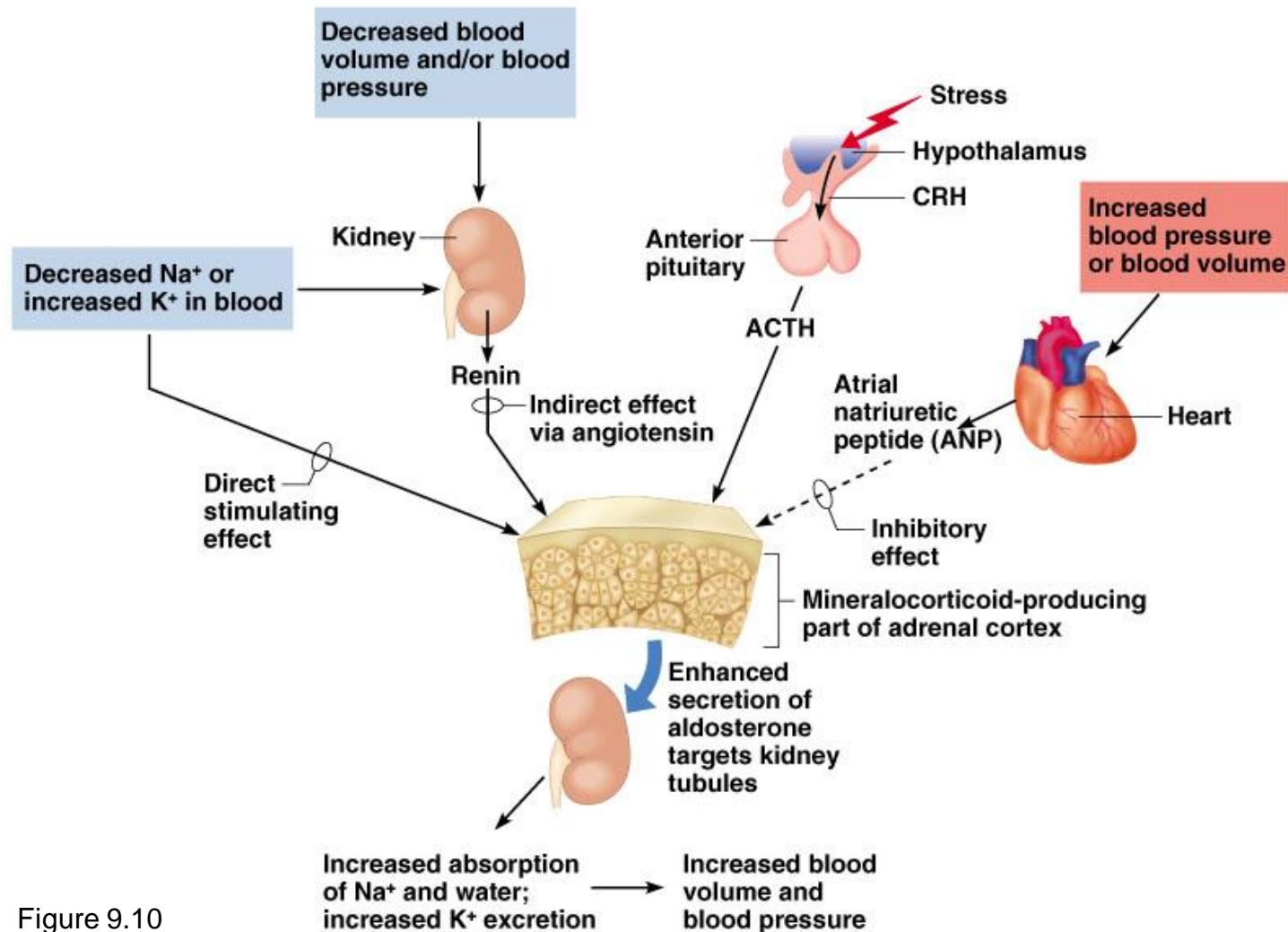
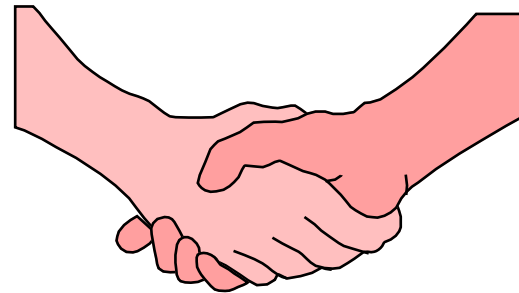
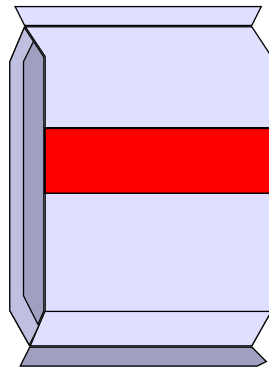
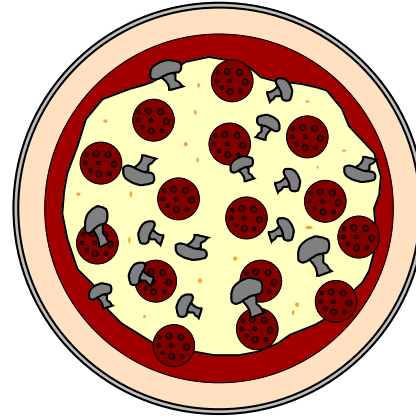


Figure 9.10

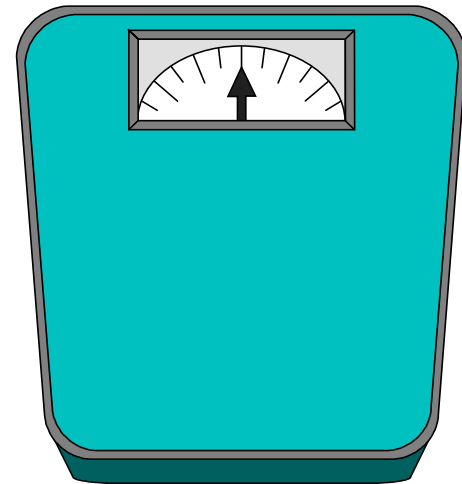
ADRENAL CORTEX

- Salt
- Sugar
- Sex



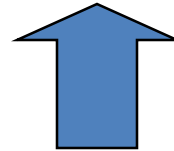
SALT

- Mineralocorticoids (F & E balance)
 - Aldosterone (renin from kidneys controls adrenal cortex production of aldosterone)
 - Na retention
 - Water retention
 - K excretion



Question:

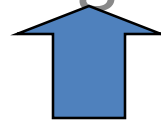
If your Na level is low, will
aldosterone secretion



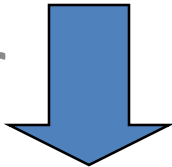
or

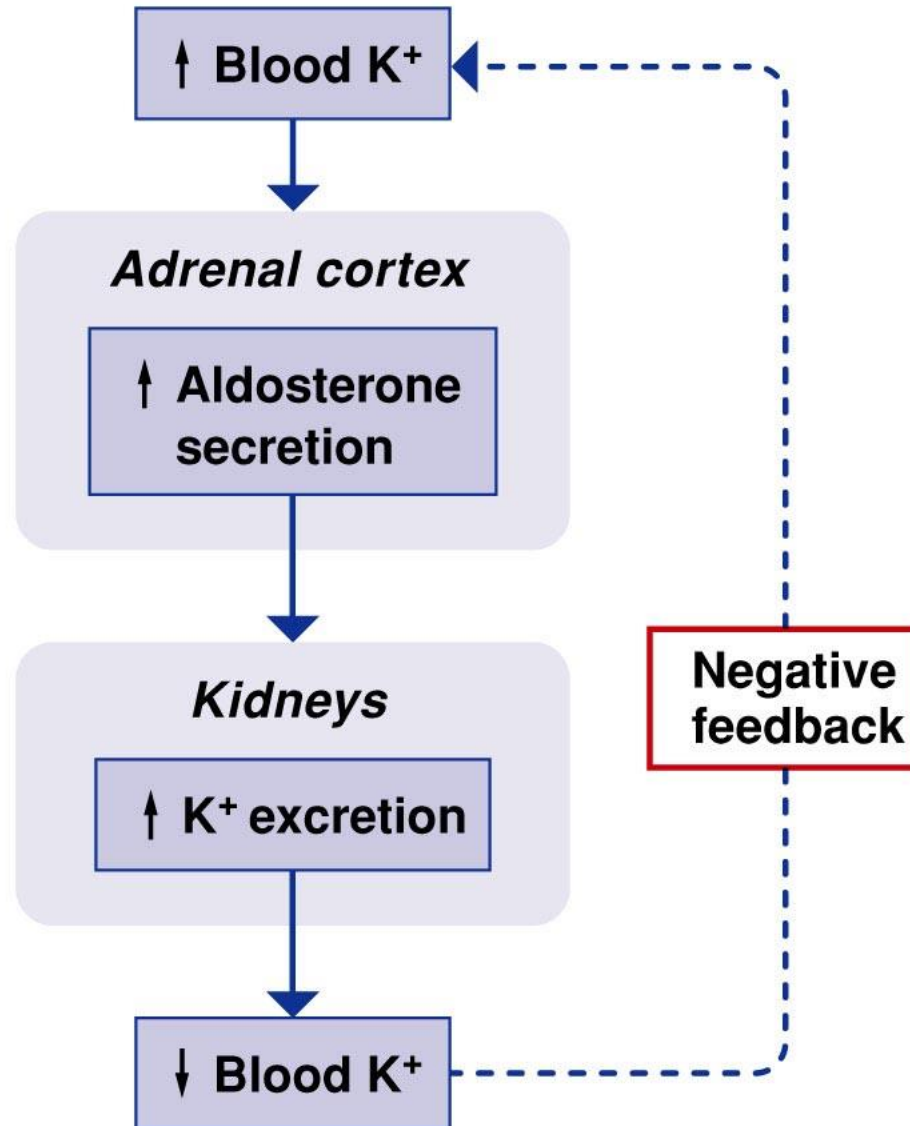


If your serum K⁺ level is high, will
aldosterone secretion



or





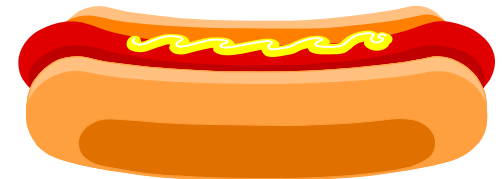
(b) Regulation of aldosterone secretion

SUGAR

- GLUCOCORTICOIDS (regulate metabolism & are critical in stress response)
 - CORTISOL responsible for control and & metabolism of:

a. CHO (carbohydrates)

- ↑ amt. glucose formed
- ↑ amt. glucose released



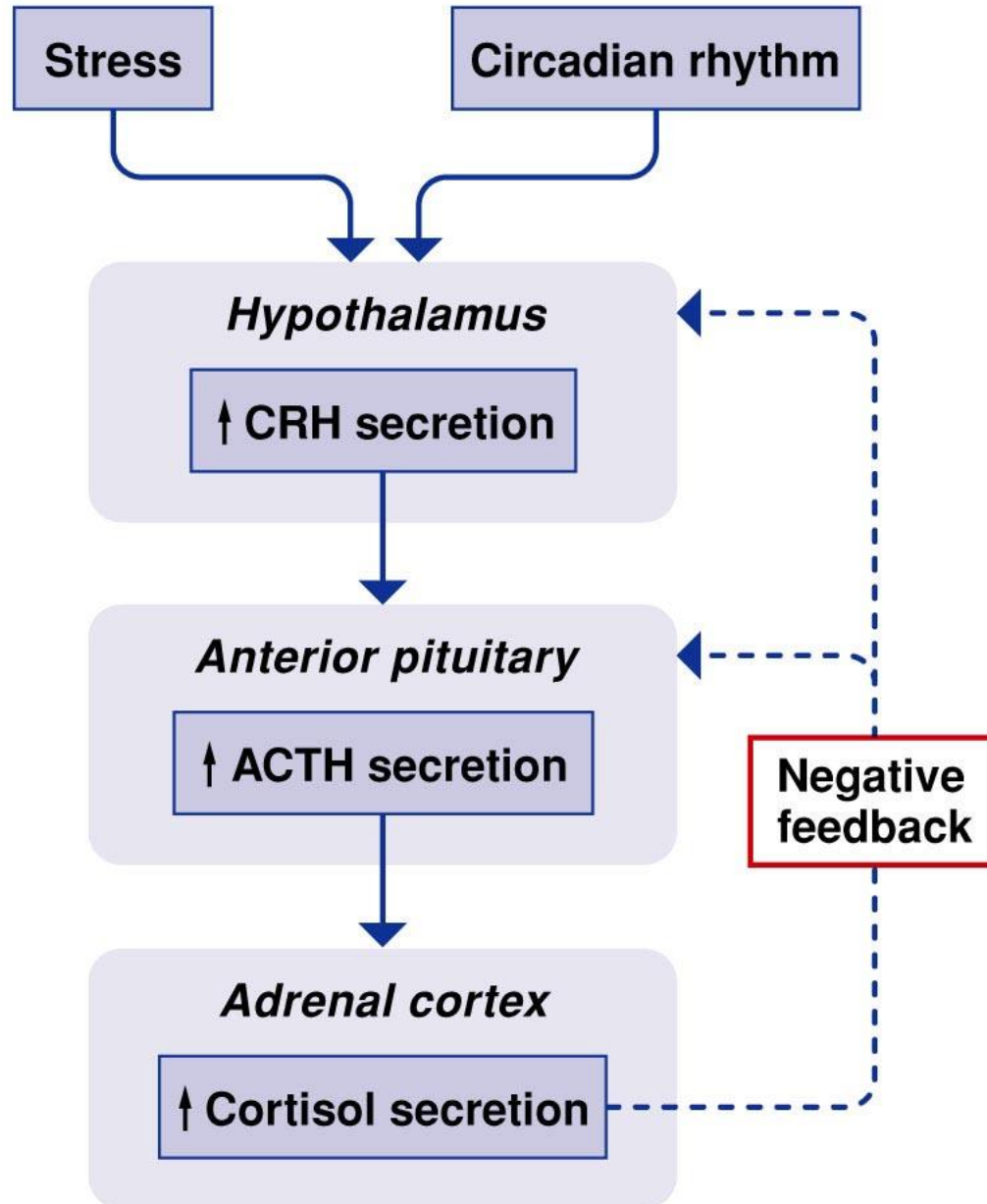
CORTISOL

b. FATS-control of fat metabolism

- **stimulates fatty acid mobilization from adipose tissue**

c. PROTEINS-control of protein metabolism

- **stimulates protein synthesis in liver**
- **protein breakdown in tissues**



SUGAR

- **Other fxs of Cortisol**

- inflammatory and allergic response



- immune system therefore prone to infection



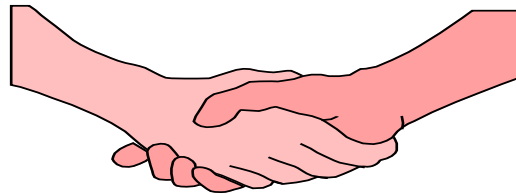
SEX

- **ANDROGENS**

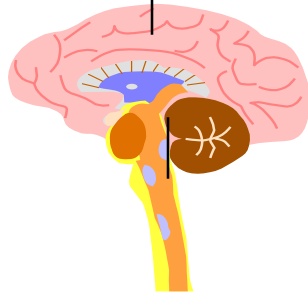
- hormones which  male characteristics

- release of testosterone

- **Seen more in women than men**

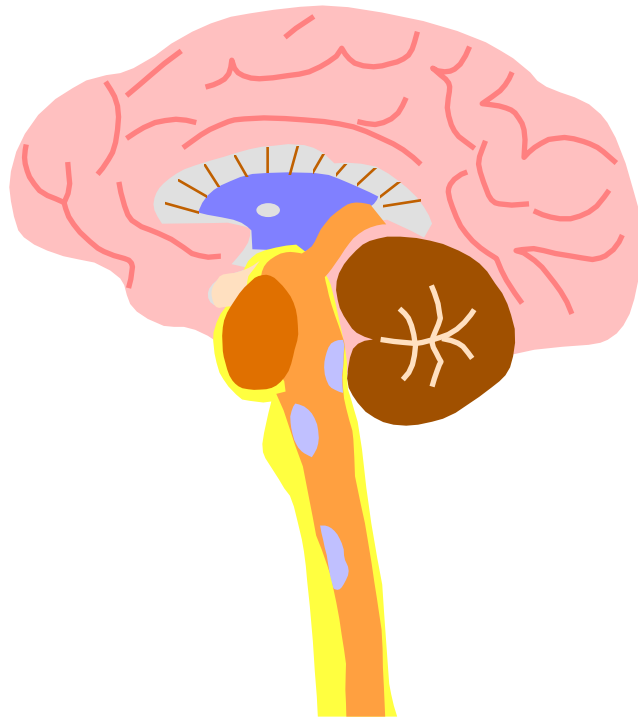


**RELEASE OF
GLUCOCORTICOIDS IS
CONTROLLED BY _____**



LET' S LOOK AT ACTH (adrenocorticotrophic Hormone)

- **Produced in anterior pituitary gland**



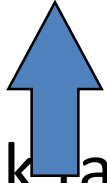
ACTH

- **Circulating levels of cortisol**

- **high levels cause stimulation of ACTH**



- **low levels cause dec. release of ACTH**



think tank: What type of feedback mechanism is this??

AFFECTED BY:

- **Individual biorhythms**
 - ACTH LEVELS ARE HIGHEST 2 HOURS BEFORE AND JUST AFTER AWAKENING.
 - usually 5AM - 7AM
 - these gradually decrease rest of day
- **Stress-** cortisol production and secretion



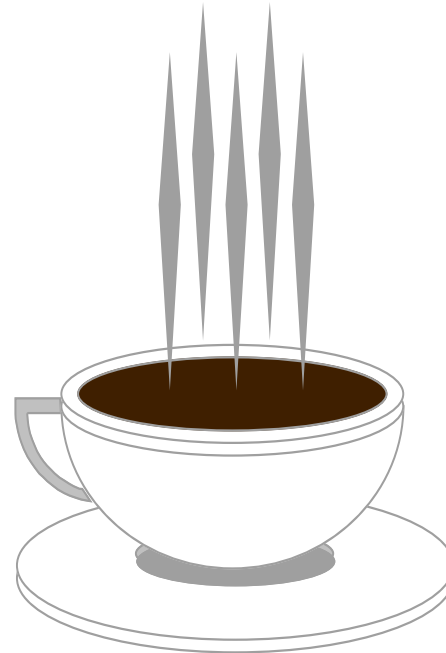
ADRENAL MEDULLA

- Fight or flight
- What is released by the adrenal medulla?



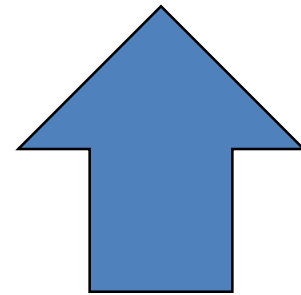
CATECHOLAMINE RELEASE

- Epinephrine
- Norepinephrine

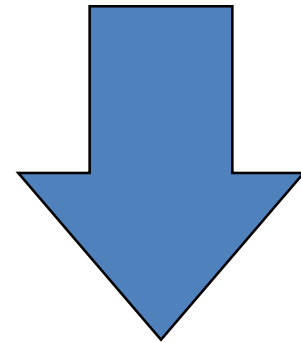


HYPER AND HYPOFUNCTION ADRENAL CORTEX HORMONES


- **Too much**

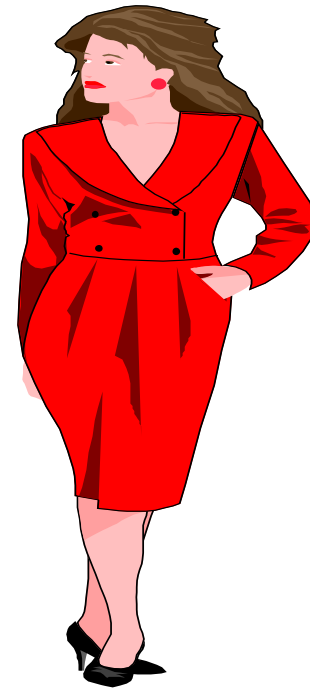


- **Too little**



I. CUSHING'S DISEASE (TOO MUCH CORTISOL!)

-  secretion of cortisol from adrenal cortex
- 4X more frequent in females
- Usually occurs at 35-50 years of age




ETIOLOGY

Cushing' s

- **Primary-tumor on the adrenal cortex**
- **Secondary-tumor on the anterior pituitary gland**
- **Ectopic ACTH secreting tumor (lung, pancreas)**
- **Iatrogenic-Steroid administration**


SIGNS & SYMPTOMS

Cushing's

-  **protein catabolism**
 - **muscle wasting**
 - **loss of collagen support**
 - **thin, fragile skin, bruises easily**
 - **poor wound healing**

SIGNS & SYMPTOMS

Cushing's

-  **S** in CHO metabolism
 - hyperglycemia
 - Can get diabetes-insulin can't keep up
 - Polyuria



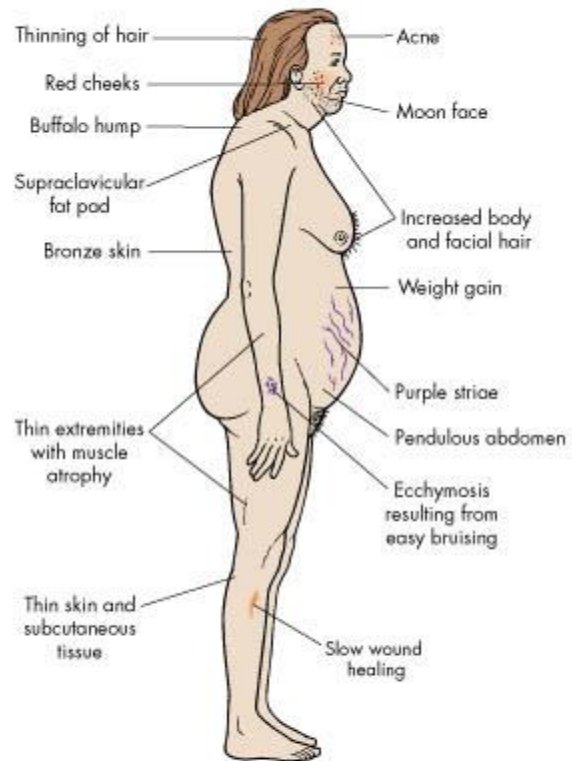





Figure 47-9 Common characteristics of Cushing's syndrome.

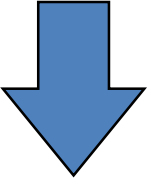

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SIGNS & SYMPTOMS

Cushing's

-  **s** in fat metabolism
 - truncal obesity
 - buffalo hump
 - “moon face”
 -  **weight but**  **strength**

SIGNS & SYMPTOMS

-  **immune response**
 - **More prone to infection**
 -  **resistance to stress**
 - **Death usually occurs from infection**

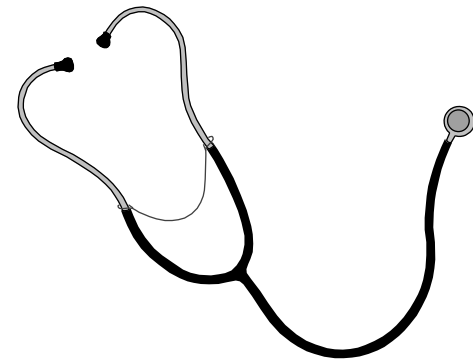
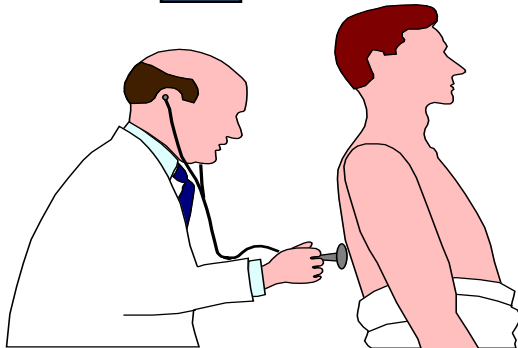
SIGNS & SYMPTOMS

-  **mineralocorticoid activity**

 _____ retention

_____ retention

 b.p. from _____



II.

HYPERALDOSTERONISM


“Conn’s Syndrome”

- **Too much aldosterone secretion**
- **Question: What does aldosterone do????**



-
- **usually caused by adrenal tumor**

SIGNS & SYMPTOMS

Hyperaldosteronism

- **Na and water retention**
 - **H/A, HTN**
-  **K⁺ (hypokalemia)**
- **What is the normal serum K⁺ level???**
- **Usually no edema**

DIAGNOSIS-Hyperaldosteronism

-  urinary K
-  plasma aldosterone levels with low plasma renin levels
- CT scan
- EKG changes

ADRENALECTOMY PRE-OP

- **Stabilize hormonally**
- **Correct fluid and electrolytes**
- **Cortisol PM before surgery, AM of surgery and during OR.**

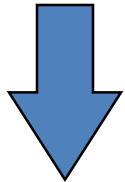
ADRENALECTOMY POST-OP

- **ICU-What type of problems to expect??**
- **IV cortisol for 24 hours**
- **IM cortisol 2nd day**
- **PO cortisol 3rd day**
- **Poor wound healing**
- **If unilateral- steroids weaned**
 - **other adrenal takes over 6-12 months**

ADDISON'S DISEASE

hypofunction of adrenal cortex

- What hormones will you have too little of???



- glucocorticoids or _____
- mineralocorticoids or _____
- androgens or _____

ETIOLOGY of Addison's

- **Idiopathic atrophy**
 - **autoimmune condition Antibodies attack against own adrenal cortex**
 - **90% of tissue destroyed**

ETIOLOGY of Addison's

- **TB/fungal infections (histoplasmosis)**
- **Iatrogenic causes**
 - **adrenalectomy, chemo, anticoagulant tx**


SIGNS & SYMPTOMS

Addison' s Disease

- **fatigue, weight loss, anorexia**
 - Why? think of cortisol fx
- **Changes in skin pigment**
 - small black freckles
 - cortisol -- ACTH-- MSH
- **Muscular weakness**
 - cortisol helps muscles maintain contraction and avoid fatigue

SIGNS & SYMPTOMS

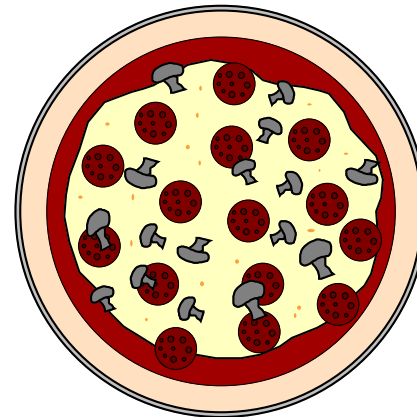
Addison' s

- **Fluid & electrolyte imbalances**
 - WHY???
-  **b.p.**
 - WHY???
- **Hyponatremia-why?**
- **Hyperkalemia-why?**
- **Hypoglycemia-why?**

SIGNS & SYMPTOMS

Addison' s

- **androgens**
 - hair loss, sexual fx
- **mental disturbances**
 - anxiety, irritability, etc.
- **salt craving-why?**



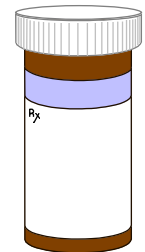
DIAGNOSIS-Addison's

- serum cortisol
- urinary 17-OHCS and 17 KS
- K,
- Na
- serum glucose

INTERVENTIONS

Addison' s Disease

- **Life long hormone replacement**
 - **primary-need oral cortisone 20-25mgs in AM and 10-12mg in PM**
 - **change dose PRN for stress**
 - **also need mineralocorticoid-(FLORINEF)**



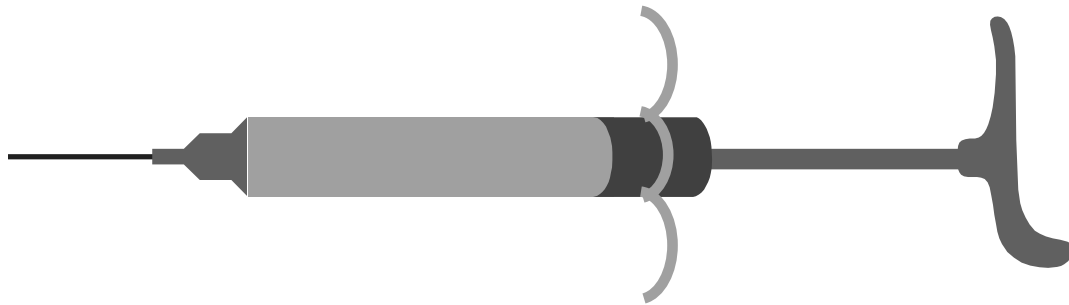
INTERVENTIONS

- **Salt food liberally**
- **Do not fast or omit meals**
- **Eat between meals and snack**
- **Eat diet high in carbs and proteins**
- **Wear medic-alert bracelet**
- **kit of 100mg hydrocortisone IM**

INTERVENTIONS

Addison' s Disease

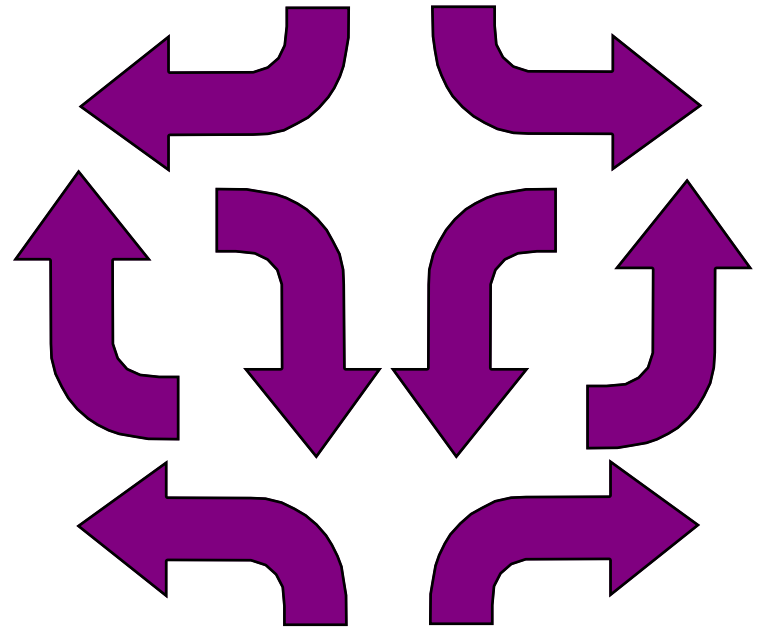
- **Keep parenteral glucocorticoids at home for injection during illness**
- **Avoid infections/stress**



COMPLICATIONS

Addison' s Disease

- **Adrenal crisis**
- **Electrolyte imbalance**
- **Hypoglycemia**



PHEOCHROMOCYTOMA

- rare, benign tumor of the adrenal medulla
- oh no...what are we going to see a hypersecretion of????



SIGNS AND SYMPTOMS

- Hallmark is hypertension-200/150 or greater
- “Spells” -paroxymal attacks
 - bladder distension,emotional distress, exposure to cold.
- NE and Epinepherine released sporadically

SIGNS & SYMPTOMS

- **Deep breathing**
- **Pounding heart**
- **Headache**
- **Moist cool hands & feet**
- **Visual disturbances**

DIAGNOSIS

- **24 hour urine-VMA (metabolite of Epinephrine)**
- **Plasma catecholamines**
- **CT to locate tumor**

INTERVENTIONS-PRE-OP

- **Adrenergic blocking agents**
 - Minipress to bp
- **Beta blocking agents**
 - Inderal to hr, b.p., & force of contraction
- **Diet**
 - high in vitamin, mineral, calorie, no caffeine
- **Sedatives**


INTERVENTIONS

- **Monitor b.p.**
- **Eliminate attacks**
- **If attack- complete bedrest and HOB
45 degrees**

DURING SURGERY

**GIVE REGITINE AND NIPRIDE TO
PREVENT HYPERTENSIVE
CRISIS**

POST-OP

- b.p. may be  initially, BUT CAN BOTTOM OUT
- Volume expanders
- Vasopressors
- Hourly I and O
- Observe for hemorrhage

Adrenal incidentaloma

- Mass lesion greater than 1 cm.
- **Serendipitiously** discovered by radiologic examinations
- Such as : - Computed tomography (CT)
 - Magnetic resonance imaging (MRI)
- **Two questions**
 - Is it **malignancy** ?
 - Is it **functioning** ?

