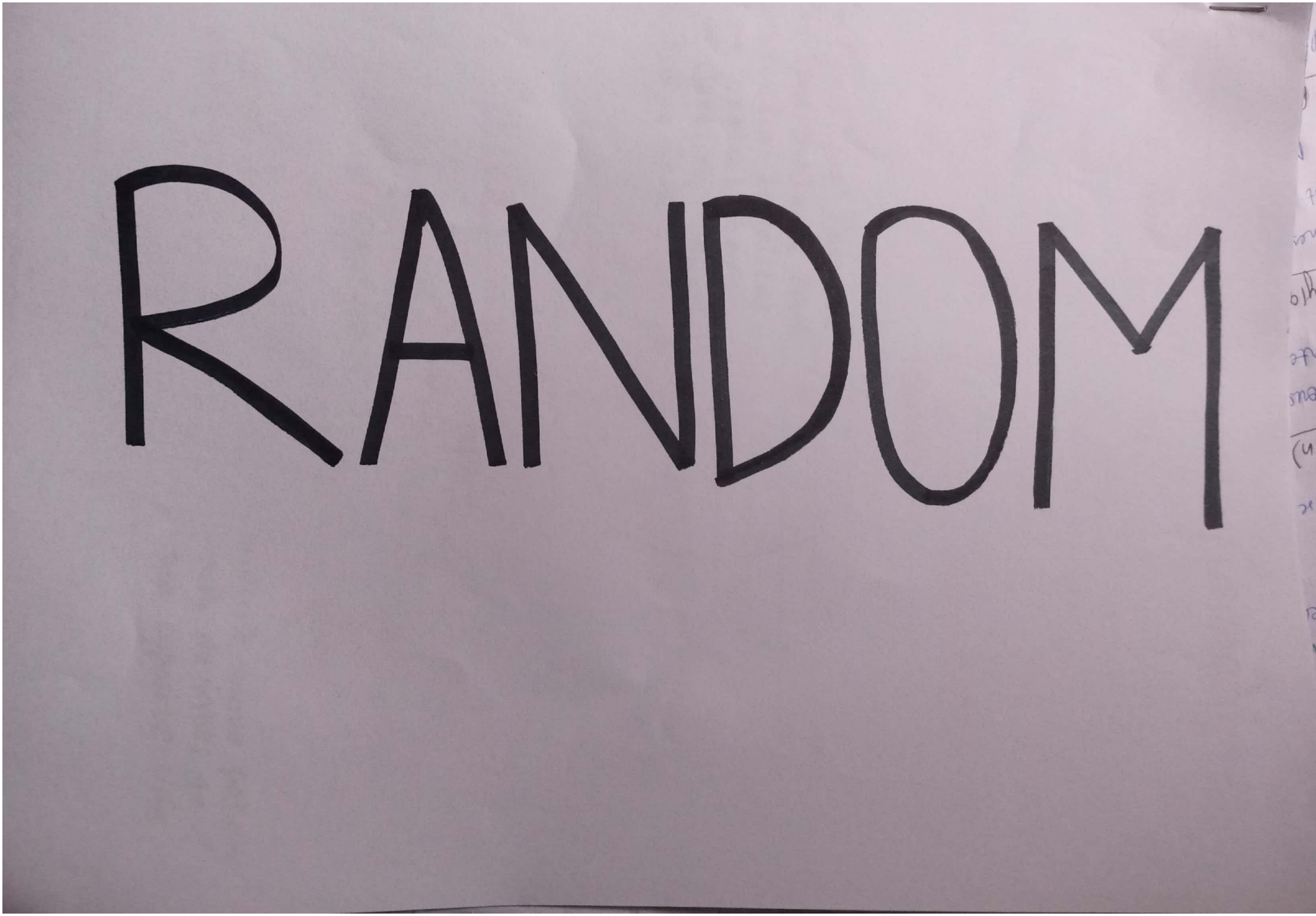


CHAPTER 72

- **Magnesium** ⇒ · catalyst for many intracellular enzymes, particularly those of CHO metabolism.

· ↑Mg^{+} ⇒ ↓CNS + ↓skeletal muscle contraction

· ↓Mg^{+} ⇒ Irritability of CNS + Vasodilation + Arrhytmias.

- **Calcium** ⇒ · ↑Ca^{+2} ⇒ Heart stops in systole + Depressant

· ↓Ca^{+2} ⇒ Tetany.

- **Phosphorous** ⇒ ATP, ADP, Phosphocreatine e.t.c.

- **Iron** ⇒ Electron carriers in ETC (Cytochromes) contain iron.

- **Zinc** ⇒ integral part of Carbonic Anhydrase, Lactate Dehydrogenase & Peptidases.

- **Vit. A** ⇒ ↓ vit A ⇒ Scaliness of skin, acne + failure of growth + failure of reproduction + keratinization of cornea.

(vit. A has been called an "anti-infection" vitamin.

- **Vit. B1** (Thiamine)

⇒ Works in the body, in the form of "Thiamine Pyrophosphate."

· ↓ vit. B_1 ⇒ Beriberi, causing ↓utilization of pyruvic acid & some amino acids but increased utilization of fats (b/c Thiamine is specifically needed for CHO & protein metabolism)

· Thiamine ↓ ⇒ ↓CNS (b/c of ↓ CHO metabolism) + Degeneration of myelin sheats + Cardiac failure (b/c of weakened cardiac muscle) + Vasodilation, resulting in peripheral edema & ascites + GI disturbances (indigestion, constipation, anorexia e.t.c)

• **Niacin** ⇒ ↓Niacin ⇒ Permanent dementia + Psychoses + skin develop vit. a cracked, scaly pigmented areas that are exposed to mechanical or sun irradiation (in Niacin ↓, skin is unable to repair damage) + irritation & inflammation of mucous membranes of mouth & other portions of GI Tract

LACKS TRYPTOPHAN → forms Niacin

• ↓Niacin → ① Pellagra (common in people on corn diet)
② Canine disease (Black Tongue).

• **Vit. B_2 (riboflavin)**

• ↓ Riboflavin → no case in human reported (but exp., similar to Niacin).

• **Vit. B_{12} (Cobalamin)**

• ↓ vit. B_{12} → Pernicious anemia + Demyelination of nerve fibers (mostly in post. & sometimes lateral columns of spinal cord)

• **Folic Acid (Pteroylglutamic Acid)**

→ Synthesizes Purines & Thymine for DNA formation + More potent growth promoter than vit. B_{12} + imp. for maturation of RBCs.

• ↓Folic Acid → Macrocytic anemia.

• **Pyridoxine (vit. B_6)**

→ Used as PLP by transaminases.

→ ↓ Pyridoxine ⇒ Dermatitis + ↓ rate of growth + fatty liver + Anemia + Mental deterioration + Seizures + GI disturbances. (rare in humans)

• **Pantothenic Acid** • ↓PA → depressed metabolism of CHO & fats.

→ Retarded growth + failure of reproduction + Graying of hair + Dermatitis + fatty liver + Hemorrhagic adrenocortical necrosis. (rare in humans)

Vit. C (Ascorbic Acid)

- essential for activating "Prolyl hydroxylase"
- ↓ Ascorbic Acid ⇒ Scurvy + Cessation of bone growth + Blood vessel walls become fragile. + many pretechial hemorrhages.

- **Vit. E** → ↓ vit. E ⇒ degeneration of the germinal epithelium in the testis, causing male sterility + resorption (abortion) of fetus. (Thus, vit. E → Antisterility hormone i.e lack of vit. E → causes sterility).

- **Vit. K**
  - Synthesize factors II, VII, IX, X.

Lateral → Hunger
Ventromedial → Satiety
Paraventricular → Satiety
Dorsomedial → Hunger

Resp. quotient
- CHO (1)
- Fats (0.7)
- Proteins (0.8)

ATP → 7300 calories
Phosphocreatine → 8500 calories

Men lying in bed all day use 1650 Calories / or 1850 (+200C b/c of process of eating & digesting).

Heatstroke depends on air:
- Dry air → > 130°F
- Wet air → >94°F

For an average diet, energy liberated per litre of oxygen used in the body is about 4.825 Calories.

- About 60% of the heat is lost by RADIATION.
- 22% by EVAPORATION.
- 15% by CONDUCTION TO AIR.
- 3% by CONDUCTION TO OBJECTS

Primary motor area for shivering is located in dorso-medial portion of the post. HT near the wall of the 3rd ventricle.

ENAL UNIT (CHAPTER 28)

Transport maximum for glucose is 375mg/min.

NOTE

Anion gap = $[Na^+] - [HCO_3^-] - [Cl^-]$ = 8-16mEq/L

In metabolic acidosis,

$[HCO_3^-]$ ↓ so 2 cases:

- ~~Anion~~ $[Cl^-]$ ↑ to normalize anion gap. (Hyperchloremia)
- Unmeasured anions ↑ to balance cations & anions, anion gap will elevate. (Normochloremia)

~~Most~~ Most of the ~~conditions~~ causes of metabolic acidosis elevate anion gap EXCEPT CARD

- Carbonic Anhydrase Inhibitors
- Addison's disease
- Renal tubular acidosis
- Diarrhea

} Normal anion gap (Hyperchloremia)

CHAPTER 27

- Renal disease, DM, Hypertension ⇒ ↓Kf → ↓GFR (↓Kf ∵ b/c of damage to the nephrons)
- Urinary tract obstruction (eg. kidney stones) ⇒ ↑P_B → ↓GFR
- ↓Renal blood flow, ↑Plasma proteins ⇒ ↑π_G → ↓GFR
- ↓Arterial pressure (small effect b/c of autoregulation) ⇒ ↓A_P → ↓P_G
- ↓Angiotensin II ⇒ ↓R_E → ↓P_G
- ↑Sympathetic activity, Vasoconstrictor hormones ⇒ ↑R_A → ↓P_G

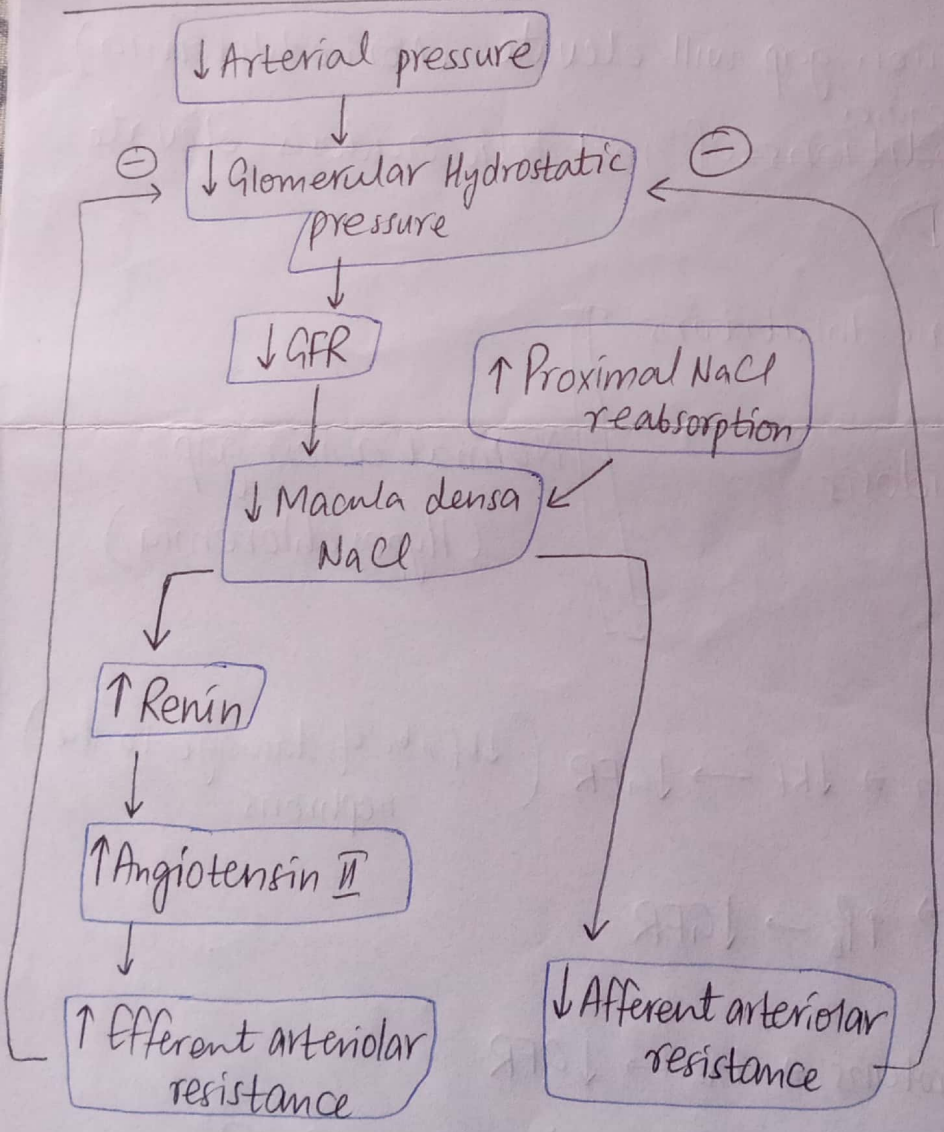
} → ↓P_G → ↓GFR

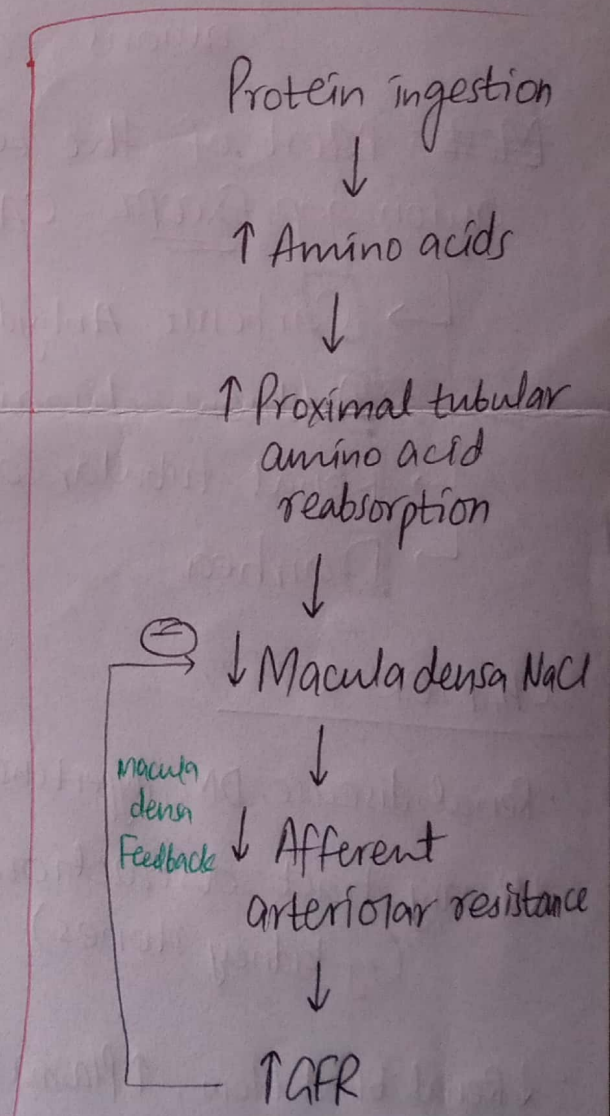
Hormone OR Autacoid	GFR
Norepinephrine	↓
Epinephrine	↓
Endothelin	↓
Angiotensin II	↔ (prevents ↓)
Endothelial-derived Nitric oxide	↑
Prostaglandins	↑

VASOCONSTRICTORS

VASODILATORS

↓ NSAIDs prevent PGE_2 & PGI_2 from functioning → ↓GFR





KIDNEYS

CHAPTER 28

- Transport max. for Glucose is 375mg/min
(NOTE: Filtered load for glucose is 125mg/min i.e after 125mg of glucose, some starts showing in urine but only at Tmax i.e 375mg/min, then all of the extra glucose is excreted in urine).

- In the thick ascending loop, movement of solutes is mediated by 1-sodium, 2-chloride, 1-potassium co-transporter.
(This co-transporter is inhibited by LOOP DIURETICS).

- In the distal tubule:
  - 1st part → Forms Macula densa.
  - 2nd part → Has Na^+-Cl^- co-transporter (inhibited by THIAZIDE DIURETICS)

- late distal tubules & cortical collecting tubules consists of 2 types of cells:
  - Principal cells (reabsorb Na^+ & H_2O + secrete K^+)
  - Intercalated cells
    - Type A ↑ ↓ Acidity
    - Type B ↑ ↓ Basicity

(Principal cells are primary sites of Potassium sparing diuretics).

Spironolactone
Eplerenone
} → Aldosterone antagonist

Amiloride
Triamterene
} → Na^+-channel blocker

$$C_S = \frac{U_S \times V}{P_S}$$

Inulin → for GFR

Creatinine → GFR (not accurate b/c some of it is secreted)

PAH → 90% of it is cleared from plasma.

↓

90% Renal Plasma Flow

CHAPTER 78

Aldosterone → exerts approx. 90% of the mineralocorticoid activity.

- Cortisol can also bind to mineralocorticoid receptors BUT renal epithelial cells express the enzyme 11β-Hydroxysteroid Dehydrogenase Type-2 (11β-HSD2) which converts cortisol to cortisone & prevents mineralocorticoid function.

NOTE → In patients with 11β-HSD2 deficiency, cortisol also has ↑ mineralocorticoid effect ⇒ resulting in Apparent Mineralocorticoid Excess Syndrome (AME).

Ingestion of large amounts of licorice,

which contain glycyrrhetinic acid blocks
11β-HSD2 → resulting in AME.

Cortisol → . ↑ glucose conc in blood
. ↑ protein catabolism + ↓ protein synthesis EXCEPT in liver where it ↑ liver proteins + plasma proteins.

NOTE
POMC is acted by either of the two enzymes

- Prohormone Convertase 1 (PC1)
  - ↳ produce N-terminal peptide, joining peptide, ACTH, β-lipotropin
- PC2
  - ↳ produce α-MSH, β-MSH, γ-MSH, β-endorphin.

(NO ACTH in PC2).

To check whether Cushing's Syndrome is ACTH-dependent (b/c of tumor in hypothalamus / pituitary) or independent (b/c of tumor in adrenal gland), the patient is given dexamethasone (synthetic cortisol):

- ACTH does not get low with small dose → ACTH-dependent Cushing's
- ACTH gets very low → ACTH independent Cushing's

CONN'S SYNDROME

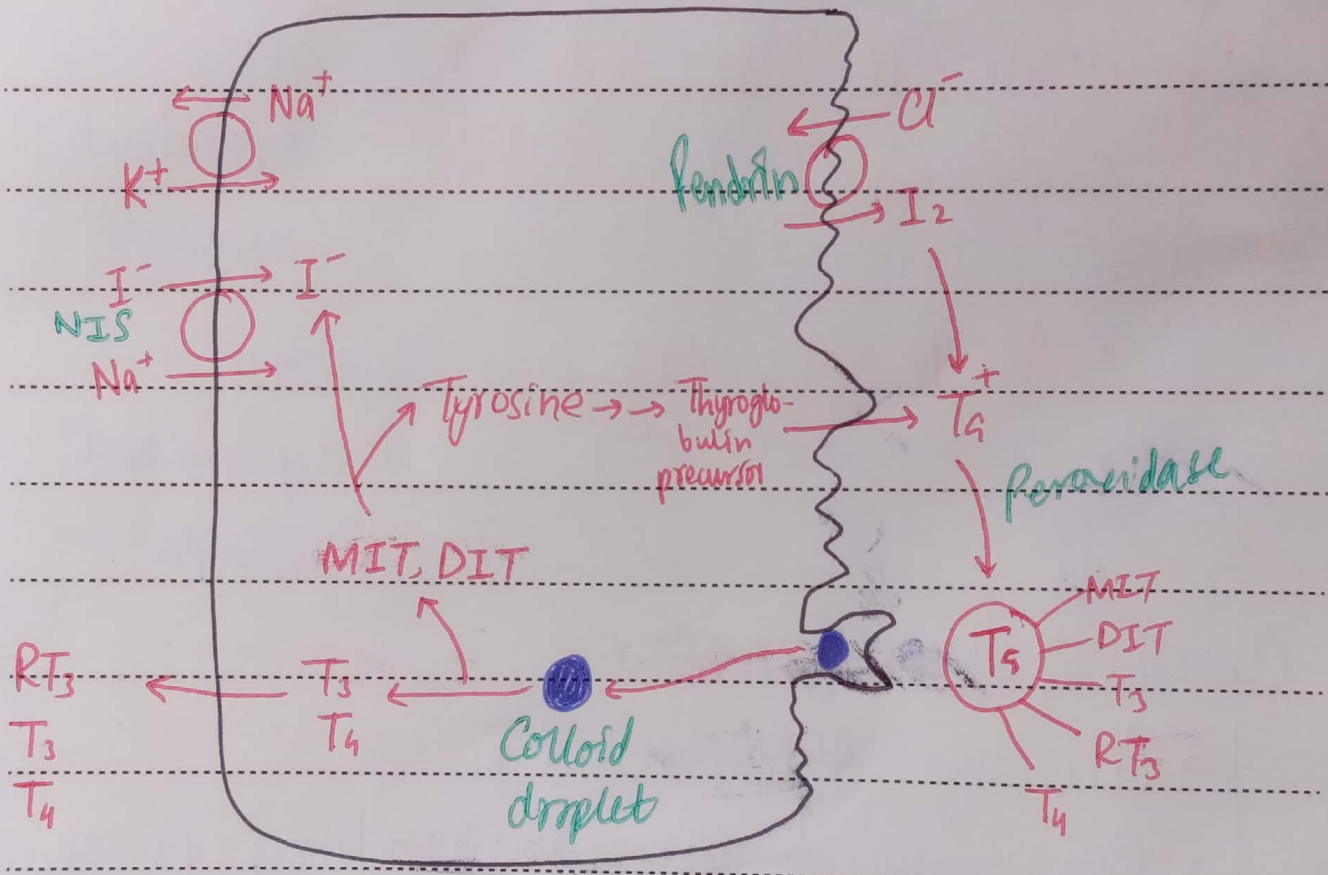
- Primary Aldosteronism
- Common diagnostic finding is a decreased plasma renin conc.

NOTE → In adrenogenital syndrome, excretion of 17-keto-steroids ↑ in urine.
derived from androgens

CHAPTER 77

50mg of I_2 is required per year OR 1mg per week.

- Salt is iodized with about 1 part sodium iodite per 100,000 parts of NaCl.



Each molecule of Thyroglobulin has 70 tyrosine amino acids.

- 1st step is to oxidize I^- to I^0 or I_3^-

Each molecule of Thyroglobulin has 30 T_4 molecules & few of T_3.

NOTE

↑ Thyroid Hormone ↑ Free Fatty acids BUT ↓ conc of cholesterol, phospholipids & triglycerides.

IMP

↳ Thyroid Hormone ↑ results in NO CHANGE in MEAN arterial pressure (b/c pulse pressure & systolic pressure ↑ but diastolic pressure ↓ corresponding amount).

TRH is a tripeptide amide - Pyroglutamyl - histidyl - proline-amide (GHP).

TRH $\xrightarrow{\text{Phospholipase C}}$ TSH $\xrightarrow{\text{cAMP}}$ Thyroid Hormones

NOTE

- Cold region people have ↑ TRH & TSH (to feel warm by ↑ BMR by 15-20%)
- Excitement & anxiety conditions that greatly

stimulate SNS - cause ↓ in TSH (b/c body is already heated) (3)

ANTI THYROID DRUGS

① THIOCYNATE

→ Thiocynate ions ↓ iodide trapping b/c they COMPETE with I^- b/c the pump can transport both Thiocynate & iodide ions. (also perchlorate & nitrate ions).

↳ Can lead to goiter. (b/c ↑ Thyroglobulin ↑ TSH)

② PROPYLTHIOURACIL

→ Blocks:

- ⓐ Peroxidase enzyme to convert I^- to I^0 OR I_3^- (which can add to Tg)
- ⓑ Coupling of MIT & DIT

↳ Can lead to goiter (b/c ↑ Tg → ↑ TSH)

③ High conc. of IODIDES

→ Suppressed Iodide trapping + No endocytosis of colloid.

→ Regression of thyroid occurs for only a few weeks

→ Only given 2/3 weeks before surgical removal of thyroid gland to shrink the gland & help in easing the surgery.

GRAVE'S DISEASE

→ High Thyroid Hormones b/c of TSI.

→ TSH is low.

NOTE

Severe HYPERthyroidism ↗ BMR is +30 – +60

. conc. of TSI ↗ High in Graves & Thyro-toxicosis but low in Thyroid adenoma. (no TSH in thyrotoxicosis)

• Some foods are goiterogenic b/c they have substances of propylthiouracil-type i.e TURNIPS & CABBAGES.

MYXEDEMA occurs in Hypothyroidism b/c in HYPOT, Hyaluronic acid & Chondroitin sulfate are greatly increased in interstitial spaces (bounded to protein) which ↑ osmotic pressure → edema of face (non-pitting edema).

↳ BMR is −30 to −50.

CHAPTER 76

Thyrotropes (The) }
Gonadotropes (Girls) } → Glycoprotein of 2 subunits

Lactotropes (Like) }
Somatotropes (Snap) } → Single chain of amino acids
Corticotropes (Chat) }

Prolactin-inhibiting-hormone is Dopamine.

NOTE

Insulin causes liver & other tissues to release small proteins called SOMATOMEDINS (or Insulin-like growth factor).

→ 4 IGF are isolated.

→ Most important is Somatomedic C i.e IGF-1.

Pygmies of Africa have congenital inability to synthesize SC or IGF-1

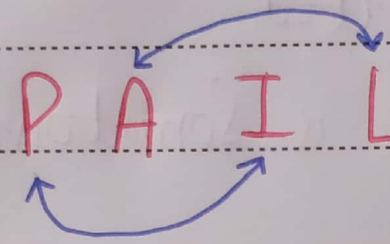
→ They are dwarfs

→ Lévi-Lorain dwarfs also have lack of Somatomedin C (IGF-1).

- GHRH is secreted by Ventromedial nucleus of HT.

- Catecholamines ↑ GH release
- Dopamine ↓ Prolactin release

Vasopressin & Oxytocin both have 9 amino acids & are similar EXCEPT that in vasopressin, Phenylalanine & Arginine replace Isoleucine & Leucine of the oxytocin molecule.



CHAPTER 75

3 classes of proteins:

- Proteins & Polypeptides (PPP)
  (Ant & Post: Pituitary, Pancreas, Parathyroid gland)
- Steroids
  (Adrenal cortex, ovaries, testes, placenta)
- Amines (derivative of Tyrosine) (T_3/T_4, E/NE, Dopamine)

Location for Hormone receptors:

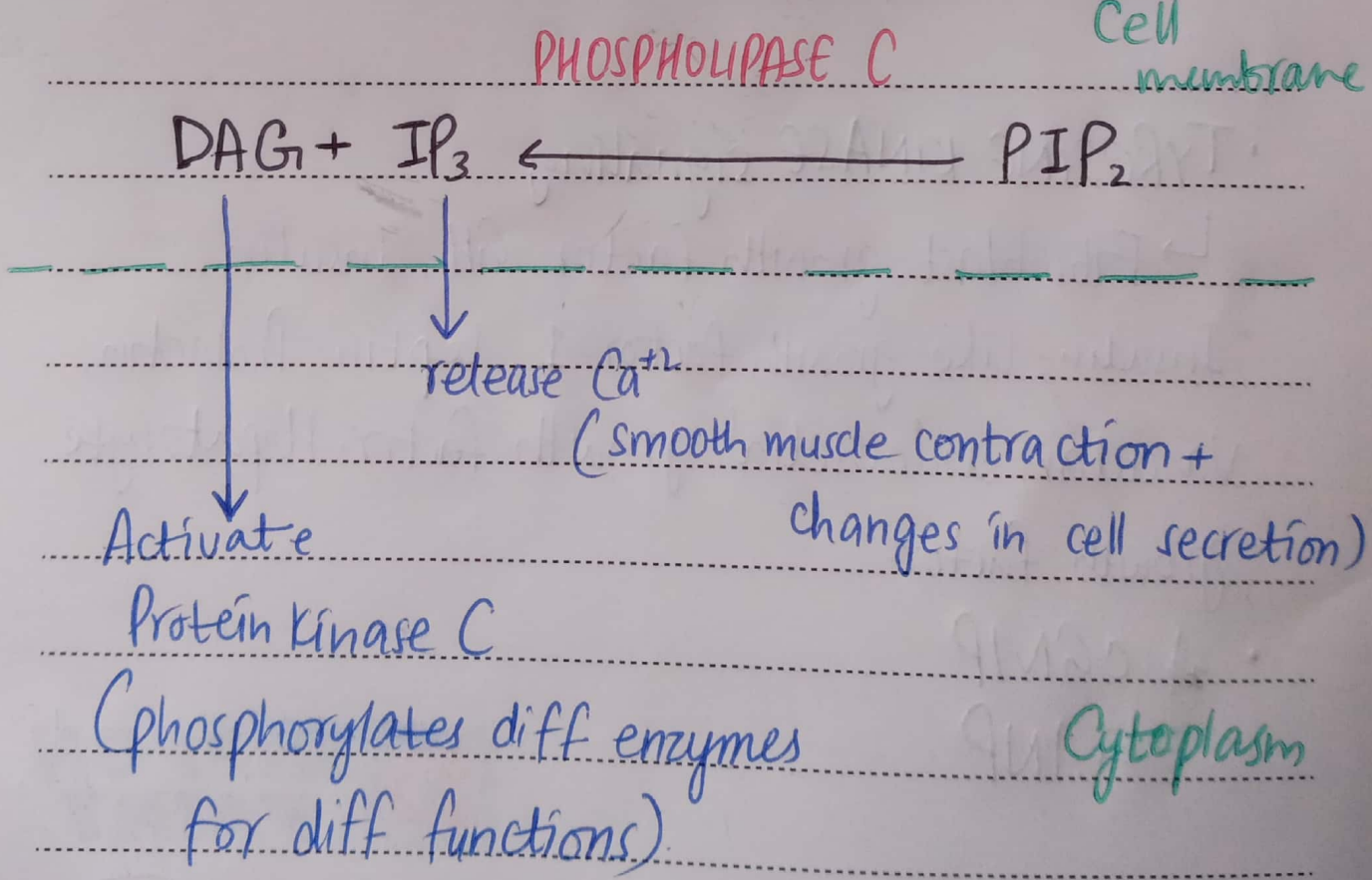
- In or on the surface of cell membrane
  (protein, peptide, catecholamines)
- In cytoplasm
  (steroid)
- In nucleus
  (T_3/T_4)

- TYROSINE KINASE signaling
  - Fibroblast growth factor, GH, Insulin, Insulin-like growth factor-1, Leptin, Prolactin, Vascular endothelial growth factor, Hepatocyte growth factor.
- cGMP
  - ANP

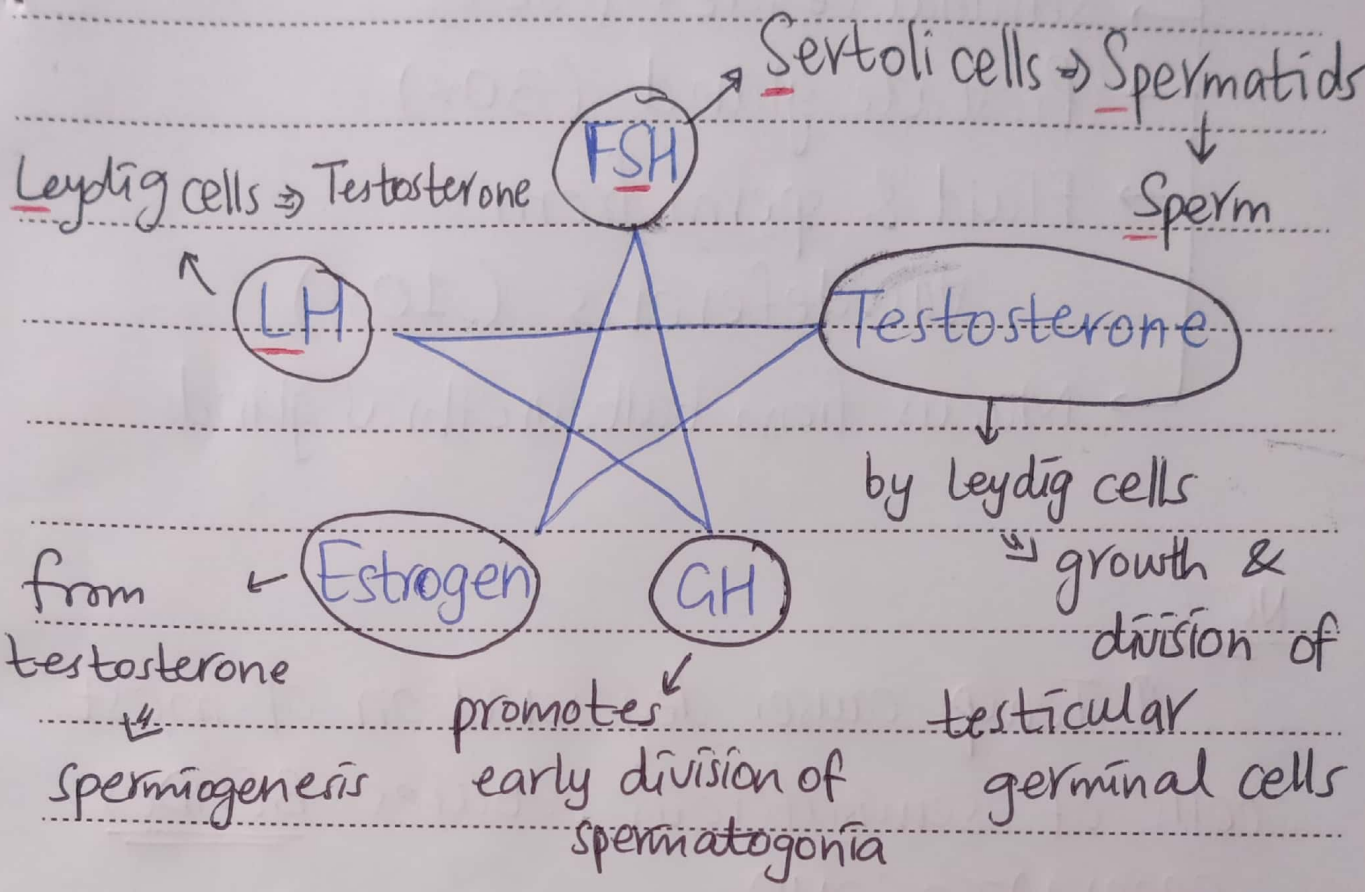
Phospholipase-C 2nd messenger system

- Angiotensin II (vascular Smooth Muscle)
- Catecholamines (α receptors)
- GnRH
- Parathyroid Hormone
- Oxytocin
- TRH
- Vasopressin (V1 receptor, vascular smooth muscle)

Working of Phospholipase C



CHAPTER 81



3 stages of Menstrual Cycle:

① PROLIFERATIVE (11 days)

↑Estrogen

② SECRETIVE (12 days)

↑Progesterone

③ MENSTRUAL (5 days)

NOTE

↳ Activity of sperm ↑ with alkaline pH & High temp

↓

6.0-6.5 (neutral to slightly alkaline)

Semen (pH = 7.5)

- Seminal vesicles (60%)
- Prostate gland (30%)
- Fluid & sperm from Vas deferens (10%)
- Mucus from bulbourethral glands

NOTE

↑ Temp. causes degeneration of most cells of seminiferous tubules BESIDES SPERMATOGONIA.

- Normally, there are 120 Million sperm per ml of semen.
- < 20 Million sperm per ml means the person is infertile.

CANTHARIDIN is an aphrodisiac

Twins are born 19 days earlier.

Adiposogenital Syndrome
(Fröhlich's Syndrome / Hypothalamic eununchism)

- → Hypogonadism
- → Genetic inability of HT to secrete normal amounts of GnRH
- → Associated with abnormality at the feeding centre of the HT, causing the person to overeat.

CHAPTER 82

- Estrogen → TFSH receptors on granulosa cells.
- Estrogen + FSH → TLH receptors on granulosa cells.
- Estrogen + LH → Proliferation of follicular thecal cells & ↑ their secretion as well.

In ♂ → Sertoli cells → INHIBIN

In ♀ → Leutine cells → INHIBIN

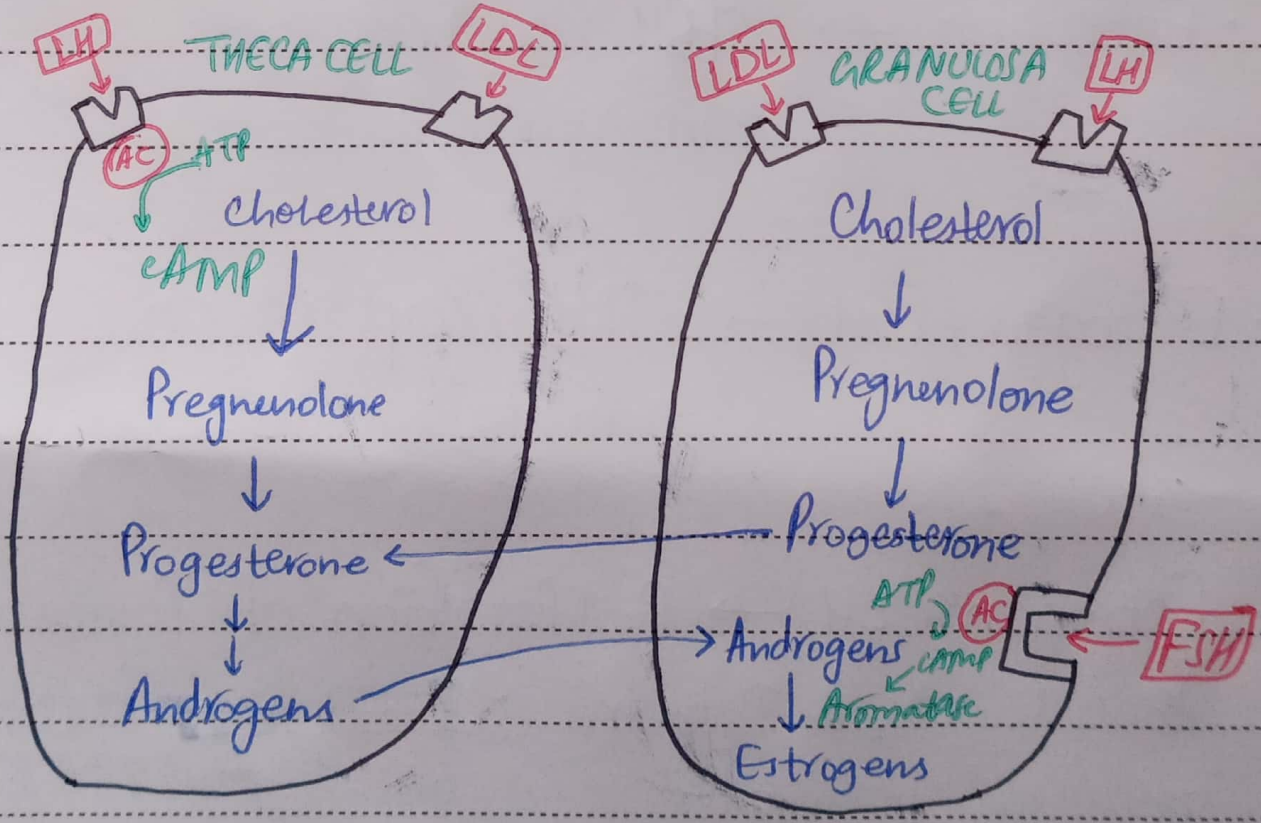
Pregnancy & Lactation ↑

FSH → stimulate growth of primary follicle + form theca layer

Progesterone

Estrogen → Secondary sexual characteristics of ♀

LH → ovulation can not occur without it + convert follicular cells to secrete progesterone now



Average weight of fetus at birth is 7 pounds (4.5 – 11 pounds)

weight $\propto$ length^3

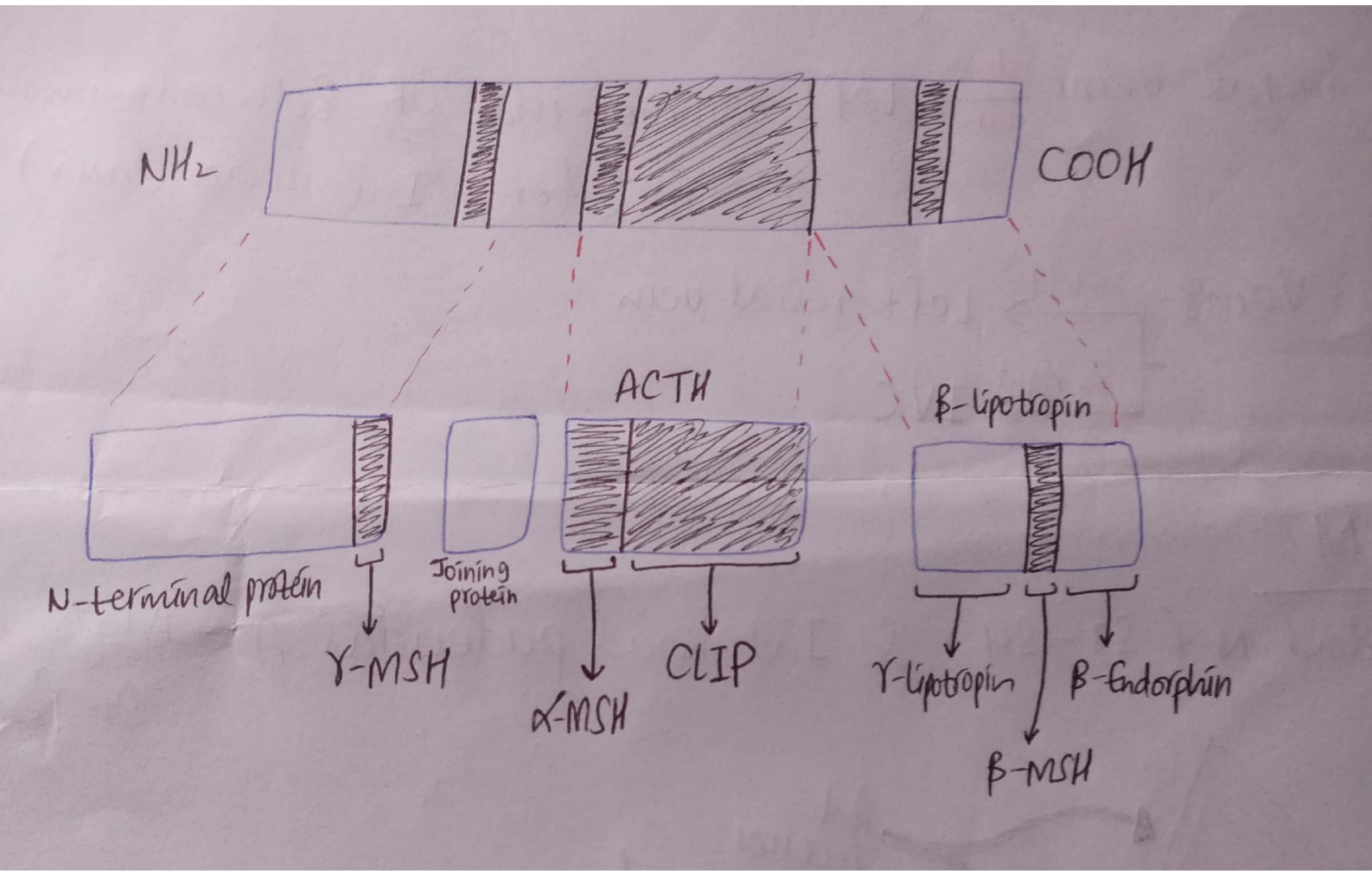
but,

length $\propto$ age

so,

weight $\propto$ age^3

For neonate's first breath, 25mm Hg of -ive inspiratory pressure in the lungs is required. → easier 2nd time & onwards



Mon Tue Wed Thu Fri Sat Sun

EMBRYOLOGY (2)

Date

CHAPTER 21:

At the end of 4th month, skin has 4 layers:

Horny Layer	Horny
Granular "	Girls
Spinous "	Spicy
Basal "	Boys

↳ Germinative Layer

WAARDENBERG SYNDROME
- Patches of white skin & hair
- Heterochromia irides (eyes of diff. colour)
- Deafness

Dermis is derived from mesenchyme that has 3 sources:
① Lateral plate mesoderm ⇒ Dermis in the limbs & body wall.
② Paraxial mesoderm ⇒ Dermis in the back.
③ Neural crest cells ⇒ Dermis in the face & neck.

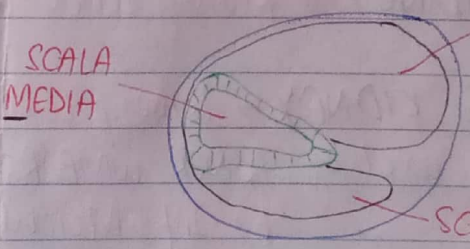
At birth, the skin is covered by a whitish paste "VERNIX CASEOSA" formed by secretions from sebaceous glands & degenerated epidermal cells & hairs. It protects the skin against macerating action of amniotic fluid.

ICHTHYOSIS ⇒ Excessive keratinization of skin ⇒ Results in HARLEQUIN FETUS

ALBINISM ⇒ Reduced/Absent pigmentation in SKIN, HAIR & EYES.
VITILIGO ⇒ Loss of melanocytes due to autoimmunity ⇒ include SKIN & OVERLYING HAIR & ORAL MUCOSA

HYPERTRICHOSIS ⇒ Excessive hairiness ⇒ due to unusually abundant hair follicles.
ATRICHIA ⇒ Congenital absence of hair ⇒ associated with abnormalities of ectodermal derivatives eg. teeth & nails.

CHAPTER 19:



Visitors May Try

galaxy

Mon Tue Wed Thu Fri Sat Sun

Date

CHAPTER 16 (Kidneys):

Both the urinary & the genital system develop from INTERMEDIATE MESODERM + initially, the excretory ducts of both systems enter a common cavity, the cloaca.

Kidney develops from 2 sources:

- Metanephric Mesoderm (form excretory units) → glomerulus → distal convoluted tubule
- Ureteric Bud (form collecting system)

Autosomal RECESSIVE polycystic kidney disease → Cysts form from COLLECTING DUCTS
↳ Renal failure occurs in infancy.

Autosomal DOMINANT polycystic kidney disease → " " " ALL SEGMENTS OF NEPHRON → do not cause renal failure UNTIL ADULTHOOD.

NOTE

Actual function of a Metanephric kidney begins at Week 12.

Kidneys → Mesoderm

Bladder → First mesoderm but then replaced with Endodermal epithelium

Ureter → Endoderm

PELVIC KIDNEY → Kidney stuck with umbilical artery in pelvis.

HORSE SHOE KIDNEY → lower poles of both kidneys fuse with one another.
↳ At level of LOWER LUMBAR, its ascent is prevented by Inf. Mesenteric Artery.

CHAPTER 13 HISTOLOGY

Date

Lip ⇒ Stratified squamous keratinized epithelium.

Tongue ⇒ In the lower half of tongue & surrounded by skeletal muscles are present ANTERIOR LINGUAL GLANDS (it is a mixed gland & contains both mucous acini & serous acini, as well as mixed acini).

- Lingual epithelium that covers the circumvallate papilla is stratified squamous epithelium.
- In lamina propria ⇒ Tubuloacinar serous (von Ebner) glands.

Filliform → No taste buds Fungiform → Taste buds on apical surface

Foliate → Taste buds on apical surface Circumvallate → Taste buds on peripheral (lateral) surface

Salivary glands ⇒ Their ducts are as follows:

> Serous glands have well-developed intercalated & striated ducts & v.v.

Serous/Mucus acinus ⇒ Intercalated ducts (low cuboidal) ⇒ Striated ducts (columnar)

⇒ Excretory intralobular ducts (C/T) ⇒ Interlobular & Interlobar ducts (stratified low cuboidal/columnar)

Parotid gland's secretion has more Protein (i.e. Serous) ⇒ Serous gland

Sub Mandibular gland ⇒ Mixed

Sublingual gland ⇒ Mixed (but mostly mucous cells with serous demilunes)

Mon Tue Wed Thu Fri Sat Sun

Date

Saliva (1L/day) ⇒ produce:

lysozyme → kills bacteria

IgA (produced by plasma cells in C/T)

NOTE: ~~STRIATED~~ ducts REABSORB Na^+ & Cl^- but SECRETE K^+ & HCO_3^- into the Saliva.

IMPORTANT

INTERCALATED DUCTS ⇒ Secrete HCO_3^- & absorb Cl^-

STRIATED DUCTS ⇒ Secrete K^+ & HCO_3^- & absorb Na^+ (& Cl^-)

IgA in saliva is produced by Plasma cells in the C/T around the salivary glands.

Cells of the pigment epithelium forms blood-retina barrier.

↓

retinal pigmented epithelial layer

EMBRYOLOGY

Upper lip ⇒ 2 medial nasal & 2 maxillary prominences.

Lower lip ⇒ 2 mandibular prominences

Nasolacrimal groove ⇒ b/w maxillary & lateral nasal prominence.

Van der Woude Syndrome ⇒ Most commonly associated with cleft palate

Pharyngeal arches appear in week 4-5

22q11.2
↳ Most common type of deletion syndrome.

galaxy

- In ovary ⇒ Medullary cords degenerate (Chicks have Cortical cords)
  Cortical cords develop

CHAPTER 19:

Each otic or auditory vesicles (otocysts) divides into:

ANTERIOR COMPONENT (Ventral) ⇒ give rise to Saccule & Cochlear duct (SnapChat)

DORSAL COMPONENT ⇒ " " " Utricle, Semicircular canals & Endolymphatic duct.

NOTE: 1st pharyngeal arch forms TUBOTYMPANIC recess
- forms Eustachian tube
- enlarges to form the tymp. cavity

Together, they form Membranous labyrinth.

NOTE:

Higher frequencies (High pitch) are heard near the oval window where fibers connecting the basilar membrane are shorter & stiffer.
Lower frequencies are heard farther up the cochlea where the fibers are longer & more flexible.

CHAPTER 20:

1) Pars Optica Retinae ⇒ Posterior 4/5th of inner (neural) layer of the optic cup ⇒ It forms rods & cones.

2) Pars CecA Retinae ⇒ Anterior 1/5th of inner (neural) layer of the optic cup ⇒ It divides into:
   a) Pars iridica retinae ⇒ Forms inner layer of iris
   b) Pars ciliaris retinae ⇒ Forms ciliary body.

Coloboma ⇒ Occurs when choroid fissure fails to close

Congenital Cataracts ⇒ Mother having Rubella (German measles) have children born with cataracts but only if:
⇒ The mother is affected by Rubella virus before 7th week of gestat
⇒ If the mother is affected AFTER 7th week ⇒ NO CATARACT but the child can have HEARING LOSS.

Mon Tue Wed Thu Fri Sat Sun

Date

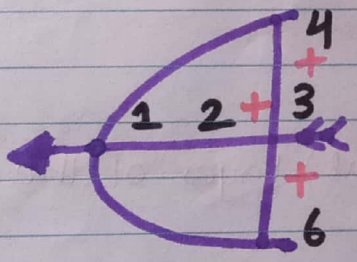
Neural crest cells derivatives (Max Payne):

M → Melanocytes & Meninges
A → Adrenal Medulla
G → Ganglia (DRG & Post ganglionic Autonomic)
S → Schwann Cells

P → Parafollicular C cells & Pharyngeal arches
A → Aortopulmonary septum
N → Nice teeth (Odontoblasts)
E → Endocardial cushions

Derivatives of Pharyngeal Arches:

1 2 3 4 6 (no 5!)



- 3+2 = 5 (5th C.N) by 1st P.A
- 3+4 = 7 (7th C.N) by 2nd P.A
- 3+6 = 9 (9th C.N) by 3rd P.A
- 4+6 = 10 (10th C.N) by both 4th & 6th P.A

NOTE ⇒ In the diagram, 4th P.A is shown SUPERIOR so it derives SUPERIOR laryngeal N & recurrent laryngeal N. is derived by 6th P.A.

CHAPTER 16:

In ♂, Mesonephric ducts (Wolffian) gets stimulated & Paramesonephric ducts (Mullerian) gets diminished & v.v (Men have Mesonephric ducts)

In Testes ⇒ Medullary cords develop (Men have Medullary cords)
No Cortical cords

NOTE ⇒ Vagina has 2 origins
① Upper half made of uterine canal.
② Lower " " " urogenital sinus.

galaxy