1. All of these are correct of renal physiology *except:*

a) Sodium absorption occurs in DCT

b) Potassium is both secreted and absorbed in tubules

c) Glucose is reabsorbed in DCT

d) All

e) None

Correct Answer - C

Ans. C i.e. Glucose is reabsorbed in DCT

RENAL HANDLING OF SUBSTANCE

In PCT:

- 60-70% of filtered water reabsorbed passively.
- Coupled mainly to sodium reabsorption.
- Glucose & amino acids Absorbed completely (100%).
- Maximum (90%) bicarbonate absorption.

In DCT:

- **Principal (P) cells reabsorb sodium & water** from lumen & **secrete potassium** into lumen.
- **Intercalated (I) cells reabsorb potassium & secrete hydrogen** into lumen.
- Sodium reabsorption a**pproximately 7% filtered Na^{2+} reabsorbed.**

In Henle loop:

Thin descending segment -

- **Water reabsorption: Highly permeable to water.**
- Reabsorption of solutes: **Impermeable to solutes (Na^{2+}, Cl^{-} & urea).**

- **Minimal urea secreted.**
  In thin ascending limb:
- $NaCl^-$ reabsorption occurs - Due to high $NaCl^-$ permeability.
- Less permeable to water.
  Thick ascending limb:
  Sodium, Potassium & Chloride reabsorption:
- Transports one Na^{2+}, one K^+, & two Cl^-.
- Active sodium absorption occurs.
- 30% filtered Na^{2+} reabsorbed.
  - **Water reabsorption: Totally impermeable to water.**

2. Blood brain barrier is absent in ?

a) Adenohypophysis

b) Neurohypophysis

c) Hypothalamus

d) Thalamus

e) None

Correct Answer - B

Ans. is 'b' i.e., Neurohypophysis

Blood brain barriers exist both at the choroid plexus and at the tissue capillary membranes in essentially all areas of the brain parenchyma except in some areos of the hypothalamus, pineal gland, a d arca posttema, where substances diffuse with greater ease into the tissue spaces.

Four areas that are outside of BBB are (l) the posterior pituitary (neurohypophysis) and the adjacent ventral part of the median eminence of the hypothalamus, (2) the area postrema, (3) the organum vasculosum of the lamina terminalis (OVLT, supraoptic crest), and (4) the subfornical organ (SFO).

Referred to collectively as the circumventricular organs

3. True regarding HbA2 is/are?

a) It has more capacity to carry oxygen

b) Concentration is more than HbA

c) Level is increased in Thalasemia

d) Consists of 2 alpha and 2 beta chains

e) None of the above

Correct Answer - B
Ans. is'c'i.e., Level is increased in Thalassemia
Ref: Ganong 23d/e p. 523-525 https: / /www. aafp.org/ alp / 2009 /08 1 5 /p3 39.html

- "The hemoglobin electrophoresis with beta thalassemia trait usually has reduced or absent HbA, elevated levels of HbA2. and increased HbF.
- However, a normal concentration of HbA2 does not rule out beta thalassemia trait. especially if there was coexistent iron deficiency, which can lower HbA2 levels into the normal range."
- "Hemoglobin A2 may be increased in beta thalassemia or in people who are heterozygous for the beta thalassemia gene.

4. TRUE statement(s) regarding "loop of Henley" in kidney is/are?

a) Ascending limb actively absorbs Na

b) Ascending limb actively absorbs Cl

c) Ascending limb secretes water in lumen

d) Descending limb secretes water

e) Descending limb receives hyperosmolar fluid from PCT

Correct Answer - A:B

Ans. is 'a' i.e., Ascending limb actively absorbs Na+ & 'b' i.e. Ascending limb actively absorbs Cl-

Ref: Ganong 25th/e P. 680-691; Essentials of medical physiology p. 271

LOOP OF HENLE

- The loop of Henle has a thin descending, a thin ascending and a thick ascending segments.

REABSORPTION IN THIN ASCENDING LIMB:

- $NaCl^-$ reabsorption occurs -
- Due to high $NaCl^-$ permeability.
- Less permeable to water.
- Tubular fluid is iso-osmotic.

REABSORPTION IN THICK ASCENDING LIMB:

Sodium, Potassium & Chloride reabsorption:

- By “Secondary active transport” -
- **Through Na^{2+}-K^+-$2Cl^-$- carrier transporter.**
- Transports one Na^{2+}, one K^+, & two Cl^-.
- Active sodium absorption occurs.

- 30% filtered Na^{2+} reabsorbed.

Water reabsorption:

- **Totally impermeable to water.**
- Ascending segment also referred “Diluting” segment:
- Due to sodium & solute absorption without water.
- Resulting in tubular fluid dilution.
- **Tubular fluid is hypotonic.**

5. Iodine is transported to the thyroid gland by ?

a) Active transport

b) Diffusion

c) Passive transport

d) Pinocytosis

e) None

Correct Answer - A

Ans. is 'a' i.e., Active transport [Ref: Ganongjs 24th/e p. 3411]

Iodine uptake for thyroid hormone synthesis:

- Iodine uptake mediated by thyroid follicular cells from the blood plasma is the first step for the synthesis of thyroid hormones.
- This ingested iodine is bound to serum proteins, especially to albumins.
- The rest of the iodine which remains unlinked and free in bloodstream, is removed from the body through urine.
- Basolateral membrane of thyroid cells (follicular cells) have active transport system for iodine uptake - Na+ : I- symporter (NIS) (Secondary active transport).
- This trapping stimulated by TSH,

6. Antioxidant effects are shown by?

a) Vitamin C

b) Vitamin E

c) Selenium

d) Zinc

e) Vitamin B

Correct Answer - A:B:C:D

Ans. is'a' i.e., Vitamin C, 'b' i.e. Vitamin E, 'c' i.e., Selenium &'d', Zinc

Ref Harper's 30th/e p. 565; Robbins's th/e p. 66-67, http:/ / www.rroij. coml

Naturally occurring antioxidants:

- Alkaloids and related compounds
- Amino acids and peptide derivatives:- cysteine, tryptophan, melatonin, and tryptamine
- Vitamins: -Beta carotene, Vitamin A, Vitamin C, Vitamin E (tocopherol)
- Minerals:- selenium, zinc
- Enzymes :- catalase, superoxide dismutase (SOD), and glutathione peroxidase
- Flavonoids & Isoflavonoids: Chalcones and catechins
- Carnosine
- Clorogenic & melanic acids
- Curcumin and derivatives
- Ergothioneine
- Free phenolic acids
- Hydroquinones and quinones

- Lignans
- Lipoic acid
- Lycopene
- Tetrapyrroles
- Uric acid and other ourines

7. Right combination of sensory receptor and sensation carried by them includes?

a) Krouse's bulb - pressure

b) Pacinian corpuscels - vibration

c) Meissner's corpuscles - pressure

d) Ruffini's end organs - pressure

e) Merkel's disc - cold temperature

Correct Answer - B:D

Ans. is 'b' i.e., Pacinian corpuscles - vibration &'d' i.e. Ruffini's end organs pressure

[Ref: Guyton 12th/e p. 560 table G6.1); Principles of medical physiology p. 647, 648

Tactile (Touch) receptor:

- Whether a tactile receptor senses pressure or vibration depends on whether receptor is fastly adapting or slowly adapting.
- Touch, pressure, & vibration are different forms of same sensation.
- Pressure is felt when force applied on skin is sufficient to reach deep receptors.
- Touch is felt when force is insufficient to reach deep receptors.
- Hence, detected by superficial receptors (Merkel's disc & Meissner's corpuscle).
- Vibrations are rhythmic variations in pressure.
- I.e. Rhymic variations of force that reaches deep receptors.

Divisions:

2a. Slowly adapting:

- Examples include, "One each from superficial & deep cutaneous

receptors"

- **Ruffini's end organ -**
- **Meant to detect sustained pressure.**
- **Useless for vibrations.**
- Merkel's disk -
- Detect two-point discrimination.

2b. Rapidly adapting:

- Examples,
- "One each from superficial & deep cutaneous receptors"
- **Pacinian corpuscle -**
- Stops discharge in response to sustained pressure.
- **Useful to detect vibrations** - I.e., when pressure fluctuates rapidly**.**
- **Meissner's corpuscle -**
- **Detect surface texture.**
- Hence, Higher the rate of receptor adaptation → Greater is detectable vibration frequency.

3. Based on type of tactile sensations detected:

3a. Superficial sensations:

- Generally touch
- **By Meissner's corpuscle** (detect surface texture i.e. rough or smooth)
- By Merkel's disc (detect two-point discrimination).

3b. Deep sensations:

- **Pressure (Deep touch)** - **Detected by Rufini organ.**
- **Vibrations** - Detected by **Pacinian corpuscle.**

SUMMARY:

1. Superficial cutaneous receptors:

- Detect touch (Superficial sensation)
- **Merkel's disk - Slowly adapting & detect two-point discrimination.**
- **Meissner's corpuscle - Rapidly adapting & detect surface texture.**

2. Deep cutaneous receptors:

- Detect deep touch, pressure, & Vibration.
- **Ruffini's end organ - Slowly adapting & detect sustained pressure/deep touch.**
- **Pacinian corpuscle - Rapidly adapting & detect**

vibrations (useful only when pressure fluctuates rapidly. i.e. during vibrations).

- Higher the rate of adaptation of receptor, the greater vibration frequency it can detect.

8. TRUE regarding hypoxemia is/are?

a) Decrease in ventilation

b) Decrease in delivery of oxygen to tissues

c) Inadequate utilization of oxygen by tissues despite normal delivery of oxygen

d) Decreased oxygen pressure in blood

e) All of the above

Correct Answer - A:D

Ans is'a' i.e., Decrease in ventilation & 'd' i.e. Decreased oxygen pressure in blood.

[Ref: Ganong 25th/e p. 647 6 24/e p. 649; Principles of medical physiology p. 354, 355; https://www.ncbi.nlm.nih.gov/pmc/articles/PMc52341994]

- Option b & c are related with hypoxia, not hypoxemia.

Hypoxemia and hypoxia:

- The term hypoxia and hypoxemia are not synonymous.
- Hypoxemia is defined as a decrease in the partial pressure of oxygen in the blood whereas hypoxia is defined b! reduced level of tissue oxygenation.
- Hypoxia can be due to either defective delivery or defective utilization of oxygen by the tissues.
- Causes of hypoxemia
- The inspired air has reduced oxygen content (e.g., at high altitude or due to other causes).
- Insufficient gas exchange is caused by alveolar hypoventilation.

9. According to WHO, normal semen findings are?

a) Volume - 1.5 ml

b) Concentration - 15 million/ml

c) Progressive motility - > 40%

d) Normal morphology - > 10%

e) Ph - < 6.3

Correct Answer - A:B
Ans. is'a'i.e., Volume - 1.5 ml &'b'i.e. Concentration - 15 million/ml https://www.institutobernabeu.com/foro/en/2014/02/17/seme quality-parameters-according-to-the-world-health-organisation-who/

- The World Health Organisation (WHO) has published several editions of the “Manual for the Examination of Human Semen and Sperm-Cervical Mucus Interaction", the last one in 2010.
- The concept of "Lower Reference Limit (LRL) was established in the last manual of the WHO.
- There are many parameters obtained through a spermiogram, the most frequently studied are:
- Volume:The normal volume of an ejaculate sample after 3 /5 days of sexual abstinence is 1.5ml approximately. Lower volumes might suggest hypospermia.
- Color: Sperm is usually opalescent white, slightly yellow. When the color is altered, it is recommended to study possible causes.
- pH: Value should be greater than T.l. Lower values might be a sign of azoospermia (lack of spermatozoa) or chronic inflammatory processes.

- Sperm concentration: Normal values are around 15 million per ml eiaculated or 39 million per complete semen sample. When these values are lower it could indicate Oligozoospermia.
- Motility: The percentage of motile spermatozoa and progressively motile is analyzed. The progressive motility value should be over 32%, on the contrary it might indicate Astenozoospermia.
- Vitality: The percentage of vital spermatozoa must be over 58%. Lower values could indicate Astenozoospermia.
- Morphology: There might be 4% or more normal spermatozoa in a usual spermiogram. Lower percentages could indicate teratozoospermia.

10. Normal value of hydrogen ions in human fluids is?

a) 35 meq/L

b) 40 meq/L

c) 45 meq/L

d) 50 meq/L

e) None of the above

Correct Answer - E

Ans is 'e' i.e., None of the above

- The normal hydrogen ion concentration of blood and other body fluids is quite low <0.0001 mEq/L) compared with the body fluid concentrations of other electrolytes.
- Because it is so low, hydrogen ion concentration is measured in pH units, calculated as the negative logarithm of the concentration in milliequivalents per liter.
- Normal pH ranges from 7 .35 to 7 .45 for arterial blood and from 7 .31 to 7.41 for venous blood.

11. Which of the following play most important role in memory:

a) Synaptic network

b) Electric conduction network

c) Conductivity circuit

d) Conductivity network

e) None

Correct Answer - A

Ans: a. Synaptic Net.

[Ref: Ganong 25th/283-88; Guyton 12th/ 67; A K Jain 6th/1039-40]

- Synaptic network s single best answer "Long-term memory involves changes in the structure of neurons including growth of new processes and synapses.
- So, to the extent that you remember anything about this material on memory tomorrow, or next week, or next year, it will be because structural changes in synapses are beginning in your brains.

12. Cyanide poisoning block K influx & Na efflux. But ATP reverse this effect. So true statement(s) related to mechanism of action of cyanide is/are:

a) K influx & Na efflux is regulated by Na-K ATPase enzyme

b) K influx & Na efflux is regulated by Na-K pump

c) ATP provide energy for this channel

d) Na-K ATPase channel is ATP independent

e) None

Correct Answer - A:B:C

Ans: a. K influx & Na Efflux Is Regulated By Na-K-ATpase Enzyme b. K influx & Na Efflux Is Regulated By Na-K pump c. ATP provides energy for this channel.

[Ref: Reddy 32nd/595; Katzung 13th/1010; Guyton 12th/ 357; A K Jain 6th/459; Harrison 19th/262e-7]

Cyanide:

- Directly poisons the last step in the mitochondrial electron transport chain, cytochrome a3, which results in a shutdown of cellular energy production.
- This poisoning results from cyanide high affinity for certain metals, notably Co and Fe+++. Cytochrome a3 contains Fe+++, to which CN- binds.

Cyanide Poisoning:

- It inhibits the action of cytochrome oxidase, carbonic anhydrase & probably of other enzyme system.
- It blocks the final step of oxidative phosphorylation & prevents the

formation of ATP & its use as an energy source.

13. True about Carbon monoxide poisoning:

a) CO has 100 times more affinity than 02 for Hb

b) Cause right side shifting of 02 dissociation curve

c) Oxygen-haemoglobin saturation curve becomes hyperbolic shape

d) Pulse oximetry can accurately detect level of CO

e) 10-15% level of CO normally may occur in healthy nonsmoker

Correct Answer - C

Ans: c. Orygen-haemoglobin saturation saturation Curve Becomes Hyperbolic Shape

[Ref Ganong 25th/650-51; Guyton 12th/352; A K Jain 6th/ 431; httpst/pedclerk. bsd. uchicago. edu/page/ (www. nebi. Nlm. nih. gov)

Carbon-monoxide-poisoning:

- Carbon monoxide shifts the oxygen-haemoglobin saturation curve to the left and changes it to a more hyperbolic shape.
- Less oxygen is available for the tissues.
- plasma level of carboxyhemoglobin is normally quite low.
- At baseline, levels up to 3 percent ,nay be seen in nonsmokers, while smokers may have levels up to 10-15 % percent.
- Left shift of O2-Hb dissociation curve occur in - CO poisoning HbF, myoglobin eb decrease in body temperature.
- CO has about 240 times the affinity of O2for Hb; this means that CO will combine with the same amount of Hb as 02 when the CO partial pressure is 240 times lower.

14. Dead space is increased in:

a) Positive pressure ventilation

b) Extension of neck

c) Anticholinergic drug

d) Endotracheal tube intubation

e) Emphysema

Correct Answer - A:B:C:E

Ans: a. Positive pressure ventilation b. Extension of neck c. Anti Cholinergic drug e. Emphysema

Ref Ajay Yadav 5th/4-5; Ganong 25th/632-33; Guyton323; A Klain 6th/421

Anatomical Dead Space Increased in:

- OId age
- Neck extension
- jaw protrusion
- Bronchodilators
- Increasing lung volume (more in inspiration)
- Atropine(cause bronchodilation)
- Anaesthesia mask, circuits
- Intermittent positive pressure ventilation (IppV) & positive end expiratory pressure(PEEP)

Alveolar Dead Space increased by:

- Lung pathologies affecting diffusion at capillary membrane like interstitial lung disease, pulmonary embolism, pulmonary edema & ARDS
- General anaesthesia
- IPPV

- PEEP
- HYPotension

15. Which of the following is true about cardiac innervation:

a) T1 -T5 is sympathetic supply

b) Inferior & superior cervical ganglia not involve in innervation

c) Parasympathetic supply is from vagus nerve

d) Great cardiac nerve arise from superior cervical ganglia

e) Inferior cervical ganglia gives off Inferior cardiac nerve

Correct Answer - A:E

Ans: a. T1-T5 is sympathetic e. Inferior cervical ganglia gives off inferior cardiac nerve

[Ref: BDC 6th/ Vol. I 267;Grayb 40th/982; Guyton 12th/178; A K lain 6th/ 324]

Cardiac Innervation

- The cervical ganglia are paravertebral ganglia of the sympathetic nervous system.
- The cervical ganglion has three paravertebral ganglia.
- Superior cervical ganglion (largest) - adjacent to C2 & C3
- Middle cervical ganglion (the smallest) - adjacent to C6; target: heart,neck.
- Inferior cervical ganglion. The inferior ganglion may be fused with the first thoracic ganglion to form a single structure, the stellate ganglion adjacent to C7.
- The middle cardiac nerve (great cardiac nerve), the largest of the three cardiac nerves, arises from the middle cervical ganglion.
- Nerves emerging from chemical sympathetic ganglia contribute to the cardiac plexus.

- SymPathetic supply: T 1 to T 5 spinal segments.
- Sympathetic preganglionic fibres pass into the symPathetic trunk to superion middle & inferior cardiac ganglion
- Sympathetic postganglionic fibres passes via superior middle & inferior cardiac sympathetic nerves
- Parasympathetic supply to heart is via two vagus nerves with their cell bodies located in the medulla in the nucleus ambiguus.

16. True about cortisol level in blood plasma:

a) Morning concentration is 17-18nmol/d1

b) Morning concentration is 5-23 pg/dL

c) Evening concentration is almost half of morning concentration

d) Evening concentration is 5-23 i.ig/dL

e) None

Correct Answer - B:C
Ans: b. Morning concentration is 5-23 microg/dL c. Evening concentration is almost Half Of Morning Concentration

- Evening concentration is almost half of morning concentration (a/c below reference values).
- Cortisol concentration at 8. 00 am in morning 5-20 mcg/dL (140-550 nmol/L).

17. Saccadicc eye movement is controlled by:

a) Parietal lobe

b) Prefrontal lobe

c) Temporal lobe

d) Frontal cortex

e) Occipital lobe

Correct Answer - D

Ans: d. Frontal cortex

[Ref Ganong 25th/189, 195-96; Guyton 12tlt/786; A K Jain 1115-16]

- Normally saccadic movements are voluntary but can be aroused by peripheral visual or auditory stimuli by stimulation of frontal eye fields(area 8).
- Thus these movements are programmed in the frontal cortex.
- The bilateral frontal eye fields in this part of the cortex are concerned with the control of saccades, and an area just anterior to these fields is concerned with vergence and the near response.

18. True about normal ECG:

a) Normal PR interval is 0.12-0.20 s

b) PR internal correspondence initiation of P wave to initiation of R wave

c) QT internal correspondence initiation of Q wave to initiation of T wave

d) Normal QRS interval < 0.12 s

e) Normal QTc interval

Correct Answer - A:D

Ans: a. Normal PR interval is 0.12-0.20 s d. Normal QRS interval

[Ref: Ganong 25th/524; Guyton 12th/179-80; ECG made Easy by Hamptot 4th/6-71]

- The PR interval is measured from the beginning of P wave to the beginning of QRS complex.
- A QTc interval longer than 0. 45 s is likely to be abnormal.
- Normal QRS interval duration is no greater than 0. 12s.
- QT interval is a measure of the time between the start of the Qwave and the end of the T wave in the heart's electrical cycle.

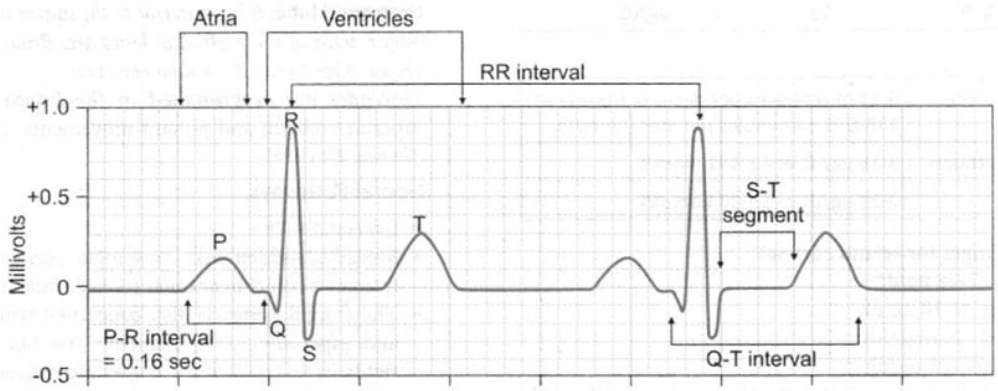


Fig *(Guyton 12th/ 179)*: Normal electrocardiogram

19. Which of the following is/are true about SIADH:

a) Desmopressin is used for treatment

b) Vasopressin level is inappropriately high

c) Plasma osmolality is higher than urine osmolality

d) Ted Osmolality of urine

e) Ted Osmolality of plasma

Correct Answer - B:D

Ans: b. Vasopressin level is inappropriately High d. Ted Osmolality of urine

[Ref Harrison 19th/2280; Ganong 25th/698; A K Jain 6th/ 673-74]

- Desmopressin is very useful in the management of diabetes insipidus.

Syndrome of Inappropriate Antidiuretic Hormone

- The syndrome of "inappropriate' hypersecretion of antidiuretic hormone (SIADH) occurs when vasopressin is inappropriately high relative to serum osmolality.
- Vasopressin is responsible not only for dilutional hyponatremia (serum sodium < 135 mmol/L) but also for loss of salt in the urine when water retention is sufficient to expand the ECF volume, reducing aldosterone secretion

Features:

- Hyposmolality
- Increased urine osmolality
- Urine osmolality becomes higher than plasma osmolality
- Urinary Na+ exceeds 20 mEq/L

20. Which of the following feature(s) is/are suggestive of nehogrnic DI in comparison to central DI :

a) Desmopressin nasal spray restore urine output to normal level

b) Basal vasopressin level > 1 pg/ml

c) Normal posterior pituitary bright spot is not visible on MRI scan

d) Change in water loss during fluid deprivation test

e) None

Correct Answer - B

Ans: b. Basal vasopressin level > 1 pg/ml

[Ref Ganong 25th/698; Guyton 12th/488-89; A K Jain 6th/674]

Failure to Produce ADH: "Central" Diabetes Insipidus.

- The treatment for central diabetes insipidus is administration of a synthetic analog of ADH, desmopressin, which acts selectively on V2 receptors to increase water permeability in the late distal and collecting tubules.
- Desmopressin can be given by injection, as a nasal spray, or orally, and it rapidly restores urine output toward normal.
- The polyuria anil polydipsia of nephrogenic DI are not affected by treatment *ith standard doses of DDAVP.

21. True stateinent (s) about Olfactory system :

a) Olfactory mucosa cover upper 1/3 of nasal cavity

b) Olfactory pathway passes via thalamus to orbitofrontal cortex

c) Adaptation to odour develop only after 1-2 minutes

d) Olfactory receptors act via cAMP

e) Rate of olfactory nerve impulses change approximately in proportion to the logarithm of stimulus strength

Correct Answer - A:B:D:E

Ans. (A) Olfactory mucosa cover upper 1/3 of nasal cavity (B) Olfactory pathway passes via thalamus to orbitofrontal cortex (D) Olfactory receptors act via cAMP (E) Rate of olfactory nerve impulses change approximately in proportion to the logarithm of stimulus strength

- Rate of olfactory nerve impulses change approximately in proportion to the logarithm oF stimulus strength.
- The olfactory receptors adapt about 5O% inthe first second or so after stlmulatlan. Thereafter, they adapt very little and very slowly.
- Adaptation: It develops within seconds on minutes, depending on the nature of the substance.
- Weber-Fechner Law states that the subjective sensation(ofodor, sound or light intensity) is proportional to the logarithm of! the stimulus intensity''
- The receptor in the olfactory mucous membrane are coupled to G-proteins.
- Olfactory regions: the Upper 1/3 of lateral walls (upto superior

concha), corresponding part of the nasal septum and the roof of the nasal cavity from the olfactory region' Here, mucous membrane Is paler in color

22. Vomiting centre (s) involved in post - operative vomiting

a) Area postrema

b) Chemoreceptor trigger zone (CTZ)

c) Reticular formation located in medulla

d) Nucleus tractus solitarius

e) Basal ganglia

Correct Answer - A:B:D

Ans. A,Area postrema B,Chemoreceptor trigger zone (CTZ) & D,Nucleus tractus solitarius

Postoperative Nausea and Vomiting (PONV):

- PONV is defined as any nausea, retching, or vomiting occurring during the first 24-48 h after surgery in patients.
- According to our current model, the brain structures involved in the pathophysiology of vomiting are distributed throughout the medulla oblongata of the brainstem, not centralized, In an anatomically defined 'vomiting centre'.
- **Such structures include the chemoreceptor trigger zone (cRTZ), Located at the caudal end of the fourth ventricle in the area postrema, and the nucleus tractus solitarius (NTS), located in the area postrema and lower pons.**
- PONV can be triggered by several perioperative stimuli, including opioids, volatile anaesthetics, anxiety, adverse drug reactions, and motion.

23. True about special anatomy and Physiology of lung :

a) Surfactant prevent collapse of small alveoli into larger one

b) Larger alveoli has more tendency to collapse than smaller alveoli in absence of surfactant

c) Surfactant decrease chance of collapse

d) Surfactant increases surface tension

e) With surfactant, large alveoli tend to become smaller and smaller ones tend to become larger

Correct Answer - A:C:E

Ans. (A) Surfactant prevent collapse of small alveoli into larger one (C) Surfactant decrease chance of collapse (E) With surfactant, large alveoli tend to become smaller and smaller ones tend to become larger

- Upper region alveoli have larger volumes.
- Already filled with air and are less compliant compared to those to dependent regions
- Low surFace tension alveoli are small - due to the presence in the fluid lining the alveoli of surfactant, a lipid surface-tension-lowering agent.
- Surfactant deficiency is an important cause of infant respiratory distress syndrome (IRDS, also known as hyaline membrane disease.
- Surface tension in the lungs of these infants is higher, and the alveoli are collapsed ln matry areas (atelectasis).

24. All are true about acromegaly except :

a) Increased IGF-1 levels

b) Excessive growth occurs before fusion of the epiphyses of the long bones

c) Somatostatin analogues can be used

d) Growth hormone levels increased

e) Transsphenoidal surgical resection is the preferred primary treatment for pituitary adenoma

Correct Answer - B

Ans. B. Excessive growth occurs before fusion of the epiphyses of the long bones

- In acromegaly, IGF-I levels are invariably high and reflect a Log-Linear relationship with clrculatlng GH concentrations.
- For acromegaly, somatostatin analogues and GH receptor antagonists are indicated
- Age-matched serum IGF-I levels are elevated in acromegaly.
- Somatostatin analogues are used as adjuvant treatment for preoperative shrinkage of large invasive macroadenomas.
- Transsphenoidal surgical resection by an experienced. surgeon is the preferred primary treatment.
- Tumors of the somatotrophs of the anterior pituitary (pituitary adenomas) secrete large amounts of growth hormone, leading to glgantbm ln chlUren and acromegaly in adults.
- Hypersecretion of growth hormone is accompanied by hypersecretion of prolactin in 20-40% of patients with acromegaly.

25. True statement (S) is/are:

a) Vasopressin increase only water reabsorption, not solute reabsorption

b) Aldosterone increase Na+ reabsorption from tubules

c) Glomerular filtrate of PCT has similar osmolarity as of plasma

d) Urine is hyperosmolar in early DCT

e) Generally urine osmolarity equals to plasma osmolarity

Correct Answer - A:B:C

Ans (A) Vasopressin increase only water reabsorption, not solute reabsorption (B) Aldosterone increase Na+ reabsorption from tubules (C) Glomerular filtrate of PCT has similar osmolarity as of plasma

- Antidiuretic hormone(ADH, Vasopressin) increases permeability of distal tubules(mild action) and collecting ducts(mainly) to water)increases water reabsorption.
- Aldosterone causes retentlon of sodlumtrom the kidney and increased urinary excretion of potassium; it has little effect on water excretion.
- PCT:The osmolality of fluids tn tubule is unchanged at approx. 3(X)mosm ie, isotonicity is maintained.
- The tubular fluid entering the DCT is always hypotonic to plasma.
- The fluid in the descending limb of the loop of Henle becomes hypertonic as water moves out of the tubule into the hypertonic interstitium.
- In the ascending limb lt becomes more dilute because of the movement of Na+ and Cl- out of the tubular lumen, and. when fluid reaches the top of the ascending lt.

- Adrenal mineralocorticoids such as aLDosterone increased tubular reabsorption of Na+ in association with secretion of K+ and H+ and also Na+ reabsorption with Cl-.

26. Rapidly adapting receptor(s) is/are:

a) Pain receptor

b) Pacinian corpuscles

c) Muscle spindle

d) Golgi tendon organs

e) Meissner corpuscles

Correct Answer - B:D:E

Ans. (B) Pacinian corpuscles (D) Golgi tendon organs (E) Meissner corpuscles

- Rapidly adapting: Rapidly adapting mechanoreceptors include Meissner corpuscle end-organs, Pacinian corpuscle end-organs, hair follicles receptors and some free nerve endings.
- Merkel's discs and Melssner's corpuscles are tactile receptors.
- They are rapidly adapting receptors.
- Pacinian corpuscles: They respond to deformation caused by firm pressure and are quietly adapting.

27. Which of the following is/are true about normal level:

a) Total Calcium: 8.5-10.5 mg/dL

b) Sodium:135-145 mmol/L

c) Potassium: 3.5-5.1 mmol/L

d) Creatinine: 0.6-2.6 mg/dL

e) TSH level: 0.1-3.1 mIU/L

Correct Answer - A:B:C

Ans. (A) Total Calcium: 8.5-10.5 mg/dL (B) Sodium:135-145 mmol/L (C) Potassium: 3.5-5.1 mmol/L

- Davidson 22ed / 1308, Harrison L9rh/2762, 2763,
- TSH -.2-4.5mU / L
- Calcium(total):8.5 - 10.5 mg/ dL
- Potassium - 3.5-5.0 meq/L
- Sodium - 136-146 meq/L
- Serum creatinine - 0.6-1.6mg/dl

28. True about Action Potential in skeletal muscle fibers and nerve fibres:

a) Skeletal muscle fibres conduction velocity is 1/4 of thick myelinated nerve fiber

b) Action potential of both qualitatively similar

c) Resting membrane potential almost same

d) Duration of action potential same in both

e) Action potential of both quantitively similar

Correct Answer - B:C

Ans. (B) Action potential of both qualitatively similar

(C) Resting membrane potential almost same

- Muscle Action Potential-Comparison with Nerve Action Potential Guyton I lth/89
- Resting membrane potential: about -80 to -90 millivolts to skeletal fibers-the same as ln large myelinated nerve fibers.
- Duration of action potential 1 to 5 milliseconds tn skeletal muscle about five times as long as in large myelinated fibers..
- Velocity of conduction:3 to 5m/sec-about 1/13th the velocity of conduction in large myelinated terae fibers that excite skeletal muscle.

29. Comprehension preserved in which of the follwing aphasia

a) Broca's aphasia

b) Conduction aphasia

c) Wernicke's aphasia

d) Gobal aphasia

e) Anomic aphasia

Correct Answer - A:B:E

Ans. A,Broca's aphasia B,Conduction aphasia & E,Anomic aphasia

	Comprehension	**Repetition of Spoken Language**	**Naming**	**Fluency**
Wernicke's	Impaired	Impaired	Impaired	Preserved or increased
Broca's	Preserved (except grammar)	Impaired	Impaired	Decreased
Global	Impaired	Impaired	Impaired	Decreased
Conduction	Preserved	Impaired	Impaired	Preserved
Nonfluent (motor) transcortical	Preserved	Preserved	Impaired	Impaired
Fluent (sensory) transcortical	Impaired	Preserved	Impaired	Preserved
				No

Isolation	Impaired	Echolalia	Impaired	purposeful speech
Anomic	Preserved	Preserved	Impaired	Preserved except for word-finding pauses
Pure word deafness	Impaired only for spoken language	Impaired	Preserved	Preserved
Pure alexia	Impaired only for reading	Preserved	Preserved	Preserved

30. Tissue elevation of which of the following cause vasoconstriction :

a) Na^+

b) K^+

c) Mg

d) Ca^{2+}

e) H^+

Correct Answer - D

Ans. D. Ca^{2+}

- **Vascular Control by Ions and Other Chemical Factors Guyton 12th(SAE)/269**
- An increase in calcium ion concentration causes vasoconstriction.
- An increase in potassium ion concentration,.within the physiological range, causes vasodilation.
- An increase in magnesium ion concentration causes powerful vasodilation.
- An increase in hydrogen ion concentration (decrease in pH) causes dilation of the arterioles.
- Anions that have significant effects on blood vessels are acetate and citrate.An Increase in carbon dioxide concentration causes moderate vasodilation in most tissues but marked vasodilation in the brain.

31. Which of the following statement (s)is/are true changes at time of ovulation:

a) GnRH level decreases

b) Gonadotropin hormone surge

c) hCG surge

d) 1‘ Prostaglandins

e) Activation of proteolytic enzymes

Correct Answer - B:D:E

Ans. B,Gonadotropin hormone surge D,1‘ Prostaglandins & E,Activation of proteolytic enzymes

Ovulation:

- The midcycle LH surge is responsible for a dramatic increase in local concentrations of prostaglandins and proteolytic enzymes in the follicular wall.
- These substances progressively weaken the follicular wall and ultimately allow a perforation to form.
- If pregnancy does occur, placental hCG will mimic LH action and continually stimulate the corpus luteum to secrete progesterone.

Feedback Effects:

- At 36-48 h before ovulation, the estrogen feedback effect becomes positive, and this initiates the burst of LH secretion (LH surge) that produces ovulation.
- Ovulation occurs about 9 after LH peak- FSH secretion also peaks, despite a small rise in inhibin, probably because of. the strong stimulation of gonadotropes by GnRH.
- During the luteal phase, the secretion of LH and FSH is low because

of the elevated levels of estrogen, progesterone, and inhibin.

32. Which of the following statements are true regarding diffusion of gas in lung -

a) Diffusion of gas is perfusion limited

b) CO, diffuses 20 times faster than 02

c) PO_2 gradient is low between alveoli & blood vessel in case of restrictive lung disease

d) Diffusion of gas is decreased in emphysema

e) Diffusion capacity of 0, is 25

Correct Answer - A:B:D:E

Ans. (A) Diffusion of gas is perfusion limited (B) CO, diffuses 20 times faster than 02 (D) Diffusion of gas is decreased in emphysema (E) Diffusion capacity of 0, is 25

Ref: Textbook of respiratory physiology 3rd ed / p 913

- Flow-limit (Perfusion - limited) Vs diffusion - limited transport:
- Diffusion of O2, CO2, N2O across the respiratory membrane are all flow (perfusion) limited.
- CO transfer is diffusion-limited - Since carbon monoxide (CO) is taken up by hemoglobin and it binds so avidly with Hb.
- Diffusion Capacity Of O2 - 2O-25 ml/min/mmHg.
- Diffusion Capacity Of CO2 - 400 ml/min/mmHg
- CO2 diffuses 15-20 times faster than O2

Diffusion of gas in emphysema:

- Emphysema Causes thickening of respiratory membrane → Causing reduced diffusion to gases.

33. Which of the following about renin angiotensin system are true -

a) Renin is produced by modified smooth muscles of glomerular capillary

b) Macula densa cells are part of this pathway

c) Angiotensinogen is converted to angiotensin by this pathway

d) Angiotensin converting enzyme is present in lung capillary endothelial cell

e) Angiotensin -II is decapeptide

Correct Answer - A:B:C:D

Ans. (A) Renin is produced by modified smooth muscles of glomerular capillary (B) Macula densa cells are part of this pathway (C) Angiotensinogen is converted to angiotensin by this pathway (D) Angiotensin converting enzyme is present in lung capillary endothelial cell

Ref: Principles of medical physiology p. 417 Ganong 25th/e p. 672-700

Juxtaglomerular apparatus:

- The juxtaglomerular aPParatus is located at the angle of the afferent and efferent arterioles, where it comes in contact with the distal tubules.
- It comprises the macula densa, juxtaglomerular (JG cells), and the lacis cells.
- Juxtaglomerular (granular) cells are modified smooth muscle cells in the scala media of the terminal part of the afferent arterioles.
- They contain large granules and secrete renin.

- Lacis cells (extraglomerular mesangial cells) that are located in the angular space between the junction of afferent and efferent arterioles & also contain some renin.
- The part of the distal tubule which comes in contact with the afferent arteriole is made of a specialized epithelium called the macula densa.

RENIN-ANGIOTENSIN SYSTEM:

- Renin is a protease enzyme which is secreted by juxtaglomerular (jG) cells of afferent arterioles.
- Most powerful stimulus for renin release is reduced renal perfusion pressure
- Lowered pressure stimulate renin release.
- Increased NaCl in distal tubules is sensed by macula densa and the signal is transmitted to JG cells.
- This results in decreased Renin release.
- Opposite occurs when decreased NaCl is delivered in distal tubule, i.e., increased renin release.
- Adenosine is probably the mediator of signal.
- JG cells are innervated by sympathetic fibers. They release renin in response to sympathetic discharge, and by circulating catecholamines.
- The renin released from the jG cells enters the circulation and acts on an alpha 2-globulin.
- Angiotensinogen (secreted by the liver to convert it into a decapeptide, angiotensin I by splitting Leucine-Valine bond of angiotensinogen.
- The enzyme angiotensin converting enzyme (ACE) then acts on angiotensin I and convert it into an octapeptide, angiotensin II, by splitting phenylalanine-histidine bond of angiotensin II.
- ACE is found on the surface of capillary endothelium of lung, therefore angiotensin II is formed on lung capillary endothelium.
- Angiotensin II is degraded into angiotensin III by splitting asparagine-arginine bond by aminopeptidase.

34. True about renal tubular system are ?

a) Ascending loop of Henle actively pumps Chloride out of tubule

b) Ascending loop of Henle actively pumps Carbonate out of tubule

c) Descending loop of Henle is permeable to water

d) Ascending loop of Henle is impermeable to water

e) Descending loop of Henle receives hypotonic solution

Correct Answer - A:C:D

Ans. (A) Ascending loop of Henle actively pumps Chloride out of tubule (C) Descending loop of Henle is permeable to water (D) Ascending loop of Henle is impermeable to water

Ref: Ganong 25th/e p.680-682

Thin descending segment (limb):

Highly permeable to water.

- Water absorption is obligatory and occurs through aquaporin-1 water channel.
- Relatively impermeable to solutes (sodium, chloride and urea).
- Therefore, only water is reabsorbed from the thin descending Henle → hypertonic fluid.
- No active secretion or reabsorption.

Thin ascending segment (Limb):

- Less permeable to water but is very much permeable to Nacl.

Thick ascending segment (limb):

- Totally impermeable to water.
- Hypotonic to plasma.
- Hence, Diluting segment.
- 30 % of filtered Na- is reabsorbed in ascending limb (60%,

reabsorbed in proximal tubule).

35. True statement about nerve muscle physiology is ?

a) Action potential traverses along T tubules

b) Contraction is mainly because of extracellular calcium

c) Rynadine receptors sense the action potiential

d) actin pulls the myosin

e) ATP binds to myosin

Correct Answer - A:C:E

Ans. (A) Action potential traverses along T tubules
(C) Rynadine receptors sense the action potiential (E) ATP binds to myosin

Excitation contraction coupling:

- Skeletal muscle fiber is innervated by A-alpha neuron.
- Carries the impulse (action potential) to neuromuscular junction where release of acetylcholine from presynaptic vesicle occurs.

Events:

- Each sarcomere has T-tubules.
- T-tubule depolarizes, conformational changes occur in dihydropyridine Receptors (DHPR) of T-tubules.
- Leads to an interaction between DHPR and Ryanodine receptors (RyR) in the terminal cisterns of sarcoplasmic reticulum.
- DHPR-RyR interaction leads to release of Ca+ ions from the terminal cisterns into the cytoplasm (sarcoplasm).
- Diffusion of Ca+ into sarcoplasm causes muscle Contraction.

Molecular events:

- **Cross-bridge cycle:**

- Cross-bridging of myosin with actin → produces bending (flexion) of myosin head → produces “Power stroke” sliding of actin on myosin and muscle contraction.

36. True about copper metabolism is are ?

a) Intestinal absorption occurs in duodenum

b) 95% bond to albumin in the serum

c) Ceruloplosmin contains 6 atoms of copper

d) Failure to Synthesize ceruloplasmin causes wilson's disease

e) Copper excretion mainly occurs in urine

Correct Answer - A:C:D

Ans. (A) Intestinal absorption occurs in duodenum
(C) Ceruloplosmin contains 6 atoms of copper (D) Failure to Synthesize ceruloplasmin causes wilson's disease
Ref: Dinesh puri 3ed/ p. 412

- Copper primarily functions as a component of metalloenzymes or proteins that participate in redox reactions.
- Adult human body contains 50-100 mg of copper of which largest amount are present in muscles (30-50mg), bones (10- 20mg), and liver (10-15 mg).

Absorption:

- Intestinal absorption of copper occurs mainly from duodenum.

Significance of Ceruloplasmin:

- From portal circulation, copper is transported to liver, bind to albumin,within hepatocytes copper is incorporated into apoceruloplasmin to form ceruloplasmin.
- Ceruloplasmin contains 6-8 atoms of copper.
- Failure to synthesize ceruloplasmin is implicated in pathogenesis of wilson disease.

Transport and excretion

- Plasma concentration of copper is 100-200 mg/dl, about 95% of

which is bound to ceruloplasmin,

- Excretion of copper mainly occurs in bile.

37. True about gas equation -

a) Gas constant is 0-9

b) PV = constant

c) PV = nRT

d) Diffusion is directly related to molecular weight of gas

e) Oxygen has more diffusion coefficient

Correct Answer - C

Ans. C. PV = nRT

Gas equation:

- The ideal gas law is quantitative expression of the foregoing principles: PV= nRT.
- Where P is the pressure, V is the volume, n is the number of gram molecules of the gas, R is the gas constant and T is the absolute temperature.
- Value of R is 0.082 (R = 0.082), when the units employed are atmosphere, litres and centigrade.
- The rate of infusion (D) is directly proportional to the pressure gradient (LP) and gas diffuses from higher pressure areas to lower pressure areas.
- Partial pressure gradient (gas pressure difference) is the basic factor which promote diffusion of a gas.
- Rate of diffusion is directly proportional to other factors also, viz. (i) Surface area of respiratory membrane (A); and (ii) Solubility of gas concerned (S).
- The rate of diffusion is inversely proportional to (i) The thickness of the respiratory membrane (d); and (ii) Molecular weight of the gas (MW).

38. True about Prostaglandins -

a) Derived from lipooxygenase pathway

b) First product is PG G2

c) PG E_2 causes vasoconstriction

d) PG F_{2a} causes bronchoconstriction

e) PG 1_2 causes fall in BP

Correct Answer - B:D:E

Ans. (B) First product is PG G2 (D) PG F_{2a} causes bronchoconstriction (E) PG 1_2 causes fall in BP

Prostaglandins (PG) synthesis:

- Prostaglandins (PGs), thromboxanes (TXs), prostacyclin (PGI) and leukotrienes are collectively called eicosanoids.
- Theses are derivatives of prostanoic acid.
- These eicosanoids are derived from 5, 8, 11, 14 eicosa tetraenoic acid (arachidonic acid), the fatty acid released from membrane lipids by the action of phospholipase-A2.

39. Which is/are feature(s) of prostaglandins -

a) 20 carbon atom compound

b) 10 carbon atom compound

c) Cyclopentane ring

d) -OH group at 15^{6} position

e) Trans double bond at 10^{th} position

Correct Answer - A:C:D

Ans. (A) 20 carbon atom compound (C) Cyclopentane ring (D) -OH group at 15^{6} position

(Ref: Harper jP/e p. 239-40; Lippincott 6h/e p. 213-15; Vasudevan 5th/e p. 167; Shinde 7/e p. 64-65; Satyanarayan 4th/e p. 664)

- Prostaglandins are 20 carbon compounds, containing a cyclopentane ring. They have hydrox (OH) group at position-15 and trans-double bond at position-13.

40. Which of the following is/are effect of increased 2,3-DPG on oxygen-hemoglobin dissociation curve?

a) ↑ ed affinity of heamoglobin to oxygen

b) ↓ ed affinity of haemoglobin to oxygen

c) Left shift of oxygen-hemoglobin dissociation curve

d) Right shift of oxygen-hemoglobin dissociation curve

e) No change in oxygen-hemoglobin dissociation curve

Correct Answer - B:D

Ans. (B) ↓ ed affinity of haemoglobin to oxygen (D) Right shift of oxygen-hemoglobin dissociation curve

[Ref: Ganong 25th/e p. 610-41; Guyton's 12'h/e p.j56-57; A K lain 6'h/e p. 430]

- Oxygen-hemoglobin dissociation curve is 2,3 DPG in RBC.
- DPG is an optional by-product of the glycolytic pathway.
- DPG binds with deoxygenated hemoglobin but not with oxygenated hemoglobin.
- Raised DPG concentration releases oxygen from oxyhemoglobin by shifting the following reversible reaction to the right.

Mechanism:

- One molecule of DPG binds with one mole of deoxyhemoglobin.
- Hence an increase in DPG concentration shifts the oxygen-hemoglobin dissociation curve to the right.
- Thus 2,3 DPG causes delivery (unloading) of O, to the tissues.
- Fetal hemoglobin has considerably less affinity for 2,3 - DPG than does adult hemoglobin therefore fetal hemoglobin has a greater

affinity for oxygen than adult hemoglobin.

- In human blood, the affinity of fetal hemoglobin for 2,3-DPG is only about 4O% that of adult hemoglobin.
- This makes fetal hemoglobin behave as if 2,3-DPG levels are low.

41. Oxygen consumption by the heart is determined by ?

a) Intramyocardial tension

b) Contractile state of the myocardium

c) Initial length of the myocardial muscle fiber

d) Heart rate

e) Basal oxygen consumption of myocardium

Correct Answer - A:B:C:D:E

Ans. (A) Intramyocardial tension (B) Contractile state of the myocardium (C) Initial length of the myocardial muscle fiber (D) Heart rate (E) Basal oxygen consumption of myocardium

[Ref: Ganong 25th/e p. 550; Guyton's 12th/e p. 216-17]

Myocardial oxygen demand - Factors influencing:

- The basal metabolism of the heart tissue normally accounts of 25% of myocardial oxygen demand in resting individuals.
- Myocytes contraction (cardiac contraction) is the primary factor determining myocardial oxygen consumption above the basal leyek and cardiac contraction accounts for 75% of myocardial oxygen consumption.
- Myocardial wall tension,
- Heart rate (Chronotropy),
- Inotropic state (contractility).
- Myocardial wall tension is directly proportional to intraventricular pressure (P) and ventricular radius (R)' and inversely proportional to myocardial wall thickness (myocardial mass).
- Intraventricular pressure (intracavitary pressure) is determined by

aortic pressure (i.e., after load) and ventricular radius is determined by end diastolic ventricular volume (i.e., Preload).

42. Insulin causes intracellular shift of which of the following ion?

a) Na^+

b) K^+

c) Chloride

d) Calcium

e) Bicarbonate

Correct Answer - B

Ans. B. K^+

[Ref: Ganong 25th/e p. 433-34; Guyton's 12'h/e p. 613; A K lain 6,h/e p.748]

- Insulin lowers serum K+ concentration i.e., causes hypokalemia.
- The hypokalemic action of insulin is due to stimulation of K+ intake by the cells mainly in muscle and adipose tissue.
- Insulin increases the activity of Na+ - K+ ATPase in cell membrane, so that more K+ is pumped into cells.

43. Hypothalmk pituitary axis (HPA) controls all except -

a) Thyroid

b) Parathyroid

c) Pancreas

d) Testis

e) Adrenals

Correct Answer - B:C

Ans. (B) Parathyroid (C) Pancreas

[Ref: Ganong 25'h/e p. 308-14; Harrison's p. 401e-2]

- Almost all secretion by the pituitary is controlled by either hormonal or nervous signals from the hypothalamus.
- Secretion from the posterior pituitary is controlled by nette signals that originate in the hypothalamus and terminate in the posterior pituitary.
- Secretion by anterior pituitary is controlled by hormones called hypothalamic releasing and hypothalamic inhibitory hormones (or factors) secreted within the hypothalamus and then conducted to the anterior pituitary through hypothalamic hypophyseal portal vessels.

44. True statement about male reproductive physiology -

a) Sertoli cells secrete Miillerian inhibiting substance (MIS)

b) Inhibin is released by sertoli cell

c) Primary spermatocyte is diploid

d) LH and FSH are steroidal in nature

e) Inhibin stimulates follicle-stimulating hormone (FSH)

Correct Answer - A:B:C

Ans. (A) Sertoli cells secrete Miillerian inhibiting substance (MIS) (B) Inhibin is released by sertoli cell (C) Primary spermatocyte is diploid

Hormones of the Testes:

- The hormone-secreting cells in the testes are the leydig cells and sertoli cells.
- Leydig cells have receptors for LH and secrete all the androgens, i.e., testosterone (majorandrogen),dihydrotestosterone (DHT), androstenedione and dehydroepiandrosterone (DHEA).
- All of them have 19 carbon atoms.
- Sertoli cells are under the control of FSH, i,e., have receptors for FSH. When stimulated by FSH, these cells secrete
- androgen binding protein (ABP), inhibinand,MIS (mullerian inhibiting substance). Sertolicells also contain aromatase;
- the enzyme that converts androgens to estrogens.
- Beside these hormonal function, junction between adjacent sertoli cells forms blood-testis barrier which does not allow harmful substances to enter the area where spermatogenesis is going on.

- Sertoli cell ako have rec4,tors for androgens (testosterone) which stimulates spermatogenesis.
- Hormonal control of testicular function.
- LH is tropic for leydig cells and the secretion of testosterone is under the control of LH.
- FSH is tropic for sertoli cell and, stimulates sertoli cells to secrete inhibin and androgen binding protein (ABP).
- Primary spermatocyte is diploid.

45. Erythropoietin is/are produced by -

a) Juxtaglomerular cells

b) Interstitial cells of the peritubular capillary bed of the kidneys

c) Pars recta of PCT

d) Macula densa

e) Mesangial cell

Correct Answer - B

Ans. B. Interstitial cells of the peritubular capillary bed of the kidneys

[Ref: Ganong 25e/e p.706; Guyton's 12e/e p. 461; A K lain 6e/e p. 68]

- Erythropoietin is a glycoprotein hormone which stimulate erythrocyte production.
- In adults, about 85% of erythropoietin comes from the kidney (interstitial cells in peritubular capillary bed) and 15% from liver (Perivenous hepatocytes). Small amount is also produced in brain; and uterus and oviduct.

46. True about carotid sinus -

a) Chemoreceptor

b) Present in early part of internal carotid artery

c) Has glomus cells

d) Baroreceptor

e) Supplied by glossopharyngeal nerve

Correct Answer - B:D:E
Ans. (B) Present in early part of internal carotid artery
(D) Baroreceptor (E) Supplied by glossopharyngeal nerve
[Ref: Ganong 25th/e p.658; Guyton's l2h/e p.251-52; A Klain6th/e p. j27-29; Gray,s4p/e p. 447]

- Carotid sinus is a little bulge at the root of internal carotid artery,
- Is a type of a baroreceptor.
- It is innervated by the sinus nerve, a branch of glossopharyngeal (IX cranial) nerve.

47. Stress hyperglycemia occurs due to all except -

a) Increased level of ACTH

b) Increased level of cortisol

c) Decreased level of norepinephrine

d) Insulin resistance

e) Increased level of epinephrine

Correct Answer - C

Ans. C. Decreased level of norepinephrine

[Ref: Ganong 25th/e p.364; Guytan's 12'h/e p-598-556; Schwartz th/e p. 17-2a; A K lain 6'h/e p. 606; Bailey 6 Love 2Ch/e p. 4'9; CSDT 1l'h/e p. 103-05]

Stress Hyperglycemia:

- Suppression of insulin secretion coupled with increased secretion of glucagon, growth hormone, glucocorticoids (cortisol), and catecholamines (epinephrine ,
- norepinephrine) leads to hyperglycemia.

48. Parasympathetic nerve stimulation results in:

a) Sphincter closure of gall bladder

b) Increased peristalsis

c) Decreased GIT motility

d) Detrusor muscle relaxation

e) Gall bladder musculature contraction

Correct Answer - B:E

Ans. (B) Increased peristalsis (E) Gall bladder musculature contraction

[Ref Ganong 25th/257-60, 24th/265; Katzung 13th 110-111]

- Parasympathetic nerves are motor to musculature of the gallbladder & bile duct, but inhibitory to the sphincter.
- Sympathetic nerves from T7-9 are vasomotor & motor to sphincters.
- The cranial outflow of the parasympathetic division supplies the visceral structures in the head via oculomotor, facial, and glossopharyngeal nerves, and those in the thorax and upper abdomen via the vagus nerves.
- Pupil - Constricted (Miosis)
- Ciliary muscle - Constricted (near vision)
- Glands (Nasal, Lacrimal, Parotid, Submandibulal Gastric Pancreatic) - Stimulation of copious secretion (containing many enzymes for enzyme-secreting glands)
- Sweat glands - Sweating on palms of hands
- Bronchial muscle - Contraction
- Gallbladder and bile ducts - Contracted

- LUmen - Increased peristalsis and tone
- Detrusor - Contracted
- Trigone - Relaxed

49. True about muscle spindle:

a) Group Ia fiber contain sensory afferent

b) Nuclear bag & nuclear chain fibers present in intrafusal muscle fiber

c) Motor supply by Aa fiber

d) Motor supply by y fiber

e) Secondary ending is stimulated by nuclear bag fiber

Correct Answer - A:B:D

Ans. (A) Group Ia fiber contain sensory afferent (B) Nuclear bag & nuclear chain fibers present in intrafusal muscle fiber (D) Motor supply by y fiber

[Ref. A.K.Jain 6th/87 3-76; Guyton 12th/ 770-73]

MUSCLE SPINDLES

- Are **"Stretch receptor"** located within a muscle.
- Yet found, intermingling with muscle fibers.
- **'Intrafusal fibers' - Specialized muscle fibers seen within spindle**

(**Note: -** Fusus refers to spindle).

Nuclear bag fibers:

- **Usually, 2 per spindle.**

Nuclear bag fiber 1 -

- With low level of myosin ATPase activity.

Nuclear bag fiber 2 -

- With high level of myosin ATPase activity.
- **Nuclear chain fibers**
- **Are thinner & shorter.**
- Four or more fibers per spindle (more than nuclear bag fibers)

Sensory/afferent innervation:

- Two afferent fiber types originate intrafusally,

Annulospiral/primary endings:

- Found wound around central region of both nuclear bag & nuclear chain fiber.
- Are "Aα"/"Ia" fibers.

Flower-spray/secondary endings:

- Innervate peripheral parts/ends of nuclear chain fiber.
- Are "Aβ"/"II" fibers.

2. Motor/efferent innervation:

- Innervates peripheral parts of both nuclear bag & nuclear chain fibers.
- Mainly by "Aγ" type/"γ-motor neurons"/"Fusimotor neuron"/"Small motor nerve system of Leksell efferents".
- Because of their characteristic smaller size.

50. Hyperbaric oxygen therapy is/are used in:

a) Radiation induced proctitis

b) Tension pneumothorax

c) Bleomycin induced lung damage

d) Gasa angrene

e) Carbon mono-oxide poisoning

Correct Answer - A:D:E

Ans. (A) Radiation induced proctitis (D) Gasa angrene (E) Carbon mono-oxide poisoning

[Ref Manipal surgery p. 176;A.K. Jain p. 461]

Hyperbaric Oxygen Therapy- Indication:

- Anaemic hypoxia especially due to carbon mono-oxide poisoning or severe blood loss)
- Stagnant hypoxia
- Histotoxic hypoxia (Radiation induced tissue injury & gas gangrene)
- CO poisoning.
- Infection (gas gangrene).
- Cancer therapy to potentiate rcdiathcrapy
- Arterial insufficiency
- Decompression sickness & air embolism

Contraindication -

- Untreated pneumothorax
- During treatment with drugs like - Bleomycin (bleomycin-induced lung
- injury), Doxorubicin (Adriamycin), cisplatin, Disulfiram.

51. Peripheral cyanosis is/are associated with:

a) SLE

b) TAPVC

c) Atrial septal defect

d) Methemoglobinemia

e) Cardiogenic shock

Correct Answer - E

Ans. E. Cardiogenic shock

[Ref: PJM 20th/16-19; Ganong 25th/642.]

Peripheral cyanosis:

- Caused by slowing of blood flow and increased extraction of oxygen from normally saturated blood.
- Results from vasoconstriction or decreased peripheral blood flow, reduced cardiac output or vascular occlusion.
- Characterized by cyanosis of skin alone and sparing of mucous membranes

Causes:

- Vasculor occlusion
- Arterial obstruction
- Venous obstruction
- Reduced cardiac output
- Cold exposure
- Redistribution of blood flow from the extremities

52. Blood in foetus is/are formed by:

a) Liver

b) Lymph nodes

c) Spleen

d) Bone marrow

e) Yolk sac

Correct Answer - A:B:C:D:E

Ans. (A) Liver (B) Lymph nodes (C) Spleen (D) Bone marrow (E) Yolk sac

- Blood formation occur later (5wk) throughout embryonic mesenchyme, then liver, spleen/thymus, bone marrow lymph node (ref: embryology.mrd.unsw.au).
- Formation of blood include formation of RBC, WBC & platelet.
- Blood production starts from 3rd week of intrauterine life.
- 3rd week to 3rd month (intravascular phase) - Erythropoiesis occurs in the mesoderm of yolk sac
- B/w 3rd to 5th month of intrauterine life, erythropoiesis occur principally in the liver (to some extent in the spleen).
- 5th month onwards (myeloid phase) = Erythropoiesis occurs in red bone marrow (all marrow is red bone marrow at this stage)

53. Important buffer system operating in blood:

a) Protein system buffer

b) Phosphate buffer

c) Carbonic acid- Bicarbonate system buffer

d) Hemoglobin system buffer

e) None

Correct Answer - A:C:D

Ans. (A) Protein system buffer (C) Carbonic acid- Bicarbonate system buffer (D) Hemoglobin system buffer

[Ref A.K.Jain 6th/ 5 59-60,55; Ganong 25th/643 -44]

- Acid and base shifts in the blood are largely controlled by three main buffers in blood: (1) proteins, (2) hemoglobin (3) the carbonic acid-bicarbonate system
- More than 90% of blood's capacity to buffer carbonic acid is attributed to the haemoglobin buffer system.
- Carbonic acid-bicarbonate system is one of the most effective buffer systems in the body.
- In plasma, phosphate concentration is too low for this system to be a quantitatively important buffet but it is important intracellularly.

54. Pepsinogen, the inactive form of pepsin, is secreted by:

a) Interstitial cell of Cajal

b) Chief cell

c) Paneth cell

d) Goblet cell

e) Zymogen Cells

Correct Answer - B:E

Ans. (B) Chief cell (E) Zymogen Cells

[Ref Ganong25th/456,24th/457-59]

- The gastric mucosa contains many deep glands.
- In the pyloric and cardiac regions, the glands secrete mucus.
- Body of the stomach, including the fundus, the glands contain parietal (oxyntic) cells, which secrete hydrochloric acid and intrinsic factor, and chief (zymogen, peptic) cells secreting pepsinogen.

55. Type IIB muscle fibers are different from type I fiber with having:

a) Small diameter

b) Calcium reWlease by sarcoplasmic reticulum is low

c) Fast fatigable

d) Color pink

e) Faster acting

Correct Answer - C:E

Ans. (C) Fast fatigable (E) Faster acting

[Ref Ganong 25th/108, 24th/107t 23rd/103]

Classification Erlanger & Gasser	**Lloyd & Hunt**	**Characteristics of fibers**	**Function**
A alpha	I	Diameter - 13-20 Myelination - **Heavily myelinated & thick** Conduction - 70-120 (**maximum velocity)**	• **Proprioception -** ◦ Due to fiber thickr • **Motor supply to skeletal muscle (extrafusal to muscle spindle)**
A beta	II	**Diameter - 4-13** Myelination - Present	• Touch • **Kinesthesia**

		Conduction - 25-70	• Pressure
A gamma	- No comparable ent Diameter - 3-6 Myelination - Slightly myelinated Conduction - 15-30ity -	Diameter - 3-6 Myelination - Slightly myelinated Conduction - 15-30	• Motor supply to intrafusal muscle fibers (Muscle spindles)
A delta	III	**Diameter - 1-5** Myelination - Some myelination Conduction - 5-30	• **Pain - "Fast/Epicritic/Fi pain.** • Since fibers are relatively fast • Temperature • Pressure • Touch
B fiber	- No comparable entity -	Diameter - 1-3 Myelination - Some myelination Conduction - 3-14	• **Preganglionic autonomic fibers** • (both sympathetic parasympathetic)
C fiber	IV	Diameter - 0.2-1.0 **Myelination - Unmyelinated** Conduction - 0.2-2 (**minimum**)	◦ **Pain - Slow pain ("Protopathic /Second pain)** • **Temperature** • **Pressure** • **Postganglionic autonomic fibers**

56. Which of the following is true about myoglobin:

a) Bind 1 mol of oxygen per mole of myoglobin

b) Dissociation curve is a rectangular hyperbola

c) Its curve lies right of the hemoglobin curve

d) Bind oxygen at low P02 pressure

e) Show Bohr effect

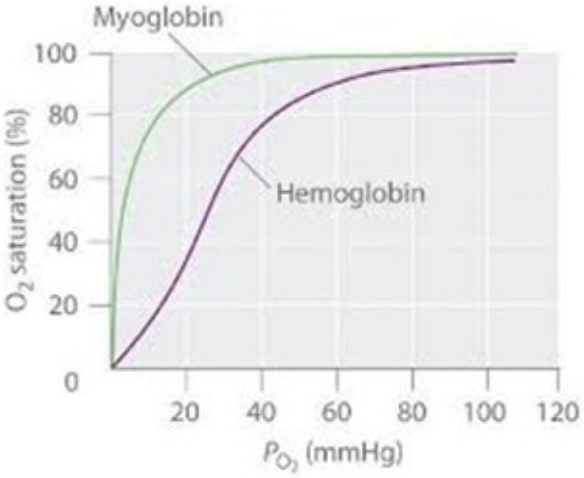
Correct Answer - A:B:D

Ans. (A) Bind 1 mol of oxygen per mole of myoglobin (B) Dissociation curve is a rectangular hyperbola (D) Bind oxygen at low P02 pressure

Ref Ganong 25th/641-42, 24th/643-zt4; Guyton 12th/96

Myoglobin:

- Iron-containing pigment found in skeletal muscle.
- Contains one heme group with one polypeptide chain.
- Resembles hemoglobin, but myoglobin binds 1 rather than 4 mol of O2 mole.
- Its dissociation curve is a rectangular hyperbola rather than a sigmoid curve.
  ? Because it's curve is to the left of the hemoglobin cune, as it takes up O2 from hemoglobin in the blood.
- Does not show Bohr effect.


Myoglobin
Hemoglobin
100
80
60
40
20
0
O_2 saturation (%)
20
40
60
80
100
120
P_{O_2} (mmHg)

57. Vasomotor inputs to rostral nuclesus of ventomedial medulla is/are from:

a) Inhibitory input from caudal ventrolateral medulla

b) Excitatory inputs from cerebral cortex via hypothalamus

c) Inhibitory inputs from cerebral cortex via hypothalamus

d) Inhibitory inputs from brain stem reticular formation

e) Inhibitory inputs pain pathway

Correct Answer - A:B:C

Ans. (A) Inhibitory input from caudal ventrolateral medulla
(B) Excitatory inputs from cerebral cortex via hypothalamus
(C) Inhibitory inputs from cerebral cortex via hypothalamus
[Ref Ganong 25th/587-89, 24th/589-91]

Medullary control of the cardiovascular system:

- One of the major sources of excitatory inPut to sympathetic nerves controlling the vasculature is a group of neurons located near the pial surface of the medulla in the Rostral Ventrolateral Medulla (RWM).
- This region is sometimes called a vasomotor area
- Neurovascular compression of the RVLM has been linked to some cases of essential hypertension in humans
- The activity of RVLM neurons is determined by many factors

Factors affecting the activity of RVLM

Excitatory inputs:

- Cortex vio hypothalamus, mesencephalic periaqueductal gray, brain stem reticular formation, pain pathway, somatic afferent (somatosympathetic reflex), Carotid & aortic chemoreceptors

Inhibitory inputs:

- Cortex vid hypothalamus, caudal ventrolateral medulla, caudal medullary raphe nuclei, lung inflation afferents; carotid, aortic & cardiopulmonary baroreceptors

58. For Growth hormone testing, which of the following stimulate the secretions of Growth hormone:

a) Glucagon

b) Insulin

c) Cortisol

d) Water deprivation

e) Arginine

Correct Answer - A:E

Ans. (A) Glucagon (E) Arginine

[Ref: Ganong 25th/328-29,24th/330-32; Guyton 12th/555-56;]

GH Testing:

Stimulate Growth Hormone:

- Decreased blood glucose
- Decreased blood free fatty acids
- Increased blood amino acids (arginine)
- Starvation or fasting
- Protein deficiency
- Trauma
- Stress
- Excitement
- Exercise
- Testosterone
- Estrogen
- Deep sleep (stages ll and lV)
- Growth hormone- releasing hormone

- Ghrelin

59. Which of the following are feature of blood-brain barrier:

a) Thick basement membrane

b) Podocyte

c) Closely associated layer of astrocyte

d) Tight junction

e) Decreased vesicles in endothelial cells

Correct Answer - A:C:D:E

Ans. (A) Thick basement membrane (C) Closely associated layer of astrocyte (D) Tight junction (E) Decreased vesicles in endothelial cells

Ref; Ganong 25th/671, 24th/604-06; Guyton 12th/816-17

Blood-brain barrier (BBB):

- Barriers exist both at the choroid plexus and at the tissue capillary membranes in essentially all areas of the brain parenchyma except in some areas of the hypothalamus, pineal gland, and. area postrema where substances diffuse with greater ease into the tissue spaces.
- Cause of the low permeability of the blood-brain barrier is the manner in which the endothelial cells of the brain tissue capillaries are joined to one another.
- They are joined by so-called tight junctions.
- That is, the membranes of the adjacent endothelial cells are tightly fused rather than having large slit-pores between them, as is the case for most other capillaries of the body.
- Glial cells are derived from neuroectoderm (macroglia: astrocytes,

oligodendrocytes, ependyma) or from bone marrow (microglia).

- Glial cells (astrocytes) form a layer around brain blood vessels and may be important in the development of the 8BB.
- Astrocytes may be also be responsible for transporting ions from the brain to the blood

60. Which of the following statement is/are true regarding Fick principle of measurement of cardiac output:

a) Cardiac output is calculated by amount of oxygen consumed by whole body per unit mass divided by A-V Oxygen difference across the lung

b) Oxygen concentration in artery is measured by passing catheter to Pulmonary artery

c) Mixed venous blood is measured by inserting catheter into pulmonary artery

d) Rate of oxygen absorption by the lungs is measured by spirometry

e) For oxygen content of artery, any artery of body can be chosen

Correct Answer - A:C:D:E

Ans, (A) Cardiac output is calculated by amount of oxygen consumed by whole body per unit mass divided by A-V Oxygen difference across the lung (C) Mixed venous blood is measured by inserting catheter into pulmonary artery (D) Rate of oxygen absorption by the lungs is measured by spirometry (E) For oxygen content of artery, any artery of body can be chosen

[Ref: Ganong 25th/543-44, 24th/546-47; A.K. Iain 5th/356; Guyton1 lth /244]

Cardiac Output Measurement:

- Fick principle states that the amount of a substance taken up by an organ (or by the whole body) per unit of time is equal to the arterial level of the substance minus the venous level (A-V difference) times

the blood flow.

- Principle can be used to determine cardiac output by measuring the amount of O, consumed by the body in a given period and dividing this value by the A-V difference across the lungs.
- In applying this Fick procedure for measuring cardiac output in the human being, mixed venous blood is usually obtained through a catheter inserted up the brachial vein of the forearm, through the subclavian vein, down to the right atrium, and, finally, into the right ventricle or pulmonary artery.
- Rate of oxygen absorption by the lungs is measured by the rate of disappearance of orygen from the respired air, using any type of oxygen meter (e.gclose circuit spirometry)
- Because systemic arterial blood has the same O2 content in all parts of the body, the arterial O2 content can be measured in a sample obtained from any convenient artery.

61. Feature (s) of hyperprolactinemia is/are all except:

a) Amenorrhoea

b) Decrease milk production

c) Galactorrhoea

d) Hypogonadotropic hypogonadism

e) Hypothyroidism may cause hyperprolactinemia

Correct Answer - B

Ans. B. Decrease milk production

[Ref: Ganong 25th/331-33, 24th/334-35; A.K. Iain 5th/695-96; Guyton 11 th / 907, 9 1 8-92 1, I 039-40;CMDT 20 1 6/ 1 096-97, 06/ 1113- 14]

Hyperprolactinemia:

- Due to any cause may result in hypogonadotropic hypogonadism.
  - Hypogonadotropic hyPogonadism often develops in patients with hyperprolactinemia; it may be reversed with treatment of hyperprolactinemia.
- Women may note oligomenorrhoea or amenorrhoea.
- Galactorrhoea, defined as Lactation in absence of nursing, is common.
- Prolactin deficiency inhibits postpartum lactation.
- Primary hypothyroidism is associated with mild hyperprolactinemia, probably because of compensatory TRH secretion

62. Which of the following is/are Pain scale:

a) McGill Pain Questionnaire

b) Visual analogue scale

c) Coloured Analogue Scale

d) All of the above

e) None of the above

Correct Answer - D

Ans. A,McGill Pain Questionnaire B, Visual analogue scale & C, Coloured Analogue Scale

List of Pain Measurement Scales:

- Wong-Baker FACES Pain Rating Scale
- Visual analog scale (VAS)
- McGill Pain Questionnaire (MPQ)
- Neck Pain and Disability Scale -NPAD
- Lequesne algofunctional index.
- Behavioral Pain Scale (BPS)
- Brief Pain Inventory (BPI)
- Clinical Global Impression (CGI)
- Critical-Care Pain Observation Tool (CPOT)
- COMFORT scale
- Faces Pain Scale -Revised (FPS-R)

63. True about Oxytocin:

a) Secreted from anterior pituitary

b) Secreted by posterior pituitary

c) Decapeptide

d) Gonadotropin releasing hormone (GnRH) stimulate its secretion

e) Cause milk ejection by contraction of myoepithelium of breast

Correct Answer - B:E

Ans. (B) Secreted by posterior pituitary (E) Cause milk ejection by contraction of myoepithelium of breast

[Ref: Ganong 25th/311-13, 24th/311-l3; Guyton p918, 1040-41, 928]

Oxytocin:

- Stimulates postpartum milk let down in response to suckling.
- Nonapeptide (9 amino acids).
- Differs from AVP only at positions 3 and 8.
- Relatively little antidiuretic effect and seems to act mainly on mammary ducts to faci-litate milk let down during nursing.
- May help initiate or facilitate labor by stimulating contraction of uterine smooth muscle, but it is not clear if this action is physiologic or necessary for normal delivery.
- Gonadotropin-releasing hormone (GnRH): It is secreted from hypothalamus & stimulates secretion of FSH & LH.

64. True about hormone sensitive lipase:

a) Activity is increased by insulin

b) Found intracellular

c) Activated by Epinephrine

d) Located in wall blood capillaries

e) None

Correct Answer - B:C

Ans. B,Found intracellular & C, Activated by Epinephrine

[Harper 30th/ 261 -62, 28th/ 220]

Hormone-sensitive lipase:

- Hormone-sensitive lipase is activated by ACTH, TSH, glucagon, epinephrine, norepinephrine, and vasopressin and inhibited by insulin, prostaglandin E1, and nicotinic acid
- Triacylglycerol undergoes hydrolysis by a hormone- sensitive lipase to form free fatty acids and glycerol.
- This lipase is distinct from lipoprotein lipase, which catalyzes lipoprotein triacylglycerol hydrolysis before its uptake into extrahepatic tissues.

65. Which of the following is true regarding GLUT-5:

a) Present in brain

b) Present in Adipose tissue, skeletal muscle & skin

c) Insulin mediated transporter

d) Sodium independent transport

e) Present in RBC

Correct Answer - D

Ans. (D) Sodium independent transport

[Ref: Ganong 25th/435, 24th/435; Harper 30th/ 19 1, 28th/ 17 1; Lippincott Biochemistry 4th/97]

- GLUT-5 is unusual in that it is the primary transporter for fructose (instead of glucose) in the small intestine & the testes.
- Has sodium independent facilitated diffusion mechanism.

66. True statement relating to compliance of lung:

a) Increased by surfactant

b) Decreased in emphysema

c) At height of inspiration compliance is less

d) It can be measured by measuring intrapleural pressure at different lung volume

e) None

Correct Answer - A:C:D

Ans. (A) Increased by surfactant (C) At height of inspiration compliance is less (D) It can be measured by measuring intrapleural pressure at different lung volume

[Ref: Ganong 25th/629-32,24th/629-33; Guyton llth /473-75; A. K. Jain 5th/437]

Lung compliance:

- Measured by measuring intrapleural pressure at different lung volume.
- An important factor affecting the compliance of the lungs is the surface tension of the film of fluid that lines the alveoli.
- Deficiency of surfactant-less compliance; more surfactant-more compliance.
- Compliance decreases with the inflation of the lungs as more pressure is required to distend the already distended lung.
- The curve is shifted downward and to the right (compliance is decreased) by pulmonary congestion and interstitial pulmonary fibrosis; pulmonary fibrosis is a progressive disease of unknown

cause in which there is stiffening and scarring of the lung.

- The curve is shifted upward and to the left (compliance is increased) in emphysema.

67. True about Hering-Breuer reflex:

a) Signal initiated through mechanoreceptor receptors of lung

b) Signal initiated through Chemoreceptor of lung

c) Signal initiated through Carotid & aortic body

d) Transmit signals through the vagus nerve

e) None

Correct Answer - A:D

Ans, (A) Signal initiated through mechanoreceptor receptors of lung (D) Transmit signals through the vagus nerve

[Ref: Ganong 25th/662, 24th/664; Guyton 12th/372; A.K.lain 5th/461, 463,465]

Hering-Breuer inflation Reflex-Lung inflation Signals Limit Inspiration:

- Hering-Breuer inflation reflex is an increase in the duration of expiration produced by steady lung inflation, and the Hering-Breuer deflation reflex is a decrease in the duration of expiration produced by marked deflation of the lung.
- In human beings, the Hering-Breuer reflex probably is not activated until the tidal volume increases to more than three times normal (greater than about 1.5 liters per breath).

Lung Inflation Signals Limit Inspiration-The Herireuer Inflation Reflex:

- Stretch receptors to mechanoreceptor class.
- Stretch receptors, located in the muscular portions of the walls of the bronchi and bronchioles throughout the lungs, transmit signals through the vagi into the dorsal respiratory group of neurons when the lungs become overstretched.

68. True about blood supply of kidney:

a) Flow is 600 ml/min each kidney

b) It receives more blood supply per unit mass than the brain

c) Renal medulla have more supply than renal cortex

d) It is under direct sympathetic control

e) None

Correct Answer - A:B:D

Ans. (A) Flow is 600 ml/min each kidney (B) It receives more blood supply per unit mass than the brain (D) It is under direct sympathetic control

[Ref: Ganong 25th/602, 674, 24th/676-77; Guyton 12th/466-67]

- Essentially all the blood vessels of the kidneys, including the afferent and efferent arterioles, are richly innervated by sympathetic nerve fibers.
- Blood flow to the two kidneys is normally about 22 percent of the cardiac output, or 1100 ml min
- The outer part of the kidney, the renal cortex, receive most of the kidney's blood flow.
- Blood flow in renal medulla accounts for only 1 to 2% of the total renal flow
- On a per-gram-weight basis, the kidneys normally consume oxygen at twice the rate of the brain but have almost seven times the blood flow of the brain.
- In a resting adult, the kidneys receive 1.2-1.3 L of blood per minute, or just under 25% of the cardiac output

69. All are true about Brunner's gland except:

a) It lies in duodenum only

b) It lies in duodenum & ileum

c) It secretes bicarbonate rich fluid

d) It secretions neutralizes acidic pH of stomach

e) Secretes mucus rich fluid

Correct Answer - B

Ans. B. It lies in duodenum & ileum

[Ref Guyton 12th/400; A.K.lain 5th/202-03]

Brunner's Gland:

- Sub-mucous glands & are tortuous, long & penetrate the muscularis mucosa
- Drains into the crypts of lieberkuhn.
- Numerous in first part of duodenum (duodenal cap or bulb) meager below the common opening of bile & pancreatic ducts.
- Ingestion of fatty food or secretin injection produces large volume of thick alkaline mucous secretion which probably helps to protect the duodenal mucosa from the gastric acid.
- In the duodenum there are in addition the small, coiled acinotubular duodenal glands (Brunn er's glands

Functions:

- Protects the duodenal wall from digestion by the highly acidic gastric juice emptying from the stomach.
- Mucus contains a large excess of bicarbonate ions, which add to the bicarbonate ions from pancreatic secretion and liver bile in neutralizing the hydrochloric acid entering the duodenum from the stomach"

70. Oxygen binding to hemoglobin cause allosteric activation. This allosteric property of Hb results in :

a) Maintaining iron in ferrous state (Fe2+)

b) Increase oxygen supply to tissue

c) Increases oxygen binding

d) Increases 2,3-DPG in blood

e) None

Correct Answer - B:C

Ans. (B) Increase oxygen supply to tissue (C) Increases oxygen binding

[Ref Harper 30th/ 5 4- 5 5, 29th/ S0 - 5 1 ; Ganong 2 STH/ 6 39 -4 I, 24th/ 64 I - 44; Guyton 12th/353-56; A.KIain 5th e/p.57]

- The iron in haem ls in fenous state (Fe2+) form.
- Each Fe2+ combine loosely & reversibly with one molecule of oxygen.
- Combination of haem with oxygen is called oxygenation & not oxidation, because after combination with orygen, iron in haem stay in Fe2+ state

Oxygenation of Hemoglobin Triggers Conformational Changes in the Apoprotein:

- Hemoglobins bind four molecules of 02 per tetramer, one per heme.
- A molecule of O2 binds to a hemoglobin tetramer more readily if other O2 molecules are already bound.
- Termed cooperative binding, this phenomenon permits hemoglobin to maximize both the quantity of O2 loaded at the PO2 of the lungs

and the quantity of O_2 released at the PO_2 of the peripheral tissues.

- The Allosteric Properties of Hemoglobins Result froM Their Quaternary Structures.
- The properties of individual hemoglobins are consequences of their quaternary as well as of their secondary and tertiary structures.
- The quaternary structure of hemoglobin confers striking additional properties, absent from monomeric myoglobin, which adapts it to its unique biological roles.

71. Calcitriol in children is formed in:

a) Glomerulus

b) Bowmann capsule

c) PCT

d) DCT

e) Collecting duct

Correct Answer - C

Ans. (C) PCT

[Ref: Ganong 25th/ 377 -7 8, 24th/ 46 1 Nelson 19th/ 204; A.K.lain Sth/ 7 30: OP Ghai 8th/112]

- Calcitriol is produced in the cells of the proximal tubule of the nephron in the kidneys by the action of 25-hydroxyvitamin D3 1-alpha-hydroxylase, a mitochondrial oxygenase and an enzyme which catalyzes the hydroxylation of 25-hydroxycholecalciferol (calcifediol).
- The actIVIty of the enzyme is stimulated by pTH.
- The reaction is an important control point in Ca2+ homeostasis.

72. Secretion of insulin is increased by:

a) Fatty acid

b) Aminoacid

c) Adrenaline

d) Acetylcholine

e) Somatostatin

Correct Answer - A:B:D

Ans. (A) Fatty acid (B) Aminoacid (D) Acetylcholine

[Ref Ganong 25TH/439, 24th/441; Guyton 12th/615]

Increase insulin Secretion:

- Increased blood glucose
- increased blood free fatty acids
- Increased blood amino acids
- Gastrointestinalhormones (gastrin, cholecystokinin, secretin, gastric inhibitory peptide)
- Glucagon, growth hormone, cortisol
- Parasympathetic stimulation; acetylcholine
- Beta-adrenergic stimulation
- Insulin resistance; obesity
- Sulfonylurea drugs (glyburide, tolbutamide)

73. True about carbohydrate metabolism:

a) It supplies 4 kcals per gram

b) It increases insulin secretion

c) Stored in liver

d) In starvation glycogen in liver is exhausted only after 24-48 hr

e) It provide 80% calorie need of body

Correct Answer - A:B:C:E

Ans. A,It supplies 4 kcals per gram B,It increases insulin secretion C,Stored in liver & E,It provide 80% calorie need of body

[Ref: Harper 30th/176; Park 23rd/613; Lippincott Biochemistry 6th/329: Ganong 25TH/24, 24th/441; A.KIain 5th/622-29]

Carbohydrate metabolism:

- After 12 to 18 hours of fasting, liver glycogen is almost totally depleted.
- The liver serves as receiving, manufacturing, storing & distributing centre for glucose.
- Liver glycogen is nearly exhausted after 10-18 hour of fasting.
- Provides 4 k/cals per grams (protein-4; fat-9; dietary fibre-2)
- The main source of energy in diets is carbohydrates are carbohydrates derived largely from cereals.
- These cereals constitute about 80% of our diet & provides 50-80% of daily energy intake.

74. Nerve velocity is increased by:

a) Myelination

b) Smaller axon diameter

c) Decreased temperature

d) Increase in intracellular calcium

e) Increase in extracelluar sodium

Correct Answer - A
Ans. A. Myelination
[Ref Ganong 25TH/94, 24th/91; Guyton 12th/72-7j; A.K'lain 5th/147]
Greater the diameter of a given nerve fibre, the greater is its speed (because a large fiber offers less resistance to high current.
In myelinated fibres, the speed of conduction is approximately 6 times the fiber diameter.
The diameter of myelinated fibers range from 1-20 micro/m, therifore conduction velocity varies from 6-120 mts/sec