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AIIMS 2017

AIIMS November 2017



Highlights

- For the First time Two Leading Educationists (Dr Thameem Saif and Dr Apurv Mehra) have together compiled this to the point precise and crisp content backed up with their knowledge and experience of more than one decade.
- The content has been prepared by Subject Specialists (Team MedMiracle)
- The Book terms with support at MedMiracle.in, MedMiracle App and MedMiracle Facebook Page Being handled by The Team MedMiracle.

Thameem Saif
Apurv Mehra

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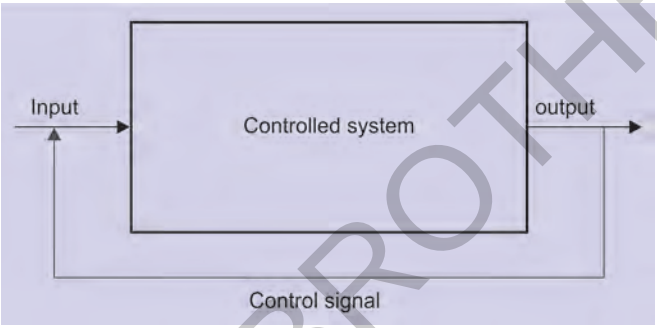
9. There are two kinds of loop control systems encountered in homeostasis. Feed forward homeostasis can be seen for:

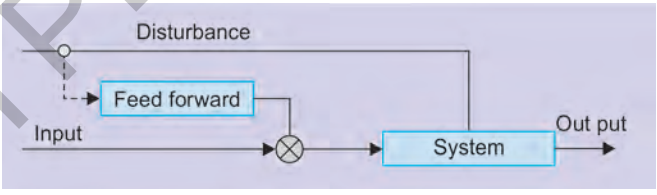
a. Blood pressure
b. pH
c. Blood volume
d. Temperature

Ans. d. Temperature

1. **Feedback system:** Feedback occurs when outputs of a system are routed back as inputs as part of a chain of cause-and-effect that forms a circuit or loop.



2. **Feed-forward system**: In this system, the disturbances are measured and accounted for before they have time to affect the system. That is, anticipatory changes are made before the disturbance causes any change in the output. This system has some prerequisites, like how the system works and measurement of the changes caused by the feedforward on the output, since the control variable adjustment is not error-based.



At first glance, the temperature regulation in the body appears to be a pure feedback system. This is because there are skin temperature sensors which send feedback to the hypothalamus' core temperature sensors and cause suitable compensatory effects on the body. However, the **thermal inertia of the core sensors is too great** to rely on feedback alone. Thus, reflex responses to changes in the average skin temperature may be thought of as anticipatory rather than negative feedback in nature.

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The correct answer is **(d) Temperature**.

Other examples under control of positive feedback mechanisms are:

- Clotting of blood (Thrombus formation)
- Ca^{2+} entry into sarcoplasmic reticulum
- LH surge during ovulation
- Action potential
- Shock
- Parturition

(a), (b) and (c) are incorrect because they are controlled mainly through feedback regulation.

10. Which of the following functional proteins are not seen in the region marked in the image shown?



a. Macula adherens
b. Fascia adherens
c. Connexons
d. Zona occludens

Ans. d. Zona occludens

The image shown is of cardiac muscle cell and the arrow points towards the intercalated discs seen in cardiac muscle cells.

Epithelial cell to cell contacts can be of four types:

Tight junctions (Zonula occludens): The claudins, a large family of proteins, are the principal structural elements of the tight junction.

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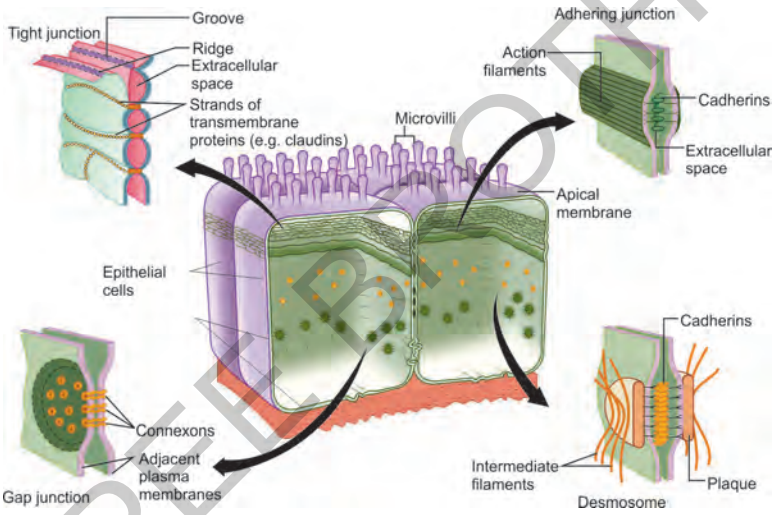
Adhering junction (Zonula adherens): An adhering junction (or zonula adherens) is a belt that encircles an entire epithelial cell just below the level of the tight junction. These junctions provide clues to the cell about which end is up, and what its neighbours are. Cadherins are the chief proteins in this junction.

Desmosomes: A desmosome (or macula adherens) holds adjacent cells together tightly at a single, round spot. The chief proteins are once again cadherins, with intermediate filaments radiating from that round spot.

Gap junctions: These channels, composed of connexons, are channels which connect the cytosol of two adjacent cells, allow small molecules to pass freely through them.



Cardiac muscle cells have a unique histological feature called intercalated discs. These are composed of three kinds of cell-cell junctions: gap junctions, desmosomes and fascia adherens. Gap junctions are to ensure that the heart acts as a functional syncytium. Desmosomes hold the cells together when the heart contracts. Fascia adherens are an analog of adhering junctions in the heart, which also act as anchors for actin. The answer is, hence, **(d) Zonula occludens**, because that is the only type of junction not present.

11. In an excitable tissue, three freely permeable ions X, Y, Z are present. If no electrogenic cell pumps are working and the current of X is - 30 & Y is – 50 then at resting membrane potential what is the current of Z ion.

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a. –40 b. +20
c. –20 d. +80

Ans. d. +80

Resting membrane potential:
It is the static/ground state of a membrane where the net transmembrane electrical flux is zero.

That is, the net current across the membrane is zero.

This makes the rest of the question very easy.

$$I_x + I_y + I_x = I_{total} = 0$$

Hence, I_z is $-(I_x + I_y)$

$$I_z = [-(-30) + (-50)]$$

$$I_z = \textbf{+80 units}$$

12. Slow wave potentials in GIT are produced by

a. Smooth muscle b. Myenteric plexus
c. Parasympathetic stimulation d. Interstitial cells of Cajal

Ans. d. Interstitial cells of Cajal

There are two kinds of movements of the intestine:

1. Mixing movements: These movements are used for mixing the contents of the chyme. They have very little propulsive activity.
2. Propulsive movements: These movements are for moving the contents of the gut in the anal direction.

The movements of the GI are due to an integrated effect of two kinds of electrical activities:

a. Basic Electrical Rhythm or slow wave potentials:
   - These are not action potentials.
   - They are slow undulating intrinsic changes in the resting membrane potential.
   - They are caused by complex interactions between smooth muscle cells and pacemaker activity of **interstitial cells of Cajal.**
   - They do **not** cause contractions of the gut. They merely set the rhythm for the action potentials to cause contractions.

b. Spike potentials or true action potentials:
   - These are true action potentials.
   - They are superimposed on the upstroke of the slow wave potentials.
   - They are caused by influx of Ca^{2+} into the smooth muscle cells.
   - Their frequency is modulated by several external factors like stretch, acetyl choline and epinephrine.

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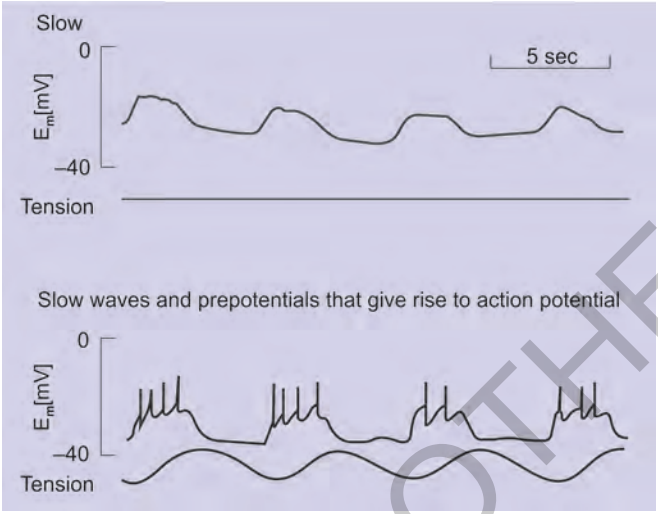
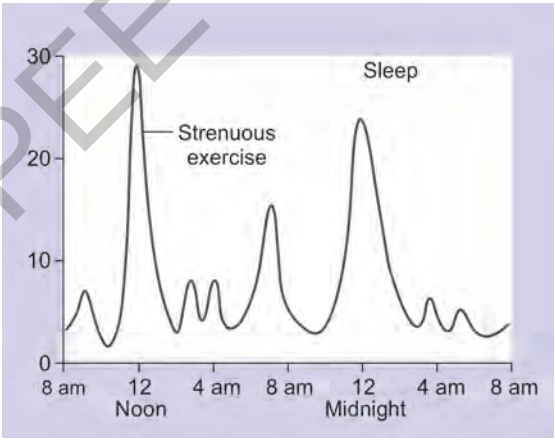


They cause contraction of the gut.
Thus, the answer to the question is **(d) interstitial cells of Cajal.**

13. The blood levels of a hormone are elevated during exercise and sleep as shown. Which hormone fits the description



a. GH
b. Insulin
c. Cortisol
d. Thyroid

Ans. a. GH

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The only hormone out of the given options which increases both during sleep and exercise is **growth hormone**.

Growth hormone is secreted in pulses.

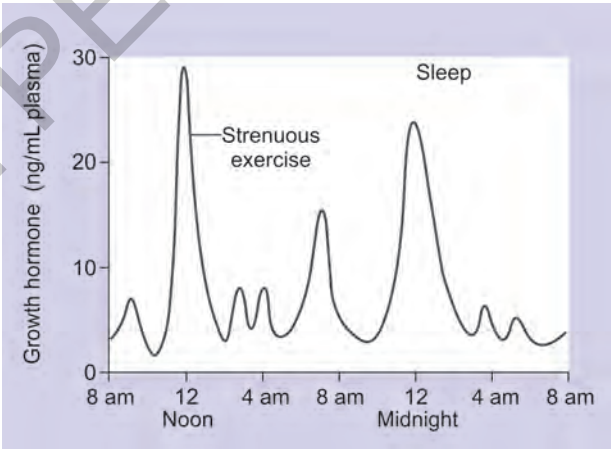
To understand the factors which affect secretion of growth hormone, we must first understand its functions and physiological effects.

a. First, growth hormone, obviously, causes growth. This phenotypic effect is mediated by several metabolic changes:
   - Increased protein formation in the tissues.
   - Increased utilisation of fat deposits by mobilising them into the blood.
   - Increased blood concentration of glucose (this diabetogenic effect is thought to be a consequence of the insulin resistance caused by increased fatty acids in blood)
   - All of these changes cause an increase in lean body mass.

b. Also, it has been seen that GH regulation by hypothalamus is done in a region which also responds to starvation. Thus it is reasonable to believe that some of the same signals that modify a person's behavioral feeding instincts also alter the rate of growth hormone secretion.

d. These factors explain the following regulators of GH secretion:

Factors which increase GH	Factors which decrease GH
Decreased blood glucose	Increased blood glucose
Decreased blood free fatty	Increased blood free fatty acids
Hypoglycaemia in acute conditions	Hyperglycemia
Starvation	Obesity



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Some other rather inexplicable factors include **slow wave sleep** (classic of GH) and **exercise**.

The other options do not show this pattern of secretion.

14. Potassuim homeostasis is not affected by:

a. Epinephrine →↑ Na+ K+pump action
b. Large plasma osmolality change
c. Insulin → K+ efflux
d. Aldosterone →↑ excretion of K+

Ans. c. Insulin → K+ efflux

There are several factors which shift the balance between intracellular and extracellular concentrations of potassium.

Shifting K+ into cells

- Insulin
- Aldosterone
- Beta adrenergic agonists
- Alkalosis

Shifting K+ out of cells

- Insulin deficiency
- Aldosterone deficiency
- β-adrenergic blockade
- Acidosis
- Cell lysis
- Strenuous exercise
- Increased extracellular fluid
- Osmolarity
- **Insulin:** It shifts the potassium from outside to inside, hence **K^+ influx.**
- **Plasma osmolality:** Increased extracellular fluid osmolarity causes osmotic flow of water out of the cells. The cellular dehydration increases intracellular potassium concentration, thereby promoting diffusion of potassium out of the cells and increasing extracellular fluid potassium concentration.
- **Aldosterone** affects the renal handling of potassium via the principal cells of the DCT and Collecting ducts.
- **Epinephrine** increases the action of the sodium-potassium pump, thereby causing a change in the potassium concentration. It also has an effect much the same way as beta adrenergic blockers.

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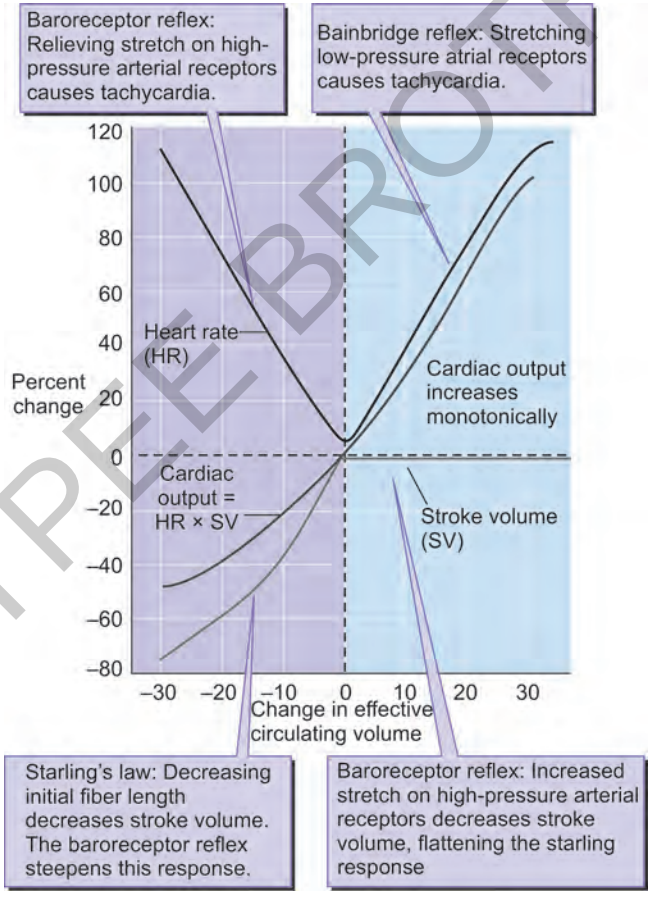
15. Increase in atrial volume leads to increase in heart rate. This is according to:

a. Frank starling law
b. Bain bridge reflex
c. Bezold Jarisch reflex
d. Vasovagal reflex

Ans. b. Bain bridge reflex

From the given graph (curve in upper two quadrants), we can see that heart rate is minimum at the normal effective circulating volume.

- When the circulating volume decreases, the high-pressure receptors come into play eliciting the baroreceptor reflex.



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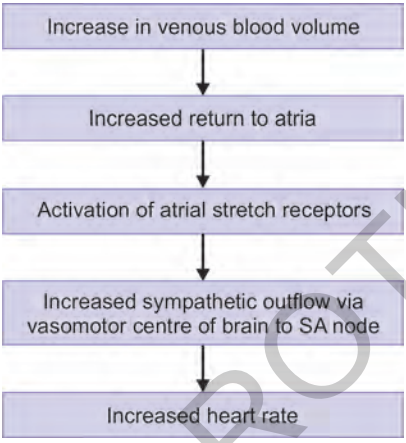
On the other side of the spectrum, at increased circulating volumes, the low-pressure atrial receptors are activated. This causes an activation of sympathetic nervous output to SA node, causing tachycardia. This reflex is to prevent the pooling of blood in the venous system.



Thus the answer, is **(b) Bainbridge reflex.**

16. If there is efferent arteriole constriction, what will not happen?

a. Decrease in GFR
b. ↑ Glomerular hydrostatic pressure
c. Increase in oncotic pressure of peritubular capillaries
d. Decrease in blood flow of peritubular capillaries

Ans. a. Decrease in GFR

It can be seen from the diagram that glomerular filtration is dependent on several factors; the exact relation can be stated thus:

GF = Kf * net filtration pressure, where Kf is the glomerular capillary filtration coefficient.

GF = Kf* (Capillary hydrostatic pressure – glomerular hydrostatic pressure + glomerular oncotic pressure – capillary oncotic pressure)

If efferent arteriole is constricted, the capillary hydrostatic pressure increases. This causes **the glomerular filtration to increase**. Increase in GFR causes an increase in the amount of fluid in the glomerulus, causing an **increase in the glomerular hydrostatic pressure.** Since glomerular filtration increases, more water escapes out of the glomerular capillaries,

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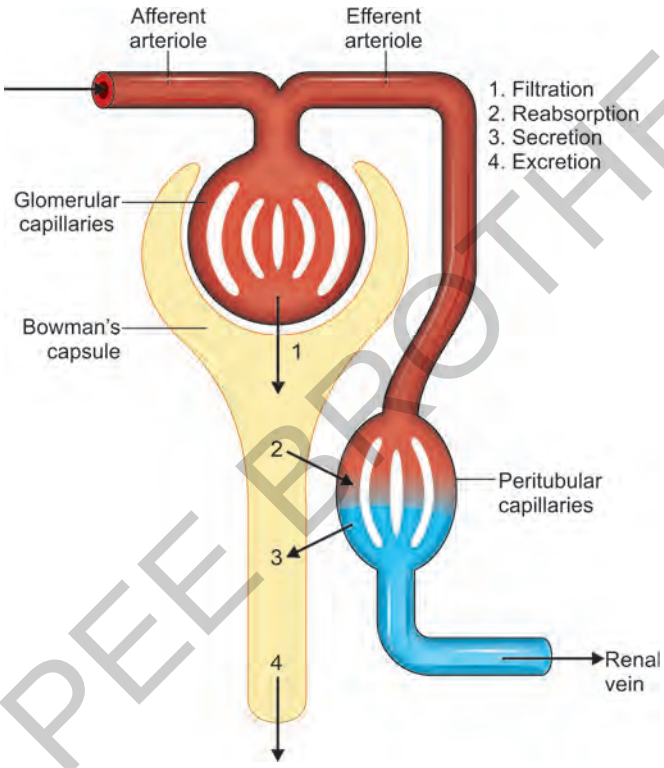
making the remaining blood more concentrated. Hence the **peritubular oncotic pressure increases**. Also, constriction of efferent arteriole causes a **decrease in both total renal blood flow, as well as a relative blood flow to peritubular capillaries** due to increased filtering at the glomerular level.



17. Which one of the following is responsible for absolute refractoriness of a nerve fibre during an impulse.

a. Closure of the inactivation gates of Na^+ channels
b. Closure of activation gates of Na^+ channels
c. Efflux of K^+ from cell
d. Cl^- Channel closure

Ans. a. Closure of the inactivation gates of Na^+ channels

The following diagram depicts the changes occurring in a sodium channel during an action potential:

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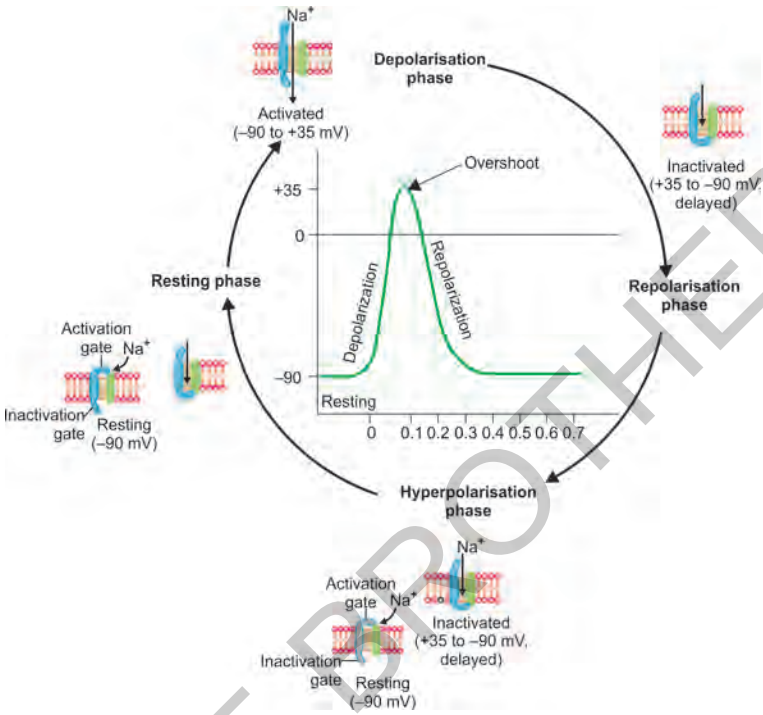

The inactivated sodium channels cannot respond to any increase in threshold potential. In the repolarisation phase, most sodium channels are inactivated. Hence, this is a period of absolute refractoriness.

In the hyperpolarisation phase, some sodium channels return to resting phase. Since all sodium channels do not reach resting phase, a higher increase in membrane potential is required to cause an action potential, called the effective refractory period.

Hence, the answer is **(a) closure of inactivation gates of sodium channels.**

18. What is not correct for grey rami communicantes?

a. It is preganglionic
b. It is located lateral to white rami communicantes
c. It connects sympathetic ganglion to spinal nerve
d. It is unmyelinated

Ans. a. It is preganglionic

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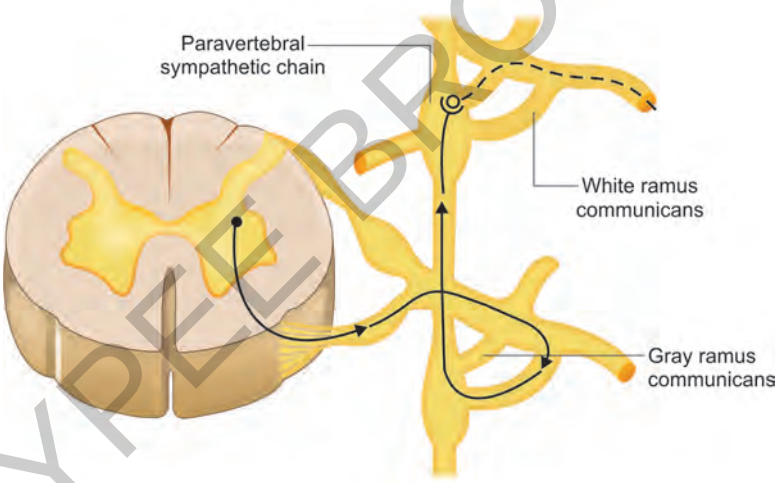
The structure indicated is the **gray ramus communicantes** (known collectively as the **gray rami communicantes**). It is grey because the axons are **unmyelinated**.

The preganglionic sympathetic nerve travels through the spinal nerve, and then goes to the paravertebral sympathetic chain via the white rami communicantes. From there, a **postganglionic** sympathetic nerve travels back to the spinal nerve via the grey rami communicantes.

The preganglionic nerve fibre which passes through the white ramus communicans has three potential outcomes:

1. **Synapse** in the paravertebral ganglion.
2. **Travel up or down** a level in the sympathetic chain to synapse with a paravertebral ganglion at a higher or lower level.
3. **Travel straight through** the paravertebral ganglion without forming a synapse, to form a synapse at a distant ganglion anterior to the vertebral column, in a plexus.



The answer is, hence, **(a) it is preganglionic**, since the wrong option is being asked.

19. What is incorrect about renal basement membrane.

a. It is a part of filtration barrier
b. It consists of type 3 collagen
c. It is stained with PAS
d. It has a lamina rara and lamina dura

Ans. b. It consists of type 3 collagen

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This work was completed on time due to unmatchable dedication by Dr. Akhil Monga & Dr. Dipin Sudhakaran.

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Highlights of AIIMS November 2017—Questions With Explanations

- For the first time Two Leading Educationists (Dr Thameem Saif and Dr Apurv Mehra) have together compiled this to the point precise and crisp content backed up with their knowledge and experience of more than one decade, unmatchable in The Medical Education Industry.
- Original Questions with all four options to the best of our knowledge
- MCQs have been arranged subject-wise for easy understanding
- Each subject has been written and verified by Subject Specialist
- Authentic and Concise Explanations with reference to latest editions of standard textbooks
- Completely colored book with HD Colored Images for better identification and interpretation
- Useful Tables, Diagrams and Flowcharts have been added to make it easier to remember.

Thameem Saif MD Medicine is a renowned teacher held in very high regard by medicos both in India and the US. He is an intellect of high order with brilliant teaching skills. His inputs have been found to be very valuable by his students across the country and he has helped lots of students achieve their dreams of clearing the tough Indian Medical PG Entrance Exams and The USMLE. Most of the toppers in the country today thank him in their heart for playing an important role in their success. He is well known for solving MCQs in an organized approach to reach towards the answer. His Orientation about how to approach MCQs with latest patterns proposed for National Eligibility Entrance Test is an important aspect of his sessions.

Apurv Mehra is the founder of Vidya Jeevan orthopedics centre. He is world renowned computer navigation joint replacement surgeon and specialist in sports medicine. He is one of the most sought after surgeon due to his ethical practice. He is also the founder of Medmiracle the online support system for Medical students. He is rated as ONE of the Best and most respected Faculties in the Medical World. His message is simple, powerful and practical. In his more than eleven years of teaching, Dr Apurv Mehra's (Ortho Dhoom Dhadaka) lectures have not only helped many students to achieve top ranks in entrance exams but also many of them, having being influenced by him, have chosen Orthopedics as their career. His Book 'Orthopedics Quick Review', has been labelled as Magic Book of Orthopedics. His New Releases MOM-Mehra's Orthopedics for MCI, Review of Pediatrics has received overwhelming response across the globe.

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