

(b) Cerebellum/Pons Varolii and Medulla oblongata/Hypothalamus
2020 New: (i) Similarity between nervous and hormonal coordination: Both use chemical transmission
(ii) Annelida and Arthropoda
(iii) (a) Four irregular shaped cavities in the brain containing cerebrospinal fluid
(b) Midbrain, Pons Varolii, Medulla oblongata
(iv) Links central nervous systems to sensory and motor neurons and facilitates nerve impulse propagation/Coordinates and produces reflexes

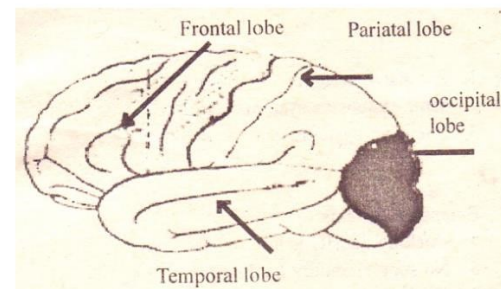
2020 Old: (i) Pia mater, arachnoid mater, dura mater
AL 2021 Old (i) Mid brain/Pons Varolii/Medulla oblongata
2021: Sensory areas (receive and process sensory information)/Association areas (recognition and interpretation of sensory information)/ Motor areas (directing skeletal muscle movement)
2022: (i) (a) Platyhelminthes (b) Maintains uniform pressure within CNS/Acts as shock absorber between brain and skull (iii) Structures from forebrain: Cerebrum, thalamus, hypothalamus and pineal body

Essay Aid Answers

1. Describe the human cerebrum's structure and functions:

1. Largest part of the human brain
2. Divided into right and left cerebral hemispheres by a deep cleft
3. Connected by corpus callosum (a mass of white matter)
4. Consists of: Superficial part: Gray matter (nerve cell bodies) forming cerebral cortex
5. Deeper layers: White matter (nerve fibers)
6. Shows many infoldings to increase surface area
7. Cerebral cortex divided into four lobes:
8. Frontal lobe
9. Temporal lobe
10. Parietal lobe
11. Occipital lobe
12. Functions: The cerebral cortex has three main functional areas:
13. Sensory Areas
14. Receive and process sensory information
15. Process perception of:
16. Pain
17. Temperature
18. Touch
19. Sight
20. Hearing
21. Taste
22. Smell
23. Association Areas
24. Recognition and interpretation of sensory information
25. Integration of sensory information

26. Processing of complex mental functions:
27. Memory
28. Intelligence
29. Reasoning
30. Judgment
31. Emotions
32. Motor Areas
33. Direct skeletal (voluntary) muscle movement
34. Control voluntary muscle contraction
35. Initiate and control voluntary movement



**SAMPATH
LANKADHEERA**
B.Sc. (Hons), M.Sc.



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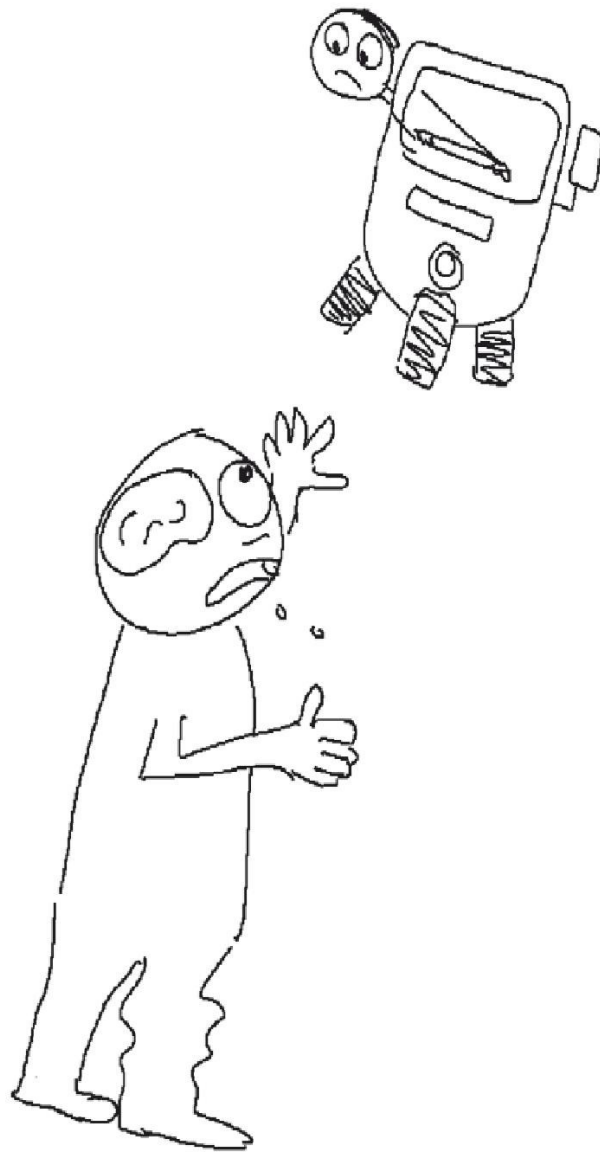


**UNIT
05** Animal Form and Function
Nervous System

**SAMPATH
LANKADHEERA**
B.Sc. (Hons), M.Sc.

Processes and systems involved in coordination

.....



AL 2020 Old

(i) Name the meninges in the central nervous system of man in correct sequence, starting from the innermost membrane.

.....

AL 2021 old

(i) What are three parts of human brain that forms the brain stem

.....

(ii) State two functions of human spinal cord

.....

AL 2021

(i) Name 3 major functional areas of the brain

.....

AL 2022

(i) (a) Name a phylum which includes animals with a brain and longitudinal nerve cords.

.....

(b) State two functions of cerebrospinal fluid other than circulation of nutrients and hormones.

.....

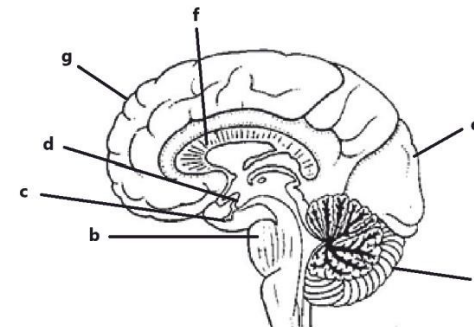
(ii) Name two structures of the brain which are developed from the forebrain of the embryo.

.....

Structured EssayAid Answers

AL/2005:

(i) Coordination between stimuli and responses to maintain constant internal environment inside the body of an organism for existence.



(ii) (a) Processing visual information (b) Transfers information between PNS and midbrain/forebrain, coordinates large scale body movements, helps regulate respiration Coordinates voluntary muscular movements, maintains posture and balance, helps in learning and remembering motor skills

AL 2012: (i) Cerebrum, thalamus, hypothalamus and pineal body/(ii) Neuroglia

AL 2017: (a) GHRIH/PIH (b) Regulates body temperature/Regulates thirst and water balance/Regulates appetite/Regulates sleep and wake cycles/Control of autonomic nervous system/Initiates fight-or-flight response/Plays a role in sexual behaviors

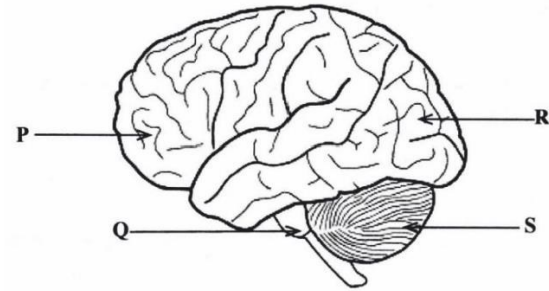
AL 2019 Old (a) P: Frontal lobe, Q: Pons Varolii, R: Occipital lobe, S: Cerebellum

AL 2019 New (a) P: Hypothalamus, Q: Pons Varolii, R: Medulla Oblongata, S: Occipital lobe, T: Cerebellum



2019 old

- (i) This question is based on the following diagram of the human brain.
 (a) Name the parts labeled as P, Q, R and S.

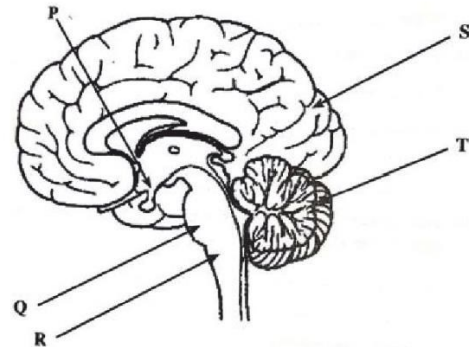


- (b) Which of the above parts has/have been developed from the embryonic hind-brain?

 (c) Which of the above parts coordinates the voluntary muscular movements?

AL 2019 new

- (i) This question is based on the following diagram of the human brain.
 (a) Name the structures labeled as P, Q, R, S and T in the above diagram.



- (b) Name the structures responsible for the following functions of man.
 Maintaining posture :
 Coordination of running :
 Regulation of thirst :

2020 New

- (i) State a similarity between nervous coordination and hormonal coordination.

 (ii) Name two phyla that include animals With brain, ventral nerve cord and segmented ganglia.

 (iii) (a) What are known as ventricles in the human brain?

 (b) What are the three parts of the human brain that form the brain stem?

 (iv) State two functions of the human spinal cord.

Systems contributing to coordination

Animals unlike plants have two different but related systems for coordination of body function. They are the nervous system and the endocrine system.

Similarities and differences (in relation to coordination) of the nervous system and endocrine system

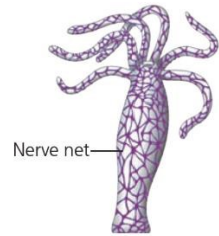
Feature	Nervous coordination	Hormonal coordination
Transmission	through neurons	through blood
Nature of transmitter	chemical and electrical	chemical
Response	localized	diffused
Time taken to start the response	fast acting	slower action
Duration of response	short	long

Organization of nervous systems in different animal Phyla

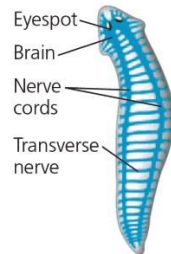
Animals have specialized systems of to sense their surroundings and respond rapidly. In the animal kingdom, Cnidarians are the animals having a system. They have a nerve net which is composed of individual neurons.

In more complex animals, the nervous systems contain groups of organized into nerves, and often and a '.....'. In some Platyhelminthes such as Planaria, the nervous system contains a pair of ganglia in the anterior region ('brain') and a pair of longitudinal nerve cords. In planarians, the eye spots which are located near the act as Annelids and arthropods have a somewhat brains and ventral nerve cords. The ventral nerve cord contains They are arranged Nervous system of Echinodermates is composed of radial nerves and a nerve ring. Nervous system of the chordates consists of a central nervous system (CNS) and a peripheral nervous system (PNS). The CNS is composed of the and the cord. The PNS is composed of nerves and ganglia.

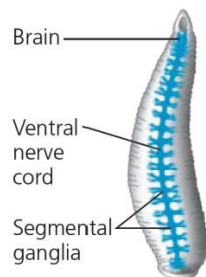
Cnidaria
Nerve net
Eg: Hydra



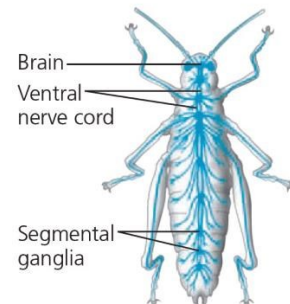
Platyhelminthes
Brain, longitudinal nerve cords
Eg: *Planaria*



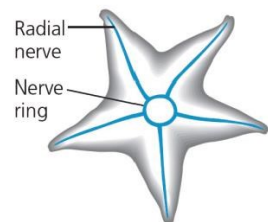
Annelida
Brain, ventral nerve cord, segmental ganglia.
Eg: Leech



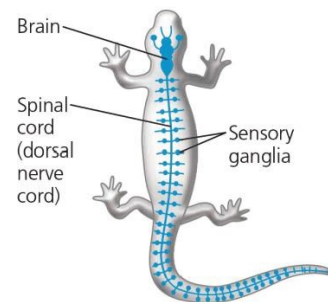
Arthropods
Brain, Ventral nerve cord, Segmental ganglia.
Eg: Cockroach



Echinodermata
Nerve ring and radial nerves.
Eg: Sea star



Chordata
Brain, spinal cord (dorsal nerve cord), nerves and ganglia.
Eg: Gecko



MCQ Aid Answers

(1) 3	(2) 3	(3) 2	(4) 4	(5) 2	(6) 5	(7) 1	(8) 1	(9) 1	(10) 1
(11) 1	(12) 3	(13) 2	(14) 1	(15) 2	(16) 4	(17) 3	(18) 1	(19) 4	(20) 5
(21) 3	(22) 3	(23) 1	(24) 1	(25) 4	(26) 3	(27) 5	(28) 4	(29) 2	(30) 4
(31) 5	(32) 5	(33) 2	(34) 3	(35) 5	(36) 5	(37) 3	(38) 1	(39) 4	(40) ACD

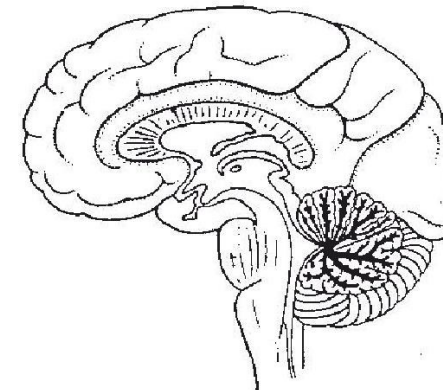
Structured Essay Aid

AL/2005

1. (i) What is the central role of the nervous system?
.....

(ii) In the diagram given below indicate the following parts (a-g) by drawing arrows and labeling them.

- (a) Cerebellum (b) Pons Varolii (c) Pituitary gland (d) Hypothalamus
(e) Occipital lobe of cerebral cortex (f) Corpus callosum (g) Frontal lobe of cerebral cortex



(iii) Give one main function for each of the following

- (a) Occipital lobe of cerebral cortex
(b) Pons Varolii
(c) Cerebellum

AL 2012

(i) Name the parts of human brain derived from embryonic fore-brain.
.....

(iii) What is the most abundant type of cells in brain of man?
.....

AL 2017

(a) Name two inhibitory hormones secreted by human hypothalamus
.....

(b) What are functions carried out by human hypothalamus other than secretion of hormones
.....



30. Contribution of which one of the following systems is least important in coordination?
 (1) Circulatory system (2) Muscular system (3) Endocrine system (4) Digestive system
 (5) Nervous system (2014/19)
31. Pons Varolii of the human brain
 (1) forms a bridge between the fore-brain and hind-brain. (2) is located in the mid-brain.
 (3) controls reflex movements of the head. (4) controls blood pressure.
 (5) regulates ventilation of lungs. (2015/18)
32. Select the incorrect statement regarding human brain.
 (1) Functional area concerned with speech is located in the frontal lobe.
 (2) Corpus callosum connects the two hemispheres of the cerebrum.
 (3) Cerebellum plays an important role in maintaining balance and equilibrium
 (4) Thalamus is involved in the integration of sensory information.
 (5) Reflex centre for coughing is located in the pons varolii. AL 2016/18
33. Which of the following statements regarding the human brain is correct?
 (1) Corpora quadrigemina is derived from embryonic hind-brain.
 (2) Pons Varolii regulates breathing rate.
 (3) Forebrain controls reflex movements of eye muscles.
 (4) Cerebellum controls sneezing and coughing.
 (5) Cerebrum is involved in sensory perception of pain. AL 2017/18
34. Pons Varolii of humans is involved in
 (1) regulation of blood pressure. (2) recognition of sensory information.
 (3) regulation of ventilation of lungs. (4) regulation of the rate of heart beat.
 (5) regulation of reflex movements of eye muscles. AL 2018/15
35. In humans, voluntary muscular movements are coordinated by
 (1) thalamus. (2) pons Varolii. (3) mid-brain. (4) medulla oblongata. (5) cerebellum AL 2019/24
36. Embryonic origins of pons Varolii, hypothalamus and corpora quadrigemina in the human brain are respectively
 (1) fore brain, mid brain and hind brain. (2) mid brain, fore brain and mid brain.
 (3) hind brain, fore brain and hind brain. (4) mid brain, mid brain and hind brain.
 (5) hind brain, fore brain and mid brain. 2021 Old/16
37. Select the response that correctly indicates the part of the human brain and its function.
 (1) Thalamus — regulation of appetite
 (2) Hypothalamus — maintenance of posture
 (3) Mid brain — coordination of visual reflexes
 (4) Pons Varolii — regulation of sleep and awake cycles
 (5) Cerebellum — initiation of fight or flight response AL 2021 new/25
38. Select the correct statement regarding human brain.
 (1) Brain stem is developed from embryonic mid brain and hind brain.
 (2) Frontal lobes of the cerebral cortex contain visual sensory areas.
 (3) Mid brain contains the fourth ventricle of the brain.
 (4) Corpus callosum connects the two hemispheres of the cerebellum.
 (5) Thalamus regulates the sleep and awake cycles. AL 2021/24
39. In the human brain, cardiovascular centre is located in the
 (1) hypothalamus. (2) mid brain. (3) pons Varolii. (4) medulla oblongata. (5) cerebellum. AL 2022/24
40. In the human brain,
 (A) three ventricles are located in the forebrain.
 (B) pineal body is developed from the embryonic hind brain
 (C) Pons Varolii is situated between the mid brain medulla oblongata
 (D) superficial part of the cerebrum composed of nerve cell bodies.
 (E) Hypothalamus is linked to the anterior pituitary gland by long nerves AL 2023/46

The gross structure and the functions of the human nervous system

Organization and main parts of the human nervous system

Human nervous system consists of and nervous systems. In vertebrates, the brain and the spinal cord form the central nervous system. Nerves and forms the main components of the peripheral nervous system.

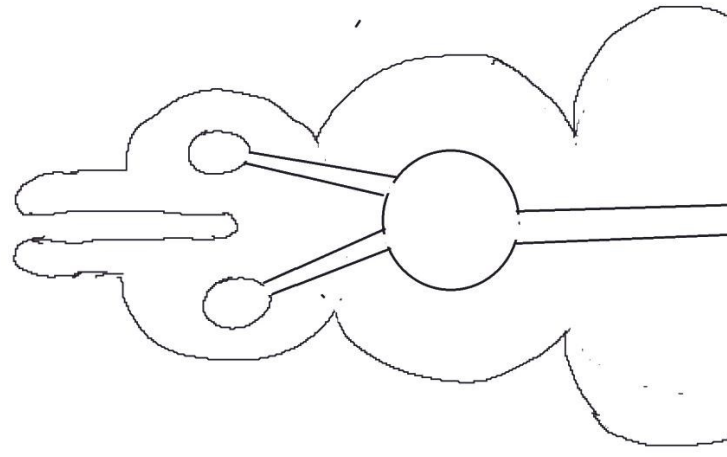
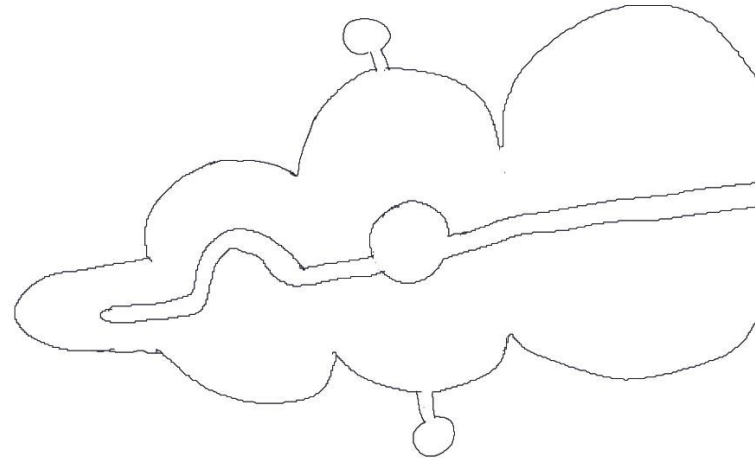
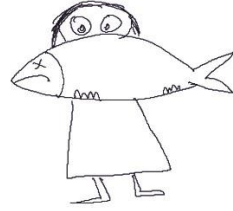
Central nervous system (CNS)

Central nervous system consists of the brain and the spinal cord. In vertebrates, the CNS develops from the dorsal nerve cord during development. Anterior part of the central nervous system enlarges and forms the brain which has three major regions:, and The central canal in the brain forms four irregular shaped cavities called ventricles

The brain contains four ventricles: ventricles are present in the fore brain and ventricle is in the hind brain. This central canal continues in the spinal cord. The ventricles and central canal contains fluid. This fluid helps to maintain uniform pressure within the CNS and act as a between the brain and skull. It also helps to circulates and as well as to remove waste products The brain and the spinal cord have several adaptations to be protected from physical injuries.

The brain is enclosed by a skull. The spinal cord is surrounded by vertebrae which forms the vertebral column. Further protection to the CNS is given by of tissues called the The outermost layer is called the mater, the innermost layer as mater and in between these two layers is the mater.





19. Cerebellum functions include:
 (1) Coordinates voluntary muscular movements (2) Maintains posture and balance
 (3) Helps in learning motor skills (4) All of above (5) None of above
20. Functions of hypothalamus include: (1) Regulates body temperature (2) Controls thirst and water balance (3) Regulates appetite (4) Controls sleep-wake cycles (5) All of above

Questions No. 21 and 22 are based on the following table. Three parts of the human brain are listed in the first column. The second column gives their major functions and the third column gives their origin.

Column 1 Parts of the brain	Column 2 Major function	Column 3 Organ P
A - Hypothalamus	L - Control of eye movements	- Hindbrain
B - Cerebellum	M - Coordination of voluntary muscle action	Q - Midbrain
C - Corpora quadrigemina	N - Homoeostasis	R - Forebrain

21. The correct sequence showing the major functions of A, B and C is
 (1) M, L, N. (2) N, L, M. (3) N, M, L. (4) L, N, M. (5) M, N, U (2001/26)
22. The correct sequence showing the origin of A, B and C is
 (1) Q, P, R. (2) P, R, Q. (3) R, P, Q. (4) R, Q, P. (5) P, Q, R. (2001/27)
23. Which one of the following statements is incorrect regarding the hypothalamus of man?
 (1) It is developed from the embryonic mid brain. (2) It is essential for thermoregulation.
 (3) All hormones secreted by it act on the pituitary. (4) It synthesizes oxytocin.
 (5) It is involved in the regulation of the rate of heart beat. (2004/21)
24. A person developed a tumor between pons varolii and thalamus affecting the functions carried out by that region of the brain. Which of the following could be most affected by this tumor?
 (1) Movement of eyes (2) Maintenance of balance (3) Memory (4) Control of respiration
 (5) Speech (2011/16)

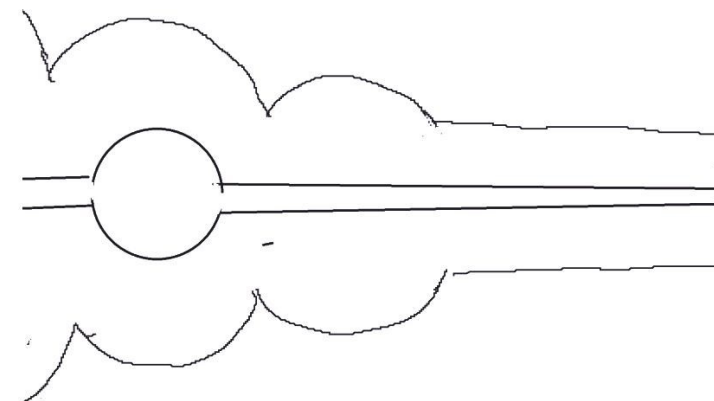
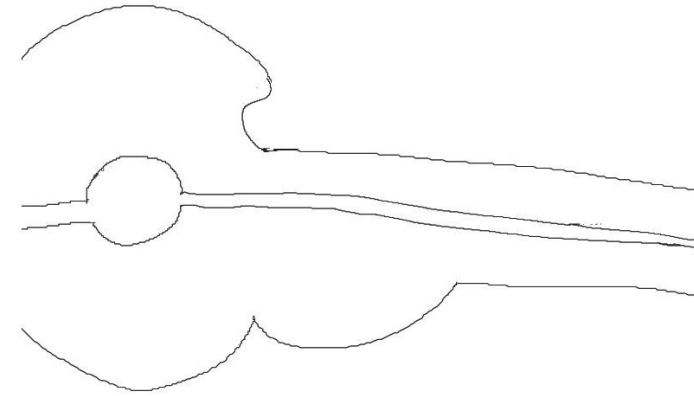
Questions 25 is based on the following animals.

- (A) Earth worm (B) Planaria (C) Cockroach (D) Prawn
25. Which of the above animals have a double ventral solid nerve cord?
 (1) A only (2) A & C only (3) C & D only (4) A, C & D only (5) A, B C & D (2011 old/22)
26. Of the following organs of man, which one is associated with the largest somatic motor area of the cerebral cortex?
 (1) Ear (2) Penis (3) Hand (4) Eye (5) Tongue (2011 old/23)
27. Which one of the following statements regarding human hypothalamus is incorrect?
 (1) It is derived from the embryonic fore-brain. (2) It releases trophic hormones.
 (3) It contains the thermoregulatory centre. (4) It regulates hunger and thirst.
 (5) It acts as a rely centre in brain. (2012/13)
28. Some parts of human brain and their functions are given below. Which of the following "part of the brain - function" combination is incorrect?
 (1) Hypothalamus - Regulation of hunger
 (2) Medulla oblongata - Regulation of rate of heart beat
 (3) Cerebellum - Regulation of posture
 (4) Temporal lobe - Regulation of speech
 (5) Thalamus - Integration of sensory information (2013/21)
29. Which of the following statements regarding human brain is incorrect?
 (1) Thalamus is derived from embryonic forebrain.
 (2) The surface of cerebellum is formed of white matter.
 (3) It has four large cavities.
 (4) Endocrine functions of the pituitary is regulated by the hypothalamus.
 (5) Large representation is devoted to hand in the sensory area of the cerebrum. (2014/18)



MCQ Aid

- How many meninges cover the human brain
(1) 3 (2) 2 (3) 1 (4) 4 (5) 5
- Right and left cerebral hemisphere are connected by a cord of tissue called
(1) Thalamus (2) Internal capsule (3) Corpus callosum (4) Corpus albicans (5) None
- Nearly 80% of the human brain is
(1) Cerebellar cortex (2) Cerebral cortex (3) Medulla oblongata (4) Meninges (5) Hypothalamus
- Functions of cerebellum include:
(1) Coordinates voluntary muscles (2) Maintains posture and balance
(3) Helps in learning motor skills (4) All of these (5) None of these
- What is not true for the brain of humans?
(1) Pineal gland present (2) mid brain regulate respiration (3) Largest cerebral hemisphere
(4) Sulci and gyri present (5) Cerebrum important in vision
- Functions of hypothalamus include:
(1) Regulates body temperature (2) Controls autonomic nervous system (3) Regulates appetite
(4) Controls sleep-wake cycles (5) All of these
- Identify the correctly matched pair
(1) Cardiac center - Medulla oblongata (2) Thermoregulatory center - Cerebellum
(3) Respiratory center - Hypothalamus (4) Hunger - Olfactory lobe (5) Pons - Muscle tone
- of cerebrum processes sensory information:
(1) Sensory areas (2) Motor areas (3) Association areas (4) All of these (5) None of these
- Maximum evolutionary change has occurred in a part of brain called
(1) Cerebrum (2) Cerebellum (3) Optic lobes (4) Olfactory lobes (5) Pons
- Hypothalamus is part of
(1) Fore brain (2) Cerebellum (3) Pons (4) Medulla (5) Mid brain
- Compare nervous and hormonal coordination. Which feature is correct?
(1) Nature of transmitter: Chemical vs Chemical and electrical (2) Response: Diffused vs Localized (3) Duration: Long vs Short (4) Speed: Fast vs Slow (5) None of these
- Which phyla have brain, ventral nerve cord and segmental ganglia?
(1) Annelida only (2) Arthropoda only (3) Both Annelida and Arthropoda (4) None of these
- Identify the part of brain which has the third ventricle
(1) Olfactory lobe (2) Thalamus (3) Medulla (4) Optic lobes (5) Mid brain
- The following structures form the brain stem:
(1) Mid brain, pons varolii, medulla oblongata (2) Cerebellum, pons varolii, medulla
(3) Mid brain, cerebellum, pons varolii (4) Medulla oblongata, cerebellum, mid brain
- Cerebellum controls and coordinates
(1) Dilation and constriction of pupil (2) Muscle function (3) Blinking of eye
(4) Knee-jerk reaction (5) None of the above
- Hypothalamus does not control
(1) Hunger and satiety (2) Thermo-regulation (3) Pituitary
(4) Creative thinking and consciousness (5) Circadian rhythms
- Spinal cord is covered by highly vascularized
(1) Arachnoid mater (2) Dura mater (3) Pia mater (4) Epithelial layer (5) Internal capsule
- The hindbrain develops into:
(1) Cerebellum and medulla oblongata (2) Pons varolii and mid brain
(3) Cerebrum and thalamus (4) Hypothalamus and pituitary





PRACTICAL NO.28

Explaining the organization of the human nervous system using diagrams or models

Objectives

- Students should be able to
- describe the general organization of human nervous system,
- identify central nervous system and peripheral nervous system,
- identify the main parts of human brain,
- illustrate the human brain with labeled diagram.

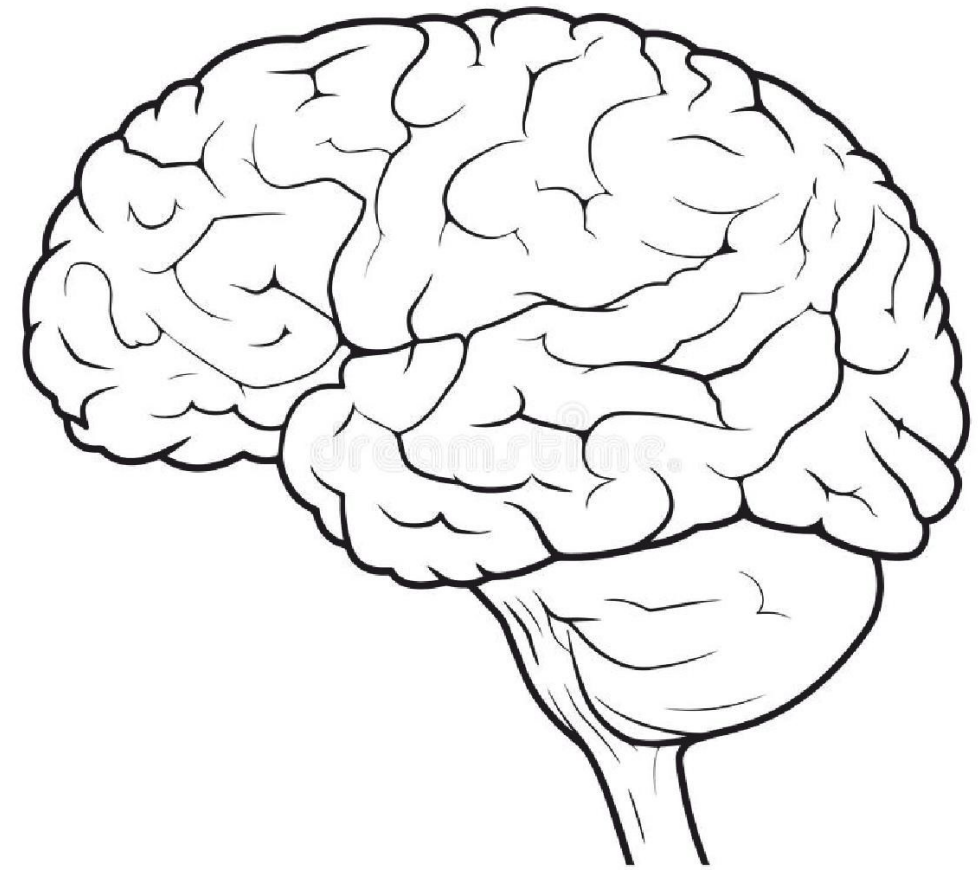
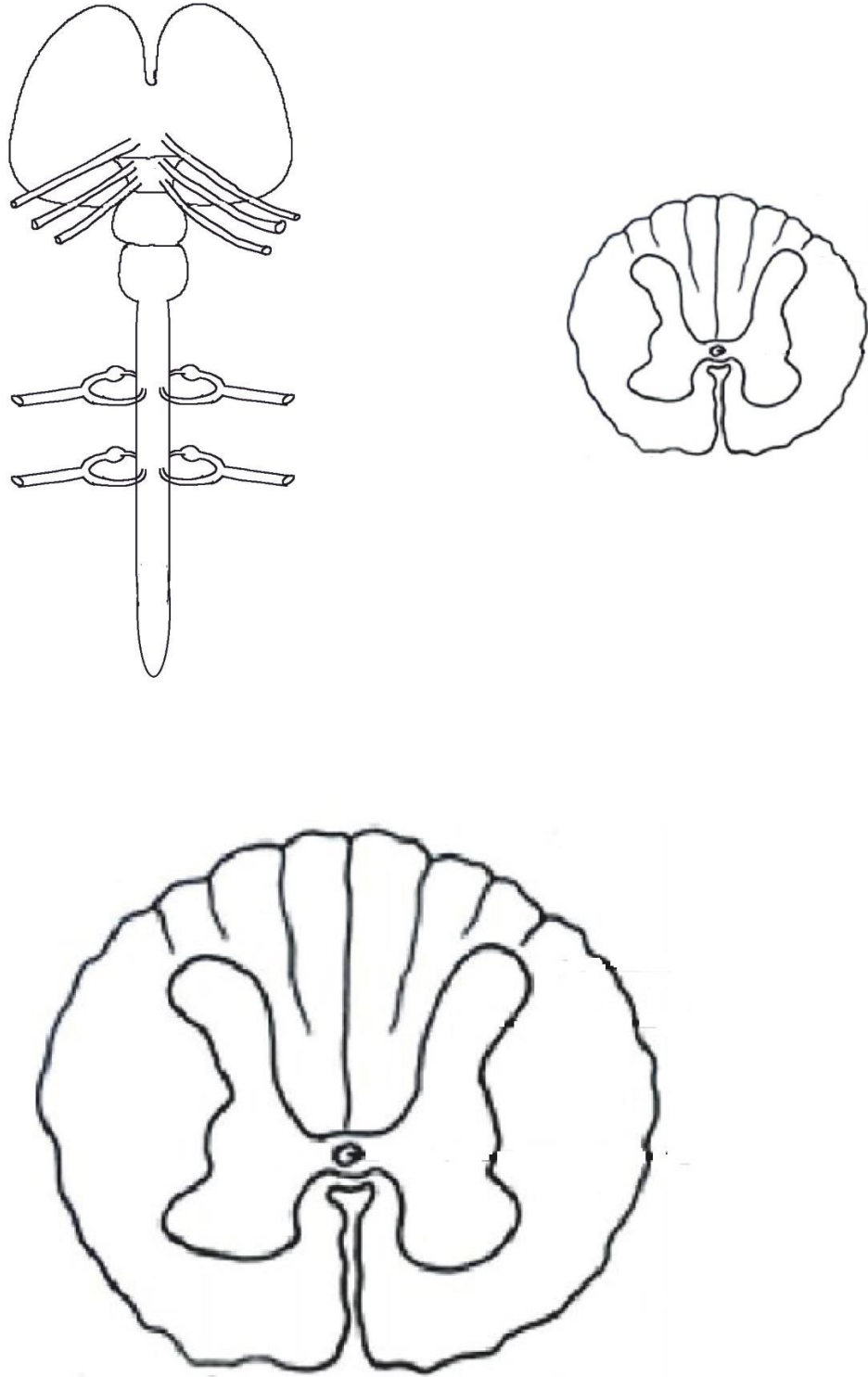
Materials and equipment

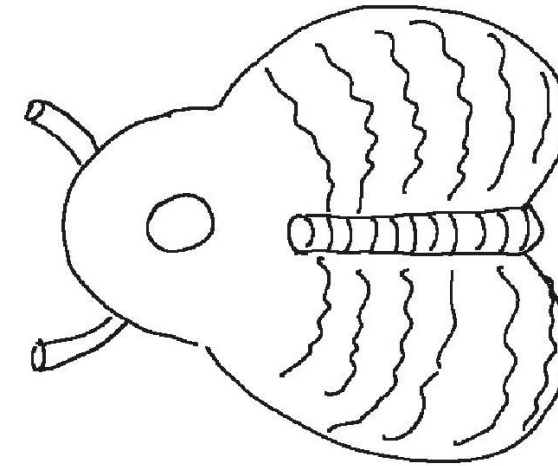
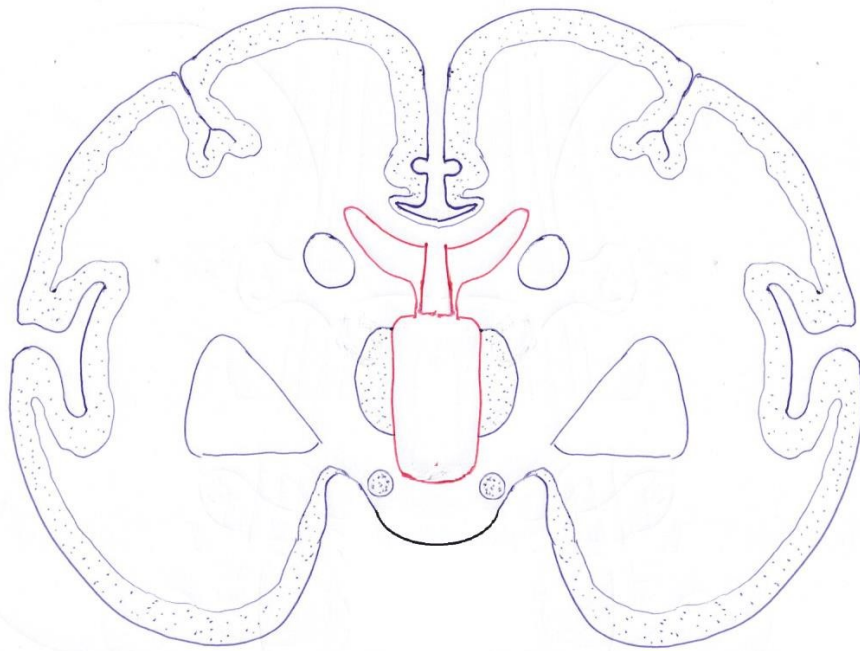
- Models/ diagrams of human nervous system.

Instructions

- Allow students to study the general organization of human nervous system.
- Instruct them to identify central nervous system and peripheral nervous system.
- Guide students to identify the main parts of the human brain.
- Instruct them to draw and label a diagram of human brain.







Spinal cord

- The spinal cord is an structure suspended in the vertebral canal. It is continuous with the medulla oblongata.
- Centre of the spinal cord contains the central canal which is surrounded by grey matter. Outer region of the spinal cord is made up of white matter.

Functions:

- Links the central nervous systems to sensory and motor neurons and facilitates nerve impulse propagation towards the brain and away the brain
- Coordinates and produces reflexes

- It also contain nerve fibers passing between higher levels of brain and spinal cord.
Groups of nerve cell bodies in the Pons Varolii form centers that regulate respiration.
- Some nerve cell bodies in the pons act as relay stations.

Functions:

- Transfers information between PNS and the midbrain and forebrain
- Coordinates large scale body movements such as climbing and running
- Together with the medulla oblongata helps regulate respiration,

Medulla oblongata

-
- It consists of cardiovascular centre, respiratory center and reflex centers.

Functions:

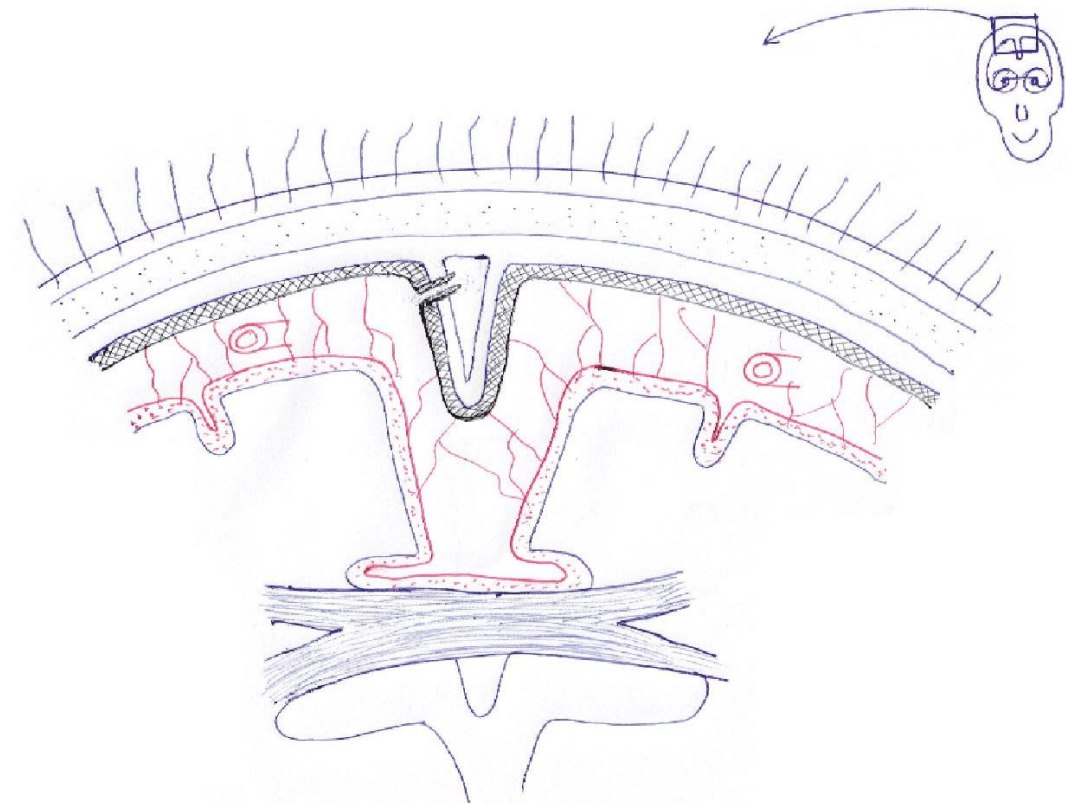
- Transfers information betweenand the mid brain and the fore brain
- Coordinates large scale body movements such as running, climbing
- Controls several autonomic, homeostatic functions including breathing, heart and blood vessel activities (contains respiratory centre, cardiovascular centre)
- Controls involuntary reflexes such as vomiting, swallowing, coughing, sneezing through reflex centres

Cerebellum

-

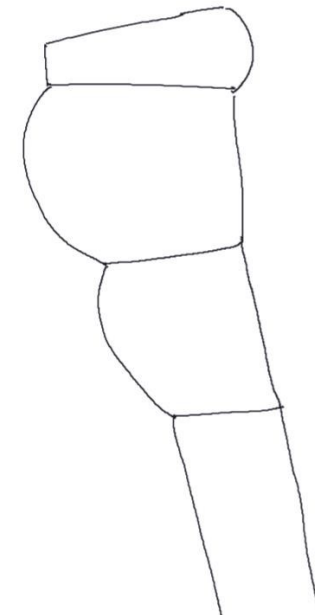
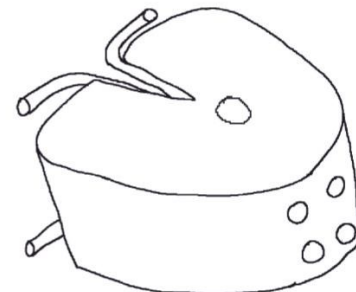
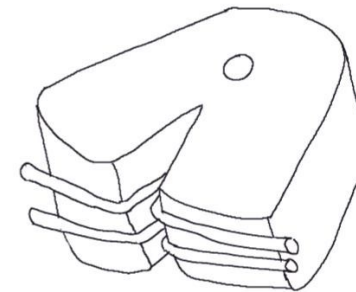
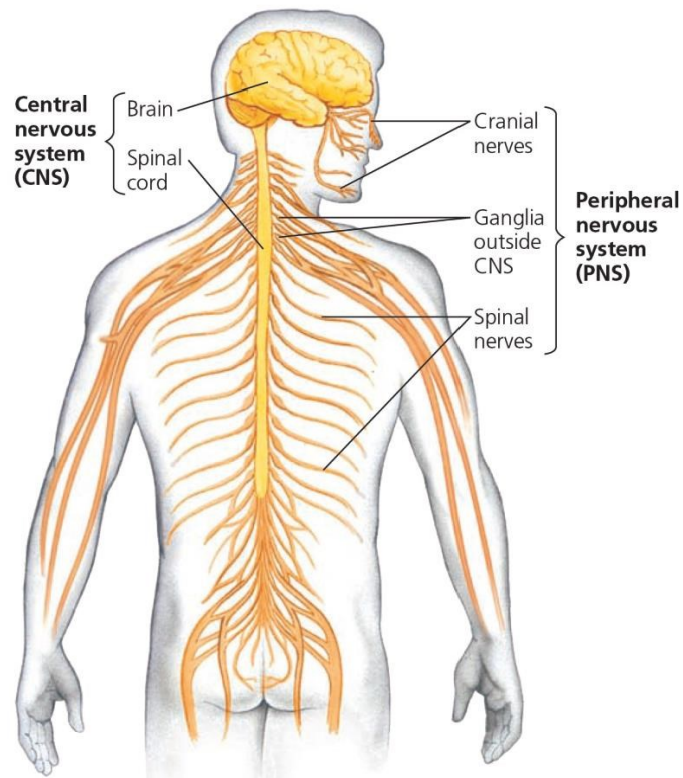
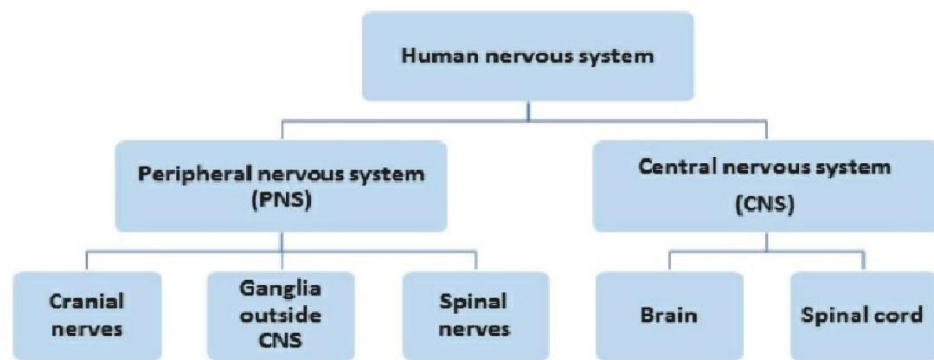
Functions

- Coordinates voluntary muscular movements
- Maintains posture and balance
- Helps in learning and remembering motor skills



Main parts of the human Brain

The forebrain, midbrain and hindbrain of the human embryo develops into the brain. The forebrain gives rise to the,, and The mid brain gives rise to of the The hind brain gives rise to cerebellum, pons Varolii and medulla oblongata. The brain stem consists of the midbrain, pons Varolii and medulla oblongata





Cerebrum

Cerebrum is the largest part of the human brain. It is divided by a
 into right and left cerebral The superficial part of the cere-
 brum is of nerve cell bodies (or grey matter) forming the cerebral
 cortex and deeper layers consist of nerve fibers (or White matter).

The cerebral are connected by
 which is a mass of White matter. The
 cerebral cortex shows many to increase the surface area of the cere-
 brum, The cortex of each cerebral hemisphere is divided into lobes:
 lobe, lobe, lobe and
 lobe. Three main functional areas of the cerebral cortex have
 been identified. They are;

1. : Which receive and process sensory
 information including the perception of,,
, and

2. : Which are responsible for recogni-
 tion and interpretation of sensory information and integration and processing of com-
 plex mental functions such as,,
, and
3. : Which are responsible for direct-
 ing skeletal (voluntary) muscle movement through the initiation and control of volun-
 tary muscle contraction

Thalamus

- Thalamus is situated within the cerebral hemispheres just below the corpus callosum. It consists of two masses comprising and matter.

Functions:

- Thalamus acts as the main center of sensory information from spe-
 cial sense organs and sensory receptors in the and organs.
- This sensory information is sorted and directed to specific location of the cerebral cortex
 for further and
- The thalamus and nerve impulses from most
 parts of the brain to cerebral cortex.



Hypothalamus

- Hypothalamus is situated and of the thalamus, immediately above the pituitary gland.
- It is linked to the posterior lobe of the pituitary gland by and to the anterior lobe by a complex system of blood vessels.

Functions:

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Mid brain

- Mid brain is the upper part of the brain stem. It is situated between the cerebrum (above) and the Pons Varolii (below) surrounding the cerebrospinal fluid filled connection of the third and fourth ventricles
- Mid brain contains, aggregates of nerve cell bodies and nerve tracts which connect the cerebrum with lower brain and spinal cord.

Functions:

- Acts as relay stations for ascending and descending nerve fibers
- Receives and integrates sensory information (auditory and visual) and sends it to particular regions of the fore brain.
- Coordinates auditory and visual reflexes

Pons Varolii

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-
-
- It contains nerve fibers that form a bridge between the two hemispheres of the cerebellum

