

Bogomolets National Medical University

Department of Human Anatomy

GUIDELINES
for students

<i>Academic discipline</i>	Human Anatomy
<i>module number</i>	2
<i>Semantic module number</i>	1 1
<i>Study subject</i>	Relief of pallium. Localization of functions in the cerebral cortex of the brain.
<i>Course</i>	I
<i>Number of hours</i>	3

1. Specific objectives:

After the classes a student should know and be able to:

- 1.1 To know and show gyri and sulci of the superolateral, medial and inferior surfaces on the preparations of the brain.
- 1.2 To identify and demonstrate frontal, parietal, occipital, insular, limbic (temporal) lobes, gyri and sulci that they contain on the preparations.
- 1.3 To demonstrate structures of the brain on the surface of the cortex, edges and poles on the preparation of whole brain and its sagittal cut.
- 1.4 To identify and present cerebral lobes, their limits, gyri and sulci that define them on the surfaces of the cerebral hemispheres
- 1.5 To define the term "analyzer".
- 1.6 To analyze the components of the analyzer; demonstrate the centers of the first and second signal systems.
- 1.7 To determine the structure of paleocortex, archicortex and neocortex.
- 1.8 To describe the structure of the cerebral cortex.

2. Basic level of preparation.

Before classes a student should know and be able to:

- 2.1 Functions of the nervous system;
- 2.2 Classification of the brain;
- 2.3 The development of the human brain;
- 2.4 Patterns in phylogenesis and ontogenesis of the brain;
- 2.5 To identify and show parts of the human brain.
- 2.6 To classify the neurons according to their structure and functions.
- 2.7 To know the structure and functions of the formations of white and gray matter of the spinal cord and the brain;
- 2.8 To know and show the parts of the forebrain on the preparations;
- 2.9 To determine the limits of the limbic share.

3. The organization of the content of educational material.

Before studying this particular topic parts of the brain shall be reviewed. It's advised to review the original forebrain..

Cerebrum is the largest part of the brain, which includes cerebral hemispheres that are separated by the longitudinal fissure. In the posterior part between the hemispheres and cerebellum is the transverse fissure of the brain.

Then study the external structure of the cerebral hemispheres - the *surface and edges*:

- top edge, turned to the cranial vault;
- inferolateral edge turned downward and laterally to the base of the skull;
- inferomedial edge turned downward and medially to the base of the skull;
- superolateral surface facing upward and laterally to the cranial vault;
- medial surface facing the opposite hemisphere;
- lower surface facing the base of the skull and cerebellum.

Localization functions in the cortex

On the surface of each hemisphere there is a layer of pallium that has multiple grooves (sulci) that divide the hemisphere into lobes, lobules and gyri.

Initially examine the deep grooves - sulci, that divide the pallium into lobes

- Lateral (Sylvian) sulcus begins on the bottom surface in the form of deep pits, goes up and laterally separates the temporal lobe from the frontal and parietal;
- Central (Rolandova) sulcus is about halfway superolateral surface, separate the Lobo's share of the parietal;
- parietal-occipital sulcus, located on the medial surface of the hemisphere between the parietal and occipital lobes;

Total are 6 parts:

- frontal lobe, located in front of the central sulcus, reaches frontal pole;
- parietal lobe, limited in front by the central sulcus, behind - by the parietal-occipital;
- occipital lobe, located behind the parietal-occipital sulcus, reaches the occipital pole;
- temporal lobe, separated from the frontal and parietal lobes by the lateral sulcus, reaches the temporal pole;
- insular lobe is located within the Sylvian fissure. It is completely covered by the frontal, parietal and temporal lobes.
- Tipping (limbic) lobe is a part of the limbic system.

Then examine gyri and sulci on the surfaces of the cerebral hemispheres.

Then examine the concept of the analyzer (by I. P. Pavlov), links between the analyzer and structures of the cortical ends of analyzers. Examine localization of cortical centers of major analyzers.

Analyzer - is a complex nervous mechanism consisting of a receptor system, pathways and think tank, where the analysis of stimuli coming from the environment and of the human body occurs.

Examine parts of the *cortex*:

- somatosensory cortex (center of cutaneous and proprioceptive sensitivity) is located in postcentral gyrus;
- visual cortex lies on the edges of calcarine sulcus of the occipital lobe;
- auditory cortex lies in the region of the transverse gyri located on the inner surface of the superior temporal gyri;
- olfactory cortex located in the area of the hook of the hippocampal gyrus;
- centers of control skeletal muscles are located in the cortex of the central gyri and in the central sulci;
- Center of auditory speech (Wernicke's area) is localized in marginal gyri;
- Center of visual language is localized in the angular gyri;
- Motoric center of articulation of speech (Broca's area) is located in the triangular part of the frontal lobe;
- Motoric center of written speech is located in the back of the middle frontal gyri.

Further, examine the structure of the cerebral cortex of the brain. The basic *structure of the cortex* type:

- 1) Molecular plate;
- 2) External granular plate;
- 3) External pyramidal plate;
- 4) Internal granular plate;
- 5) Internal pyramidal plate;
- 6) Multiforme plate.

The founder of the study of the architecture of the cerebral cortex is Kyiv anatomist V.

A. Betz. He described the microscopic structure of individual sections of the cortex and discovered the giant pyramidal cells.

Theories of evolution of cerebral cortex vary. Most of it (95.6%) is the new *cortex*, neocortex. In hippocampal areas, dentate gyri and hook of the hippocampal gyrus is the ancient crust, *archicortex*, which is associated with olfactory brain. Small areas of the olfactory bulb and olfactory cortex triangle are covered with *old*, paleocortex.

The structure of the old and ancient cortex are more primitive and only includes two or three layers.

Teaching materials include:

- Anatomical specimens, some anatomical preparations of a brain, sagittal section of the brain, the cerebral hemispheres without cerebellum or the pia mater.
- Casts, tables, drawings related to the topic.

4. Plan and organizational structure of the training session.

number z.p	Stages classes	Average time	Types of control	learning Tools (objects that are used in the classroom,)
1.	2	3	4	5
1.	Preparatory stage.	20 min.		

1.1	Organizational issues	1 min.		- Manual "Tests" "Step 1". -
1.2	Formation of motivation.	2 min.		Textbook "Anatomy of man."
1.3	CONTROL of entry-level training (standardized controls).	17 min.	1. Written answers to standard tests. 2. Checking homework students: 2.1. Correctness names in their dictionaries anatomical terms students Latin and Ukrainian languages. 2.2. Review of standardized tasks of a manual.	- Own student dictionaries anatomical terms. - Training manual "Human Anatomy (self-control training for practical classes)." - Questions to control the entry-level knowledge.
2.	The main stage.	80 min.	Formation of new knowledge, practical skills for specific purposes lesson structure semantic module №2 through self-study of anatomical objects in active consultations teacher, the decision of situational problems custom options structure body. Oral questioning of students on issues relevant content of educational material on the semantic module №2 anatomical preparations. Correction answers.	- The corpse of a human anatomical preparations relevant content topics classes. - Situational tasks topic. - Question And objectives on the content of the theme. - Textbook "Anatomy man."
3.	Final stage.	30 min		
3.1.	Control of final level of knowledge.	25 min.	Oral questioning of students on issues the final level of training.	- Question and objectives the end level of training.
3.2	Overall student learning activities.	2 min.		- Anatomical preparations on the topic of employment.
3.3	Informing students about the topic of the next session.	3 min.		

4.1 The content of the material.

- The structure of the cerebral cortex of the brain. V. A. Betz and his legacy.
- To describe and show the cerebral hemispheres, the surface, the lobes and their boundaries on the preparations.
- Relief (sulci and gyri) of the superolateral surface of the cerebral hemispheres; describe and demonstrate on the preparation.
- Relief (sulci and gyri) of the medial surface of the cerebral hemispheres; describe and demonstrate on the preparation.
- Relief (sulci and gyri) of the lower surface of the cerebral hemispheres; describe and demonstrate on the preparation.
- The relief of the frontal lobe, describe and demonstrate on the preparations. Localization of cortical ends of analyzers in the cortex of the frontal lobe.
- The relief of parietal lobe, describe and demonstrate on the preparations. Localization of cortical ends of analyzers in the cortex of the parietal lobe.
- The relief of the occipital lobe, describe and demonstrate on the preparations. Localization of cortical ends of analyzers in the cortex of the occipital lobe.
- The relief of the temporal lobe: describe and demonstrate on the preparations. Localization of cortical ends of analyzers in the cortex of the temporal lobe.

5. Methods of educational process on a practical level.

5.1. Preparatory stage.

5.1.1. Formation of motivation for learning activities focused on the study of anatomy of the brain clarifying its purpose for medical professional:

- The study of anatomy of forebrain is the basis of interpretation of its normal and pathological function, extends the variety of ways to treat pathological processes;
- Thorough knowledge of localization of function in the cerebral cortex of the brain expands the choice of specialty in neurosurgery, psychiatry and neuropathology.

5.1.2. Introducing students to specific goals and lessons' plan the article "Methodical recommendations for teachers" in item 1 - specific purposes; by Clause 3 - The content of the material.

5.1.3. Implementation of standardized testing of entry-level training of students:

5.1.3.1. -Tests to study the topic;

5.1.3.2. - Initial questions to check the knowledge.

5.2. The main stage.

Training on anatomical preparations, models and drawings of the structure of the content of educational material, solving situational problems. Individual techniques applied by teachers to assist with a complicated subject.

Students independently study the structure of the brain hemispheres by active consultations with a teacher. Knowledge of students is checked with specific questions and tasks for the content of topic.

5.3. Final stage.

- Assessment of the current activity and the activity of each student during classes;
- A final standardized control of students' knowledge;
- Announcement of marks of the student and putting them in the log of attendance and

student achievement;

- Group leader provides a journal of attendance and success on the lessons, teachers certify them with a signature;
- Teacher informs students with the content of the topic next session, recommends instructional techniques for its preparation.

6. Applications. Means of control:

- Tests;
- Situational problem;
- Questions and tasks within the content of the material;
- Quiz for entry-level training of students;
- Quiz for final level of training;
- Standardized practical skills;
- List of practical skills

Benchmarks

1. A patient is suffering from symptomatic epilepsy since childhood, in which epileptic seizure is a symptom of glioma in the brain. The patient's cramps are accompanied with visual hallucinations, which allowed the doctor to determine the location of the tumor. In what region of the brain is the pathological process localized?

A. Lobus temporalis

B. Lobus occipitalis

C. Uncus

D. Gyrus supramarginalis

E. Lobus frontalis

2. Patient in his 40s is having symptomatic epilepsy, in which epileptic seizure is caused by a process in the cortex of the brain - tuberculoma. A patient having tonic-clonic spasms in the face, which led to accurately determine the location of the tumor. In what area of the cerebral cortex is tuberculoma located?

A. The lower section gyrus precentralis

B. The upper section gyrus precentralis

C. Average area gyrus precentralis

D. Gyrus supramarginalis

E. Gyrus frontalis superior

3. The patient who is 60 years after stroke has been observed to have violations of visual-spatial orientation, accompanied by emotional symptoms (depression or euphoria). What is the area of the brain affected?

A. The right hemisphere of the brain

B. The left hemisphere of the brain

C. Cerebellum

D. Spinal cord

E. Corpus callosum

4. Woman in her 40s is having total loss of initiative, emotional dullness, disinhibition of instincts, ability to memorize is not lost. What part of the limbic system is likely affected?

A. Fornix corpora mammilaria

B. Bulbus olfactorius

C. Hippocampus

- D. Gyrus cinguli
- E. Fornix

5. Child '12 is having progressive weakness and atrophy of muscles - atrophy or Verdnh-Hoffman disease. Scientists have evidence that in this pathology Betz cells are destroyed and there is atrophy of the pyramidal tract. What gyrus of the brain does pyramidal way begin with?

- A. *Gyrus precentralis*
- B. Gyrus postcentralis
- C. Uncus
- D. Gyrus supramarginalis
- E. Gyrus angularis

6. A man in 50s is having olfactory hallucinations. Irritation of which areas of the cerebral cortex is expressed?

- A. Gyrus precentralis
- B. Gyrus postcentralis
- C. *Uncus*
- D. Gyrus supramarginalis
- E. Gyrus angularis

7. Child (left-handed) is having alalia ("lalia" - language). The child doesn't understand verbal language. Where is the pathological process localized?

- A. *Gyrus temporalis*
- B. Gyrus postcentralis
- C. Uncus
- D. Gyrus supramarginalis
- E. Gyrus angularis

8. The child is having severe alexia, which was first described by Kussmaul in 1876. The patient can not read (either in voice or himself). In which part of the brain pathological process is localized?

- A. Gyrus precentralis
- B. Gyrus postcentralis
- C. Uncus
- D. Gyrus supramarginalis
- E. *Gyrus angularis*

9. Man '50 suffered a severe stroke, after stabilization of the general condition he observed inability to pronounce words clearly. Defeat of what area of the brain caused language and motor center disorders?

- A. Gyrus temporalis
- B. *Gyrus frontalis inferior*
- C. Gyrus postcentralis
- D. Gyrus supramarginalis
- E. Gyrus angularis

10. Scientists have proved that the transparent membrane is responsible for feelings of

pleasure. What structures include pellucidum?

- A. limbic system
- B. pyramidal system
- C. extrapyramidal system
- D. Tsyrkumventrykulyarna system
- E. tipping share

1	2	3	4	5	6	7	8	9	10
B	A	A	A	A	C	A	E	B	A

Situational problem.

1. The patient had hemorrhage in the brain in the region of the hook of gyrus hippocampal. What are the functional disorders the patient might suffer given the localization of the pathology?

- (Violation of smell)

2. After bleeding in the brain woman lost tactile sensitivity in the right hand. Feeling well-known objects with her eyes closed, she did not recognize them. Where is the center of hemorrhage in a patient?

(- a second upper parietal lobulus)

3. The patient had hemorrhage in the brain in the area of calcarine sulcus in the parietal lobe. What functional disorders might the patient suffer?

(- blurred vision)

4. The patient after bleeding in the brain lost understanding of written words. Where is the analysis of writing? After bleeding in the brain a patient can't understand the written language. Where is the sensory analyzer of written speech located.

(- In the marginal gyrus)

5. The patient had hemorrhage in the brain in the region of the superior temporal gyrus. What are functional disorders the patient might suffer?

(- Hearing impairment)

6. After bleeding in the brain a woman does not understand the words that are pronounced. The ability to speak is not lost. Where is the focus of hemorrhage located?

(- Angular gyrus)

7. The patient had bleeding in the brain, followed by significant changes in the language. The patient may cry and even sing, but lost the ability to speak a word. Where is the focus of hemorrhage located?

(- A triangular lower part of the frontal gyrus)

8. After bleeding in the brain the patient is observed to have vestibular disorders (ataxia) -he can't stand still and sways. Where is the focus of hemorrhage located?

(- In the area of the middle and lower temporal gyri).

9. After bleeding in the brain a patient lost tactile, pain and temperature sensitivity in a lower extremity. Where is the focus of hemorrhage?

(- Upper parietal gyrus)

10. Hemorrhage in the brain caused paralysis of the left half of the body. Damage to what area of cerebral hemispheres leads to such disorders?

(- Right antero-centralis gyri).

Quiz to check the entry-level training of students.

1. Name the parts of the brain.
2. What belongs to the forebrain?
3. How are hemispheres separated from each other and from the cerebellum?

4. What surfaces do cerebral hemispheres have?
5. Which edges do cerebral hemispheres have?
6. Name the lobes of cerebral hemispheres.
7. What sulci limit the frontal lobe?
8. What sulci limit the parietal lobe?
9. What sulci limit the occipital lobe?
10. What sulci limit the temporal lobe?
11. Where is the islet lobe located?
12. Name the components of the limbic share.
13. What applies to the neocortex?
14. What areas belong to the ancient crust?
15. What areas belong to the old crust?

Control questions and tasks to check the final level of training with student.

1. Name and demonstrate components of the forebrain on the preparations.
2. What surfaces and edges does a hemisphere have? Demonstrate on preparation.
3. What are the poles does a hemisphere have? Demonstrate on preparation.
4. On the picture of the preparations of the frontal lobe of the brain and sulci that limit it.
5. On the picture of the preparations of the parietal lobe of the brain and sulci that limit it.
6. On the picture of the preparations of the occipital lobe of the brain and sulci that limit it.
7. On the picture of the preparations of the temporal lobe of the brain and sulci that limit it.
8. On the picture of the preparations of the islet lobe of the brain and sulci that limit it.
9. On the picture of the preparations of the limbic lobe of the brain and sulci that limit it.
10. What are the sulci and gyri frontal lobe has on superolateral surface?
11. What are the sulci and gyri frontal lobe has on medial surface?
12. What are the sulci and gyri frontal lobe has on inferior surface?
13. What are the sulci and gyri parietal lobe has on superolateral surface?
14. What are the sulci and gyri parietal lobe has on medial surface?
15. What are the sulci and gyri temporal lobe has on superolateral surface?
16. What are the sulci and gyri temporal lobe has on inferior surface?
17. What are the sulci and gyri occipital lobe has on superolateral surface?
18. What are the sulci and gyri occipital lobe has on medial surface?
19. What are the sulci and gyri occipital lobe has on inferior surface?
20. What are the sulci and gyri islet lobe has?
21. What are the sulci and gyri limbic lobe has?
22. Under the influence of what receptors was the forebrain formed?
23. The more limited antero-centrally and convolutions and sulci? To what lobe they belong? Show on preparation.
24. On the picture of the preparations show the postcentral gyrus. What is it limited by? To which lobes belong?
25. What limits top of the parietal lobe and lobules? Show on preparation.

26. On the picture of the preparations show supramarginal and angular gyri. What are they limited by? To which lobes belong?
27. What are the most limited gyri? Show on preparation.
28. On the picture of the preparations show lower frontal gyri. What part of it is shared?
29. On the picture of the preparations show the cingulum . What is it limited by? To which lobe belongs?
30. On the picture of the preparations show hook of hippocampal gyrus . What is it limited by? Which lobe belongs?
31. On the picture of the preparations show calcarine sulcus. To which lobe does it belong?
32. On the picture of the preparations show the transverse temporal gyri. To what lobe do they belong?
33. Explain the concept of "old cloak" and "a new mantle." What types of cerebral cortex are distinguished by features of phylogenetic development? Name the structure and location of these types of cortex in humans.
34. In what areas of the cerebral hemispheres is new, old and ancient cortex located?
35. What six layers does neocortex have??
36. What is meant by the term "analyzer"?
37. What is the concept of "first signaling system" and "second signal system" for I. P. Pavlov?
38. What cortical ends of analyzers first signal system you know ?
39. What cortical centers belong to the second signal system?
40. Where is the cortical center of motor analyzer? Show on preparation.
41. Where is cortical center of analyzer of overall sensitivity located? Show on preparation.
42. Where is cortical center of analyzer of turning head and eyes in the opposite direction located? Show on preparation.
43. Where is the cortical center of visual analyzer located? Show on preparation.
44. Where is the cortical center of auditory analyzer located? Show on preparation.
45. Where are the cortical centers of gustatory and olfactory analyzers located? Show on preparation.
46. Where is the cortical center of cortical visual analyzer writing located? Show on preparation.
47. Where is the cortical center auditory analyzer oral language located? Show on preparation.
48. Where is the cortical center of propulsion analyzer of articulation of language located? Show on preparation.
49. Where is the cortical center of motor analyzer of written speech located? Show on preparation.

A standardized list of practical skills:

- Longitudinal fissure of the brain
- The side hole of the brain
- The frontal lobe;
- The parietal lobe;
- The temporal lobe;
- The occipital lobe;
- The islet lobe;

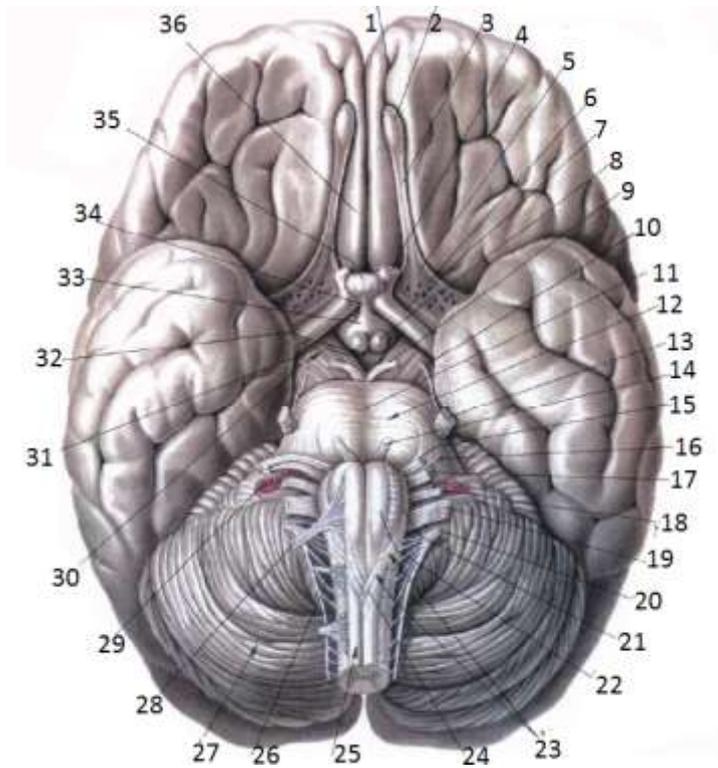
Superolateral surface of the brain

- The central sulcus;
- The lateral sulcus;
- The frontal lobe;
- The frontal pole;
- Precentral sulcus;
- Precentral gyrus;
- Superior frontal sulcus;
- Inferior frontal sulcus;
- Superior frontal gyrus;
- Medial frontal gyrus;
- Inferior frontal gyrus:
 - The ascending branch;
 - The front branch;
 - Pars opercularis.
- The triangular part
- The orbital part
- The parietal lobe
- Postcentral sulcus
- Postcentral gyrus
- Superior parietal lobule;
- Intraparietal sulcus;
- Inferior parietal lobule:
 - The angular gyrus;
 - The supramarginal gyrus.
- The temporal lobe:
 - Superior temporal sulcus;
 - Inferior temporal sulcus;
 - Superior temporal gyrus;
 - Medial temporal gyrus;
 - Inferior temporal gyrus;
 - Transverse temporal gyri;
- The occipital lobe;
- the occipital pole;
- Islet lobe;
- Islet gyrus.

Medial and inferior surface of the cerebral hemisphere:

- Sulcus corpus callosum;
- Gyrus cingularis;
- Cingulum;
- Isthmus cingulate;
- Hippocampal sulcus;
- Prehippocampal sulcus;
- Uncus;
- Dentate gyrus;
- Olfactory sulcus;
- Precentral sulcus;
- Precentral gyrus;
- Parietal-occipital sulcus;
- Wedge;
- Calcarine sulcus;
- Lingual gyrus;
- Bypass sulcus;

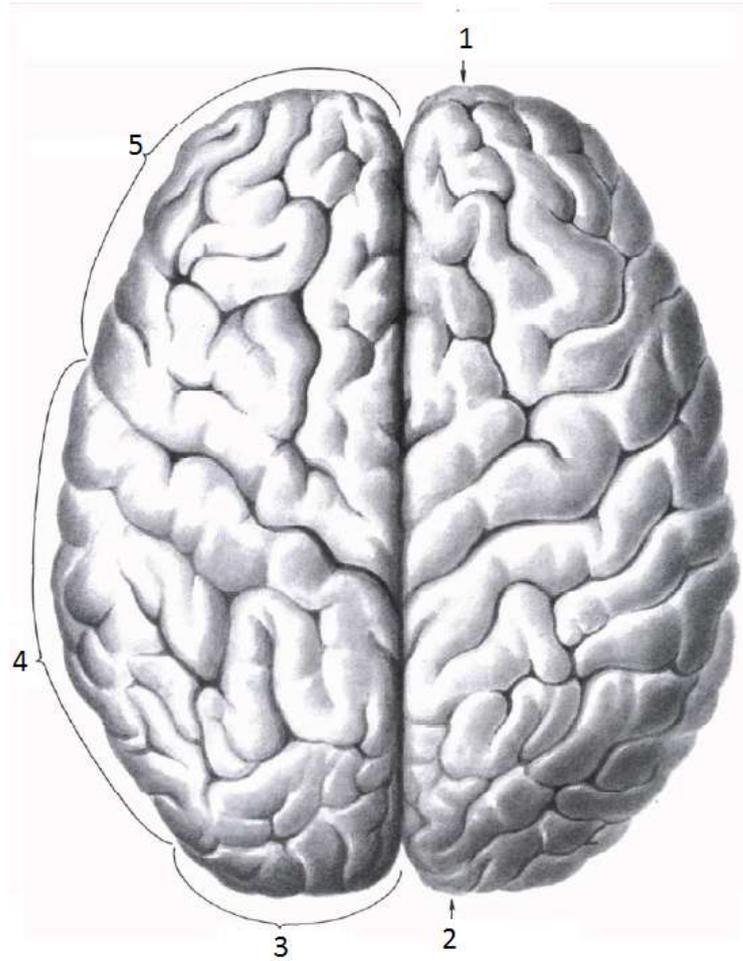
- Medial occipital-temporal gyrus;
- Occipital-temporal sulcus;
- Lateral occipital-temporal gyrus;
- Rectal gyrus;
- Olfactory sulcus;
- Orbital sulci;
- Orbital gyri.



The brain (_____). Bottom view. The bottom surface

A Ukrainian and Latin terms to 1-36:

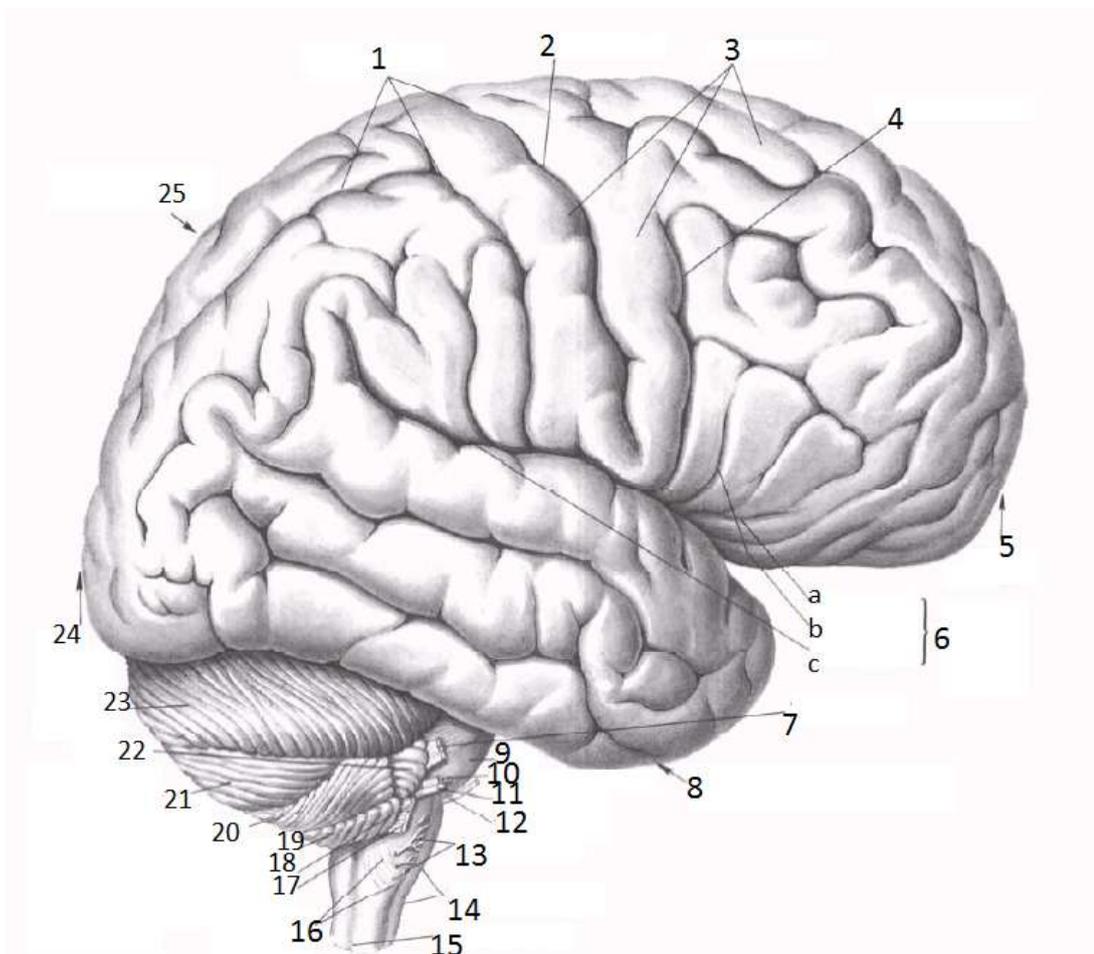
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| 17. | 35. |
| 18. | 36. |



Big brain (_____). Top view. Meninges removed.

A Ukrainian and Latin terms to 1-5:

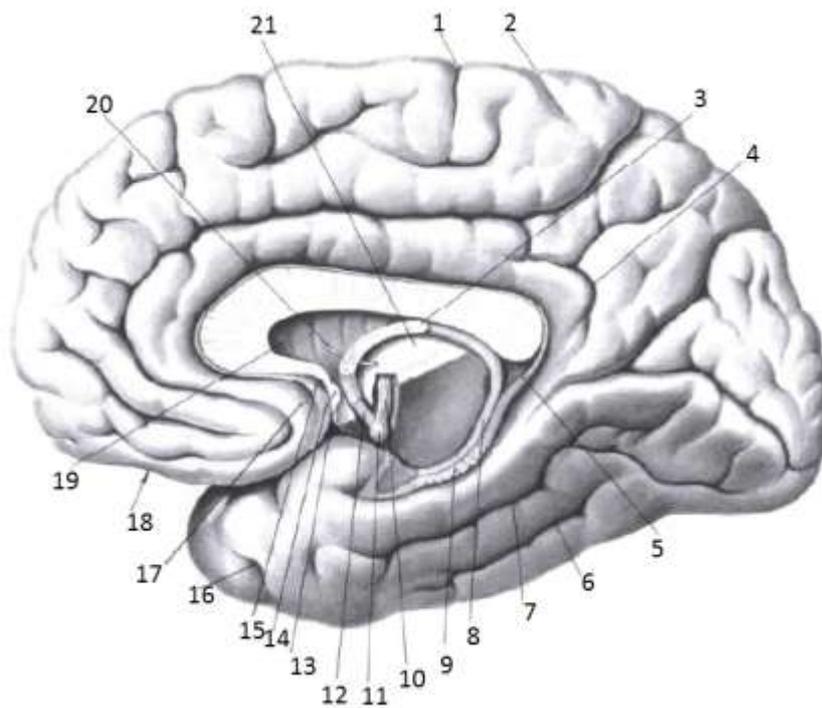
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- 2.
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- 4.
- 5.



The brain, side view.

A Ukrainian and Latin terms to 1-25:

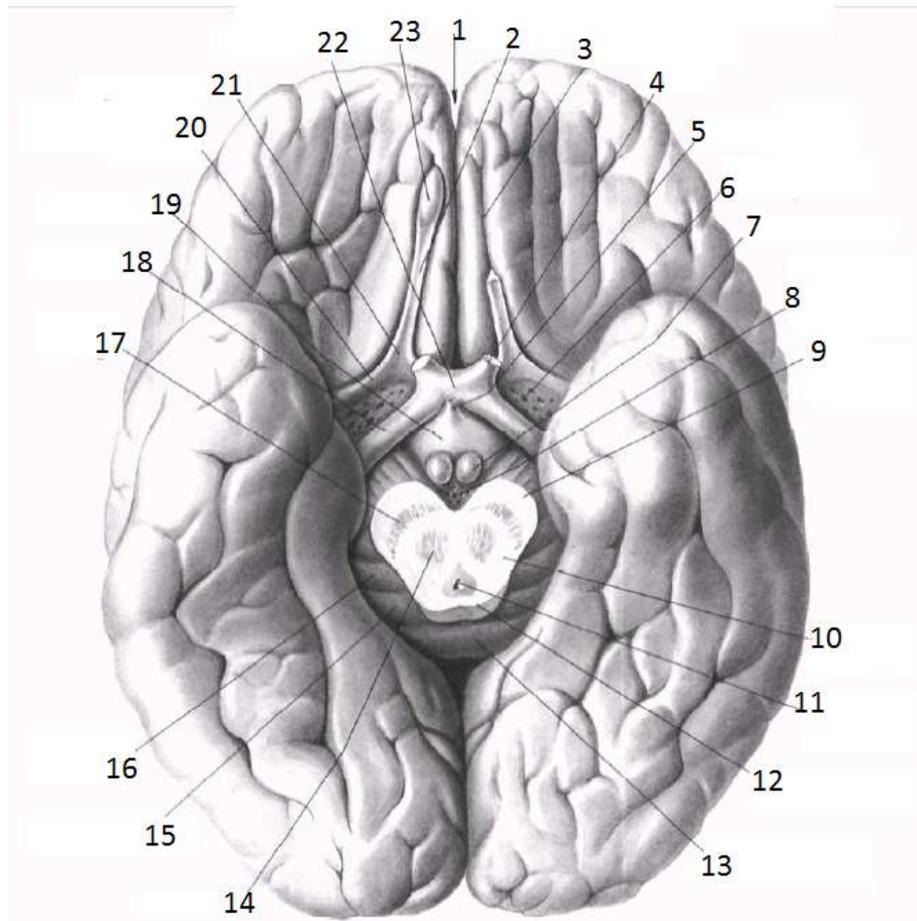
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| | 25. |



Big brain (_____). The right hemisphere (_____). The medial part . (Stem and cerebellum removed)

A Ukrainian and Latin terms to 1-21:

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|-----|-----|
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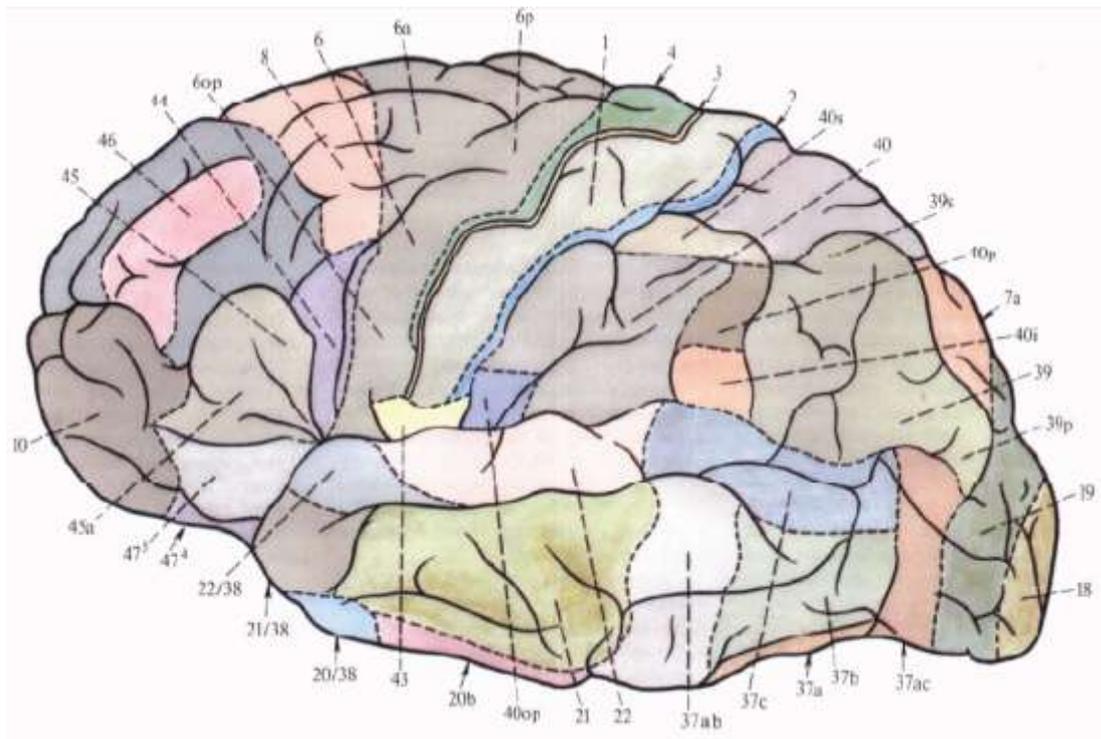


Big brain (_____), view from below .

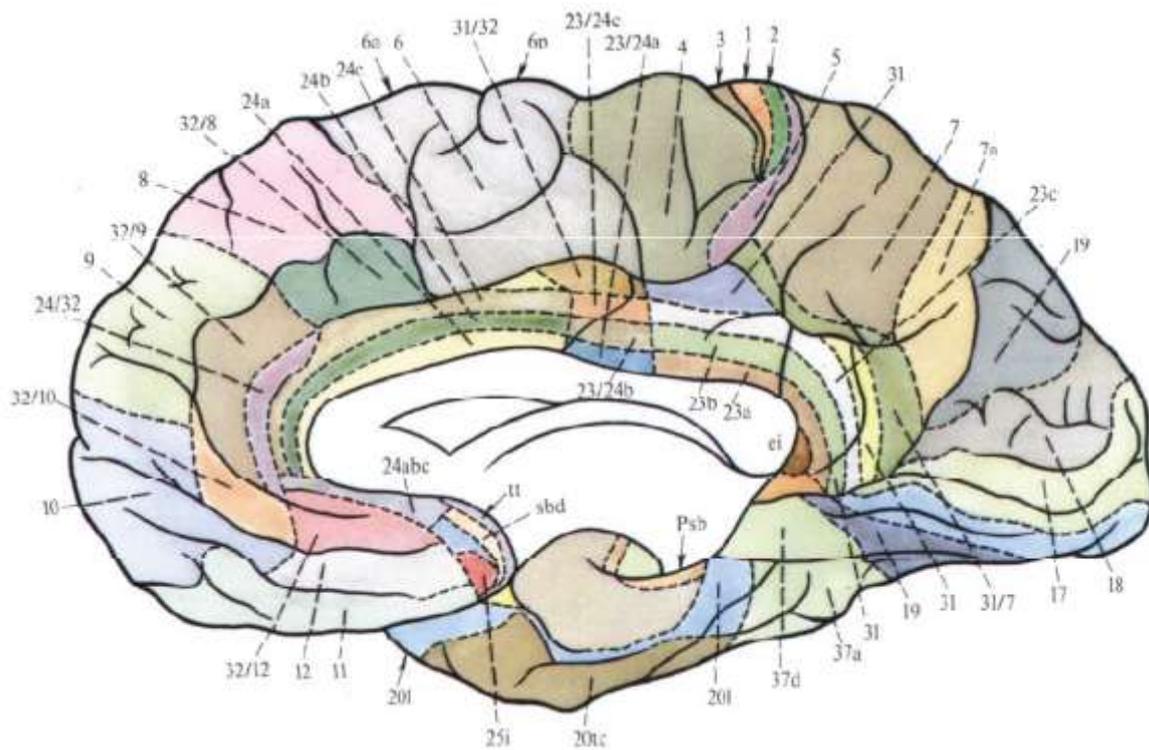
(Sulci and gyri of base of the brain stem, cerebellum, and pituitary gland and part of the left olfactory path removed)

A Ukrainian and Latin terms to 1-23:

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| 12. | |



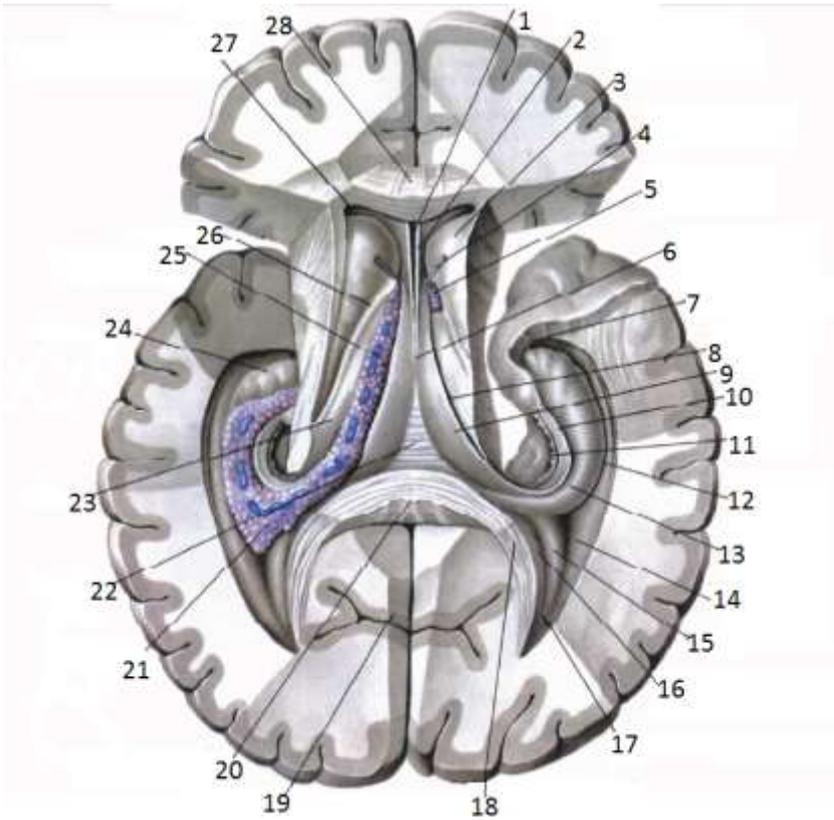
Cytoarchitectonics field cerebral cortex of the brain. (Lateralis surface .)
 (According to Sinelnikov)
 A Ukrainian and Latin terms:



Cytoarchitectonic field cerebral cortex of the brain . (Medial surface).

(According to Sinelnikov.)

A Ukrainian and Latin terms:



The lateral ventricles (_____). Top view.

(Deleted are the trunk of the corpus callosum, opened front, back, bottom and central part of the horns of the lateral ventricles.)

A Ukrainian and Latin terms to 1-28:

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