HUMAN ANATOMY

ATLAS

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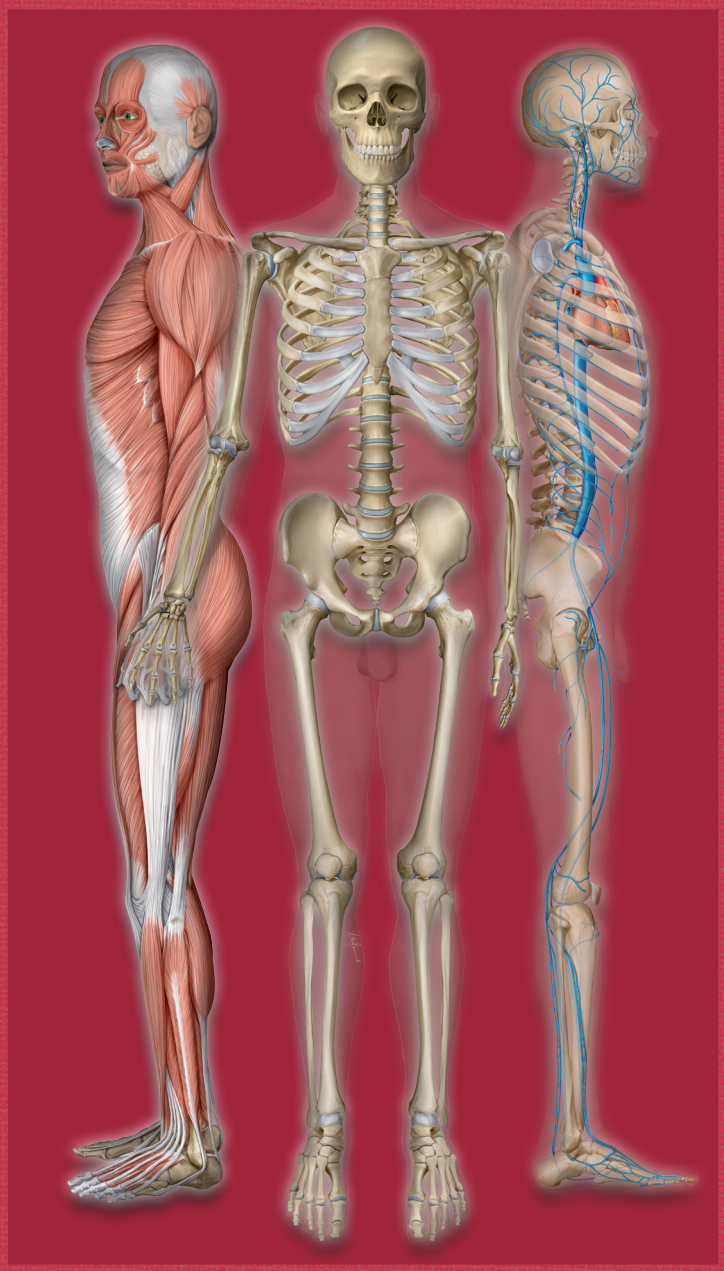
Editor English Edition



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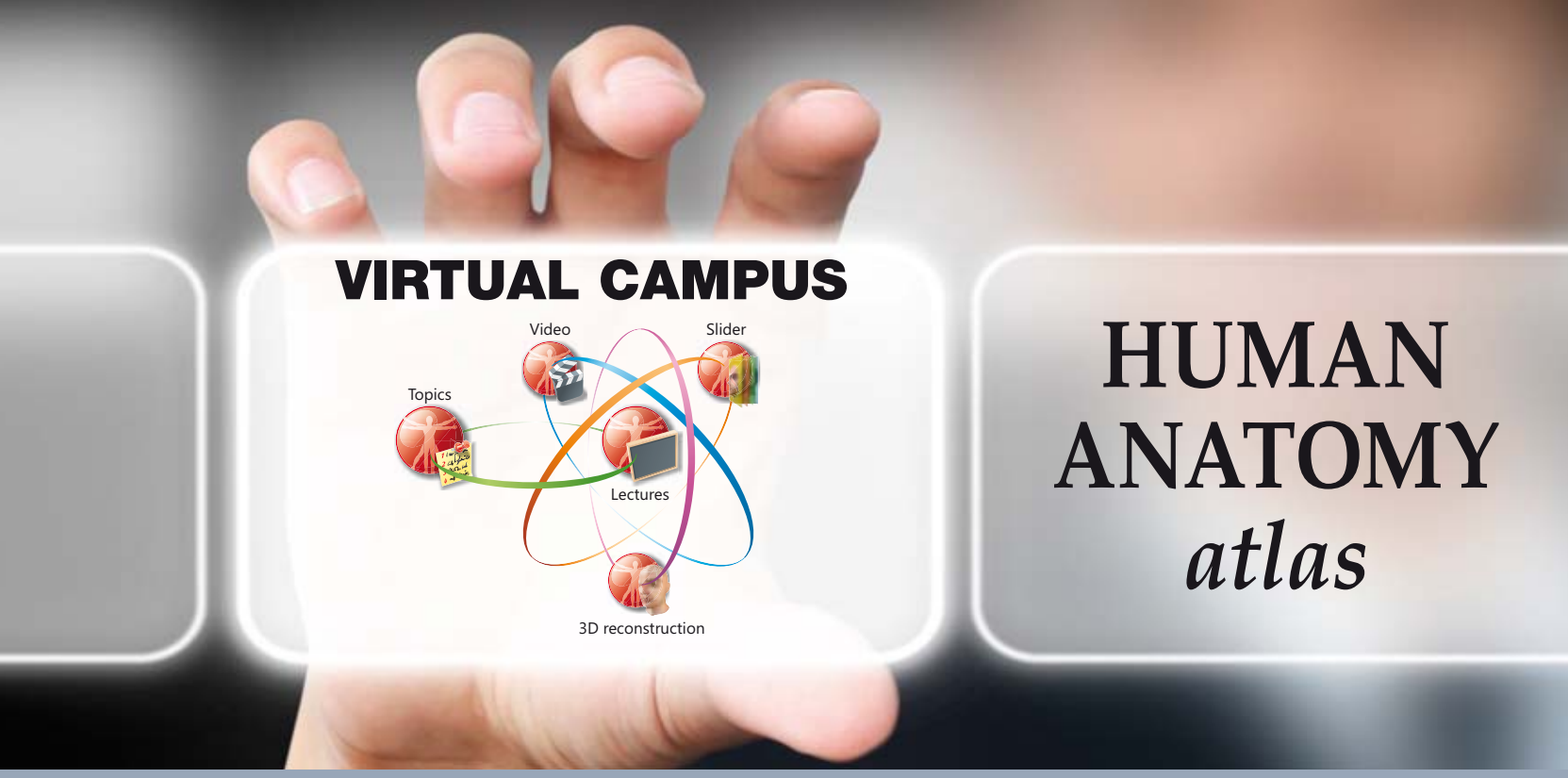

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Atlas

Digital Edition

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HUMAN ANATOMY - ATLAS - Giuseppe Anastasi, Eugenio Gaudio, Carlo Tacchetti (eds)
Estomih Mtui (ed English edition)

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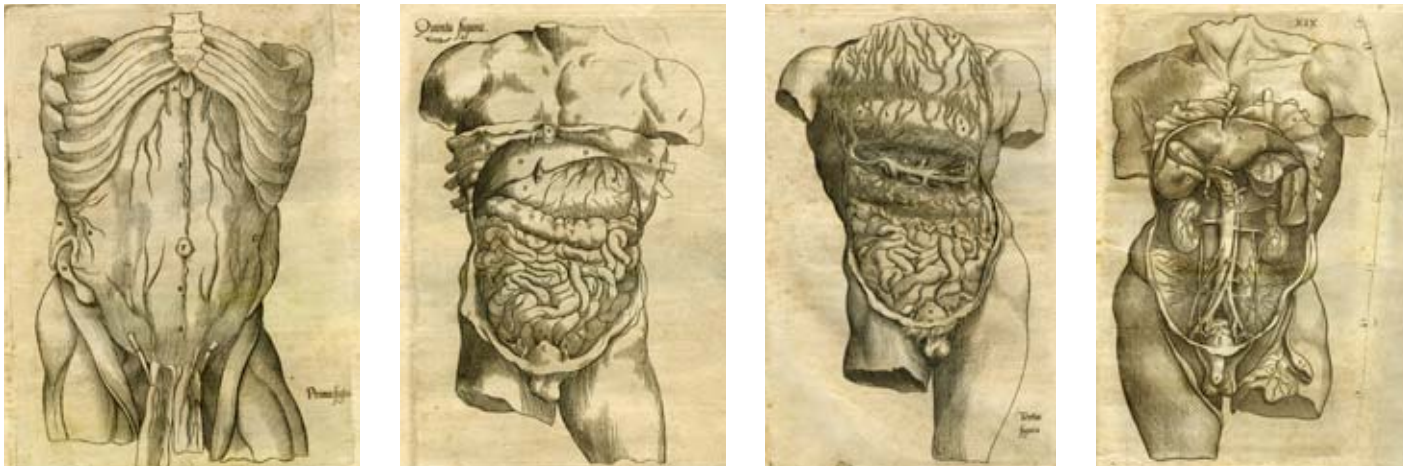
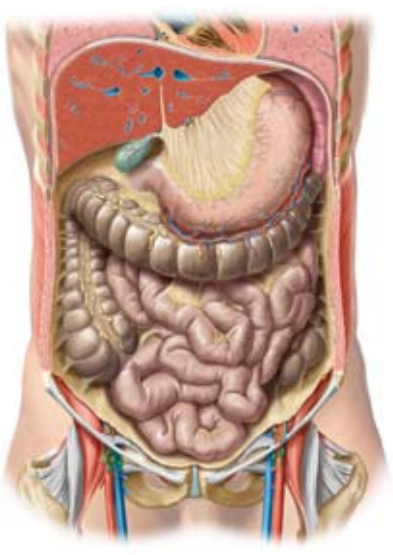
Preface

The study of Human Anatomy requires significant theoretical learning coupled with an indispensable visual and manual contact with the human body. In theoretical learning, graphic representations play an important role in rendering the comprehension more immediate with respect to verbal description, notwithstanding its elaborate detail. Hence, the common need on the part of teachers and students to have clear and explanatory images – teachers for their lessons and students for their personal study. Ever since the beginning of the study of Human Anatomy – with the drawings of Leonardo da Vinci and Andreas Vesalius – anatomic illustration has always been an indispensable tool used alongside dissection to show students the topographic reality of organs and systems.



Andreae Vesalii, *Suorum de humani corporis fabrica librorum epitome*, Londini 1545
(courtesy of the Department of Experimental Medicine, Section of Human Anatomy, University of Genoa)

In the last few years, technological progress has enabled computer graphics, image post-processing methods and diagnostic imaging technologies to attain levels of detail and resolution unimaginable even just a decade ago. Combining these approaches, it is now possible to obtain extraordinarily realistic two- and three-dimensional anatomic representations of the living human body. And, with the aid of invasive diagnostic



Exemplificative images
from the Atlas of Human Anatomy

techniques (e.g. endoscopy, laparoscopy or thoracoscopy), one can also accompany these with images and videos of high anatomic quality and comprehensibility.

Thus the study of Human Anatomy on the cadaver can profit and gain from that based on the living human body, i.e. what the future doctors and health professionals will eventually be dealing with.

Based on these considerations we have created an innovative Atlas composed of an amply illustrated text and of a web area rich in original contents, in which both Anatomy as studied on the cadaver and Anatomy of the living human body find their place within a coordinated, organized framework.

The print version of the Atlas is organized on a regional and topographic basis. Each chapter is illustrated with the aid of:

- accurately executed and didactically useful drawings
- stratigraphic sequences that allow the reader, page by page, to reconstruct the organization of the various anatomic regions
- realistic CT or MR images of the living human body, elaborated with a program of three-dimensional volume rendering
- photographs of laparoscopic and endoscopic examinations.

The ***"Virtual Campus"*** web platform gathers together a vast catalogue of didactic material that is immediately accessible to the user thanks to its innovative organization with respect to the general world of Anatomy atlases. Each resource proposed is clearly framed within its area of reference; in addition, to shorten research times, the user can take advantage of interactive guided courses that provide full-fledged descriptions of anatomic areas presented in the format of a frontal lesson.

Contents of the web platform include:

- video lectures of Topographic Anatomy guide the user through resources related to the specific topic, by means of links becoming available when required
- interactive 3D reconstructions of CT or MR examinations of single organs or regions
- commented videos of laparoscopies and endoscopies
- commented videos of anatomic dissections on cadavers
- interactive stratigraphic animations.

Our aim with this work was to create a useful instrument both for students and teachers: as a tool for students in the study of anatomy and an indispensable companion throughout the whole course of their studies leading to graduation; and as an aid for teachers in the preparation of their own lessons.

But not only: it is now statistically proven that the knowledge of Anatomy acquired in the course of studies tends to diminish over time, and so needs to be updated constantly. Hence, this Atlas is also addressed to health professionals as a valid tool of consultation for updating their knowledge.

The particular development of some parts - that may appear to be highly specialized - makes this Atlas suitable for students and health professionals not only in the area of Medicine and Surgery, but also in the areas of Physiotherapy, Nursing Sciences, Motor Sciences, Dentistry and for all health professional courses.

This compact edition, although with fewer illustrations and a limited reorganization, covers exhaustively all parts of the human body, with the same attention to details given to the three-volume version, and offering, especially by the students, an easier and handy consultation.

We feel the need to express a sincere and heartfelt gratitude to the Publisher's staff, for the great professionalism and enthusiasm demonstrated in the realization of this work alongside all of us.

We also extend our thanks to all those – colleagues, scientists, teachers and assistants – who have helped us with their advice, materials and critical review, stimulating us to bring to reality a milestone in the international panorama of publishing.

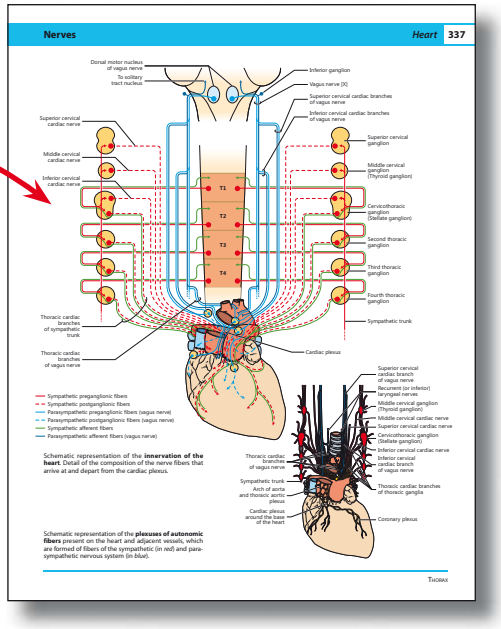
the Editors and the Contributors

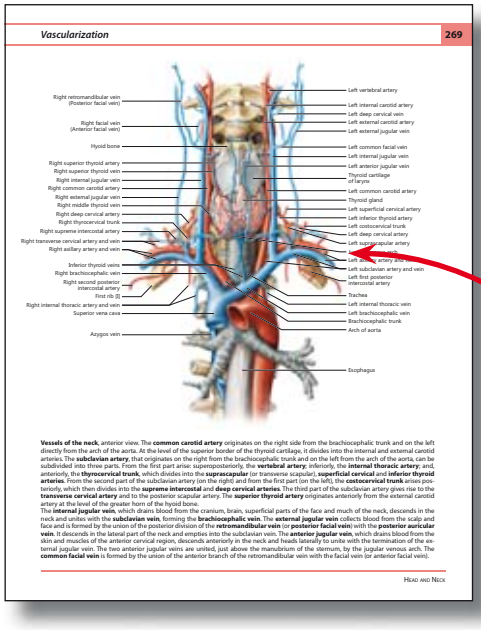
Constituent Elements of the Atlas

The Atlas deals with the organization of the human body through various means of displaying the complex structures composing it.

Schematic Representations

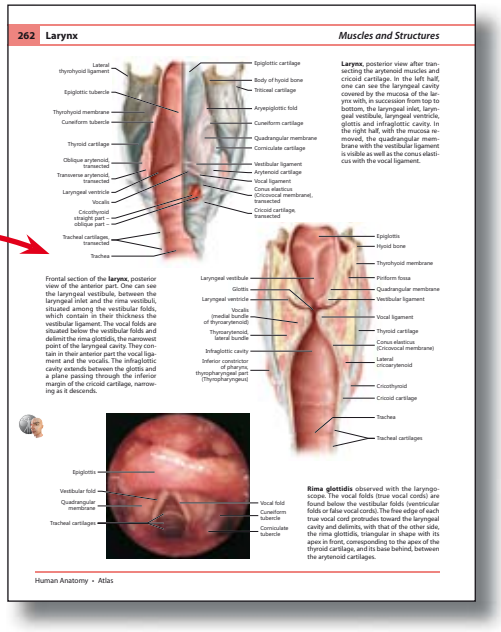
Simple and immediate summary diagrams present the distribution and drainage pathways of arteries, veins, and lymphatic vessels in a concise and explanatory manner.





Traditional Pictorial Illustrations

Traditional, top notch iconography with color drawings, masterfully made specifically for this work, basic teaching aids accompanied by extensive explanatory captions.

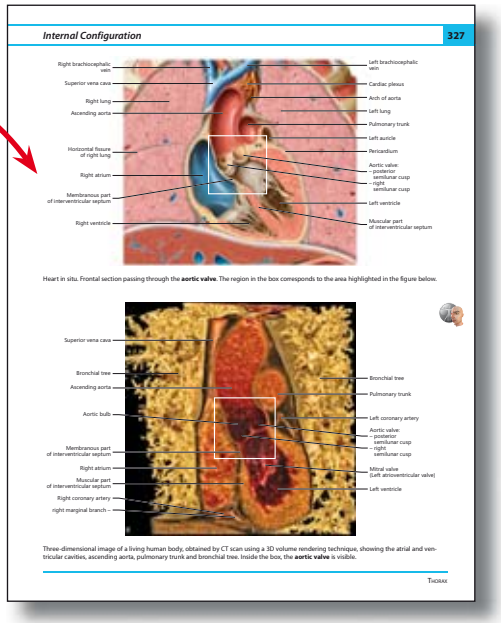


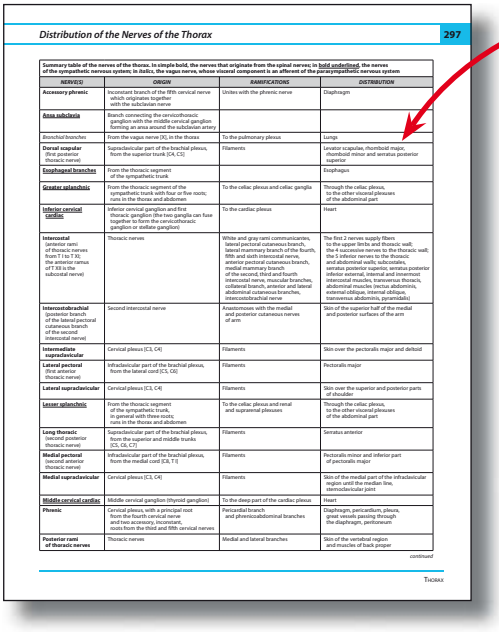
Live Endoscopic Images

Images obtained during diagnostic examinations of thoracoscopy, laparoscopy, and endoscopy provide details of the anatomy of the living.
The images are taken from videos entirely available as digital subsidies on the web platform associated with the Atlas.

Live Three-dimensional Images

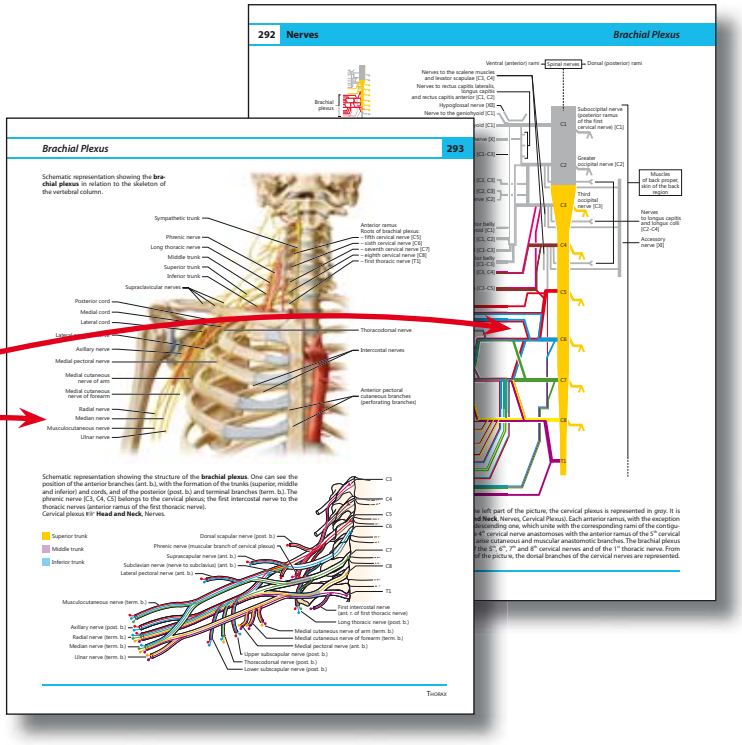
The three-dimensional images of the living obtained with 3D volume rendering technique, of CT or MR image sequences help to understand the most refined anatomic details. Stratigraphic sequences and interactive 3D reconstructions are present in the Atlas web platform.
The reader, either a student or a professional, will have access to anatomic images – derived from cadavers, pictorial or obtained from a living human subject, through the use of diagnostic imaging techniques such as NMR or CT, viewed from diverse angles, or projections. In particular, except in the case of particular visualizations which are otherwise indicated, images on a transverse plane obtained with diagnostic imaging techniques are always presented according to a conventional projection from below, with the subject placed in supine position. In contrast, anatomic pictorial images or representations are presented according to a projection from above.





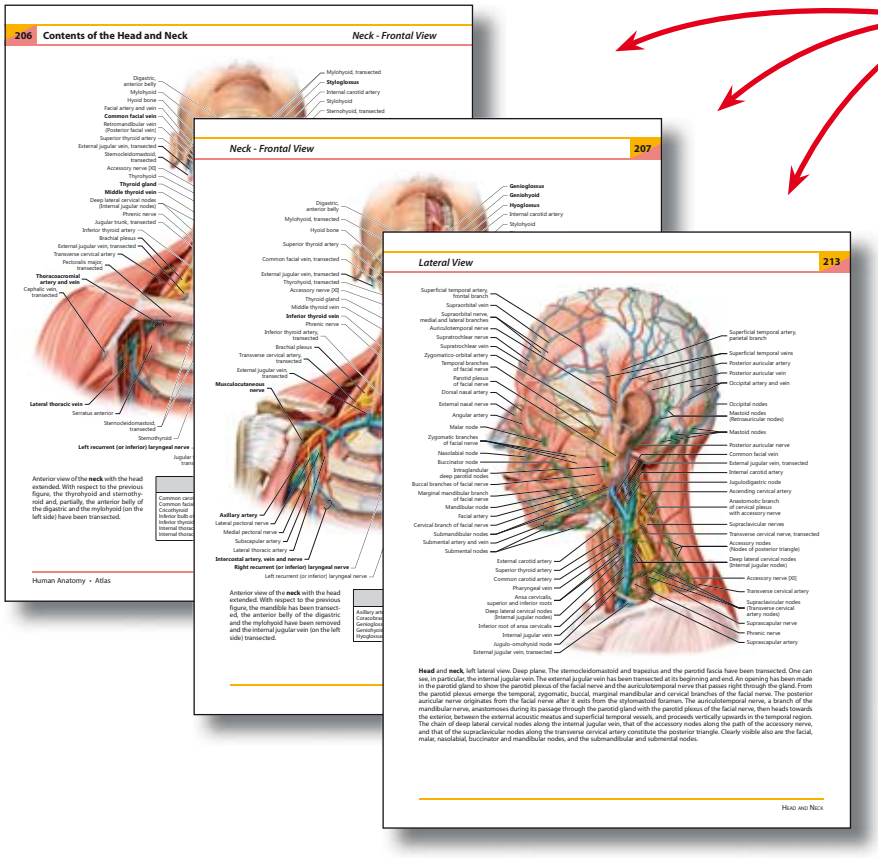
Summary Tables

Numerous tables summarize the boundaries and content of anatomical regions, arteries, veins, nerves, lymph nodes, muscles, joints, and bones, providing and organizing the most relevant information for each item schematically.



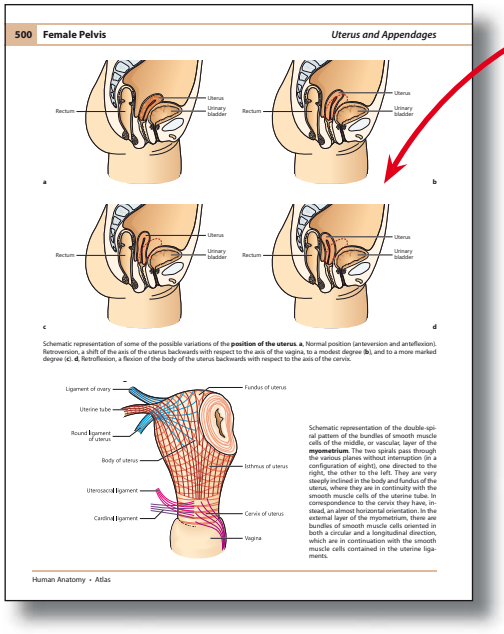
Diagrams Provide Examples of Nerve Plexuses

The organization of the nerve plexuses, sensory, and motor pathways is presented with effective summary patterns that accompany the most complex anatomical drawings.



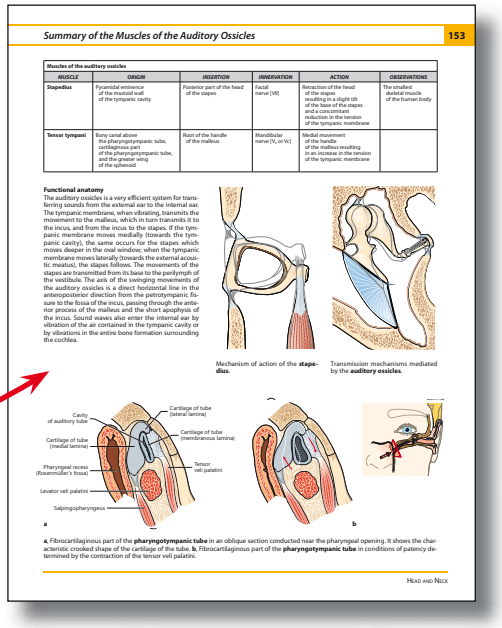
Frontal and Lateral Slider

A sequence of drawings allow the student to study the contents of the cavities or the organization of anatomical regions with a stratigraphic multidimensional approach on frontal planes, sagittal planes or successive transverse planes. The different anatomical structures seen in each cavity or region are overlapped and added progressively. Sliders are available in the interactive form in the web platform associated with the Atlas.



Physiological and Clinical Indications

Physiological and clinical aspects and references were incorporated in order to illustrate the anatomical basics in a logical manner.



Elements of Biomechanics

Drawings, diagrams, and tables facilitate understanding and memorization of bones, joints, and muscular complexes and joint dynamics.

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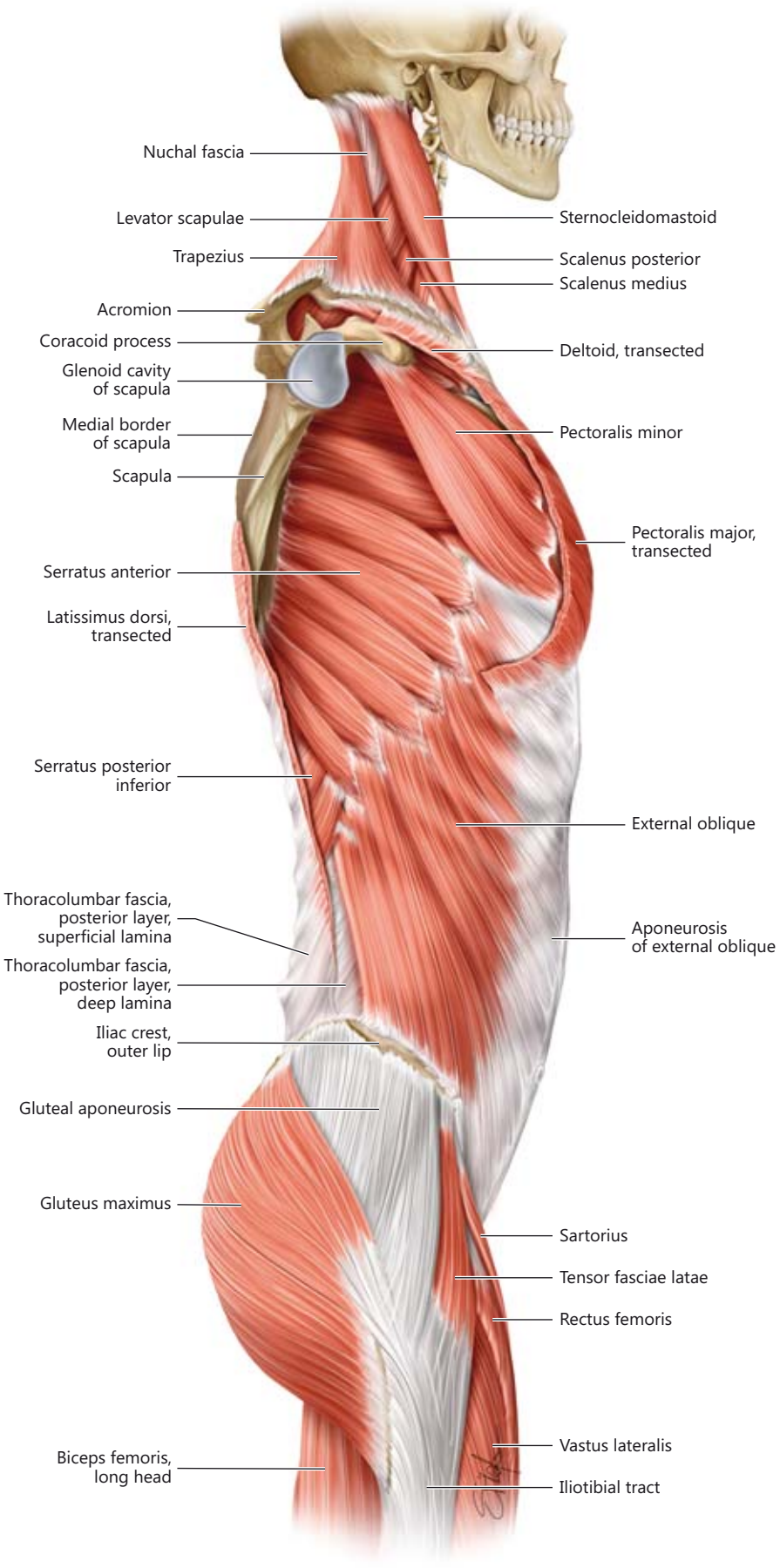
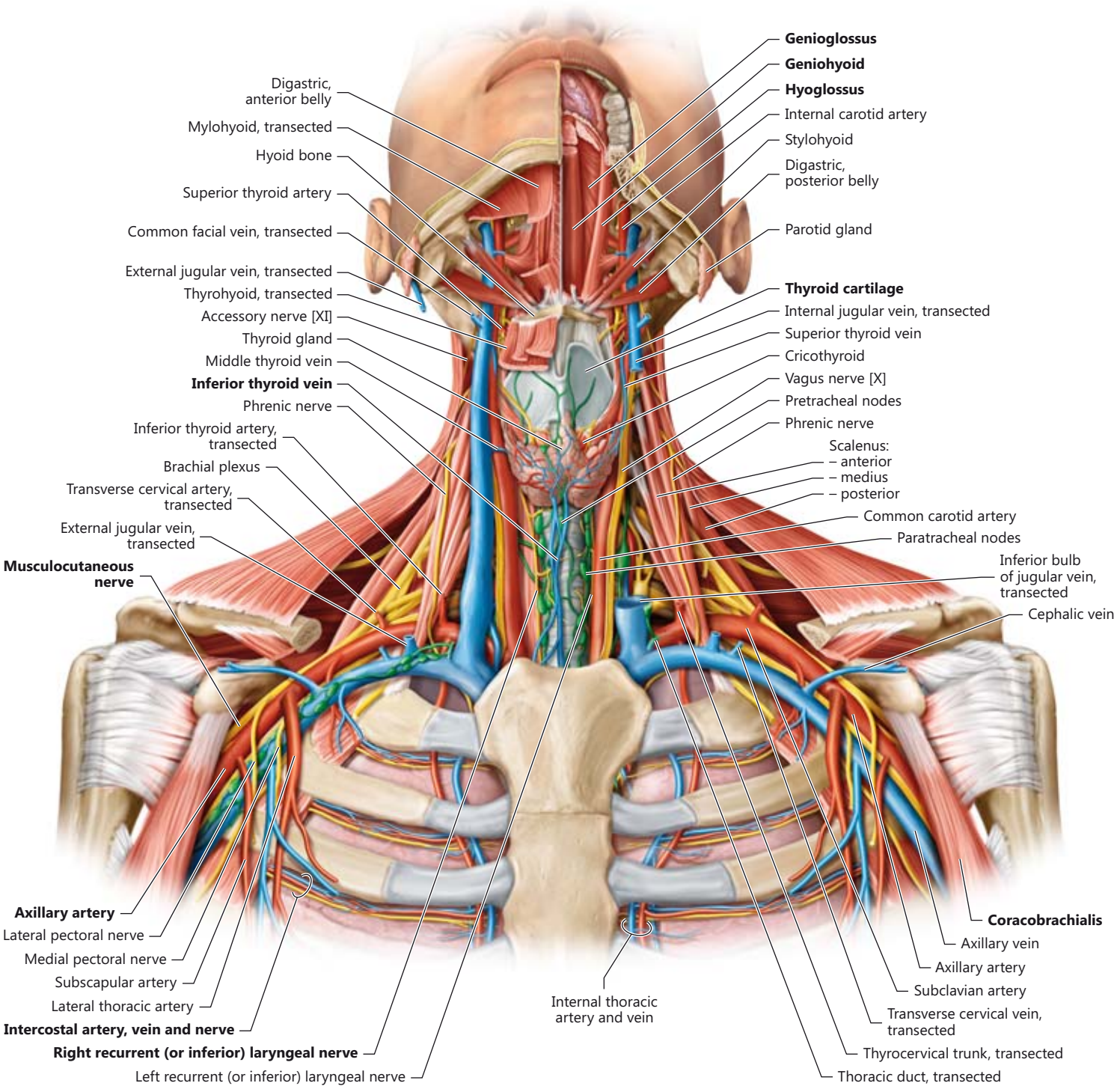
NERVOUS SYSTEM AND SENSE ORGANS

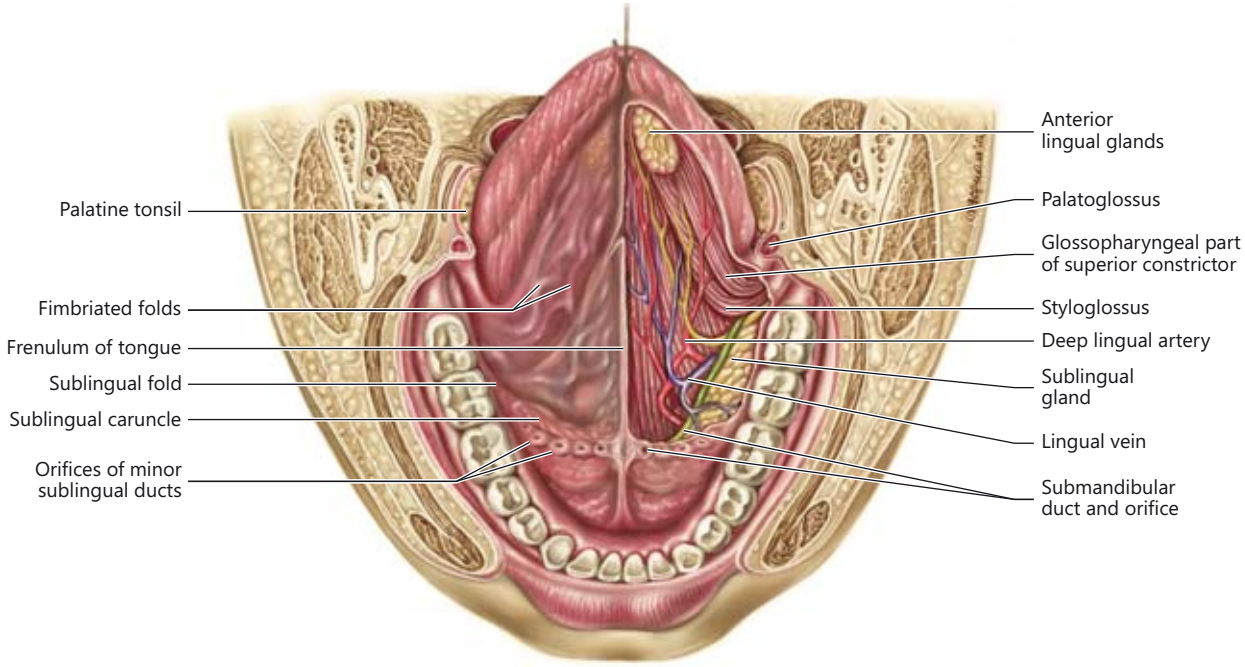


Extensive resection of the **latissimus dorsi** and **pectoralis major** highlights the **pectoralis minor**, located deep to the pectoralis major, and **serratus anterior**, found on the lateral surface of the rib cage. The **external oblique**, along with the **internal oblique** over which it is superimposed, and the **transversus abdominis**, which lies deep to the **internal oblique**, form the lateral wall of the abdomen.

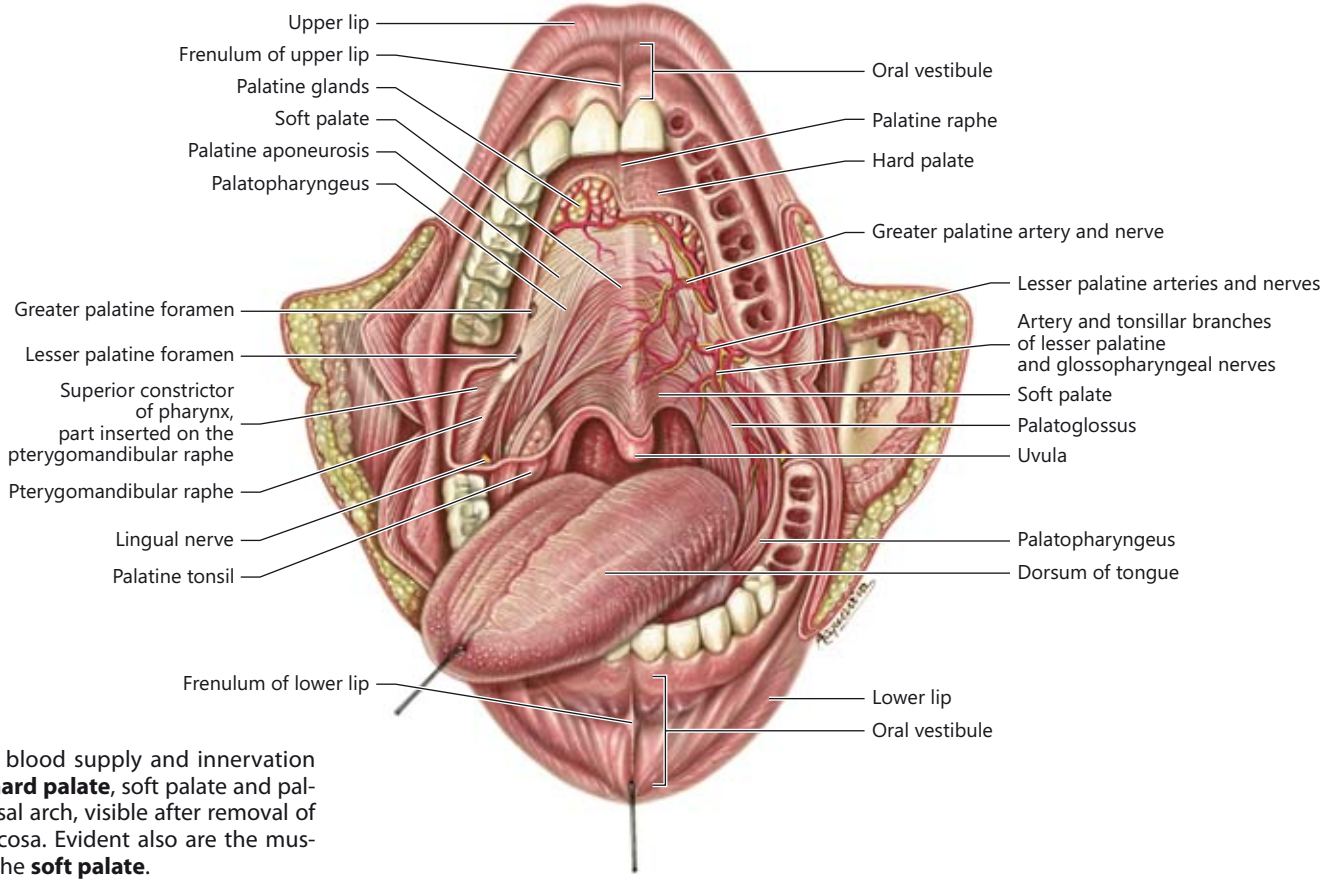


Anterior view of the **neck** with the head extended. With respect to the previous figure, the mandible has been transected, the anterior belly of the digastric and the mylohyoid have been removed and the internal jugular vein (on the left side) transected.

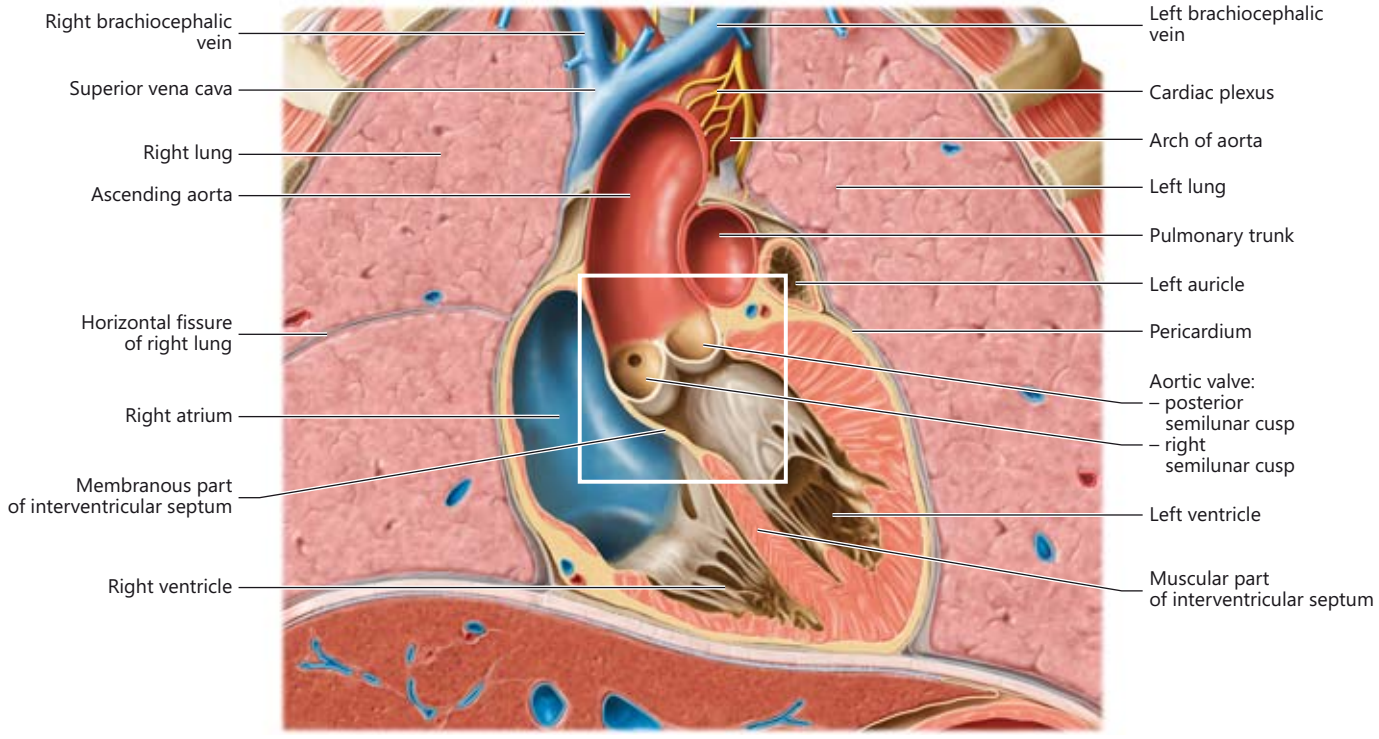
CONTENTS OF THE HEAD AND NECK (in bold are the structures added with respect to the preceding figure)		
Axillary artery Coracobrachialis Genioglossus Geniohyoid Hyoglossus	Inferior thyroid vein Intercostal artery Intercostal nerve Intercostal vein Musculocutaneous nerve	Right recurrent (or inferior) laryngeal nerve Thyroid cartilage



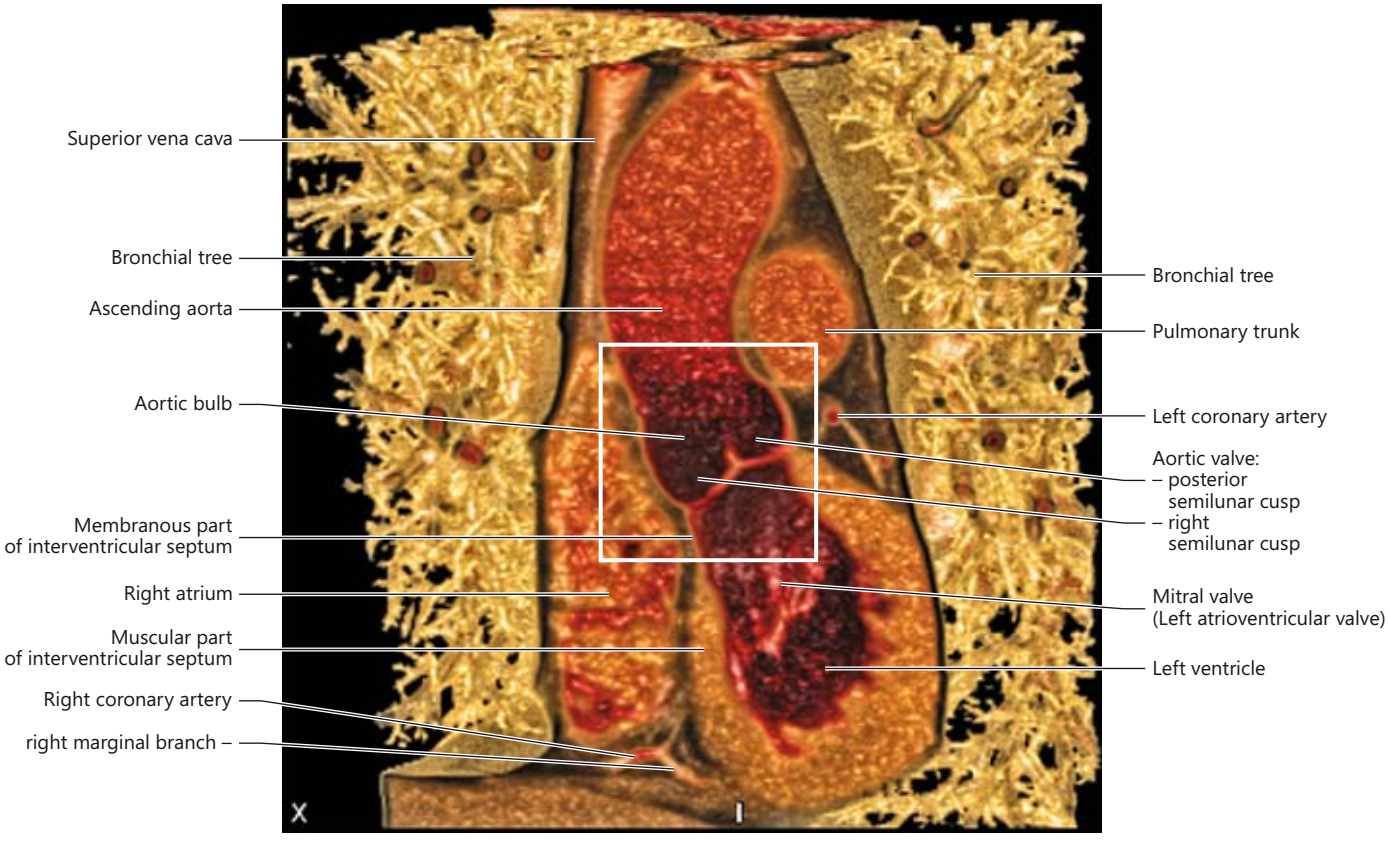
Sublingual sulcus. Transverse section of the head passing through the oral fissure. The tongue raised backwards shows the sublingual sulcus. On the right side, where the mucosa is intact, the veins of the submucosa can be seen showing through. On the left, the mucosa has been removed, and one can see affluents of the lingual vein and branches of the deep lingual artery. In addition, in the sublingual sulcus, the orifices where the ducts of the submandibular and sublingual glands open into the sulcus are visible.



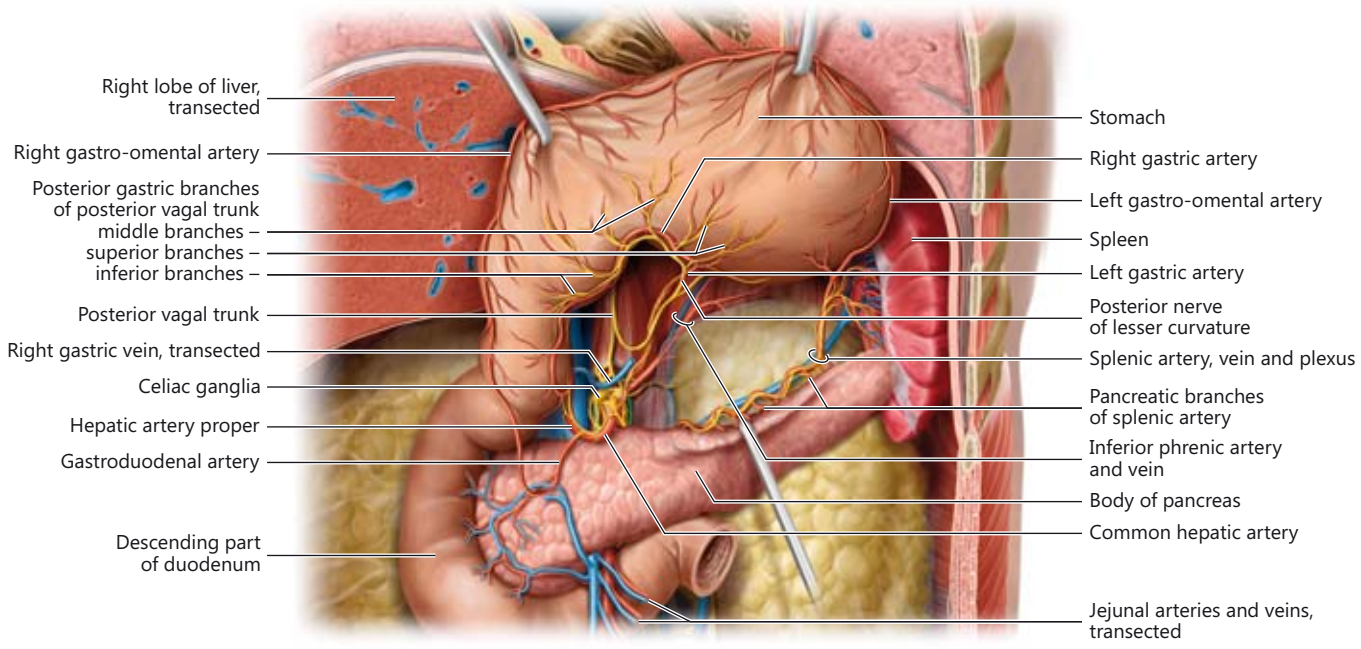
Arterial blood supply and innervation of the **hard palate**, soft palate and palatoglossal arch, visible after removal of the mucosa. Evident also are the muscles of the **soft palate**.



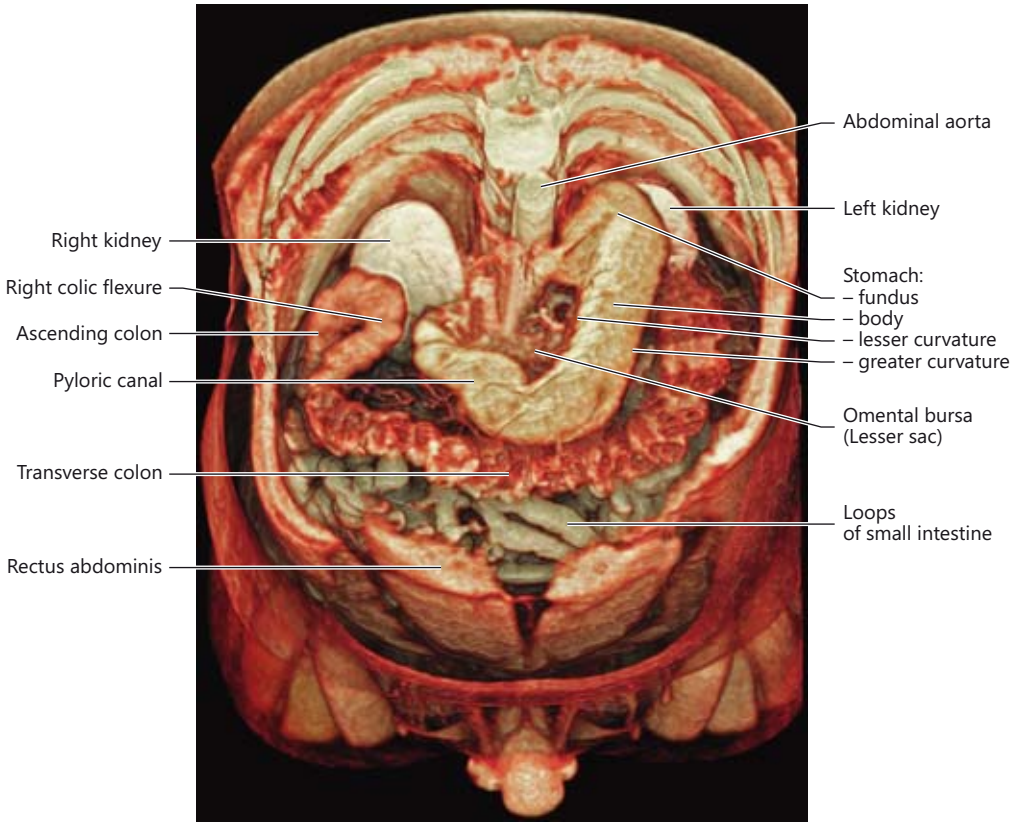
Heart in situ. Frontal section passing through the **aortic valve**. The region in the box corresponds to the area highlighted in the figure below.



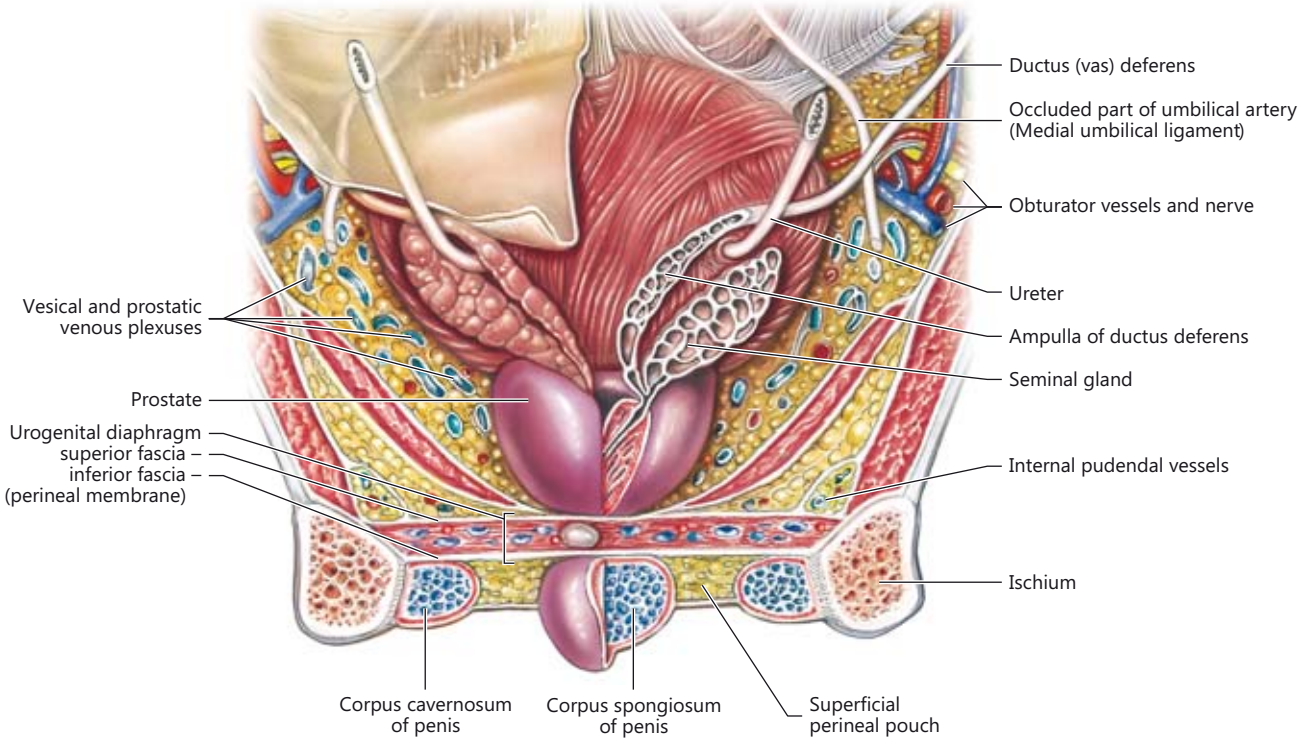
Three-dimensional image of a living human body, obtained by CT scan using a 3D volume rendering technique, showing the atrial and ventricular cavities, ascending aorta, pulmonary trunk and bronchial tree. Inside the box, the **aortic valve** is visible.



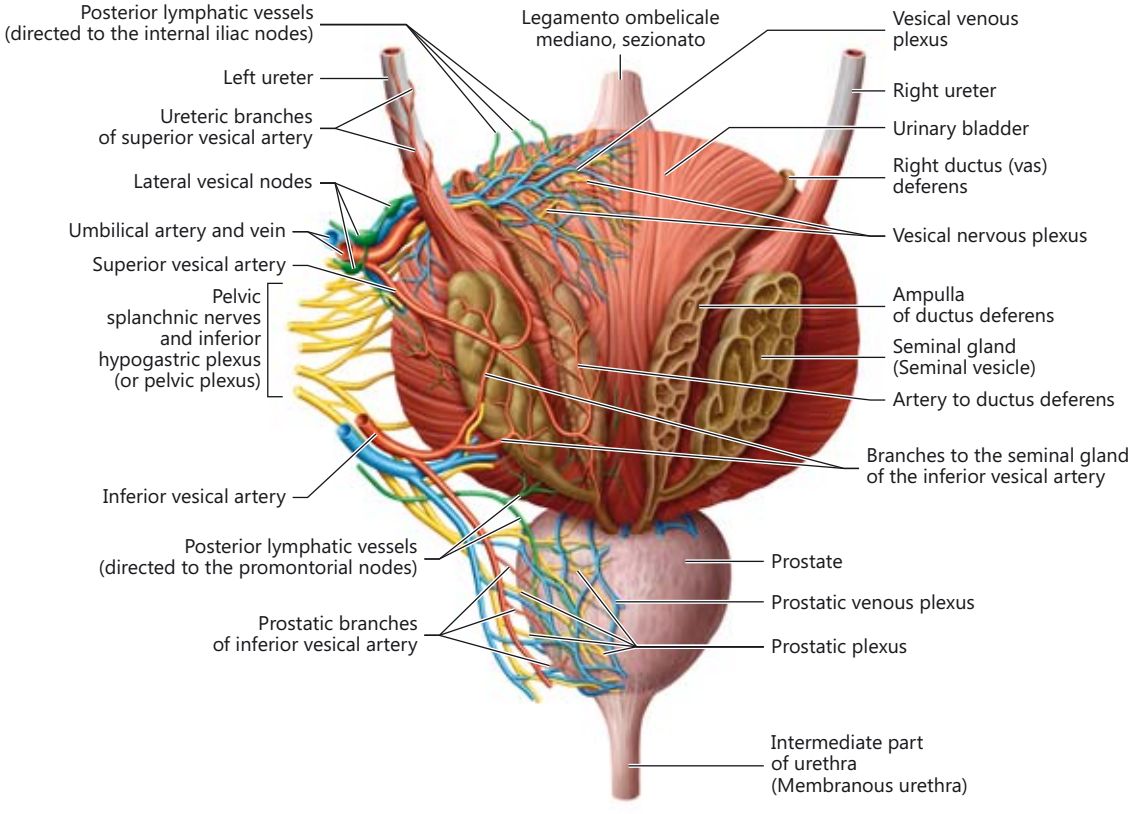
The **posterior vagal trunk** consists mainly of vagal fibers of the right vagus nerve. It gives origin to the posterior gastric branches, homologous to the anterior gastric branches of the anterior vagal trunk. The last and largest posterior gastric branch is termed the posterior nerve of the lesser curvature. The posterior vagal trunk also gives origin to a celiac branch; one of its poles reaches the right celiac ganglion, while the other one receives the right greater splanchnic nerve. This particular formation is known as ansa memorabilis, or Wrisberg's ansa.



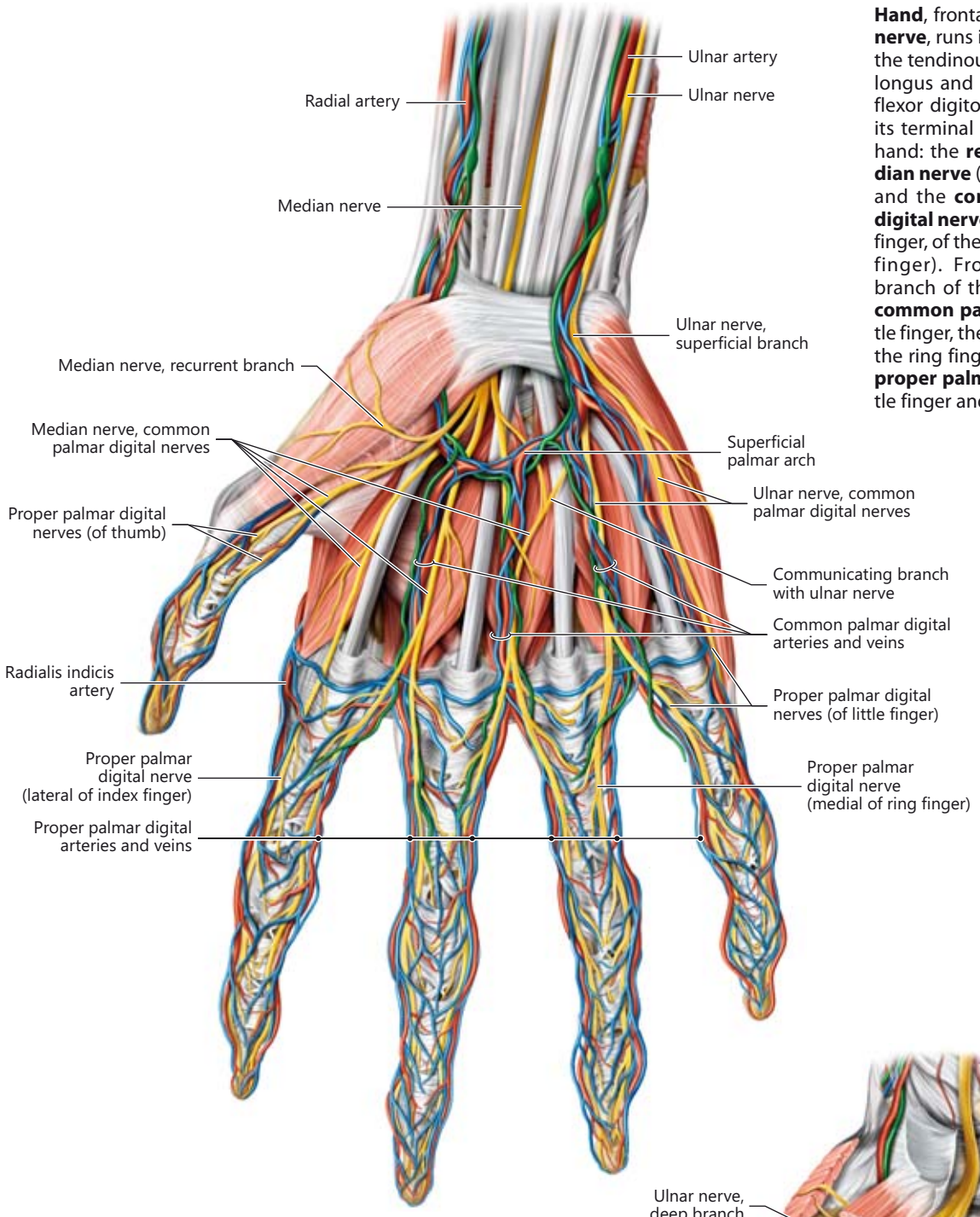
Three-dimensional image of a living human body, obtained by CT scan using a 3D volume rendering technique, showing the **abdominal organs** in a transverse section passing through the eleventh thoracic vertebra.



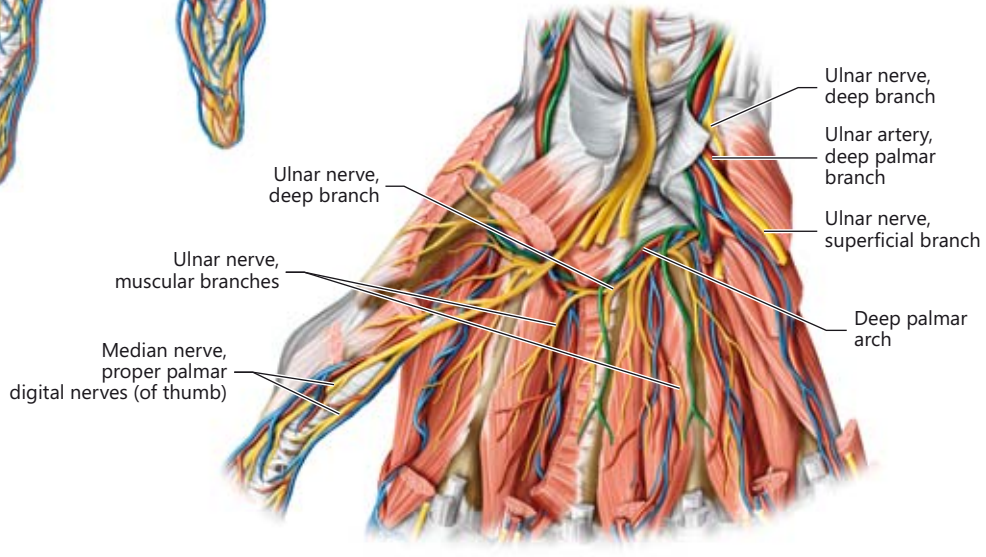
The **pelvic part of the ureter**, in the male, initially runs on the lateral wall of the pelvis, crosses the obturator vessels and nerve laterally, and reaches the pelvic floor; it then proceeds forward and medially, crossed anteriorly by the ductus deferens in correspondence to the lateral margin of the bladder; finally, in its last section, it wedges between the vesical wall and the anterior surface of the seminal gland. The right half-side of the image displays a frontal transection of the ampulla of the ductus deferens, seminal gland and prostate, to show their internal conformation.



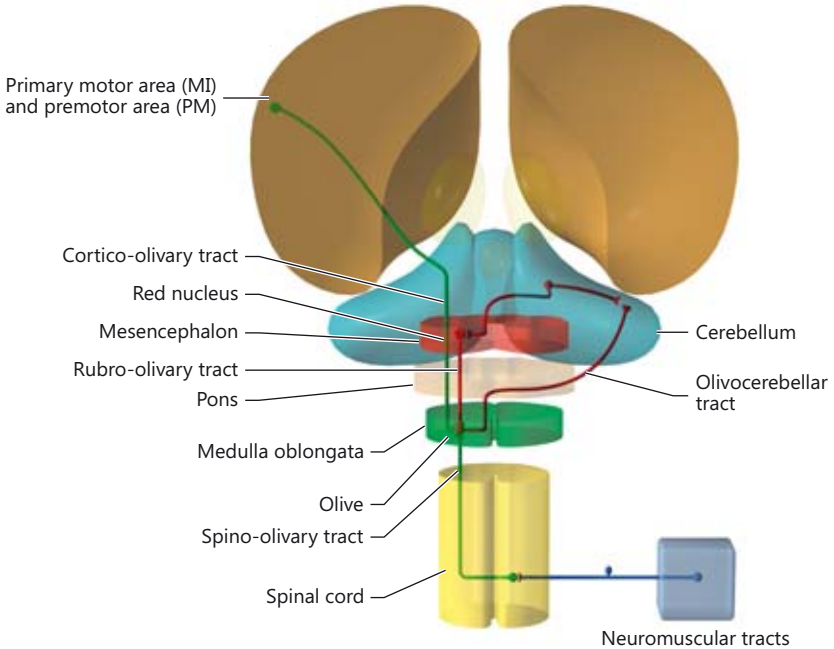
Relations of the last section of the **ductus deferentes**, **ampullae of the ductus deferentes** and **seminal glands** with the ureters, bladder and prostate. The preparation is viewed from behind; the ampulla of the ductus deferens and the right seminal gland have been opened to show the irregularity of the lumen. The inferior vesical artery (also known as the vesicoprostatic artery in the male), a branch of the internal iliac artery, provides the ureteric and prostatic branches and branches to the seminal gland. The artery of the ductus deferens can originate from the vesiculodeferential artery (not represented here) or from one of the superior vesical arteries (variable in number, 1 to 5).



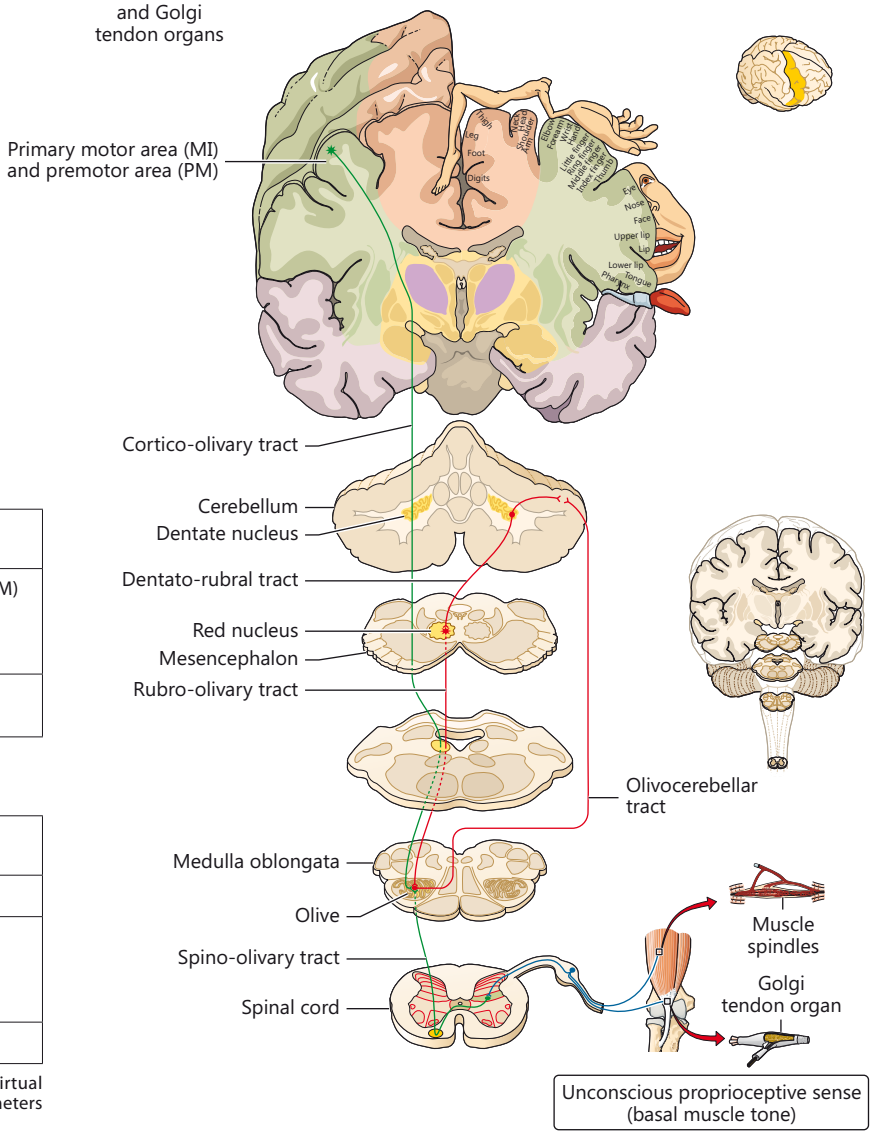
Hand, frontal (palmar) view. The **median nerve**, runs in the carpal tunnel, between the tendinous sheath of the flexor pollicis longus and the tendinous sheath of the flexor digitorum profundus, and ends in its terminal branches in the palm of the hand: the **recurrent branch of the median nerve** (or nerve of thenar eminence) and the **common and proper palmar digital nerves** (of the thumb, of the index finger, of the middle finger and of the ring finger). From the superficial palmar branch of the ulnar nerve originate the **common palmar nerves** (one for the little finger, the other for the little finger and the ring finger), from which originate the **proper palmar digital nerves** (of the little finger and the ring finger).



Hand, frontal (palmar) view. The deep branch of the **ulnar nerve**, a prevalently motor nerve, runs deeper into the palm of the hand, together with the deep palmar branch of the **ulnar artery**, following the three central metacarpals, and forming an arch, concave laterally and superiorly, where numerous muscular branches originate.



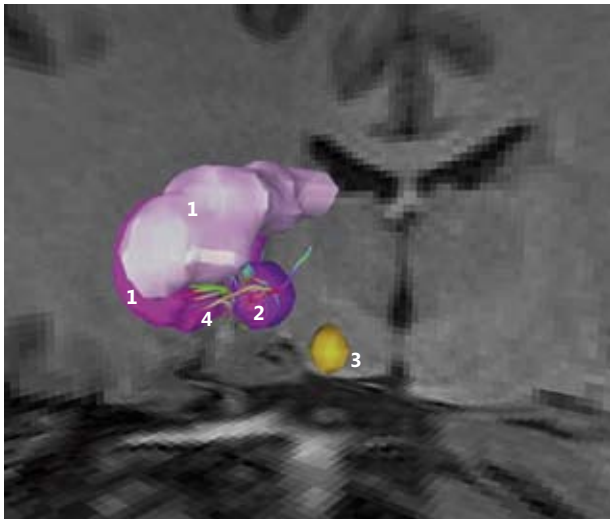
The cerebellum is involved in the construction of the motor gesture acting on the lower motor neuron through the **vestibulocerebellum circuits** (☞ **Nervous System and Sense Organs**, Vestibular System, Lateral and Medial Vestibulospinal Tracts) and through the **paleocerebellum circuits** (☞ **Nervous System and Sense Organs**, Brainstem, Reticolospinal Tracts - Medial and Lateral - and Rubrospinal); it also acts on the upper motor neuron through the neocerebellum circuit (*blue*) (☞ **Nervous System and Sense Organs**, Neocerebellum Circuit, next page). In particular, in the cooperation between the cerebral cortex and the cerebellar cortex, the **olive** plays a key role, both in learning the parameters that characterize the specific motor action (*green*) and in memorizing the same parameters (*red*).



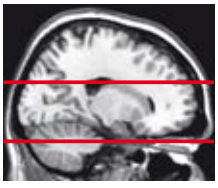
Olive (acquisition of motor parameters) (*green* in the graphs)	
Afferences	From the primary motor (MI) and premotor (PM) areas of the cerebral cortex and from the laminae VI and VII of the spinal cord to the olive
Efferences	From the olive to the entire cerebellar cortex (archi-, paleo- and neocerebellum)

Olive (memorization of motor parameters) (*red* in the graphs)*	
Neuron I	From the olive to the cerebellar cortex
Neuron II	From the nuclei of the cerebellum and, in particular, from the dentate nucleus to the parvocellular part of the red nucleus (neorubro)
Neuron III	From the neorubro to the olive

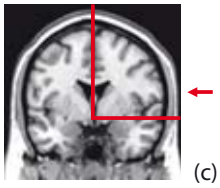
* The order in roman numbers of the three neurons is only virtual because it is a closed circuit that is repeated until the parameters change and new parameters are acquired.



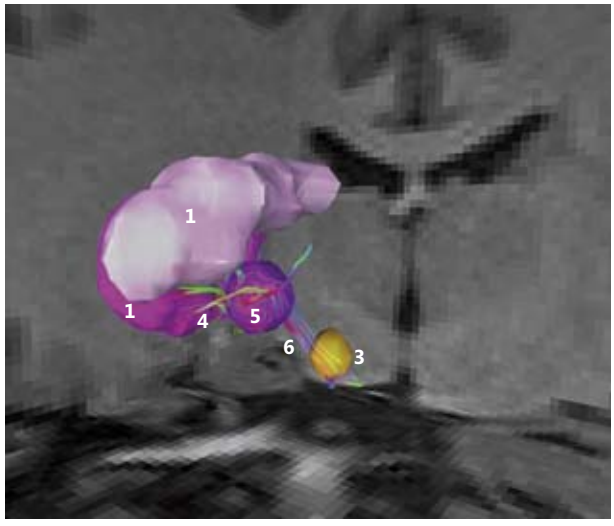
a



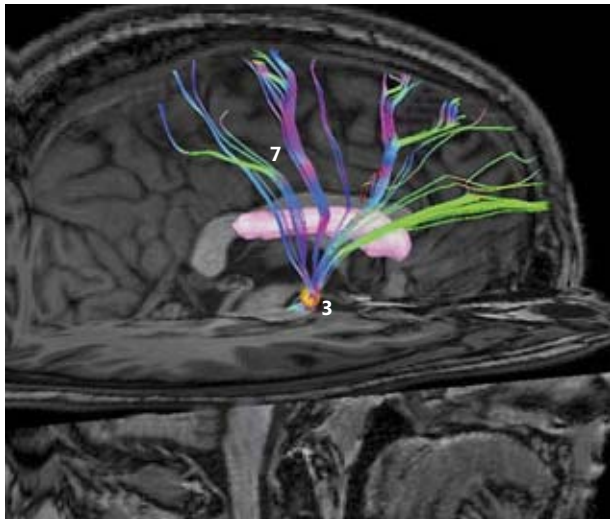
(a, b)



(c)



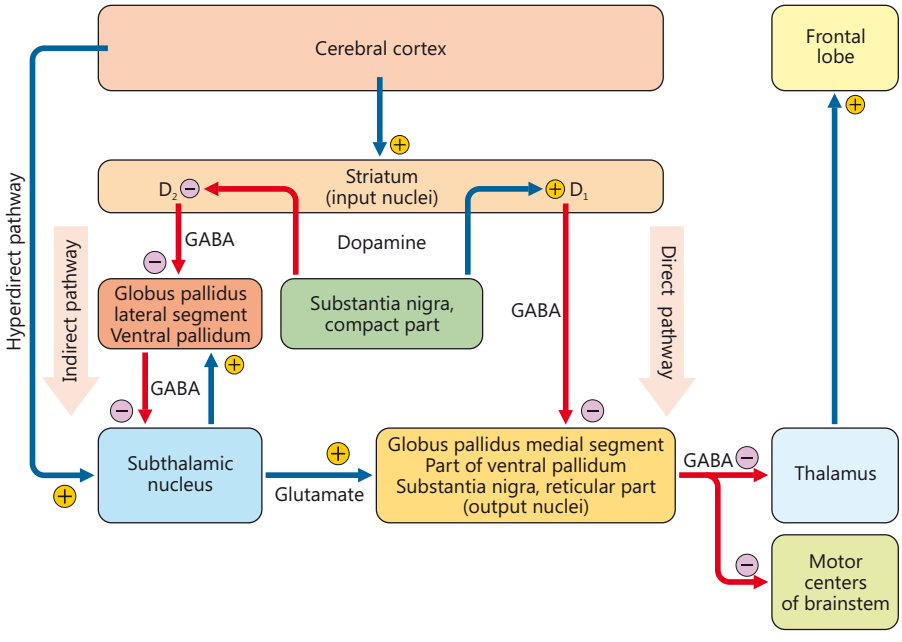
b



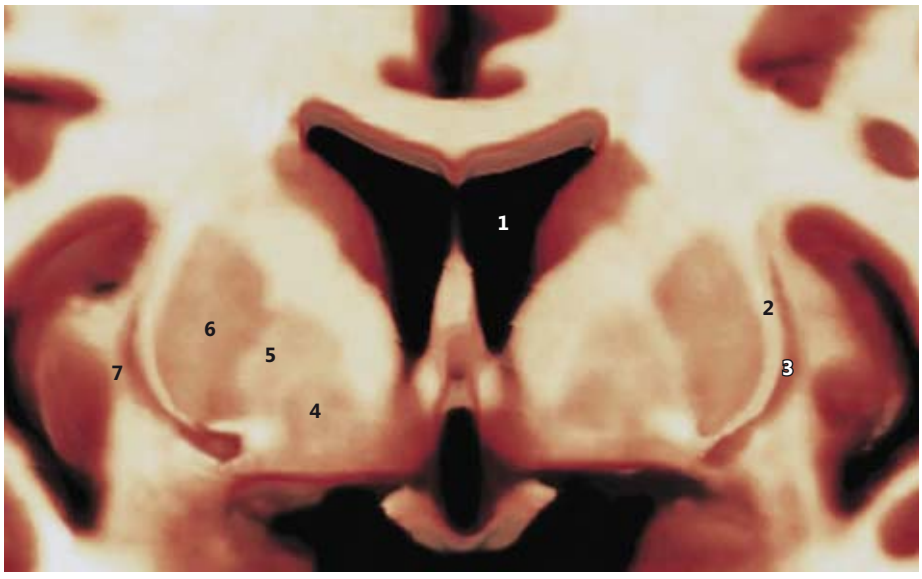
c

Three-dimensional image of a tractography obtained by diffusion-weighted MRI sequences showing the **direct pathway** (**a**), the **indirect pathway** (**b**) and the **hyperdirect pathway** (**c**).

1, Neostriatum
2, Globus pallidus medial or internal segment (GP_i)
3, Subthalamic nucleus (Luys' body)
4, Neostriatopallidal fibers
5, Globus pallidus lateral or external segment (GP_e)
6, Pallidosubthalamic fibers
7, Corticosubthalamic fibers

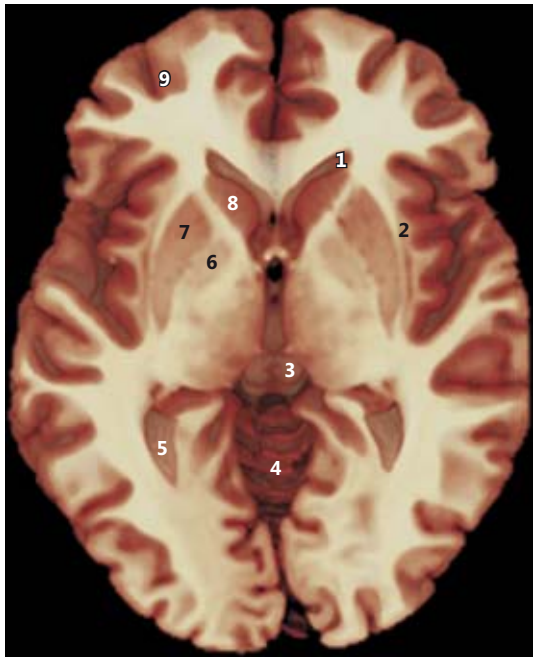


Simplified diagram of the **direct**, **indirect** and **hyperdirect pathways in the basal nuclei**. The activity of the two principal nuclei projecting to the thalamocortical pathway (reticular part of the substantia nigra and internal segment of the globus pallidus) is regulated by the dopamine released in the striatum by the dopaminergic neurons localized in the compact part of the substantia nigra. This regulation takes place through a direct GABAergic pathway, with inhibitory function, and through an indirect pathway. The output from the indirect pathway consists of excitatory glutamatergic fibers from the subthalamic nucleus. The dopamine has an excitatory role on the striatum D1 receptors, and inhibitory on the D2 receptors. *Blue* lines indicate excitatory pathways and *red* lines inhibitory pathways.

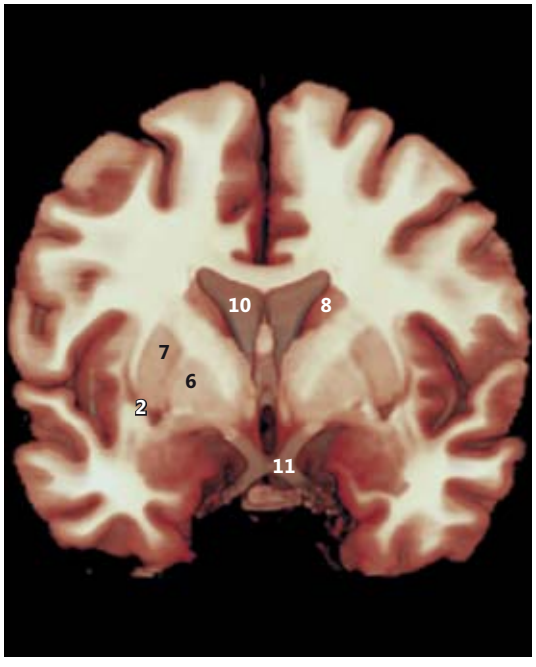


Three-dimensional image of a living human body, obtained by NMR using a 3D volume rendering technique, of a coronal section passing through the rostrum of the corpus callosum showing the **claustrum**.

1, Lateral ventricle
2, External capsule
3, Claustrum
4, Globus pallidus medial segment
5, Globus pallidus lateral segment
6, Putamen
7, Extreme capsule



a



b

Three-dimensional image of a living human body, obtained by NMR using a 3D volume rendering technique, of a transverse section passing through the genu of the corpus callosum (**a**) and of a coronal section passing through the rostrum of the corpus callosum (**b**), showing the **claustrum**.

1, Frontal horn of lateral ventricle
2, Claustrum
3, Tectal plate (Quadrigeminal plate)
4, Vermis of cerebellum [I-X]
5, Occipital (posterior) horn of lateral ventricle
6, Globus pallidus, lateral or external segment (GP_e)
7, Putamen
8, Head of claudate nucleus
9, Superior frontal gyrus
10, Lateral ventricle
11, Optic chiasm