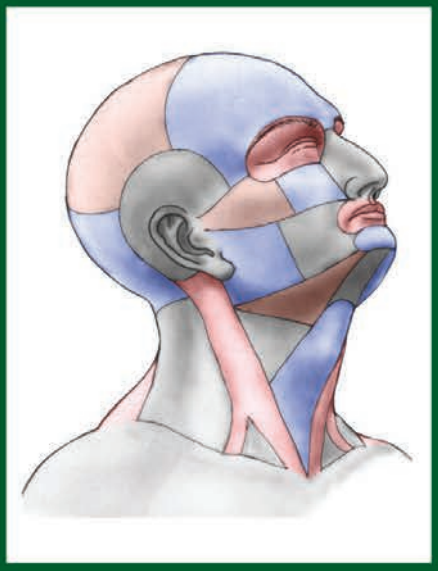
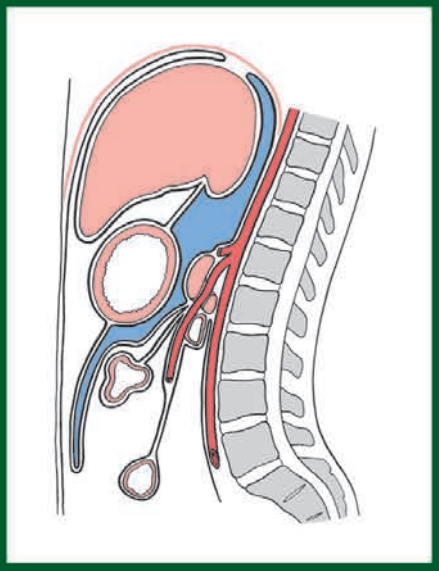
Josef Stingl, Miloš Grim, Rastislav Druga

REGIONAL ANATOMY





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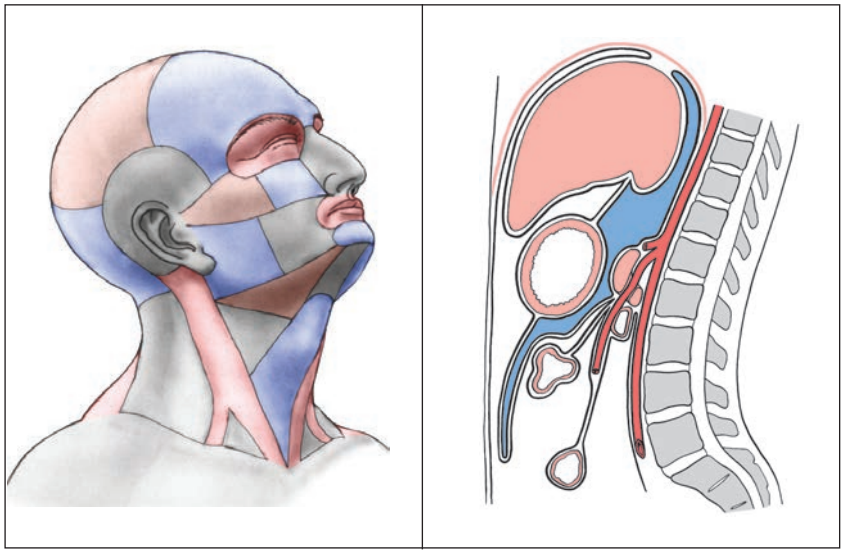

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Contents

Foreword

The Czech version of Basic Anatomy, Volume 5, dedicated to the memory of Prof. Karel Weigner (1874–1937), chair of the Institute of Anatomy in Prague and founder of Czech regional and clinical anatomy, is part of a five-volume textbook of anatomy for first year medical students. Since its publication, this series has gained a lot of popularity among students of the systems-based curriculum for its convenient format, clear figures and concise text. While the main benefit of the organ system-based teaching method is its clear connection with microscopic anatomy, physiology and clinical specialities, topographic approach needs an integrative component that puts all the structures together in a region-oriented way. This is the main objective of this volume covering Topographic Anatomy.

Most English anatomy textbooks are region-based because of the prevalence of a regionally-oriented curriculum in the US. One might rightfully ask what makes this volume stand out in comparison. In fact, the translation was prompted by repeated prodding of our English-taught medical students, who wanted the same textbook their Czech colleagues were using during the dissections and preparations for the final examination. While we provided online translation of some of the most commonly used figures, it still did not satisfy their longing for a full text.

Comparing the external appearance of this book with that of most frequently used volumes (Gray's Anatomy for Students, Moore's Clinically Oriented Anatomy or Snell's Clinical Anatomy), the main difference seems to lie in its size: it is several times smaller than the other volumes in both thickness and weight. This is due to a deliberate omission of detailed description of the individual organs which was already provided in the Systems Anatomy.

This book focuses on the relationships between varied organs as encountered during the dissection course, making it a useful tool during this highly enriching, but also stressful time. The description of key anatomical regions is supplemented by ample coloured schematic drawings and often complemented by matched radiographic images. The book follows the dissection of a human body from head to toe, providing external landmarks and superficial anatomy, as well as detailed descriptions of the structures. Key points of clinical implications are highlighted in gray boxes. A lot of emphasis has been put on cross-sectional anatomy, as it is the way in which the students will encounter the human body in the future. Three dimensional integration of knowledge gained during dissection with these imaging modalities (CT, MRI) is a must for functional understanding of the human body not only for surgery, but also for other branches of medicine.

We sincerely hope that the English-speaking students will find this book as useful as our Czech students, and wish all of them success on their path to become medical doctors.

Prague, December 2011

Milos Grim
(for the authors of the original Czech version)

David Sedmera
(for the team of translators)

1 Regions of the head, *regiones capitis*

The head can be subdivided into ***neurocranium*** (the calvaria) and ***splanchnocranium*** (the face). It is defined from the neck by a conventional line running from the external occipital protuberance across the superior nuchal line towards the external acoustic meatus and then along the posterior and inferior border of the lower jaw to the midline in the mental region. The border between the brain case and face is the line running from the external acoustic meatus anteriorly along the zygomatic arch and eyebrows to the glabella. In the depth, these two regions are separated by the external cranial base.

In the brain case are first described the superficial regions and then the cranial base. In the facial region of the head are also first found the superficial regions followed by the orbital, nasal and oral cavities and finally infratemporal and pterygopalatine fossa and related regions.

1.1 The brain case

The skeleton of the brain case is composed of the cranial vault, the ***calvaria*** (the skull cap) and the ***basicranium*** (the cranial base).

1.1.1 Frontal, parietal and temporal region

These regions (Fig. 1.1) correspond to underlying bones of the same names. Because the arrangement of the layers in these regions is similar, they are de-

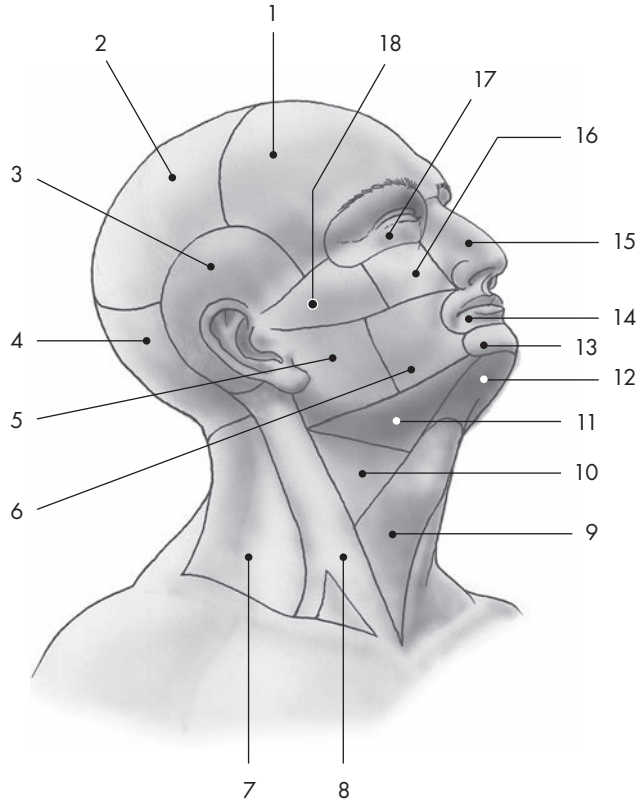

Fig. 1.1 Overview of regions of the head and neck.
1 – frontal region
2 – parietal region
3 – temporal region
4 – occipital region
5 – parotideomasseteric region
6 – buccal region
7 – lateral cervical region
8 – sternocleidomastoid region
9 – muscular triangle
10 – carotid triangle
11 – submandibular triangle
12 – submental region
13 – mental region
14 – oral region
15 – nasal region
16 – infraorbital region
17 – orbital region
18 – zygomatic region

scribed together. Their base is formed by the cranial vault, the ***calvaria***, covered by soft tissues – the **scalp** (Fig. 1.2).

The principal layers are formed by:

- **S**kin, which is very thick, and normally covered by hair;
- Subcutaneous **c**onnective tissue, with a large amount of fibrous bundles that connect the deep layer of the skin with the galea aponeurotica. This arrangement allows only minimal movement of skin against the galea aponeurotica. In the subcutaneous tissue are found thin walled veins that frequently gape when injured, causing profuse bleeding;
- Galea **a**poneurotica, a layer of dense connective tissue into which different parts of the epicranius muscle insert: occipitofrontal and temporoparietal. It is also sometimes called the epicranial aponeurosis;
- **L**oose connective tissue under the galea which allows large movements of the skin and galea aponeurotica against the periost. This can also be a site of large hematomas after blunt skin trauma;
- **P**eriosteum, the fibrous layer covering the bones of the cranial vault.

In the temporal region, underneath the temporoparietal muscle, is the temporalis muscle, covered by strong temporalis fascia. This fascia has two layers that run from the inner to the outer border of the zygomatic arch and fuse together superiorly where the muscle attaches to the superior temporal line. Between these two layers is a layer of fatty tissue.

The periosteum covering the bones of the cranial vault is called the pericranium. It can easily be peeled off the bones in the newborn child, but is firmly adhered in the adult, particularly in areas of cranial sutures.

The wounds that do not penetrate the galea aponeurotica do not gape greatly; in contrast, the wounds penetrating into the sub-galear connective tissue do gape. Separation of the hairy skin together with the galea is called the scalping injury.

Vascular and nerve supply to the scalp

The frontal region is supplied by the branches of the **supraorbital** and **supratrochlear** artery (Fig. 1.5). There are rich anastomoses positioned laterally to the branches of the zygomaticoorbital and superficial temporal arteries. The temporal region is supplied by

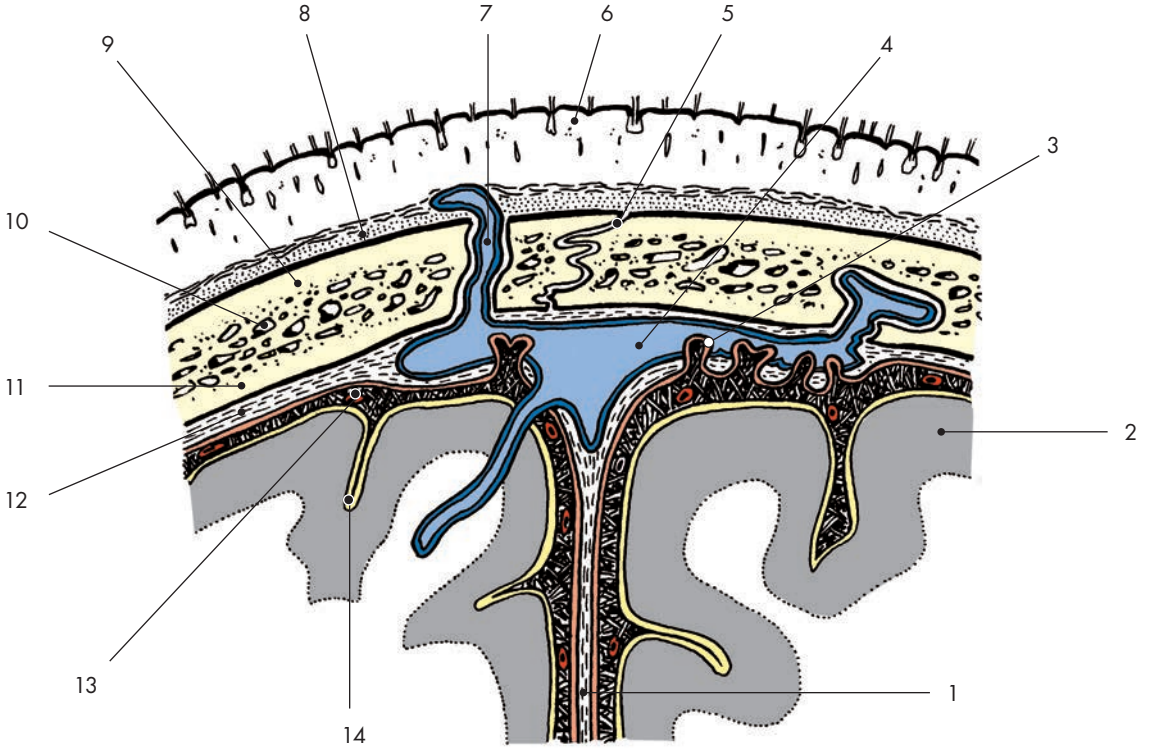

Fig. 1.2 Frontal section showing the soft tissues of the head, the bones of the cranial vault and brain coverings. 1 – falx cerebri, 2 – cerebral cortex, 3 – arachnoid granulations, 4 – superior sagittal sinus, 5 – sagittal suture, 6 – skin, 7 – emissary vein, 8 – pericranium (periost), 9 – outer compact layer, 10 – diploe, 11 – inner compact layer, 12 – dura mater, 13 – subarachnoid space, 14 – pia mater

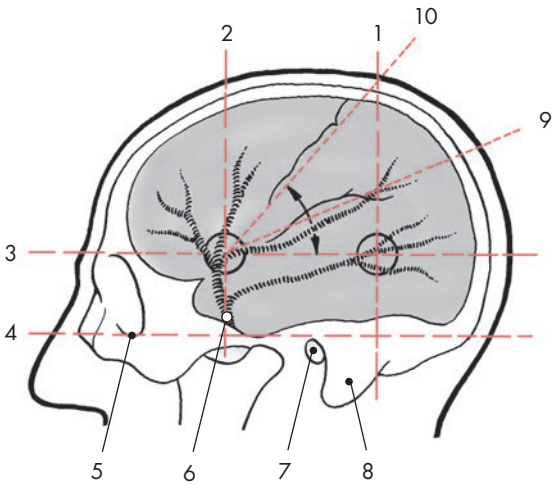

Fig. 1.3 Projection of the anterior and posterior branches of the middle meningeal artery (circles) and central and lateral sulcus of the brain.
1 – perpendicular line through the posterior edge of the mastoid process (intercepts line no. 3 in the posterior point of Krönlein), 2 – perpendicular line through the centre of the zygomatic arch (intercepts line no. 3 in the anterior point of Krönlein), 3 – line parallel with the auriculoorbital line passing through the superior rim of the orbit, 4 – auriculoorbital line (so-called Frankfurt horizontal) passing through the inferior rim of the orbit (5) and the upper rim of the external acoustic meatus, 5 – lower rim of the orbit, 6 – entrance of the middle meningeal artery to the skull through the foramen spinosum, 7 – external acoustic meatus, 8 – mastoid process, 9 – projection of the lateral sulcus of the brain (the line of projection splits the angle between lines 3 and 10 in half), 10 – approximate projection of the central sulcus of the brain (line connecting the anterior point of Krönlein with the point of intersection of the vertical line number 1

the branches of **superficial temporal artery**, which splits above the auricle into frontal and parietal branches. Its pulsations can be palpated against the bone. Underneath the temporalis muscle run the deep temporal arteries and nerves. Blood supply of the occipital region is provided by the **occipital artery** (Fig. 1.7).

The **veins** of the scalp empty anteriorly into the veins of the orbit, laterally into the superficial temporal vein and the pterygoid plexus, and from the occipital region into the external jugular vein.

Lymphatics from the frontal and temporal region drain into the parotid lymphatic nodes, from the temporoparietal region into the retroauricular lymph nodes and from the occipital region into the occipital lymph nodes.

Motor innervation of the entire epicranius muscle as well as the muscles of the auricles is provided by the facial nerve. The temporalis muscle is innervated by the third division of the trigeminal nerve.

Sensory innervation of the skin is provided anteriorly up to the interauricular line by the trigeminal nerve via the supraorbital, auriculotemporal and zygomaticotemporal branch of the zygomatic nerve. Behind the interauricular line, it is provided by the great auricular and the greater and lesser occipital nerves (Fig. 1.7).

The **cranial vault** proper, the **calvaria**, is formed by the parietal bones, squamous parts of the frontal, occipital and temporal bones, and greater wings of the sphenoid bone. It is thinnest in its temporal and parietal regions, whereas anteriorly and posteriorly it is more robust. The bones of the cranial vault are composed of the outer and inner compact layers with a spongy bone called the diploe between them (Fig. 1.2). The venous blood from the diploe drains through the diploic veins to the dural sinuses. Anteriorly, the frontal bone shows variable pneumatization by often asymmetric frontal sinuses. In the temporal region run the branches of the middle meningeal vessels on the inner aspect of the vault (Fig. 1.3).

Bleeding from torn meningeal vessels causes epidural hematoma.

The deepest layer of these regions is the dura mater of the brain, which adheres to the bones from the bottom and is stuck to their periost. In between the dura and the periosteum are the dural venous sinuses: the superior sagittal sinus, the confluence of the sinuses, the transverse sinus, and the occipital sinus (Figs. 1.2 and 1.4).

1.1.2 External surface of the cranial base

The lower aspect of the cranial base, ***basis cranii externa***, borders underneath the anterior cranial fossa with the spaces of the splanchnocranium, the nasal cavity and the orbit. Underneath the middle cranial fossa there is in the center the sphenoidal sinus and lateral to the cartilagineous part of the nasopharyngeal (Eustachian) tube, the pterygopalatine fossa, the infratemporal fossa and the temporomandibular joint. Underneath the posterior cranial fossa is the attachment of the pharynx and the middle and parapharyngeal space. Behind the pharynx lie the atlantooccipital joint and the attachments of the deep nuchal muscles.

1.1.3 Internal surface of the cranial base

The upper aspect of the cranial base, ***basis cranii interna*** (Fig. 1.4), is covered with the dura mater and is subdivided into three cranial fossae:

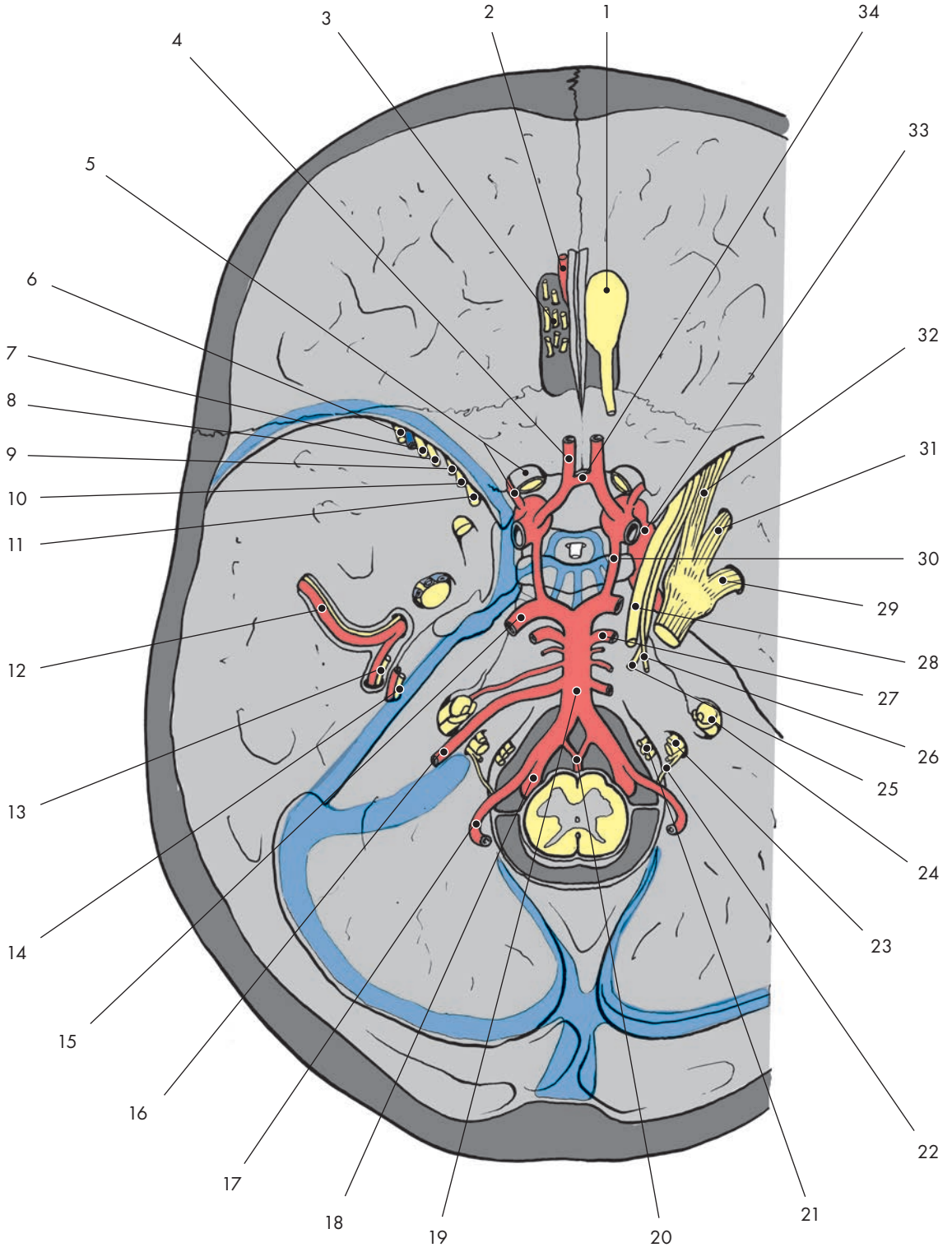

Fig. 1.4 Interior of the base of the skull, basis cranii interna (blue marks the position of the sinus durae matris, with the dura mater partially removed). 1 – olfactory bulb, 2 – anterior meningeal artery, branch of the anterior ethmoidal artery, 3 – olfactory nerves, 4 – anterior cerebral artery, 5 – optic nerve and ophthalmic artery, 6 – lacrimal nerve and superior ophthalmic vein, 7 – frontal nerve, 8 – trochlear nerve, 9 – abducent nerve, 10 – nasociliary nerve, 11 – oculomotor nerve, 12 – middle meningeal artery, 13 – lesser petrosal nerve, 14 – greater petrosal nerve, 15 – posterior cerebral artery, 16 – anterior inferior cerebellar artery, 17 – posterior inferior cerebellar artery, 18 – vertebral artery, 19 – basilar artery, 20 – anterior spinal artery, 21 – hypoglossal nerve, 22 – spinal root of the accessory nerve, 23 – glossopharyngeal, vagus and accessory nerve, 24 – facial nerve and vestibulocochlear nerve, 25 – abducent nerve, 26 – trochlear nerve, 27 – superior cerebellar artery, 28 – oculomotor nerve, 29 – mandibular nerve, 30 – posterior communicating artery, 31 – maxillary nerve, 32 – ophthalmic nerve, 33 – internal carotid artery, 34 – anterior communicating artery

a) The **anterior cranial fossa**, bordered anteriorly by the frontal bone and posteriorly by the margin of the lesser wings of the sphenoid bone. The majority of its surface is formed by the orbital parts of the frontal bone, between which is wedged the cribriform plate of the ethmoidal bone. On the orbital parts of the frontal bone lie the frontal lobes of the brain hemispheres and on the cribriform plate, the olfactory bulbs. The anterior ethmoidal nerves and vessels run from the orbit through the cribriform plate. In the medial part of the lesser wings of the sphenoidal bone is the optical canal, an opening containing the optic nerve and the opthalmic artery.

b) The **middle cranial fossa**, bordered anteriorly by the lesser wings of the sphenoidal bone, and posteriorly by the crests of the pyramids of the temporal bone. In the middle, sits sella turcica. The middle cranial fossa is filled by the temporal lobes of both hemispheres. Under the dura is found:

- The **hypophyseal fossa**, with the hypophysis, covered from the top by the dura mater, the **sellar diaphragm**, with a hole for the hypophyseal stalk.
- The **cavernous sinus**, located along the sides of the hypophysial fossa. From the outside it is covered by the dura mater, under which run from top to bottom: the **oculomotor nerve**, the **trochlear nerve**, the **ophthalmic nerve**, the **maxillary nerve**, and the **mandibular nerve**. Deep in the center is located the **internal carotid artery**, externally to which lies the **abducent nerve**. The rest of this space is filled with the venous plexus of the cavernosus sinus proper. Anteriorly and posteriorly to the hypophysial fossa are two **intercavernous sinuses**.
- Antero-medially, the **superior orbital fissure**, delimited by the edges of the lesser and greater wings of the sphenoid bone. Into the medial part of the fissure enter into the orbit all three nerves for the extraocular muscles, followed by the **ophthalmic nerve** and the **superior ophthalmic vein**.
- Under the fissure is found the **foramen rotundum** containing the **maxillary nerve**, and further latero-dorsally the **foramen ovale**, through which passes the **mandibular nerve** into the infratemporal fossa. Behind the foramen ovale is a small **foramen spinosum** containing the **middle meningeal vessels**.
- At the apex of the pyramid inside the trigeminal impression under the dura mater lies the **trigeminal ganglion**, which sends forward three branches: the ophthalmic nerve (to the superior orbital fissure), the maxillary nerve (to the foramen rotundum) and the mandibular nerve (to the foramen ovale).
- On the anterior surface of the pyramid under the dura mater run the **lesser** and **greater petrosal nerve** toward the **sphenopetrosal synchondrosis**.

c) The **posterior cranial fossa** is formed in the middle by the clivus of the occipital bone, which descends to the **foramen magnum**, lateral to the posterior surface of the pyramid and posterior to the occipital bone. From above the posterior cranial fossa is covered by the **cerebellar tentorium**, which has a horseshoe-like **tentorial notch** in the middle**.** Posterior cranial fossa contains the cerebellum connected to the brainstem. Through the foramen magnum along the clivus enter two **vertebral arteries**, which combine to form the **basilar artery**. Just before the superior border of the pons arises the **posterior cerebral arteries**. In the central part of clivus, the **abducent nerve** plunges underneath the dura mater.

The relationship of midbrain to the edge of tentorial notch is clinically significant. During cerebral edema or other expansive processes the cerebral crura are pushed against the edge of the cerebellar tentorium. Their compression manifests itself as a disorder of the pyramidal tract (first affecting the lower limbs, then the upper limbs). In a similar way, the brainstem is, in such situations, pressed into the foramen magnum, especially the medulla oblongata.

The **internal acoustic meatus**, containing the **VII.** and **VIII. cranial nerves** and the labyrinthine artery, faces into the posterior fossa. Underneath is the **jugular foramen**, into which enters the **sigmoid sinus** that becomes the **superior bulb of jugular vein**. Medially from the sinus, three cranial nerves enter into the jugular foramen: the **glossopharyngeal nerve**, the **vagus nerve**, and the **accessory nerve**. Foramen magnum contains the transition of the brainstem into the spinal cord and both **vertebral arteries**. At the outer perimeter of the foramen magnum is the **hypoglossal canal** of the **hypoglossal nerve**. Above the canal is the opening of the **condylar canal** containing an emissary vein forming a connection between the extracranial and intracranial veins.

Along the upper and lower margin of the posterior surface of the pyramid run the superior and inferior petrosal sinus in the grooves bearing the same name.

1.2 Superficial regions of the face

The foundations of the facial part of the head are the bones of the splanchnocranium.

1.2.1 Orbital region

The boundaries correspond to the extent of orbicularis oculi muscle (Fig. 1.1). The main feature of the region are the **eyelids**, ***palpebrae***, which close the entrance to the orbit together with the **orbital septum** spread between the edge of the tarsal discs and

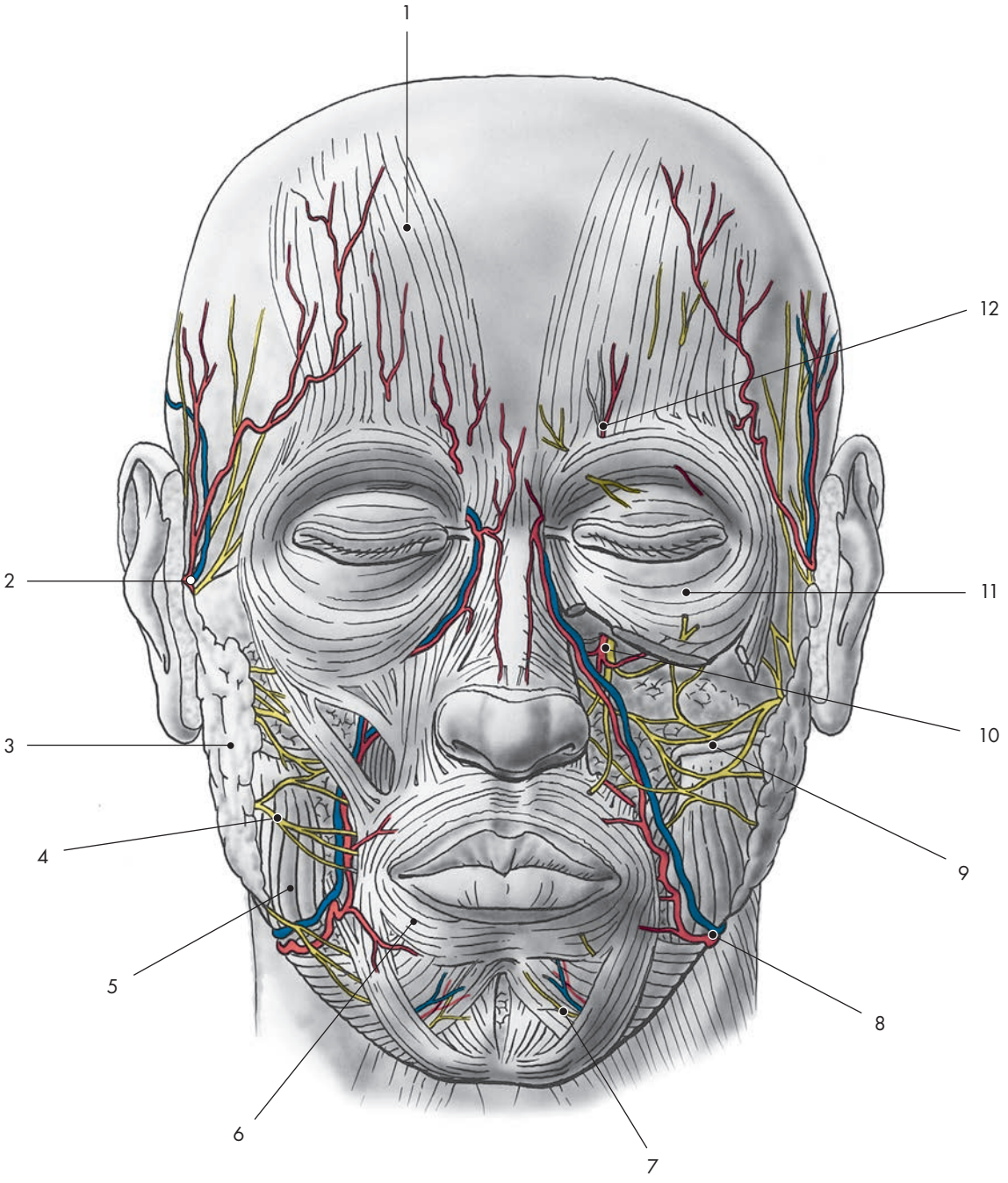

Fig. 1.5 Superficial regions of the face, frontal view. 1 – frontal belly of the epicranius muscle, 2 – auriculotemporal nerve with superficial temporal vessels, 3 – parotid gland, 4 – branches of the facial nerve, 5 – masseter muscle, 6 – orbicularis oris muscle, 7 – mental nerve, 8 – facial vessels, 9 – parotid duct, 10 – infraorbital nerve and vessels, 11 – orbicularis oculi muscle, 12 – supraorbital nerve and vessels

the perimeter of the orbit. The upper eyelid is wider and semilunar, and therefore covers a larger portion of the cornea than the sickle-shaped lower eyelid. At the medial corner are found the components of efferent lacrimal pathways: the **lacrimal caruncle**, the **lacrimal puncta**, and the **lacrimal sac**.

The **skin** of the **eyelids** stretches easily, and is often pigmented. The upper eyelid is innervated from 1st branch of trigeminal nerve, the lower eyelid from the 2nd branch (Fig. 1.6).

Subcutaneous tissue contains loose connective tissue without fat, which allows the formation of edema and hematoma. In the subcutaneous tissue of the free edges of both eyelids run fine arterial arcades, the **superior** and **inferior palpebral arches**. From the medial side run small branches of the superior and inferior medial palpebral arteries, and both branches of the ophthalmic artery. Further contribution comes from the terminal branch of the angular artery, and the branch of the facial artery. Lateral contributions come from the branches of the superior and inferior lateral palpebral artery, from the lacrimal artery, and the branches of zygomaticofacial and transverse facial arteries. Along the perimeter of the orbit anastomoses are further developed among the supraorbital artery, the supratrochlear artery, and the superficial temporal artery, completing the **complex of fine peripheral anastomoses** between external and internal carotid arteries. Venous blood drains into the veins of both orbits as well as to the facial vein.

The **muscular substrate of the eyelids** is the **orbicular oculi muscle** (Figs. 1.5, 1.7), circularly spread on the anterior surface of both tarsal plates and the orbital septum; its outer **orbital part** extends all around the edge of orbit. The next layer is the tarsal disc, and the last layer of the eyelid is the conjunctiva, specifically its **palpebral part**.

Laterally under the roof of the orbit is placed the **palpebral part of the lacrimal gland**. It extends caudally to the superior conjunctival fornix and is separated from the larger orbital part of the gland by the outer edge of the tendon of the levator palpebrae superioris muscle.

1.2.2 Nasal region

The **surface boundary** runs from the root of the nose to the inner eye corner and along the perimeter of the nasal wings toward the nasolabial groove. The foundation of this region is the bony and cartilaginous skeleton of the nose.

The **skin** is thin on the root and the ridge of the nose, then thickens downward and contains numerous sebaceous and sweats glands, especially at the wings.

The **subcutaneous tissue** is sparse and low in fat tissue in the upper part of the region, so the skin of the dorsum and root is easily movable against the base, while the apex and wings adhere more firmly to the perichondrium. Deep in the subcutaneous tissue on the dorsum and the wings is **nasalis muscle**, at the root of nose is found the **procerus muscle**.

The arterial supply comes from the branches of the angular artery (branch of the facial artery), the **dorsal nasal artery** (branch of the supratrochlear artery) and the infraorbital artery. Venous blood drains into the facial vein, as well as through the nasofrontal vein into superior ophthalmic vein and through deep connections into the veins of the walls of the nasal cavity.

Lymphatic drainage flows into the parotid and submandibular lymph nodes.

Sensory innervation is supplied by the infratrochlear, the anterior ethmoidal, and the infraorbital nerves from the 1st and 2nd trigeminal divisions. Muscles are innervated by the facial nerve.

1.2.3 Oral region

The oral, or labial region, is formed by the upper and lower lip. The region is bordered by the **nasolabial groove** and the **mentolabial groove**.

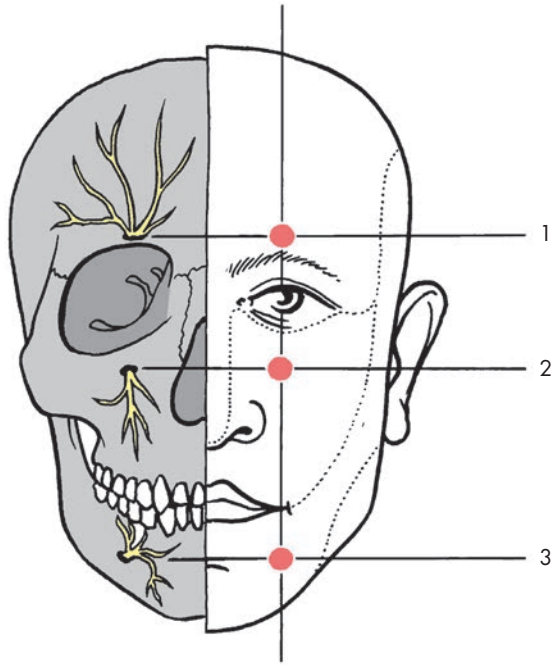

Fig. 1.6 Palpation points of the exits of the trigeminal nerve branches in the face. 1 – palpation point of first branch of the trigeminal nerve (supraorbital nerve), 2 – palpation point of the second branch of the trigeminal nerve (infraorbital nerve), 3 – palpation point of the third branch of the trigeminal nerve (mental nerve)

The **skin** of the lips is tough and thick, less movable against the base. It contains numerous sweat and sebaceous glands and hairs, in men beards, *barbae*. The skin changes into mucosa of the oral cavity in the transitional zone of lips – the vermillion border. The skin is thin here and the epithelium does not

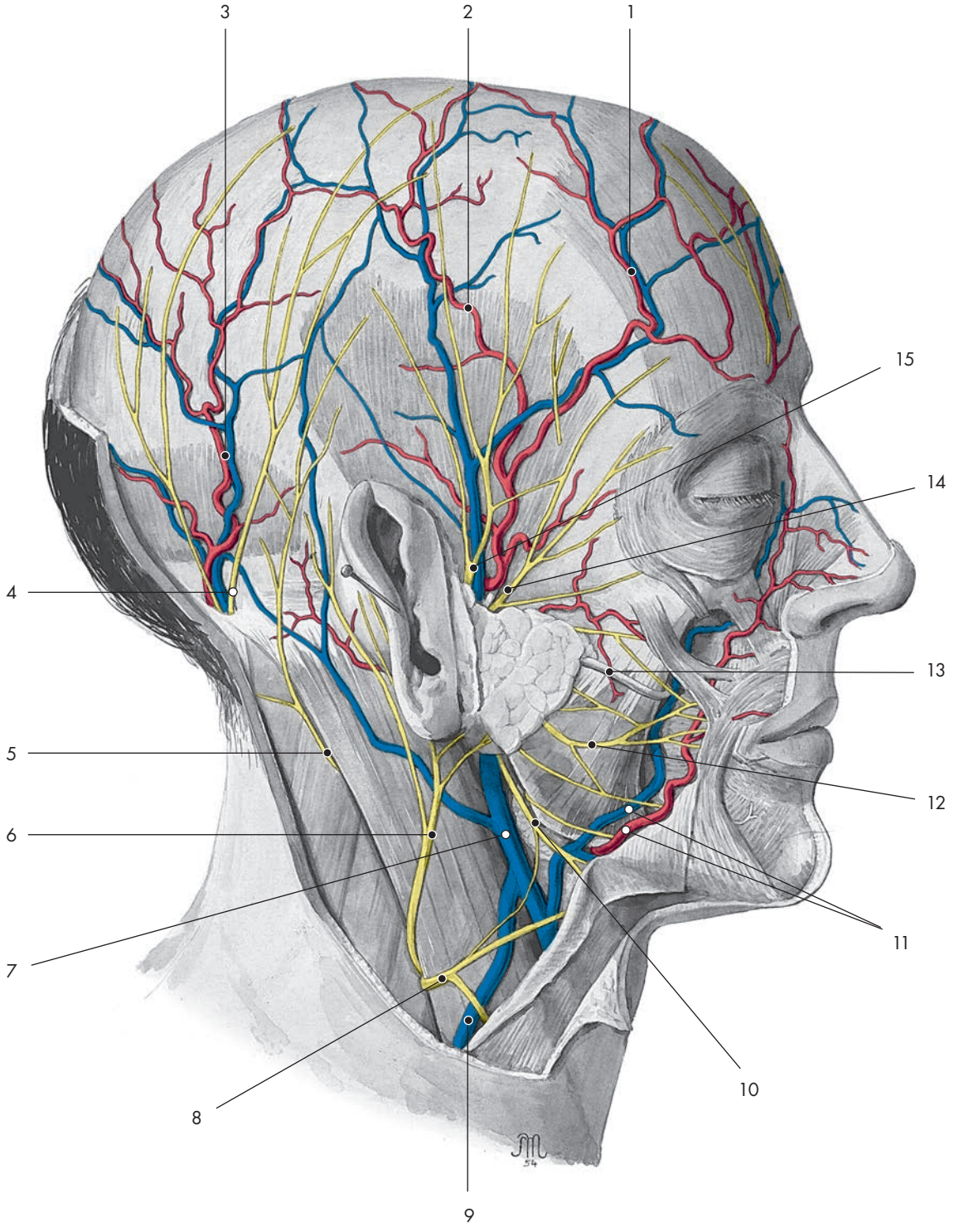

Fig. 1.7 Superficial regions of the face, lateral view. 1 – frontal branch of the superficial temporal artery, 2 – parietal branch of the superficial temporal artery, 3 – occipital artery and vein, 4 – greater occipital nerve, 5 – lesser occipital nerve, 6 – great auricular nerve, 7 – retromandibular vein, 8 – transverse cervical nerve, 9 – external jugular vein, 10 – cervical branch of the facial nerve, 11 – facial artery and vein, 12 – buccal branches of the facial nerve, 13 – parotid duct, 14 – temporal branches of the facial nerve, 15 – auriculotemporal nerve

keratinize. The redness of the lips is due to underlying blood vessels. Under the subcutaneous connective tissue (the fascia is absent) is the **orbicularis oris muscle**, into which insert radially in the corners the surrounding facial muscles. This common insertion about 1 cm lateral to the angle of the mouth is called the muscle connective knot of the corner of the mouth, ***modiolus***. The layer of subcutaneous tissue and mucous lining of the **oral vestibule** follow.

Arterial supply to the lips is provided by the **superior** and **inferior labial arteries**, the branches of the facial artery (Figs. 1.5 and 1.7). Venous blood drains predominantly to the facial vein. The lymph drains to the **submandibular lymph nodes** and from the center of the lower lip into the **submental lymph nodes**.

The upper lip has sensory innervation from the 2nd division of the trigeminal nerve (superior labial branches), and the lower lip from the mental nerve, a branch of the 3rd trigeminal division (Figs. 1.6 and 1.7). Muscles are innervated by the facial nerve.

1.2.4 Buccal region

The buccal region (Figs. 1.5, 1.7, 1.10) continues laterally from the lips. The anterior **border** is made by the nasolabial sulcus, the superior border is formed by the perimeter of the lower eyelid, and the edge of the mandibular body makes the inferior border. Posteriorly, the buccal region transitions smoothly into the parotideomasseteric region. The entire face is accessible to palpation from both outside and inside (from the oral vestibule).

The **skin** is thick, stretchable, and towards the lower eyelid gradually thins out. It contains numerous sweat and sebaceous glands. **Subcutaneous tissue** has an areolar structure and separates the skin from the muscles of facial expression.

The **superficial layer of** the **muscles of facial expression** is formed by the orbicularis oculi (orbicular part), the levator labii superioris alaeque nasi, the levator labii superioris, the zygomatic muscles, the

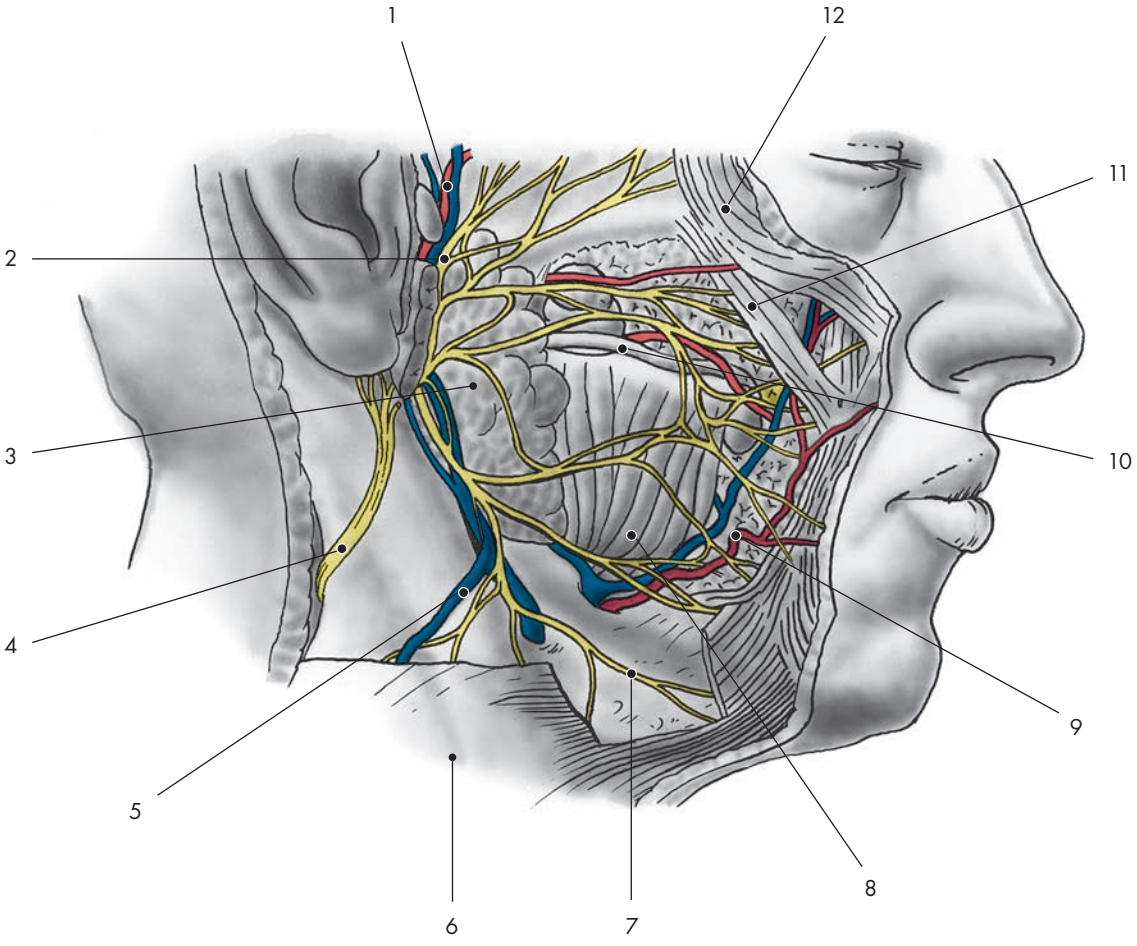

Fig. 1.8 Superficial regions of the face (lateral view, superficial part of the parotid gland removed). 1 – frontal branch of the superficial temporal artery, 2 – temporal and zygomatic branches of the facial nerve, 3 – parotid gland, 4 – great auricular nerve, 5 – retromandibular vein, 6 – platysma muscle, 7 – marginal mandibular branch of the facial nerve, 8 – masseter muscle, 9 – facial artery, 10 – parotid duct, 11 – greater zygomatic nerve, 12 – orbicularis oculi muscle

risorius, the levator anguli oris, and the superior part of platysma.

Underneath is the **intermuscular space**, a slit-like space between the superficial and deep muscle layers. This space is filled with loose connective fatty tissue that condenses dorsally, creating the **buccal fat pad**, ***corpus adiposum buccae***, reaching back between the internal surface of masseter and buccinator muscles.

Blood vessels and nerves, arranged from the surface to the deep, are principally the **facial artery**, the **facial vein**, and their branches. The facial artery is palpable on the edge of the mandible, right in front of the anterior margin of the masseter muscle; at this point it can be easily compressed.

The connection between the facial vein and the pterygoid plexus, is important for the spread of infection from the face to the intracranial veins.

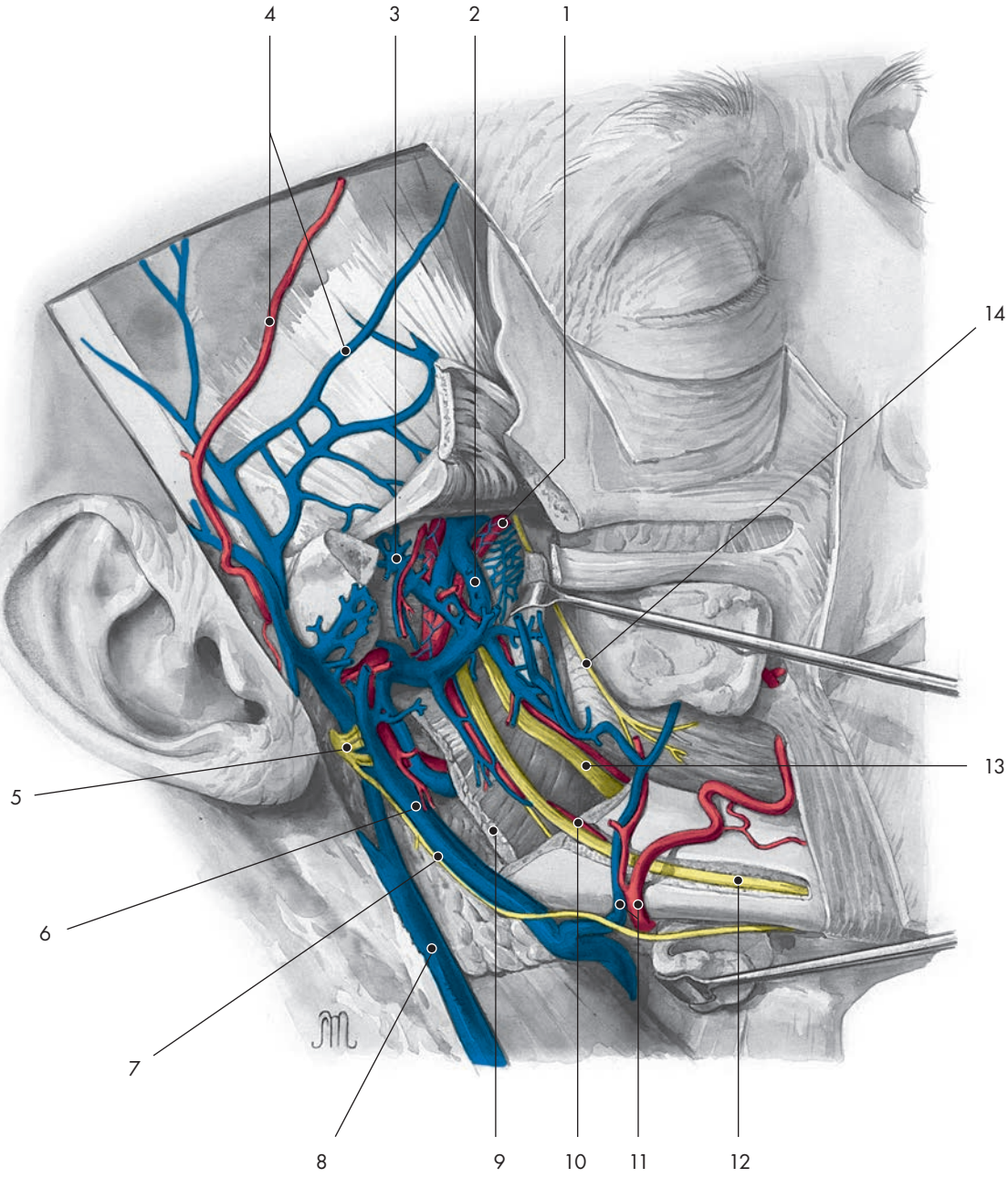

Fig. 1.9 Infratemporal fossa with preserved venous system (zygomatic arch and part of the mandible removed). 1 – maxillary artery, 2 – maxillary vein, 3 – part of the pterygoid plexus, 4 – superficial temporal artery and veins, 5 – facial nerve, 6 – retromandibular vein, 7 – marginal mandibular branch, 8 – external jugular vein, 9 – medial pterygoid muscle, 10 – inferior alveolar artery, 11 – facial artery and vein, 12 – inferior alveolar nerve, 13 – lingual nerve, 14 – buccal nerve

Branches of the **facial nerve** emerge from the anterior margin of the parotid gland, and supply the muscles of facial expression. Lymph is drained into the **submandibular lymph nodes**.

Over the anterior edge of the masseter muscle passes the **parotid duct**. It wraps the surface around the anterior edge of the buccal fat pad and pierces through the buccinator muscle and the mucosa of oral vestibulum.

The **deep muscle layer** is formed by the **buccinator muscle**, which underlies the entire region. Its surface is covered by the **buccopharyngeal fascia**.

The submucosal tissue of the face contains the buccal glands. The deepest layer is the mucosa lining of the oral vestibule.

1.2.5 Parotideomasseteric region

The **boundaries of the region** (Fig. 1.8) are formed superiorly by the zygomatic arch anteriorly by the anterior margin of masseter muscle, inferiorly by the lower edge of the mandible, and posteriorly by a line connecting the angle of mandible with the anterior border of the external ear canal. Deeper this is continuous with the infratemporal space. The masseter muscle is palpable in this region, and posteriorly one can feel the head of mandible and its movements in the temporomandibular joint.

The **skin** is thicker than on the face and in males it is covered by beard. From the **subcutaneous tissue** radiate the branches of the **facial nerve** from the superior, anterior and inferior border of the parotid gland to supply the muscles of facial expression, i.e., the temporal, zygomatic, buccal, marginal mandibular, and cervical branch. From the neck runs the great auricular nerve and in front of the tragus the auriculotemporal nerve and the superficial temporal vessels.

The main content of this region is the **parotid gland**, and internally and caudally from the gland is the **masseter** muscle. Both these structures are covered by thick **parotideomasseteric fascia**, which sends to the gland fine septa and adheres firmly to the muscle. It runs from the zygomatic arch toward the edge of the mandible, over which it continues smoothly to the neck as the **superficial layer** of **cervical fascia**. At the angle of the mandible it is reinforced by an oblique band, **stylomandibular ligament**, ***tractus angularis***, which separates this region from the submandibular space.

The **facial nerve** enters the parotid gland about 1 cm below the edge of the external ear canal. In the gland it branches and forms the **parotid plexus** (Fig. 1.8). The gland is thus incompletely divided into the superficial and deep parts. Posteriorly, the parotid gland touches the sternocleidomastoid muscle, the temporomandibular joint and the external ear canal; medially, it lies on the muscles of the prestyloid septum and structures of the prestyloid space. Superiorly, the terminal part of the **external carotid artery** passes through the gland and divides inside it into the **superficial temporal artery**, and the **maxillary artery**. Their corresponding veins, the superficial temporal vein and the maxillary vein, join inside the gland to form the **retromandibular vein**.

The **temporomandibular joint** is dorsolaterally covered with the parenchyma of the parotid gland. It lies dorsally to the bony and cartilaginous part of the external ear canal, from which it is separated by a venous plexus (called Zenker's retroarticular pillow) that is a dorsal process of the pterygoid plexus. Along the medial joint surface passes the chorda tympani and the anterior tympanic artery; lateral pterygoid muscle attaches from the ventral side into the joint, or rather to the joint capsule and the articular disc.

The divergent course of the facial nerve branches in this and the buccal region should be taken into account during surgery. It is recommended to keep incisions parallel to its course.

1.2.6 Mental region

This region is found between the **mentolabial sulcus** and the edge of the mandible. The subcutaneous tissue contains the chin group of muscles of facial expression, through which the **mental nerve**, the terminal branch of the inferior alveolar nerve, pierces toward the skin. The area where the mental nerve emerges from the mental foramen is the palpation point of the 3rd trigeminal branch (Fig. 1.6).

1.3 Deep regions of the face

1.3.1 Infratemporal region

This region (Figs. 1.9, 1.10, 1.12) continues caudally and medially from the temporal region. Its walls correspond to the borders of the infratemporal fossa, fossa infratemporalis: the **roof** is formed by the inferior surface of the large wings of the sphenoidal bone, the **medial wall** is formed by the medial plate of the pterygoid process and the continuing lateral wall of the pharynx. The **anterior wall** is formed by the maxillary tuberosity, the **lateral wall** is formed by the ramus of mandible, and

the **posterior wall** is formed by the styloid septum with its muscles.

This space is connected with the surrounding regions:

- cranially through the foramen ovale and the foramen spinosum with the middle cranial fossa;
- anteriorly and superiorly through the inferior orbital fissure with the eye socket, or orbit;
- anteriorly and inferiorly it transitions smoothly into the submandibular triangle;
- medially it continues into the pterygopalatine fossa;
- anterolaterally it communicates through the pterygomandibular space with the face.

The content of the infratemporal space are the **pterygoid muscles** and parts of the **parotid gland** extending around the mandibular ramus. This region contains numerous blood vessels and nerves (Figs. 1.9 and 1.10).

Arteries: the largest artery is the **maxillary artery**, one of the terminal branches of the external carotid artery. It arrives through an aperture between the neck of the mandible, *collum mandibulae*, and the sphenomandibular ligament. It bears anteromedially

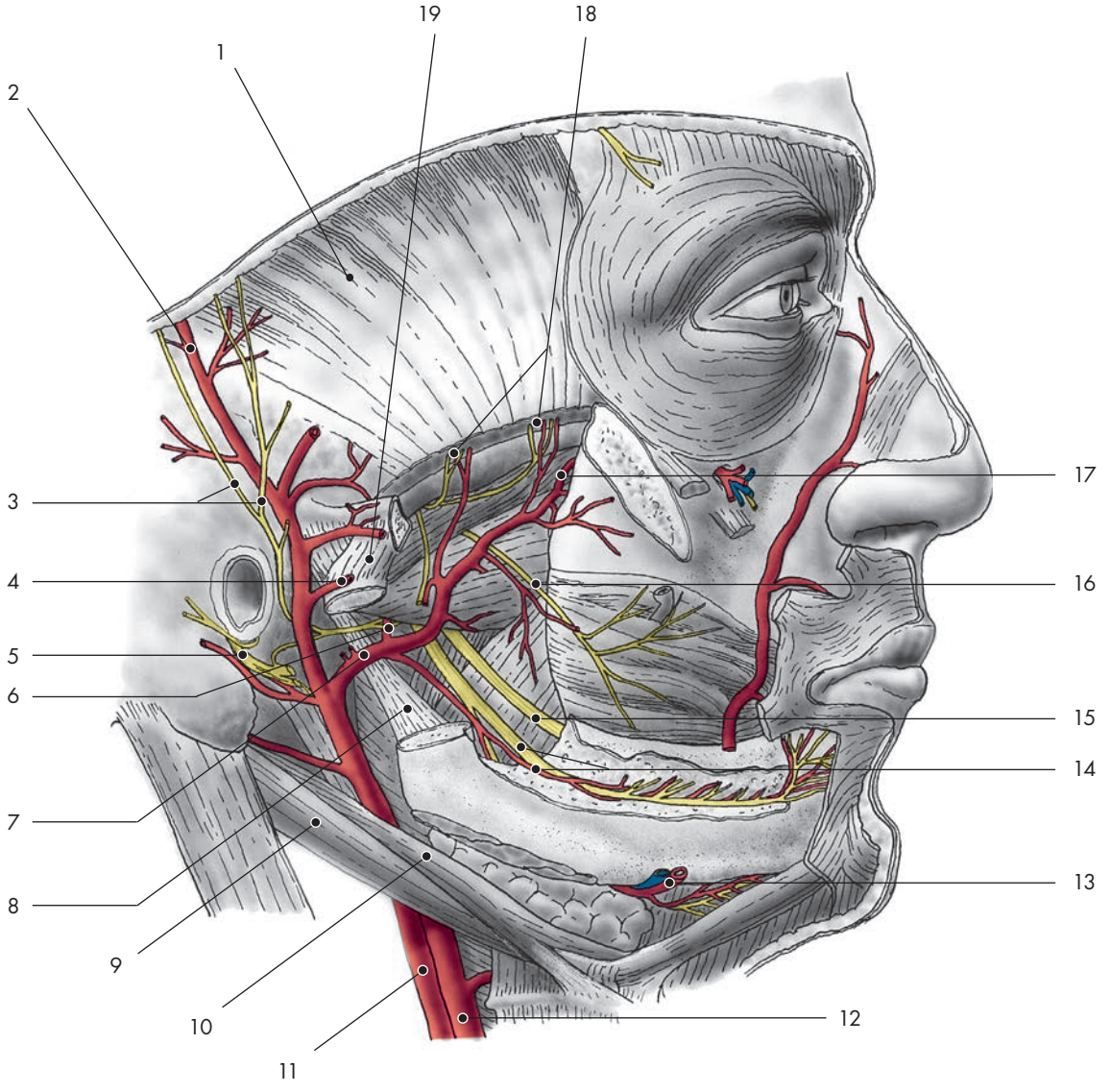

Fig. 1.10 Infratemporal fossa (zygomatic arch and part of the mandible removed, veins not shown). 1 – temporalis muscle, 2 – parietal branch of the superficial temporal artery, 3 – auriculotemporal nerve, 4 – transverse facial artery, 5 – facial nerve, 6 – middle meningeal artery, 7 – maxillary artery, 8 – sphenomandibular ligament, 9 – digastric muscle, 10 – stylohyoid muscle, 11 – internal carotid artery, 12 – external carotid artery, 13 – facial artery, 14 – inferior alveolar artery and nerve, 15 – lingual nerve, 16 – buccal nerve and artery, 17 – sphenopalatine artery, 18 – deep temporal arteries and nerves, 19 – capsule of the temporomandibular joint