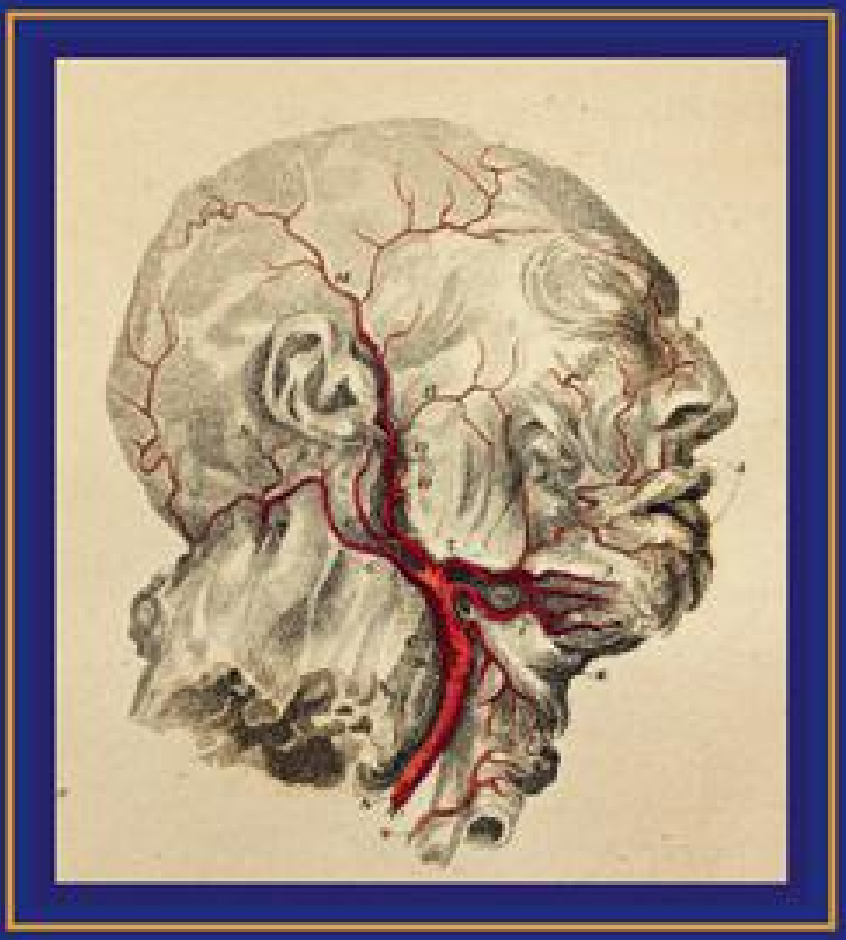
FACIAL TOPOGRAPHY

Clinical Anatomy of the Face



Joel E. Pessa
Rod J. Rohrich

Illustrator
Amanda Yarberry Behr

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Joel E. Pessa, MD, FACS

Associate Professor, Department of Plastic Surgery,
University of Texas Southwestern Medical Center,
Dallas, Texas

Rod J. Rohrich, MD, FACS

Professor and Chairman; Crystal Charity Ball Distinguished Chair in Plastic Surgery;
Betty and Warren Woodward Chair in Plastic and Reconstructive Surgery;
Distinguished Teaching Professor, Department of Plastic Surgery,
University of Texas Southwestern Medical Center, Dallas, Texas

ILLUSTRATOR
Amanda Yarberry Behr, MA, CMI

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This book is dedicated to the donors and their families
of the University of Texas Southwestern Willed Body Program—
their priceless gift made this work possible

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Preface

The surface of the face is a roadmap for the underlying anatomy. Anatomy is not arbitrary: structures show a remarkable consistency between individuals. It is the difference in the shapes of facial structures and their relationship to one another that determine the unique and distinct appearance of each individual. This is the premise of *Facial Topography: Clinical Anatomy of the Face.* The term *topography* in this context refers to more than a definition of anatomic structures; it encompasses and attempts to define *surface landmarks*—shapes, contours, creases, and lines—that help to predict the course and location of deeper structures. These shapes are first described as anatomic regions, strictly defined by superficial and deep boundaries. Within each region, anatomic subunits are likewise determined by true anatomic structures. Thus basic concepts and principles of facial anatomy can be developed that will enable us to systematically visualize and analyze the human face.

The potential clinical applications of such systematic analysis open exciting and challenging new avenues for exploration: the ability to predict the location of deeper structures based on surface landmarks is invaluable to both aesthetic and reconstructive surgeons. For example, knowledge of the facial fat compartments and how they atrophy not only helps us to understand their role in facial aging but also explains the disease processes of the face. As we refine techniques for facial rejuvenation and reconstruction, developing less-invasive procedures with smaller incisions and with greater reliance on the use of toxins, fillers, and fat for facial shaping, it is essential to fully understand the topography of each patient's face to determine the optimal anatomic location for surgical manipulation, volume enhancement, and facial contouring.

In writing this book, we had several goals in mind. The first was to demonstrate, in a clear and straightforward manner, how facial anatomy appears in real life. Fresh cadavers are priceless for achieving this end, and the images presented here will illuminate these anatomic units for all students of anatomy, whatever their level of expertise. Our conscious emphasis has been to show rather than tell; the dissections themselves speak volumes about the structures described succinctly in the text. The second goal was to demonstrate how the parts of the face are related to one another to help physicians create a three-dimensional model in their mind's eye. If we understand the anatomic subunits of a region and how they affect surface shape—the topography—we can then work backward using surface shapes as landmarks for the underlying anatomy.

By combining photographs of meticulous dissections of each region of the face with beautifully rendered parallel medical illustrations, we have endeavored to define the underlying structures of each area and to illuminate the clinical importance of the anatomic lessons that have been revealed.

Surface shapes are the common thread that runs throughout these pages as each region of the face is examined and analyzed. The book begins with a focus on the central forehead, a key area of facial expression. Next we turn our attention to the cheek, eyelids, nose, temporal fossa, and preauricular region. We conclude with a discussion of the lips and chin, two distinct anatomic regions that share the common denominator that less research has been directed at their basic soft tissue anatomy than for other facial regions. This last chapter serves as an example of how the tenets developed throughout the book can be applied in clinical practice to help us better understand the anatomy of any given region and how it influences potential outcomes.

The use of surface landmarks is an emerging science, made possible by synthesizing past and present research. The work presented here is based on findings in more than 1000 dissections and encompasses 20 years' worth of work. Many of these observations are presented for the first time, but each observation is backed by multiple dissections performed in a rigorously controlled manner. We anticipate that some of the observations will serve as the basis for future research: many of the concepts and principles discussed here can be applied to better define any given region.

Just as this book was written with several goals in mind, it is also intended for physicians in several fields and at various levels of expertise and training. For trainees, it provides valuable information for understanding key anatomic landmarks. For clinicians who deal with changing the shape and form of the face through surgical manipulation and/or the injection of toxins, fillers, or fat, the book presents critically important findings to ensure safe and effective treatment, suggesting techniques to achieve a successful result.

As with any emerging science, some of the conclusions reached in these pages may miss their mark. Future research is needed to redefine, reclassify, and advance our understanding of the information explored here. We hope that these basic concepts and principles set the stage for additional work in this area.

Mastering anatomy is a lifelong process, and we can say with complete certainty that we are finally ready to begin to learn this dynamic and fascinating science.

Joel E. Pessa
Rod J. Rohrich

Acknowledgments

We would like to thank all of the members of the University of Texas Southwestern Willed Body Program: Claudia Yellott, Brad Dillon, Liesl Brooke Shepard, Michael Cunningham, Ronnie Money, Yolanda King, Vanessa Lambright, and Justin Fisher. Their expertise and dedication helped facilitate this work; their enthusiasm made it a pleasure to be part of the team. The anatomy department graciously offered access to their dissection lab.

Kind thanks to William E. Maina for his help in reviewing the Rare Books Collection at the University of Texas Southwestern Library.

Our gratitude to the staff of Quality Medical Publishing: Karen Berger, Michelle Berger, Andrew Berger, Amy Debrecht, Amanda Behr, Suzanne Wakefield, Carol Hollett, Carolyn Reich, and Lane Wyrick for their hard work, patience, and guidance.

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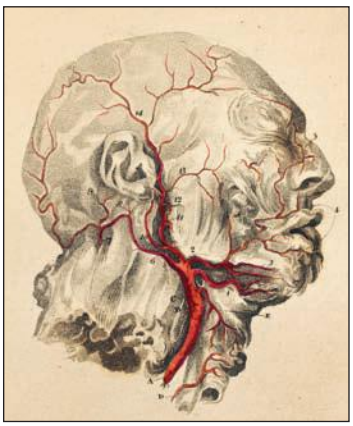
Classic Cadaver Dissections Introducing Each Chapter

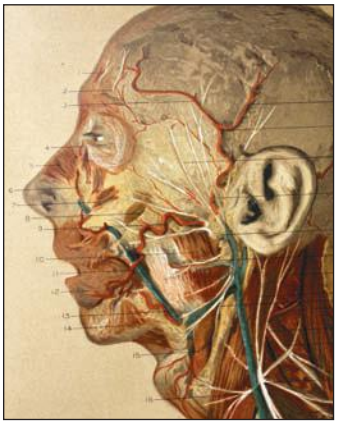
Each chapter is introduced using a classic dissection from one of the great atlases of human anatomy. In this way, we hope to show the continuity between the current subject, facial topography, and basic research preceding this work. Each dissection presented illustrates the association between surface form and underlying structure. Taken as a group, these dissections suggest many of the basic concepts and tenets of facial topography.



Chapter 1, Terminology of Facial Topography, and Chapter 8, The Lips and Chin

Bell Charles, Bell John. Engraving of the Arteries. Philadelphia: Lea & Febiger, 1833. Reproduced with permission from the Rare Books Collection of the University of Texas Southwestern Medical Center.

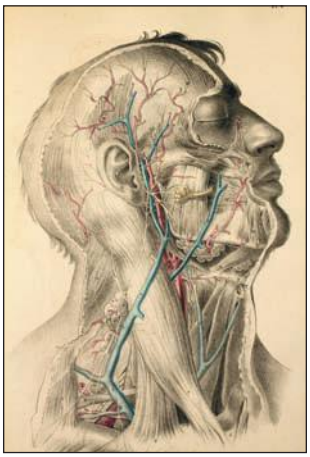
Perhaps one of the greatest anatomists of all time, Sir Charles Bell is best remembered for his differentiation between the motor innervation of the fifth and seventh cranial nerves. However, Bell's dissections covered many other regions in addition to the face. His book, Engravings of the Arteries, *described the vascular supply of the body in detail. This illustration is remarkable for its precision. It shows the ascending philtral arteries and the boundary vessels of the central lip. The boundary of the lateral lip compartment is defined, and the artery associated with the lip-chin crease is noted. On an even finer level, Bell showed the vessels to the corner of the lip and modiolus, thereby defining the origin of the lateral oblique chin crease and the boundary of the lateral lip compartment.*



Chapter 2, The Central Forehead

McClellan G. Regional Anatomy in its Relation to Medicine and Surgery, vol 1. Philadelphia: JB Lippincott Co, 1892. Reproduced with permission from the Rare Books Collection of the University of Texas Southwestern Medical Center.

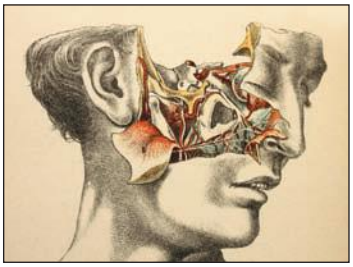
McClellan was the grandson of the founder of Jefferson Medical College, Philadelphia, the nephew of Civil War General George McClellan, and the patron of anatomy at the College. McClellan set a precedent for studying surface anatomy and correlating it with underlying structure with his hand-colored photographs of predissection and postdissection images. The illustration presented here notes the intimate relationship between the nerves and vessels of the forehead, a basic principle of human anatomy.



Chapter 3, The Cheek

Maclise J. Surgical Anatomy. Philadelphia: Blanchard & Lea, 1859. Reproduced with permission from the Rare Books Collection of the University of Texas Southwestern Medical Center.

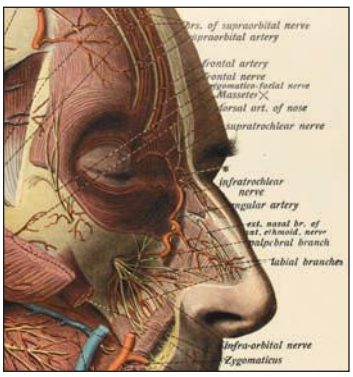
Maclise's statements rank him among the earliest topographic anatomists: "The unbroken surface of the human figure is as a map to the surgeon, explanatory of the anatomy arranged beneath." The goal of his landmark book was, in his words, "to indicate the interior through the superficies." Maclise was trained as a classical artist, as well as a surgeon and anatomist; the plates of his book are each illustrative of his desire to show the relationship between surface form and underlying anatomy. This illustration details the proximity and superficial course of the frontal branch of the facial nerve to the lateral forehead artery as it approaches the frontalis muscle, a potential site of nerve injury.



Chapter 4, The Eyelids

Cloquet J. Manuel D'Anatomie Descriptive du corps Humain. Paris: Place de l'École de Médecine, 1825. Reproduced with permission from the Rare Books Collection of the University of Texas Southwestern Medical Center.

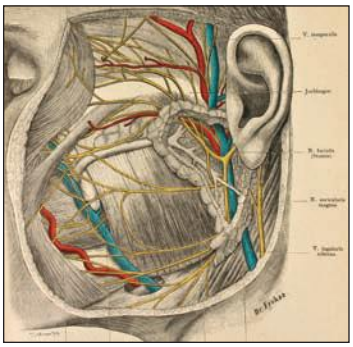
Jules Cloquet was a celebrated Parisian surgeon as well as an accomplished lithographer. A prolific writer, Cloquet covered the entire breadth of human anatomy. Less well known is the fact that he was interested in cross-sectional anatomy. In this respect he predated all others, including Deaver, who studied the face, and Kanavel, who introduced the concept of spaces on the hand.



Chapter 5, The Nose

Sobotta J. Atlas and Text-Book of Human Anatomy. Philadelphia: WB Saunders, 1906. Reproduced with permission from the Rare Books Collection of the University of Texas Southwestern Medical Center.

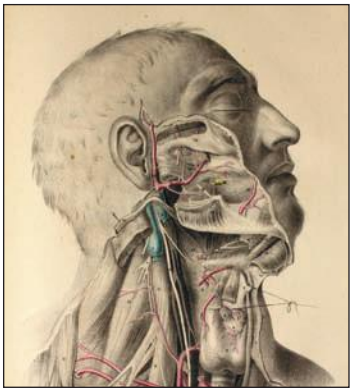
Johannes Sobotta's textbook is one of the classic major treatises of human anatomy. After 15 editions, his work retains the freshness and clinical relevance of the original text. Sobotta's text is perhaps best appreciated for its superb illustration, rendered in a style that is still taught to this day. This illustration shows the lateral boundary of the nose as a separate anatomic region. The path of the infraorbital nerve is noted to cross the cheek-nose boundary, emphasizing the point that structures travel within and through anatomic subunits.



Chapter 6, The Temporal Fossa

von Bandeleben K, Haeckel H. Atlas der topographischen Anatomie. Jena, Germany: Verlag von Gustav Fischer, 1904. Reproduced with permission from the Rare Books Collection of the University of Texas Southwestern Medical Center.

Fritz Frohse, better remembered for his work on the path of the radial nerve, here illustrates the pattern of nerve branching within the temporal region and their relationship to the frontal branch of the facial artery. A Berlin anatomist, Frohse and his brother worked on several texts, among them a well-known handbook of anatomy. This illustration is unique in that it is one of few that accurately portrays the extent of the preorbital part of the orbicularis oculi muscle. Frohse's detail is such that he included the minor branch of the transverse facial artery as it approaches the danger zone for nerve injury referred to as McGregor's patch.



Chapter 7, The Periauricular Region

Maclise J. Surgical Anatomy. Philadelphia: Blanchard & Lea, 1859. Reproduced with permission from the Rare Books Collection of the University of Texas Southwestern Medical Center.

Joseph Maclise expertly defined the anatomy of the periauricular region, including its medial boundary, the superficial temporal artery. Maclise, as an engraver as well as a surgeon, helped to illustrate several other texts, including Quain's handbook on the vascular supply of the body.

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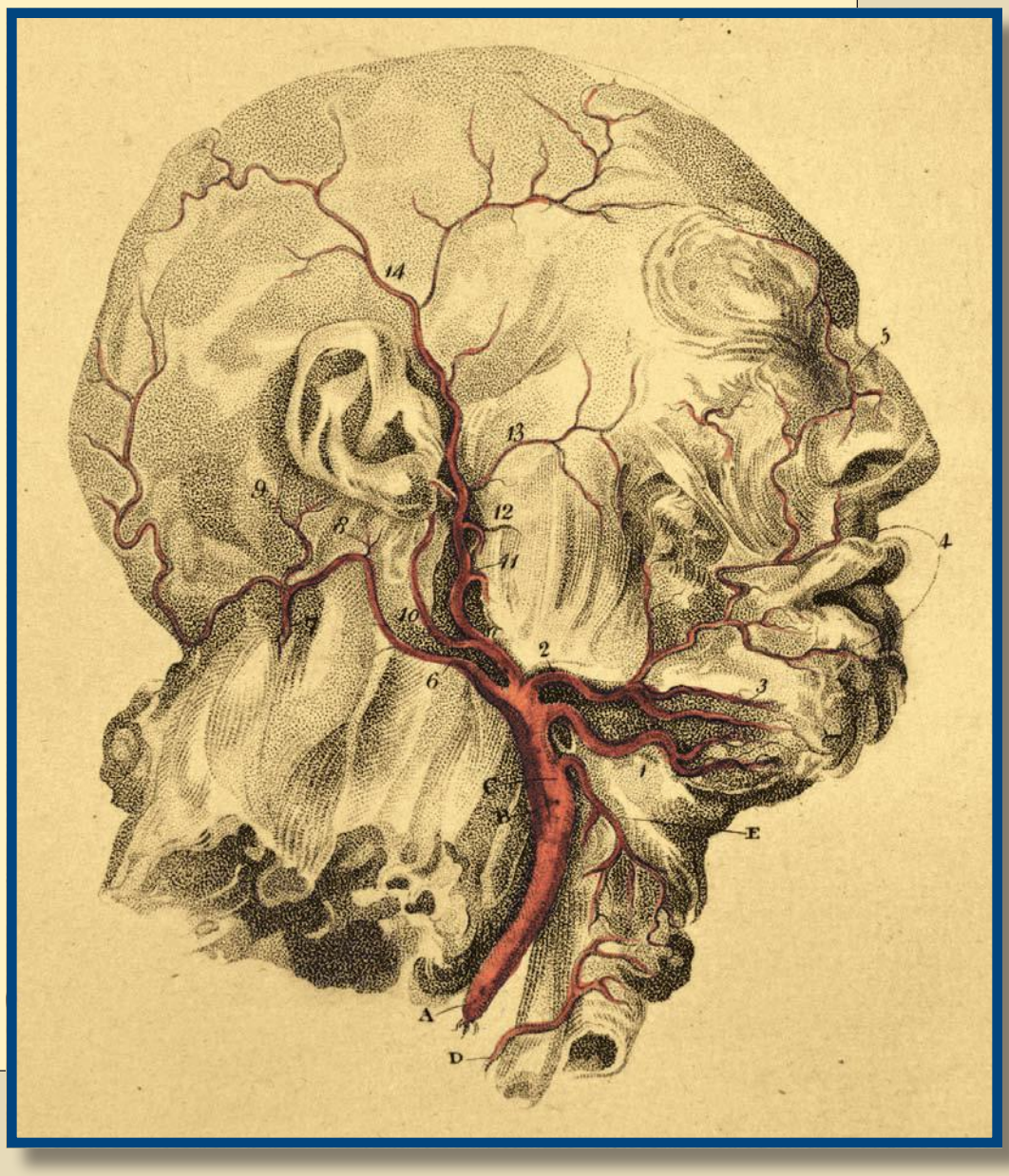
CHAPTER 1

Terminology of Facial Topography



The terminology of facial topography is unique: each word or phrase is considered in the context of how it relates to surface contour, shape, and form. This is slightly different from the thought process applied to standard anatomic terms.

For example, it is entirely correct to define the *angular artery* as a branch of the supratrochlear artery that anastomoses with the facial artery. In the field of reconstructive surgery, the angular artery might be described as a blood supply to the nasolabial flap. In cosmetic surgery, it may be added that the angular artery is near the nasomaxillary junction where the nasal bone will be fractured.

From the perspective of facial topography, the angular artery defines the superficial boundary between the nose and the cheek. The term is thought of in reference to how it affects, or is affected by, surface topography. The utility of this method is that information is not limited to one field or specialty; it can be applied to any endeavor that deals with the human face.

TERMINOLOGY

aesthetic subunits Regions of the face defined by planes and reflected light. Aesthetic subunits are an aid to reconstructive surgery. (Compare *aesthetic subunits* with *anatomic subunits.*)

A-frame deformity Distinct peak of the upper eyelid between the transitional fat and the preaponeurotic fat pads that occurs in some individuals.

alar cleft Shallow groove in the ala of the nose that occurs between anatomic compartments. This cleft may develop a crease in some individuals. The thickness of subcutaneous fat and/or dermis is different on either side of this cleft.

alar groove Region of the lower nasal sidewall directly above the ala. Dermis and subcutaneous fat are thinner at the alar groove. The groove is a boundary zone between the ala and lateral nose and is a landmark for the course of the arterial arcade.

alar rim Aesthetic subunit of the lower third of the nose.

anatomic compartments Discrete regions of facial adipose tissue. Anatomic compartments may be superficial or deep. Superficial anatomic compartments are defined by blood supply; the nasolabial fold and malar mound are examples

of superficial anatomic compartments. Deep anatomic compartments are defined by fascia or fusion zones; buccal and temporal fat are examples of deep anatomic compartments.

anatomic subunits Areas of the face defined by the boundaries of a superficial and/or deep fat compartment. These consist of discrete compartments of adipose tissue, along with the muscles, nerves, and vessels that travel within and through them.

angular artery Vascular boundary of the lateral nasal sidewall. A reference point for the location of the levator labii superioris alaeque nasi muscle.

anterior auricularis muscle Inferiormost superficial muscle of the temporal fossa. Contraction of this muscle leads to vertical creases in front of the ear.

anterior cheek projection Forward projection of the cheek as measured at the medial cheek compartment. This measurement is affected by several factors: maxillary curvature, the thickness of deep medial cheek fat, and the thickness of medial cheek fat. It is usually assessed relative to the anterior cornea or orbital rim.

apparent boundaries Regions of the face where it appears that tissue is confluent between anatomic compartments. Examples occur at the nose-cheek junction and at the cheek-neck junction.

arcus marginalis Fusion zone of multiple fascias and periosteum along the inferior orbital rim. This occurs several millimeters above the lid-cheek crease.

auriculotemporal nerve Sensory nerve to the scalp that parallels the anterior superior auricular compartment.

boundary zone Area between two or more anatomic compartments. Nerves transit through boundary zones between compartments, both superficial and deep.

buccal branch of facial nerve Branch of the seventh nerve that travels through the buccal space. This branch innervates the upper lip and eyelid and provides ancillary innervation to the medial forehead muscles.

buccal fat Deep anatomic compartment situated posterior and lateral to the zygomaticus major muscle that exists as multiple lobes or lobules. The buccal fat helps to define the jowl. The inferior lobe of buccal fat is a topographic landmark for the parotid duct, the facial artery, and marginal mandibular nerve.

buccal space Deep space of the face defined by superficial and deep fascias. It is continuous from the temporal fossa to the lower cheek. Structures from the pterygopalatine fossa travel within this space, as does the buccal branch of the facial nerve.

central chin crease Crease between two superficial medial chin compartments. A fold forms on either side of this crease.

central compartment of lower lip Analogous structure in the lower lip to the central compartment of the upper lip. This is visible in some individuals, and likewise identifies the position of ascending arteries.

central compartment of upper lip Anatomic subunit of the upper lip, found between the two philtral columns. It is defined by ascending philtral arteries.

central forehead artery Vessel that defines the midline forehead wrinkle.

central neck compartment Superficial anatomic compartment directly caudal to the submental fat compartment. The boundaries of this compartment may tether the neck skin. Visible skin creases are the topographic landmarks for this compartment and its blood supply.

cheek Anatomic region with precise boundaries: the superior boundary is the lower eyelid, the lateral boundary the periauricular region, inferior boundary the neck, and the medial boundary is formed by the nose, lips, and chin. These boundary zones occur at both a superficial and a deep level.

cheek-chin crease Boundary between superficial anatomic compartments of the cheek and chin. Cheek tissue is thicker than chin tissue at this boundary.

cheek-chin fold Another name for the inferior part of the jowl.

corrugator crease Skin crease between the medial and lateral corrugator compartments. Because perforators from the supratrochlear artery define this crease, it is a topographic landmark for the position of the artery.

corrugator supercilii muscle Medial forehead muscle having two parts. The length of this muscle spans both the corrugator and supraorbital creases.

crease Surface landmark for underlying arterial vessels. A crease occurs between two superficial anatomic compartments of different thickness. Tonic muscular contraction accentuates the crease that occurs perpendicular to the direction of muscular contraction.

danger zone Area of increased risk of nerve injury, either sensory or motor. Danger zones can be predicated based on underlying anatomy. Three types of danger zones exist: transition zones between superficial compartments; fusion zones of fascias; and points where multiple compartments meet to form a tethering band.

deep fat Adipose tissue deep to superficial or deep fascia. Examples of deep fat include temporal fat below the deep fascia and deep medial cheek fat beneath the superficial fascia.

deep lateral chin compartment Fat compartment deep to the depressor anguli oris muscle. This is also referred to as *prejowl fat.*

deep medial cheek fat Deep anatomic compartment. This fat contributes to anterior cheek projection.

depressor anguli oris muscle Lower lip muscle that depresses or lowers the corner of the mouth. Tonic contraction of this muscle contributes to the cheek-lip crease.

external nasal artery Artery that determines the superficial lateral nasal compartment. The external nerve travels with this artery along a boundary zone.

extraconal intraorbital fat Precise definition of what is commonly referred to as *intraorbital fat.* The intraorbital fat pads, all identified by surface contour, are partially intraorbital and extraorbital.

eyelid Anatomic region of the face. The upper eyelid and lower eyelid have precise boundaries from the rest of the face and from one another.

facial artery Source vessel of the face, the position of which can be predicted based on surface landmarks such as creases and folds.

facial muscles Muscles of the face, either mimetic or involved with chewing. Facial muscles cross boundary zones between two or more anatomic compartments and do not define either compartments or subunits. The facial muscles are in the same plane or depth as the superficial fascia. Deep fat is found below any facial muscle where gliding is required. The presence of facial muscles is signified by the wrinkle or crease with which each is associated.

facial nerve Motor nerve to the mimetic facial muscles. The course of this nerve can be predicted based on topographic landmarks.

fold Contour change in surface topography of the face that is associated with different thicknesses of adjacent superficial compartments.

forehead Region of the face separate from the upper eyelid, temporal fossa, and nose. Deep and superficial boundaries exist between the forehead and other regions.

forehead-lid crease Crease defined by vascular arcade between the forehead and upper eyelid.

frontal branch facial artery Surface landmark beneath which the frontal branch of the facial nerve travels to the frontalis muscle.

frontal branch of facial nerve Technically the branch of the facial nerve that innervates the frontalis muscle. The frontal branches also innervate anterior, superior, and posterior auricularis muscles as well as the temporoparietalis muscle.

frontalis muscle One of the forehead muscles from which the frontal branch of the facial nerve takes its name. The frontalis muscle elevates the brow and forms the horizontal forehead wrinkles.

fusion zones Areas of fusion between superficial and deep fascia. Folds may form at fusion zones.

great auricular nerve Sensory nerve to the lateral cheek, ear, and ear sulcus. This nerve can be injured by improper transitioning techniques during surgery.

inferior lobe buccal fat Discrete lobe of fat within the buccal space that predicts the location of the parotid duct. A branch of the facial nerve and the facial artery travel at the inferior margin of this deep fat.

inferior oblique muscle Intraorbital muscle, the position of which can be predicted based on surface landmarks of the intraorbital lower eyelid fat.

infraorbital nerve Sensory nerve to cheek and upper lip. Its course and origin coincide with the convergence of the nasojugal and lid-cheek creases.

intraorbital fat Deep fat of the upper and lower eyelids beneath orbicularis oculi muscle.

jowl Region of the face defined by superficial superior and inferior compartments and buccal fat.