Chapter 1 Oral Structures and Tissues

Arthur R. Hand and Marion E. Frank

1 Department of Craniofacial Sciences and Cell Biology, School of Dental Medicine, University of Connecticut
2 Department of Oral Health and Diagnostic Sciences, University of Connecticut

The oral cavity and its component cells, tissues, and structures constitute a unique and complex organ system and environment. Of necessity, we study its various parts individually, but the health and function of the components of the oral cavity depend upon and influence one another. Importantly, the oral cavity relies on as well as influences the health and function of the entire body.

The oral cavity is the gateway to the body, and most of the substances that enter our bodies do so through the oral cavity. It is exposed to the physical insults of mastication, hard objects and various food substances, and extremes of temperature. A variety of chemicals, including those present in foods and drinks and produced by commensal and pathogenic organisms, affect the oral cavity. It functions in alimentation, respiration, innate and immune defense, special and general sensation, speech, and human interactions. The tissues and structures of the oral cavity are subject to unique as well as general disease processes. Diseases originating in the oral cavity can have systemic effects; likewise, systemic diseases can affect the oral cavity and the first signs and symptoms of many diseases may appear in the mouth.

The oral cavity

The readily visible components of the oral cavity include the lips (labia), the inside of the cheeks (bucca), the teeth and gums (gingivae), the hard and soft palates, the floor of the mouth, and the tongue (Fig. 1.1). Not visible, but clearly important, are the muscles, nerves, blood vessels, glands, joints, and especially the bones of the upper (maxilla) and lower (mandible) jaws that provide support for and function with the visible components. The oral cavity begins at the junction of the vermilion border of the lips and the mucosa lining the inside of the lips, and extends posteriorly to the palatoglossal folds or arch. Beyond the palatoglossal folds are the palatopharyngeal folds and the beginning of the oropharynx, where the digestive and respiratory tracts come together. The palatine tonsils are located in the tonsillar fauces between the palatoglossal and palatopharyngeal folds. The lymphoid tissue of the palatine tonsils, along with that of the pharyngeal tonsil (adenoids) and the lingual tonsils, guards the entrance to the oropharynx. Anteriorly, the respiratory tract (nasal cavity) is separated from the oral cavity by the hard palate, and posteriorly by the soft palate. The hard palate has an arch-like shape that varies in width and height among individuals. It also plays an important role in manipulation and mastication of food, and in speech. The soft palate functions to seal the oropharynx from the nasopharynx during swallowing and speech. However, during exhalation, receptor cells that detect odors in the olfactory mucosa are activated by oral vapors moving from the posterior oral to posterior nasal cavity through the nasopharynx, effectively expanding the mouth. It is this retronasal route that gives food and drink the odors that contribute much to flavor perception.

The lips and cheeks are separated from the alveolar processes of the maxilla and mandible that support and hold the teeth by a space called the vestibule. The vestibule is limited posteriorly by the ramus of the mandible, and superiorly and inferiorly by the mucolabial and mucobuccal folds. The mucosal lining of the vestibule is continuous with the mucosa of the lips and cheeks, and with the mucosa covering the alveolar processes (Fig. 1.2). Folds (frena [singular, frenum]) of the mucosa, located at the midline and in the canine regions, extend across the vestibule to anchor the lips and cheek to the maxilla and mandible. The secretions of the parotid salivary gland enter the vestibule.
through its main duct, which opens at the **parotid papilla** on the buccal mucosa opposite the maxillary second molar tooth.

The mucosa surrounding the necks, or cervical regions of the teeth, is called the gingivae. The **attached gingiva** is clearly demarcated from the alveolar mucosa at the **mucogingival junction**. The attached gingiva is firmly bound to the bone of the alveolar process, and through the **junctional epithelium** is bound to and creates a seal around each tooth. The **free gingiva** is separated from the tooth by the **gingival sulcus** or **crevice**, and forms the **interdental papilla** between adjacent teeth.

---

**Figure 1.1** Diagram illustrating the anatomy and main structures of the oral cavity. (Modified from Tortora, G.J. & Grabowski, S.R. 2000. *Principles of Anatomy and Physiology*, 9th edition, Wiley, New York. Reproduced by permission of John Wiley & Sons.)

**Figure 1.2** Oral mucosa, gingivae and mandibular teeth. Blood vessels visible through the thin non-keratinized epithelium of the alveolar mucosa give it a redder color than the gingivae with their thicker keratinized epithelium. (From http://commons.wikimedia.org/wiki/File:Healthy_gingiva.jpg)
The tongue occupies the space within the maxillary and mandibular arches, from the floor of the mouth to the hard and soft palates. The mucosa of the dorsal surface of the tongue has several types of specialized structures called papillae that function in the manipulation of food and in taste. The tongue also is critical for forming proper speech sounds. The anterior portion of the tongue is anchored to the floor of the mouth by the lingual frenum. The ducts of the submandibular and sublingual salivary glands open on either side of the lingual frenum at the sublingual caruncle; smaller ducts of the sublingual gland open along the sublingual fold on each side of the floor of the mouth.

**Oral mucosa**

Mucosa is a wet, soft tissue membrane that lines an internal body space, e.g., the oral cavity, the gastrointestinal, urinary, and reproductive tracts. The oral mucosa consists of three layers: a surface epithelium; a supporting lamina propria consisting of a layer of loose connective tissue (papillary layer) just below the epithelium and a deeper layer of dense irregular connective tissue (reticular layer); and an underlying submucosa consisting of dense irregular connective tissue (Fig. 1.3). The submucosa frequently contains minor salivary glands, and in some locations may contain adipose tissue. In some regions of the oral cavity, the submucosa may be absent, and the mucosa is bound to either bone or muscle by the lamina propria.

Three subtypes of mucosa are found in the oral cavity. Lining or moveable mucosa has a stratified squamous non-keratinized epithelium, and is found on the inside of the lips and cheeks, in the vestibules and the floor of the mouth, and on the alveolar processes, the ventral surface of the tongue, and the soft palate. Masticatory mucosa has a stratified squamous keratinized or parakeratinized epithelium, and is found on surfaces subjected to the stresses induced by chewing our food (mastication), the hard palate and the gingivae. Specialized mucosa is found on the dorsal surface of the tongue. This mucosa is considered specialized because it forms four different types of papillae, three of which have taste buds through which taste sensations are received. Multiple fungiform papillae dot the dorsal anterior lingual surface, whereas two series of papillae with associated trenches or troughs, the medial circumvallate and lateral foliate papillae, are found far posterior near the base of the tongue (Fig. 1.4). The walls of the trenches are lined with specialized mucosa containing taste buds. The ducts of minor salivary glands (von Ebner’s glands) open into the trenches, and substances present in the trenches are flushed out by their secretions. Because the mucosa of the tongue has a stratified squamous keratinized epithelium, and because it plays an important role in mastication of food, this mucosa also may be classified as masticatory mucosa.

The oral mucosa has several functions. These include providing protection from physical and chemical insults through its multilayered and keratinized epithelial surface; serving as a permeability barrier to prevent passage of microorganisms and toxic materials; detecting and responding to pathogenic microorganisms and foreign antigens through its immunological components; lubricating and moistening the oral surfaces through secretion of fluid and mucins; and general and special sensation through free and encapsulated nerve endings and taste buds.

![Figure 1.3](image1.png) Light micrograph showing the layers and components of the oral mucosa. A submucosa is not present in all regions of the oral cavity.

![Figure 1.4](image2.png) Light micrograph of a section through a foliate papillary trench of the tongue of a hamster. Arrows point to taste buds in the epithelial lining of the trench. Mucous cells (M) are present in the excretory duct of von Ebner’s gland (VE) as it opens into the trench. Small duct from a VE lobule (d); skeletal muscle (sm); stratified squamous keratinized epithelium (E). Scale bar = 100 μm.
Teeth

The teeth are among the most unique and complex structures of the body. Although they are designed to last a lifetime, teeth can be destroyed or lost in a relatively short time if we fail to take care of them. They consist of three different hard, or mineralized, tissues – dentin, cementum, and enamel – and are supported by a fourth hard tissue – bone (Fig. 1.5). The interface between the teeth and the gingivae is the only place in the body where a structure composed of hard tissues breaches a soft tissue covering. This unique anatomic arrangement is the site of significant pathology that can lead to the destruction of the supporting tissues of the tooth (periodontium) and its eventual loss.

Humans have two sets of teeth, the primary, or deciduous, teeth and the permanent teeth. The primary teeth are the first set to form and erupt into the oral cavity, beginning at about 6 months of age. There are a total of 20 primary teeth, 10 in the maxilla and 10 in the mandible, arranged in the form of an arch. On each side (quadrant) of the arch of each jaw, there is a central incisor, lateral incisor, canine (or cuspid), and first and second molars. The permanent teeth, also called succedaneous or successional teeth, which replace the primary teeth beginning at 6 to 7 years of age, develop in relation to the primary teeth. The permanent molars, or accessional teeth, have no primary precursors and develop posterior to the second primary molars. There are a total of 32 permanent teeth, eight in each quadrant; these include the central and lateral incisors, canine, first and second premolars (or bicuspids), and first, second, and third molars (Fig. 1.1).

A tooth consists of a crown, containing the pulp chamber and one or more roots, which contain the pulp canals (Fig. 1.5). The anatomic crown is covered by enamel, the hardest biological substance known; the clinical crown is the portion of the crown exposed in the oral cavity. One or more cusps and ridges separated by grooves and sulci are present on the occlusal surface (upper or grinding surface) of premolars and molars. The incisal surface of incisors is flatter and thinner and that of canines is more pointed; these teeth function in biting and tearing. The surfaces of the crowns of premolars and molars that face the cheeks are the buccal or facial surfaces (Fig. 1.6). The surfaces of the crowns of incisors and canines that face the lips are the labial or facial surfaces. The surfaces of the maxillary teeth that face the palate are the palatal surfaces; the surfaces of the mandibular teeth adjacent to the tongue are the lingual surfaces. The surfaces of the teeth in each arch that face the adjacent teeth are the proximal surfaces. The proximal surface of premolars and molars facing the posterior part of the oral cavity is the distal surface; that facing the anterior part of the oral cavity is the mesial (toward the midline) surface. This convention is maintained for the incisors and canines: distal, toward the adjacent tooth in the arch closer to the posterior teeth; mesial, toward the midline.

![Figure 1.5](image1.png) Diagram illustrating the structure of a tooth and its supporting tissues. (Modified from Ross, M.H. & Pawlina, W. 2011. Histology: A Text and Atlas, 6th edition, Wolters Kluwer/Lippincott Williams & Wilkins, Philadelphia. Reproduced by permission of Wolters Kluwer Health.)

![Figure 1.6](image2.png) Tooth surfaces and directions in the oral cavity. (Modified from Tortora, G.J. 1995. Principles of Human Anatomy, 7th edition, Wiley, New York. Reproduced by permission of John Wiley & Sons.)
The main tissue of the tooth is dentin. Dentin supports the enamel, which covers the crown, and it forms the root of the tooth. Dentin encloses the pulp, which through its blood and nerve supply and immunologic and regenerative functions maintains the vitality of the dentin and the cells that produce it, odontoblasts. Odontoblasts line the periphery of the pulp and secrete and mineralize the matrix components of dentin, predominantly collagen. Each odontoblast has a long apical or distal cytoplasmic process, the odontoblast process, that extends partway through the dentin in a dentinal tubule. The dentinal tubules are created as the dentin is deposited around the odontoblast processes and the odontoblasts gradually move deeper into the pulp. Some of the dentinal tubules also contain nerve endings, which in conjunction with the odontoblasts and other nerve endings associated with the odontoblasts are responsible for the sensation of pain in dentin. Odontoblasts respond to challenges to the integrity of the tooth, such as dental caries, by rapidly sealing off the dentinal tubules and depositing additional dentin in an attempt to protect the pulp.

Enamel is a product of cells derived from the oral ectoderm. Thus, its composition and structure differ markedly from those of the mesenchymally derived dentin, cementum, and bone. Whereas the latter are living tissues, with collagen-based mineralized extracellular matrices, and capable of repair and regeneration (although limited in the case of dentin and cementum), enamel is non-living, has a temporary non-collagenous extracellular matrix, and is incapable of biological repair. Enamel consists of rods, or prisms, of large, elongated crystals of the mineral hydroxyapatite. Similar mineral crystals are located between adjacent rods, in interrod enamel. Enamel is formed by cells called ameloblasts, which progress through several morphologically and functionally distinct stages during the process of enamel matrix secretion, matrix removal, and mineralization. Upon eruption of the teeth into the oral cavity, the ameloblasts are lost, thus enamel that is damaged or worn away cannot be replaced through cellular activity.

Supporting tissues of the teeth

The teeth are supported by the alveolar bone of the mandible and maxilla and held in place by the collagenous periodontal ligament (PDL) (Fig. 1.3). The collagen fibers of the periodontal ligament insert into the cementum, which is adherent to and covers the dentin of the root, and into the alveolar bone. Although cementum is part of the tooth, its main function is to provide anchorage for the periodontal ligament fibers. Cementum is produced by cells called cementoblasts, and like dentin has a collagen-based mineralized matrix. However, its structure is different from that of dentin. Cementum covering the portion of the root closest to the crown is acellular, i.e., it is composed solely of extracellular matrix components and mineral; cells and cell processes are not present. Cementum covering the portion closer to the tip, or apex, of the root, and in the furcation area (where the roots diverge below the crown) of multirooted teeth, is cellular. In addition to extracellular matrix components and mineral, cellular cementum contains the cell bodies and processes of cementoblasts that have become trapped as cementocytes. The continued deposition of cementum throughout life helps to maintain the attachment of the periodontal ligament as teeth reposition themselves in response to long-term functional changes.

The collagen fibers of the periodontal ligament, like collagen in other soft tissues, is produced and maintained by fibroblasts. Groups of fibers with different orientations help retain the tooth in the alveolus, provide resistance to intrusive forces during mastication, and hold adjacent teeth together in the dental arch. Other fibers help hold the gingival tissues against the alveolar bone and teeth. Through its blood supply, the periodontal ligament provides nourishment for the cementum and alveolar bone and the cells that form these tissues. Through its nerve supply, the periodontal ligament also functions in proprioception, so we know how hard to bite and the position of our jaw when we are chewing, and in stimulation of salivary gland secretion.

The alveolar bone of the mandible and maxilla supports the teeth. The portion of the alveolar bone lining the alveolus provides anchorage for the periodontal ligament fibers. Because of the insertion of these fibers, the bone at the surface of the alveolus is called bundle bone. Beneath this surface layer, typical lamellar bone is present. Like all bone, alveolar bone has a collagen-based, mineralized extracellular matrix that is produced by osteoblasts, is degraded and remodeled by osteoclasts, and contains osteocytes and their processes. Typical Haversian systems, or osteons, are found in the cortical bone of the facial and lingual (palatal) surfaces of the alveolar processes. Maintenance of the alveolar bone depends on the presence of the teeth; it forms as the teeth erupt, and it is resorbed and disappears if the teeth are lost. Alveolar bone also may be lost due to disease, e.g., periodontitis, with a concomitant loss of tooth support and attachment.

Salivary glands

In addition to the minor salivary glands present in most regions of the oral mucosa, there are three major salivary glands, the parotid, submandibular and sublingual glands (Fig. 1.7). These are paired glands located outside of the oral cavity, and connected to it by long ducts. The salivary glands produce and secrete the fluid, ionic and macromolecular components of saliva. Saliva functions to moisten and lubricate the oral tissues, clear food debris and bacterial products from the oral cavity, form a coating (pellicle) on all oral surfaces, buffer the acids produced by bacteria, protect the oral tissues through its content of electrolytes and antimicrobial substances, and initiate the digestion of certain food substances.

The secretory cells of the glands are arranged in spherical or tubular-shaped endpieces, or acini. Each endpiece is connected to a small intercalated duct, which empties into a striated duct. The striated ducts are a prominent component, and characteristic of the major salivary glands. They function to modify the saliva produced by the secretory cells of the endpieces by reabsorption and secretion of electrolytes. The striated ducts connect to larger ducts, the excretory ducts, which eventually merge to become the main excretory duct that empties into the oral cavity.

There are two types of secretory cells found in salivary glands, serous cells and mucous cells (Fig. 1.7). Serous cells
Figure 1.7 Location of the major salivary glands. (Modified from Tortora, G.J. & Grabowski, S.R. 2000. *Principles of Anatomy and Physiology*, 9th edition, Wiley, New York. Reproduced by permission of John Wiley & Sons.)

(a)

Zygomatic process of temporal bone
Articular capsule
Lateral ligament
Styloid process of temporal bone
Stylomandibular ligament
Mandible
Maxilla
Parotid gland
Parotid duct (Stensen’s)
Zygomatic arch
Opening of parotid duct
2nd maxillary molar tooth
Tongue
Lingual frenum
Lesser sublingual duct (Rivinus)
Sublingual gland
Submandibular duct (Wharton’s)
Submandibular gland

(b)

Mandibular fossa of temporal bone
Synovial cavity
Superior compartment
Inferior compartment
Articular disc
Articular eminence of temporal bone
External auditory meatus
Condylar process of mandible
Styloid process of temporal bone
Zygomatic bone

produce a number of proteins and glycoproteins, many of which have antimicrobial or enzymatic activity or bind to various substances, including microorganisms. Mucous cells mainly produce highly glycosylated proteins called mucins. Mucins provide lubrication, allowing oral tissues to glide easily over one another, and have certain binding and antimicrobial activities. Serous cells, and to a lesser extent mucous cells, also secrete water and electrolytes. A third cell type present in the endpieces is the myoepithelial cell. Myoepithelial cells contract to help expel saliva from the endpieces into the duct system. They also help maintain the organization and differentiated state of the endpiece cells.

**Temporomandibular joint**

Although not part of the oral cavity per se, the health and function of the **temporomandibular joint** (TMJ) are intimately related to oral cavity function. The temporomandibular joint consists of the mandibular condyle, the portion of the temporal bone that includes the mandibular fossa and the articular eminence, the articular disc, the ligaments that hold the condyle in place, the joint capsule and associated structures, and the muscles that move the joint (Fig. 1.8).

The temporomandibular joint is a **ginglymoarthrodial synovial joint** that undergoes both translational and rotational movements. Its main function is to allow opening and closing of the mouth and movements of the mandible during mastication and speech. The unique structural and functional features of this joint can lead to specific types of dysfunction, such as displacements of the articular disc. Dysfunction of the joint, due to joint-related, muscle-related, or unknown causes, may result in pain conditions called **temporomandibular disorders**. Pathological conditions that occur in other synovial joints, such as osteoarthritis and rheumatoid arthritis, also may occur in the temporomandibular joint.

**Glossary**

**Alveolar processes**: The bony portions (alveolar bone) of the mandible and maxilla that support the teeth and in which their roots are embedded.

**Ameloblast**: The cell type that synthesizes, secretes, and mineralizes tooth enamel.

**Apex**: The end of the root of the tooth; apical:0000 of or toward the end of the root.

**Articular disc**: The dense connective tissue structure in the temporomandibular joint interposed between the mandibular condyle and the temporal bone.

**Articular eminence**: The bony prominence of the temporal bone anterior to the mandibular fossa; the articular disc slides over the eminence during mandibular function.

**Bone**: A mineralized, collagen-based skeletal tissue providing support and protection for internal organs and to which muscles are attached; lamellar bone consists of sequentially deposited sheets or lamellae of oriented collagen fibrils and mineral crystals; bundle or woven bone is immature bone, with a more irregular pattern of collagen fibrils, commonly found where tendons and ligaments insert into bone.

**Bucca**: The cheek; buccal: of or toward the cheek.

**Canine (cuspid)**: The third tooth from the midline in each arch; it has a conical shape for holding and tearing food.

**Cementoblast**: The cell type that synthesizes, secretes, and mineralizes cementum.

**Cementocyte**: Cells derived from cementoblasts that are enclosed within lacunae in cellular cementum.

**Cementum**: The mineralized tissue covering the roots of the teeth; cementum may contain cells present in lacunae (cellular cementum) or may lack cells (acellular cementum). Periodontal ligament fibers attach to the cementum to hold the teeth in their sockets (alveoli).

**Condyle**: The portion of the mandible that articulates with the temporal bone in the temporomandibular joint.

**Crown**: The portion of the tooth covered by enamel (anatomic crown); the portion of the tooth visible in the oral cavity (clinical crown).

**Cusp**: A pointed or rounded projection on the occlusal surface of a posterior tooth or canine; ridges are linear elevations; grooves or sulci are valleys or depressions between cusps and ridges.

**Dental caries**: Lesions of the tooth tissues (enamel, dentin, cementum) caused by dissolution of mineral (hydroxyapatite) by acids and destruction of organic matrix by proteolytic enzymes produced by oral bacteria.

**Dentin**: The main tissue of the tooth, consisting of a highly mineralized collagenous matrix produced by odontoblasts; dentin supports the enamel in the crown and forms the tooth root.

**Dentinal tubules**: Channels or tubules extending through the dentin from the pulpal surface to the enamel; formed by deposition of dentin matrix around the distal odontoblast processes.

**Ducts**: Epithelium-lined tubular conduits that convey secretions from salivary gland endpieces to the oral cavity and modify them in the process; they include intercalated, striated, and excretory ducts.

**Enamel**: The ectodermally derived, highly mineralized tissue covering the crowns of the teeth; produced by ameloblasts.

**Endpiece (acinus)**: A cluster of salivary gland secretory cells organized around a lumen and connected to an intercalated duct.

**Epithelium**: A layer of cells lining a body surface; the epithelium of the oral mucosa is a multilayered stratified squamous epithelium, either non-keratinized, keratinized, or parakeratinized.

**Facial**: Of or toward the face.

**Fibroblast**: The main cell type of connective tissues; responsible for secretion, maintenance, and repair of the fibrous components, glycoproteins, and proteoglycans of the extracellular matrix.

**Frenum**: A fold of oral mucosa that connects the alveolar process to the cheek or the ventral surface of the tongue to the floor of the mouth.

**Furcation**: The region on the underside of the crowns of multirooted teeth where the roots diverge.
Gingivae: The portion of the oral mucosa adjacent to the teeth, covered by stratified squamous keratinized or parakeratinized epithelium; *attached gingiva* is bound to the underlying bone or tooth surface; *free gingiva* forms the margin of the gingiva and is not bound to the tooth.

**Gingival sulcus (crevice):** The space between the free gingiva and the tooth surface; lined by stratified squamous, non-keratinized epithelium.

**Gingivomucosal synovial joint:** A joint that combines hinge and gliding movements, with a joint space containing synovial fluid.

**Haversian system (osteon):** The basic structural unit of compact bone, consisting of a central canal containing blood vessels, nerves, and osteoblasts or bone lining (endosteal) cells, surrounded by concentric lamellae of bone with osteocytes in lacunae.

**Hydroxyapatite:** The crystalline calcium phosphate mineral of bones and teeth, Ca_{10}(PO_{4})_6(OH)_2; usually present with carbonate (CO_3^2-) and/or fluoride (F-) substituting for OH-, or CO_3^2- substituting for phosphate.

**Incisal Edge:** The biting surface or edge of an anterior tooth; *incisal*: of or toward the incisal edge.

**Incisor:** Anterior teeth with a sharp edge for cutting and shearing food; each arch contains two central and two lateral incisors.

**Interdental papilla:** The gingival tissue located below the contact point between the proximal surfaces of adjacent teeth.

**Interrod enamel:** Enamel tissue surrounding enamel rods; it is produced by ameloblasts and secreted at the sides of 'Tomes' processes; interrod enamel crystals have a different orientation than rod enamel crystals.

**Junctional epithelium:** The epithelium that attaches the gingival tissues to the tooth surface; initially derived from the reduced enamel epithelium.

**Labia:** The lips; *labial*: of or toward the lips.

**Lamina propria:** The connective tissue that supports the epithelium of the oral mucosa; the *papillary layer*, consisting of loose connective tissue, is located immediately below the epithelium; the *reticular layer*, consisting of dense irregular connective tissue, is located below the papillary layer.

**Lingual:** Of or toward the tongue.

**Mandible:** The lower jaw; the body contains the lower teeth and the flattened *ramus* extends upward at angle, ending in the coronoid and condylar processes.

**Mandibular fossa:** The depression or concavity in the temporal bone that articulates with the condyle/disc complex.

**Maxilla:** Two maxillae form the upper jaw; each maxilla contains the upper teeth and the maxillary sinus; forms the hard palate, floor and lateral wall of the nasal cavity, and the wall of the orbit.

**Molar:** A multirooted posterior tooth used for grinding food; there are three molars on each side of each arch.

**Mucogingival junction:** The boundary between the alveolar mucosa, with non-keratinized epithelium and the attached gingivae, with thicker, keratinized epithelium.

**Mucolabial, mucobuccal folds:** The depth of the oral mucosa in the vestibule, from the mandible or maxilla to the lips or cheeks, respectively.

**Mucosa (mucous membrane):** The lining of a body cavity exposed to the external environment or of an internal organ; consists of an epithelium and supporting connective tissue; involved in secretion, absorption, and protection; mucosae of the oral cavity include *lining* or *moveable*, *masticatory*, and *specialized*.

**Mucous cell:** A secretory cell of the salivary glands; produces highly glycosylated proteins called mucins.

**Myoepithelial cell:** A contractile cell found in salivary, lacrimal, sweat, and mammary glands; its contractions force fluid from the endpieces into the ducts; also helps maintain the differentiated state of the secretory cells.

**Nasopharynx:** The uppermost portion of the pharynx; extends from the base of the skull to the soft palate, posterior to the nasal choanae (posterior openings of the nasal cavity).

**Occlusal surface:** The upper or grinding surface of premolar and molar teeth; *occlusal*: of or toward the occlusal surface.

**Odontoblast:** The cell type that is responsible for synthesis, secretion, and mineralization of the dentin matrix; also participates in sensory, defensive, and reparative functions; *odontoblast process*: the elongated distal portion of the odontoblast present within a dentinal tubule.

**Olfactory mucosa:** The mucosa of the upper portion of the nasal cavity; the epithelium contains olfactory neurons with odor receptors involved in the sense of smell.

**Oropharynx:** The portion of the pharynx posterior to the oral cavity, extending from the soft palate to the epiglottis.

**Osteoblast:** The cell type that synthesizes, secretes, and mineralizes the matrix of bone.

**Osteoclast:** A large multinucleated cell formed by fusion of bone-marrow-derived precursors; responsible for bone resorption through the secretion of acid and proteolytic enzymes.

**Osteocytes:** The cells of bone; they are derived from osteoblasts and located in lacunae surrounded by mineralized bone and function in mechanosensation and regulating bone growth and turnover.

**Palate:** The structure separating the oral and nasal cavities; the anterior *hard palate* consists of the bony palatal processes of the maxillae covered by masticatory mucosa orally and respiratory mucosa nasally; the posterior *soft palate* consists of muscular tissue covered by lining mucosa orally and respiratory mucosa nasally; *palatal*: of or toward the palate.

**Palatoglossal fold:** The arch-like fold of the oral mucosa covering the palatoglossal muscle, the anterior tonsillar pillar, and the posterior limit of the oral cavity.

**Palatopharyngeal fold:** The arch-like fold of the oral mucosa covering the palatopharyngeus muscle and the posterior tonsillar pillar.

**Papillae:** Tissue projections from the dorsal surface of the tongue filiform papillae cover most of the anterior two-thirds of the tongue; *fungiform* papillae with dorsal taste buds are present in the anterior two-thirds; *circumvallate* and *foliate* papillae with taste buds in the walls of their associated trenches are present posteriorly and laterally, respectively.

**Parotid papilla:** A raised area of mucosa on the inside of the cheek opposite the second maxillary molar; the site of opening of the parotid gland duct.
Pellicle: The coating on the surfaces of the teeth and oral mucosa consisting of adsorbed salivary proteins, glycoproteins, and mucins.

Periodontal ligament: The collagenous ligament attaching the cementum on the root of a tooth to the bone of the alveolus.

Periodontitis: An inflammatory disease of the periodontal tissues resulting in loss of tooth support, caused by the response to a microbial biofilm adherent to tooth surfaces.

Periodontium: The supporting tissues of the teeth, including the alveolar bone, the periodontal ligament, the cementum, and the gingivae.

Permanent (succedaneous/successional, accessional) teeth: The teeth that replace (succedaneous or successional) or erupt posterior to (accessional) the primary teeth, beginning at about 6 to 7 years of age.

Premolar (bicuspids): A permanent tooth located between the canines and molars, shaped for grinding food; two premolars are present on each side of each arch.

Primary (deciduous) teeth: The first teeth to develop in children; four incisors, two canines, and four molars in each jaw; they are replaced by permanent teeth beginning at about 6 years of age.

Proximal (mesial, distal) surfaces: The tooth surfaces facing adjacent teeth; mesial surfaces face toward the midline; distal surfaces face toward the back of the oral cavity.

Pulp: The living tissue inside the crown and root(s) of a tooth; consists of connective tissue and connective tissue cells, and includes odontoblasts, blood and lymphatic vessels, and nerves; pulp chamber: the space enclosed by the dentin of the tooth crown containing pulpal tissue; pulp canals: narrow extensions of the pulp chamber through the length of the root containing pulpal tissue.

Quadrant: One-half of the dental arch of each jaw; contains five primary teeth or eight permanent teeth.

Retronasal: Posterior route of access to the nasal cavity and olfactory epithelium, through the oro- and nasopharynges.

Rod (prism): The basic structural unit of enamel, extending from the dentin surface to the tooth surface; it consists of elongated enamel crystals.

Root: The portion of the tooth embedded in and attached to the alveolar bone via the periodontal ligament; consist of dentin covered by cementum; contains the pulp canal.

Saliva: The product of the salivary glands; contains water, electrolytes, proteins, glycoproteins, mucins, and small organic molecules; saliva in the mouth also contains epithelial cells, white blood cells, and microorganisms.

Salivary glands: Exocrine glands producing saliva; major glands located outside of the oral cavity are the parotid, submandibular, and sublingual glands; minor salivary glands are located in the submucosa in many regions of the oral cavity.

Serous cell: A secretory cell of the salivary glands; produces proteins and glycoproteins with enzymatic, antimicrobial, and other protective activities.

Sublingual caruncle: A small papilla near the base of the lingual frenum; site of opening of the submandibular gland duct and the major duct of the sublingual gland.

Sublingual fold: An elevated fold of the mucosa in the floor of the mouth, between the tongue and the body of the mandible; minor ducts of the sublingual gland open along the sublingual fold.

Submucosa: The deepest layer of the oral mucosa; it contains dense irregular connective tissue, larger blood vessels and nerves and may contain minor salivary glands and adipose tissue; it is not present in all regions of the oral cavity.

Taste buds: A small cluster of taste receptor cells, supporting cells, and nerves located within the epithelium covering fungiform papillae and lining the trenches of circumvallate and foliate papillae of the tongue.

Temporomandibular joint: The joint formed by the mandibular condyle and the temporal bone; it allows opening and closing of the mouth and lateral excursions during mastication.

Temporomandibular disorders: A group of conditions characterized by pain in the temporomandibular joint or jaw muscles, limitation of jaw movement, and clicking or crackling sounds in the joint; the cause may be joint-related, muscle-related, or unknown (idiopathic).

Tongue: The muscular organ of the oral cavity which functions in tasting, manipulating and swallowing food, and in forming speech sounds.

Tonsillar fauces: The space between the palatoglossal and palatopharyngeal folds containing the palatine tonsils.

Tonsils (palatine, pharyngeal, lingual): Collections of lymphatic tissue located around the pharynx that guard the entrance to the digestive and respiratory tracts.

Vermilion border: The reddish-colored region of the lips, separating the skin from the oral mucosa; it is covered by a thin stratified squamous, keratinized epithelium.

Vestibule: The space between the lips or cheeks and the alveolar processes of the maxilla and mandible; lined by stratified squamous, non-keratinized epithelium.

von Ebner’s glands: Minor serous salivary glands located in the tongue; their ducts open into the trenches of the circumvallate and foliate papillae of the tongue.