COLOR ATLAS OF ORAL PATHOLOGY

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Histology and Embryology • Developmental Disturbances • Diseases of the Teeth and Supporting Structures • Diseases of the Oral Mucosa and Jaws • Neoplasms

461 Figures in Color

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Foreword

The treatment and prevention of the ills of humanity are the prime objectives to which the professions of dentistry and medicine are dedicated. Without a basic knowledge and understanding of the pathologic conditions that characterize disease, these objectives of the professions cannot be fully attained. There are many diseases which originate in and are peculiar to the oral cavity. Many systemic diseases have their early visible manifestations in this area. The early detection and identification of these diseases of the oral cavity is an important part of diagnosis. The Color Atlas of Oral Pathology has been designed to present basic knowledge about the diseases found in the oral cavity, which will aid in their early recognition and treatment.

This book should appeal to the busy clinician as well as the student, for it offers to them a concise, pictorial reference guide from which knowledge may be readily gained. The text is clear, succinct and authoritative. Each disease entity is uniformly portrayed and described from its macroscopic appearance to its microscopic aspects. This Atlas is unique in that all illustrations except roentgenograms are in full color. This is a most welcome feature, for the clinical characteristics of many oral lesions can be properly portrayed only by natural color; and photomicrographs in color give a much more realistic impression of what the microscope reveals than do black-and-white illustrations.

While this Atlas was prepared primarily for use in the officer training programs of the Naval Dental Corps, this knowledge has a universal appeal and is therefore certain to be of great value to all members of the health professions who are interested in oral disease.

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Preface

The purpose of this book is to present in concise form the fundamental facts concerning oral disease. The volume is an atlas in the strictest sense—a book of pictures. The written material, which merely supplements the color plates, is confined to the page on which an entity is illustrated.

This Atlas is designed primarily for general practitioners, to help them achieve their main objective—arriving at a diagnosis so that treatment can be planned intelligently.

In general, diseases having similar causes have been grouped together, but when it appeared more logical they were arranged according to anatomic site. The amount of space allotted to an entity is not related to its frequency or importance, but rather reflects the number of pictures deemed necessary to depict salient points adequately. When appropriate, it has been the policy to illustrate the clinical, roentgenographic and microscopic appearance of lesions. Each disease has been designated by a preferred term, but commonly used synonyms are also given. The term "disease" has been used in its broadest sense, to denote any condition which is considered outside the zone of normality. Because a knowledge of histology and embryology is extremely important to the thorough understanding of pathology, a brief section on these two subjects has been included to provide a ready reference for the reader.

While the text is brief, as much pertinent information as possible has been condensed into the space available, including a precise definition of each entity and—where a systemic disease is under consideration—a discussion of the general as well as the oral aspects. No attempt has been made to cover oral pathology or oral diagnosis as academic subjects. Those readers desiring further information should refer to standard textbooks and to the periodical literature. To aid in locating such additional information, a brief list of articles relating to the various entities is included at the end of the book. Only papers which are written in English and appear in readily available publications have been selected. This suggested supplemental reading list in no way exhausts the available literature on any subject.

Pathology is not an exact science, and therefore it is to be expected that, through subsequent investigative procedures, some concepts presented in this Atlas may be proved incorrect. Care has been taken, however, not to perpetuate erroneous information. An effort has been made not to be dogmatic but to submit, when space permitted, various opinions regarding controversial subjects.

It is hoped that this book will be of value to those clinicians who seek further knowledge of oral disease as a background for formulating proper treatment.

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Acknowledgments

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The Commanding Officers of the U. S. Naval Dental School during the period in which this book was being prepared were Rear Admiral Clemens V. Rault (DC) USN, Captain Louis D. Mitchell, Jr. (DC) USN, Rear Admiral Ralph W. Taylor (DC) USN, and Captain Curtiss W. Schantz (DC) USN.

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The color transparencies used in the preparation of this Atlas were principally from three sources: the School of Dentistry, University of Michigan; the College of Dentistry, Ohio State University; and activities of the U. S. Naval Dental Corps. Pictures from other sources are acknowledged on the page on which they appear. Those from Memorial Hospital, New York City, are used through the courtesy of Hayes Martin, M.D. In each instance the acknowledgment concerns the illustration only, and the contributors should not necessarily be considered responsible for statements accompanying the pictures.

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Numerous other individuals have assisted in many ways in the preparation of this Atlas. While they are not acknowledged individually, their various contributions are greatly appreciated.

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Contents

Histology and Embryology

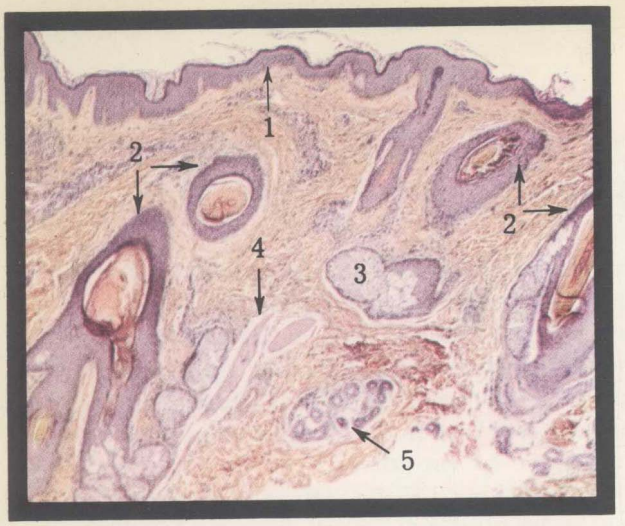
In order to understand the abnormal, it is of course necessary to have knowledge of the normal. It is important to recognize various tissues microscopically and to be acquainted with normal development. Many individuals become frustrated in the study of pathology because of a feeling of inadequacy in the fields of histology and embryology. While a wealth of knowledge in these two areas is certainly advantageous, it is surprising how few facts one need learn or recall to be able to develop an understanding of disease adequate for the intelligent practice of general dentistry. This section of the Atlas is by no means designed to replace standard texts in histology and embryology but only to present the minimum of information regarding tissue recognition and development of the head and neck that one must have in order to approach the study of pathology.

Before examining histopathologic material, it is necessary to be able to identify microscopically the following: skin and cutaneous appendages, oral and respiratory mucous membrane, salivary gland tissue, skeletal muscle, fibrous connective tissue, nerve tissue, cartilage, bone, enamel, dentin, cementum, pulp and the various inflammatory cells.

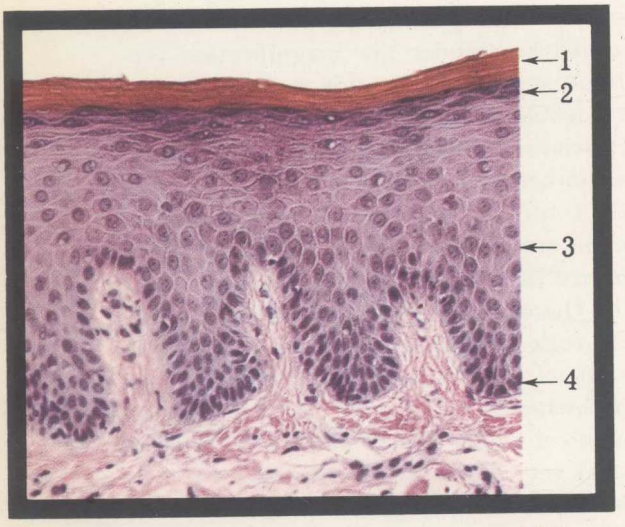
It is of little value simply to try to memorize what a certain tissue, organ, or cell looks like. The easiest, most rapid and surest method of tissue recognition is to learn the identifying characteristics of the various structures. Dependence on color in the identification of histologic structures is a bad practice. For instance, if an attempt is made to "spot" eosinophils by their red cytoplasm, it is possible to confuse them with polymorphonuclear neutrophils that have been stained heavily with eosin, or with Russell-Plimmer bodies. However, if the special features of the eosinophil (reddish cytoplasm with coarse granules) are relied upon for identification, no difficulty should be encountered. Likewise, under certain circumstances mucous and serous acini may be confused if the staining characteristics alone are considered.

In examining a tissue section, it is advisable to look at it first with the naked eye or a reversed eyepiece to learn the general characteristics of the section. When it is placed under the microscope, it should be studied first under low magnification (approximately ×30). At this magnification it is possible to determine the natural and artificial margins, the relation of one tissue to another, and any regions in which tissues vary from the normal. Areas that appear to be abnormal under low power should be examined further at a magnification of 100 or 200. Occasionally, it is necessary to investigate regional cellular detail with a magnification of 500. Oil immersion need be used only when searching for microorganisms. Some cells look nearly alike when viewed under very high power, and it is possible to identify them only by switching to a lower power and determining their arrangement and their relationship to other structures. Most histopathologic material may be evaluated without resorting to a magnification higher than 100, but it is a common error for those not familiar with tissue microscopy to make too great a use of the higher magnifications.

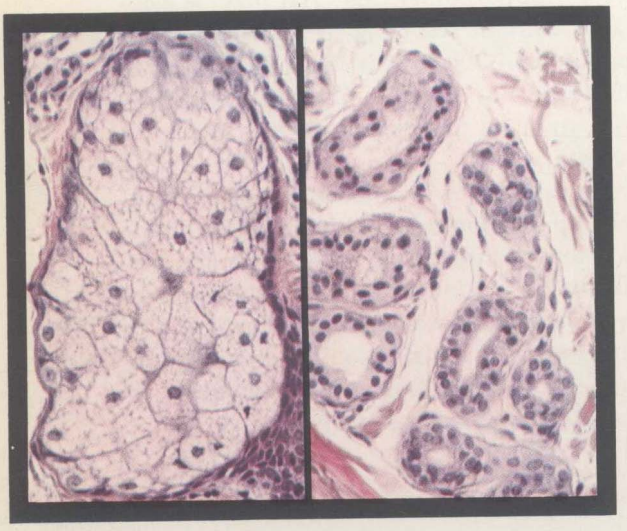
Acquisition of detailed information concerning development of the head and neck is a long, painstaking process. Unless specialization is contemplated, it should suffice to know tooth development in detail and to understand the main points regarding the branchial arches and the development of the tongue, palate and face.



Skin X 35



Stratified Squamous Epithelium X 220



SKIN

(Top) The skin consists of epidermis (1), which is stratified squamous epithelium, and corium (dermis), which is mainly connective tissue. The corium supports the secondary skin structures, or cutaneous appendages: hair follicles (2), sebaceous glands (3), arrectores pilorum (4) and sweat glands (5).

(Center) Stratified squamous epithelium is composed of three main layers: stratum germinativum, stratum granulosum and stratum corneum. Stratum germinativum may be subdivided into the basal layer and the prickle cell layer. The basal cell layer (4) consists of a single row of dark-staining columnar cells which are perpendicular to the dermoepidermal junction. The prickle cell layer, or stratum spinosum (3), is composed of several rows of polyhedral cells which connect with each other by fine, spinous processes (intercellular bridges). Stratum granulosum (2) usually consists of two layers of flattened cells which contain dark-blue-staining keratohyalin granules. The stratum corneum, or horny layer (1), is made up of densely packed cells filled with keratin. The fingerlike processes of epithelium extending into the dermis are rete pegs. The connective tissue between two rete pegs is called a dermal papilla. The following terms refer to abnormalities of epithelium: acanthosis—hyperplasia of the prickle cell layer; pseudoepitheliomatous hyperplasia—benign overgrowth resembling carcinoma; hyperkeratosis—thickening of stratum corneum; parakeratosis—retention of nuclei in cells of the horny layer.

(Bottom) The sebaceous gland (left) is composed of large polyhedral cells having small, centrally placed nuclei and abundant, light-staining, vacuolated cytoplasm. The secretion, sebum, which usually is released into a hair follicle, becomes available when the individual cells rupture. The destroyed cells are replaced from the layer of squamous cells that surround the gland. Sweat glands (right) are coiled structures, but they appear in microscopic sections as nests of small cut tubules, each lined by a single row of cuboidal cells. At the periphery of the tubules a few spindle-shaped myo-epithelial cells may be seen.

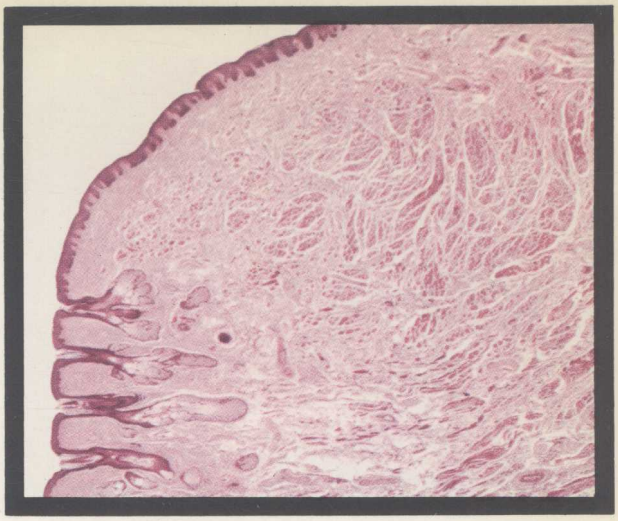
MUCOUS MEMBRANE

Oral mucous membrane differs from skin mainly in that no secondary skin structures are present in the subepithelial connective tissue (corium, lamina propria). Oral epithelium is usually thicker than epidermis, and the rete pegs are longer. Contrary to widely held belief, oral mucous membrane does have a keratinized layer in most areas, although this layer may consist of parakeratin rather than keratin. If parakeratin alone is formed, there is usually no granular layer. A well-developed horny layer on the oral mucosa is demonstrated in the center picture on the opposite page. This photomicrograph, used to illustrate the layers of stratified squamous epithelium, is of a section from the palate.

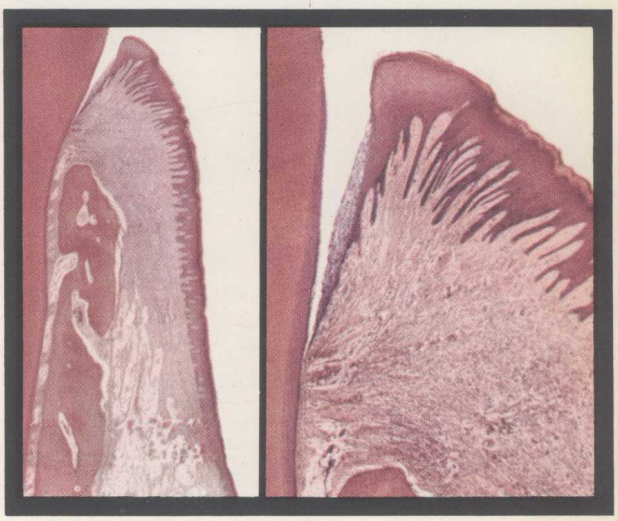
(Top) This illustration demonstrates the transition zone between skin and mucous membrane on the lower lip. At the far left is an abrupt termination of the hair follicles and sebaceous glands. Above this point is the vermilion border of the lip, and below it is skin. The rete pegs extend progressively deeper into the corium as the oral cavity is approached.

(Center) Low- and high-power photomicrographs of the epithelial attachment on lingual surface of a maxillary molar tooth. (Rotate 180° for proper orientation.) Both the free and the attached portions of the gingiva are characterized by long rete pegs which gradually diminish in size in the region of the palatal mucosa. In the higher magnification the epithelial attachment may be identified as the area of lighter-staining cells. These epithelial cells have been torn from the cementum in the preparation of the specimen. The bottom of the gingival sulcus is at the coronal end of the epithelial attachment. The sulcus epithelium has a thin keratinized layer, but on the external gingiva this layer is quite thick.

(Bottom) The nasal cavity proper and the paranasal sinuses are lined by pseudostratified ciliated columnar (respiratory) epithelium. This epithelium appears to be stratified because the nuclei are at different levels in the cells. The epithelium illustrated is from the maxillary sinus.

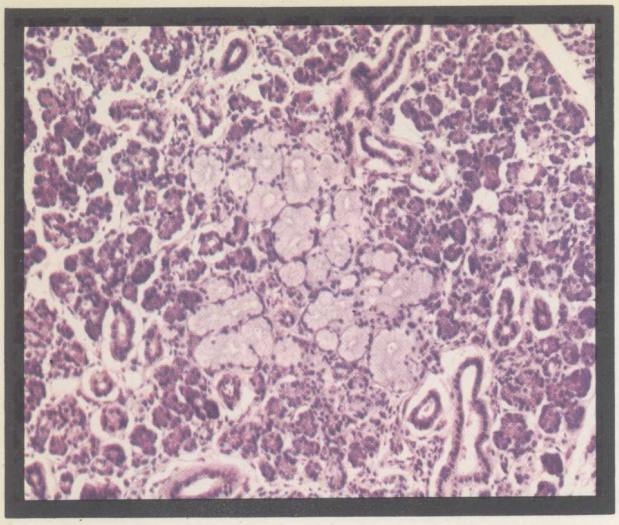


Mucocutaneous Junction, Lip X 14

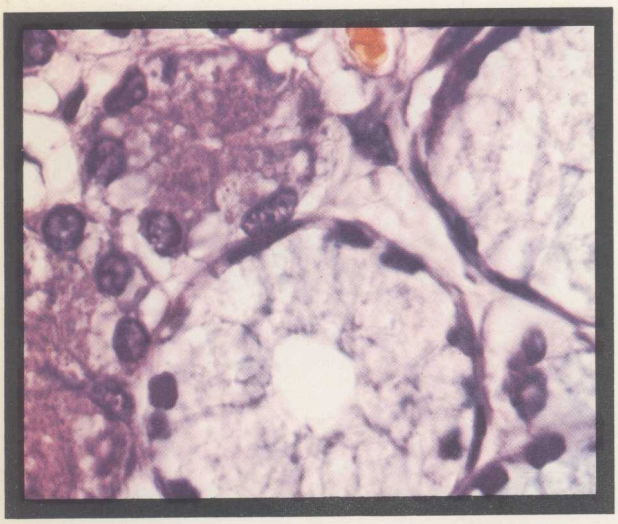


X 9 Gingiva X 40

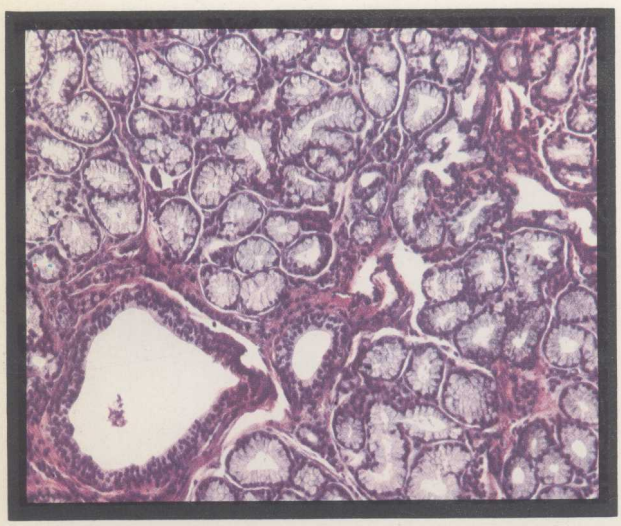
Pseudostratified Ciliated Columnar Epithelium X 220



Submaxillary Gland X 60



Serous and Mucous Acini X 750



Accessory Salivary Gland X 100

SALIVARY GLANDS

The three major salivary glands are composed of serous and mucous cells in the following proportions: parotid—almost 100 per cent serous; submaxillary—about 80 per cent serous; sublingual—usually more mucous than serous and always at least half mucous. Accessory salivary glands (located nearly everywhere in the oral mucosa but especially in the lips, palate, buccal mucosa and tongue) are predominantly mucous except for the serous glands of von Ebner, which open into the groove around each circumvallate papilla.

(Top) Salivary gland tissue composed mainly of serous acini, which at this magnification appear as groups of dark-staining cells. The light-staining units in the center of the field are mucous acini. The structures with the large lumina are ducts.

(Center) A mucous acinus (bottom of picture) is composed of triangular cells which are arranged in a circle, forming a distinct lumen. The nuclei of these cells are compressed against the basement membrane, and the cytoplasm is nearly colorless when stained with hematoxylin and eosin. A serous acinus (upper left) differs from the mucous type in that the nuclei of the individual cells are spherical, larger, and not compressed against the basement membrane, though they are situated near it. The cytoplasm of serous cells contains dark-blue-staining zymogen granules. Serous acini tend to be smaller than the mucous variety, and their lumina are rarely visible. A mixed acinus usually consists of a mucous unit partially surrounded by a cap of serous cells (serous demilune).

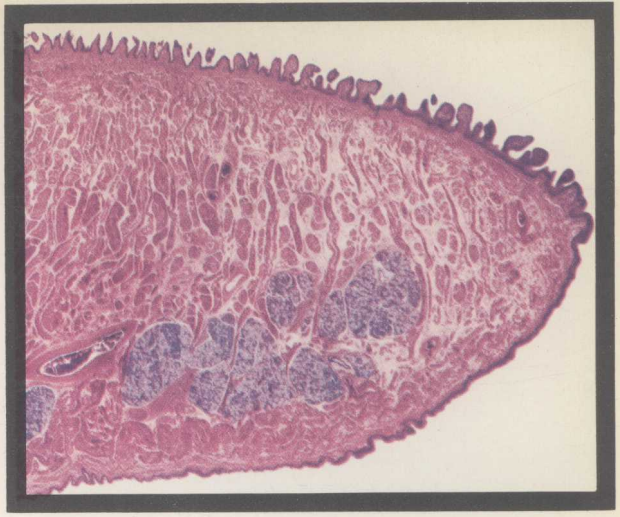
(Bottom) In this section of salivary gland tissue, which is from the lip, the acini are all of the mucous type. Ducts are evident near the lower border. The duct system varies in the different salivary glands, but in the main the peripheral ducts are small and are lined by a single row of short epithelial cells. As the surface is approached, the ducts become larger and are lined by taller cells. Close to the surface there is often a double row of cells. Finally, the last portion of the duct is lined by oral cavity epithelium.

TONGUE

(Top) Histologic section through the tip of the tongue, demonstrating papillated dorsal surface and relatively smooth undersurface. The red-staining material that makes up the bulk of the tongue is voluntary muscle running in all directions. This complex musculature is peculiar to the tongue. The light-blue-staining areas (groups of mucous acini) constitute the anterior lingual gland.

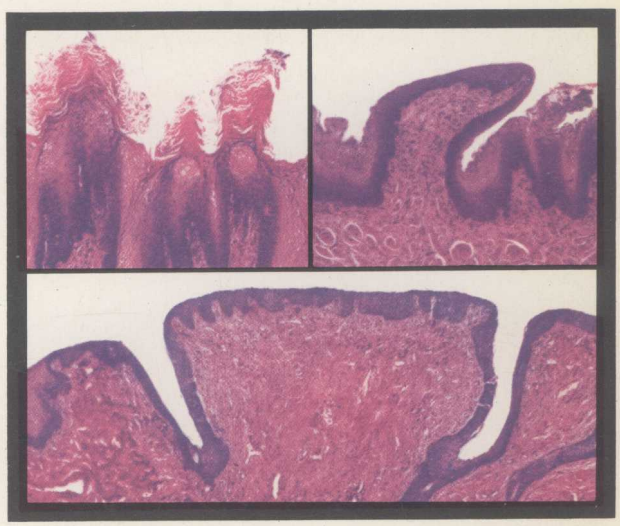
(Center) Voluntary (skeletal) muscle fibers are extremely large, multinucleated cells composed of numerous myofibrils. The identifying features of skeletal muscle—cross striations and peripherally placed nuclei—are apparent in the photomicrograph of two longitudinally cut fibers. In cross section the fibers appear as eosinophilic islands, some of which have rounded nuclei situated just under the cell membrane.

(Bottom) There are three types of lingual papillae—filiform, fungiform and circumvallate. The filiform papillae (upper left) are small, conical epithelial projections covered by laminated keratin. The degree of keratinization of these papillae, which are the most numerous of the three types, is reflected in the amount of tongue coating. The fungiform papillae (upper right) are scattered among the filiform type but are found most frequently on the sides and apex of the tongue. They consist of toadstool-like projections of connective tissue covered by a rather thin layer of epithelium. These papillae appear clinically as small red nodules because the thin covering epithelium does not mask the color of the underlying vascular connective tissue. The circumvallate papillae (lower), 8 to 12 in number, are arranged in the form of a V at the posterior part of the tongue, the apex of the V being at foramen cecum. Each of these papillae, which protrude only slightly above the normal mucosal level, is surrounded by a deep groove. Taste buds are found in the epithelium on both sides of this groove. In some individuals, rudimentary foliate papillae appear as parallel folds of mucosa on the lateral margins of the posterior part of the tongue. Nodules of lymphoid tissue may also be found in these same areas.

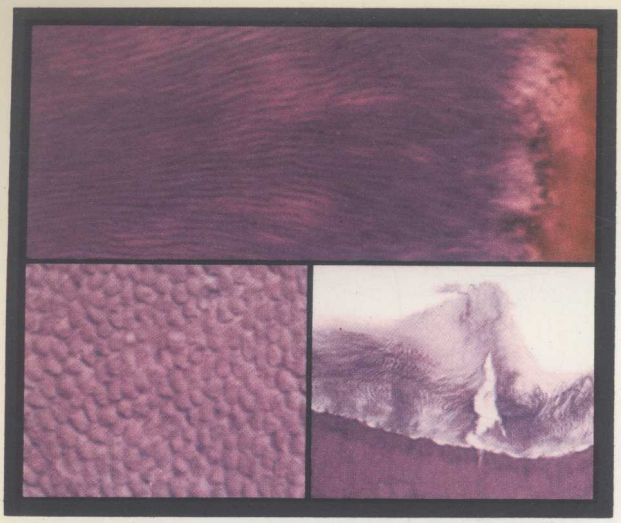


Tongue, Sagittal Section, Newborn Infant X 11

Voluntary Muscle X 1080



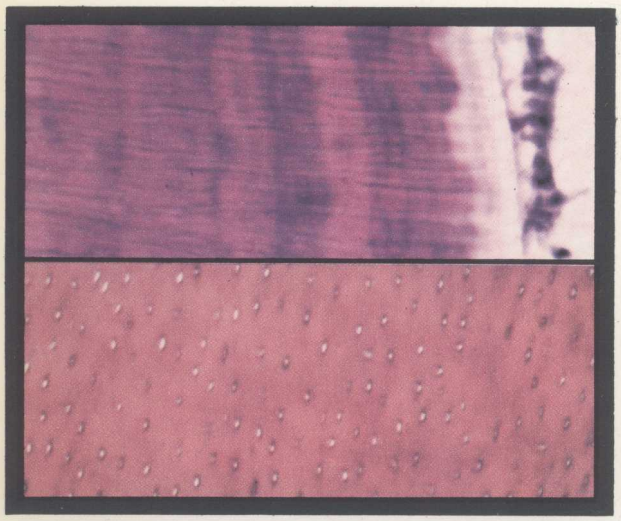
Lingual Papillae Upper X 35, Lower X 28



Enamel — Upper X 427, Lower Left X 513, Lower Right X 100

ENAMEL

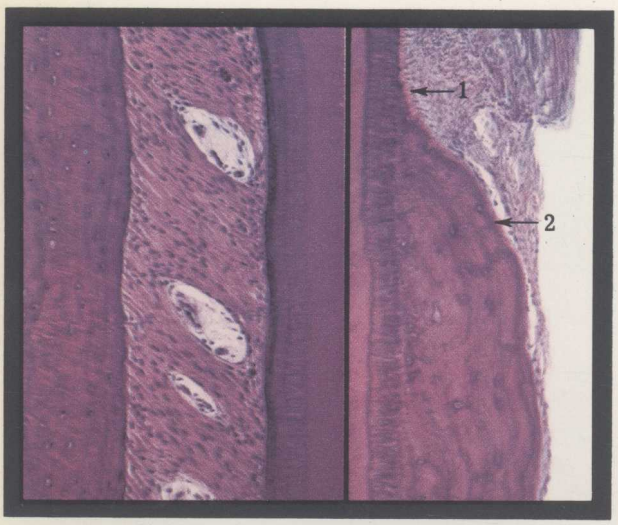
(Top) Newly formed enamel matrix is demonstrated in the upper photomicrograph. A small area of dentin is seen at the right. Despite decalcification of this specimen, the enamel is well preserved because at this stage of development it does not contain much inorganic material. In the ground cross section of mature enamel (lower left) the ends of the enamel rods, as well as the interrod substance, may be seen. The appearance of rods cut in this plane has been likened to fish scales. In the lower right photomicrograph is a decalcified section of an erupted tooth. The dentin is at the lower border, and above this is a remnant of the acid-insoluble organic enamel matrix.



Dentin — Upper X 550, Lower X 490

DENTIN

(Center) In the upper half of the illustration, a row of odontoblasts is seen at the right. To the left of this region is a band of pale-staining predentin, and further to the left is calcified dentin. The light streaks that extend from the odontoblasts through the predentin and dentin are tubules which contain the dentinal (Tomes') fibers. The lower photomicrograph illustrates the dentinal tubules cut in cross section.



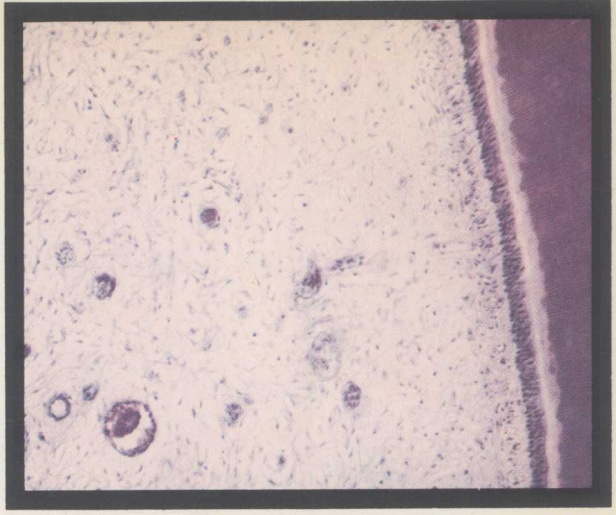
Periodontal Membrane X 100 Cementum X 100

PERIODONTAL MEMBRANE AND CEMENTUM

(Bottom) In the center of the left photomicrograph are oblique fibers of the periodontal membrane which are attached to alveolar bone (left) and cementum (right). The oval light-staining areas, between the bundles of principal fibers, are composed of very loose connective tissue in which are nerves, blood vessels and lymphatics. The right photomicrograph demonstrates acellular cementum (1) and cellular cementum (2). The first cementum deposited against the dentin is usually of the acellular variety. There is a slow but continuous formation of cementum throughout the life of the tooth which compensates for tooth movement and allows new fibers of the periodontal membrane to be embedded in the surface of the root.

PULP

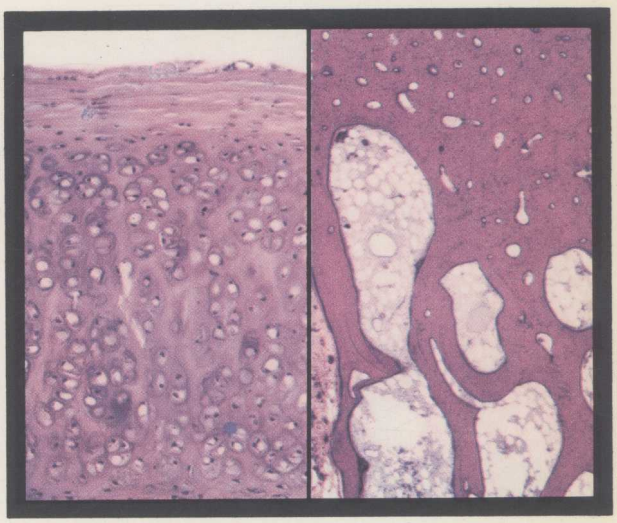
(Top) Cross section of the coronal pulp of a third molar from a 21-year-old patient. The pulp consists of delicate, loose connective tissue in which there are numerous blood vessels, lymph vessels and nerves. Odontoblasts constitute the outermost portion of the pulp. In young pulp the fibroblasts, which are somewhat star shaped, are quite numerous, but with age the pulp becomes less cellular and more fibrous.



Pulp X 100

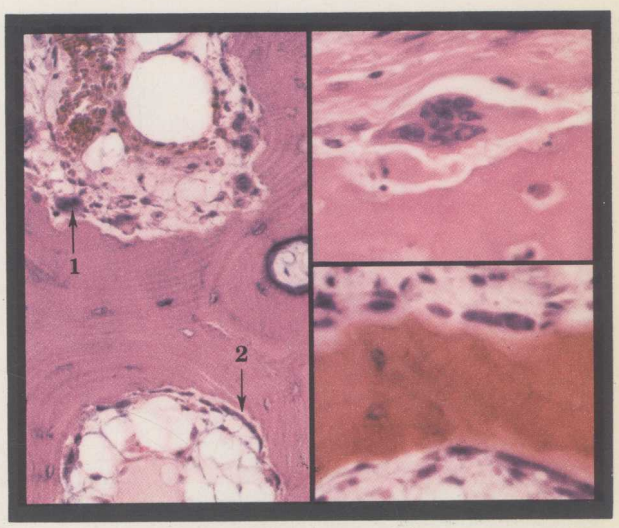
CARTILAGE AND BONE

(Center) Hyaline cartilage (left photomicrograph) is identified easily by its lavender-staining homogeneous matrix. In the matrix are spaces which contain one to four large cells with prominent centrally placed nuclei. In the upper portion of the illustration is a dense layer of fibrous connective tissue, the perichondrium, from which appositional growth takes place. The right photomicrograph is a low-power view to demonstrate compact bone (above) and trabecular bone (below). The relatively clear spaces enclosed by the trabecular bone are composed mainly of yellow or fatty marrow. Trabecular (spongy or cancellous) bone may be changed to the compact type by the deposition of layers of new bone on the sides of the trabeculae, so that finally the marrow spaces are reduced to small channels that contain only blood vessels. Bone is not a static substance, for its architecture is constantly changing (remodeling) in accordance with functional needs.



Cartilage X 100 Bone X 20

(Bottom) Osteoclasts are present at (1) and osteoblasts at (2) in the left photomicrograph. The osteoclasts (high power, upper right) are large multinucleated cells which are associated with bone resorption. Usually they are seen in small harborlike spaces (Howship's lacunae). Osteoblasts (high power, lower right) are spindle-shaped mesenchymal cells which secrete, or promote formation of, the organic intercellular substance of bone. Many of the osteoblasts become surrounded by this intercellular substance and remain in the bone as osteocytes. The vitality of bone is determined histologically by the presence of osteocytes.



X 190 Osteoclasts and Osteoblasts Upper X 456, Lower X 380