A Manual of

OTOLOGY, RHINOLOGY AND LARYNGOLOGY

BY

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Fourth Edition, Enlarged and Thoroughly Revised, With 136 Illustrations and 3 Color Plates

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PART IV. The Ear

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PREFACE TO THE FOURTH EDITION

In this fourth edition, many changes have been made and the opportunity has been taken to rewrite entirely the sections on Physiology of the Nose, the Eustachian Tube, Hearing, and the Vestibular Labyrinth. The physiology of these structures is an important factor in the proper understanding of the diagnosis and treatment of the various lesions of the nose, throat and ear. Other important sections which have been added or largely rewritten are Allergy and its various manifestations, Malignant Neoplasms of the Larynx and their treatment, and Ménière's Disease and its allied syndromes. The newer concepts of many pathologic conditions such as Bell's Palsy, Acoustic Trauma and the Indications for Tracheotomy including the Treatment of Secretional Obstruction of the Airway have been added or rewritten. In brief, the entire text has been subjected to a most careful and critical review and brought up to date in all respects. Many new illustrations have been added or redrawn and some less satisfactory ones have been deleted.

The original concept and intent of the book as prepared for undergraduate teaching of medical students, for nurses, general physicians and as a ready reference for otolaryngologists has been adhered to, namely the presentation of the more common pathologic conditions of the nose, throat and ear under the various related clinical entities rather than from a symptomatic approach. The latter may have some value for graduate students of otolaryngology, but the authors believe the undergraduates and the non-otolaryngologists will obtain a better understanding of this branch of medicine as presented.

Winnetka, Illinois

H. C. B.
J. J. B.

PREFACE TO THE FIRST EDITION

THE author, after some years' experience in teaching otolaryngology to undergraduate medical students, has felt the need for a small, concise text-book on diseases of the nose, throat and ear which would emphasize anatomy, etiology, symptoms and diagnosis; and would include only the usually accepted general and local treatments. Due to the very limited number of hours allotted to these subjects in the various undergraduate medical schools he has been convinced that unnecessary theories, questionable treatment and surgical technic should be curtailed or omitted entirely.

With these ideas in view the present work has been prepared based somewhat upon the larger and more comprehensive work of Ballenger's *Diseases of the Nose, Throat and Ear*. Portions of the text contributed by the author (H. C. B.) have been used, as well as many of the illustrations and plates. Some new illustrations and a colored plate pertaining to anatomy and pathology have been added.

While the text has been prepared primarily for the undergraduate medical student, it is the hope of the author that the general physician, nurse and occasionally the otolaryngologist will find the book convenient for reference.

The author is indebted to Dr. John J. Ballenger for his painstaking work in reading proof and for his many valuable suggestions.

H. C. B.

WINNETKA, ILLINOIS

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PART IV. THE EAR

Otology, Rhinology and Laryngology

PART I. The Nose and Accessory Sinuses

Chapter

1

THE CLINICAL ANATOMY OF THE NOSE AND ACCESSORY SINUSES

THE ANATOMY OF THE NOSE

The External Nose.—The more or less pointed tip of the nose is known as the apex. Extending superiorly and somewhat posteriorly is the dorsum, leading to the root of the nose where the dorsum merges with the forehead. The columella extends from the tip or apex of the nose posteriorly and inferiorly to the lip. The point where the lip is reached is known as the base. On either side of the columella are the right and left anterior nares bounded laterally by the alae of the nose and inferiorly by the floor.

The supporting framework of the external nose consists of the two nasal bones, the frontal process of the maxillary bones (processus frontalis maxillæ), the upper lateral cartilage, the paired lower lateral (greater alar) cartilages and the anterior (ventral) edge of the cartilaginous nasal septum (Fig. 1). The support of the nose is probably affected primarily by the first four named structures. The upper lateral cartilages at their medial ends blend with the cartilaginous septum and at their craniad ends are firmly attached to the under surface of the nasal bones and frontal processes.

The lower or caudal margins of the upper lateral cartilages lie under the upper or craniad margin of the lower lateral cartilages. On elevating the lower lateral cartilage with a retractor this margin, the limen nasi, of the upper lateral cartilage is visible. At times the opposing margins of the upper and lower lateral cartilages may not be closely adjacent at their medial extremities. In such a case, the

support of the external nose is potentially less secure at this point. Between the upper and lower lateral cartilages laterally are found the one or more sesamoid cartilages. The lower lateral cartilage has a horseshoe shape. The lateral crux of this is broad and strong and provides the framework of the ala of the nose. The medial portion

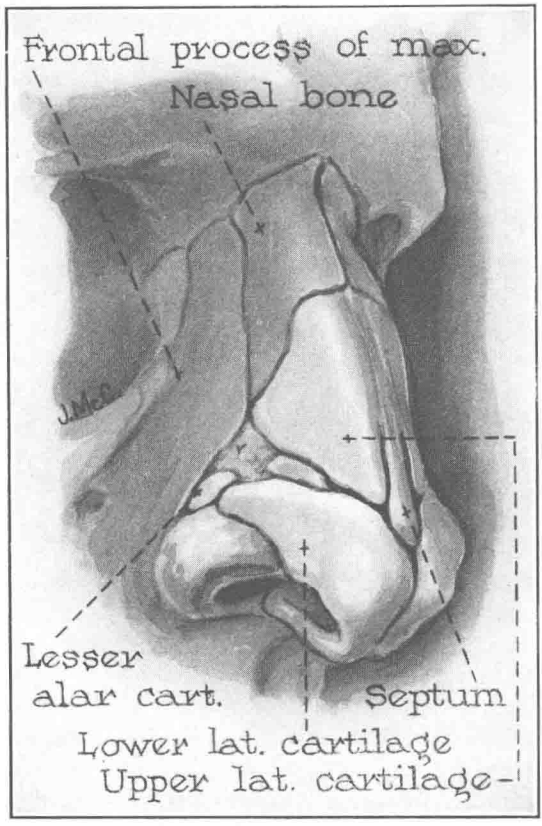

FIG. 1.—The supporting framework of the nose.

is weak and extends along the free, caudal edge of the cartilaginous septum.

In the bony skull the pear-shaped nasal opening is called the pyriform aperature. The superior lateral margins are formed by the nasal bones and frontal processes of the maxillæ. The base is formed by the alveolar process of the maxilla. In the midline of this last structure is a prominence called the anterior nasal spine. Dividing the aperture

into two parts is the anterior edge of the perpendicular plate of the ethmoid bone.

The alar muscles consist of two sets, the dilators comprising the dilatores naris (anterior and posterior), the m. procerus, and the caput angulare of the quadratus labia superioris muscle; and the constrictors comprising the m. nasalis, the depressor septi, and the depressor alæ nasi.

The Nasal Septum.—The septum divides the nose into two cavities or chambers, the right and the left. The septum is formed superiorly by the perpendicular plate of the ethmoid, anteriorly by the septal (quadrilateral) cartilage and the membranous columella, and inferiorly and posteriorly by the vomer, the maxillary crest, the palatine crest, and the sphenoidal crest.

The Nasal Chambers.—The Floor.—The floor of the nose is formed by the palatal process of the maxilla and the horizontal process of the palate bones.

The Roof.—The roof from before backward is composed of the nasal bone, the nasal process of the frontal, the body of the ethmoid, and the body of the sphenoid. The **lamina cribrosa** or the **cribriform** plate of the ethmoid which forms the major portion of the roof of the nose transmits the filaments of the olfactory nerve as it descends from the undersurface of the olfactory bulb to its distribution in the mucous membrane covering the upper portion of the superior turbinate and a corresponding portion of the septum.

The External Wall.—The lateral nasal wall of the nose is formed by the frontal process and inner surface of the maxilla, the lacrimal, the superior and middle nasal turbinates of the ethmoid, the inferior nasal turbinate, the perpendicular plate of the palate bone, and the medial pterygoid plate.

The Turbinates (Conchæ).—The nasal fossa is divided into three meati by the three turbinates. The space situated between the inferior turbinate and the floor is called the inferior meatus, the space between the middle turbinate and the inferior turbinate is known as the middle meatus and above the middle turbinate is the superior meatus. The superior turbinate is frequently rudimentary or absent. Occasionally a fourth turbinate (supreme turbinate) is observed above the superior turbinate. The supreme, superior and middle turbinates originate from the lateral mass of the ethmoid. The inferior turbinate is a separate bone and is attached to the superior maxilla and to the palate bones.

The inferior turbinates are two elongated shell-like laminæ of bone, attached by their superior borders to the lateral wall of the nasal cavity on either side. They have curved borders separating a medial

and a lateral surface. The inferior, or free portion, is curved from before backwards and from above downward with the convex surface facing the septum. The bone which forms the turbinate is deeply pitted and of somewhat cellular character which gives a slightly rough and uneven appearance. The anterior and posterior extremities are somewhat pointed. The surface of the bony turbinates is perforated in numerous places by apertures through which the blood supply is transmitted. Longitudinal grooves or partial canals also help distribute the large blood supply. The mucous membrane is thick, very vascular, and adherent to the underlying perichondrium or periosteum.

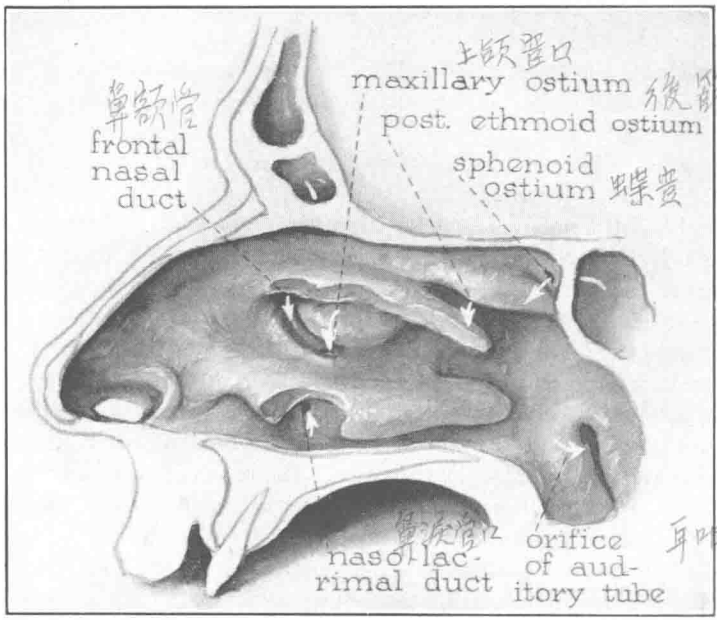

FIG. 2.—Sagittal section through the nose. Portions of the middle and inferior turbinates have been removed to show various structures.

Both the middle and the inferior turbinates are covered with pseudo-stratified ciliated columnar epithelium but the anterior tip of either the middle or the inferior turbinates in the adult may be replaced by low cuboidal or squamous-cell epithelium. The stroma of the middle turbinate is characterized by the presence of many glands whereas that of the inferior turbinate is characterized by many blood lakes. Glands, too, are found in the inferior concha but not to the extent of the middle. These blood lakes or venous plexuses constitute the erectile tissue of the nose and are distributed chiefly along the inferior

border of the inferior turbinate and the posterior ends of both the middle and inferior turbinates.

The Superior Meatus.—The superior meatus or ethmoidal fissure is a narrow slit-like space situated between the septum and the lateral mass of the ethmoid. The posterior group of ethmoid cells drain by one or more orifices of variable size into the central portion of the meatus. Above and behind the superior turbinate and in front of the

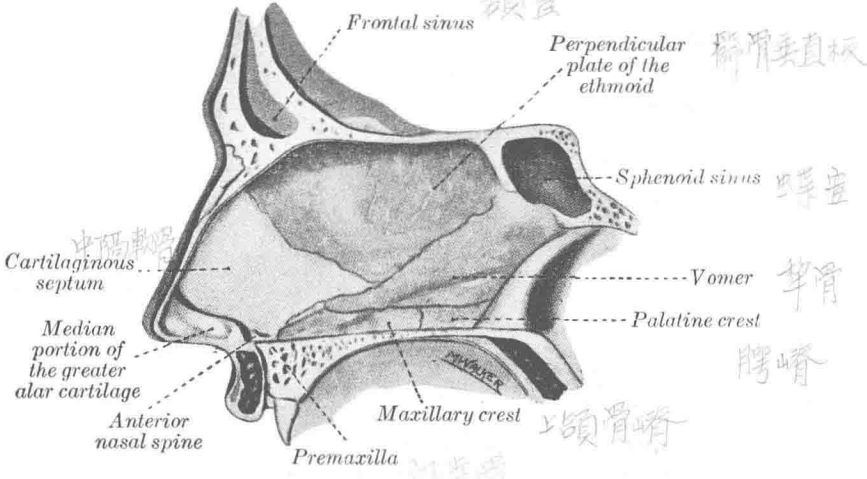

FIG. 3.—The nasal septum denuded of its membrane.

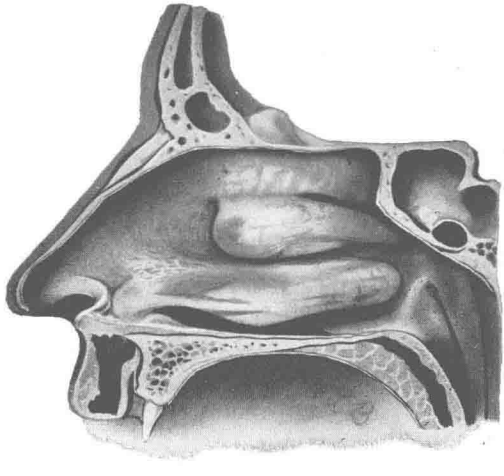

FIG. 4.—The middle and inferior turbinates. The superior turbinate, which may be absent or rudimentary is not shown.

body of the sphenoid is the **spheno-ethmoid recess,** into which opens the sphenoid sinus.

The Middle Meatus.—The middle meatus, a much more roomy space than the superior meatus, contains the orifices of the frontal and maxillary sinuses and of the anterior group of ethmoid cells. Hidden by the anterior half of the overhanging middle turbinate and situated on the external wall is a deep crescentic groove (Fig. 17), the **infundibulum.** The crescentic opening or fissure leading from the middle meatus into the infundibulum is called the **hiatus semilunaris.** The inferior and median wall of the infundibulum forms a shelf-like ledge known as the **uncinate process.** Above the infundibulum is a hemispherical prominence, the **bulba ethmoidalis.**

The orifices of the frontal sinus, maxillary antrum and anterior ethmoid cells usually drain into the infundibulum. The frontal sinus and anterior ethmoid cells usually drain into the anterior upper portion, and the maxillary sinus drains posterior[y to the frontal sinus. However, certain ethmoid cells may have openings located above the bulla ethmoidalis, and the fronto-nasal duct sometimes has an independent orifice anterior to the infundibulum.

The Inferior Meatus.—The inferior meatus, the largest of the three, contains the orifice of the nasal-lacrimal duct located on the lateral wall from 3 to 3.5 cm. behind the posterior margin of the nostril.

The **posterior nares** or **choanæ** through which the nasal fossæ and the nasopharynx communicate are oval-shaped apertures located one on each side of the nasal septum. Each opening is formed inferiorly by the horizontal plate of the palate bone, internally by the vomer, superiorly by the vaginal process of the sphenoid and the ala of the vomer, and externally by the medial pterygoid plate of the sphenoid.

The **anterior nares** provide communication of the nasal cavity with the outside. They are considerably smaller than the posterior nares or choanœ, the latter being about 2.5 cm. in height and 1.25 cm. in width.

THE NASAL ACCESSORY SINUSES

The nasal sinuses are eight in number, four on each side of the nose: the right and left frontal sinuses, the right and left ethmoids (anterior and posterior), the right and left maxillary sinuses (antra of Highmore), and the right and left sphenoid sinuses. The sinuses are lined with the nasal mucous membrane, all are filled with air and all communicate with the nasal fossa through their various ostia.

The sinuses are divided for clinical purposes into two groups, namely, the anterior and the posterior sinuses. The anterior group is composed of the frontal, the anterior ethmoid, and the maxillary sinuses.