phosis of red corpuscles. The grounds at Napa Soda Springs cover over a thousand acres of hill and valley. The place is thoroughly improved, and the visitor will find every arrangement provided for his comfort and recreation while sojouring there. Among the attractive features should be mentioned the excellent bathing facilities, both tub and plunge. There is also a swimming bath measuring one hundred and fifty feet in length by fifty feet in width, and with a depth of water varying from four to ten feet. *James K. Crook.*

NAPHTALIN.—Under the title *Naphtalinum*, Naphtalin, the United States Pharmacopœia makes official the hydrocarbon *naphthalene* ($C_{10}H_8$), known also by the common name of "tar camphor." Naphtalin (to use the pharmacopœial spelling), like benzene, is the fundamental member of a series of aromatic compounds. Naphtalin is a common constituent of tars, and is obtained from coal-tar by fractional distillation. Naphtalin, when purified, presents itself in large, colorless, crystalline, rhombic plates of a pearly lustre and an unctuous feel. It has a burning taste and a faint peculiar odor. It is insoluble in water, but dissolves in alcohol, ether, benzene, oil of turpentine, glacial acetic acid, and warm oils, both fixed and volatile. It melts at 80° C. (176° F.) and boils at 218° C. (424.4° F.), but yet sublimes at a much lower temperature than that of its boiling-point, and, mixed with boiling water, rises in vapor with the steam. Even at ordinary temperatures a gradual sublimation occurs. It should be kept in well-stoppered bottles.

Naphtalin is, locally, but slightly irritant, and constitutionally is not ordinarily poisonous—probably because of incomplete absorption due to its insolubility in aqueous fluids. Yet naphtalin is decidedly "antiseptic" in the common medical sense of the word. Taken internally, some absorption certainly occurs, since naphtalin, swallowed, reappears in the urine. Naphtalin has been used in medicine to prevent decomposition of the urine in cystitis, by administration, by the mouth, of an aggregate of five grains daily; but its main use internally has been for local antiseptic purposes in the intestinal canal, as in diarrhœa and dysentery, and as a vermifuge. It has been vaunted also as an expectorant in bronchitis and as a constitutional remedy in typhoid fever. The ordinary dose ranges from 0.13 to 1 gm. (gr. ij. to xv.), and, because of the disagreeable taste, the medicine is best given in capsule. A case of poisoning—an exceptional circumstance—has been reported from the taking of a dose of eight grains; and it is certainly risky to give much of the drug if there be any kidney disease or weakness. As an anthelmintic for the "seat-worm," naphtalin may be given by enema, in sweet oil (1 gm. in two or three tablespoonfuls of the oil). For ordinary internal uses naphtalin has been largely supplanted by naphtol.

Externally, naphtalin has been used for the making of antiseptic dressings in surgery. In this application naphtalin combines the features of a fair degree of efficiency on the one hand, and freedom from irritant or poisonous effects, and from offensive smell, on the other. The only untoward effects charged against naphtalin so far have been that the sharp points of the crystals may wound tender granulations, and that the powder may cake with fluid exudates, and so tend to obstruct the free drainage of discharges. Most reporters upon the use of naphtalin in surgery, however, have failed to observe either of these effects. Naphtalin may be applied in bulk, in fine powder, to wound surfaces, or by means of gauze or wool charged with the substance, by the device of steeping the dressing in a strong solution of naphtalin, and then permitting the solvent to evaporate. By this means a porous material becomes thoroughly impregnated with a fine powder of the hydrocarbon. A common solution for the making of such dressings is a twelve-and-a-half-per-cent. solution of naphtalin in a mixture of alcohol and ether in equal proportion. [See also Naphtalin in the article on *Antiseptics in Surgery.*] *Edward Curtis.*

NAPHTO-CRESOL is an alcohol-soluble substitue for creolin. *W. A. Bastedo.*

NAPHTOFORMIN is a condensation product of alpha- and beta-naphtol with formaldehyde and ammonia. It is an insoluble powder, and, being readily split into its components, is a powerful antiseptic for use in surgery. *W. A. Bastedo.*

NAPHTOL.—By the substitution, in the molecule of the hydrocarbon *naphthalene*, of a molecule of hydroxyl (—OH) for one of the atoms of hydrogen, a derivate, $C_{10}H_7.OH$, is obtained, bearing precisely the same relation to naphtalin that common phenol ("carbolic acid") does to benzene. Such derivate is styled *naphthol*, and according to the position in the naphtol molecule of the hydroxyl substitution, two distinct naphtols are obtainable, known respectively as *α-naphthol* and *β-naphthol*. Of these two bodies *β-naphthol* is the more easily made, and is the article used in medicine. It is official in the United States Pharmacopœia under the title and spelling *Naphtol*, Naphtol.

The common naphtol of the markets is an impure article, occurring in reddish or deep violet-brown crystalline masses of a disagreeable, pungent smell. Such a naphtol, because of the poisonous nature of some of the impurities, needs purification for medicinal use. Properly purified, naphtol presents itself in beautiful silver crystalline scales, nearly or entirely odorless, but of a sharp, burning taste. The crystals are very slightly soluble in water (in about one thousand parts of cold, and in seventy-five parts of boiling water), but dissolve freely in alcohol, ether, chloroform, benzol, and oils. Gently heated, naphtol sublimes, and may be distilled with steam. It should be kept in dark amber-colored bottles, well stoppered. Naphtol is locally distinctly irritant, exciting upon tender surfaces redness, smarting, and even inflammation, and, upon the healthy skin also, if in *alcoholic* solution, acting occasionally with sufficient energy to develop an eruption resembling nettle-rash. Solutions in oils or fats, however, are said to be without effect upon the sound skin, although acting energetically upon an eczematous surface (Kaposi). *Constitutionally*, naphtol, in therapeutic doses, produces but little derangement. Some experimental dosings of animals have been followed by hæmoglobinuria, with convulsions and death, and, in one instance in the human subject, an external application of naphtol produced hæmaturia, ischuria, unconsciousness, and eclampsia (Kaposi). But since these effects are exceptional, it is likely that the samples used in the cases cited were not pure. Ordinarily doses of from 0.20 to 0.32 gm. (gr. iij. to v.), given a number of times daily, are innocent of harm beyond some possible disturbance of the stomach. The medicine therefore ranks among the non-poisonous, and its value lies in the fact that while it is thus non-poisonous to the human system it is yet quite potent to arrest the development of many micro-organisms. It is said to be five times as powerful in this regard as carbolic acid. Naphtol is accordingly used as an internal medicine to disinfect the alimentary canal, as in cases of diarrhœa, dysentery, intestinal dyspepsia, and especially in typhoid fever, in which disease its efficacy was first proclaimed by Bouchard. The doses are those already mentioned. The article is also used as a local application in many skin diseases, notably *scabies*, *psoriasis*, and *eczema*. It is commonly applied in ointment ranging in strength of naphtol from one-half to ten per cent., or even fifteen per cent. The remedy should not be used upon denuded parts, and weak applications only should be made to irritated parts such as so commonly present themselves in eczema.

For *iodonaphtol*, see under the caption *Di-iodo-beta-naphtol*, in Vol. III. *Edward Curtis.*

NAPHTOL ARISTOL. See *Di-iodo-naphtalin.*

NAPHTOL BENZOATE is benzonaphtol (*q.v.*).

NAPHTOL BISMUTH, orphol, basic beta-naphtol bismuth $[(C_{10}H_7O)_3\,Bi]_2 + Bi_2O_3$ or $(C_{10}H_7O)_3\,Bi + 3H_2O$, is a neutral, non-irritating, light-brown powder of very slight odor and slightly aromatic taste. In the intestines and to some extent in the stomach orphol is split up into its components, bismuth oxide and beta-naphtol, and so acts as an intestinal sedative and antiseptic in diarrhœa, dysentery, and intestinal putrefaction. The dose is 0.5 to 1 gm. (gr. viij. to xv.), usually given in capsule. Chaumier gave 5 gm. (gr. lxxv.) a day to young children without ill effects. In such large doses probably most of the drug passes through unchanged. Orphol is also applied externally as an antiseptic dusting and drying powder for impetigo, herpes, etc., and has been used locally in gonorrhœa and other mucous-membrane inflammations. *W. A. Bastedo.*

NAPHTOL CARBONATE, $(C_{10}H_7O)_2CO$, is a di-naphthyl ester of carbonic acid prepared by acting on beta-naphtol sodium with phosgene gas. It occurs as shining colorless scales which are insoluble in water. Recommended as a non-irritating intestinal antiseptic in dose of 0.12 to 1 gm. (gr. ij. to xv.). *W. A. Bastedo.*

NARCEINE. See *Opium.*

NARCOTINE ($C_{22}H_{23}NO_7$).—Narcotine is, next to morphine, the most abundant alkaloid of opium, varying widely in percentage, both in different varieties and in different lots of the same variety. The amount has been reported as low as one per cent. and as high as ten per cent. It occurs in colorless, shining, acicular or prismatic crystals, melting at 176° C. (349° F.), almost insoluble in water, soluble in 100 parts of alcohol, 35 parts of ether, 2.7 parts of chloroform, 22 parts of benzene, and rather freely in hot acetic acid, by which it is usually extracted. It is only faintly basic and its salts are not crystalline. It is not bitter, but its salts are so, and are at the same time acid. Sulphuric acid turns it, after a time, to a yellow, changing to orange and red; the same, mixed with nitric acid, turns it blood-red. It is decomposable into meconin and *cotarnine* ($C_{12}H_{13}NO_3$), the latter far more strongly basic than narcotine itself. Various other substances are obtained from it by different methods of treatment, but they are not of importance except from a chemical standpoint.

Crawford and Dohme (Proc. Amer. Phar. Assn., 1902) report experiments on warm-blooded animals, showing that it produces a fall in blood pressure and slowing of the heart, accelerated but weakened respiration, diminished saliva by small doses, increased by large doses, an anodyne effect upon the intestine, prompt and marked diminution of the urine, and a diminished size of the kidney. Partial elimination through the kidneys and stomach was observed, but none from the bowels, at least not as narcotine. Similar symptoms have been observed in man, together with profuse diaphoresis. The alkaloid, if pure, is in no sense a narcotic, for which reason the name "anarcotine" has been proposed for it, though it does not seem wise to introduce this element of confusion.

Therapeutically, narcotine is an antiperiodic, recognized as of considerable value in five-grain doses. Fortunately, since it is used in such large doses, its weakly basic character renders it easily freed from the associated active alkaloids, a character to which careful attention should of course be given. It is a valuable stomachic and digestive tonic in one- or two-grain doses three times daily.

Narcotine has been considerably employed as a secret remedy for the cure of the alcohol and other narcotic habits. Ebert reports many such cases cured or benefited through its use, and his results are confirmed by Schulte. The form of administration in these cases was a grain hourly. No harm resulted from the use of a gram or more per day, beyond the temporary loss of the appetite for food, followed later by an increase of appetite, and by weakening, amounting in some cases to semi-prostration, from the profuse perspiration. *Henry H. Rusby.*

NASAL CAVITIES: ANATOMICAL RELATIONS AND RHINOSCOPY.—I. Anatomy.—The nose forms the commencement of the air tract, and is composed of two large air channels in the centre of the face. The lower portion of this tract is used to convey air; the upper portion has distributed throughout its mucous membrane the terminal filaments of the olfactory nerve; while the whole cavity is employed in voice production.

The nose is divided into the external nose and the nasal cavities. The nasal cavities are separated from one another by a thin partition of bone and cartilage, called the septum. Each nasal cavity is surrounded by a set of accessory cavities, all of which communicate with the nasal cavity. In considering the anatomy of the nose, we find that three divisions may readily be made: (1) The external nose; (2) the nasal cavities; (3) the accessory cavities of the nose.

1. *The External Nose.*—The external nose forms the pyramidal projection in the centre of the face, extending from the brow to the upper lip. It is directed downward and forward. It is composed of bone, cartilage, and muscles which are covered externally with the facial epidermis and internally with the nasal mucous membrane.

The apex of the pyramid—the root of the nose, the radix nasi—joins the forehead; the lateral walls form by their junction the dorsum nasi, or back of the nose, which extends from the tip, the apex nasi, to the root of the nose; the lateral borders slope outward to form two wing-like leaflets, which are known as the alæ nasi or wings of the nose; the free edges of the alæ nasi form the outer borders of the two nasal orifices, known as the anterior nares, which are separated by a median pillar, or columna, the ponticulus nasi. The two anterior nasal orifices open downward and communicate with the vestibule of the nose, which is composed of that portion of the nose which is contained within the cartilaginous framework and extends from the anterior nasal orifice to the commencement of the osseous framework.

The walls of the nose proper are composed of the nasal bones and nasal spine of the frontal bone, the nasal processes of the superior maxilla, the premaxillary portion of the upper maxilla, the pars incisiva, and the lateral cartilages of the nose. The nasal bone articulates above with the frontal bone; its outer border articulates with the nasal process of the maxilla; while along their inner border, by their union, the nasal bones form a crest for articulation with the nasal spine of the frontal bone, the perpendicular plate of the ethmoid and the triangular cartilage of the nose. The outer surface of this bone is smooth; its inner surface presents a longitudinal groove for the nasal nerve. Lying external to the nasal bone is the nasal process of the maxilla, which articulates along its anterior border with the nasal bone, above with the frontal, and posteriorly with the lachrymal bone. Its external surface is smooth, while its inner surface presents two crests for the attachment of the middle and inferior turbinate bones. The pars præmaxillaris of the superior maxilla unites with its fellow below to form the lower rounded portion of the apertura pyriformis, the pear-shaped opening of the osseous nasal cavity. To the apertura pyriformis is attached the lateral cartilage of the nose, thus completing the outer portion of the external nose. The cartilages of the nose are the septal cartilage; the triangular, or superior lateral cartilages; the alar, or inferior lateral, cartilages; the accessory, or sesamoid, cartilages; and the accessory quadrate cartilages.

The cartilage of the septum is the most anterior structure of the septum, and is irregularly quadrilateral in form. Its anterior inferior border is unattached, and lies above and behind the inner plates of the two inferior lateral cartilages, extending to the anterior nasal spine, which it embraces. Its anterior superior border is attached to the crest on the under surface of the nasal bone, and below the nasal bones the sides of its border are continuous with the superior lateral cartilages. Its posterior superior border is in contact with the perpendicular plate

of the ethmoid, and the posterior inferior border is received within a groove formed in the anterior nasal spine of the superior maxilla and the vomer for its reception.

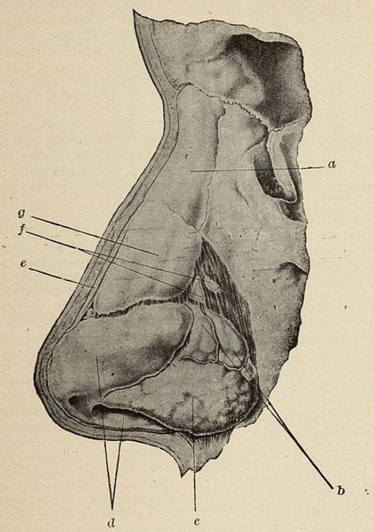

FIG. 3482.—Dissection of the External Nose, Demonstrating the Cartilages and Bones of this Part of the Nose and their Relations to One Another. *a*, Nasal bone; *b*, sesamoid cartilages; *c*, fibrous tissue of ala of nose; *d*, inferior lateral cartilage; *e*, cartilage of nasal septum; *f*, accessory quadrate cartilages; *g*, superior lateral cartilage.

The cartilaginous septum is thinnest in the vestibule of the nose, and increases gradually in thickness as it approaches its attachment to vomer and ethmoid.

The superior lateral cartilage is flat and triangular in shape, partially continuous with the anterior border of the septal cartilage, of which it forms flange-like extensions. It is closely attached along its superior and posterior border to the nasal bone and the nasal process of the superior maxillary bone. Its inferior border is attached to, and partially covered by, the inferior lateral cartilage. The inferior lateral cartilage is bent sharply around in front of the anferior nares so as to form an inner and outer plate. The outer plate lies in the plane of the superior cartilage of the nose, and makes up a part of the outer surface of the nose, while the inner plate lies in contact with the corresponding fellow of the opposite side and forms a portion of the inner border of the anterior nares. The lower lateral cartilages unite over the dorsum, but extend only about half-way back to the maxillæ, so that the intervening space in the alæ nasi not filled with cartilage is made of dense fibrous tissue.

The accessory cartilages are four in number in each lateral wall of the nose. Two of these cartilages are situated in the fibrous tissue which fills in the space between the posterior border of the lower lateral cartilage and the nasal process of the maxilla. Situated immediately above these are two others which are known as the accessory quadrate cartilages. The nose is supplied with certain external muscles which are concerned with the movements of the alæ nasi and with facial expression. These muscles are the pyramidalis nasi, compressor naris, levator labii superioris alæque nasi and depressor alæ nasi. The vessels which supply the external nose are branches of the facial and ophthalmic arteries. The veins empty into the angular vein. The lymphatics empty into the submaxillary lymphatic glands. The muscles of the nose are supplied by branches of the facial, and the general sensation by branches of the first and second divisions of the fifth nerve.

The Nasal Cavities.—The nasal osseous cavities are two large quadrangular-shaped cavities in the centre of the face, and are separated from one another by the septum narium, which extends from the vestibule anteriorly to the choanæ or posterior nasal orifices.

Each nasal cavity has a floor which is almost horizontal; a roof which is horizontal in its middle portion, but inclined downward and forward in its anterior portion, and downward and backward in its posterior portion; an inner wall which is vertically directed; and an outward wall which is directed downward and slightly outward. The inner wall, or septum, is partly cartilaginous and partly osseous. The osseous septum is formed by the crest at the juncture of the nasal bones, the nasal spine of the frontal bone, the perpendicular plate of the ethmoid, the vomer, the crest of the sphenoid bone, and the crest situated at the juncture of the two palatal processes of the superior maxillæ and the two horizontal plates of the palate bones.

The vomer is irregularly quadrilateral in form, its lower border articulating with the nasal crest of the superior maxillæ and the palate bones. Its superior border is attached to the rostrum of the sphenoid bone by two wing-like expansions, or alæ. The posterior border is concave and lies free between the posterior nasal orifices. Its anterior border is the longest, the upper portion of which articulates with the vertical plate of the ethmoid, while to the lower portion is attached the cartilage of the septum. Running downward and forward nearly at its middle is a shallow groove for the naso-palatine nerve. The vertical plate of the ethmoid is pentagonal, and its short anterior border articulates with the nasal spine of the frontal bone and the crest of the nasal

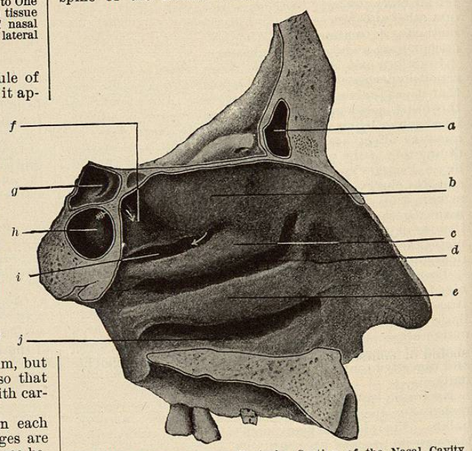

FIG. 3483.—Vertical Antero-Posterior Section of the Nasal Cavity, Demonstrating the Outer Wall of this Cavity. *a*, Frontal sinus; *b*, superior turbinate; *c*, middle turbinate; *d*, middle meatus; *e*, inferior turbinate; *f*, spheno-ethmoidal recess; *g*, right sphenoid sinus; *h*, left sphenoid sinus; *i*, superior meatus; *j*, inferior meatus.

bones. Its superior border is continuous with the cribriform plate of the ethmoid, and its posterior border with

the crest of the sphenoid. The anterior inferior border gives attachment to the cartilage of the septum, and its posterior inferior border articulates with the vomer.

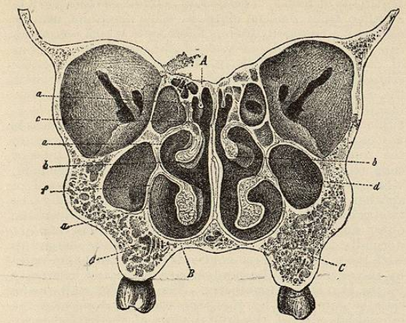

FIG. 3484.—Vertical Transverse Section through the Nasal Fossæ, somewhat Behind their Centre. (Zuckerkandl.) *A*, Roof of nasal cavity; *B*, floor of nasal cavity; *C, C*, alveolar processes; *D*, external wall of nasal cavity; *a, a, a*, three meatuses; *b, b*, middle turbinated bodies; *c*, olfactory slit; *d*, respiratory region.

The septum is covered with mucous membrane, which is continuous with that which lines the whole of the nasal chambers.

The roof of the nasal cavity is divided into naso-frontal, ethmoidal, and sphenoidal parts. The naso-frontal portion is directed downward and backward, and is composed of that portion of the roof which is formed by the nasal bone. The ethmoidal portion is horizontally directed, and is formed by the cribriform plate of the ethmoid. It is lined with two rows of foramina for the passages of the median and lateral branches of the olfactory nerve. The most anterior foramina give passage to the nasal nerve. The sphenoidal portion looks downward and forward, and is formed by the body of the sphenoid bone.

The opening of the sphenoidal sinus is to be seen on the anterior vertical surface of the body of the sphenoid. The floor of the nose is flattened from before backward, concave from side to side, and wider in the middle than at either extremity. It has a slight inclination downward and backward. It is formed in front by the pars incisiva of the superior maxilla and its palatine process, and behind by the palatine process (horizontal plate) of the palate bone. It presents, just behind the nasal spine, the upper orifice of the anterior palatine canal. In the region of the anterior palatine canal, the mucous membrane presents a small diverticulum, which is the rudimentary Jacobson's organ. This organ is more highly developed in some of the lower animals, and is an organ of the sense of smell.

The outer wall is the most complicated and interesting portion of the nasal cavity. It is formed, in front, by the nasal process of the superior maxilla and the lachrymal bone; in the middle, through the lateral mass of the ethmoid, by the body of the superior maxilla and the inferior turbinated bone; and posteriorly by the perpendicular plate of the palate bone and the pterygoid process of the sphenoid. The lateral mass of the ethmoid bone, which forms a portion of the outer wall of the nasal cavity, and contains the ethmoid cells, reaches from the roof of the nasal chamber, where it articulates with the frontal bone, to the level of the floor of the orbit, where it articulates with the orbital portion of the superior maxilla and the palate bone. Anteriorly, it articulates with the lachrymal bone and the nasal process of the superior maxilla; posteriorly, with the rough surface on the side of the body of the sphenoid bone. These various articulating surfaces serve to complete the ethmoid cells, and the participating bones frequently contain accessory cells. From the anterior end of the medial plate of the lateral mass proceeds a curved process known as the processus uncinatus, which serves to complete the orifice of the maxillary sinus and forms the lower boundary of the hiatus semilunaris. This process is a narrow bony plate, which curves downward and backward almost parallel with the lower border of the middle turbinate bone. It articulates with the superior maxillary and inferior turbinate bone, and, through this union, aids in closing the orifice of the maxillary sinus.

Encroaching upon the lumen of the nasal cavity are three scroll-like shells of bone which are known as the turbinate bones. These bones are scroll-like in form, each larger than the other from above downward; their convex surfaces look upward and inward, with a more or less irregular free border. The superior and middle turbinate bones are projections from the lateral mass of the ethmoid; the inferior is an independent bone.

The superior turbinate bone forms a distinct ridge posteriorly, but merges into the middle turbinate anteriorly. The middle turbinate is a broad, thin, bony plate, scroll-like in outline, curling down upon itself, and has at its anterior inferior surface a slight projection which is known as the agger nasi. The inferior turbinate articulates anteriorly with the inferior turbinate crest of the superior maxilla, behind this by the lachrymal process with the lachrymal bone, and posteriorly it articulates with the ethmoid and the lower crest of the palate bone. Through its maxillary process it aids in closing the lower part of the opening to the antrum. The body of the inferior turbinate curls downward and outward. These three bones, through their situation and outline, necessarily divide the nasal chambers into three anterior-posterior incomplete canals, which are designated as the three meatuses of the nasal cavity. The inferior meatus lies between the under surface of the inferior turbinate and the floor of the nose. Slightly in front of

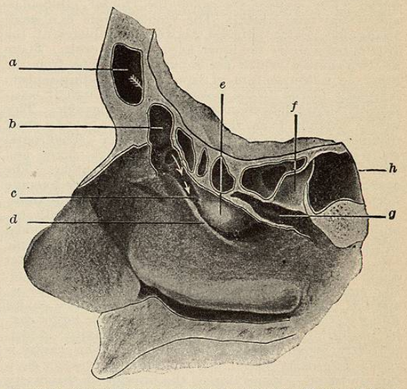

FIG. 3485.—Outer Wall of the Right Nasal Cavity. The superior and middle turbinates have been removed, thus demonstrating the hiatus semilunaris, the bulla ethmoidalis (*e*), the frontal (*a*), the ethmoidal (*b*) and the sphenoidal (*h*) sinuses, the infundibulum (*c*), and the openings of the frontal and anterior ethmoidal cells into the nasal cavity (indicated by white arrow heads). The processus uncinatus is shown at *d*, and the spheno-ethmoidal recess at *f*.

the centre of that portion which is covered by the inferior turbinate bone is the inferior or nasal orifice of the lachrymal canal.

The middle meatus presents many points of great interest to the rhinologist. This meatus lies between the concave under surface of the middle turbinate bone and

the convex upper surface of the inferior turbinate bone; and it extends anteriorly from the vestibule of the nose, into which it opens widely, through the communication which is known as the atrium of the middle meatus, to the anterior fold of the Eustachian tube posteriorly. It is truncated in form with its widest portion directed anteriorly. The outer wall of the middle meatus presents a deep groove, or semilunar sulcus, known as the hiatus semilunaris. This groove extends from the lower border of the infundibulum, at the anterior extremity of the middle turbinate, to just below its centre. The average length of the hiatus is from 15 to 20 mm. The upper boundary of the hiatus semilunaris is created by a bulbous expansion of ethmoid cells, which is designated as the bulla ethmoidalis. This groove is crescentic in shape, and varies from a shallow furrow to almost a complete canal; its direction is from above downward and backward, with its concavity directed upward and backward. At its upper extremity we have the orifice of the frontal sinus, while at its posterior shallow portion is the orifice of the maxillary antrum; slightly irregular in their locations, but usually quite near the orifice of the frontal sinus, we find the openings of the anterior ethmoidal cells. Behind the opening to the antrum we occasionally find a second orifice communicating with the same cavity, known as the ostium maxillare accessorium. The superior meatus is closed in front and opens downward and backward. This meatus presents the orifices of the posterior ethmoidal cells and the sphenoidal sinus. In reality, the orifice of the sphenoidal sinus is near the roof of the nasal fossa, on a level with the superior turbinate bone in the recessus spheno-ethmoidalis, which is the recess formed by the junction of the ethmoid with the body of the sphenoid.

3. *The Accessory Cavities of the Nose.*—Surrounding the nasal chamber are a set of pneumatic cavities which through their location, as well as by their direct communication with the nasal cavity, have an important anatomical as well as pathological relationship to this organ. The sinuses are called the frontal, ethmoidal, sphenoidal, and antral. The frontal sinus is a small triangular cavity situated between the plates of the frontal bone above the inner angle of the orbit. There are two cavities which are separated, the one from the other, by a thin septum of bone. The dividing septum is usually placed in the mesial plane, although it occasionally shows deflections to one or the other side. This cavity extends from the mesial plate outward a short distance beyond the supra-orbital foramina. The frontal sinuses are very irregular as to their size, shape, and uniformity of relationship one with the other. The average vertical measurement is 31.60 mm., the average horizontal measurement 18 mm., and the average transverse measurement 25.8 mm. The shape is usually triangular, but rarely it may be very irregularly pyramidal through its projecting upward inordinately between the two plates of the frontal, or outward toward the outer angle of the orbit. The cavities are usually of uniform size and outline, although marked variation in this respect is found to exist. There may be only one cavity filling in the space occupied by two, or one larger cavity projecting over toward a second small cavity; in fact, perfectly symmetrical cavities are rare. This cavity is rarely irregularly placed, and more rarely accessory cavities are found. Inspection of the interior of the cavity shows rarely imperfect partitions which form recesses, giving the interior an irregular outline. It has an anterior wall formed by the outer plate of the frontal bone, a posterior wall formed by the inner table of this bone, an inner wall formed by the mesially placed septum, and the floor which is formed by the orbital plate of the frontal bone. The fronto-nasal opening, the ostium frontale, lies in relation to the septum of the sinus, and is situated in the lowest part of the floor. This opening terminates in the middle meatus through the naso-frontal canal at the commencement of the hiatus semilunaris. The ethmoidal cells fill in the space between the orbital and lateral walls of the nasal fossa. They vary greatly in shape and size, and are divided into an anterior and a posterior group. These sinuses are composed of a number of small cavities separated from one another by thin partitions of bone. These small cellular cavities vary in number from one to eight in each mass and usually open by a common duct. Those cells which communicate with the middle meatus of the nose, below the line of origin of the middle turbinate bone, are the anterior ethmoidal cells. Those cells which communicate with the superior meatus above the origin of the middle turbinate are the posterior ethmoidal cells. The space occupied by each collection of cells in the lateral mass is not uniformly constant, nor is there any regularity in the number of cells in each collection. The anterior cells may extend far backward, almost to the sphenoid, while the posterior group may extend as far forward in another specimen. The plate of bone separating the two groups of cells is placed diagonally between the outer and inner walls of the lateral mass, and does not normally present any communication of the one group with the other. The ethmoid cells are bounded externally by the os planum, the lamina papyracea, and internally by the two ethmo-turbinates. The superior wall of the cells is completed by the depressions or foveæ on the ethmoidal edge of the orbital plate of the frontal bone. Inferiorly they are completed by the ethmoidal edge of the orbital plate of the superior maxilla. Anteriorly they are closed in by the nasal process of the superior maxilla and the lachrymal bone. Posteriorly they articulate with the sphenoidal spongy bone.

The maxillary sinus, or antrum of Highmore, is a pyramidal-shaped cavity situated wholly within the body of the superior maxilla. Its roof is a thin plate of bone which also forms the floor of the orbital cavity. The infra-orbital canal, which serves to convey the superior maxillary nerve and infra-orbital vessels in their passage to the face, lies in the roof of the cavity. The floor of the sinus is formed by the alveolar border of the superior maxilla. This wall bears an important relation to the teeth. The converging of the facial and nasal walls at their angle of junction is frequently so acute as to leave a mere groove to form the floor, which is then called the sulcus alveolaris. The floor of the antrum is usually on a level with the floor of the nasal cavity. The layer of spongy bone between the floor of the antrum and the root of the teeth varies greatly. Occasionally this layer is so thin that a mere shell of bone separates the teeth from the antral cavity. Ofttimes slight elevations are seen in the floor corresponding to the fangs of the teeth. When of average dimensions, the floor has in relation to it the second bicuspid and the three molar teeth. The posterior wall is the thin plate of bone which forms the anterior boundary of the zygomatic fossa. The inner or nasal wall of the antrum, as it forms the outer wall of the nasal chamber, is the most interesting aspect of this sinus. That portion of the inner wall which is situated below the inferior turbinate bone is continuously osseous, thinnest immediately below the attachment of the turbinate bone, and forms the outer boundary of the inferior meatus of the nose. In the thin portion of this wall, immediately below the attachment of the inferior turbinate, is the point of selection for exploratory puncture. That portion of this wall which is situated above the inferior turbinate is partly osseous and partly membranous. The aperture, the ostium maxillare, by which this cavity communicates with the middle meatus, is situated here. As the ostium maxillare lies just beneath the level of the roof of the antral cavity, it permits of only imperfect drainage. Sometimes an additional opening exists in the membranous portion of the nasal wall, designated as the ostium maxillare accessorium. This accessory opening is said to exist in about ten per cent. of cases. The accessory opening communicates with the middle meatus at a plane lower than and posterior to that of the ostium maxillare, and this accounts for the occasional draining away of fluids from the antrum posteriorly into the pharynx. The anterior or facial wall is thin; at its upper

margin is the infra-orbital foramen. In front this surface is marked by the canine ridge, which corresponds to the socket of the canine tooth. The facial wall is limited externally by the malar ridge. Between these two prominent ridges, the canine and malar, is a depression, the canine fossa. The canine fossa varies greatly in depth. It is at this point that the external or facial opening is made into the antral cavity. The antral cavity varies also in shape and size, and occasionally septa divide the cavity more or less completely by vertical or horizontally placed lamellæ of bone. The average dimensions are as follows: Vertical height, 3.5 cm.; the transverse breadth, 2.5 cm.; and the antero-posterior depth, 3.2 cm.

The sphenoidal sinus, on account of its intimate relationship with the cranial, orbital, and nasal cavities, forms one of the most interesting of the accessory sinuses. They are two in number and occupy the anterior portion of the body of the sphenoid bone; a vertical mesial plate of bone forms the division wall between the two cavities. Each cavity presents six walls: a roof, floor, an anterior, a posterior, an external, and an internal wall. The roof is formed by the root of the lesser wings of the sphenoid, the olivary process, and the sella turcica. This wall is in intimate contiguity with important cranial structures. The plate of bone which forms the roof of the sinus is extremely thin. At the junction of the external wall with the roof of the sinus, the optic nerve and the ophthalmic artery pass forward to the orbital cavity. The floor of the sphenoidal sinus forms the posterior part of the roof of the nasal chamber. The anterior wall is in the vertical plane, although at its lower border it inclines slightly downward and backward to join the floor. This wall is extremely thin, and contains the orifice of communication with the nasal cavity. This wall may be divided into an internal portion, which presents the orifice of the ostium sphenoidale (which opens into the spheno-ethmoidal recess), and the outer portion which articulates with the posterior extremity of the lateral mass of the ethmoid, and thus completes the posterior ethmoidal cells. The posterior wall is formed of the posterior portion of the sphenoidal body. The external lateral wall of the sinus varies in thickness, and is in important relationship to neighboring structures. On its cranial aspect, it is in relation to the groove for the internal carotid artery and cavernous sinus. At its anterior aspect it forms the internal boundary of the sphenoidal fissure and the inner wall of the orbit. The internal wall, or septum, is a thin vertical plate of bone which is usually situated in the mesial plane, separates completely one cavity from the other, and rarely is defective. The septum may be irregularly placed, or wanting, thus giving rise to great irregularity in the shape and size of the sphenoidal cavities. These vary in size, shape, and relation to each other. Occasionally accessory cavities are found in the wings of the sphenoid. The average dimensions are as follows: Vertical height, 20 mm.; antero-posterior depth, 21 mm.; transverse breadth, 18 mm. All of these sinuses are lined with a muco-periosteal covering, which is continuous with the mucous membrane of the nasal cavity. The surface of the mucosa is lined with columnar ciliated epithelium.

The Mucous Membrane of the Nose.—The mucous membrane lining the nasal cavities is continuous with that of the pharynx, and extends into the pharyngeal orifice of the Eustachian tube and the accessory sinus.

Anteriorly the integument of the face supplied with hair and sebaceous glands enters the nostrils and extends to the inner extremity of the alar cartilage. At the junction of the superior lateral cartilage and the alar cartilage, the limen nasi, there is a narrow zone where the integument presents the characteristics of mucous membrane, and is lined with pavement epithelium and supplied with muciparous glands. From this point the transition is rapid into the characteristic mucosa of the nasal chamber. The anterior portion of the inferior turbinate, as well as the opposite portion of the septal cartilage, may have a mucosa lined with pavement epithelium, or with the columnar ciliated variety. The portion of the nasal tract, known as the olfactory region, is lined with columnar non-ciliated epithelium. This area extends from the roof as low down as the middle turbinate and the upper third of the septum. The remaining portion of the nasal cavities, the respiratory tract, is supplied with a columnar ciliated epithelium. These cells are long and spindle-shaped, and interspersed numerously among these cells are the so-called goblet or chalice cells. The thickness of the epithelial layer is from 30 to 70 μ. The cilia wave toward the post-nasal orifices. The cilia are stated to move in a thin layer of fluid. The nasal mucous membrane is inseparable from the perichondrium, or periosteum. The mucous membrane is very thin in the accessory sinuses, very thick over the turbinals, somewhat thinner over the septum, and very thin again over the floor and the under surface of the turbinated bodies.

The muciparous glands are of the tubular and racemose variety, and are present in great numbers. These glands do not differ in any essential particulars from similar glands located elsewhere in the mucous membrane, being most abundant at the middle and posterior portions of the nasal cavities, and of greatest size at the lower and posterior part of the septum. Beneath the columnar cells of the mucous membrane, we find a homogeneous basement membrane, and below this there is a connective-tissue layer, which is continuous with the periosteum.

The submucous connective tissue and the epithelial elements contain evidences of lymphoid tissue in the presence of leucocytes, lymphoid collections, and occasional lymph follicles.

In the olfactory region, the mucous membrane has quite a different histological structure from that in the respiratory tract. Here the mucous membrane is very thin, and not so vascular. The epithelium is of the columnar type, but is devoid of cilia, having a branching base and a large nucleus. Lying among them are the olfactory cells of Schultze, which are connected directly with the non-medullated filaments of the olfactory nerve. Beneath the epithelial covering, and opening upon its surface, are numerous branched tubular glands, which secrete a serous fluid. These glands are known as Bowman's.

The gross appearance of the colorization of the mucous membrane in the living subject varies in the different portions of the nasal chambers. In the upper, or olfactory, region the membrane is of a yellowish-pink in color; in the respiratory tract it is a light pink; at the posterior ends of the turbinates it is almost white; while in the accessory cavities it is of a pale pink.

A most interesting feature of the soft structures of the nasal chambers is the arrangement of the submucous tissue over the middle and inferior turbinates and the lower part of the septum. This important feature is the aggregation of venous sinuses and their large size, forming plexuses of blood-vessels over the turbinate bones. These are designated as the turbinate bodies. This term, the turbinate body, is applied to the bone and the investing soft tissue. The mucous membrane over the turbinates is divided into two layers, the adenoid layer with its epithelial covering, and a deep layer forming the periosteum of the turbinate bones. Between these two layers we have a stroma which contains lymph structure. Within this lymph structure we have an abundance of venous channels forming plexuses, which, on account of their rapid dilatation and contraction, under various stimuli, have been designated as erectile tissue, the Schwellkörper of the Germans.

This peculiar action of the venous plexus in the so-called turbinal tissue is not so much due to the arrangement of the veins and their relation with arterial twigs as to the characteristic walls possessed by these vessels and the arrangement of the muscular fibres and elastic tissue in the surrounding stroma. The muscular layer of these walls is very thick, greater than the walls of the corresponding arteries, and the walls are known to be thrown into irregular folds. The arrangement of the