muscular fibres is irregular, although the circular fibres predominate. This arrangement of the vessel walls, as well as the character of surrounding stroma, adapts these walls for the rapid emptying and filling of the venous plexuses. The venous plexuses are more pronounced over the inferior turbinate, especially as to its anterior and posterior extremities; over the middle turbinate, especially along the lower border and posterior extremity; and on the septum, in a line with the middle turbinate, corresponding with the anterior extremity of this turbinate—the tuberculum septi.

The vascular supply to the nasal chambers is obtained from the anterior and posterior ethmoidal arteries, branches of the ophthalmic; from the spheno-maxillary and the alveolar arteries, branches of the internal maxillary artery; and from the artery of the septum, which is derived from the facial artery. The spheno-palatine artery enters the nasal chambers through the spheno-palatine foramen with the naso-palatine nerve. Its internal branch, the naso-palatine, accompanies the nerves of the same name, passing downward and forward upon the septum (which it supplies) toward the anterior palatine foramen.

The external branches supply the outer wall of the nose, the nasal fossæ, the ethmoid cells, the frontal sinus, and the antrum of Highmore. The antral and posterior ethmoid supply the roof, upper portion of the septum, outer wall of the nasal fossa, the ethmoidal cells, and the frontal sinuses. The alveolar branch of the internal maxillary supplies the lining membrane of the antrum. The artery of the septum is a branch of the superior coronary, a branch of the facial. The septal artery supplies the columnar and the lower part of the septum.

The veins of the nasal cavity form plexuses beneath the mucous membrane, and these in turn are drained by various veins. The veins which perform this function are the veins which accompany the spheno-palatine artery and empty into the pterygoid plexus, those which accompany the ethmoidal artery and empty into the ophthalmic vein, and those which empty into the facial vein; and still other veins convey the return blood through the foramen cæcum and the cribriform plate to the superior longitudinal sinus and the intracranial veins.

The lymphatic vessels of the nasal cavity empty into the post-pharyngeal, the internal maxillary, the parotid, and the upper deep cervical lymphatic glands. Through the cribriform plate of the ethmoid, the nasal lymphatic vessels communicate with the intracranial lymphatics and the subdural space.

The nerve distributions for the nasal cavity consist partly of nerves of olfaction and partly of nerves of general sensation. The olfactory nerve, the nerve of the special sense of smell, arises by three roots: an external root, commencing in the deep substance of the middle lobe of the cerebrum; a middle root, from the caruncula annularis; and an internal root, from the inner and back part of the anterior lobe of the cerebrum. The three roots unite and run forward as a flat band on the under surface of the brain until it reaches the cribriform plate of the ethmoid, where it expands into what is known as the olfactory bulb. From the under surface of the olfactory bulb are given off from fifteen to eighteen filaments, which, piercing the foramina of the cribriform plate, are further subdivided and distributed to the nasal mucous membrane. They can be divided into three groups: an inner group which spreads out over the upper third of the septum, an outer group supplying the superior turbinate and the upper surface of the middle turbinate, and a middle group which is distributed to the roof of the nasal cavity.

General sensation is supplied to the nasal mucosa through the nasal branches of the ophthalmic division of the trigeminus. This nerve enters the nasal cavity through a slit beside the crista galli, and then divides into two branches. The internal of these two branches supplies the mucous membrane of the anterior part of the septum; while the other, the external, descends in a groove on the inner surface of the nasal bone where, at the junction of the nasal bone with the lower lateral cartilage, it passes out of the nasal cavity. This branch, in its passage through the nasal cavity, supplies the mucous membrane of the outer wall as low down as the inferior turbinate body. Branches of the anterior dental nerve are distributed to the mucous membrane of the inferior meatus and the inferior turbinate body. Branches from Meckel's ganglion gain access to the nasal cavity through the spheno-palatine foramen, and, after further subdivision, supply the mucous membrane covering the superior and middle turbinate bodies, the ethmoidal cells, and the upper and posterior part of the septum. The naso-palatine, in its passage forward across the roof, distributes filaments in its course, and descends downward and forward along a groove in the septum to the anterior palatine foramen, where it joins the anterior palatine nerve. The Vidian nerve supplies the upper and posterior part of the septum and the superior turbinate. Branches of the sympathetic are also distributed to the nasal mucous membrane, being derived principally from the spheno-palatine ganglion of the sympathetic.

II. Physiology.—The physiological function of the nose is of a threefold character: (1) In relation to respiration; (2) in connection with olfaction; and (3) in phonation. The respiratory function of the nose is by far the most important physiological duty that this organ performs. It is during the passage of inspired air through the nasal chambers that it is warmed, saturated with moisture, and freed from coarse material therein floating. According to the experiments of Aschenbrandt, which have been confirmed by others, a column of air, in its passage through the nasal chambers, on reaching the pharynx, has had its temperature raised to 86° F., and its degree of humidity raised to the point of almost complete saturation.

This function takes place whatever may be the degree of temperature or humidity of the external atmosphere, and is so complete in its action as to functionate perfectly during sudden and very marked changes in both of the enumerated conditions. This function is performed through the exquisite working of the so-called turbinal tissue. When we consider the constant and excessive changes in its functional activities that are persistently taking place, one cannot but marvel at the wonderful nature of this mechanism.

The second important physiological function of the nose is that of olfaction. The sense of smell is dependent upon the impinging of the odorous particles upon the terminal filaments of the nerve ends in the olfactory apparatus. In order for various substances contained in the atmosphere to be appreciated as having an odor, it is necessary that the air should reach the olfactory region and that the peripheral apparatus should be normal. According to Paulsen, the inspired air passes first directly upward under the dorsum of the nose, and then follows the roof, the greater portion of the column passing through the superior and middle meatus and then descending downward to the post-nasal orifice. Odorous particles reach the nose in various forms. Various theories have been offered to explain the mechanism of olfaction, the most important of which are the mechanical, the vibratory, and the chemical. (For further information in regard to the sense of smell, consult the article on *Olfactory Nerve.*)

The third physiological function of the nose is the part which it plays in connection with phonation. The nasal cavities, in connection with the pharynx and the buccal cavity, constitute that portion of the vocal apparatus by which quality and character are given to the voice. The importance of the nasal organ in that office is well demonstrated by the alteration of the character of the voice when from any cause one or both nasal cavities are obstructed.

III. Rhinoscopy.—In order to obtain a successful inspection of the nasal cavities and neighboring parts, it is necessary to have the best illumination that it is possible to obtain, means for projecting this light, and aids





through which this light can gain ingress into the remote parts to be examined.

Previous to the inspection of the interior of the nasal cavity, it is always well to make a thorough examination of the external nose. The external configuration of the nose, the aspect which it presents at the root, the evidences of deviation, the presence or absence of marked movement of the alæ nasi, the presence or absence of sound in nasal breathing, the relation of the alæ to the septum, and the outlines of the anterior nares should all be thoroughly considered before the interior of the nose is inspected. The appearance of the cutaneous covering of the external nose, the presence of excoriation on the upper lip, the odor of the breath, and the character of the voice should all be thought of in this preliminary examination.

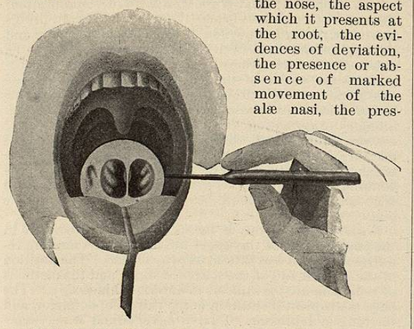

Fig. 3486.—Posterior Rhinoscopy Mirror in Position Showing Image Reflected Therein.

In order that the examination may be successful, it is necessary to have, first, a good source of light; second, a concave reflecting mirror for projecting this light; third, variously devised instruments called speculums by which the vestibule of the nose is expanded and a greater volume of light admitted to the interior; and small plane mirrors for diverting the reflected light and receiving the image which is thus created.

The Light. On account of the exigencies of circumstances, the use of the best light obtainable, sunlight, is not possible. The light which is sought is one as nearly white as possible. The three sources of light which are most frequently used are gaslight, electric light, and lamplight. Any source of light of sufficient intensity and penetrating power can be used when circumstances demand it, and one should adapt himself to these varying conditions. In office work the source of light can be controlled, and one should select that which gives the best illumination with the least inconvenience. For average general utility, gas fed through an Argand burner serves the best purpose. To increase its efficiency use may be made of the Welsbach mantle, which gives a whiter light. With a moderate degree of care the mantles last for many months. The light thus obtained may be fixed or movable. It is better to have the burner attached to a movable bracket which can be placed at various angles and raised or lowered at pleasure. The apparatus is completed by surrounding the light with a cylindrical japanned tin or asbestos chimney, which has a circular opening of two and a half inches in diameter through its lateral wall at the middle. This contrivance shuts off all the rays of the light excepting those coming through the lateral aperture. A further part of the equipment is the device known as the Mackenzie condenser. This latter device is not essential, but renders the examination easier for the examiner.

The electric light may be used in two methods, directly and indirectly. The direct method is the use of the electric headlight; the indirect method is the use of the electric light by reflection, as we use gaslight. The objection to the electric headlight is its weight and its want of penetration. With the use of the ground-glass globes we have a very good source of indirect illumination in electricity. The student's, or Rochester lamp, forms the best form of oil light. This light can be made whiter by the addition of a small piece of camphor to the oil, as suggested by Sajous.

The instrument by which the light is reflected into the various cavities to be examined is known as the head mirror. This mirror is a round, concave mirror, from three to four and a half inches in diameter, with a focal distance of from eight to fifteen inches. It should be supplied with a central orifice. The central orifice is for the purpose of more exact observation, as, through its use, the angles of incidence and reflection are made to coincide, and, therefore, the picture is rendered more perfect. This mirror is more serviceable if it is worn suspended through a ball-and-socket joint from a head-band which encircles the forehead. It may also be suspended from a rod which is attached to the lamp which furnishes the source of light. Steadiness and immobility, when it is fixed at the proper angle, are the most desirable features in the reflecting mirror. One having a diameter of three and a half inches has, in my hands, proved the most serviceable. For the purpose of permitting as much light to enter the nasal cavity as possible, it is necessary gently to dilate the vestibule through the means of a speculum which is introduced into the anterior nares. Those speculums which are constructed on the bivalve system are the most serviceable. Their numbers are legion. I prefer the Schnitzler's. Hartmann's, Ingals', Roth's, and others are of this style. A number of fine, wire-like speculums, such as the Jarvis, the Bosworth, the Goodwillie, and the Ives, are made on the bivalve principle. Others are made to be self-retaining. The Schnitzler instrument, as offered for sale in the shops, is too cumbersome. I have it in a light frame, which not only makes a neater but a more useful instrument. The individual preference in speculums is also a question of adaptability and use. In making examination of the post-nasal space and the nasal cavities from behind, what is called posterior rhinoscopy, it is necessary to have, in addition to a good light and the head reflector, small plane mirrors constructed like those used in examining the larynx, and a tongue depressor. These small plane mirrors are fixed at an angle of 105° to the shaft, and vary in size from three-eighths to three-quarters of an inch in diameter. The largest mirror which it is possible to use in the individual case should always be employed. This mirror is used to reflect the light behind the curtain of the palate.

Usually it is necessary to control the tongue, as only a few patients are able to hold it relaxed in the floor of the mouth during an examination; therefore it becomes necessary to depress it through the aid of a tongue depressor.

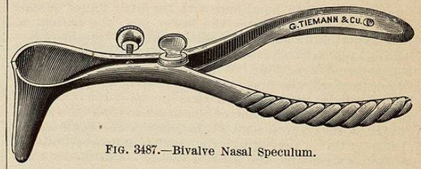


Fig. 3487.—Bivalve Nasal Speculum.

Numerous forms of depressors are on the market, but one that especially recommends itself, on account of its simplicity and of the ease with which it may be kept aseptic, is the one invented by Dr. D. Braden Kyle (Fig. 3488).

The nasal probe is indispensable to a thorough examination and understanding of diseased conditions in the nasal cavities.

Examination of the nasal chambers through the anterior nares is called anterior rhinoscopy, while examina-

tion of the upper pharynx and nasal chambers from behind is known as posterior rhinoscopy.

In these examinations of the nasal cavities the relationship of the patient and physician with regard to the source of light is absolutely the same as it is in laryngoscopic examinations. The patient sits in a simple straight-back chair, without head support. The physician sits directly in front of the patient, or, what is preferable, directly beside and on the left-hand side of the patient. The source of light should be to the right of the patient, just to the side of and on a level with the upper border of the right ear. The patient should sit in an easy, erect, comfortable position, when the examiner reflects the light in a circle just upon the area to be examined. Either may then move, within a certain latitude, from this fixed position; nevertheless, it will be noted that when they return to the examining position the light will fall directly on the point upon which it originally fell. The method of examination, as well as the character of furniture used for patient and doctor, is a question of individual preference and perfected method on the part of the operator.

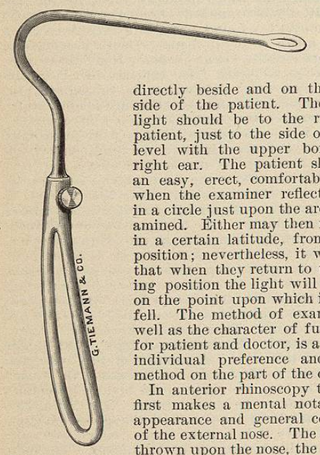


FIG. 3488. — Kyle's Tongue Depressor.

In anterior rhinoscopy the operator first makes a mental notation of the appearance and general configuration of the external nose. The light is then thrown upon the nose, the head of the patient is slightly tilted backward, and the general appearance, the patency, and the outline of the anterior nares are noted, after which the tip of the nose is slightly tilted upward and the vestibule is thoroughly inspected. Little children fear instruments, and, as their hairs are undeveloped, we can often make a thorough inspection without the use of speculums. Special care should be made to note fissures, abrasions, or pimples on the inner surface of the nares, which would make the introduction of the speculum painful.

We are now prepared to introduce the speculum. This instrument should be gently insinuated into the anterior nares in a closed state. After the speculum is placed slightly within the vestibule, it is moderately dilated until slight resistance is felt. No pain should ever be given. With the instrument in position, the two crura being controlled by the pressure of the thumb and index finger of the left hand and with the little finger of the same hand hooked under the lower jaw, the patient is practically under control of the examiner. Slight pressure is usually all that is sufficient to make the patient move in a required direction. With the patient's head slightly tilted forward, the first object that attracts attention is the prominent rounded red mass on the outer wall projecting nearly to the floor of the nose, and which we recognize as the anterior end of the inferior turbinate body. Opposite this we recognize the cartilaginous wall of the septum, and below, the floor of the nose and the inferior meatus. According to the amount of space between the inferior turbinate and the septum, we can see to a greater or less depth within the nasal cavity toward the pharynx. In many cases, with a fair amount of space between these parts, or when the turbinal tissue is contracted under the use of cocaine, we can well see the posterior pharyngeal wall. A tilting of the patient's head slightly backward brings into view the middle turbinate, which is paler and more translucent than the inferior, and just opposite its anterior extremity on the septal wall is seen often an aggregation of erectal tissues, which is designated the tuberculum septi. The whole extent of the visible upper surface of the inferior turbinate is seen in this position, as well as the middle meatus. It is only when the middle turbinate is removed or has undergone great atrophy that the interesting features contained within the middle meatus are brought under observation. Tilting of the patient's head still farther backward brings into view the upper portion of the middle turbinate and the roof of the nasal cavity. It is rather unusual to be able to demonstrate the superior turbinate body. Occasionally the orifice of the sphenoidal sinus can be made out. The use of the probe is indispensable in making this examination, and so also is the instillation, after the preliminary examination, of a very mild solution of cocaine, —a procedure which should be followed by a re-examination of the parts after the effects of the drug have become manifest. Great care should be exercised in examining the septum; it should be viewed from both sides, and the head should be held carefully in the middle line.

Posterior rhinoscopy is the most difficult procedure in the examination of the upper air tract, and therefore requires more tact and skill in its prosecution. The position of the patient and of the source of light, and the methods of reflection are the same as in anterior rhinoscopy. The only instrumental addition is the rhinoscopic mirror and the tongue depressor. I have never found it necessary to make use of the so-called palate retractors, but see no objection to the use of such an instrument, for holding forward the soft palate, if the examiner so desire. The most desirable instrument for retracting the palate is that invented by Dr. J. A. White. Occasionally the examination can be made without the use of a tongue depressor, but this is exceedingly rare. After depressing the tongue, and noting the space between the soft palate and the pharyngeal wall, as well as that between the pendent uvula and the base of the tongue, the largest size mirror which it is possible to use is gauged. The mirror is first heated to a proper temperature and the tongue carefully depressed. In introducing the tongue depressor care should be exercised in so introducing it that the tip of the tongue depressor first comes in contact with the tongue just posterior to its arch, which is somewhat anterior to the circumvallate papillæ. The tongue is then drawn downward and forward into the floor of the mouth. Backward pressure of the tongue is always to be avoided, as it is certain to give rise to retching and gagging.

If the depressor is so placed as to excite distress on the patient's part, it should be immediately removed and replaced. The depressor should be held between the thumb and index finger of the left hand, while the other fingers pass under the patient's chin. The mirror, which has been properly warmed, being lightly held between the thumb and index finger of the right hand, is now quickly introduced into the widely open mouth along its left wall until we come to the dependent palatine arch. The important feature in the introduction of the mirror is so to insert it as not to come in contact with any of the tissues. As the palatine arch is reached, the mirror is gently insinuated by slight depression and rotation so as to glide through the space between the left pillar and the base of the tongue without coming in contact with either.

After the mirror has passed behind the palate and has reached the pharyngeal space, the operator, by slightly rotating the handle, may bring the reflecting surface around so as to face him, and then he should slightly depress the handle so as to carry the mirror upward until its upper border is slightly hidden behind the soft palate. The mirror now being in position, its handle is so held toward the left angle of the patient's mouth that there is no interference with the thorough illumination of the buccal cavity. Finally, the mirror is to be rotated from right to left, depressed and elevated, and given different degrees of angles while in position so as to bring into view in rapid succession the various surfaces and parts of the upper pharynx and back of the nose.





The success of the procedure depends upon the depression of the tongue, the careful introduction of the mirror, and the ability of the patient, not only thoroughly to relax the soft palate, but also to hold it immobile in this relaxed state long enough for the operator to make a thorough inspection of the parts. The patient is an uncertain quantity. Many can submit to a rhinoscopic examination without any difficulty; others require careful manipulation and several efforts have to be made before a successful view is obtained; and, finally, there are a few who are so constituted as to present almost insurmountable difficulties to the exploration. The greatest difficulty is the retraction of the soft palate, which in some individuals takes place immediately upon the introduction of the mirror into the mouth. Careful training in nasal breathing with the open mouth and with the sounding of the nasal consonants en and em, will often overcome this obstacle. Among the other methods which have been suggested for overcoming these obstacles may be mentioned the application of a five-per-cent. solution of cocaine to the palate and post-pharyngeal wall, and the employment of the palate hook. The image reflected in the mirror at any given moment represents only a small section of the whole region. Consequently, in order to gain a fairly complete view, it is necessary to construct it in one's mind from the separate smaller pictures obtained by changing from time to time the angle at which the mirror is placed. Usually one observes first the upper surface of the soft palate and the lower portion of the posterior border of the septum which forms the inner boundary of the post-nasal orifice, the choanæ. Then, by giving the mirror a slight upward inclination, it will bring into view the whole length of the septum, broad above and tapering to a narrow edge below, and the posterior view of the nasal cavities as displayed through the choanæ. On either outer wall, from above downward, will be noted the ridge of the superior turbinate body; immediately below it and separated from it by a dark line—the superior meatus—will be observed the middle turbinate body which stands out as a somewhat elongated fusiform body of a very faint pinkish-white appearance. Below the middle turbinal body will be seen the middle meatus, and immediately below this the upper half of the inferior turbinate body, which oftimes seems to merge into the floor of the choanæ.

The color of the inferior turbinal body is of a grayish-white, resembling much the color that an ordinary mucous membrane assumes when œdematous. By slightly inclining the mirror to right or left, the corresponding mouth of the Eustachian tube will be observed, as well as the depression which separates it from the post-pharyngeal wall—the fossa of Rosenmüller. By changing the angle of the mirror to a more obtuse angle, the dome-like vault of the pharynx will be brought into view, as well as the upper portion of the post-pharyngeal wall. The vault of the pharynx is usually dome-like and smooth in its contour. In some individuals it may show elevations and depressions, or be so filled out as to appear flat, these alterations depending upon the amount and degree of enlargement of the pharyngeal tonsil.

Besides the rhinoscopic methods of exploration of the nasal chambers and post-nasal cavity we have, as additional aids to diagnosis, the digital exploration and the use of electric transillumination. Digital exploration is especially of value in exploration of the post-nasal cavity in very youthful patients and in adults in whom it is impossible to make use of posterior rhinoscopy, or in whom, for various other reasons, it is desirable to make use of this method. This procedure can usually be made in little ones, without causing alarm, by the use of judicious tact. No instruments are necessary. The hands should be well washed and the index finger scrubbed with a nail brush before the examination is made. The child is seated in the examining chair while the parent sits in front of the child and holds the little one's hands. The operator stands to the left side of and facing the patient, with the right hand firmly grasping the vertex of the head. I usually find it wise to tell the patient what I propose doing and of its unpleasant nature, but at the same time I assure him that the procedure does not cause pain. The patient is then told to open widely the mouth, the hands and head are firmly grasped, and the index finger of the right hand is quickly but dextrously introduced into the mouth and behind the soft palate into the post-nasal place. In this manner the character and condition of this region may be quickly determined through the tactile sense.

Another method of making the examination is by placing the child in the position described by Dr. A. A. Bliss. By this method the child is placed in the lap of a nurse or parent, facing forward. The little one's legs are held firmly between the legs of the assistant, while the arms of the assistant are slipped under the armpit of the patient and the hands extended upward and held firmly on either side of the head. The child is thus held immobile. Transillumination of the accessory cavities is resorted to as an aid to the diagnosis of the condition of these pneumatic cavities. The value of this method of exploration lies in the fact that most of the pneumatic spaces in the normal state allow the transmission of rays of light through their thin walls. The light used for this purpose is electric, furnished through the medium of a small lamp of about six candle-power. The method of its application will be described in the article devoted to the diseases of the accessory sinuses.

*Charles W. Richardson.*

**NASAL CAVITIES, DISEASES OF: ABSCESSES OF THE NASAL SEPTUM.**—Abscess of the septum may be either acute or chronic. The former is generally the result of hæmatoma, erysipelas, typhoid fever, or smallpox, and is located upon one or both sides of the cartilaginous septum. The chronic abscess is generally due to syphilitic infection, but it may be the result of poisoning by arsenic, copper, or mercury, or it may possibly be traumatic.

While the acute abscess is commonly found over the cartilaginous septum, the chronic abscess generally extends to the bony part, and it is often caused by disintegration of gummatous infiltration of the mucous surfaces. The swellings are usually rounded, and they appear red and inflamed and sensitive to the touch. When a syphilitic abscess is opened it emits foul-smelling pus, and if a probe be introduced into the abscess cavity necrosed cartilage or bone may be detected. In most chronic cases the treatment, after the abscess has been opened, is the same as that recommended for nasal syphilis.

*E. Fletcher Ingals.*

**NASAL CAVITIES, DISEASES OF: ACTINOMYCOSIS.**—I have been unable to discover any report of well-marked cases of actinomycosis of the nose, though it is probable that the disease sometimes affects this organ.

*E. F. I.*

**NASAL CAVITIES, DISEASES OF: ACUTE INFLAMMATIONS.**—The many varieties of acute inflammation of the nasal mucous membrane that are mentioned in medical literature may be comprised under the following headings: (1) Acute Catarrhal Rhinitis, (2) Acute Purulent Rhinitis, (3) Acute Membranous Rhinitis, (4) Acute Phlegmonous Rhinitis, and (5) Acute Rhinitis due to Occupation or to Trauma.

(1) ACUTE CATARRHAL RHINITIS.—Synonyms: Acute Coryza, Cold in the Head, Acute Nasal Catarrh, etc.

This disease is an illustration of the simplest form of exudative inflammation occurring in a mucous membrane and affords us the most accessible illustration of such a process inasmuch as the changes occur under direct observation. Any special peculiarities which it presents are amply explained by the vascular mechanism of the nose, which calls for a somewhat extended consideration.

*Vascular Mechanism of the Nose.*—The vascular mechanism of the nose (and the glandular as well) is somewhat unique, and a full understanding of it is called