To the great advantage of the catheter over the large and clumsy stomach tube it is hardly necessary to refer. Its introduction is much less startling and uncomfortable to the patient, and, if the food be properly prepared, highly concentrated preparations being employed, after the manner of Debove, the large tube will be unnecessary. As a general rule, the irritation caused by the passage of the tube increases with its size. The tube should be introduced in the usual manner; that is, the patient's mouth being opened and his tongue protruded, the catheter should be carried to the base of the tongue, then the patient should be told to swallow, and, as he does so, the catheter should be pushed into the œsophagus, and thence downward as far as may be deemed necessary. The larynx may be avoided with certainty by using the finger as a guide. Before its introduction the tube should be carefully lubricated, for which purpose white of egg, mucilage, or even milk, are useful. An excellent plan is to allow the patient to swallow slowly, just before the introduction of the catheter, a drachm or two of pretty thick mucilage. Vaseline, glycerin, and oil are unpleasant to the patient and should on no account be used. In passing the catheter gentleness should be observed, and great care taken to avoid, as far as possible, all points of special tenderness. In many cases the patient himself may be taught to pass the tube much more successfully and comfortably than it can be done for him, since the manœuvre is not difficult, and no one knows so well as the patient the exact situation of the painful spots. Sometimes, especially with children, the point of greatest irritability is in the palatine arches, and any attempt at passing a tube across them will be followed by violent gagging. In such cases a soft-rubber tube may be passed through the nostril and pharynx, and thence into the œsophagus, and thus contact with the fauces be wholly avoided. Should the introduction of the tube cause dyspnœa, direct the patient to take full breaths. The instrument may also cause nausea when it passes the pharynx, and for the relief of this Dujardin-Beaumetz advises the administration of bromide of potassium; and then again it may cause nausea when it reaches the stomach, in case it be inserted so far. In the latter case, however, the introduction of food will quickly bring relief.

Of course, the passage of the tube will not always prove an easy or a painless operation. A little practice, however, will render it possible in nearly every instance, while the advantages to be gained far outweigh any ordinary objection to the method.

As to the special conditions in which dysphagia will call for relief, the reader is referred to the various articles, in other parts of the HANDBOOK, in which these subjects are discussed. *D. Bryson Delavan.*

DYSPNŒA.—Dyspnœa is a striking symptom of a vast variety of diseases, at times very simple of interpretation, at other times requiring a comprehensive knowledge of physical diagnosis, clinical diagnosis, and the symptomatology of disease, in tracing it to its cause. It is a symptom which stimulates careful efforts in differential diagnosis, since it is very seldom that it can be relieved unless its causal disease be correctly diagnosed and treated. Pain, on the other hand, is a common symptom which can usually be relieved without a diagnosis of the causal disease. The object of this article is to impress upon the general practitioner the importance of careful and time-consuming examinations, and to assist him in tracing this particular symptom to its cause. In my work I have examined patients suffering with extreme dyspnœa whose cases had been diagnosed repal asthma because albumin had been found in the urine, and cardiac asthma because of irregular pulse and cardiac murmurs. In both cases examination of the chest and aspiration showed that the dyspnœa was to a large extent dependent upon extensive hydrothorax, which was secondary to the cardiac and renal disease. In adult life diseases of the lungs and pleuræ, heart and kidneys, are the most common causes of dyspnœa, while in childhood diseases of the naso-pharynx, larynx, trachea, and bronchi play this rôle.

We must distinguish between simply increased breathing (over twenty-four respirations in the minute) and difficult or hindered breathing, *i.e.*, dyspnœa. The former is found in emotional and hysterical conditions, after exertion, and in fever. Dyspnœa bears about the same relation to normal breathing that palpitation of the heart does to the normal action of the heart. In health and when not undergoing exertion, we are unconscious of the action of the heart and practically so of the act of respiration. When conscious of the forcible or irregular action of the heart, whether the rate be normal or increased, palpitation is present. In dyspnœa one is usually conscious of distress. The alæ nasi move, there is forcible movement of the chest, and the auxiliary muscles of respiration are brought into action proportionate to the degree of dyspnœa. The respirations may be normal in rate, but deeper than usual, or they may be increased in frequency and shallow, or they may be both increased in frequency and in depth.

Dyspnœa may be continuous or paroxysmal. Again, it is either inspiratory, expiratory, or mixed, depending upon the cause. It may be so severe as to compel the upright position, when it is termed orthopnœa. It may be associated with peculiar alterations in rhythm and strength, when it is termed the Cheyne-Stokes type of breathing. Dyspnœa may be accompanied by peculiar sounds as in laryngismus stridulus, hysteria, inflammation of the larynx, Cheyne-Stokes breathing, and pneumonia. Dyspnœa with cyanosis is a very important symptom, pathognomonic of incompensated heart disease or advanced lung disease; in rare cases abdominal disease which interferes with the action of the diaphragm causes this type of dyspnœa. The character of the dyspnœa is in some instances indicative of the nature and location of the disease causing the obstruction. Inspiratory dyspnœa is caused by a stenosis of the upper air passages, the result of inflammatory conditions, growths, or spasmodic contractions. Expiratory dyspnœa is caused by the presence of a tumor, usually in the larynx, which acts like a valve, being forced up against the glottis during expiration. In emphysema and asthma the expiratory form of dyspnœa predominates. The mixed type, involving both inspiration and expiration, is found in diseases of the heart and blood, lungs and kidneys.

In the dyspnœa of childhood it is very important to know whether the obstruction is located in the larynx or in the trachea, as upon it depends the decision between intubation and tracheotomy. If the obstruction be in the larynx, it is seen to rise and fall during respiration. If the dyspnœa is severe the head is bent back, the neck is stretched, the muscles of the neck are contracted, the spaces above the sternum and at the side of the trachea are drawn in with each inspiration, the alæ of the nose work vigorously, and there is a change in the voice. If the dyspnœa is from stenosis of the trachea, the larynx is not markedly moved during breathing, and the patient bends the head forward rather than backward. There is no change in the voice except that it may be weakened.

CAUSES OF DYSPNŒA.—Musser gives the following classification: 1. Anything cutting off or lessening the normal amount of air required for oxygenation of the blood. 2. Affections which lessen the amount of blood. 3. Affections in which red corpuscles are diminished. 4. Pulmonary embolism and thrombosis. 5. Fat embolism. 6. Interference with the nervous mechanism of respiration.

1. (*a*) *Obstruction of the Air Passages.*—Under this heading we find many of the common causes of dyspnœa in children, such as occlusion of the nares and naso-pharynx, especially by adenoids, unless compensated for by mouth breathing. The importance of examining suspicious cases for adenoids and instituting the proper treatment cannot be overestimated. Enlarged tonsils, retro-pharyngeal abscess, or any obstruction in the throat, such as diphtheritic swelling, may cause dyspnœa.

Dyspnœa is one of the most common symptoms of

laryngeal disease. Its causes are: (1) constriction by inflammatory or œdematous swelling; (2) spasm; (3) tumors or foreign bodies in the larynx; (4) cicatrization of ulcers after syphilis or lupus; (5) paralysis of abductors or adductors of the larynx.

Pressure on the larynx producing dyspnœa may be caused by cellulitis of the neck, tumors of the lymph glands, goitre, and retro-pharyngeal abscess. It should be remembered that in diphtheria dyspnœa may be due to pressure of enlarged glands on the larynx or bronchi. Sudden œdema may occur in syphilitic and tuberculous ulceration, and may kill the patient. I have recently seen a patient with leukæmia die from the sudden development of œdema of the glottis.

Pressure on the trachea and bronchi causing dyspnœa may be exerted by tumors of the thyroid gland, by thoracic aneurism, by mediastinal tumors, by cancer of the œsophagus, and in rare cases by dilated auricle; foreign bodies and diseases of the walls, and syphilis, also cause dyspnœa.

In the dyspnœa of bronchial obstruction, which may be caused by the pressure of an aneurism, the laryngeal movement is not increased and the voice is not changed. The physical signs over the lung of the obstructed bronchus become pronounced.

(*b*) *Diminution of Air Space from Causes Within and Outside of the Thorax.*—This division is very large and includes the most common causes of dyspnœa in adults, namely, the numerous acute and chronic diseases of the lungs and pleura, such as the various forms of tuberculosis, acute and chronic, different forms of pneumonia, capillary bronchitis, pneumothorax and empyema, emphysema, asthma, new growths in the lungs and pleura; the various forms of pleurisy, with effusion and chronic dry with adhesions; pericarditis with effusion, acting like pleurisy with effusion, with the additional factor of greater interference with the action of the heart.

The extra-pulmonary causes which diminish the air space are chiefly diseases below the diaphragm, ascites, tympanites, and ovarian tumors.

The severity of the dyspnœa is strikingly dependent upon the suddenness with which the cause acts. It is a case of adaptation, and the development of compensation. In pleurisy with the rapid formation of a large effusion, or especially in certain forms of pneumothorax, dyspnœa is at first alarming; while in a chronic pleurisy or in an advanced tuberculosis which has been months or years in developing, and in which a much larger air space is involved and rendered useless, there may be no dyspnœa except on exertion.

(*c*) *Interference with the Action of Muscles.*—This may be the result of weakness, paralysis, pain, or tetanic contractions, as in hydrophobia and tetanus. Obesity, myxœdema, œdema, trichinosis, and myositis may interfere with the action of the respiratory muscles. Paralysis of the phrenic nerve causes an interesting form of dyspnœa. There is marked interference with the action of the diaphragm, with the result that during inspiration the epigastrium and the hypochondriac regions are drawn in, and during expiration pushed out, the reverse of the normal phenomenon.

Pain, due to disease of the pleura, muscles, or intercostal nerves, or due to conditions below the diaphragm, may cause dyspnœa.

2. *Affections which Lessen the Amount of Blood*, as obstructive heart diseases, and (rarely) tumors pressing upon blood-vessels. Dyspnœa due to heart disease is nearly always associated with cyanosis. It is clinically divided into (1) dyspnœa caused or increased by exertion; (2) paroxysmal dyspnœa; (3) orthopnœa; (4) rhythmical dyspnœa or Cheyne-Stokes respiration.

The dyspnœa of effort comes on after the slightest exertion. In paroxysmal dyspnœa the attack comes on without apparent cause. It must be distinguished from the paroxysmal dyspnœa of uræmia, asthma, or emphysema. The physical signs of lung disease usually point to the latter. The paroxysmal dyspnœa of heart disease is attended by more violent efforts in breathing than the physical state of the lungs admits, and the difficulty attends both inspiration and expiration. Wheezing is not so marked as in forms of asthma. There is some obstruction to the out-going air, but, on account of air hunger, all of the efforts of the patient are exerted to fill the chest. In paroxysmal dyspnœa the breathing usually becomes quiet if the patient is placed in a comfortable position, provided there is no lung or pleura complication. The position does not modify the severe dyspnœa of asthma or emphysema.

3. *Affections in which Red Corpuscles are Diminished.*—In the various anæmias, primary and secondary, even with a very low blood count, the patient does not suffer with dyspnœa while resting. Slight exertion, walking, or climbing stairs, brings on labored breathing. Cyanosis is not usually associated with this variety of dyspnœa.

4 and 5. *Pulmonary Embolism and Thrombosis* are rare causes of dyspnœa. Weak hearts favor their development. A clot may be dislodged from a uterine sinus after labor, or a clot resulting from inflammation of the veins in any location may be carried to the lungs, and completely block a larger or smaller pulmonary vessel. Fat embolism occurring in parturient women three or four days after labor, in fractures, and in diabetes, acts in the same way.

6. *Interference with the Nervous Mechanism of Respiration.*—The possibility of tumors, hemorrhage, or degeneration about the respiratory centre must be kept in mind. The history and the exclusion of other conditions by careful examination will aid in the diagnosis. The irritation of the respiratory centre by toxic agents in the blood, as in uræmia, diabetes, auto-intoxication from gastro-intestinal disorders, and warm blood in fevers, is a very important cause of dyspnœa. A routine examination of the urine will prevent many mistakes in diagnosis.

CHEYNE-STOKES BREATHING.—Modifications of the breathing are among the important symptoms of uræmia. A common type in the uræmia of chronic nephritis is the Cheyne-Stokes breathing. It is a form of periodic respiration, very interesting and important as a bad prognostic sign. It is seen most commonly in apoplexy, tumors of the brain, meningitis, incompensated heart diseases and toxic conditions, such as uræmia, morphine poisoning, acute infectious diseases, especially typhoid fever, and in acute diffuse peritonitis. The patient is usually stupefied or comatose.

In this form of breathing there is a cycle consisting of two periods of nearly equal length. The period of apnœa, during which there is not the slightest respiratory effort, lasts a variable length of time, from a few seconds to two minutes. This is followed by the period of active respiration, which I have observed to be a few seconds longer than the period of apnœa. A very faint, scarcely perceptible, sighing respiration first occurs; this is followed by gradually increasing and deepening respirations, till in marked cases abnormally deep and loud respirations, accompanied by snoring or groaning sounds, are taken. The respirations now gradually decrease in strength, running down the scale, till the period of apnœa is again reached. This cycle may be repeated for several days or even for weeks or for months.

In one of my cases of apoplexy the patient was completely comatose during the period of apnœa, but, as the respirations became deep, he roused himself sufficiently to groan and ask questions. The number of respirations in each cycle varies; most often there are from eight to twelve following each other in about normal celerity, but at the beginning and end of the period they are sometimes somewhat slower. Occasionally there are, besides some secondary symptoms, regular contractions of the pupil during apnœa, and dilatation of them at the height of respiration, and retardation of the pulse during apnœa. Sahli has observed that the patients become cyanotic at the beginning of respiration and that the cyanosis increases till the height of respiration is reached, which corresponds with the conduct of the pupils.

The cause of Cheyne-Stokes breathing is supposed to

be an alteration in the function of the respiratory centre. The theory is that there is a periodic diminution in the excitability of the respiratory centre, or that the excitability of the medulla oblongata becomes exhausted. *Biot's respiration* is probably a modification of Cheyne-Stokes breathing, with the same significance.

Pulmonary symptoms are quite common in uræmia; in fact, spasmodic dyspnœa is the first and sometimes the only symptom for a long time. Later, the renal symptoms become pronounced, pointing to the nature of the disease.

Dyspnœa in Special Diseases.—*Asthma* is a form of paroxysmal dyspnœa, dependent most often upon nasal, bronchial, and gastro-intestinal reflexes. It is a striking picture of air hunger, and suggests the following alteration in the lines from "The Ancient Mariner," "Air, air everywhere and not a bit to breathe." There are diminished respiratory movement and prolonged expiration. The frequency of respiration is diminished sometimes to one-half the normal rate; the rhythm is altered, inspiration is short and gasping. A natural consequence of an asthma of long duration is the advent of *emphysema*, when the dyspnœa becomes more constant. The dyspnœa is proportionate to the degree of emphysema and is aggravated by the coexistence of bronchitis, asthma, and eccentric hypertrophy of the right ventricle (which are frequent complications in long-standing cases). When emphysema is only moderate, dyspnœa is not complained of, except on climbing or walking briskly, or after a hearty meal, but when it is great, the dyspnœa is constant, interferes with all exertion, frequently necessitates orthopnœa and prevents continuous speech.

In *Aortic Aneurism* and mediastinal tumors, dyspnœa is a frequent symptom, and is due chiefly to pressure.

In *Capillary Bronchitis* of infancy, respirations may be as many as 60 to 80 per minute. Dyspnœa is more or less constant, but becomes urgent in paroxysms, and the patient may have to be propped up in bed to breathe. It is expiratory. Inspiration may be free and easy or difficult, but expiration is always difficult and prolonged.

Gastric Disease.—Dyspnœa occurs in many cases of dyspepsia, if the subject is the victim of asthma, anæmia, or cardiac disease. In asthma it is usually reflex. In anæmia it is due to atony of the stomach and gaseous accumulation. In cardiac disease it is mechanical, from the pressure of a stomach distended with gas.

In *Hydrophobia*, the spasmodic contraction of the larynx may become so strong as to excite urgent dyspnœa, with the emission of curious sounds.

Hysteria sometimes explains obscure cases of dyspnœa. Such cases have been reported by physicians of the German army. In the fall of 1898 a soldier entered the University of Michigan hospital, suffering with a continuous dyspnœa, so severe at times that it compelled the orthopnœic position. Very careful physical and clinical examinations failed to reveal any adequate cause for the dyspnœa. It was perhaps hysterical.

In *Nephritis* dyspnœa may be a pronounced symptom, due either to uræmia or to œdema of the glottis, to effusions into the pleura, or to bronchitis. If dilatation of the heart occurs, dyspnœa may arise, due to that or the secondary œdema of the lungs.

In *Phthisis* dyspnœa is almost constant. The degree varies with the association of fever; when the latter is present, dyspnœa is more pronounced. It is also more pronounced in acute cases. In miliary tuberculosis the frequency of respiration is out of all proportion to the physical signs. In this form cyanosis is more marked. In chronic localized phthisis the dyspnœa may occur only on exertion, after eating, or upon excitement. In later stages the dyspnœa is constant and in proportion to the extent of involvement of the lungs and the degree of fever.

In *Pneumonia* frequent respirations—40 to 60 in adults, 60 to 90 or more in children, per minute—is a characteristic symptom. It is panting in character, particularly when pneumonia occurs in old subjects; both inspiration and expiration are brief, though sometimes separated by a rather long pause. Expiration is usually accompanied by an audible grunt, indicating great oppression. Dyspnœa may be absent, or, as the case progresses, may become either increased or greatly diminished, according to the severity of the type.

The chief causes of dyspnœa in pneumonia are involvement of lung, bronchitis, pericarditis or extensive pleurisy, cardiac failure, collateral congestion with œdema, *fever*, and the intense pain in the side. That, in a frank case of pneumonia, irritation of the respiratory centre by toxins or warm blood, is the chief cause of dyspnœa, and not the lung involvement, is proved by the fact that synchronous with the crisis and the fall of temperature (while the consolidation of the lung still exists) the dyspnœa disappears.

In *Pneumothorax* developing in the course of a tuberculosis, severe dyspnœa and frequently cyanosis, are among the first symptoms. The difficulty in breathing is often accompanied by a sense of impending suffocation. The stress of the dyspnœa depends upon the amount of air that suddenly gains entrance into the pleural cavity. If the orifice be large and valvular, the air cannot escape and rapidly accumulates, and forces all of the air out of the lung by compression, and the respirations become frequent, 60 or more per minute.

In *Tetanus*, thoracic oppression, dyspnœa, and more or less cyanosis follow interference with the respiratory function, especially if there is spasm of the glottis.

The treatment of dyspnœa is the treatment of the various diseases with which it is associated.

James Rae Arneill.

EAR: ANATOMY OF THE TYMPANIC MEMBRANE AND OSSICLES.—The tympanic membrane, membrana tympani, or drum membrane, is composed of three layers: viz., the external or dermoid layer, the middle or fibrous, and the inner or mucous layer.

The dermoid or skin layer of the membrana tympani is a continuation of the skin of the external auditory canal. In this layer, however, there are no hairs nor follicles, as are found elsewhere in the cutis of the auditory canal. In other respects it is true skin, but extremely thin and transparent. The outer or skin layer of the membrana tympani is the only one of the three component layers of the drum membrane which can be inspected directly from without. When the auditory canal is illuminated and a normal membrana examined from without, several prominent features in it attract the observer's attention: viz., its almost circular shape, and peculiar polish and color; its vertical and horizontal inclinations; the ridge formed in one of its radii by the handle of the hammer bone; the short process at the upper end of the latter; the folds of the membrana; the flaccid portion of the tympanic membrane, the portion above the short process of the hammer, the so-called Shrapnell's membrane; the white, tendinous periphery of the membrane; and, finally, the bright, triangular reflection of light in the antero-inferior quadrant of the membrane, running from the lower end of the malleus, at the centre of the membrane, the umbo, toward the periphery. This reflection is called the "pyramid of light" (see Fig. 1678). Generally a delicate plexus of vessels can be seen in the region of the folds and in the membrana flaccida, and one or two delicate arterioles can be traced downward along the manubrium of the malleus.

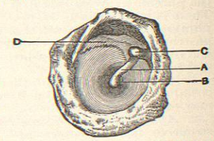

Fig. 1677.—View of Outer Surface of Membrana Tympani. (Gruber.) *A*, malleus, manubrium; *B*, lower end of manubrium; *C*, short process; *D*, posterior fold of the membrana.

For purposes of convenient description, the membrana tympani is called circular in shape. Its form, however, varies between that of an ellipse and an irregular oval, while in some cases, in which the lateral portions of the

annulus tympanicus are especially curved outward, it assumes a heart shape. Strictly, it may be considered an ellipse, the long diameter of which, amounting to 9 or 10 mm., runs from above and in front downward and backward, and the shortest diameter of which runs from below and in front, upward and backward. The proportion between these diameters is 4.3‴: 4.0‴ (Von Troeltsch and Hyrtl). Since the difference between them is so slight, and their inclinations are so nearly vertical and horizontal, the outline of the tympanic membrane is considered circular, and is divided into quadrants by the horizontal and vertical diameters, which greatly aids in locating points to be described.

Fig. 1678.—The Normal Membrana Tympani.

Color.—The normal color of the membrana tympani is not constant, because it varies, just like the color of the teeth, with the individual. As the latter varies from a bluish to a yellowish-white, so the drum membrane varies, in a perfectly normal condition, from a bluish to a yellowish-gray, the former being the commoner tint. This color is generally spoken of as a "pearl color," but, whatever color the tympanic membrane possesses, it is always modified by the physical conditions incident to stretching a nearly transparent membrane over a darkened cavity.

The color of the membrana tympani is furthermore modified by the color it transmits from the tympanic cavity, the latter factor being modified by the varying degrees of tenuity of the membrana, as well as by the varying conditions and colors of the mucous lining and the contents of the tympanic cavity. That part of the membrana tympani behind the lower end of the manubrium, and over the promontory of the cochlea, is rendered yellowish-gray by the rays of light reflected from this part of the inner wall of the tympanic cavity.

The membrana tympani owes its peculiar lustre to the delicate and shining epithelium of the skin layer. The slightest maceration, exfoliation, or thickening of this delicate epithelium deprives the membrane of its beautiful gloss. The dermis of the membrana is thickest in children, and hence their membranæ rarely shine as brightly as those of adults.

The Inclinations.—Another important feature attracting the eye of the observer is that the membrana tympani, in its normal condition, is inclined outward in its vertical plane at an angle of 45°, and in its horizontal plane ten degrees toward the right on the right side and ten degrees toward the left on the left side. If the planes of both membranæ be extended downward until they intersect, the angle they will then form will be equal to from 130° to 135°. Of still greater importance than this, however, is the direction of the walls of the auditory canal from the plane of the membrana tympani. Thus if a perpendicular be drawn from the upper pole of the drumhead to the inferior wall of the auditory canal, it will strike the latter about 6 mm. from the inferior pole of the membrane. A similar result will be obtained by drawing a perpendicular from the middle of the posterior periphery of the drum membrane to the anterior wall of the auditory canal, from which it is manifest that the lower anterior part of the membrana is farther from the external opening of the canal than the posterior upper part is. The membrana tympani is inclined the most in very young children, being almost horizontal in the early years of life. As the osseous canal does not exist at this early period of life, the upper part of the membrana tympani lies very near the external meatus at this time.

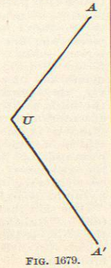

Fig. 1679.

In some instances there is observed a physiological variation in the obliquity of the membrana tympani, and a filling in of the segment of Rivinus (the region of the membrana flaccida) with osseous tissue. Hence on inspection it is found that a large portion of the field at the fundus of the canal is taken up by the upper wall of the canal, which seems to dip down to join the membrana tympani on a line with its folds. In such cases there is very little or no membrana flaccida. This condition is observed in the feeble-minded with other cranial defects in development. Moos and Steinbrügge observed in a cretin, with defective cranial development, a difference of 40° in the inferior angle of the membrana tympani, on each side. In such cases the difference may be from 10° to 50° greater than normal.

The Handle of the Malleus.—Running from above downward and backward to the centre, or umbo, of the tympanic membrane is seen the ridge formed by the *manubrium* or handle of the hammer. This slightly elevated ridge, entirely opaque and decidedly whiter than the surrounding membrana tympani, is in the diameter which divides the tympanic membrane into two unequal parts, the anterior being the smaller and the posterior the larger. At the upper end of this ridge is the short process of the malleus, projecting sharply outward, somewhat above the general surface of the handle of the hammer. In general appearance it is not unlike a pimple with pale-yellowish contents. The lower end, or tip of the ridge, which curves slightly forward, is flatter, broader, and yellower than the rest of the outer covering of the manubrium. This is due to the fact that the bone at this point is spade-shaped, and also because the radial fibres of the middle layer, the *membrana propria*, centre at this lower end of the handle. The lower end of the hammer draws the membrana tympani very markedly inward, and forms the depressed centre of the membrane called the *umbo*. The concavo-convex shape of the drumhead from the tip of the manubrium outward toward the periphery is due to the comparatively large number of circular fibres at a point between the umbo and periphery, which constrict, as it were, the radial fibres so as to form a kind of funnel.

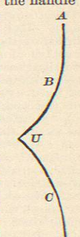

Fig. 1680.

Pressure or traction applied to the centre of a membrane stretched over a ring tends to draw the former into a conical shape, a vertical section of which is represented by the line *AUA'* in Fig. 1679. But if a smaller concentric ring be placed at *BC*, in Fig. 1680, so as to resist the indrawing force at *U*, the curve assumed by the membrane will be represented by the line *AUA'* in Fig. 1680, and the whole membrane will be drawn into a concavo-convex surface, the line *AUA'*, Fig. 1680, representing on the right-hand side the curve of the tympanic membrane on its outer surface.

The yellow spot at the end of the handle of the malleus, in the centre of the umbo, is a purely physiological condition. It is, in fact, part of the cartilaginous structure at the end of the manubrium of the hammer.

Trautmann[1] concluded that: 1. Its physiological significance is the same as that of an epiphysis of a long bone. 2. The diagnostic value of the yellow spot is apparent in cases of thickening of the membrana tympani, as the former will disappear much sooner than the sharp edge of the malleus. 3. Opacities of the membrane with thickening change the color of the yellow spot. 4. When the malleus is twisted on its long axis the form of the spot will be altered. 5. If the spot does not move during alterations in the atmospheric pressure in the canal induced by the pneumatic speculum, it is fair to conclude that either ankylosis of the malleus or its adhesion to the inner wall of the drum cavity has occurred. In the latter instance, the differential diagnosis is aided by the necessary foreshortening of the handle of the hammer.

Folds of the Membrana Tympani.—From the short process of the manubrium of the malleus two delicate ridges may be seen, one passing forward, the other backward to the periphery. These are the so-called folds of the mem-