In the other patient I have found it not only impossible to have this patient learn to ride the bicycle, but even to use what is called the "Home Trainer" in the house. The simple revolution of the pedals of the bicycle, without propulsion and almost no resistance, for five or ten minutes always induces such severe pains that the experiment has been given up, though persistently pursued for some time. And yet both these subjects will use the same muscles with equal energy for other purposes without ill results. For example, I have known the first subject to haul furniture about a room, and make quite violent muscular action which she strongly desired without the slightest pain following, although the gymnastic movements above referred to always resulted in pain. The second patient is able to walk quite long distances, go up and down stairs, etc., also without pain.

In both these cases it has been manifest that the development of pain with muscular exertion depends very largely upon the attitude of mind of the patient. When the muscular action is a customary one, or one that is enjoyed and desired by the patient, the pains do not usually follow unless the patient is fatigued; but when the muscular exertion is a novel one, involving new co-ordinations of movements, or is disagreeable and not to the taste of the patient, the pains always follow. The explanation of this difference is, that in the latter class of cases much more effort of will and nervous energy is required than in the former class.

The most probable explanation of the phenomenon itself, it seems to the writer, is this diffusion of nervous energy intended for the muscles to sensory centres. This may be the cause of the pain in torticollis and some of the occupation neuroses in which muscular spasm plays a prominent part. Why in certain cases special sensory areas should be excited in preference to others must depend upon various intricate conditions which we are not yet in a position to define, but among them will be found the natural anatomical and physiological associations of the brain on one hand, and such antecedent pathological conditions on the other as may have originally excited directly these sensory areas and brought them into close association with the other centres in question.

Habit Symptoms.—It is very common for secondary symptoms of this kind, as well as original primary symptoms, to persist long after the pathological condition which gave rise to them has ceased to exist. They then continue as habit symptoms, and may complicate the original neurosis, or persisting alone may give rise to a pseudo-neurasthenia or hysteria. It is not inconsistent with probabilities that the way in which this comes about is as follows: the frequent excitation of nervous processes of whatever nature (motor, sensory, vaso-motor, mental, etc.) in association with each other, or with any physiological act, tends to group them together and so unite them that the excitation of one of them or the performance of the physiological act, excites all the others. At first the nervous processes (symptoms) are pathological; but with every repetition of the excitation the union of the different members of the group becomes firmer until finally any thing that excites one member excites the rest. For example, let us take the pain in the eyes (above discussed) brought on by effort in neurasthenia. At first this depends on fatigue and the increased effort needed to overcome this condition. By frequent repetition this pain becomes associated with

contraction of the muscles of accommodation and of the eyeball, etc. The final result is that after fatigue has passed away, any use of these muscles brings on the same pain which then becomes a habit pain. Habit symptoms, or association symptoms, of this kind are in their nature truly functional, and if this interpretation be correct, depend upon the same physiological law upon which all education depends. It is owing to the same law that we are able to acquire the faculty of language, the mechanical arts, the art of music, painting, —in fact, all acquirements and knowledge. The musician who sees a bar of musical notation before him, hears at once the sounds of various orchestral instruments necessary for the score, and his fingers automatically strike the keys of the instruments that will reproduce the sounds. The auditory images, the visual images and the motor impulses are all associated in one group. These are all physiological habits. The essential difference between physiological habits and pathological habits is that one is the result of voluntary education and is agreeable, and the other is the result of involuntary education and is disagreeable. The law which governs the two classes is the same. The nervous system has not two laws, one for pleasant feelings and desired acquirement, and one for unpleasant feelings and undesired acquirements; but the laws governing the nervous system are general not special.

But the sensations that accompany physiological habits may have an unpleasant character, their purpose evidently being to aid in the preservation of the species. Among such habits may be mentioned the feeling of hunger and the local gastric feelings that are felt at a particular hour of the day, that is, in association with various daily actions. If the dinner hour is changed, say from 1 to 2 o'clock, these feelings after a time are correspondingly delayed and a new habit formed. Likewise the feelings in connection with a desire to urinate, which may become associated with various social habits, and from this cause may become so frequently excited as to become a neurosis, as I have seen in several cases.

(To be continued.)

CHANGES IN THE TURBINATED BONES IN CONNECTION WITH DEFORMITIES OF THE SEPTUM.¹

BY A. COOLIDGE, JR., M.D.

THE path travelled by the air in respiration between the external nostril and the naso-pharynx is bounded throughout by the septum as its inner wall. From the outer wall, for the greater part of the distance, project the turbinated bodies, which much diminish the lumen of what would otherwise be a wide passage. At each end the lumen contracts, forming an entrance and exit to the central nasal cavity, and at these points the outer wall is simply an arch of bone; the nasal process of the superior maxillary in front and the internal pterygoid plate behind (Fig. 1). These arches are in most skulls fairly symmetrical.² The posterior border of the vomer, which forms the free edge of the septum as seen in the posterior nasal mirror, is almost always perpendicular, so that the passages from the

¹ Read before the Boston Society for Medical Improvement, March 7, 1898.

² See Harrison Allen, *Transactions American Laryngological Association*, vol. x.

two nasal cavities to the cavity of the pharynx are in most skulls the same in size. But in the rest of the septum and the turbinates irregularities are so common that asymmetry is the rule.

The entrances to the nasal cavities, between the cartilaginous septum and the nasal processes of the maxillary bone, or soft parts in front of them, are often of unequal size. The septum is here often bowed or bent, and this must necessarily contract the lumen of one of the passages. This point is anterior to the erectile structures of the turbinated bones, and consequently the area of cross-section of the air-channel is not constantly varying, as it is within the nasal cavity proper. A small degree of narrowing of one or both sides at this point is of no consequence; a greater degree must necessarily cause a perceptible obstruction to breathing.

Horizontal section through nasal cavity a short distance above floor.

Deviation of the septum and adjustment of the turbinated bodies.

My object here is to discuss those changes in the size and shape of the turbinated bodies which we find almost constantly opposite deformities of the septum, and I therefore leave out of consideration all cases in which there is irregularity of the anterior portion of the cartilage of the septum in front of the turbinates.

Within the normal nasal cavity by the varying turgescence of the erectile tissue of the turbinated bones the area of cross-section of the air-channel is constantly changing, increasing with an increased demand for air, either on account of increased bodily activity or on account of temporary obstruction of the other side, and decreasing again when less air is demanded by the lungs. These respiratory channels through the nasal cavities tend to take the shape of slits rather than of cylindrical tubes, a manifestly better device for warming and moistening the inspired air (Fig. 3). In such an organ it is evident that the slightest departure of the septum from a perpendicular plane would seriously obstruct one nostril and widen the other, unless there were a corresponding change in the size and shape of the turbinated bones or of the tissue covering them. This change is found pretty constantly in cross-sections of skulls; but it is much better studied clinically; that is, the change in shape of the turbinated bodies is due to a change in size and shape partly of the bones, partly of the soft parts covering them. The ethmoid cells also often take

part in such changes as affect the middle turbinated bone.

The nasal septum, both bone and cartilage, is in most skulls bent more or less out of a perpendicular plane. This bowing may be simple or sigmoid or irregular, and may extend for a longer or shorter distance in a horizontal (Fig. 2) or perpendicular (Fig. 4) direction, or in both. There are also commonly found certain spurs or ridges of cartilage and bone, following the lines of suture between the triangular cartilage and the septal bones, and occurring more frequently on the convex side of a bowing septum. These outgrowths obstruct one of the nasal cavities in the same way that a deviating septum does, but without any corresponding concavity on the opposite side. These spurs, or the convexity of the septum itself, may come in contact with one of the turbinated bodies,

but in the great majority of cases they do not; the turbinates recede, and the air channel is maintained. Conversely, in the opposite or concave side the turbinated bodies advance, equalizing the air-carrying capacity of the two passages (Figs. 2 and 4). The accuracy of this adjustment is often very pretty. A localized depression in the septum is accompanied by a bulging of that part of the turbinated bone which is just opposite to it; or a ridge running the greater length of the upper border of the vomer has opposite to it an oblique furrow in the lower turbinate. It is only when the ridge projects so far that the turbinated bone is crowded to the wall, as it were, that a permanent contact takes place.

Taking up the subject from a clinical standpoint I will begin with the following propositions, and then speak of each separately:

(1) Within the nasal cavities nature attempts to maintain slit-shaped channels for the passage of air, to avoid contacts and to keep the air-carrying capacity of the two sides approximately equal. This is done by change in shape of the turbinated bodies to correspond with deformities of the septum. From this it follows

(2) That the question of pathological hypertrophy or atrophy of a turbinated body must be judged not from its actual size but from the width of the air-passage. A turbinate should be large if it is opposite

a concavity in the septum; in fact, a normal-sized turbinate in this position is pathological.

(3) Consequently, in treatment, the removal of such a turbinate is not indicated, except possibly in connection with operations on the septum.

(4) We do not know to what this vicarious change in the size of the turbinated bodies is due.

I am aware that these propositions differ to a greater or less extent from the orthodox teaching of many of our text-books. The anatomical facts have long been observed, notably by Zuckerkandl,² but the explanation has generally, it seems to me, involved too much pathology. A twisted septum may justly be considered pathological, but an adjustment of the turbinated body to that twisting should not be called hypertrophic or atrophic rhinitis.

In order to judge of the clinical importance of this

Fig. 3.
Perpendicular cross-section through the nasal cavities.

central bowing of the septum, compensated by these changes in the turbinated bodies, I have asked a large number of patients to tell me which of the two nostrils was generally the more open. Among those in whom the deformity is not unusually excessive, and where the anterior inch of the septum is not obstructing, the common answer is that they have not noticed any difference. Where one side is thought to be more often obstructed than the other, even with those patients who had given attention to the subject, the concave side with the large turbinated body is as frequently chosen as the other. The relative proportion of air passing through the two nasal chambers is in many persons constantly changing, first one side and then the other taking less than its proper half. This is more true in cases of catarrhal disturbance, but it occurs also without other symptoms.

I do not wish to be understood as saying that a bowing of the septum in the nasal cavity does not affect the respiratory capacity of the nose. In a normal nose there is a great difference between the actual and the possible amount of air-space. The actual space is just enough to let sufficient air through and to warm and moisten it. The possible space is that which is made by shrinkage of the erectile tissues. This reserve space is useful when more air is needed by the body, or when one side is doing all the work. A bow-

ing of the septum necessarily diminishes the possible space of one side while the shrinkage of the turbinated bodies keeps the actual space sufficient for ordinary breathing. On the opposite side the enlargement of the turbinated bodies is often more than enough to make up for the increase in space due to the concavity of the septum, and consequently the possible space is diminished in this side also. The result is a decreased power of the nose to respond to a demand for more air, and an increased liability to stoppage on account of catarrhal swelling.

In the examination of a nose with the nasal speculum a large turbinated bone is easier to see than a localized bowing of the septum. This should be known by every one before he begins to judge of the appearances which he sees in the nose. A large turbinated bone should lead to a careful examination of the sep-

Fig. 4.
Deviation of the septum and adjustment of the turbinated bodies.

tum; and, as I said in my second proposition, the integrity of the turbinated body should be judged by the width of the air-space remaining between it and the septum (Fig. 4).

There are a large number of cases in which this adjustment has not, or has only partially, taken place. These cases are generally the ones which show distinct pathological symptoms, and so accentuate the fact that this adjustment is essential for preserving the functions of the nose. In cases in which this enlargement to fill a concavity has for some reason not taken place, or when the turbinated bone has been destroyed, most of the air goes through this side, the mucous membrane becomes dry, crusts may form, and we have the appearances of a unilateral atrophic rhinitis. Where a turbinated bone has not properly receded from a spur or a convexity, or cannot recede farther, we find contacts and obvious obstruction to breathing.

The more common operations for straightening the septum, the breaking up of the resiliency of the cartilage and the insertion of splints or tubes, such as that of Asch, affect principally the anterior portion and derive their brilliant results from opening a clear passage into the nasal cavity proper.

An operator may be tempted to attack the most obvious abnormality in a nose, one very large turbinated body; but operation directed to this enlarged turbinated body, simply because it is large, seems to me a

² Anatomie der Nasenhöhlen.

mistake. If we succeed in permanently diminishing its size, we have increased the air-carrying capacity of one side at the expense of the proper ventilation of the other side; we run the risk of destroying the normal functions of the nose and defeat a device of nature for minimizing the disadvantages of a bent septum. If we want more space we should open the narrow nasal cavity by removing ridges and bring the septum towards a perpendicular plane. This may bring the redressed septum into actual contact with the large turbinated bone on one side and leave a wide space between the septum and the small turbinated bone of the other (Fig. 4). But this is a condition which nature will be able to relieve by a readjustment in the shape of the turbinated bodies. This readjustment I have found in a few cases. My experience is that it is accomplished mostly by erectile tissue, but that sometimes, especially in young persons, the bone itself gradually changes its shape. It is sometimes advisable to remove part of the large turbinated bone after this redression.

In seeking for the cause which produces this change in the shape of the turbinated bodies to fit the irregularities of the nasal chambers, it seems to me that no local mechanical process is sufficient to explain it, and that we must look upon it broadly as a special power of adjustment given to the turbinates to enable them to fulfil their physiological duties, which but for this would be seriously hampered by even a slight bend in the septum. Other instances in which a deformity of some part of the body is followed by readjustment of neighboring parts are not uncommon. The shape of the face, and especially of the eyes in long standing cases of wry neck; and different changes in connection with deformity of the spine may be mentioned.

It has been suggested that the bending of the septum may be the effect and not the cause of the irregular turbinated bones; but in that case it is hard to see why the turbinated bones of the two sides should so act in harmony; neither is it likely that a part of a lower turbinated bone receding from a spur should be the cause and not the effect of the spur. Also the septum is especially liable to deformity anterior to the turbinated bones, where the external nasal walls are symmetrical and unyielding.

Other theories to account for this change are based upon the supposed action of the air current which, going with more freedom through the larger opening produces trophic changes in certain parts of the turbinated bodies, either by change in tension or by the impact of the air, causing local inflammatory processes or hyperemia or anemia. But as I have said before, there is not necessarily more air going through the concave side. Also the one or the other nasal channel may be obstructed anteriorly without affecting this adjustment.

In this connection I should like to call attention to two cases in which there had been congenital occlusion of the nares, and consequently no currents of air had passed through the nose. In both of these cases the septum was bent, and in both of them the turbinated bodies followed the irregularities of the septum.

The first case I saw by the kindness of Dr. J. P. Clark, who reported it before this Society on November, 15, 1897.⁴

The second case is briefly as follows: M. P., Swedish domestic, eighteen years of age, had a fever when

six years of age. Otherwise no history of any disease, either general or local. As long as she can remember she has never been able to breathe through the right nostril. Patient came to the Massachusetts General Hospital on September 9, 1897. She was then breathing comfortably through the left nasal passage, not being obliged to use her mouth except on exertion. The left cavity was normal. The right was separated from the post-nasal space by a plate of bone covered with mucous membrane. The posterior rhinoscopic mirror showed a normal posterior nares on the left side. On the right was a smooth surface continuous with the pharyngeal wall with no line separating it from the septum or the vault of the pharynx. This partition I drilled through with trephines and the patient now breathes well through it, although I have not yet completely removed it. The point to which I especially wish to call attention is the fact that there is a localized bowing of the septum beyond the middle of the nasal chamber, presenting a concavity in the right side opposite the lower turbinated bone (Fig. 2), and that there is a corresponding bulging of the turbinate towards this concavity, as in the case of Dr. Clark's, where the occlusion was bilateral.

In closing, I have only to add that it has seemed to me that the subject is one which has not received the attention which it deserves. This adjustment of the turbinated bodies is clinically so common that to a certain degree it might be said to be the rule rather than the exception; and still it is very lightly touched on in our text-books, and is a constant source of error to students and to practitioners with a limited experience in examination of the nose.

OBSERVATIONS ON MALIGNANT ADENOMA OF THE RECTUM.¹

BY A. T. CABOT, M.D.,

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IN malignant disease of the rectum the rational time for operation has usually passed when the surgeon first sees the case. The early stages of cancer of the rectum are painless, and the slight irritation felt at first is commonly disregarded. During the time thus lost the lymphatics become infected and any radical cure is thereafter hopeless.

Since Kraske's paper in 1885 the operative technique has been so improved that the removal of a growth in the lower bowel is not extremely difficult or dangerous. The ready access to the parts afforded by the posterior incision, with the removal or displacement of the lower part of the sacrum, enables us to make our dissection intelligently under the guidance of the eye and to readily control hemorrhage.

The upper part of the rectum is so movable that it can be drawn down for a considerable distance, and the peritoneum has no terrors for us when any opening made into it is in sight and can be closed by sutures. The exactitude with which operations of this region can be carried out greatly increases the chance of the radical cure of malignant growths there; but, in order that this cure may be accomplished, it is important to recognize these growths early.

Most carcinomata of the rectum, except the epitheliomata of the margin of the anus, have a distinctly

¹ Read before the Boston Society for Medical Improvement, March 7, 1898.

⁴ See Journal of February 24th, p. 171.