

And, in the Third Report of the General Board of Commissioners in Lunacy for Scotland, we learn that the results of 1858 and 1859 tend to show that females are more liable to lunacy than males.

I have no explanation to offer of this singular exception from other statistics of lunacy, that the males preponderate in numbers so much over female criminal lunatics.

This paper has already extended too far; and I therefore adjourn to another article what further particulars I have to offer on the mental disorders and diseases of the criminal class.

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ARTICLE V.—*On the Function of the Epiglottis.* By R. BEVERIDGE, Esq., M.B. Aberdeen, etc.

IN most anatomical works, the function of the epiglottis as a distinct part of the larynx is either omitted altogether, or is vaguely put down as in some way connected with deglutition, the precise *modus operandi*, however, being left unexplained. The following considerations may probably tend to render more precise our knowledge of this point.

The superior opening of the larynx is in direction oblique, commencing a little behind the root of the tongue, and sloping downwards and backwards. It is triangular in form, widest above and in front, and gradually narrowing to a point at its lowest and most posterior part. In the latter situation it corresponds to, and is in fact formed by, the summits of the two arytenoid cartilages; the fore part is formed by the base (or widest part) of the epiglottis, which separates it from the tongue; while laterally it is bounded by two folds of mucous membrane, which extend from the side of the base of the epiglottis to the summit of each arytenoid cartilage, and are usually termed the aryteno-epiglottic folds. These last form the greater part (fully three-fourths) of the margin of the opening; and it seems clear that, if the whole margin had been similarly formed, there would have been nothing to prevent these folds falling together in the same manner as do the walls and folds of the alimentary canal when empty. It is true that outside them, on either hand, are the great horns of the hyoid bone and the upper border of the thyroid cartilage; but a slight glance at the parts is sufficient to show that these are too far off and too loosely connected with the folds in question to have any effect in keeping them asunder, and thus maintaining the opening between them patent. This effect seems to be produced solely by the epiglottis, which, by its vertical position and its great elasticity, not only keeps permanently asunder the anterior ends of the folds, but also keeps them constantly tight, and that, too, whatever may be the position of the larynx in the neck. It might at first sight be supposed that such an effect could be as well produced by the connection of the two folds with the side of the base

of the tongue, without the intervention of such a body as the epiglottis; and so it would, if the larynx had been either motionless or moveable only along with the tongue; but the larynx admits of a very considerable amount of motion in the neck as a means of modifying the note of the voice, and, but for the presence of the epiglottis, the raising of the larynx would have slackened the two folds so much as to have allowed them to fall together, and so close the opening. The attachment, however, of the epiglottis by its narrow-pointed lower extremity to the angle of the thyroid cartilage, causes it to move upwards and downwards along with the larynx; and in this manner the folds forming the lateral boundary of the superior opening of the larynx are kept permanently tense, and the constant patency of that opening is secured.

But why should the epiglottis be formed of fibro-cartilage instead of cartilage, as are the other pieces of the larynx; or, in other words, why does it require to be more flexible than the rest of the larynx? The answer to this involves the consideration of its function with regard to deglutition.

The epiglottis is itself of a triangular or leaf-like form, having its broad upper end immediately behind the tongue. This upper end is rounded, the central portion of it being free, while the lateral have attached the aryteno-epiglottic folds. Immediately below this the epiglottis is placed in the hollow or curve formed by the hyoid bone, to the body of which it is attached by elastic tissue, and, narrowing rapidly below this, is connected by its lower end with the retiring angle of the thyroid cartilage. Its position is thus vertical, and, so long as it remains so, it will keep tense the aryteno-epiglottic folds. This vertical position is in no ways affected by the raising or lowering of the larynx in the production of the different notes of the voice, for during these movements the hyoid bone and larynx move together. This simultaneous movement is, in fact, the only one producible by the muscles called into play; for the larynx is raised by the action on the hyoid bone of the digastric and stylohyoid, and *perhaps* also of the genio-hyoid and mylo-hyoid muscles;<sup>1</sup> while it is lowered by the joint action on the hyoid bone and larynx

<sup>1</sup> I put the latter as *perhaps*, because I am under the impression that these last do not act but in deglutition. There is this important difference between the raising of the hyoid bone and larynx in speaking or singing and the same movement in swallowing, that in the former the movement is effected while the lower jaw is depressed and the mouth open, while in the latter the lower jaw is always raised and the mouth firmly closed. It would seem probable, therefore, that the elevation in the former case is performed by muscles independent of the jaw, as the digastric and stylo-hyoid, which act from the cranium, while those taking their fixed point from the jaw will act only in the latter case, when by the elevation and fixing of the jaw they will obtain a firm point of action; and this is rendered still more probable from the circumstance, that in the former case the larynx is inclined slightly backwards, while in the latter case it is decidedly pulled forwards—motions which correspond with the varying directions in which the two sets of muscles act.



of the omo-hyoid, sterno-hyoid, and sterno-thyroid muscles, which, acting together, will draw the whole down in one mass. In deglutition, however, the epiglottis no longer remains vertical, but is bent upon itself in the following manner:—The mouth being closed, or the lower jaw fixed, the hyoid bone is raised, and then, by a sort of spasmodic action of the thyro-hyoid muscles, the thyroid cartilage is drawn up by a jerk, so as to come upon and slightly overlap the hyoid bone. By this means the lower part of the epiglottis is made to bear upon the under part of the hyoid bone; and the result is, that the upper part is turned backwards, the aryteno-epiglottic folds are relaxed, they collapse and fall together, and thus the superior opening of the larynx is closed. The curved position thus given to the epiglottis is only momentarily retained; for its elasticity almost immediately forces down the thyroid cartilage, thus restoring itself to its vertical position, and so tightening the aryteno-epiglottic folds, and again opening the superior orifice of the larynx. It would appear as if this movement required the whole power of the muscles in order to overcome the elasticity of the epiglottis; for the effect is but temporary, and no effort of the will can prolong it, nor can it be very rapidly repeated. There seems to be in most cases a small muscular slip present in each of the aryteno-epiglottic folds, to which some ascribe the function of lowering the epiglottis; but, setting aside the difficulty of seeing how so weak a muscle could overcome the elasticity of such a body as the epiglottis, whose chief attachments are in front, its action could in no way account for what evidently takes place—the sudden and spasmodic raising of the thyroid cartilage. It is probable enough, however, that after the aryteno-epiglottic folds are relaxed in the way I have described, this muscular slip may assist in the manner of a sphincter in closing the opening.

On this view, the function of the epiglottis might be shortly stated to be the keeping open the superior opening of the larynx by its elasticity maintaining the aryteno-epiglottic folds in a state of tension; and when bent upon itself by the jerking upwards of the thyroid cartilage, to slacken these folds, and so momentarily to close that orifice during deglutition.

Müller indicates as a further function of the epiglottis, one connected with the voice,—that, “by being pressed down so as to cover the superior cavity of the larynx, it serves to render the notes deeper in tone;” adding, in support of this view, the remark, “at least, such seems to be the object of the retraction and depression of the tongue while we press down the head in front, in endeavouring to produce very deep notes.” For the reason indicated above, I do not see how the position of the epiglottis can be affected in any other way than that pointed out, and therefore doubt the accuracy of Müller’s explanation. It seems more probable that this lowering of the chin in producing very deep notes is for the purpose of relaxing the parts between the lower jaw and hyoid bone, and thus permitting the depressors of the larynx to lower it as much as possible in the neck.