the diaphragm is adherent to the somatic wall just opposite the brachial plexus and developing limbs, and the backward course of the nerve is caused by the increased size of the heart and lungs, and the consequent pushing backwards of the diaphragm. It appears to me that from the nerve-supply of the muscle we are supplied with a hint that ontogenetically the diaphragm is related to the same muscular stratum as the infra-hyoid muscles.

ON THE MECHANISM OF THE NOSE AS REGARDS RESPIRATION, TASTE, AND SMELL.¹

By GREVILLE MACDONALD, M.D.LOND.,
Physician to the Throat Hospital, Golden Square.

CERTAIN experiments I have lately been making on the functions of the nose as regards the raising of temperature and hygrometric condition of the inspired air, as well as certain deductions from clinical observation, have appeared to me of sufficient importance to bring under your notice and criticism.

By the simple device of connecting a tracheotomy cannula with one nostril, I have proved it possible for a tracheotomy patient to breathe through the nose, the inspired air passing in at one nostril and out at the other. By a valvular arrangement attached to the tracheal end of the connecting tube, the expired air is prevented from passing into the nose; while in the nasal termination a sensitive thermometer is placed which will indicate the temperature of the inspired air after traversing the nasal cavities.

Next it occurred to me that it would be a perfectly simple matter to connect the tracheal end with the mouth instead of to the trachea, and that so experiments might be made upon ordinary individuals. And it is in this manner that my experiments have been conducted. I find that the effort at drawing the air through the tube attached to the mouth is sufficient to close the post-nasal space completely, and so cut off the nasal from the buccal cavities. And this contraction of the soft palate is quite involuntary, or at least unconscious. But, to prevent all source of error, I have employed a valvular arrangement similar to that used on the tracheotomy patient.

The same method of passing the air through the nose was adopted in estimating the hygrometric condition. A measured bell jar was held over water by an assistant who allowed it to sink as the air was exhausted by the lungs. Connected with the upper opening of this was a vessel containing chloride of calcium, which in its turn carried tubing fastened in one nostril. Thus, a measured quantity of dry air would pass through the nose. The connection between the other nostril and the mouth contained in its course three chloride of calcium tubes, which abstracted the moisture contained in the air after passing through the nose. The whole of this circuit was weighed before and after the passage of a known quantity of dry air through the nose, the difference giving the hygrometric condition.

First, let me give you some results of my observations on temperature:

At - 7° C.,	the air was raised to 28.8° C.
At 1.7° C.	" " 35° C.
At 7° C.	" " 34° C.
At 12° C.	" " 35.6° C.
At 45° C.	it was reduced to 33.6° C.

These are but a few of a great number of experiments on different individuals. *Cæteris paribus* the robust raise the temperature two or three degrees higher than the anæmic. A noteworthy fact is that cocaine, by inducing collapse of the inferior turbinated bodies, will lessen the acquired temperature by two or three degrees. Doubtless this throws some light on the functions of these structures, although it would appear that they are not directly of much importance in imparting caloric.

In estimating the quantity of aqueous vapour absorbed, I find that it varies considerably according to the barometric pressure in the nose. For instance, I found that any alteration in the arrangement of the tubes causing respiration to be more difficult increased the amount of water, and *vice versa*. Hence any degree of stenosis in the nose would result in an additional degree of saturation in the inspired air. In most of my experiments there has

been more or less obstruction to easy respiration, and in some the weight of aqueous vapour has almost doubled that of saturated air at the temperature of the nose and the external barometric pressure. One may consequently assume that the air on passing through the nose is always saturated with water as well as raised to the temperature of the blood, and that the usual statements in the textbooks as to the quantity of moisture exhaled by the lungs are incorrect. Ordinarily, there must always be a *minus* pressure in the nose during inspiration and a *plus* during expiration, and one may even suppose a slight deposit of dew in the respiratory passages during expiration, this excess of moisture being reabsorbed by the next inspired air. Cocaine applied to the nasal mucous membrane has the effect of slightly lessening the amount of moisture absorbed.

Remembering the latent heat of aqueous vapour, and that it is when the external temperature is lowest that the most water is vapourised in the nose, one realises the enormous quantity of heat given up by the nose.

A consideration of the course pursued by the inspired current of air will bring me to these points in connection with the senses of smell and taste which I am venturing to bring under your notice. The orifice of the nostrils lies for the most part a quarter of an inch or so below the floor of the nasal fosse. This arrangement obviously tends to give some of the indrawn current an upward as well as a backward direction, so that the middle as well as the inferior meatus is used for respiratory purposes. That such is the case we can readily satisfy ourselves by considering the changes in position of the *alæ* during olfaction. In the presence of an unpleasant smell, we instinctively "turn up the nose," in common parlance, or, in other words, contract the *levator labii superioris alæque nasi*, and so bring the external opening of the nose on a level with the floor of the inferior meatus. Contrarily, when we wish to enjoy an agreeable odour, we sniff it up, or, in other words, depress the upper lip and with it the *alæ*, thus directing the inspired air more towards the olfactory region. The influence of these movements on the perception of smell can be submitted to very simple experiment.

I have frequently noticed in cases of obstruction in the middle meatus from the presence of nasal polypi, etc., a deepening in the furrow running from the angle of the nose to that of the mouth, and for a time I was much puzzled to account for it; but as it is obviously caused by a constant contraction of the *levator labii superioris alæque nasi*, we may consider it as a result of the effort to facilitate respiration through the inferior meatus. One might even classify the muscle as one of those accessory to inspiration.

The olfactory nerve is divided into two main divisions, an anterior and a posterior, the former being distributed over the middle turbinated body and septum, while the latter is consigned to the superior spongy body. This latter again is almost, if not quite, sheltered from the inspired air by the overshadowing middle turbinated, so that it can hardly take part in what is commonly designated as smell. With expiration, however, its position and importance is reversed. The expired air is driven vertically upwards, and odoriferous particles from the mouth, such as flavours, would take the same course. In each case the superior turbinated bone would lie exposed to their influence; so that I am venturing to ask the question, Mr. President, whether we might not aptly pay some consideration to the subjective distinction between smell and taste, that is, the perception of flavour, and assign to the superior spongy body the latter sense, reserving the middle spongy for simple olfaction?

Certain clinical observations have considerable weight in my argument. In inflammatory and other affections of the nose it is very frequently observed that smell is abolished without taste being deteriorated. Moreover, I have frequently heard such patients aver that, although they have altogether lost their sense of smell, they can sometimes *taste*, as they say, bad odours when forcibly inhaled through the nose. This last observation further suggests to me that on the superior spongy being reached either by inspiratory or expiratory efforts, in either case the nerve-stimulation is interpreted subjectively as taste rather than smell.

PRESENTATION.—Mr. Cecil G. Westropp, L.R.C.P., M.R.C.S.I., on resigning the post of medical officer of the Derrylin Dispensary District to practise at Monkstown, has received several farewell addresses from local bodies, together with a handsome timepiece and salver.

PROFESSOR SCHÄFER'S textbook of histology has been translated into German by Professor W. Krause.

¹ Read in the Section of Anatomy and Physiology, at the Annual Meeting of the British Medical Association, held in Glasgow, August, 1888.