

No 4

A NEW ÆSTHESIOMETER.

BY LEWELLYS F. BARKER, M. B.

[Exhibited to the Johns Hopkins Hospital Medical Society, January 18th, 1897.]

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## A NEW ÆSTHESIOMETER.

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I exhibited at this Society some time ago the test hairs employed by Professor von Frey in studying pain and pressure sense. These consisted, it may be recalled, of short wooden handles of suitable length, to which finer and coarser hairs were fastened at one end at right angles with sealing wax. The most suitable form is perhaps a four-sided wooden handle measuring 4 mm. on each side and 80 mm. in length. Hairs of different strength are obtained from the scalp of men, women and children; hairs from the beard, from the horse's tail and hog bristles are also of service where stronger

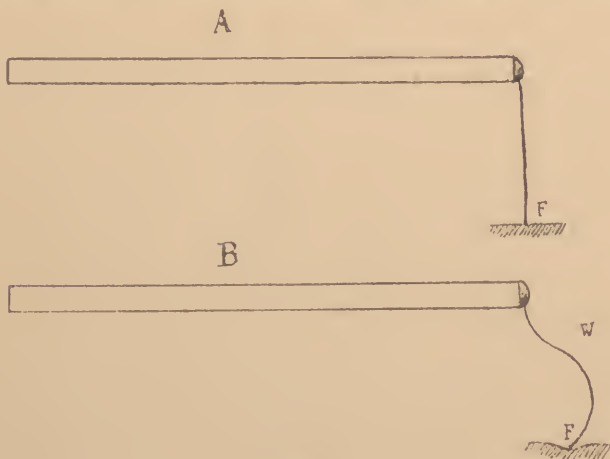
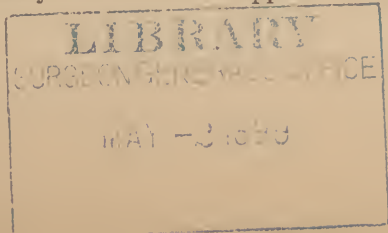


FIG. 1.

stimuli are required. The advantage of these test hairs consisted, it will be remembered, (1) in the very small surface of skin acted upon, and (2) in the possibility of grading accurately the intensity of the stimulus applied. In order to test



the stimulus-value of the hair, its area in cross section must be determined, as well as the weight which can be lifted by the hair when it is pressed with its cross section against one of the scale pans of a delicate balance. I described on the former occasion the methods of determining these two constants and shall not now repeat the details. Suffice it to say that with time and patience a set of such test hairs can be prepared varying in stimulus-value from 0.1 gr./mm<sup>2</sup> to 300 gr./mm<sup>2</sup>, though, as Professor von Frey says, the preparation of them is "nicht jedermanns Sache."

The form of the hair and its mode of action are shown in Fig. 1. A represents the test hair when it is placed upon the skin at the point F, though as yet no pressure has been exerted. In B the handle is nearer the skin, through pressure made parallel to the surface of the skin, and the hair is bent into an S-shaped curve, the turning point of which is at W. If W is perpendicularly above the point F, then the hair exerts exclusively an influence of pressure upon the skin; but if W be directed to one side, there arises along with the pressure a "shoving" component. The latter appears, as one finds on bending the hair, as soon as it begins to twist out of one plane; that is, a space-curve arises instead of the plane-curves.

The set of hairs which I pass around were prepared under Professor von Frey's direction in Leipzig in the spring of 1895. I have tested them at intervals since that time and find that they have undergone very little variation. For accurate testing of pressure and pain sense some such delicate testing mechanism is indispensable. Such hairs, however, are not in the market, and I fear if one wished a set of them he would have to prepare them for himself.

Recently, however, Prof. von Frey, with the aid of the mechanic Zimmermann, has prepared a simple instrument which, for purposes of clinical examination at least, will take the place of the set of test hairs. This *æsthesiometer*, which depends upon the same principle as that involved in the construction of the test hairs, has the advantage that with a single hair one can obtain a large series of pressure values at will. It consists of a long hair pushed through a capillary tube of very narrow lumen, much like that of a thermometer tube; the hair can be shoved through the lumen

easily, but on pressure only the part of the hair outside the capillary tube can bend, and the force exerted is always greater the less the amount of hair outside the tube, and feebler the greater the length of hair not inside the capillary tube. In Fig. 2 the mechanism is shown, though the sample which I pass around has some improvements not illustrated in the figure. The capillary tube consists of a brass tube, S, of very narrow bore, over which a sheath H glides with slight friction. In the axis of the sheath, and of the same length as this, runs a wire, which fits in the bore of the tube S, and at the end of which the test hair is fastened. If the sheath be shoved entirely over the scale the hair projects in its greatest length, and has accordingly only very slight force. On the other hand, if the sheath be drawn back as far as possible the greatest part of the hair disappears within the bore, and the short still projecting part is capable of exercising very considerable pressure force. By means of a screw the sheath can be held firmly in any position corresponding to a test hair of any desired length. There is a millimetre scale on the tube, by the help of which a given length of test hair can always be found again, together with a protecting tube for the free end of the hair to complete the instrument.

The testing of the hair for its pressure values at different lengths can be carried out with the aid of a delicate balance, and if one makes determinations for every fifth or tenth line of

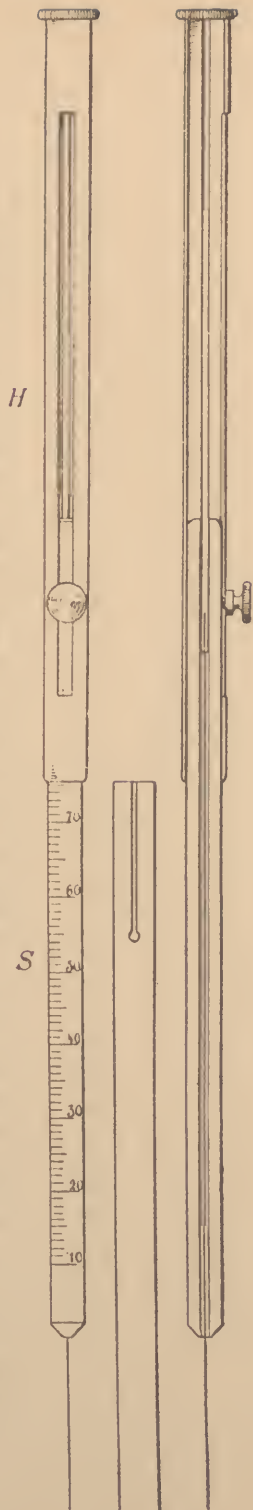


FIG. 2.

the millimetre scale he can easily calculate the values for the intervening lines. With this instrument it is easy to pass from very low pressure values, even below the threshold for the most delicate pressure points, to pressure values above the pain threshold in parts of the body where the pain threshold is high.

The value of this instrument was demonstrated with Dr. Cushing in the ward the other day. In a case in which ordinary slight stimuli appeared to call forth pain constantly, the idea had arisen that pressure sense was absent, the pain sense being very much exaggerated. It was easy with this instrument to show that the pressure sense was not abolished, though the threshold for pain was almost at the same level as the threshold for touch. With care, however, the pressure points could easily be made out. The significance of careful examinations in such cases is obvious, for it would be easy for the clinician to make the statement that tactile sense was destroyed in a given case in which in reality it was unaffected or but little affected. If such a case should come to autopsy, one might be entirely misled in interpreting the lesions found.

The æsthesiometer is not expensive, costing I believe five marks, when purchased from E. Zimmermann of Leipzig. I cannot recommend it too highly for use in clinical examinations.



