

on the morning of the following day he observed the comet rise just before the sun at Simon's Bay, and says he will never forget the beauty of the scene. Many drawings of the comet were made at the Cape Observatory, and some photographic pictures were obtained with the assistance of Mr. Allis, of Mowbray. To obtain a perfect picture of the more delicate details of the comet, an exposure of not less than half an hour was found to be necessary.

The following places are abbreviated from an ephemeris calculated by Mr. Chandler from his last elliptical elements:—

At Greenwich mean noon.

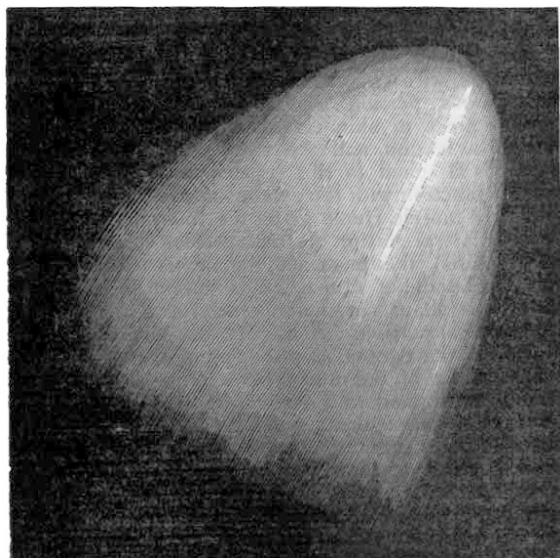
	Right Ascension.	Declination.	Log. distance from
	h. m. s.	° ' "	Earth. Sun.
December 7	8 31 41 ...	-29 42'7 ...	0'1868 ... 0'3110
9	8 25 28 ...	29 57'6 ...	
11	8 19 10 ...	30 9'8 ...	0'1917 ... 0'3250
13	8 12 48 ...	30 19'1 ...	
15	8 6 24 ...	30 25'5 ...	0'1978 ... 0'3384
17	7 59 58 ...	30 28'9 ...	
19	7 53 33 ...	30 29'3 ...	0'2051 ... 0'3512
21	7 47 9 ...	30 26'8 ...	
23	7 40 49 ...	-30 21'4 ...	0'2137 ... 0'3635

Up to Nov. 6 the comet discovered by Mr. Barnard had been sought for unsuccessfully at the Cape Observatory.

We have received the following communications on the comet:—

WITH the permission of Vice Admiral Stephen C. Rowan, U.S.N., Superintendent of the Observatory, I send you a sketch made at 17h. Washington Mean Time, November 15, with the 26-inch Washington equatorial. At the time of observation the head of the comet was about 45 minutes east of the meridian.

As it is extremely difficult to represent such an object faithfully in a woodcut, I will call attention to the fol-



Comet δ , 1882, November 15'7, U.S. Naval Observatory, Washington.

lowing points:—The nucleus presents a very woolly, nebulous appearance, with a main point of condensation, almost circular; near its following end, and about 18" from this towards the tail, a second point of condensation, prolonged about 54" in the direction of the tail in a narrow ridge of light. This ridge which has heretofore appeared broken up into four or five beads, is now a continuous line of light with, perhaps, in one or two places, faint indications of condensation. The nucleus is decidedly eccentric with regard to the general direction of the head, and the head is flattened on the *north-following* side.

The position-angle of the major axis of the nucleus was 309°·4. The distance between the centre of the two main points of condensation, from a series of measures with the filar micrometer was 18". A magnifying power of about 200 diameters was used. On November 17'7 the extreme length of the nucleus was found by Commander Sampson to be 74".

The following meridian observation for position was obtained on November 15'7 with the transit circle;—

1882 November 15'74 (Washington M.T.)

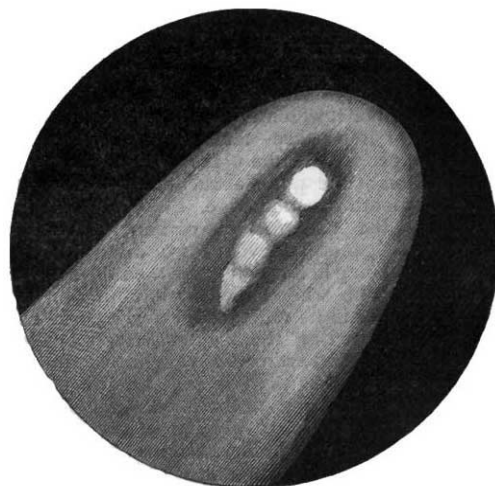
R.A. ... 9h. 27m. 50s. 72
N.P.D. ... 114° 49' 18" 9

The part observed was the main point of condensation near the following end of the nucleus. The observation is corrected for refraction, but not for parallax.

WILLIAM CRAWFORD WINLOCK,

Assistant Astronomer, U.S. Naval Observatory

THE drawing represents the appearance of the great comet at 5 a.m. on the morning of October 12 this year. I delayed the publication of my observations on this morning in the hope of securing some more views, but the bad weather prevented any further observations of this object here. The drawing shows distinctly four condensations in the nucleus, whose angle of position on the 12th was about 102°. Its length was 40"·3, as measured with the filar micrometer on the great refractor. The visible length of the tail was estimated at 21°. No doubt



The Great Comet seen in the Markree Refractor, October 12, 1882, 5 a.m..
by W. Doberck.

it was really much greater. Its southern side was well defined. As seen with the naked eye the nucleus shone as brightly as a star of between the first and the second magnitude. On the morning of the 6th I had seen the end of the tail, which was then apparently 15° long, present a feature very like that indicated in Major Herschel's drawing (NATURE, vol. xxvi. p. 622), but I am not sure of this, as the sky was partly covered with cirro-cumulus clouds.

On October 28, at 5h. 45m. a.m., the angle of position of the nucleus was about 113°, and its length amounted then to 67". The tail was less curved than on the 12th.

Markree Observatory, December 2 W. DOBERCK

FUNCTION OF THE MEMBRANA FLACCIDA OF THE TYMPANIC MEMBRANE

WHY should a smart blow, as, for instance, with the palm of the hand on the side of the head, or on the wing of the ear, cause rupture of the membrana tympani?

It was in endeavouring to trace the connection between these events, of no very uncommon occurrence, that I was led to the discovery of a most important factor in the physiology of the ear, and one which gives a new and more rational significance to the mechanism of the ossicles and membrane. In the shape of anatomical details I have nothing new to adduce, but in exhibiting the relationship of a series of minute particulars hitherto enigmatical and glanced at separately and only casually by anatomy, I have obtained a valuable result for otology. I must here present those details in the order most convenient for a brief demonstration, giving only the main features.

The membrana tympani, though but a single membrane, consists of two portions. The lower is firm and transparent, and of conical shape, being attached along its centre to the handle of the malleus, and fixed round its whole circumference to the sulcus tympanicus. The upper is comparatively loose, and much less transparent, and being in reality mainly fastened to the skin of the upper wall and only slightly to the bone, there being here no sulcus, but only a smooth margin (*margo tympanicus*), is easily displaced with a little gentle pressure outwards or inwards. Between the two there is a line of dense fibres forming a ligament, called by Helmholtz the anterior ligament of the membrane, and towards the anterior border of which the short process of the malleus is inserted. With this marked limiting line there is thus a striking difference in the character and mode of attachment of the two portions of membrane, and this reaches to the very foundations of the structures, and is the most remarkable feature in their development. It is to be remembered that the superior arch of bone, forming at its inner end the tympanic margin alluded to, is part of the squamous bone, which is characterised by the general smoothness of its surface—a character it preserves along the whole upper wall of the osseous meatus, not excepting its termination at the porus acousticus externus, where it presents a smooth bevelled edge. But the os tympanicum which forms the inferior arch of bone is contradistinguished by the general unevenness or asperity of its surface, not only being hollowed out by the sulcus at its inner end, but along the whole floor, maintaining a roughness which culminates in its rugged edge at the porus externus. Nature, in constructing the meatus, selects one bone for its smoothness, another for its roughness, and the evident intention is, that what is laid on the one surface shall adhere, what is laid on the other shall glide over it. While, therefore, the lower portion of the drum of this ear is fixed by its connection with the os tympanicum, the upper portion is loosely connected with the os squamosum, which affords it a movable surface. Helmholtz believes that the lower firm portion is alone concerned with sound-waves, the upper lying above the handle of the malleus, and having therefore no direct connection with the chain of ossicles. On this ground, in his treatise on the mechanism of the membrane and ossicles, he leaves the membrana flaccida out of consideration altogether, and no physiologist, as far as I am aware, has ever hinted at its function. Having from the foregoing description obtained an insight into its relation with the bone, it must now be viewed in connection with the skin lining the upper wall of the passage, which is quite distinct in character from that covering the rest of the osseous passage, and next needs to be specially noticed.

Prof. Henle says: "The skin which covers the external meatus has originally the appearance and structure of the cutis, and retains this character along the upper wall beyond the rounded rim of the squamous bone which helps to complete the porus acousticus externus up to the site of the membrane, whereas in the rest of the circumference the skin, in passing from the cartilaginous to the osseous meatus, abruptly changes its character, decreasing in thickness and assuming the peculiar silvery glance

of a fibrous skin."¹ Thus along the whole passage the skin on the upper wall retains its ordinary character, being elastic and movable, and having, as noticed by Von Frölsch, the same kind of loose connective tissue glands and hair cysts as any other part, whereas the movability of the remaining portion ceases with the cartilaginous meatus, as beyond that it ceases to be true skin.² Add to this that the one lies on a roughened, the other on a smooth surface, and this singular deviation in apparently so simple a matter and in so minute a particular, must strike the examiner as significant of purpose. If we next turn to the arrangements at the porus acousticus externus, it becomes manifest.

What is noticeable in regard to the rim of bone constituting the porus is simply corroborative of what has already been said. Thus, whereas the under semicircle is comparatively rough and uneven, and projects slightly beyond the upper semicircle, the latter has a smooth-rounded edge bevelled in the manner of bone over whose margin a tendon plays. It is to the curved uneven lamella of the under circumference known as the auditory process that the cartilaginous meatus is principally attached. This is effected by means of strong, slightly movable ligamentous tissue, or rather, as Henle puts it, "by means of a compact cartilaginous substance richly interspersed with elastic ligamentous tissue, which fills up the rough interspaces of the lamella and extends the lower portion of the osseous canal about two millimeters."³ The upper semicircle, on the contrary, is closed simply by a dense fibrous membrane, there being here a large deficiency of cartilage (Quain). The difference is that while below the osseous canal blends insensibly into the cartilaginous with only dawning facility for movement, above it terminates abruptly, admitting there and then a large measure of movement.

Thus then it appears that from the membrana flaccida of the membrane, which is easily movable at its margin, we have a piece of movable skin running over a smooth polished surface along the whole upper meatus of the bone, which is here bevelled off, and is immediately continuous with the movable membranous roof of the cartilaginous portion of the external passage. The movable piece of skin serves, after its manner, the purpose of a tendon, and the muscle which mainly plays upon it is attached to this upper membranous wall at its point of junction with the osseous meatus.

Of this muscle Henle gives the following account:—"Of the lateral portion of the musculus epicranii (occipito-frontalis), the musculus epicranii temporalis is a very thin bundle of fibres, and is anterior to and smaller than the attollens auriculum, which forms the remainder of the lateral portion. It has its tendinous origin below the root of the zygoma, near the rim of the osseous canal, to the capsule of the inter-articular cartilage (operculum cartilagineum), and to a tendinous arch through which the vasa temporalia pass into the deep structures. Its muscular fibres spread out in parallel lines forwards and upwards, some of them stretching to the border of the frontalis, and of the orbicularis oculi, and so partly curving upwards around the lateral border of the frontalis, and intermixing with the upper fibres of the orbicularis, they are finally inserted into the glabella."⁴

It will thus be observed that, when the muscle contracts, it raises the membranous roof of the canal upwards and slightly forwards, making the movable patch of skin glide outwards, and so telling upon the membrana flaccida, which is, even in the adult, almost in a line with the upper wall, and is therefore so much the more easily influenced by such a movement. When the delicacy of the parts concerned are borne in mind, it will be obvious that no extensive movement is thus indicated, and in a

¹ "Anatomie des Menschen," Z. B. 5, 732.

² "Diseases of the Ear," Roosa's Translation, p. 53.

³ Loc. cit. p. 722.

⁴ Loc. cit., s. 136.

more complete demonstration a good deal further illustrating the actual movement, has to be said on that head. Here we have space only for a general outline.

The muscle, of course, has no isolated voluntary action, but its effect is brought into play when the eyebrows are forcibly raised by the contraction of the occipito-frontalis. Indeed, although itself really a muscle as described, much of its effect is derived after the fashion of an elastic tendon connected with the great epicranial muscle. It is further assisted by the consentaneous action of certain small muscles of the auricle, notably the attollens auriculum. Its movement is quite perceptible to the finger placed in the sulcus, between the pinna and side of the head, and to an experienced eye its effect on the membrane is distinctly visible through the speculum when the occipito-frontalis is made to contract.

It would be beyond the scope of a single paper to enter into a demonstration of the effect of this movement of the membrana flaccida on the membrane and ossicles—but it can be shown that, in opposition to the so-called tensor tympani muscle, it helps to bring the umbo or deepest part of the membrane outwards, thus tending to reverse the cone, and bring the membrane generally into a more vertical position, relatively to the lower wall of the meatus. This is beyond all question its position for acutest hearing, and it is thus important to observe that by the single contraction of the occipito-frontalis muscle, both eyes and ears are brought simultaneously into the attitudes of strained attention. Hence, in endeavouring to hear as well as to see intently, we involuntarily raise the eyebrows in order to tell upon the drum of the ear.

A smart blow administered on the side of the head, as is too often thoughtlessly done by schoolmasters and parents in correcting children, may cause sudden spasmodic action of the muscle, and thus, through the action of the mechanism described, serious injury or even rupture of the drum.

JOHN M. CROMBIE

WEIGHTS AND MEASURES

THE Board of Trade lay before Parliament an Annual Report of their proceedings and business under the Weights and Measures Acts, &c., and their Report for the current year has just been issued.

It is required by law that the three Parliamentary copies of the Imperial Standards of measure and weight, which are deposited at the Royal Mint with the Royal Society, and in the Royal Observatory, respectively, should be compared with each other once in every ten years. The period for such decennial comparisons having recently arrived the Board took the necessary steps for the removal of these Standards to their office. The methods of comparison adopted and the actual differences between the Standards are shown in a memorandum by Mr. H. J. Chaney, which is attached to the Report. It appears that the comparing apparatus in use at the Standards Office is found to require alteration, and that in considering the changes necessary to be made the Board have had the valuable assistance of a Committee of the Royal Society, composed of Sir G. Airy, Major-Gen. A. R. Clarke, and Prof. Stokes. It is really important that a department which is charged with the care and use of our national standards, should have the best apparatus, and we trust, therefore, that the Report of the Committee may be speedily and fully carried out.

Reference is also made to the papers issued by the Comité International des Poids et Mesures, Paris, and the Report acknowledges the assistance the Standards Department has received from these papers, particularly with reference to the measurement of heat and the determination of volume and weight. This country is the only civilised country which has not joined the Comité International, and taken part officially in their proceedings, although it would appear that it has not failed to avail itself of their labours.

The two ancient standards of the metric system, the Toise du Perou and the Toise du Nord, are stated to be still at the Paris Observatory, in a good state of preservation, as also are the measures used by Borda, Brisson, and Lavoisier. By a decree of the Sultan, the metric system came into force in Turkey on March 1st last, and the equivalents of the old and new Turkish weights and measures are stated in this Report.

The Board have had their attention directed to the question of a uniform system of screw threads, as well as to that of a standard wire gauge. Reference is made to the want of uniformity in the system of screw threads used in the construction of scientific and optical instruments. It is hoped that the attention which is now being given to this question may result in the adoption of a standard system of screw threads. Any step which tends to lessen the high cost of construction and of repair of scientific apparatus is to be welcomed.

From time to time, as science advances and commerce extends, it is found that new kinds of standards are needed, and the attention of the Department has therefore been this year called to the expediency of adopting new photometric tests for gas, and also as to possible means of measuring electrical energy. In the proposed Bill for amending the enactments for regulating the sale of gas, and of dealing with the mode of testing the illuminating power of gas, we trust that Mr. Vernon Harcourt's new air gas-flame test, on which Dr. Williamson and Dr. Odling have reported, may receive favourable consideration.

Under the Petroleum Acts rules are laid down for determining the "flashing-point" of oils, or the temperature at which they begin to give off inflammable vapours, but it appears by the Report that Dr. Foerster has lately called attention to the omission in these rules of any allowance for variations of atmospheric pressure. The rules in this respect evidently, therefore, require some amendment.

The Report also contains much information valuable to local inspectors and others practically interested in weighing and measuring.

ON THE PROPOSED FORTH BRIDGE

IN offering some remarks (which I trust may be final) merely explanatory of preceding notes on this proposed structure, I shall refer generally to my letter of October 19 (*NATURE*, vol. xxvi. pp. 598-601).

First, I have to modify the force of my expressions relating to the danger arising from the use of certain long struts to support very heavy end-pressures. My remarks were the consequence of error in the engraved longitudinal vertical plan, circulated (I understood) under the authority of the Official Board. In this plan, by the indiscretion of the engraver, the tubular struts of 340 feet length and 240 feet length respectively, are drawn clearly and distinctly as unconnected in their entire length with any other braces. In other parts of the plan, each connection of that class is indicated by a rose; but there is no such mark upon these rods. A person scrutinising the plan might well feel alarm at the prospect of unbraced rods 340 feet long, intended to support end-pressures exceeding 600 tons. But Mr. Fowler has kindly informed me that the plan is erroneous, and that there is connection at each place where the strut crosses a brace, and that the flexible length of the strut is thus reduced to 170 feet. This diminishes the danger of buckling in a vertical plane so greatly that I imagine it may be passed without further notice. Still I remark that the danger of buckling in a horizontal direction, with a length of 340 feet, remains undiminished, unless it is counteracted by bracing not known to me.

In regard to some effects of the wind, the following comparison between the proposed Forth Bridge and the