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I.—Description of the Plates illustrating Mr. W. K. Parker's Paper on the Development of the Crow's Skull.

(Continued from page 226.)

[N.B.—The description of the various stages of the Crow's Skull, and the first three Plates, will be found in the November number of this Journal, pages 217-226.]

DESCRIPTION OF PLATES.

PLATE XXXVII.—Structure of the skull of the Nestling of the Carrion Crow (*Corvus corone*), one week old. The figures are enlarged one-half. Fig. 1. Basal view of skull and face. Fig. 2. Side view of skull and face, including the mandible, showing its outer aspect. Fig. 3. Upper view of the skull, upper jaw, and nasal sacs. Fig. 4. A longitudinally vertical section of skull and face, showing the brain-cavity, auditory bones, septum nasi, and cranio-facial axis. Fig. 5. End view of skull and lower jaw. Fig. 6. Inner view of right mandible, or lower jaw. Fig. 7. "Os hyoides," or distal part and base of 2nd post-oral arch, and the whole of the third, with its basal element.

PLATE XXXVIII.—Figures illustrating the skull of a Fledged Nestling of the Rook (*Corvus frugilegus*), natural size. Fig. 1. Basal view of skull, face, and nasal capsules. Fig. 2. Side view of skull and face, including outer view of mandible. Fig. 3. Upper view of skull and upper jaw. Fig. 4. A longitudinally vertical section of skull and nasal capsules, showing cranial cavity, auditory mass, septum nasi, cranio-facial axis, and inner view of mandible.

PLATE XXXIX.—Skull of Fledged Nestling of Rook—continued. Fig. 1. End view of skull of a scarcely fledged Nestling. Fig. 2. Ditto of an older Nestling. Fig. 3. Nasal labyrinth, dissected out and seen from above. Fig. 4. Transversely vertical section of nasal capsule in front of lateral ethmoids. Fig. 5. A similar section, seen behind the lateral ethmoids. Fig. 6. Inner view of nasal capsule, as seen in a longitudinally vertical section. Fig. 7. "Os hyoides."

II.—Proposal for a Standard of Comparison of the Magnifying Powers of Compound Microscopes. By J. E. INGPEN, Esq.

(Read before the ROYAL MICROSCOPICAL SOCIETY, Nov. 6, 1872.)

EVERY worker with a telescope finds the necessity of ascertaining with considerable accuracy the magnifying powers of his instrument with its various eye-pieces. This is done by measuring the diameter of the reduced image of the object-glass in the eye-piece, when the telescope is focussed for parallel rays. The aperture of the object-glass, divided by the diameter of its reduced image, gives the magnifying power. The advantage of this method is, as

Admiral Smyth says, that "it does not require any knowledge of the thickness and focal lengths of any of the lenses employed in the telescope, nor yet of their number and relative positions;" and he quotes Dr. Pearson thus: "One operation includes the result arising from the most complicated construction, and sets theory at defiance with respect to calculations that must take into consideration the previous determination of all the preceding requisites, the obtaining of which is attended with practical difficulties almost insurmountable."* I can hardly imagine but that some one interested both in telescopic and microscopic research must have long since applied the same method to the microscope that has been used for the telescope with perfect success for more than a century past. So far as I know, however, this has not been done, or at any rate, published, and I therefore venture to bring this matter before the Royal Microscopical Society, in the hope that it may be of interest and utility to some few amongst us, and perhaps lead to further inquiry.

The conditions under which we use this plan of obtaining the magnifying power are not quite similar in the two cases. In the astronomical telescope we deal with parallel rays, and the focus is therefore constant for each instrument: in the microscope we use various objectives as well as eye-pieces, and conjugate foci instead of parallel rays. But if we fix upon a standard object and view it at a known distance the method is equally applicable. The standard I propose to use is the diminished image of a disk one inch in diameter, placed at ten inches below the position of an object upon the stage of the microscope; then the real diameter of that disk divided by the diameter of its reduced image will give the standard magnifying power with the objective eye-piece and length of body employed, and if the length of body is such as to make the distance between the front surface of the objective and the diaphragm in the eye-piece *ten inches*, then the real as well as the standard magnifying power is given.

The reduced image of a disk one inch in diameter viewed at ten inches below the stage is too small to be measured with accuracy when high powers and deep eye-pieces are used, but any multiple of one inch or divisor of ten inches can be employed. For most purposes the following plan seems to answer: A revolving diaphragm, capable of being adapted to the stage, is pierced with apertures of $\frac{1}{4}$ inch, $\frac{1}{2}$ inch, and $1\frac{1}{4}$ inch, and fixed to a tube at $2\frac{1}{2}$ inches from a plate of thin glass, upon the upper surface of which the objective can be focussed. This will allow of the objective being used at "uncovered," at "covered," with any known thickness of covering glass, and with a wet or dry front. On the same, or another diaphragm, some minute holes, at known distances apart, such as $\frac{1}{2}$ inch and $1\frac{1}{4}$ inch, can be pierced, and used in the same manner. It is evident

* Smith's 'Celestial Cycle,' i., 382.

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that the $\frac{1}{4}$ -inch aperture, or the holes $\frac{1}{4}$ inch apart, represent the 1-inch disk, the $\frac{1}{2}$ -inch aperture a 2-inch disk, and the $1\frac{1}{4}$ -inch aperture a 5-inch disk at ten inches distance. In the latter cases the result would have to be divided by 2 or 5 to obtain the power.

The next point is as to the mode of measuring the reduced image in the eye-piece. For low powers the ordinary divided scale dynamometer may suffice; for higher powers a double-image dynamometer, or one with a compound microscope, would be necessary. With high powers a measurement with the lowest eye-piece would suffice, as the *relative* powers of the eye-pieces can be very exactly obtained: the mean of several observations should be taken. It may be as well to subjoin an example to show the method of working:—

Disk $1\frac{1}{4}$ -inch at $2\frac{1}{2}$ inches = 5-inch disk at 10 inches distance.

Diameter of image $\cdot 0285 \cdot 00$ ($178\cdot 6$ power nearly).

I venture to think that this method will be found well adapted for a standard of measurement. It is simple, showing the power with the smallest amount of calculation, whatever may be the foci and construction of the objective and eye-piece, and length of body, adjustment for cover, &c. If the body is made, as before suggested (by means of suitable adapters), to measure ten inches from the front surface of *each* objective to the stop in *each* eye-piece, the standard will agree with the real measurement; and even if the difficulty of measuring the minute disks of light be considered too great with high-power objectives, even approximations may be useful, if based upon a standard the conditions of which can be easily remembered and reproduced.

There are two uses of the *optical* portion of the dynamometer, which, though long known, seem to have been too much overlooked of late years. In the form of Ross's centring eye-piece, *viz.* a positive eye-piece of moderate power, means are afforded of ascertaining very exactly the condition of the inside of the tube, the positions of stops, existence of stray light, extent and centricity or obliquity and direction of illumination, &c. The other use is that of obtaining the *real working* angle of aperture of an objective when direct light is used and the eye-piece is in position, and not merely the angle at which a burr of oblique light may be *just* visible. This plan was used in 1862 in examining the objectives at the International Exhibition.*

If a double-image dynamometer is used, it must be ascertained if astigmatism exists in the eye of the observer. This defect (which is much more common than is generally supposed) will greatly vitiate the measurements, unless corrected by the use of proper (cylindrical) lenses.

* See 'Quarterly Journal of Microscopical Science,' IV., N.S., 1864, p. 84.