XXVIII. *A Microſcopic Deſcription of the Eyes of the* Monoculus Polyphemus LINNÆI. *By Mr.* William André, *Surgeon; communicated by Sir* Joſeph Banks, *Bart. P. R. S.*

Read May 30, 1782.

THE wonderful ſtructure of the eyes of inſects in general, moſt commonly illuſtrated by that of the *Libellula*, or *Dragon-fly*, cannot fail of ſtriking with aſtoniſhment the naturaliſt who inveſtigates the works of the great Creator in his moſt minute productions. According to LEWENHOEK, HOOK, and others, the *corneæ* of moſt inſects are made up of an infinite number of ſmall, tranſparent, horny lenſes, each reſembling, in ſome degree, a ſmall magnifying glaſs. This ſtructure prevails in the *corneæ* of inſects in general; but the *Monoculus Polyphemus*, or *King Crab*, is, among others, an exception to this rule.

The *Monoculus Polyphemus*, or *King Crab*, is a cruſtaceous animal found in all the ſeas ſurrounding the continent of America and the Weſt India iſlands, and which frequently grows to a very large ſize *. I ſhall deſcribe ſo much of the *Monoculus* only as is neceſſary to point out the ſituation of the eyes, which have been looked upon as two in number only †, though in reality they are four. The largeſt piece of the cruſtaceous covering of this animal, when ſeparated from the reſt of the ſhell, has very much the ſhape of a barber's baſon, or the fore-

* Bossu's Travels, vol. I. p. 368.

† LINNÆI Syſtema Naturæ, tom. I. p. 1057.

part

part of a woman's bonnet. The eyes are a part of the ſhell, or, as LINNÆUS expreſſes it, they are *teſtæ innati**. They may be diſtinguiſhed by the terms large and ſmall, or lateral and anterior. If the ſhell were divided fairly in half, the large eyes would be nearly in the center of each piece, and the ſmall ones on the divided edge near the fore-part of the ſhell. The large eyes are at a great diſtance from each other; but the ſmall ones are cloſe together. It will appear hereafter, that the large eyes are made up of a great number of ſmall, tranſparent, amber-like cones, and that the ſmall ones are compoſed of one ſuch cone only; ſo that they may be divided into eyes with many cones, and eyes with a ſingle cone †. The large eyes, or thoſe with many cones, appear as two tranſparent ſpots about the ſize and nearly of the ſhape of a kidney bean, the concave edges looking towards each other, and the convex towards the edge of the ſhell. If they be examined attentively, we may diſcern on their ſurface a number of ſmall depreſſions, which point out the center of each cone. The ſmall eyes, or thoſe with a ſingle cone, look like two ſmall tranſparent ſpots, not larger than a pin's head; theſe, from their minuteneſs, are eaſily overlooked, ſee fig. 1. where A.A. ſhew the large eyes, and B.B. the ſmall ones.

The appearances which I have deſcribed may be ſeen on the external ſurface of the ſhell with the naked eye; but in order to proceed to a further inveſtigation of the ſubject, the *corneæ*

* This being the caſe, the eyes can enjoy no motion; in which particular, as well as in ſome others, the *Monoculus Polyphemus* differs from the genus of crabs, whoſe eyes are placed on petioles, or ſtalks, and are moveable.

† The Greek words πολυς κωνος, and μονος κωνος, would expreſs the ſenſe in a more conciſe manner. *Oculi polyconici et oculi monoconici.*

muſt be removed from the ſhell, and applied to a ſingle microſcope with a very ſtrong light.

The internal ſurface of the large eyes, examined with the microſcope, is found to be thick ſet witn a great number of ſmall, tranſparent cones, of an amber colour *, the baſes of which ſtand downward, and their points upwards next the eye of the obſerver †. The cones in general have an oblique direction, except ſome in the middle of the *corneæ*, about thirty in number, the direction of which is perpendicular. The center of every cone being the moſt tranſparent part, and that through which the light paſſes; on that account the perpendicular or central cones always appear beautifully illuminated at their points. In a word, they are all ſo diſpoſed as that a certain number of them receive the light from whatever point it may iſſue, and tranſmit it to the immediate organ of ſight, which we may reaſonably ſuppoſe is placed underneath them; but this laſt circumſtance can only be determined in a recent ſubject, which I have never been ſo lucky as to ſee. The cones are not all of the ſame length; thoſe on the edges of the *cornea* are the longeſt, from whence they gradually diminiſh as they approach the center, where they are not above half the length of thoſe on the edges, ſee fig. 2.

As theſe cones ſo eaſily tranſmit the light through their ſubſtance, when I firſt examined them I thought they were tubes; but I have ſince viewed them broken in different directions, and am convinced they are ſolid tranſparent bodies. If they be viewed with a deep magnifier, every cone appears divided tranſverſely by two or three internal *ſepta* or partitions.

* I have made ſome attempts to aſcertain their number, and think they amount to about 1000.

† This muſt be reverſed if the eye be conſidered in its natural poſition.

This appearance is owing to the cones themſelves being made up of ſeveral cones, one within another, the *ſepta* or partitions being nothing more than the *apices* or points of the external cones; but this will be further explained by conſidering that the *cornea* of the *Monoculus* may be divided into layers, the number of which, however, I cannot aſcertain; but I once met with a *cornea* in which the internal layer and its cones was ſeparated from the external *lamina* and their cones. A portion of the interna. layer is ſhewn fig. 4.; and the cones, very much magnified, with their *ſepta* or partitions, are exhibited fig. 5.

It is very well known, that all cruſtaceous animals depoſit their ſhells once a year, and are left with a ſoft, tender covering, which, after ſome time, acquires the hardneſs of the former ſhell. As the *cornea* in theſe animals is a part of the ſhell, it is reaſonable to ſuppoſe, that the internal layer is left with the ſoft covering, containing the rudiments of the future *cornea*; and this is the more probable, from what I have before obſerved, that I have met with an eye where the internal layer was ſeparated from the more external ones, ſee fig. 4.

The ſtructure of the ſmall eyes being leſs elaborate than that of the large ones, their internal appearance, when placed in the microſcope, will be deſcribed in a few words. They conſiſt of an oval, tranſparent, horny plate, of an amber colour, in the center of which ſtands a ſingle cone, through which and the oval plate the light paſſes, ſee fig. 3 *.

Having thus deſcribed, as conciſely as poſſible, the ſingular mechaniſm of the *corneæ* of the *Monoculus*, I ſhall add a few words concerning their uſe. The lenticular ſtructure of the *corneæ* of inſects in general certainly aſſiſts in condenſing or

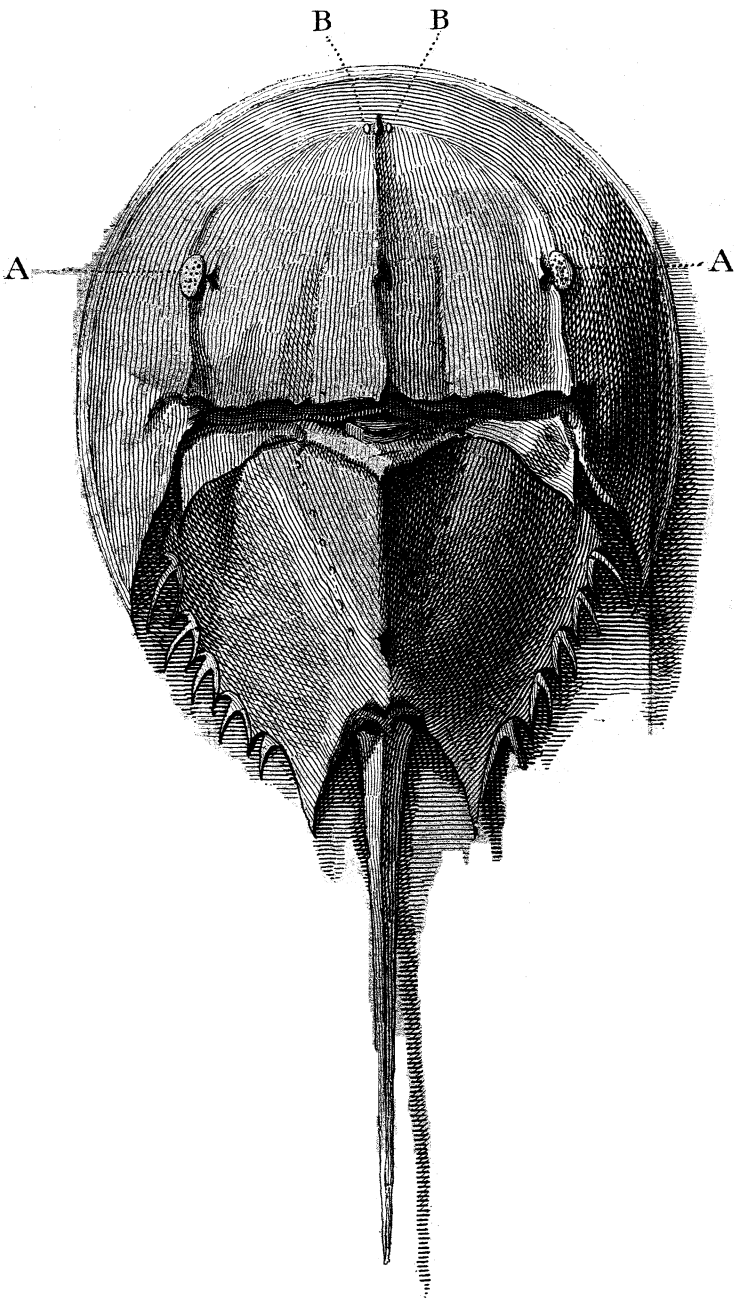
* The ſmall eyes are analogous to thoſe ſmall eyes of other inſects which entomologiſts have called *ſtemmata*.

ſtrengthening the light in its paſſage to the immediate organ of ſight. It is probable, that the cones in the *Monoculus* have the ſame effect. Whether they anſwer that purpoſe, in a more or leſs perfect manner than the lenſes in the generality of inſects, is what I cannot take upon me to determine.

EXPLANATION OF THE PLATE.

Fig. 1. The *Monoculus Polyphemus*.
AA. The large eyes.
BB. The ſmall ones.
Fig. 2. One of the large eyes magnified.
Fig. 3. One of the ſmall eyes magnified.
Fig. 4. A portion of the internal layer magnified.
Fig. 5. The cones magnified with their *ſepta* or partitions.

Fig.1.



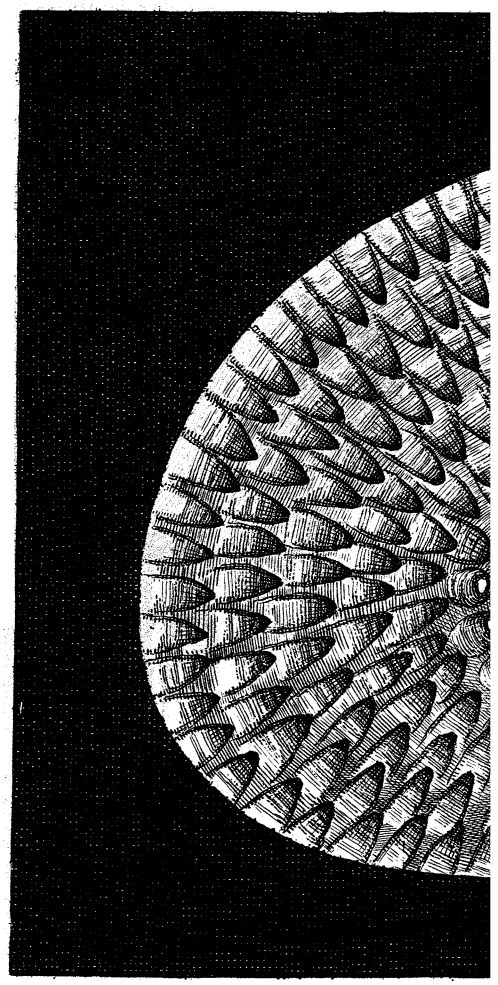


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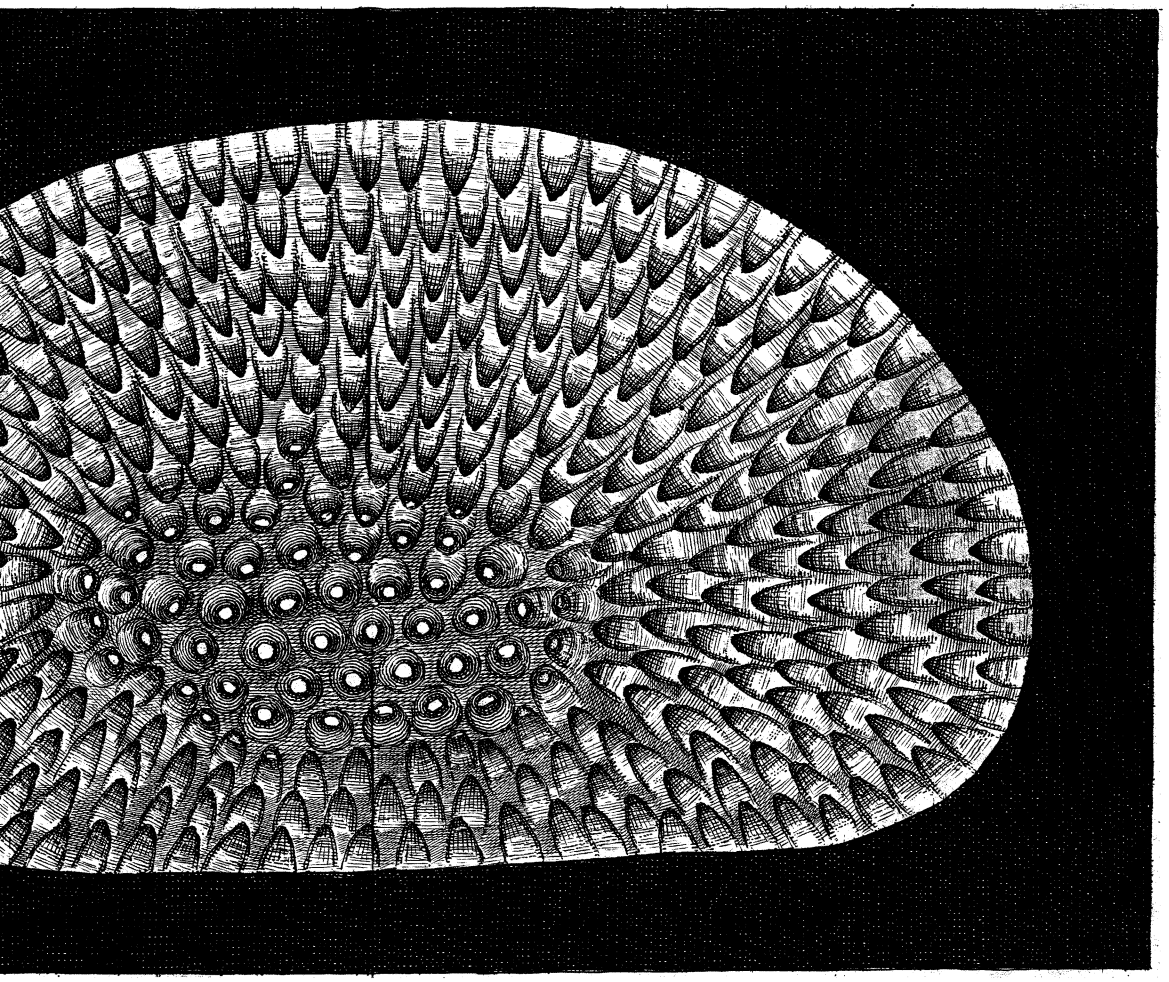
Fig. 2.



MONOCULUS Polyphemus *LINNÆI*.

Fig. 5.

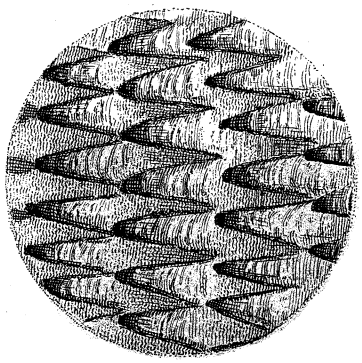


Fig. 3

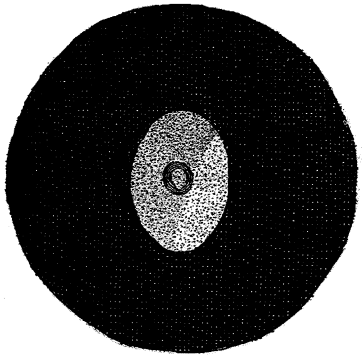
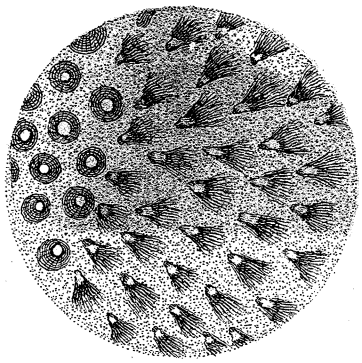


Fig. 4.



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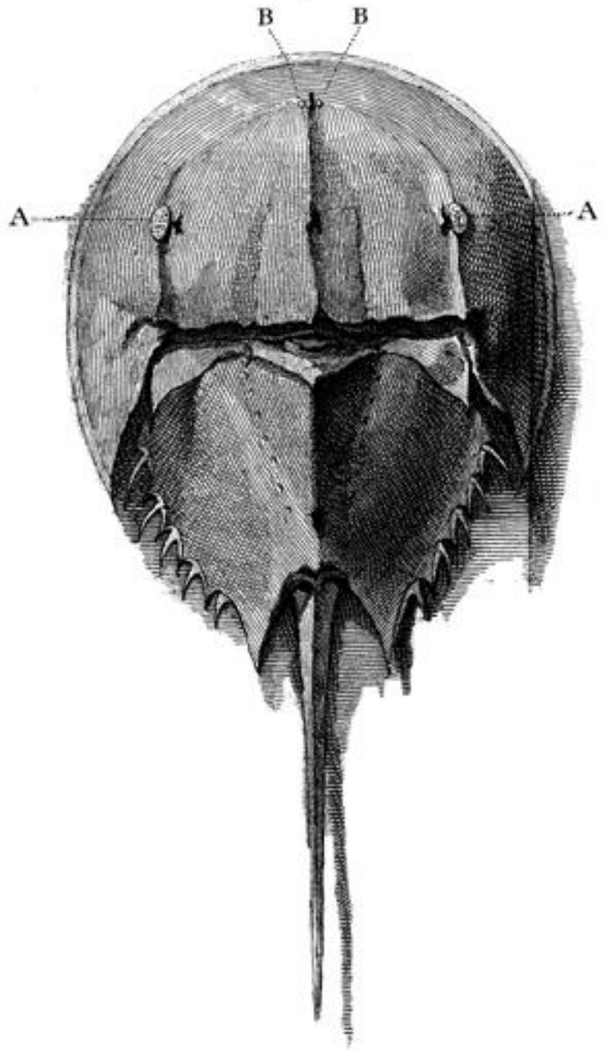


Fig. 2.

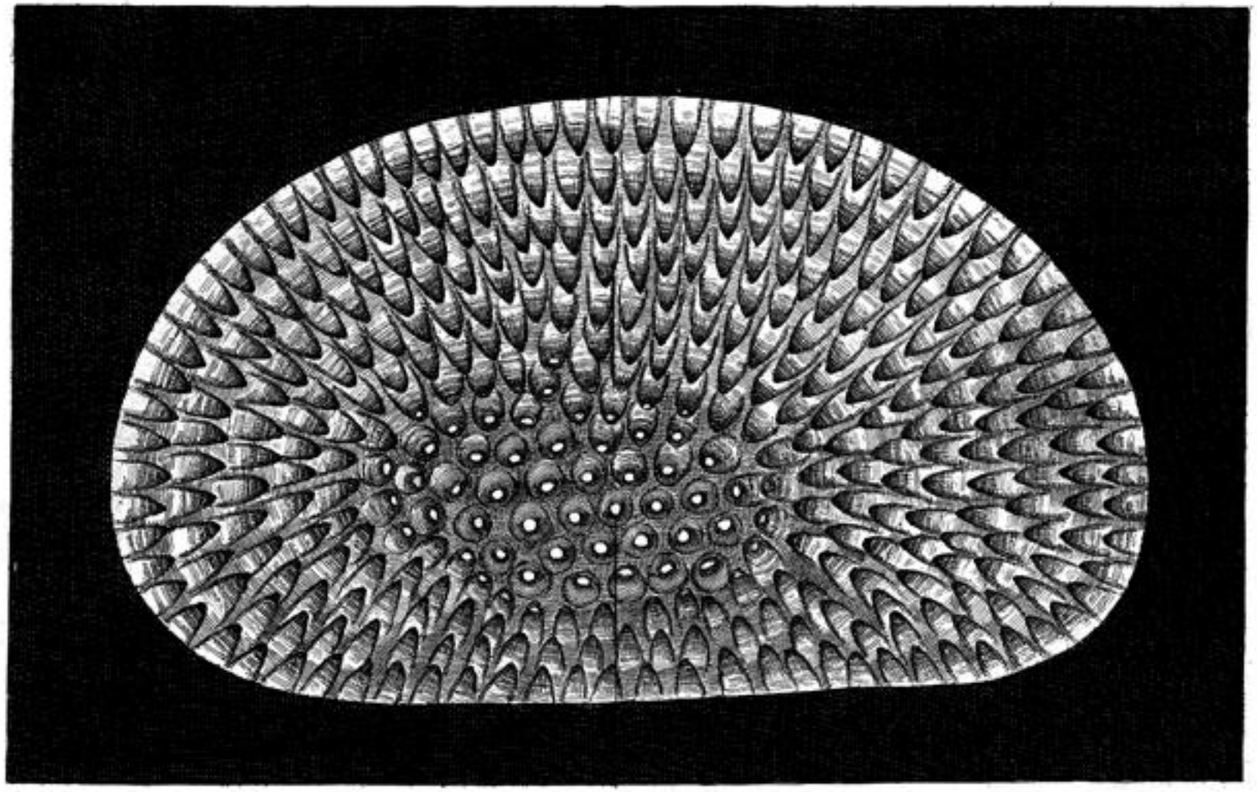
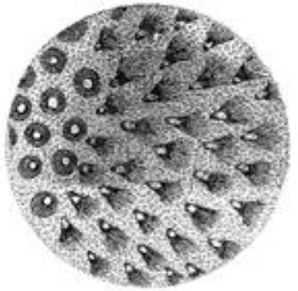


Fig. 5.

Fig. 3

Fig. 4.



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