is to be regarded as full grown. Other dimensions can not be taken on account of the distorted condition of the respective parts.

Body and head somewhat contorted and out of shape. Skin largely mutilated and worn off. General form agreeing with that of this species. The same is true of the shape and size of the caudal fin, which exhibits the characteristic outline. Details of head normal. Opening of the lids of the eyes widely distended, irregularly circular, anterior sinus indistinct (this is apparently due to preservation).

Sessile arms agreeing in size and shape with this species. All marginal membranes (outside of the suckers) very slightly developed (or worn off), the dorsal and lateral folds of these arms indistinct, and this is especially true of the high median keel of the third arm, of which only traces are seen in our specimen. Owing to the slight development of these keels all the arms appear less angular and more rounded in cross section, although the typical shape is still indicated. Tentacular arms agreeing completely with this species, only the keel on the back side of the club is less strongly developed. Marginal membranes of the suckers indistinct.

No hectocotylization on the fourth sessile arms visible; thus our specimen seems to be a female.

Arrangement, size and structure of suckers of the sessile as well as the tentacular arms agreeing perfectly with Verrill's description and the specimens used for comparison; the only difference I see is that outside of the two rows of large suckers of the club of the tentacles there are only a few smaller ones; but these may in part have been torn off and lost.

The buccal membrane agrees with this species. Color, yellowish-white, with purple chromatophores, but skin largely damaged, so that the usual color pattern is not visible; but the dark blotches above the eyes are well marked. The pen has not been taken out.

To sum it up, our specimen agrees in all essentials with *Illex illecebrosus;* the only differences observed, namely, the wide eye opening, the lack or slight development of the marginal membranes and the keels of the arms, and the absence of some suckers on the tentacles, are no doubt due to preservation and rough handling. That the latter has taken place is shown by the general abrasion of the skin, and the fact that a large number of the suckers have lost their horn rings or are entirely torn off. Similar mutilations and changes are very often observed in ill-preserved cephalopods. Therefore, I arrive at the conclusion that the present individual is in no wise different from *Illex illecebrosus* of our northeastern coasts.*

As to the alleged capture of this species in Onondaga Lake, I can only refer to what Dr. J. M. Clarke says (*l. c.*), and if it is a fact that this species lives in this lake, the only explanation is, as suggested, by a former, post-glacial connection of this lake with the St. Lawrence Gulf. But I am loath to believe that this species *lives* in Onondaga Lake. In this connection I venture only one single suggestion: this squid is largely used for bait, and the capture of squid forms a regular trade on our northeastern coasts. Could it not be possible that somebody has secured by purchase a barrel of squids, to be used as bait at the locality where our specimen was found?

A. E. ORTMANN.

PRINCETON UNIVERSITY,
December 12, 1902.

KALLIMA BUTTERFLIES.

TO THE EDITOR OF SCIENCE: Dr. Bashford Dean will find some interesting remarks on the mimicry by this butterfly, and some criticisms of museum representations of it, in an interesting article by E H A 'On the Influence of Mind in Evolution,' *Natural Science,* Vol. IX., pp. 297–302, November, 1896. The main point as regards museums made by this competent observer is that he never saw a *Kallima* sitting with its apparent stalk towards the twig of a tree. On the contrary, it 'always alights head downwards, so as to face anything coming up the tree, which is

* This species is abundant from Cape Cod to Newfoundland. Rarely it is found to the south of this range (Vineyard Sound and coast of Rhode Island).

much the most likely direction of assault from a lizard.' According to this writer, it is when the butterfly requires to rest that it settles, not on the under side of a leaf, as do most other butterflies, but 'on the bare trunk, or one of the larger boughs, of a tree.'

NAT. SCI.

SHORTER ARTICLES.

DATA WITH A POSSIBLE BEARING ON THE CAUSE OF LIGHTNING.

1. LENARD inferred from his experiments that it is necessary for the water jet to strike a solid obstacle to generate the electricty observed in the surrounding medium of air. I find that a surface of water is also efficient, and I place the electricity as a charge on the water nuclei produced, because the charge increases with the number of nuclei computed from their coronas. In other words, the mere attrition of water by water is sufficient to charge the nuclei.

In a forthcoming paper in the *American Journal of Science* I show that if each nucleus carries one electron, there must be at least 10^6 nuclei per cubic cm. 'At least,' because much of the charge is lost in the tube which conveys the nuclei into the condenser, and I have not yet allowed for this.

From the coronas simultaneously produced I find that about 5,000 nuclei are present per c.c. Hence each nucleus carries 200 electrons, while its potential is below five volts. Thus there are a million electrons in each c.c. of the air which I examine, or in a cubic kilometer there would be 10^{21} electrons, or 7×10^{11} electrostatic units of charge, or about 200 coulombs.

2. Let this region be spherical with a superficial capacity, which would then be $.62 \times 10^5$ cm. The potential* at the surface of the region would be eleven million electrostatic units of potential, or over three thousand million volts, if the nuclei were all of the same sign and were transferred to the surface. Every time the region is emptied of its nuclei, the surface acquires a charge of the enormous potential stated, and there is no reason why the nuclei may not be continually produced by attrition while they are being transferred.

3. Now regarding the transfer of nuclei, we may note that when they are produced from pure water, positive charges are usually in excess; when produced from dilute solutions, negative charges are usually in excess; but I find that the bulk of the nuclei are symmetrically positive and negative.

The velocity of the nucleus of charge e, in an electrostatic field of the potential gradient, E, is $v = Ee/6\pi\mu R$, where R is the radius of the nucleus and μ (.0002, say), the viscosity of air. Put, therefore, in this equation the values which I have here and in other places adduced, $R = 10^{-6}$ cm., $e = 200 \times 7 \times 10^{-10}$ electrostatic units, whence $v = 37$ cm./sec., or over four fifths mile an hour, for the unit electrostatic field; about .003 mile per hour of a field of one volt/cm.

Thus there is considerable mobility in these nuclei. With a strong electrostatic field at least locally in action, the nuclei of one sign would thus be driven outward, warmer nuclei into colder regions of continually increasing conduction or rarer air, where their charges would be dissipated. The other nuclei would be driven earthward, colder nuclei into warmer regions of continually decreasing conduction to be discharged, if at all, by a flash, particularly if, on growth of drops, gravity steps in as a final motor.

Whether there is sufficient commotion in thunder-storms to give rise to the attrition of water, whether comminution will not suffice if accomplished in other ways, whether an earth electrostatic field is an adequately permanent or localized occurrence, whether indeed separation of nuclei is needed if there is enough excess of charges of definite sign, must be left for further consideration; but it seems to me that data bearing on the occurrence of lightning are here suggested which deserve serious scrutiny.

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* For a mile flash of lightning 70 coulombs at a million volts are usually conceded (Lodge).