

is closely analogous to the action of nitrite of amyl. Inhaled in quantities of not less than a grain, it induces the same sensation of fulness of the head, rapid action of the heart, and some suffusion of the skin. Animals subjected to it in the proportion of fifteen minims diffused as vapour through a cubic foot of air, die almost instantaneously from sudden failure of the heart, but even up to the moment of death they retain their consciousness and sensibility. The nitrite, consequently, is in no sense to be regarded as an anæsthetic.

Precisely as the nitrite of amyl, nitrite of ethyl, when it kills, leaves the lungs entirely collapsed and so perfectly white that one could assume they had been carefully washed free of blood. This effect is due perhaps to the rapid contraction of the pulmonary capillaries. The blood is changed in colour, the arterial blood being rendered very dark, and the venous of a deep chocolate tint*; the muscles are also all left blanched, as if the death had occurred from loss of blood.

It will be remembered that, in describing the action of nitrite of amyl, I explained that in cold-blooded animals the substance suspended their animation, and that frogs that had been rendered powerless by it, and to common observation inanimate, would sometimes spontaneously recover even so long as nine days after the administration. This same phenomenon I have observed with nitrite of ethyl, together with another even more singular. It is this. If a young animal, say a kitten, be subjected so suddenly to the nitrite as to fall senseless and to appearance dead in or within the minute, it will remain in the same state for six or even ten minutes, yielding no evidence of life: it will not breathe, and the most delicate auscultation will fail to detect motion of the heart. But after a period varying from six to ten minutes it will spontaneously recommence to breathe, and with every movement of expiration a breath sufficient to dull a mirror will pass from the nostril. As the breathing recommences, the heart also begins its work, making a series of distinct intermittent strokes. This condition, looking like an actual return of life, will last so long as half an hour, and will then cease gradually, the animal lapsing again into a state of actual inertia or death.

In concluding this Report I would place the facts I have collected, in respect to the ethyl series, as follows:—

1. Oxide of ethyl, or pure rectified ether as it is commonly called, is the best of all known agents for the production of general anæsthesia by inhalation.

2. The peculiar difference of action between the oxide of ethyl and the nitrite of ethyl is due to the introduction of a new element, nitrogen, into the latter compound. This difference of composition makes the nitrite approach, in action, bodies of the alkaloidal class, strychnine and its analogues.

Second Report on the Structure and Classification of the Fossil Crustacea. By HENRY WOODWARD, F.G.S.

I HAVE now to submit a Second Report upon the Fossil Crustacea, which have for some years past occupied my attention. Since the last Report made to the British Association in Birmingham in 1865, I have described and figured a new Liassic Crustacean from the Lower Lias of Charmouth—the

* The coagulation of blood is not modified.

Æger Marder—a genus hitherto characteristic of the Solenhofen Slates of Bavaria*.

The following new genera and species of Crustacea were communicated by me to the Geological Society on the 23rd May last, and will appear in the next part of the 'Quarterly Journal' of that Society:—

"2. 'On a new Genus of Phyllopodous Crustacea from the Moffat Shales (Lower Silurian), Dumfriesshire.'

"The fossil described consists of the disk-shaped shield or carapace of an Apus-like Crustacean, the nearest known form to it being *Peltocaris aptychoides*, Salter, from which, however, it is at once distinguished by the absence of a dorsal furrow.

"A line of suture divides the wedge-shaped rostral portion of the shield from the rest of the carapace, the two parts being seldom found together. From its strong resemblance to *Discina*, the author proposed for it the generic name *Discinocaris*, and named the species *Browniana*, after Mr. D. J. Brown, who first drew his attention to it.

"3. 'On the Oldest known British Crab (*Palæinachus longipes*, H.W.) from the Forest Marble of Malmesbury, Wilts.'

"The author stated that three genera and twenty-five species of Brachyurous Crustacea had already been described by Professor Reuss and H. von Meyer from the Upper White Jura of Germany; but as no limbs or abdominal segments had been met with, it was more doubtful where to place them than the species now described, which had nearly all its limbs *in situ*, and a portion of the abdomen united to it. *Palæinachus* closely resembles the common Spider-crabs (the *Maiadæ* and *Leptopodidæ*) living on our own coasts.

"4. 'On the Species of the genus *Eryon*, Desm., from the Lias and Oolite of England and Bavaria.'

"The genus *Eryon* of Desmarest was established for certain extremely broad and flat forms of *Astacidæ* found in the Solenhofen limestone near Munich, and first described in 1757. The late Dr. Oppel has recorded fourteen species, two of which, *E. Barrovensis* and *E. (Coleia) antiquus*, are from the Lias of England. Mr. Woodward gave descriptions and figures of *E. Barrovensis*, M'Coy, and five other species, namely:—*E. crassichelis*, *E. Wilmetensis*, and *E. Brodiei*, from the Lower Lias; *E. Moorei*, from the Upper Lias of Ilminster; and *E. Oppeli*, from the lithographic stone of Solenhofen."

The plates exhibited form (with one other) the first part of the Monograph on the *Merostomata* for the Palæontographical Society, and will be published shortly†.

I have lately had the opportunity to examine specimens of *Limuli* from the Coal-measures of Kilmaurs, Dudley, and Coalbrook-dale, and am happy to state that they have enabled me in the most satisfactory manner to demonstrate the connexion between this division of Crustacea and the older *Eurypterida* on the one hand and the recent King-crabs on the other. (See Report, Section D‡.)

The forms which occur in this zone (the Pennystone Ironstone) differ from *Limulus* in the less anchylosed condition of their segments and the possession of three well-marked divisions, representing the head, thorax, and abdomen, the latter being represented by three anchylosed segments, and having the intervening segments of the thorax free and unarticulated.

* See Geol. Mag. 1866, vol. iii. p. 10, pl. 1.

† They have since (Dec. 1866) appeared.

‡ Also Quart. Journ. Geol. Soc. vol. xxiii. p. 28.

The best example of this is the *Belinurus regince* of Baily, from the Irish Coal-measures; then follows the *B. trilobitoides*, of Buckland, the *B. anthrax*, Prestwich, the *B. arcuatus*, Baily, and lastly, the *B. rotundatus* of Prestwich. By placing these forms in the order indicated, we find a gradual change from the less to the more anchylosed condition of the body-segments, which attains its greatest concentration in the recent *Limulus*.

But besides these, we have in *Hemiaspis* a form more separated into distinct segments than is *Belinurus regince*; so that the passage from *Eurypterus* to *Belinurus*, and from that again to *Limulus* proper, seems capable of being bridged over, and we are justified in placing them in the same order, though separated into distinct subdivisions.

We have adopted Dr. Dana's name of MEROSTOMATA for the order, making the first suborder, EURYPTERIDA, to contain:—

A.

- | | | | |
|----------------------------------|--------|----|----------|
| 1. <i>Pterygotus</i> , Agassiz, | having | 14 | species. |
| 2. <i>Slimonia</i> , H. W., | „ | 3 | „ |
| 3. <i>Stylonurus</i> , H. W., | „ | 6 | „ |
| 4. <i>Eurypterus</i> , De Kay, | „ | 20 | „ |
| 5. <i>Dolichopterus</i> , Hall, | „ | 1 | „ |
| 6. <i>Bunodes</i> , Eichw., | „ | 1 | „ |
| 7. <i>Arthropleura</i> , Jordan, | „ | 1 | „ |

B.

- | | | | |
|------------------------------|---|----------|----------|
| 8. <i>Hemiaspis</i> , H. W., | „ | 5 | „ |
| | | <hr/> 51 | species. |

Second suborder, XIPHOSURA, to contain:—

A.

- | | | | |
|------------------------------|--------|---|----------|
| 1. <i>Belinurus</i> , König, | having | 5 | species. |
|------------------------------|--------|---|----------|

B.

- | | | | |
|----------------------------|---|----------|----------|
| 2. <i>Limulus</i> , Müller | „ | 14 | „ |
| | | <hr/> 19 | species. |

I characterize the order MEROSTOMATA as Crustacea having the mouth furnished with mandibles and maxillæ, the appendages to which fulfil the functions of limbs, becoming walking- or swimming-feet, and organs of prehension.

Suborder EURYPTERIDA, Huxley, 1859.—Crustacea with numerous free thoracico-abdominal segments, the first and second of which bear one or more broad lamellar appendages upon their ventral surface, the remaining segments being devoid of appendages; the anterior rings united into a carapace bearing a pair of larval eyes near the centre, and a pair of large marginal or subcentral eyes; the mouth furnished with a broad postoral plate or metastoma, and five pairs of moveable appendages, the posterior of which form great swimming-feet,—the telson or terminal joint being extremely variable in form, and the integument characteristically sculptured.

XIPHOSURA (Gronov.).—Crustacea having the anterior segments welded together to form a broad convex buckler, upon the dorsal surface of which are placed two larval frontal eye-spots, and two large lateral compound eyes. Beneath this shield-like covering is placed the mouth, furnished with a small labrum and a rudimentary metastoma, and six pairs of moveable appendages. Posterior segments of the body more or less free in the fossil species, but anchylosed together in the recent species, and bearing upon their ventral surfaces a series of broad lamellar appendages. The telson or terminal segment ensiform.

I have prepared a Table which gives the species in detail, with their geological position and locality (it includes ten genera and seventy species*); also representations of all the genera save three, which require further confirmation before they can be figured otherwise than as fragments.

The geological range of this order is as follows:—We find there are 37 species in the Upper Silurian; 7 in the Lower, and 8 in the Middle Devonian; 1 in the Lower Carboniferous, and 7 in the Upper; 1 in the Permian of Russia; 1 in the Trias of Germany; 7 in the Lithographic stone of Solenhofen; 1 in the Tertiary Brown Coal of Saxony; and 4 living species inhabiting the shores of Molucca, Japan, China, the East Indies, and the eastern shores of North America. They have been met with geologically in the State of New York, especially in Buffalo county; in Ireland (Kiltorcan, fragments only); in Forfarshire, Lanarkshire, Fifeshire, and Caithness in Scotland; in Herefordshire, Worcestershire, and Staffordshire; in the islands of the Baltic (Oesel and Gothland); in Bavaria, Saxony, Poland, and as far east as the government of Perm and the Ural Mountains; so that their geological distribution is quite as wide as that of their living congeners.

The *Limulus* of the Upper White Jura cannot, so far as we are acquainted with it, be well separated generically from those of the present day. How vast, then, must have been the period represented between the lifetime of the *Belinurus* of the Coal-measures and that of the *Limulus* of the Oolites! and yet we should be unwilling to doubt their relationship by descent. Each antecedent period, then, must have been infinitely greater as we recede to the Wenlock, where the first traces of *Pterygotus* occur.

Second Report on the "Menevian Group" and the other Formations at St. David's, Pembrokeshire. By H. HICKS, and J. W. SALTER, F.G.S.

THE work of the past year has not been confined to procuring fossil specimens, although that object has been kept steadily in view.

The extent and direction of the various beds has been particularly noted; and a much greater area than was formerly suspected has been found occupied by the respective lower fossil groups Menevian, Ffestiniog, Tremadoc, and the great Arenig or Skiddaw group—formations which have only of late years been accurately explored.

Above these rocks, and forming their upper limit, we have in the St. David's promontory the Llandeilo flags, a formation that does not need a special description, since it is already well known to us in the 'Silurian System,' and under the name of Lower Bala in Prof. Sedgwick's works.

The fossil-bearing strata in the neighbourhood of St. David's are mostly exhibited in coast sections; and the grant has been very useful in enabling Dr. Hicks to employ boat-service in the work. Without boats, indeed, it would be impossible to make sure of the succession, so much have the strata been disturbed and faulted, and also in many parts covered by drift. But the series, once accurately defined by this examination, could be tested by reference to roadside and brook sections, where the beds are weathered; and hence we can now offer a tolerably accurate map of all the formations, and extend it over a larger part of the district. Moreover in all about sixty-five

* This Table has since been published by the Palæontographical Society.—Dec. 1866.