PROCEEDINGS

AND

TRANSACTIONS

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CONTENTS.

INDEX TO PROCEEDINGS.

ERRATA.

PAGE.	LINE.				
13	16,	for	*microdentopa*	read	*microdeutopa.*
22	8,	,,	*Hippornedon*	,,	*Hippomedon.*
39	6,	,,	*Swammardamii*	,,	*Swammerdamii.*
56	18,	,,	LORENI	,,	LOVENI.
,,	19,	,,	*Loreni*	,,	*Loveni.*
,,	21,	,,	*Loreni*	,,	*Loveni.*
67	14,	,,	*Sphœrium*	,,	*Sphœroma.*
69	1,	,,	*Rhizotoma*	,,	*Rhizostoma.*
88	15,	,,	stones	,,	shores.
92	30,	,,	Zeuker	,,	Zenker.
,,	33,	,,	*Zeukeri*	,,	*Zenkeri.*
96	9,	,,	NONOIDES	,,	NANOIDES.
,,	10,	,,	*nonoides*	,,	*nanoides.*
,,	4,	,,	*nonoides*	,,	*nanoides.*
186	1,	,,	*alternifolium*	,,	*alterniflorum.*

270 *ÆSCHNIDÆ* GOMPHINA (forming lines 32 and 33) should be placed before GOMPHUS (line 30).

vi line 33, for *Primu lascotica* read *Primula scotica.*

xxxviii ,, 22, ,, *flavida* ,, *flavidus.*

TRANSACTIONS

OF THE

NATURAL HISTORY SOCIETY OF GLASGOW.

I.

A CONTRIBUTION TOWARDS A CATALOGUE OF THE AMPHIPODA AND ISOPODA OF THE FIRTH OF CLYDE.

BY DAVID ROBERTSON, F.L.S., F.G.S.

[Read 27th April, 1887.]

For this contribution I have been gathering materials during a number of years. In the last two summers I was enabled to make a considerable advance towards the end in view, having, through the kindness of Mr. John Murray of the *Challenger* Expedition, had the privilege of accompanying him in his steam yacht *Medusa*, of the Scottish Marine Station, Granton, during his dredging in the Firth of Clyde. The tight little vessel is fitted up with all modern improvements, whereby the dredging work is carried on at all depths, and with the greatest ease and expedition. I had the advantage, moreover, of getting all the Amphipods that were taken, thus adding much to the list that could not otherwise have been obtained, besides throwing important light on the distribution of the species in different depths of water. I owe grateful thanks to Mr. Murray, and to all the staff, for their kind attention; also to the Rev. Canon A. M. Norman, and Mr. C. Spence Bate, of Plymouth, for their kind and willing help; and to the Rev. Thomas R.

R. Stebbing, of Tunbridge Wells, for his ever liberal and painstaking assistance.

Unfortunately there have been few workers on the Amphipoda of the Firth of Clyde; and the literature on that branch of zoology, with the exception of scattered reports, is confined to Messrs. Spence Bate and Westwood's valuable *Monograph of the British Sessile-eyed Crustacea.* It is now nineteen years since the publication of that work, and during the intervening period there have been many additions and rearrangements in both genera and species. In the following list I have adopted in some cases the arrangement of Boeck's exhaustive work *De Skandinaviske og Arktiske Amphipoder.*

In preparing the list an endeavour has been made to give the haunts and habits of the animals wherever opportunity occurred. With the exception, however, of those found within tide-mark, this could not always be satisfactorily done.

The dredge, by which the greater number of species is procured, allows few opportunities for studying their habits. When an attempt is made to do so in confinement in a glass jar or other vessel, the conditions are so different from those existing at a depth of from 10 to 100 fathoms at the bottom of the sea, that little value can be attached to the results. Those species most easily attainable and most abundant inhabit the littoral belt between high and low-water, chiefly under stones and decaying sea-weed, where any number may be procured with very little trouble. They belong chiefly to the two genera *Talitrus* and *Orchestia.*

Besides with the dredge, good work can also be done between tide-mark on the sandy shore and sheltered bays, with a sieve that will allow the sand and mud to be washed out but is close enough to retain the animals.

The surface-net is another successful appliance yielding many forms of great interest. It can be

worked from an oar-boat with as much success as from a faster-going vessel, as great speed is rather an objection when the water is made to rush into the net more rapidly than the meshes can let it out. For the surface work the best time seems to be after sunset, and the darker the better. I am not aware that any of these marine animals which crowd the surface of the water at night are peculiar to the surface. With few exceptions, all that have come under my own observation in the surface-net have also been taken by the dredge. Considering the depth of bottom from which many of them must have come, it is a question how (if ever) these tiny forms get back through the strong currents and tides to their wonted habitat. These nets were used by the steam yacht *Medusa* with great advantage, not only as surface-nets, but attached to the dredging-line at various depths, thus giving a tolerably correct idea of the minute inhabitants of the various zones in the water, to what extent they were distinct or intermixed, and whether those found at the surface by night were met with in the under zones by day.

There are a number of species occasionally met with on the surface, floating on sea-weed carried from the shore far out to sea by the winds and receding tide. Whether in general they take the journey willingly or are carried off by accident may be difficult to determine. The Amphipod most frequently found in this way, during the summer season, is *Dexamine spinosa*, and the Isopod *Idotea tricuspidata*. As the latter has been brought up in great abundance by the dredge among wrack (sea-weed) from a depth of twenty fathoms, it is not improbable that their raft of sea-weed from the shore may have got water-logged and taken them safely in concealment to the bottom, which may not be altogether inconsistent with their habits.

It is a curious fact that the Amphipoda are very seldom taken by the tow-net more than three or

four fathoms under the surface, and when they do occur it is only in ones and twos. Those prevailing most on the surface in summer months (chiefly *Dexamine spinosa*) almost entirely disappear during winter, and are replaced by another *(Atylus Swammerdamii)* that is seldom taken by the same means, and is but sparingly met with round our shores, whether by the net or dredge. When taken by the tow-net, it is generally without any accompanying amphipodal species; whereas in summer, with few exceptions, a variety of different species belonging to the same order may almost always be met with. This periodical appearance of different species seems to hold good even to a greater extent with the smaller organisms. *Ceratium tripos*, one of the Infusoria, was met with last summer in the Firth of Clyde in great abundance from surface to bottom; but, by the time winter had set in, it had wholly disappeared. The same may be said of *Noctiluca miliaris*. A few years ago it occurred in excessive abundance in Millport Bay for a very short time, but has not come under my notice since.

In regard to this section of the work, the staff of the Millport Marine Branch Station purpose to include the whole of the Invertebrate Fauna of the Firth of Clyde, taken at various depths from the surface to the bottom, whereby some knowledge may be gained concerning the various depths at which the food of fishes is attainable or most abundant, and whether the food of the herring may not be plentiful at depths hitherto unsuspected, where the fish may resort when they leave shallower water.

The following list of the Amphipoda and Isopoda taken by the surface-net after sunset, may be useful to compare with deeper takes of the net during day, and with those of the surface-net during sunlight:

Ampelisca Gaimardi.
lævigata.
tenuicornis.
Anonyx serratus.
Aora gracilis.
Atylus Swammerdamii.
Bathyporeia pilosa, ♂ and ♀.
Calliope læviuscula.
Cheirocratus Sundevalli.
Corophium Bonellii, ♂.
crassicorne.
Dexamine spinosa.
Eurydice pulchra.
Gammarus locusta.
marinus.
Gossea microdentopa.
Hyale imbricatus.
Hyale Lubbockiana.
Nilssoni.
Hyperia medusarum, and var.
Idotea parallela.
tricuspidata.
Lysianassa Costæ.
longicornis.
Mœra Othonis.
Melita obtusata.
Monoculodes æquimanus.
Pherusa bicuspis.
Proto ventricosa.
Protomedeia Whitei.
Stenothoe monoculoides.
Urothoe marinus, ♂ and ♀.
norvegica.

Another useful appliance, called the dip-net, consists of a stout ring of galvanized iron about ten inches or a foot in diameter, with a thin strong bag attached, about twenty inches deep, and rounded at the bottom. The coarse material called "cheese-cloth" answers the purpose very well. The ring is fitted with a strong handle ten or twelve feet long; and by this means the algæ and zostera-beds in shallow water may be swept from the side of a row-boat. The net may be also used, without a boat, for sweeping along the edges at low water among weedy and stony ground; and many good things may thus be obtained from spots where the dredge cannot work. We may assume that the more suitable the appliances are for the different grounds we have to work on, the greater our success is likely to be. On this point I may remark that many species are in one sense justly considered rare, *i.e.*, with the usual means of finding them, their haunts and habits being unfavourable for the ordinary means of capture. This accounts in some measure for our being indebted for many of our rarer species to the stomachs of birds and fishes. The small Ostracod *Philomedes interpuncta*, Baird, for a long time appeared from my gatherings to be moderately rare; but when the surface-net was used after sunset this species was occasionally met with in great abundance. With regard to many others

that we have long considered rare, we need not be surprised if one day, by some new or different cast, we should find the same in hundreds.

Class CRUSTACEA.

Order AMPHIPODA.

Family ORCHESTIIDÆ.

Genus Talitrus, Latreille.

TALITRUS LOCUSTA, Pallas.

Oniscus locusta, Pallas, Spicil. Zool., fasc. 9, tab. 4, fig. 7.

Astacus locusta, Pennant, Brit. Zool., iv., p. 21.

Talitrus locusta, Latreille, Hist. Nat. des. Crust. et Ins., t. 6, p. 229.—S. Bate, Ann. Nat. Hist. (2nd Series), vol. xix., p. 135.

Cancer (Gammarus) saltator, Montagu, Linn. Trans., ix., p. 94, t. 4, f. 3.

Talitrus saltator, Milne Edwards, Ann. des Sc. Nat., t. 20, p. 364.

"This species is abundant all along our sandy shores, near high-water, under decomposing sea-weed; and higher, above the ordinary tide-mark, where they burrow to the depth of three to four inches, 'till they find sufficient moisture for their wants and comfort.' Their burrows are small, round, perpendicular holes, about the size of a goose-quill. In some places the sand is so much riddled that the holes are very conspicuous. If rudely disturbed, the occupants are seen leaping about in all directions, and it takes nimble fingers to get hold of one of them. When the sand is gently rubbed off, layer by layer, with the edge of the hand, till the animals are partially exposed, they lie motionless, seemingly feigning death; but if tossed out, as already stated, they at once bound off, endeavouring to escape, which most of them generally succeed in doing.

"The belt of sand they usually occupy at high-water is above the ordinary tide-mark, whereby in continuous wet weather they must be exposed to a considerable amount of fresh-water. To test how long they could live in that element, two were put into a cupful of rain-water, where they swam about freely for a time. By three hours they were lying on their backs, but when disturbed they made efforts to swim and to stand on their feet, which they only did for a very short time. When taken out of the water they could still walk and leap a little. At this stage one was laid on sand damped with sea-water, and after a little while it recovered, and burrowed into the sand. The other, after five hours' immersion, ceased to live. From this experiment they appear to be able to bear much drenching under heavy rain, where the water drains quickly through the sand; yet we find that a few hours' close confinement in fresh-water is destructive to life."*

As this species is said never to be found voluntarily inhabiting the sea, to test how long they could live in salt-water twelve of them were put into a glass jar with about a pint of sea-water. They seemed at home for two or three days, but by the sixth day had begun to become somewhat languid. Although the experiment could not satisfactorily be carried further in the absence of food, it showed that they were fitted against any contingency of rain or flood that was likely to overtake them in their natural haunts.

Genus Orchestia, Leach.

ORCHESTIA GAMMARELLUS, Pallas.

Oniscus gammarellus, Pallas, Spicil. Zool., fasc. ix. (1772), tab. 4, fig. 8.

Cancer gammarellus, Herbst, Versuch einer Naturgesch. der Krabben und Krebse (1782-1804).

* *Trans. Nat. Hist. Soc. Glasg.*, vol. i., p. 130.

Cancer (Gammarus) littoreus, Montagu, Linn. Trans., ix., p. 96, t. 4, f. 4.

Orchestia littorea, Leach, Edin. Encyc., vii., p. 402.

Orchestia Erichore, F. Müller, Archiv. f. Naturgesch., xiv., p. 53, pl. 4.

Talitrus tripudians, Kroyer, Nat. Tidsskr., 2 R., i., p. 311, tab. iii., fig. 2, a-e.

This species has been called the shore-hopper, in contradistinction to the last-named species — the sand-hopper—which is more frequently found on tracts of sand. The shore-hopper occupies a similar belt at the upper verge of high-water mark, as well as lower down under stones and decaying sea-weed cast ashore; and it is frequently met with in moist situations, far above high-water mark, under stones grown round with grass, and in pasturage under the decaying droppings of cattle.

Bate and Westwood remark that "this species is more frequently found on rocky shores than on sandy bays, although it is met with where the two conditions meet,"* which agrees with my own experience. Like the sand-hopper, it does not seem to be able to live long continuously under water, although it appears quite at home in it for a time. When put into a vessel with sea-water, it swims along the bottom, but is more inclined to walk. In attempting to ascend in the water, it seems to depend more on the stroke given by the tail on the bottom of the vessel than on any other swimming appendage. A dozen were put into a saucer filled with sea-water at 5.30 p.m., and at 11 p.m. they appeared less active. Next morning, at 7 a.m., two only were living. These were replaced in renewed sea-water, where they lived five hours longer. I suspect that these two had got up during the night to the edge of the water, and had been refreshed by a supply of air. I have one of this species in my collection, with the second hand fully one-half smaller on the left side than on the right.

* *Brit. Sessile-eyed Crust.*, vol. i., p. 29.

ORCHESTIA MEDITERRANEA, Costa.

Orchestia mediterranea, Costa, Rend. dell. Accad. Sci. Napoli (1853), p. 171.

Orchestia littorea, Milne Edwards, Ann. Sc. Nat., t. 20.

Orchestia lævis, Spence Bate, Ann. Nat. Hist. (2nd Ser., 1857), xix., p. 136.

Habitat.—One only was taken at west end of Cumbrae under stones above high-water mark; another was sent me from the mouth of the Garnock, Ayrshire, by Mr. John Smith, Kilwinning.

It has been taken far above high-water mark in Langland Bay, near Swansea, and on the shore near the Bailey Lighthouse, Dublin Bay, by Messrs. S. Bate and Westwood; also off Rough Island, Strangford Lough, by Mr. W. Derragh.

Genus HYALE, H. Rathke.

HYALE NILSSONI, Rathke.

Amphithoe Nilssoni, Rathke, Acta Acad. Leopold., t. xx., p. 264.

Allorchestes Nilssoni, Bruzelius, Bidrag till Känn. Skand. Amphip. Gam., p. 35.

Allorchestes Danai, Spence Bate, Rep. Brit. Assoc. 1855, p. 57.

Hyale Nilssoni, Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 14.

Habitat.—Taken by the dip-net in a shallow creek at Kames Bay, Millport, Buteshire. Four were taken at the time and put into a glass vessel, where they swam about freely. One of them had another firmly clasped under its body (in the manner of *Gammarus pulex* and others), and maintained its hold till forced asunder next morning.

HYALE IMBRICATUS, Spence Bate.

Allorchestes imbricatus, Spence Bate, Report Brit. Assoc. 1856, p. 57.

Habitat.—Taken by the surface-net after sunset along the rock edges at low-water on the east

side of Kames Bay, Cumbrae. This species has seldom come under my notice. It has been taken at Penzance by Mr. G. Barlee, and also on the breakwater at Plymouth.

HYALE LUBBOCKIANA, Spence Bate.

Galanthis Lubbockiana, Spence Bate, Brit. Assoc. Report 1855, p. 57.

Nicea Lubbockiana, Spence Bate, Cat. Brit. Mus., p. 51.

Habitat.—Amongst algæ on the walls of Largs pier; in tide pools, Cumbrae; and by the surface-net along the edges of rocks about half-tide, Cumbrae. It has also been taken at Falmouth by Mr. W. Webster; at Penzance by Messrs. Harris and Barlee; and on the coast of Northumberland by the late Mr. Joshua Alder.

TRIBE NATATORIA.

Family GAMMARIDÆ.

Sub-family STEGOCEPHALIDES.

Genus STENOTHOË, Dana.

STENOTHOË MONOCULOIDES, Montagu.

Cancer (Gammarus) monoculoides, Montagu, Trans. Linn. Soc., xi., p. 4, pl. 2, fig. 3.

Montagua monoculoides, S. Bate, Rep. Brit. Assoc. 1855.

Typhis monoculoides, Milne Edwards, Ann. Sci. Nat., xx. (Aug., 1830).

Probolium monoculoides, Norman, Rep. on the Shetland Crust. (1868), p. 273.

Habitat.—Dredged in 40 fathoms on *Antennularia ramosa*, and between the Allans in one and two fathoms, gravelly bottom; also among the algæ fringing the rocks near low-water on the east side of Kames Bay; and by the surface-net after sunset, Cumbrae. It has been taken in Salcombe Harbour by Montagu; Falmouth and Tenby, Mr. Webster;

Penzance, Mr. Harris and Mr. G. Barlee; Moray Firth, Rev. Mr. Gordon; Skye and Shetland, Mr. Barlee; Plymouth, Mr. Howard Stewart; Sligo and Belfast Bay, Ireland, Mr. W. Thompson.

STENOTHOË MARINA, Spence Bate.

Montagua marina, Spence Bate, Brit. Assoc. Report 1855, p. 57.

Stenothoe marina, A. Boeck, Forh. ved de Skand. Naturf., 8de mode (1860), p. 655.

Probolium marinum, Heller. Deukschr. d. k. k. Acad. d. Wissensch. (1867), 2 Abth., p. 14.

Stenothoe marina, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 59.

Habitat.—Among floating sea-weed at low-water, Cumbrae; also dredged off Dunoon.

It has been taken on the coast of Northumberland by Mr. Joshua Alder; Banff, Mr. Edward; Macduff, Mr. Gregor; and amongst trawl-refuse near Eddystone Lighthouse, Messrs. Bate and Westwood.

Genus DANAIA, Spence Bate.

DANAIA DUBIA, Spence Bate.

Montagua dubius, Spence Bate, Report Brit. Assoc. 1855, p. 57.

Danaia dubia, Spence Bate, Ann. Nat. Hist. (1857), xix., 137.

Habitat.—Washed off stones and nest of *Lima hians* that were dredged in 7 to 8 fathoms west of Tan Buoy, Cumbrae. This was the only time I met with it. Bate and Westwood had it from Plymouth amongst trawl-refuse.

Genus LYSIANASSA, Milne Edwards.

LYSIANASSA COSTÆ, Milne Edwards.

Lysianassa Costæ, Milne Edwards, Ann. des Sc. Nat., t. xx. (1830), p. 365, pl. 10, fig. 17.—S. Bate, Report Brit. Assoc. 1855.

Gammarus glaber (Spinola), White, Cat. Brit. Mus. Crustacea (1847), p. 89.

Habitat.—Dredged in 6 fathoms on a weedy-gravelly bottom, and at about double the depth amongst Melobesia, and in sandy mud at Tan, Cumbrae; also off Skelmorlie Buoy, in 8 to 10 fathoms, bottom muddy gravel. It has been taken at Tenby by Mr. Webster; on the coast of Northumberland by Mr. Joshua Alder; Belfast Bay, Mr. Hyndman; and Plymouth, Messrs. Bate and Westwood.

LYSIANASSA TUMIDA, Kroyer.

Anonyx tumidus, Kroyer, Naturhist. Tidsskr., 2 R. 2 B. (1846), p. 16.

Lysianassa tumida, Goës, Crust. Amphip. Maris Spetsb. (1866), p. 2.

Lysianassa Audouiniana, Spence Bate, Brit. Assoc. Report, 1855.

Aristias tumidus, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 27.

Habitat.—A single specimen dredged at the mouth of Loch Fyne, in 40 to 60 fathoms, in a sponge, bottom gravelly mud. It has only been recorded before from Plymouth by Bate and Westwood.

LYSIANASSA LONGICORNIS, Lucas.

Lysianassa longicornis, Lucas, Expl. Sci. Algerie Zool. i. Crust., p. 53, pl. 5, fig. 2.

Lysianassa Chausica, Spence Bate, Ann. Nat. Hist. (1857), vol. xix., p. 138.

Habitat.—Dredged at the Tan, Cumbrae, in 7 to 8 fathoms, among the roots of *Laminaria saccharina*, bottom Melobesia. It was taken in the surface-net after sunset, in the month of September, off the west end of Little Cumbrae. It has also been taken at Banff by Mr. Edward, and in Dublin Bay by Professor Kinahan.

LYSIANASSA ATLANTICA, Milne Edwards.

Gammarus atlanticus, Milne Edwards, Ann. des. Sc. Nat., t. xx.

Lysianassa atlantica, Milne Edwards, Hist. des. Crust., t. iii., p. 22.

Lysianassa marina, Spence Bate, Ann. Nat. Hist., vol. xix. (1857), p. 138.

Opis typica, White, Pop. Hist. Brit. Crust., p. 168.

Habitat.—Dredged near the Tan Buoy, Cumbrae, in 7 to 8 fathoms, bottom Melobesia. Taken in Plymouth Sound by Bate and Westwood; Banff, Mr. Edward; Strangford Lough, Ireland, Mr. W. Thompson.

Genus ANONYX, Kroyer.

ANONYX SERRATUS, Boeck.

Anonyx serratus, A. Boeck, Forhandl. ved de Skand. Naturf., 8de mode (1860), p. 29, fig. 8.

Anonyx Edwardsii, Spence Bate, Cat. Amphip. Crust. Brit. Mus., p. 73, pl. xi., fig. 5.

Lysianassa crispata, Goës, Crust. Amphip. Maris Spetsb. (1865), p. 3, fig. 3.

Orchomene serratus, A. Boeck.

Habitat.—Dredged at the Tan Buoy, Cumbrae, 6 fathoms, at roots of *Laminaria saccharina* that were matted with Melobesia and nests of *Lima hians*. It was moderately common in the surface-net after sunset one night in the month of August. Recorded from Moray Firth by Rev. G. Gordon; Banff, Mr. Edward; Falmouth, Mr. Webster; and Plymouth Sound, Messrs. Bate and Westwood.

ANONYX OBESUS, Spence Bate.

Anonyx obesus, Spence Bate, Cat. Amphip. Crust. (1862), p. 74, pl. xii., fig. 1.

Acidostoma obesum, Lilljeborg, On the Lysianassa magellanica, etc. (1865), p. 34, pl. v., fig. 53-65.

Habitat.—Dredged off the Fairland Point, Cumbrae, and taken in the Moray Firth by Mr. Edward of Banff.

ANONYX HOLBÖLLI, Kroyer.

Anonyx Holbolli, Kroyer, Naturhist. Tidsskr., 2 R. 2 B. (1846), p. 8.

Anonyx denticulatus, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 75.

Lysianassa Holbolli, Goës, Crust. Amphip. Spetsb. (1866), p. 4.

Hippornedon Holbolli, A. Boeck, De Skan. og Arkt. Amphip., p. 136, pl. v., fig. 6, pl. vi., p. 7.

Habitat.—Dredged near the Tan Buoy, Cumbrae, in 10 to 12 fathoms; Castle Bay, Little Cumbrae, in 7 fathoms, bottom sand and sea-weed; Loch Fyne, in 80 fathoms, bottom mud; also taken by the sieve in muddy sand near low-water, Balloch Bay, Cumbrae. It has been taken in the Moray Firth by the Rev. G. Gordon and Mr. Edward; Dublin Bay, by Professor Kinahan; and in Vedlom Voe, Shetland, by Dr. J. Gwyn Jeffreys and the Rev. A. M. Norman.

ANONYX LONGIPES, Spence Bate.

Anonyx longipes, Spence Bate, Cat. Amphip. Crust. Brit. Mus., p. 79, pl. xiii., fig. 4.

Anonyx ampulla, Spence Bate and Westwood, Brit. Sessile-eyed Crust. (1863), t. i., p. 113.

Typhosa longipes, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 38.

Habitat.—Dredged in muddy sand off the north-east corner of Little Cumbrae, in 14 fathoms, washed out from the roots of *Laminaria saccharina*; also between Kilchattan and Cumbrae, in 66 fathoms, bottom soft mud. It has been taken on the Haaf fishing-ground, off Shetland, by the Rev. A. M. Norman and Dr. J. G. Jeffreys; and the ♂ from the Moray Firth by the Rev. G. Gordon and Mr. Edward.

ANONYX GULOSUS, Kroyer.

Anonyx gulosus, Kroyer, Naturh. Tidsskr. 2 R. 1 B. (1884), p. 611.

Anonyx norvegicus, Lilljeborg, Öfvers. af Kgl. Veteusk.-Akadem. Förh. (1851), p. 22.

Anonyx Holbolli, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 75, pl. xii., fig. 4.

Lysianassa gulosa, Göes, Crust. Amphip. Maris Spetsb. (1866), p. 4.

Habitat.—Dredged between the Allans, Cumbrae, in 2 to 4 fathoms, sandy-weedy bottom. It has also been taken by the Rev. G. Gordon of Elgin and Mr. Edward of Banff. Mr. Barlee dredged it on the Haaf, about 30 miles off the Shetlands, and the Rev. A. M. Norman and Dr. J. G. Jeffreys in the Outer Skerries Harbour, Shetland. Mr. Loughrin has taken it at Polperro, and Messrs. Bate and Westwood in Plymouth Sound.

On one or two occasions I have taken in the surface-net a specimen with long under-antennæ, which I believed to be the male of the same species.

Genus Callisoma, Costa (1851).

callisoma crenata, Spence Bate.

Scopelocheirus crenatus, Spence Bate, Brit. Assoc. Report 1855.

Callisoma crenata, Spence Bate, Cat. Amphip. Brit. Mus., p. 85, pl. xiv., fig. 5.

Habitat.—Loch Fyne, in 80 fathoms, bottom soft mud; Lochgoil, in 12 fathoms, mud and gravel; off Garnock Beacon, in 5½ fathoms, muddy gravel; and a little off Kilchattan Bay, in 30 fathoms, bottom sandy mud. On one occasion, while washing dredged material through a sieve in a large tub, this species was seen in great abundance floating on the surface of the water. On lifting up an old spineless and partly broken test of *Brissus lyrifer*, it was found to be crowded with the same species; and there can be little doubt that those floating in the tub had escaped from the old test. I have since observed it again under the same conditions. The eyes in life are moderately large and red.

This species has been recorded from Plymouth by Messrs. Bate and Westwood, and from Banff by the late Mr. Edward. It has also been found, in 40 fathoms, on the Middle Haaf fishing-ground, Shetland, in great abundance, by the Rev. A. M. Norman and Dr. J. G. Jeffreys.

Genus Ampelisca, Kroyer.

AMPELISCA GAIMARDI, Kroyer.

Ampelisca Gaimardi, Kroyer, Voy. en Scand., pl. 23, fig. 1.

Araneops diadema, A. Costa, Rend. del. Accad. Sc. di Nap. (1853), p. 171, tab. i., fig. 1.

Tetromatus typicus, Spence Bate, Brit. Assoc. Rep. 1855, p. 58.

Byblis Gaimardi, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 148.

Habitat.—This species is common all round our shores. It is found off Dunoon in 15 fathoms, bottom sandy gravel; off the Row pier, towards Roseneath, in 10 to 12 fathoms, bottom stinking black soft mud, which seemed to be relished by not a few genera of the crustacea; off the Caple Rock, Cumbrae, in 10 fathoms, bottom mud, gravel, and shell debris; west of the Tan Buoy, in 14 fathoms, mud and dead shells; off the south side of the Allans, Cumbrae, in 8 to 10 fathoms, mud and stones; and off the east side of Callum's Bay, Bute, in 14 fathoms, bottom gravelly. It has been taken in the Moray Firth by the Rev. G. Gordon; off the island of Skye by Mr. Barlee; on Nishbank, Dublin Bay, by Professor Kinahan; in Plymouth Sound, by Mr. T. P. Smyth and Messrs. Bate and Westwood; in 20 fathoms, at the entrance of Belfast Bay, by Messrs. Hyndman and E. Goodsir; in the Shetlands, in Outer Skerries Harbour, in from one to two fathoms; and sixty miles east of Shetland, in from 70 to 90 fathoms, by the Rev. A. M. Norman and Dr. J. G. Jeffreys.

AMPELISCA LÆVIGATA, Lilljeborg.

Ampelisca lævigata, Lilljeborg, Öfv. af Kgl. Vet.-Akad. Förh. (1855), p. 123.

Ampelisca Belliana, Spence Bate, Catal. Amphib. Crust. Brit. Mus. (1862), p. 93, pl. xv., fig. 3.

Tetromatus Bellianus, Spence Bate, Brit. Assoc. Rep. 1855, p. 58.

Habitat.—Taken in the dredge in sandy gravel, 15 fathoms, off the south shore of Cumbrae, opposite Largs; and off Fairlie in 20 fathoms, bottom sandy mud; also taken by the sieve in pure sand at low-water, at Crarae, Loch Fyne; and by the same means at low-water in muddy sand, Kilchattan Bay, Bute. Dredged off Seamill, below Portincross, in 6 fathoms, bottom sand and stones; in 1 to 2 fathoms, gravelly sand, between the Allans, Cumbrae; in the surface-net after sunset, Campbeltown Loch, September; and by the same means, after sunset, off Cumbrae, July. In this case all observed were females.

This species has also been taken in the Moray Firth by the Rev. G. Gordon and Mr. Edward of Banff; and in Plymouth Sound by Messrs. S. Bate and Westwood, who also report it from the North Atlantic, and the coasts of Norway, America, and Greenland.

AMPELISCA TENUICORNIS, Lilljeborg.

Ampelisca tenuicornis, Lilljeborg, Öfv. af Kgl. Vet.-Akad. Förh. (1855), p. 123.

Ampelisca lævigata, Spence Bate and Westwood, Brit. Sessile-eyed Crust. (1868), ii. App. p. 504.

Araneops diadema, Costa, Mem. d. R. Accad. d. Sci. di Napoli. (1856), p. 178, t. 1, fig. 1.

Habitat.—A single specimen (the only Amphipod seen in the haul) was dredged in Loch Fyne in 80 fathoms, bottom soft mud. Another was taken between the Tan, off Cumbrae and Bute, in 35 fathoms, bottom shelly mud.

AMPELISCA PROPINQUA, A. Boeck.

Ampelisca propinqua, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 145.

Habitat.—Dredged in Lochgoil, in 12 fathoms, bottom gravelly mud. One only was taken.

AMPELISCA ASSIMILIS, A. Boeck.

Ampelisca assimilis, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 142.

Habitat.—Dredged in 10 to 12 fathoms in Row Bay, Gareloch, bottom black stinking mud.

AMPELISCA MACROCEPHALA, Lilljeborg.

Ampelisca macrocephala, Lilljeborg, Öfv. af Kgl. Vet.-Akad. Förhand. (1852), p. 7.

Ampelisca Eschrichti? Lilljeborg, Öfv. af Kgl. Vet.-Akad. Förh. (1851), p. 22.

Araneops brevicornis, Costa, R. Soci. Crost. Amfip. del regno di Napoli. (1851), p. 180, tab. i., f. 2.

Habitat.—Dredged off Brodick Bay in 80 fathoms, bottom soft brownish-coloured mud. Rare.

Genus HAPLOOPS, Lilljeborg.

HAPLOOPS TUBICOLA, Lilljeborg.

Haploops tubicola, Lilljeborg, Öfv. af Kgl. Vet.-Akad. Förh. (1855), p. 135.

Haploops tubicola, S. Bate and Westwood, Brit. Sessile-eyed Crustacea, vol. ii., p. 505.

Habitat. — Dredged off Little Cumbrae in 60 fathoms, bottom soft mud; in Loch Striven, 35 fathoms, bottom soft mud, where their tubes were found in great abundance; off Dunoon in 15 to 25 fathoms, bottom mud; and off Fairlie in 6 to 8 fathoms, sandy mud.

When a mass of their tubes is brought up in the dredge (as is often the case) and emptied on the deck, a number of the species may generally be seen sprawling about free, having most probably escaped from their tubes in alarm.

Some of the tubes, which were suspected to be those of an Annelid, were put into water over-night; and in the morning a few of the Amphipods were found swimming free, which led to the discovery of the occupants. The animal can swim about briskly for a time, rolling itself up when it settles down to rest. None of them were seen to return to their tubes.

The tubes are flat, of a soft leathery consistence, chiefly composed of clay, and deriving strength and flexibility from the secretion of the animal. They are from one to two inches in length, are sometimes bent more or less, and frequently have small lobes or sacs projecting from the lower ends.

When undisturbed, the creatures are seen to lie with their head just so far out as to bring the red eye into view beyond the margin of the tube, with the antennæ spread out, no doubt awaiting passing prey.

HAPLOOPS SETOSA, A. Boeck.

Haploops setosa, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 148.

Habitat.—Dredged off Skate Island, Loch Fyne, in 100 fathoms, bottom soft mud; two only were met with.

Genus PHOXUS, Kroyer.

PHOXUS SIMPLEX, Spence Bate.

Phoxus Kroyeri, Spence Bate, Brit. Assoc. Rep. 1855, p. 58.

Phoxus simplex, Spence Bate, Ann. Nat. Hist., vol. xx. (1857), p. 525.

Habitat.—Taken at the roots of *Laminaria saccharina*, in 6 fathoms, at the Tan Buoy, Cumbrae. This species is very minute.

In their description of the species, Bate and Westwood appear not to have seen the eyes. These are small, round, and white, having a few red spots placed at regular distances near the circumference.

This species is recorded by Messrs. Bate and Westwood from Plymouth Sound where it has been taken by the dredge.

PHOXUS HOLBÖLLI, Kroyer.

Phoxus Holbolli, Kroyer, Naturh. Tidsskr., 1 R. iv. (1842), p. 151.

Habitat.—Dredged between the Allans, Cumbrae, in 2 to 3 fathoms, on a sandy-gravelly bottom, with zostera and other fragmentary sea-weed; and taken by the sieve in muddy sand, near low-water, in Balloch Bay, Cumbrae. The male of this species is furnished with long under-antennæ. It has been dredged in Plymouth Sound by Bate and Westwood, and obtained by them from Mr. Edward of Banff. Dr. G. S. Brady and I took it in the surface-net at Roundstone, Ireland, after sunset.

PHOXUS PLUMOSUS, Kroyer.

Phoxus plumosus, Kroyer. Nat. Tidsskr., 1 R. iv. (1842), p. 152.

Phoxus plumosus, S. Bate, Report Brit. Assoc. 1855, p. 58.

Harpina plumosa, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 55.

Habitat.—In 6 to 8 fathoms, muddy bottom, Lochranza, Arran; in 80 fathoms, Loch Fyne. It has also been taken in Plymouth Sound by Messrs. Bate and Westwood; in the Shetlands, by Mr. Barlee, the Rev. A. M. Norman, and Dr. J. Gwyn Jeffreys; and on the coast of Greenland by Mr. Holbol.

Genus WESTWOODILLA, Spence Bate.

WESTWOODILLA CÆCULA, Spence Bate.

Westwoodilla cæcula, Spence Bate, Cat. Amphip. Crust. Brit. Mus., p. 102.

Habitat. — Dredged in 6 fathoms, sandy bottom, Cumbrae; and taken in the tow-net off Lochranza in 20 fathoms, a little above the bottom. It has

also been taken among trawl-refuse from near Eddystone Lighthouse, Plymouth, by Messrs, Bate and Westwood; in the Moray Firth, by the Rev. G. Gordon; and at Banff, by Mr. Edward.

Genus MONOCULODES, Stimpson.

MONOCULODES AFFINIS, Bruzelius.

Œdiceros affinis, Bruzelius, Bidrag till Känn om Skand. Amphip. Gammar., Kgl. Veteusk.-Akad.'s Handlingar. Ny följd. B. 3. (1859), p. 43.

Westwoodia carinata, Spence Bate, Brit. Assoc. Rep., 1855, p. 58.

Kroyeria carinata, Spence Bate, Synop. Ann. Nat. Hist., 2nd Ser., xix. (1857), p. 140.

Monoculodes carinatus, Spence Bate, Cat. Brit. Mus. (1863), p. 104, pl. xvii., fig. 2.

Monoculodes affinis, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 84.

Habitat.—Taken by the sieve in the sand at low-water, Kames Bay and Fintry Bay; and dredged at the Clach Rock, Millport Bay, in 5 to 6 fathoms, sand and shell debris, and at the Tan Buoy in 7 fathoms, bottom Melobesia—Cumbrae; Castle Bay, Little Cumbrae; also off Seamill, below Portincross, Ayrshire, in 7 fathoms, bottom sand and gravel. It has been taken at Banff by Mr. Edward and Mr. Gregor.

MONOCULODES STIMPSONI, Spence Bate.

Monoculodes Stimpsoni, Spence Bate, Cat. Amphip. Crust. Brit. Mus., p. 105, pl. xvii., fig. 3.

Habitat.—Taken at Cumbrae in the surface-net, after sunset, in the month of October, and dredged in Loch Fyne at a depth of 105 fathoms. It has also been found amongst trawl-refuse in the neighbourhood of Plymouth, by Messrs. S. Bate and Westwood; and on the Northumberland coast, by the Rev. A. M. Norman.

MONOCULODES LONGIMANUS, Bate and Westwood.

Monoculodes longimanus, Spence Bate and Westwood, Brit. Sess.-eyed Crust., vol. ii., p. 507.

Habitat.—Dredged off the Cloch Lighthouse, and at Whiting Bay, Firth of Clyde, in 15 to 20 fathoms; and taken at Banff by Mr. Edward.

MONOCULODES ÆQUIMANUS, Norman.

Monoculodes æquimanus, Norman, MS.

Habitat.—Taken in Kames Bay, Cumbrae, in 3 to 4 fathoms, bottom fine sand; and in the surface-net after sunset; and by the same means off the Scilly Islands, by Dr. G. S. Brady and the writer.

Genus KROYERA, Spence Bate.

KROYERA ARENARIA, Spence Bate.

Œdiceros norvegicus, A. Boeck, Forhandl. ved. de Skand. Naturf., 8de mode (1860), p. 650.

Kroyera arenaria, Spence Bate, Tyneside Nat. Field Club, vol. iv. (1863), pl. i., p. 15, pl. ii., fig. 1.

Pontocrates norvegicus, A. Boeck, Crust. Amphip. Bor. et. Arct. (1870), p. 91.

Habitat.—In sandy bays plentifully, from half-tide to low-water, and sparingly to a few fathoms beyond low-water. When put into a vessel with water, they dart through it with great rapidity; but they soon settle down with their tail under their body, forming an oval like a small barley-corn, by which they can be readily distinguished. When a little sand is introduced, they burrow quickly into it. When in life, their eyes are a bright red covered by a white areola; and these organs may almost be said to be confluent, so closely do they come together on the front of the head, although in many cases a thin ridge may be seen between them.

During the summer months the females are mostly with ova, which some of them appear to produce when very young. The number of ova carried is generally about eight. They carry the young under their body for a time, but these are not readily seen till the parent is put into spirits, when the young drop out. It occasionally happens that one or two females with ova are greatly larger than the others. There are others in the same gatherings of smaller make, with long thin under-antennæ; these I take to be the males of the same species.

To try how they would behave in fresh-water, three of the females were put into a cupful, where they at once dropped motionless to the bottom. After having lain for a few seconds, they rose, making a few gyrations till they reached the surface, and then dropped gently down to the bottom, where they remained motionless. When disturbed they again performed their upward gyrations, dropping to the bottom as before; but in the course of fifteen or sixteen minutes they were unwilling or unable to rise up into the water, making only a few curving movements on the bottom. In twenty minutes they only showed life, and in half an hour they were dead.

The tracks made in the sand by this species formed the subject of observation by Mr. Hancock, as described in his *Memoir on Vermiform Fossils*, read at the meeting of the British Association at Leeds, September 22nd, 1858.* I have found *Kroyera arenaria* to be the chief burrow-maker here.

KROYERA ALTAMARINA, Spence Bate and Westwood.

Kroyera altamarina, Spence Bate and Westwood, Brit. Sessile-eyed Crust., p. 177.

Habitat.—Dredged off Callum's Bay, Bute, in 16 fathoms, mud and shell debris. Not common.

* S. Bate and Westwood, *Brit. Sessile-eyed Crust.*, vol. i., p. 175.

Genus AMPHILOCHUS, Spence Bate.

AMPHILOCHUS MANUDENS, Spence Bate.

Amphilochus manudens, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 107, pl. xvii., fig. 6.

Habitat.—A single specimen was obtained on two different occasions off the Tan Buoy, Cumbrae, in 7 to 8 fathoms, among the roots of *Laminaria saccharina*. The animal, when taken, was of a beautiful purple colour.

While looking over some small ascidians *(Molgula)*, taken in 60 fathoms, a little north of the lighthouse, Little Cumbrae, one of the above species was found with them. There can scarcely be any doubt that it had been brought up in the dredge attached to one of the ascidians.

AMPHILOCHUS TENUIMANUS, A. Boeck.

Amphilochus tenuimanus, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 51.

Habitat.—Dredged in 17 fathoms off Foreland Point, Cumbrae.

Genus SULCATOR, Spence Bate.

SULCATOR ARENARIUS, Spence Bate.

Oniscus arenarius, Slabber, Natuurkundige Verlustigingen, etc. (1775), p. 92, pl. ii., f. 4-3.

Bellia arenaria, Spence Bate, Ann. of Nat. Hist., vol. vii. (1851), p. 318.

Sulcator arenarius, Spence Bate, Ann. of Nat. Hist., vol. xiii. (1854), p. 504.

Habitat.—Moderately common all round our sandy shores near low-water, and taken most successfully by the sieve. They burrow more deeply than most of their allies, and are generally found four or five inches beneath the surface. Most of their time seems to be spent in their burrows; and in confinement, when supplied with sand, they are seldom to be seen on the surface. Their feet are short, stiff,

and well adapted for burrowing, which they do with great rapidity, throwing the sand out behind them with much force. They swim generally with their backs downwards, but their movement in the water is heavy, and is not long sustained. Like many of their kind, on coming to the surface they incline to go round in circles; and after a few whirls, or other gyrations, they allow themselves to drop gently down, tail foremost. They make almost no progress out of the water. They are of a bluish-white colour, sometimes with a tinge of brown along the back, apparently derived from the colour of internal parts. The eyes are of a cream colour, and when immersed in spirits they sometimes become dark, or almost black. Like some others of the sand-dwellers, they come to the surface to die.

This species has been taken near Falmouth by Dr. Leach; at Moray Firth by the Rev. G. Gordon; on the coast of Cumberland by Mr. Albany Hancock; and in Oxwick Bay by Mr. Moggridge and Dr. J. Gwyn Jeffreys.

Genus Urothoë, Dana.

Urothoë norvegica, A. Boeck.

Urothoe norvegica, A. Boeck, Forhandl. ved. de Skand. Naturf., 8de mode (1860), p. 647.

Urothoe Bairdii, Spence Bate, Catal. of Amphip. in Brit. Mus. (1862), p. 114, pl. xix., f. 1.

Habitat.—Moderately common in the sand between tide-mark, Lamlash Bay, Arran; Fintry Bay and Kames Bay, Cumbrae—in the latter bay in sand in a little fresh-water stream near low-water. Dredged between the Allans, Cumbrae, 1 to 2 fathoms, bottom sand and gravel; and off the same shore above forty were taken in the surface-net after sunset. Among these were two or three nearly double the size of the others, but in no other respect were they found to differ from the

rest. This species has also been taken in the Moray Firth by Mr. Gregor, Mr. Edward, and the Rev. G. Gordon; and off the Shetlands by Mr. Barlee.

UROTHOË MARINUS, Spence Bate.

Urothoe marinus, Spence Bate, Cat. Amph. Brit. Mus., p. 145, pl. xix., f. 2.

Sulcator marinus, Spence Bate, Synop. Brit. Amp.

Gammarus elegans ♂, Spence Bate, Rep. Brit. Assoc. 1855.

Urothoe elegans ♂, Spence Bate, Synop., Ann. Nat. Hist., 2nd Ser., xix. (1857), p. 145.

Habitat.—Not uncommon in sandy bays between tide-mark. I have taken it by the sieve in the sands at Irvine and Fairlie, Ayrshire; Lamlash Bay, Arran; Kames Bay, Fintry Bay, and Balloch Bay, Cumbrae; and off the same shore by the surface-net after sunset. Those taken by the surface-net are mostly males *(=elegans)*, and often have a beautiful pink blush along the inferior portion of the pleon. Some of these were kept in water for a night, and in the morning they were all found floating on the surface, showing little inclination to attach themselves to bits of sea-weed or other floating objects, as *Atylus Swammerdamii* and *Dexamine spinosa* do. The females swim briskly through the water, and can burrow into the sand with great speed. They are of a yellowish-brown colour, in some cases darker along the back. The young have two longitudinal bars along the dorsal region that are well seen before they leave the parent. The eyes of the adult are dark purple, thinly studded, as it were, with white points.

This species has also been taken in Dublin Bay by Professor Kinahan; in trawl-refuse from near to Eddystone Lighthouse by Messrs. S. Bate and Westwood; and in from 60 to 70 fathoms near Outer Haaf, Shetland, by the Rev. A. M. Norman and Dr. J. G. Jeffreys.

Genus IPHIMEDIA, Rathke.

IPHIMEDIA OBESA, Rathke.

Iphimedia obesa, Rathke, Acta Acad. Leopold., t. xx. (1843), p. 85, pl. i., f. 1.

Microcheles armata, Kroyer, Nat. Tidsskr., 2 R. 2 B. (1846), p. 66.

Habitat.—Dredged near the Tan Buoy, Cumbrae, in 7 to 10 fathoms, bottom nullipore. It has also been taken in 15 fathoms off the Garroch-head, Bute, bottom hard; and in Lochranza, Arran, 4 to 5 fathoms, mud.

This species is very variable in colour and colour-markings. On the fronds of *Laminaria saccharina*, where it is frequently met with, I have always found it marked across the back with black dotted bars; while among the roots of the same plant a few were found white, with small patches of reddish brown irregularly covering over the body. At other times its colour varies to red and reddish purple. One taken in the dredge off Garnock Beacon, in $5\frac{1}{2}$ fathoms, was closely covered over the whole body with small black dots.

Iphimedia obesa generally lies folded up, allowing itself to be lifted without effort to escape. When it does move, it darts off to the opposite side of the vessel, where it again folds itself up, making no continuous effort to swim.

The species has also been taken at Tenby, where it was dredged by Mr. Welsh; in the Moray Firth by Mr. Gregor; in Shetland and Loch Fyne by Mr. Barlee; dredged in 20 fathoms, in Belfast Bay, by Mr. Thompson; and off the north side of Drake's Island, in Plymouth Sound.

Genus OTUS, Spence Bate.

OTUS CARINATUS, Spence Bate.

Otus carinatus, Spence Bate, Cat. of Amphip. in Brit. Mus. (1862), p. 126, pl. xxiii., f. 2.

Odius carinatus, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 102.

Habitat.—Off Garnock Beacon, in 5½ fathoms, gravelly mud. The colour of the animal is a purplish brown. It has also been taken in from 70 to 80 fathoms east of the Shetland Isles by the Rev. A. M. Norman and Dr. J. G. Jeffreys.

Genus EPIMERIA, Costa.

EPIMERIA CORNIGERA, Fabricius.

Gammarus corniger, Fabricius, Reisenach Norwegen (1779), p. 383.

Cancer corniger, Herbst, Versuch einer Naturgesch. Krabben und Krebse (1792).

Epimeria tricristata, A. Costa, Cat. di Crost. Ital. del. Rev. Hope (1851), p. 46.

Vertumnus Cranchii, White, List. Crust. Brit. Mus. (1847), p. 89.

Acanthonotus Cranchii, White, Cat. Crust. Brit. Mus. (1847), p. 57.

Acanthonotus testudo, White, Cat. Brit. Crust. (1850), p. 51.

Acanthonotus Owenii, Spence Bate, Rep. Brit. Assoc., 1855, p. 58.

Amphithoe parasitica, Sars, Overs. over norksk-arct. Krebsdyr. Forhandl. i Videnskabs Selsk. i Christiania (1858), p. 131.

Epimeria cornigera, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 105.

Habitat.—Not uncommon in deep water. Off Inveraray, 25 fathoms, bottom soft; off Skelmorlie Point, 39 fathoms, mud. Colour red. It has also been taken off Arran in 80 fathoms, bottom mud and stones; and off Cumbrae Lighthouse in 55 fathoms, mud. About a dozen were taken in the haul, all being of a bright red.

Genus DEXAMINE, Leach.

DEXAMINE SPINOSA, Montagu.

Cancer (Gammarus) spinosa, Montagu, Trans. Linn. Soc., vol. xi. (1818), p. 3, tab. ii., fig. 1.

Dexamine spinosa, Leach, Edin. Encyc., vol. vii., p. 433.

Amphithoe Marionis, Milne Edwards, Ann. des Sci. Nat., xx. (1830), p. 375.

Amphithoe tenuicornis, Rathke, Fauna d. Norwegens, Acta Leopold., t. xx. (1843), p. 77, tab. 4, fig. 3.

Amphithoe spinosa, Gosse, Mar. Zool. (1855), p. 144.

Amphitonotus Marionis, Costa, R. sui Crost. Amfip. d. regno d. Napoli, Mem. d. Real. Accad. d. Sci. di Napoli (1857), p. 195.

Dexamine tenuicornis, Bruzelius, Skand. Amphip. Gamm. (1859), p. 79.

Habitat.—Moderately common all round our shores, generally in a few fathoms of water, and taken not unfrequently in the surface-net. The eye is oblong, slightly arched posteriorly, and slightly concave anteriorly, of a dark red, shading off to a paler red towards the margin. In some cases the whole animal is beautifully dotted with red, and closely studded along the back with white spots made up of small irregular points, some of the spots having a red space in the centre.

The lower-antennæ of the female are about one third shorter than the upper-antennæ, a few knobbed hairs taking the place of the pubescence on the upper surface of the third and fourth joints of the peduncle of the lower-antennæ. The lower-antennæ of the male are generally longer than the upper, and have the pubescence on the third and fourth joints. This species may be readily distinguished by the blunt tooth on the first joint of the upper-antennæ.

DEXAMINE TENUICORNIS, Rathke.

Dexamine tenuicornis, Rathke, Beitr. zur Fauna Norweg., Nov. Act., xx. (1843), p. 77, pl. xliv., fig. 3.

Habitat.—Taken at Portloy, Cumbrae, under muddy stones near low-water; at the Clach Rock, in

Millport Bay, in 7 fathoms, muddy sand; and at Lochranza, in 2 to 5 fathoms, bottom black sandy mud much mixed up with small triturated vegetable matter. It has also been taken between tide-marks at Lerwick, Shetland, by the Rev. A. M. Norman and Dr. Jeffreys.

DEXAMINE THEA, A. Boeck.

Dexamine Thea, A. Boeck, Forh. ved. de Skand. Naturf., 8de mode (1860), p. 658.

Habitat.—Dredged off Hunterston, opposite Millport, in 12 fathoms, bottom sandy gravel and sea-weed, and taken in the surface-net after sunset. The one taken in the dredge is a female in ova, and much larger than the one taken by the surface-net.

Genus ATYLUS, Leach.

ATYLUS GIBBOSUS, Spence Bate.

Atylus gibbosus, Spence Bate, Cat. Amph. Crust. Brit. Mus. (1862), p. 137, pl. xxvi., fig. 3.

Lampra gibbosa, A. Boeck, Crust. Amph. Bor. et Arct. (1870), p. 108.

Tritacta gibbosa, A. Boeck, De Skand. og Arkt. Amph. (1876), p. 318, pl. xii., fig. 2.

Habitat.—Taken frequently by the dip-net among the fronds of sea-weed, such as clumps of *Halidrys siliquosa*, *Desmarestia aculeata*, and the flaccid masses of *Ectocarpus*, along the borders of low-water. In the latter instances the young are sometimes plentiful, the fibrous, bushy tufts affording good shelter from their many enemies. The colour of this species appears to be more or less variable, and to depend in some degree on the plant it frequents. On an old plant of *Desmarestia aculeata*, dredged up from 8 fathoms, gravelly bottom, six were taken, all of a dark brown colour. On this occasion five wanted the antennæ; others taken on *Ectocarpus*, in shallow water, were lighter brown.

Taken in the surface-net after sunset, also embedded in a sponge, Cumbrae; Shetland, Mr. Barlee; in from 60 to 90 fathoms, 60 miles east of Shetland, Rev. A. M. Norman and Dr. Jeffreys; coast of Northumberland, Mr. Alder.

ATYLUS SWAMMARDAMII, Milne Edwards.

Amphithoe Swammerdamii, Milne Edwards, Ann. d. Sci. Nat., xx. (1830), p. 378.

Amphithoe compressa, Lilljeborg, Ofv. af Kongl. Vet.-Akad. Forhandl. (1852), p. 8.

Dexamine Gordoniana, Spence Bate, Ann. and Mag. Nat. Hist., 2nd Series, xix. (1857), p. 142.

Paramphithoe compressa, Bruzelius, Skand. Amphip. Gamm. (1859), p. 72.

Epidesura compressa, A. Boeck, Forh. v. de Skand. Naturf., 8de mode (1860), p. 659.

Dexamine Loughrini, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 132, pl. xxiv., fig. 3.

Atylus Schwammerdamii, Spence Bate, Catal. Amphip. Crust. Brit. Mus. (1862), p. 136., pl. xxvi., fig. 2.

Atylus compressus, Spence Bate, Catal. Amphip. Crust. Brit. Mus. (1862), p. 142.

Habitat.—Not uncommon in a few fathoms of water on a sandy or sandy-gravelly bottom. Dredged off the Tan Buoy, Cumbrae, in 7 fathoms, bottom Melobesia; and between the Allans, in 2 to 3 fathoms, sand and gravel; off Seamill, below Portincross, Ayrshire, 6 fathoms, bottom sand and stones. Also taken by the surface-net after sunset; those so obtained during summer are generally small.

On 16th December, 1886, they were taken very abundantly in Millport Bay by the surface-net after sunset, and were equally abundant a night or two after. It was remarkable that, with a single exception, no other amphipod occurred in the gathering.

It has been taken in the Moray Firth by Rev. G. Gordon, and at Plymouth by Mr. S. Bate.

ATYLUS VEDLOMENSIS, Spence Bate and Westwood.

Dexamine Vedlomensis, Spence Bate and Westwood, Brit. Sessile-eyed Crust. (1863), i., p. 242.

Atylus Vedlomensis, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 112.

Habitat.—Not uncommon. Dredged off Fairland Point, Cumbrae, in 17 fathoms, shelly mud; off the Tan Buoy, in 6 to 7 fathoms; Lock Goil, 12 fathoms, mud and gravel. Taken by the Rev. A. M. Norman in the Vedlom Voe, Shetland.

Genus PLEUSTES, Spence Bate.

PLEUSTES BICUSPIS, Kroyer.

Amphithoe bicuspis, Kroyer, Gronlands Amphip. Danske Vid.-Selsk. Afhandl., vii. (1838), p. 273, tab. 2, fig. 10.

Paramphithoe bicuspis, Bruzelius, Skand. Amphip. Gamm. (1859), p. 73.

Amphithopsis bicuspis, A. Boeck, Forhandl. ved de Skand. Naturf., 8de mode (1860), p. 662.

Pherusa cirrus, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 143, pl. xxvii., f. 6.

Pherusa bicuspis, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 144, pl. xxvii., f. 7.

Habitat.—Taken by the surface-net after sunset, Cumbrae; and by Mr. Edward at Banff, Mr. Webster at Tenby, Mr. Thompson in Belfast Bay, and at Sligo and Bangor in 6 to 10 fathoms.

PLEUSTES FUCICOLA, Leach.

Pherusa fucicola, Leach, Edin. Encyc., vii., App. to Art. Crust., p. 432.

Amphithoe fucicola, Milne Edwards, Ann. des. Sc. Nat., t. xx., p. 377.

Amphithoe Jurinii, Milne Edwards, Ann. des. Sc. Nat., t. xx., p. 376.

Amphithoe microura, Costa, Rend. della Reale Accad. delle Scienze di Napoli (1853), p. 175, tab. 3, fig. 2.

Dexamine fucicola, Spence Bate, Ann. Nat. Hist., 2nd Ser., xix. (Feb., 1857), p. 142.

Habitat.—Taken in the dip or hand-net along the rocky shores of the Allans, Cumbrae; at Falmouth and Tenby by Mr. Webster; Banff, Mr. Edward; off the coast of Naples by A. Costa; on the Atlantic coast of France, Milne Edwards; and recorded by Professor Bell as being among the crustacea brought home from the Arctic seas by Sir Edward Belcher.

Genus CALLIOPE, Leach.

CALLIOPE LÆVIUSCULA, Kroyer.

Amphithoe lœviuscula, Kroyer, Gronlands Amphip. Danske, Vid.-Selsk. Afh. vii. (1838), p. 253, tab. 3, fig. 13.

Amphithoe Rathkei, Zaddach, Syn. Crust. Prus. Prodr. (1844), p. 6.

Calliope Leachii, Spence Bate, Rep. Brit. Assoc., 1885, p. 58.

Amphithoe serraticornis, M. Sars, Forh. i Vid.-Selsk. i Christiania (1858), p. 140.

Paramphithoe lœviuscula, Bruzelius, Skand. Amphip. Gamm. (1859), p. 76.

Amphithopsis lœviuscula, A. Boeck, Forh. ved de Skand. Naturf., 8de mode (1860), p. 662.

Calliope lœviuscula, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 148, pl. xxviii., fig. 2.

Calliopius lœviusculus, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 117.

Habitat.—Moderately common, sometimes in sandy tide-pools among the algæ, Kames Bay, Cumbrae; and in Balloch Bay by the dip-net at low-water. The colour of this species is a brownish yellow, and not unfrequently it has a whitish blotch a little behind the head. In some cases the dorsal ridge is finely crenated. It is very active in the water, and swims hither and thither with great rapidity. It has also been taken on the Devonshire

coast by Dr. Leach, at Tenby by Mr. Webster, in the Moray Firth by Mr. Edward and the Rev. G. Gordon, and by Kroyer on the coast of Greenland.

CALLIOPE GRANDOCULUS, Spence Bate.

Calliope grandoculus, Spence Bate, Cat. Amphip. Brit. Mus., p. 149, pl. 28, fig. 4.

Habitat.—Taken at low-water by the dip or sweep-net among weedy stones, Cumbrae. It has also been taken in the Moray Firth by the Rev. Geo. Gordon, and at Banff by Mr. Edward.

Genus EUSIRUS, Kroyer.

EUSIRUS LONGIPES, A. Boeck.

Eusirus longipes, A. Boeck, Forh. ved de Skand. Naturf., 8de mode (1860), p. 656.

Eusirus Helvetiæ, Spence Bate, Cat. Amphip. Brit. Mus. (1862), p. 155, pl. xxix., fig. 2.

Eusirus bidens, Heller, Deukschr. d. K. K. Acad. d. Wissench., 26 B., 2 Abth. (1866), p. 32, tab. iii., fig. 19.

Habitat.—Dredged a little west of the Tan Buoy, Cumbrae, in 10 fathoms, bottom mud, gravel, and dead shells; and in Lochgoil, in 12 fathoms. Also taken in the Moray Firth by Mr. Edward. The eye of this animal is white, dotted with black points.

Genus LEUCOTHOË, Leach.

LEUCOTHOË SPINICARPA, Abildgaard.

Gammarus spinicarpus, Abildgaard, Zool. Dan., iii., p. 66, pl. cxxix., fig. 1-4, 17.

Cancer (? Gammarus) articulosus, Montagu, Trans. Linn. Soc., vol. vii., p. 70, pl. 6, fig. 7.

Leucothoe articulosa, Leach, Edin. Encyc., vii. (1814), p. 403.

Leucothoe denticulata, Costa, Rend. della Reale Acc. d. Sci. di Napoli (1853).

Leucothoe spinicarpa, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 78.

Habitat.—Dredged near the Tan Buoy, Cumbrae, in 5 fathoms, bottom Melobesia. The animal was reddish-brown and very quick in its movements, although at times, when undisturbed, it walked leisurely on the bottom of the vessel.

Taken in 92 fathoms, bottom mud, Loch Fyne. It has also been taken in the Moray Firth, by the Rev. G. Gordon; at Polperro, Cornwall; in Plymouth Sound, by S. Bate and Westwood; on the Devonshire coast, by Montagu; and on the south coast of Sweden, by Lilljeborg.

Genus GOSSEA, Spence Bate.

GOSSEA MICRODEUTOPA, Spence Bate.

Gossea microdeutopa, Spence Bate, Cat. Amph. Brit. Mus., p. 160, pl. xxix., fig. 6.

Habitat.—Taken in the dip-net at the margin of low-water, amongst algæ, moderately common; and in the surface-net after sunset, Cumbrae. This species was first taken at Ilfracombe by Mr. Gosse, whose name it bears; and it has also been taken in the Shetlands by the Rev. A. M. Norman.

Genus AORA, Kroyer.

AORA GRACILIS, Spence Bate.

Lonchomerus gracilis, Spence Bate, Rep. Brit. Assoc., 1855.

Lalaria gracilis, Spence Bate, Ann. Nat. Hist., 2nd Ser., xx. (1858), p. 525.

Aora gracilis, Spence Bate, Cat. Amphip. Brit. Mus., p. 160, pl. xxix., f. 7.

Habitat.—Dredged at the Clach Rock, 7 fathoms, bottom muddy gravel and small algæ; at the Tan Buoy, in 6 to 7 fathoms, bottom Melobesia and clumps of *Laminaria saccharina*; between the Allans, Cumbrae, in 2 to 3 fathoms, muddy sand and sea-weed; and off the Holy Isle, Arran, in 5 fathoms, among sea-weeds.

It has also been taken in Oxwick Bay by Bate and Westwood, at Polperro by Mr. Loughrin, and in Loch Fyne by Mr. Barlee. Dr. Jeffreys and the Rev. A. M. Norman obtained it in 40 fathoms, one mile north of Whalsey Light-house, and in 5 fathoms in the outer Skerries Harbour, Shetland.

Genus MICRODEUTOPUS, Costa.

MICRODEUTOPUS GRYLLOTALPA, Costa.

Microdeutopus gryllotalpa, Costa, Rend. d. Reale Accad. d. Sci. di Napoli (1853), p. 178.

Lembos Daumoniensis, Spence Bate, Brit. Assoc. Rep. 1855, p. 58.

Autonoe grandimana, Bruzelius, Skand. Amphip. Gamm. (1859), p. 26, fig. 5.

Microdeutopus grandimanus, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), App., p. 378.

Habitat. — A single specimen taken south of the Tan Buoy, in 8 fathoms, bottom Melobesia. It has also been taken under the Hoe, Plymouth, in a sponge, by Mr. Howard Stewart; at Polperro, by Mr. Loughrin; dredged in from 70 to 90 fathoms, east of Shetlands; and taken by Costa at Naples.

MICRODEUTOPUS WEBSTERII, Spence Bate.

Gammarus longipes, Lilljeborg, Öfv. af Kgl. Vet.-Akad. Forhand. (1852), p. 10.

Autonoe longipes, Bruzelius, Skand. Amphip. Gamm. (1859), p. 28.

Lembos Websterii, Spence Bate, Ann. Nat. Hist., 2nd Ser., xix. (1857), p. 142.

Microdeutopus Websterii, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 164, pl. xxx., fig. 2.

Microdeuteropus Websteri, Norman, Rep. on the Shetland Crust. (1868), p. 282.

Microdeutopus longipes, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 166.

Habitat.—Taken under stones near low-water, Portloy, Cumbrae; at the same place on two different

occasions, twenty yards apart. It has also occurred at Falmouth, where it was first taken by Mr. Webster; at Skye and Shetlands by Mr. Barlee; and dredged in 4 fathoms, in Bressay Sound, Shetlands, by the Rev. A. M. Norman and the late Dr. Jeffreys.

MICRODEUTOPUS ANOMALUS, Rathke.

Gammarus anomalus, Rathke, Acta Accad. Leop., xx. (1843), p. 63, t. iv., fig. 7.

Lembos Cambriensis, Spence Bate, Brit. Assoc. Rep., 1855, p. 58.

Autonoe anomala, Bruzelius, Skand. Amphip. Gamm. (1859), p. 25, pl. 1, fig. 4.

Microdeutopus anomalus, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 154, pl. xxx., fig. 3.

Microdeuteropus anomalus, Norman, Rep. on the Shetland Crust. (1868), p. 281.

Habitat.—Dredged off the Tan Buoy, Cumbrae, in 6 to 8 fathoms, bottom *Melobesia calcarea*, var. *rubra*, which seems to favour the growth of *Laminaria saccharina*, whose fronds (especially the large fibrous roots) yield a rich harvest of many orders of invertebrates. The search is all the more successful when the contents of the dredge are repeatedly washed in a white basin or glass jar. Also dredged, a little farther out, in mud and sea-weed; and between the Allans, in 2 to 3 fathoms, the bottom here being all covered over with patches of sea-weeds of various kinds, of which portions are generally brought up in the dredge, in most cases accompanied with a large diversity of species; and off Hunterston, opposite Millport, in 12 to 14 fathoms, on mud, sand, and gravel.

This species was first taken by Bate and Westwood in Oxwick Bay, on the coast of Glamorganshire; and by the Rev. A. M. Norman and the late Dr. Jeffreys, in 5 fathoms, in the outer Skerries Harbour, Shetlands. Rathke and Lilljeborg have taken it on the coast of Norway.

MICRODEUTOPUS VERSICULATUS, Spence Bate.

Lembos versiculatus, Spence Bate, Rep. Brit. Assoc. 1885, p. 58.

Microdeutopus versiculatus, Spence Bate, Cat. Amphip. Brit. Mus., p. 165, pl. xx., fig. 5.

Habitat.—Dredged in muddy sand a little beyond low-water, Cumbrae; and taken near Plymouth by Messrs. Spence Bate and H. Stewart.

Genus PROTOMEDEIA, Kroyer.

PROTOMEDEIA HIRSUTIMANA, Spence Bate.

Protomedeia hirsutimana, Spence Bate, Cat. Amphip. Crust., p. 168, pl. xxx., f. 6.

Habitat.—Dredged at the Clach Rock, Millport Bay, in 6 fathoms, mud, gravel, and sea-weed; also on different occasions in the neighbourhood of the Tan Buoy, Cumbrae, among the roots of *Laminaria saccharina*, some of those taken being with ova; and between Fairlie and Millport. When in confinement they walk on the bottom of the vessel much like *Sulcator arenarius*, but they do not seem to burrow. This species has also been taken near Banff by Mr. Edward.

Genus BATHYPOREIA, Lindström.

BATHYPOREIA PILOSA, Lindström.

Bathyporeia pilosa, Lindström, Öfv. af Kgl. Veteusk.-Akad. Förhandl. (1855), p. 59.

Thersites Guilliamsonia, Spence Bate, Rep. Brit. Assoc., 1855, p. 59.

Bathyporeia Robertsoni, S. Bate and Westwood, Brit. Sessile-eyed Crust. (1863), i., p. 307.

Bathyporeia pelagica, S. Bate and Westwood, *l.c.*, i., p. 309.

Habitat.—Common, burrowing in sand between tide-mark, and occasionally a few fathoms beyond low-water. On the sandy shores of Arran, Ayr, Ardrossan, Hunterston, Port-Bannatyne, Bute, Helensburgh, Fintry Bay and Kames Bay, Cumbrae.

In Kames Bay, Millport, they are very abundant from low-water up to about three-quarters tide-mark. From thence down to about half-tide their tracks are very numerous, and pass in all directions and at all angles and curves, a little under the sand, raising it up into tiny rough ridges. When the animal works a little deeper, the ridges are rounder and smoother. When above ground they make little furrows in the sand. That the ridges are more numerous a little above half-tide appears to be accounted for by the fact that the animals have more time between tides to extend their burrows than nearer low-water. In a small fresh-water stream that runs down over the sandy bay, they are found in the sand near high-water.

To test how long they could live in purely fresh-water, ten of this species were put into rain-water. In a few minutes they seemed to suffer from the change, and now and again darted to the surface, then allowed themselves to drop down to the bottom, back downwards, rising again to the surface and repeating over and over the same movements. Occasionally, when half down, they would re-ascend to the surface, making a few dashes hither and thither, and then dropping again to the bottom. By two-and-a-half hours eight of them were dead, and the other two nearly so. Suspecting that something might be hurtful to them in the water from the rain-barrel, I took more of the species from the sand in the middle of the stream at about half-tide, and put them in a vessel containing water taken from the same part of the stream. In two hours a few of them were dead, but the others were living next morning, and most of them on the surface. A number of the same species, taken from the same place, were put into pure sea-water in the afternoon. Next morning they were all right, sporting through the water, but none on the surface. Again, another batch was taken from very low water, away from any fresh-water, and put into water from the stream

about half-tide, as in the last experiment. In less than half-an-hour they were all dead.

In the first experiment, it is probable that those which died so soon had recently come up from a lower zone of the tidal belt; and having been less exposed to a mixture of fresh water, they were less able to bear the sudden change. This result is confirmed by the experiment with those taken from very low tide, which rapidly succumbed when placed in fresh water.

These experiments show that while those specimens taken from sea-water suddenly succumbed to the influence of fresh water, yet, by getting up the stream by degrees, they appeared to acquire the power of living in nearly fresh water for a considerable time. If all other conditions were favourable, there can be little doubt that they could be gradually brought to live in purely fresh water. Nothing could be better for such experiments than such a little fresh-water stream passing down over their habitat, where they can come up, sheltering under the sand, bit by bit, as they feel disposed, to where the tide covers them at shorter and shorter intervals, till the water is almost fresh.

Bathyporeia Robertsoni, Spence Bate and Westwood.—There can scarcely be any doubt that this is the male of *Bathyporeia pilosa.* It is generally rather smaller, having long under-antennæ. The males occur in much fewer numbers than the females: in my experience not more than one to twelve. There is also another variety with long under-antennæ, but the flagellum is closely ringed. The eyes of both male and female are oval and dark red, becoming black in spirits.

The female of this species "was first taken at Wisby, on a sandy bottom, from 18 to 20 fathoms, by Professor Lindström. It has been taken by Professor Williamson on a fine sandy bottom off Weymouth," and by Mr. Webster near Tenby.

The male *(Robertsoni)* was dredged by the late Dr. Jeffreys in the Shetlands.

BATHYPOREIA PELAGICA, Spence Bate.

Bathyporeia pelagica, Spence Bate, Cat. Amphip. Brit. Mus., p. 174, pl. xxxi., fig. 6.

Thersites pelagica, Spence Bate, Rep. Brit. Assoc. 1855, p. 59.

Habitat. — Taken off Callum's Bay, Bute, in 16 fathoms, bottom sandy mud; off Ardrossan in 20 fathoms, bottom stones and mud; and west of Tan, Cumbrae, in 10 fathoms, bottom mud and stones. It has also been taken in the Moray Firth by the Rev. Geo. Gordon, in a considerable depth of water.

Boeck and Norman doubt whether this is other than *B. pilosa*, Lindström. It differs in some minor particulars from *B. pilosa*, yet no less than in many other accepted species. I have never found *B. pelagica* between tide-marks in the sandy bays, where the other is so abundant, but only in from 10 to 20 fathoms, bottom mud and stones, and sandy mud. Where a difference of locality concurs with a more or less distinct change of character in a species, it becomes important to know under what conditions the change has taken place. To the geologist this clue is still more important. It matters little to him whether the forms are known by the name of "species" or "variety"; but it would be a loss to obliterate under one appellation so valuable a distinction between the two.

Genus CHEIROCRATUS, Norman.

CHEIROCRATUS SUNDEVALLI, Rathke.

Gammarus Sundevalli, Rathke, Acta. Acad. Leopold., t. xx. (1843), p. 65, t. iii., fig. 2.

Lilljeborgia Shetlandica, Spence Bate and Westwood, Brit. Sessile-eyed Crustacea (1863), p. 206.

Cheirocratus Sundevalli, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 133.

Habitat.—(L. Shetlandica ♂.) Near the Tan Buoy, in 7 fathoms, bottom Melobesia; near the Lion, 10 fathoms, gravelly; at the Clach Rock, 6 fathoms, sand and gravel, Cumbrae. Off shore, a little west of the pier, Holy Isle, Arran, 6 fathoms, bottom gravel and sea-weed. Loch Fyne, 12 fathoms, sand and gravel. Off Seamill, Ayrshire, 7 fathoms, sand and stones. Also taken by the surface-net after sunset, Kames Bay, Cumbrae.

(P. Whitei ♀.) In Loch Fyne, 12 fathoms, bottom sandy gravel. Between the Tan Buoy and Little Cumbrae, 25 fathoms, mud. Off Garroch-head, Bute, in 15 fathoms, mud, shells, and gravel; in one or two cases those obtained here were covered with orange dots of unequal shape. Taken by the Rev. A. M. Norman, in 40 fathoms, near Whalsey Light-house, and in 2 to 5 fathoms in Outer Skerries Harbour, Shetland.

CHEIROCRATUS ASSIMILIS, Lilljeborg.

Gammarus assimilis, Lilljeborg, Öfv. af Kgl. Vet.-Akad. Forh. (1851), p. 23.

Cheirocratus Mantis, Norman, Trans. Nat. Hist. Soc. Northumberland and Durham, vol. i. (1865), p. 12.

Cheirocratus assimilis, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 134.

Habitat.—Taken in deep water off the Holy Island, Arran, by the Rev. A. M. Norman.

Genus PHÆDRA, Spence Bate.

PHÆDRA KINAHANI, Spence Bate.

Phœdra Kinahani, Spence Bate, Cat. Amph. Crust. Brit. Mus., p. 119, pl. 21, fig. 1.

Habitat.—In 7 fathoms, bottom nullipora, near the Tan Buoy, Cumbrae. The colour of the animal was pale orange, its length $\frac{1}{10}$ inch.

Genus GAMMARELLA, Spence Bate.

GAMMARELLA NORMANI, Spence Bate and Westwood.

Gammarella Normani, Spence Bate and Westwood, Brit. Sessile-eyed Crust. (1863), vol. i., p. 333.

Habitat.—Brought up in the dredge, with a great deal of *Laminaria saccharina*, off Hunterston, opposite Millport. It was first taken by the Rev. A. M. Norman in Moulin Huet Bay, Guernsey, in about 10 fathoms, on sand and zostera.

Genus MELITA, Leach.

MELITA OBTUSATA, Montagu.

Cancer (Gammarus) obtusatus, Montagu, Trans. Linn. Soc., xi. (1815), p. 5, t. 2, fig. 7.

Amphithoe obtusata, Milne Edwards, Ann. d. Sci. Nat. (1830), xx., p. 377.

Gammarus maculatus, Lilljeborg, Öfv. af Kgl. Vet.-Akad. Förhandl. (1852), p. 10 (1853), p. 138.

Gammarus obtusatus, Lilljeborg, Öfv. af Kgl. Vet.-Akad. Förhandl. (1854), p. 452.

Melita obtusata, Spence Bate, Cat. Amph. Crust. Brit. Mus. (1862), p. 183.

Habitat.—Found between the dead valves of *Cyprina islandica*, brought up on a fisherman's line, in 14 fathoms, Cumbrae; the shells were covered inside and out with small *Balani*. Another, in ova, was found in the same shell; but the two first pairs of legs of this were slightly different, the other parts, however, agreeing with *M. obtusata*, of which I suspect it may have been a sexual form. Taken also in Plymouth Sound by Mr. S. Bate and Professor Kinahan; and in Salcombe Bay, by Col. Montagu.

MELITA PROXIMA, Spence Bate.

Melita proxima, Spence Bate, Cat. Amph. Brit. Mus., p. 184, pl. xxxiii., fig. 4.

Habitat. — Taken plentifully all round our coast among the suckers of the larger sizes of the star-fish *Uraster rubens*, sometimes on *Solaster papposa*,

and at other times free. It appears, therefore, not to be confined to one species of starfish. In regard to those found free, it is a question whether they may not have been detached from the starfish by the rubbing and rolling in the dredge, or whether they may not seek the starfish for shelter or for food. The eyes of this species are small, round, and white, with about ten to twelve red dots.

Bate and Westwood say of this species that it "may be readily mistaken for *M. obtusata*, of which, indeed, we are sometimes inclined to think that it may turn out to be a variety; an examination of a greater number of individuals is, however, necessary to determine this point." It may be remarked that the fact of this animal living among the suckers of starfishes points to a peculiarity in its habits not recorded of *M. obtusata*.

This species has been taken in Plymouth Sound by the authors of the *Brit. Sessile-eyed Crust.*, and on the coast of Banff by Mr. Edward.

MELITA ALDERI, Spence Bate.

Megamœra Alderia, Spence Bate, Cat. Amph. Brit. Mus., p. 228, pl. xl., fig. 1.

Habitat.—Dredged between the Allans, Millport Bay, in 2 fathoms, bottom weedy gravel and sand. This species has also been taken on the Northumberland coast by Mr. Alder, and at Banff by Mr. Edward.

Genus GAMMAROPSIS, Lilljeborg.

GAMMAROPSIS ERYTHROPHTHALMUS, Lilljeborg.

Gammarus (Gammaropsis) erythrophthalmus, Lilljeborg, Kgl. Vet.-Akad. Handl. (1853), p. 455.

Eurystheus tridentatus, Spence Bate, Brit. Assoc. Rep., 1855, p. 58.

Autonoe erythrophthalma, Bruzelius, Skand. Amphip. Gamm. (1859), p. 27.

Eurystheus erythrophthalmus, Spence Bate, Cat. Amph. Crust. Brit. Mus. (1862), p. 196, pl. xxxv., fig. 7.

Gammaropsis erythrophthalmus, A. Boeck, Crust. Amph. Bor. et Arct. (1870), p. 161.

Habitat. — Taken on *Spatangus purpureus* and among the roots of *Laminaria saccharina*, Cumbrae; and dredged off the upper side of the Otter, Loch Fyne. Taken also in the Moray Firth by Mr. Gregor and Mr. Edward.

Genus AMATHILLA, Spence Bate and Westwood.

AMATHILLA SABINI, Leach.

Gammarus Sabini, Leach, App. to Ross's First Voyage (Oct., 1819), Edit. ii., p. 178.

Amathia Sabini, Spence Bate, Cat. Amph. Crust. Brit. Mus. (1862), p. 197.

Amathia carinata, White, Hist. Brit. Crus. (1857), p. 182.

Amathia carino-spinosa, White, Cat. Crus. Brit. Mus. (1847).

Amathilla Sabini, Spence Bate and Westwood, Brit. Sessile-eyed Crust. (1863), p. 361.

Amphithoe Moggridgei, Spence Bate, Ann. Nat. Hist., 2nd Ser., vii. (1855), p. 318, pl. x., fig. 10.

Amphithoe carino-spinosa, Gosse, Mar. Zool. (1855), p. 141.

Dexamine carino-spinosa, White, Cat. Crus. Brit. Mus. (1847).

Cancer carino-spinosa, Turton, Lin. Syst. Nat. iii., p. 760.

Habitat.—This species is of wide distribution. It was first taken by Admiral Ross and General Sabine in Baffin's Bay, also on the coasts of Greenland, Iceland, Norway, and Scandinavia; and it is common both in the German and Baltic Seas. It has been taken in Berwick Bay by Dr. Johnston, in the Mersey by Mr. Byerley, and on the coast of Northumberland by Mr. Hodge. I have only taken it on one occasion at Cumbrae, in the surface-net after sunset.

Genus GAMMARUS, Fabricius.

GAMMARUS MARINUS, Leach.

Gammarus marinus, Leach, Linn. Trans. xi. (1815), p. 359.

Gammarus Olivii, Milne Edwards, Ann. d. Sci. Nat., xx. (1830), p. 369, pl. 10, fig. 9, 10.

Gammarus gracilis, Rathke, Mém. de l'Acad. Imp. d. Sci. St. Petersb., iii. (1837), p. 291, t. 4, fig. 7-10.

Gammarus pœcilurus. Rathke, Nov. Act. Acad. Leop., xx. (1843), p. 68, t. 4, fig. 2.

Gammarus Kroyeri, Rathke, Nov. Act. Acad. Leop., xx. (1843), p. 69, t. 4, fig. 1.

Habitat.—Not uncommon under stones, and gliding in small pools left by the tide, and among the *Fuci* at low-water; dredged between the Allans, Cumbrae, in 2 to 3 fathoms, on a weedy bottom. The eyes are oblong and dark red, covered with white fret-work. It has been taken on the coast of Devon by Dr. Leach; Plymouth; from the mouth of the Mersey to the River Dee; the Shetlands; the River Ban, and Lough Neagh, Ireland.

GAMMARUS LOCUSTA, Linné.

Cancer locusta, Linné, Sys. Nat., Ed. xii. (1767), p. 1055; Fauna Suecica, Edit. 2da.

Cancer pulex, Linné, Sys. Nat., Ed. xii. (1767).

Cancer macrourus, thorace articulata, cæruleus, Linné, Gothl. Resau. (1745), p. 260.

Cancer (Gammarus) locusta, Montagu, Linn. Trans. ix. (1804), p. 92, t. 4, fig. 1.

Gammarus locusta, Fabricius, Sys. Entom. (1775).

Oniscus pulex, Fabricius, Fauna Gronl. (1780), p. 254.

Gammarus Arcticus, Scoresby, Arct. Reg. (1820), i., p. 541.

Gammarus boreus, Sabine, Suppl. to App. Parry's First Voy. (1824), p. 229.

Gammarus Duebeni, Lilljeborg, Öfv. af Kgl. Vet.-Akad. Förh. (1851), p. 22.

Gammarus mutatus, Lilljeborg, Kgl. Vet.-Akad. Handl. (1853), p. 447.

Gammarus Sitchensis, Brandt, Meddendorff's Siber. Reise. (1851), ii., part i., p. 133.

Habitat.—Between tide-mark, and dredged at the Clach Rock in 6 fathoms; near the Tan Buoy about the same depth, and farther out in the channel at a depth of 35 fathoms; also taken in the surface-net —Cumbrae. "It has been taken in the Crimea by Rathke, and by Lilljeborg on the coast of Sweden, and if we judge by its size, its home is in the Arctic Seas, where specimens frequently exceed two and a half inches in length."—Dr. Walker, Naturalist to the last Arctic Expedition under Sir F. L. M'Clintock.

On 16th February, 1886, four of this species were taken far up on the tidal belt under stones, and put into a 4-oz. bottle about half full of salt-water. On the 18th one was dead, which was allowed to remain in the bottle. Shortly afterwards it was observed that the living ones had commenced to eat their dead companion, all whose remains in a short time disappeared bit by bit. Another dead amphipod was then put into the bottle, which also gradually disappeared. An air vessel of *Fucus nodosus* was also put into the bottle, where it floated on the water, and to this the amphipods often attached themselves. When at the bottom of the vessel, however, they generally lay on their back.

About the beginning of April, in removing to another house, the bottle got out of sight, and was not discovered till 11th May. Two of the three amphipods were found to be still alive, and to all appearance in good health; but the other had no doubt gone the way of its deceased brethren. By this time the water had lost about one-third of its bulk by evaporation, and had become very green and flocculent. Still, with this great addition of saltness and discoloration to the water, they seemed to be able to accommodate themselves to that state of things, apparently experiencing little if any inconvenience. Although we have seen that they eat their dead companions, there seems no evidence

that they kill and devour one another; and, as they live gregariously, it is not at all likely that such could be the case.

Since the above was written, I have taken this species at Cardross, between tide, in brackish water.

GAMMARUS PULEX, Pennant.

Squille Puce, De Geer, Mém. pour servir à l'Hist. d'Insectes (1752), t. vii., p. 525, pl. 33.

Cancer pulex, Pennant, Brit. Zool. (1776), vol. iv., p. 17.

Gammarus pulex, Desmarest, Consid. sur les Crust. (1825), p. 266, t. 45, fig. 8.

Gammarus fluviatilis, Milne Edwards, Hist. Nat. des Crust. (1840), t. iii., p. 45.

Habitat.—Common in slow-running streams, or in ditches well filled with vegetation.

Genus MÆRA, Leach.

MÆRA LORENI, Bruzelius.

Gammarus Loreni, Bruzelius, Skand. Amphip. Gamm. (1859), p. 59, fig. 9.

Mœra Loreni, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 193, pl. xxxv., fig. 1.

Habitat.—Taken off the light-house, Little Cumbrae, in 55 to 60 fathoms, and off the Isle of Arran, in 80 fathoms, bottom soft mud. Most of this genus, taken from a depth of from 60 to 80 fathoms, were pale in colour, and soon became white when put in spirits. Depth, however, does not always affect the colour of the animals, as some of the *Palœmonidæ* brought up in the same hauls were bright red.

MÆRA SEMISERRATA, Spence Bate.

Megamœra semiserrata, Spence Bate, Cat. Amph. Brit. Mus., p. 226, pl. xxxix., fig. 6.

Habitat.—Dredged on two different occasions at the Tan, Cumbrae, in 6 to 7 fathoms, bottom Melobesia; and off the Allans in 6 fathoms, bottom stony mud. Taken near Mallard Buoy, in Plymouth Sound by Bate and Westwood.

MÆRA OTHONIS, Milne Edwards.

Gammarus Othonis, Milne Edwards, Ann. des Sci. Nat., t. xx., p. 373, pl. x., fig. 11.

Megamæra Othonis, Spence Bate, Cat. Amph. Brit. Mus., p. 227, pl. xxxix., fig. 8.

Habitat.—Dredged off the Garroch-head in 15 fathoms, bottom sandy gravel; on the Allans bank, 10 fathoms, bottom gravel; off the Lion in 15 fathoms; and at the Tan, Cumbrae. Taken in Plymouth Sound by Bate and Westwood, and at Polperro by Mr. Loughrin.

MÆRA LONGIMANA, (Leach) Thompson.

Gammarus longimanus, Thompson, Ann. Nat. Hist., 1st Ser., xx. (1847), p. 242.

Gammarus lævis, Bruzelius, Skand. Amph. Gamm. (1859), p. 60, fig. 10.

Megamæra longimana, Spence Bate, Cat. Amph. Crust. Brit. Mus. (1862), p. 227, pl. xxxix., fig. 7.

Mœra longimana, Norman, Rep. Shetland Crust. (1868), p. 284.

Habitat.—Dredged at the Tan in 6 to 8 fathoms, bottom Melobesia, and off the south side of the Allans in 6 fathoms, bottom stones and mud—Cumbrae; also in Loch Fyne in 90 fathoms, bottom soft mud. Those from deep water are larger than those from 6 to 8 fathoms. It has also been taken on the south coast of England by Leach, near Belfast by Mr. Thompson, in Dublin Bay by Professor Kinahan, on the coast of Cornwall by Mr. Webster, and in the Moray Firth by the Rev. G. Gordon.

SUBDIVISION DOMICOLA.

Family COROPHIIDÆ.

Sub family PODOCERIDES.

Genus AMPHITHOË, Leach.

AMPHITHOË RUBRICATA, Montagu.

Cancer (Gammarus) rubricatus, Montagu, Linn. Trans., ix., p. 99, pl. v., fig. 1.

Gammarus rubricatus, Leach, Edin. Encyc., vii., p. 402.

Amphithoe rubricata, Leach, Edin. Encyc., App., p. 432.

Habitat.—Taken at low-water, Portloy, and off Fairland Point in 17 fathoms—Cumbrae. The colour of the animal is a bright reddish-purple; the eyes are moderately large, and dark red, dotted with white points. Although a confirmed nest-builder, it is occasionally met with free. Bate and Westwood report it from the south coast of Devonshire, where it was taken by Col. Montagu, from Plymouth Sound, and Penzance, on the shore at low spring-tides. The Rev. A. M. Norman and Dr. Jeffreys have taken it in 2 to 5 fathoms in Outer Skerries Harbour. Mr. Norman has obtained it at Cullercoats, and it has been recorded from Strangford Lough by Thompson and Hyndman.

AMPHITHOË PODOCEROIDES, Rathke.

Amphithoe podoceroides, Rathke, Acta. Leop., xx. (1843), p. 79, t. iv., fig. 4.

Amphithoe albomaculata, Kroyer, Nat. Tidsskr. Ny Rakke (1845), 2 B, p. 67.

Amphithoe littorina, Spence Bate, Brit. Assoc. Rep. 1855, p. 59.

Amphithoe punctata, Johnston, Zool. Journ., iii., p. 127, 490.

Sunamphithoe podoceroides, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 251, pl. xliii., fig. 7.

Habitat.—Frequently found between tide-mark in leathery tubes attached to the under-side of stones. When the stones are turned over, the animal seems readily to leave its tube in alarm. As there are generally two in the tube, a male and a female, frequently the male one only leaves the tube, his better half no doubt remaining to see how matters stand. If a little probing be used to the domicile, she too soon makes a speedy appearance. They

are sometimes met with in the hollows of the alga *Leathesia tuberiformis*, and in the air-vessels of *Fucus nodosus*. In almost every case where the air-vessel was perforated it contained one of this species, and sometimes two, as above mentioned. The perforations in the air-vessel were generally irregular, both in form and size, frequently so large as to let in the point of the little finger, and often extended through both sides of the vessel. Those containing the amphipod were filled more or less with a soft leathery substance under which the animal was concealed. It did not appear that the amphipod had perforated the hole, as it was irregular, and much larger than was required for the animal to get in and out by, and therefore more exposed to the attacks of its enemies. These air-vessels are also occupied by a hydrozoon, but whether it can be credited with the cutting of the opening I cannot say. As I have not, however, observed such lacerations on any other portion of the plant, it may be inferred that the air-vessel has some attractions for the depredators, whatever they may be.

As the *Fucus nodosus* is found plentifully about half-tide, the amphipod must often in wet weather be exposed to the fresh-water which then fills its cell. To test how long the animal could live in that element, one was placed in a cupful of rain-water, where it sank to the bottom as if dead. About a minute later, when touched, it swam round the dish with much vigour for a short time, and afterwards settled on its feet for a little, where it remained motionless, the antennæ standing out and forming a kind of square. In 16 minutes it turned over on its back, the movements of the natatory legs becoming less regular, and stopping at short intervals for a second or two. In 10 minutes more they became more rapidly worked, the claws widely opened, and some of the posterior legs twitched a little. At 30 minutes they stopped

moving altogether; but when the animal was touched, the legs began again to move irregularly and more languidly. At 36 minutes they stopped for about a minute, and again commenced to give an occasional stroke or two. At 40 minutes the only motion, which was very weak, was confined to one of the swimming feet. At 45 minutes all motion had ceased. Another of the same species, when exposed to the same treatment, lived for 40 minutes, and another for 35 minutes, both going through nearly the same symptoms. When in confinement, if a little weed or such other material is in the water with them, it is difficult to get them away from it, as they make every effort against being dislodged.

One that was dislodged with its nest from the side of a stone was put into a basin of water; in a few days it had the nest firmly attached to the basin. Like many of their congeners, they carry their young under their body, but these are not readily seen in life. Spence Bate and Westwood, *Brit. Sessile-eyed Crust.*, vol. i., p. 422, state that the eyes are black: but all those that I have examined are red, apparently with a white net-work or areole over the red, although by transmitted light they appear dark.

I have taken this species among the roots of *Laminaria saccharina* near the Tan Buoy, in 6 to 7 fathoms water, and by the dip-net among *Halidrys siliquosa*, Cumbrae. Bate and Westwood (*l.c.*, vol. i., p. 424) record it from Skye; Moray Firth; the Outer Skerries Harbour, Shetland; amongst confervæ in pools left by the tide near Berwick; Plymouth, between tide-mark: Co. Clare, Ireland; the coast of Normandy; and from Hummock's Island, Bass's Straits, and the Crimea.

Genus SUNAMPHITHOË, Spence Bate.

SUNAMPHITHOË HAMULUS, Spence Bate.

Sunamphithoe hamulus, Spence Bate, Brit. Assoc. Rep. 1885, p. 59.

Habitat.—Dredged in 8 fathoms, off little Cumbrae; and taken by the dip or sweep-net, at low-water, Portloy, Cumbrae, and in the surface-net after sunset. It has also been recorded as having been taken in the Moray Firth, in rock-pools at Penzance, and in 2 to 5 fathoms, Shetland.

Genus PODOCERUS, Leach.

PODOCERUS FALCATUS, Montagu.

Cancer (Gammarus) falcatus, Montagu, Linn. Trans., ix. (1808), p. 100, pl. 5, fig. 1, 2. ♂ juv.

Jassa falcata, Leach, Edin. Encyc., vii., p. 433. ♂ juv.

Cerapus pelagicus, Milne Edwards, Hist. d. Crust. (1840), iii., p. 361. ♂ juv.

Cerapus falcatus, Thompson, Ann. and Mag. Nat. Hist., xx. (1847), p. 244.

Podocerus pulchellus, Milne Edwards, Ann. des Sci. Nat. Hist., t. xx. (1830) p. 384. ♂.

Podocerus calcaratus, Rathke, Acta Acad. Leop., xx. (1843), p. 91, t. iv., fig. 9. ♂ ♀.

Podocerus falcatus, Spence Bate, Cat. Amph. Crust. Brit. Mus. (1862), p. 255, pl. xliv., fig. 1.

Podocerus monodon, Heller, Beitr. &c. Deukschr. d. K. K. Acad. d. Wissensch. (1857), 26 B., 2 Abth., p. 45, tab. iv., fig. 4, 5. ♀.

Habitat.—Taken on Millport Pier at low-water, occurring plentifully on the tufts of *Ceramium rubrum* (chiefly *P. falcatus*); on the Tan Buoy (*P. pulchellus*, together with *P. pelagicus* in ova); between the Allans, among sea-weed, in 2 to 3 fathoms; and at low-water, Portloy, Cumbrae. Also taken in the trawl-net, off Dunoon, in 4 fathoms. All the three —*falcatus*, *pulchellus*, and *pelagicus*—are generally found on piers and buoys.

PODOCERUS VARIEGATUS, Leach.

Podocerus variegatus, Leach, Edin. Encyc. (1813-14), vii., p. 433. ♀.

Podocerus capillatus, Rathke, Beitr. z. Fauna Norwegens, Nov. Act. Leop., xx., p. 894, pl. iv., fig. 8. ♂.

Jassa capillata, Bruzelius, Skand. Amph. Gamm. (1859), p. 19.

Janassa variegata, A. Boeck, Crust. Amph. Bor. et Arct. (1870), p. 170.

Habitat.—Taken among the sea-weed on Millport Pier, and by the dip-net, at low-water, among stones and sea-weed; also by the surface-net, after sunset, by the side of the rocks on the east side of Kames Bay. In this case they might have been brushed off the weed on the side of the rock when passing. It has also been dredged at the roots of *Laminaria saccharina*, in 6 fathoms, at the Tan Buoy, Cumbrae; and taken in the trawl-net, off Dunoon, in 16 fathoms, where about half a dozen were found on the body of the crab *Stenorhynchus tenuirostris*, some of them in ova, but mostly small. It has been recorded from Devon, Plymouth, Bell Rock, Whalsey Lighthouse, Banff, and Polperro.

PODOCERUS OCIUS, Spence Bate.

Podocerus ocius, Spence Bate, Cat. Amph. Brit. Mus., p. 257, pl. xliv., fig. 5.

Habitat.—Dredged at the roots of *Laminaria saccharina*, north of the Tan Buoy, Cumbrae, in 8 fathoms; and off the Clach Rock in 6 fathoms, bottom muddy sand and shell debris. It has also been taken at Ilfracombe by Mr. Gosse.

Genus CERAPUS, Say.

CERAPUS ABDITUS, Templeton.

Cerapus abditus, Templeton, Trans. Ent. Soc., i. (1836), p. 188, pl. xx., fig. 5.

Cerapodina abditus, Milne Edwards, Hist. d. Crust. (1840), t. iii., p. 62.

? Cerapus Whitei, Gosse, Nat. Rambles Devonshire Coast (1853), p. 383, pl. xxii., fig. 12.

Erichthonius difformis, Spence Bate, Ann. Nat. Hist., 2nd Ser., xix. (1857), p. 149.

Siphonœcetus Whitei, Spence Bate and Westwood, Brit. Sessile-eyed Crust. (1863), p. 467.

Podocerus punctatus ♀, Spence Bate, Ann. Nat. Hist., 2nd Ser., xix. (1857), p. 148.

Dercothoe (Cerapus ♀*) punctatus*, Spence Bate, Cat. Amph. Crust. Brit. Mus. (1862), p. 260.

Habitat.—Taken among sea-weed dredged on the north side of the Cloch Lighthouse, in 6 fathoms. Both *Cerapus abditus* and *Dercothoe punctatus* were found together in a tube on *Sertularia polyzonias*. The eyes of both were red.

It has also been taken in Oxwick Bay and Plymouth Sound by Bate and Westwood; on the coast of Northumberland by the Rev. A. M. Norman; and in the Atlantic Ocean by Mr. Templeton.

CERAPUS DIFFORMIS, Milne Edwards.

Erichthonius difformis, Milne Edwards, Ann. d. Sci. Nat., t. xx. (1830), p. 382.

Podocerus Leachii, Kroyer, Nat. Tidsskr. (1842), 1 R. iv., p. 163.

Cerapus Leachii, Spence Bate, Cat. Amph. Crust. Brit. Mus. (1862), p. 268.

Cerapus difformis, Costa, R. sui Crost. Amfip. del Regno di Napoli, p. 228.

Habitat.—Taken at Portloy, Cumbrae, at low-water, by the dip-net, and off the Fairland Point in 17 fathoms, bottom gravelly mud. It has been taken on the Northumberland coast by the Rev. A. M. Norman, at Banff by Mr. Edward, and on the coast of Brittany by M. Milne Edwards.

Genus SIPHONŒCETUS, Kroyer.

SIPHONŒCETUS TYPICUS, Kroyer.

Siphonœcetus typicus, Kroyer, Nat. Tidsskr. (1845), 2 R., 1 B., p. 481, pl. vii., fig. 4.

Siphonœcetus typicus, Spence Bate, Cat. Amph. Crust. Brit. Mus. (1862), p. 270.

Habitat.—Dredged in shell debris, in 16 fathoms, off west end of Cumbrae; a few were obtained in this haul. They were all in little free nests made

up of small chips of shells, foraminifera, grains of sand, &c. The eye, when in life, is round and white, with five or six black dots.

It also has been taken in from 70 to 90 fathoms water east of Shetland.

Genus Podoceropsis, A. Boeck.

PODOCEROPSIS SOPHIÆ, A. Boeck.

Podoceropsis Sophiæ, A. Boeck, Forh. ved de Skand. Naturf., 8de mode (1860), p. 666.

Nœnia tuberculosa, Spence Bate, Cat. Amph. Crust. Brit. Mus. (1862), p. 271, pl. xlvi., fig. 2.

Habitat.—Dredged on Skelmorlie Bank, in 10 fathoms, bottom mud and gravel; and off Skelmorlie Point, in 39 fathoms, bottom mud—Firth of Clyde. It has also been taken off Plymouth, and in Oxwick Bay, south coast of Wales, by S. Bate and Westwood; at Banff, by Mr. Edward; and in Belfast Bay, Ireland, by Mr. Thompson.

PODOCEROPSIS RIMAPALMA, Spence Bate.

Nœnia rimapalma, Spence Bate, Cat. Amph. Brit. Mus., p. 272, pl. xlvi., fig. 3.

Habitat.—Frequently found in the shell occupied by the hermit-crab *Pagurus Bernhardus*, sometimes singly, but at other times a few together. It is not readily seen until the shell has been broken. It is occasionally dredged free. Cumbrae. It has also been taken on the Northumberland coast, by Mr. Joshua Alder; and in from 70 to 90 fathoms, sixty miles east of the Shetlands, by the late Dr. J. G. Jeffreys and the Rev. A. M. Norman.

PODOCEROPSIS EXCAVATA, Spence Bate.

Nœnia excavata, Spence Bate, Cat. Amph. Brit. Mus., p. 272, pl. xlvi., fig. 4.

Habitat.—At the roots of *Laminaria saccharina*, in 10 fathoms, west of Shell-hole, Cumbrae; off Garnock Beacon, in 5½ fathoms, mud and gravel; off Kirn, in 15 fathoms, bottom mud, gravel, and shell-debris;

and taken off the coast of Northumberland by the late Mr. Joshua Alder.

This species is now considered to be only a variety of *P. rimapalmata*.

PODOCEROPSIS UNDATA, Spence Bate.

Nœnia undata, Spence Bate, Cat. Amph. Brit. Mus., p. 272, pl. xlvi., fig. 5.

Habitat.—Among the roots of *Laminaria saccharina*, in 10 fathoms, bottom mud and Melobesia; and south of Little Cumbrae, in 25 fathoms, soft black mud. Taken also off the coast of Northumberland by Mr. Joshua Alder.

Genus COROPHIUM, Latreille.

COROPHIUM GROSSIPES, Linné.

Cancer grossipes, Linné, Sys. Nat. (1767), Ed. 12, v., 80, p. 1055.

Oniscus volutator, O. F. Müller, Zool. Dan. Prodr. (1776).

Gammarus grossipes, Fabricius, Genera Insectorum (1776), p. 248.

Astacus linearis, Pennant, Brit. Zool. (1777), iv., p. 17, pl. 16, fig. 31.

Gammarus longicornis, Fabricius, Sys. Ent. (1775), ii., p. 515.

? Gammarus parvus, Fabricius, Reise nach Norwegen (1779), p. 258.

Corophium longicorne, Latreille, Gen. Crust. et Ins. (1807), i., p. 59.

Corophium grossipes, Templeton, Mag. Nat. Hist. and Jour., ix. (1836), p. 12.

Habitat.—Between tide-marks, Balloch Bay, Cumbrae; Roseneath; Langbank, near Port-Glasgow. A batch of them were lately sent me by Mr. John Smith, Kilwinning, from the mouth of the Garnock, where, as at Langbank, they do not seem to object to a bath of brackish water. I have taken them plentifully at Oban, a little to the north of Dunolly Castle. They burrow in mud and stiff clay; and where they occur in colonies, as they mostly do,

the clay is seen to be closely perforated with small holes, which at a depth of two or three inches bend sharply round, returning upwards nearly by the side of the down-going bore. This form of burrow most likely serves as a means either of retreat or escape.

I have seen the species burrowing in the soft mud, which it does rather sluggishly. In this operation it brings the points of the long antennæ together, and pushes them into the mud. The fore-feet assist in widening the hole and turning the mud sideways, and the hind feet throw it backwards; the tail is carried at a downward angle, pressing against the mud while forcing the animal forward.

It has also been recorded from Berwick by Dr. Johnston; from the Moray Firth by the Rev. G. Gordon; and from Loughor Marsh, Glamorgan, by Bate and Westwood.

COROPHIUM CRASSICORNE, Bruzelius.

Corophium crassicorne, Bruzelius, Skand. Amph. Gamm. (1859), p. 15, pl. 1, fig. 2.

? Corophium Acherusicum, Costa, R. sui Crost. Amfip. del Regno di Napoli (1853), p. 232.

Corophium spinicorne, Spence Bate, Cat. Amph. Crust. Brit. Mus. (1862), p. 281.

? Corophium Bonellii, Milne Edwards, Ann. d. Sci. Nat. Hist., t. xx. (1830), p. 385. ♀.

Habitat.—Plentiful in Balloch Bay, Cumbrae, near high-water, amongst the muddy roots of *Zostera*; and taken in the surface-net after sunset; also taken in great abundance ♂ ♀ in a muddy brackish shore pool, Little Cumbrae. In this case the males seemed to predominate to some extent.

Family CHELURIDÆ.

Genus CHELURA, Phillipi.

CHELURA TEREBRANS, Phillipi.

Chelura terebrans, Phillipi, Arct. f. Naturgesch. (1839), v., p. 120, pl. iii., fig. 5.

Nemertes nesœoides (Leach), White, Cat. Crust. Brit. Mus. (1847), p. 90.

Habitat.—All round our coasts, in the submerged timbers of piers and jetties, in which this little crustacean makes great havoc. It is frequently associated with *Limnoria lignorum*, equally destructive to submerged timbers.

Chelura is more than double the length of *Limnoria*, but not much thicker; and accordingly it gets readily into the burrows of the latter. It is more restless, is endowed with greater powers of swimming and walking, and can leap a considerable distance when out of the water; and sometimes, when irritated while out of the water, it rolls itself up like *Sphœrium*. When put into a vessel with water, it swims for some little distance, but with considerable exertion, and it soon tires, and settles down on the bottom. Professor Allman says: "Timber that has been subjected to the ravages of *Chelura* presents a somewhat different appearance from that which has been attacked by *Limnoria lignorum*. In the latter we find narrow cylindrical burrows running deep into the interior, while the excavations of *Chelura* are considerably larger, and more oblique in their direction, so that the surface of the timber thus undermined by these destructive animals is rapidly washed away by the action of the sea, and the excavations are exposed in the greater part of their extent, the wood appearing ploughed up, so to speak, rather than burrowed into." Where the work of the two species can be seen on separate pieces of timber (which I have not had the opportunity of observing), I have no doubt the difference in the direction and size of their burrows will be quite noticeable. Yet, on splitting up a piece of timber off the piles of Millport pier, both *Chelura* and *Limnoria* were found in the perforations, these being to all appearance of the same depth, and excavated in the same direction; and although *Chelura*, as stated, is much larger than *Limnoria*,

the difference of the size of their perforations was not in this case satisfactorily discernible. In the piece of wood referred to, the two animals appeared to be equally abundant; but there did not appear to be two sets of perforations of different sizes, one running deep into the interior of the wood, and the other appearing ploughed up rather than burrowed.

Family HYPERIIDÆ.

Genus HYPERIA, Latreille.

HYPERIA MEDUSARUM, O. F. Müller (1776).

Cancer medusarum, Müller, Zool. Dan. Prodromus, 2355, p. 148.

Gammarus medusarum, Fabricius, Reise nach Norwegen (1729), pp. 326 et 354.

Cancer Gammarus galba, Montagu, Linn. Trans., xi. (1815), p. 4, t. 2, f. 2.

Talitrus cyanea, Sabine, Suppl. to Parry's First Voy. (1824), p. 238, pl. 1, fig. 12-18.

Hiella Orbignii, Straus, Mem. du Muséum (1829), xviii., pl. 4.

Hyperia Latreillii, Milne Edwards, Ann. des Sc. Nat., xx. (1830), p. 388, pl. 11, fig. 1-7.

Hyperia galba, White, Hist. Brit. Crust. (1850), p. 206.

Hyperia cyanea, Milne Edwards, Ann. des Sc. Nat., xx. (1830), p. 387.

Metœcus cyanea, Milne Edwards, Hist. des Crust., p. 78.

Lestrigonus exulans, Kroyer, Gronl. Amph., p. 68, fig. 18.

Lestrigonus Boeckii, Boeck, Bem. &c. i Naturf. Fordh. (1860), p. 636.

Lestrigonus Kinahani, Spence Bate and Westwood, Brit. Sessile-eyed Crust., p. 8.

Hyperia exulans, Goës, Crust. Amph. Spetsb. (1865), p. 18.

Hyperia medusarum, Spence Bate, Cat. Crust. Amph. Brit. Mus., p. 295, pl. xlix., fig. 1.

Habitat.—Among the folds of *Rhizotoma pulmo*, Cumbrae. The form *L. Kinahani*, Spence Bate and Westwood, taken in the surface-net after sunset.

Genus PARATHEMISTO, Boeck.

PARATHEMISTO OBLIVIA, Kroyer.

Hyperia oblivia, Kroyer, Gronl. Amfip., p. 70, pl. 4, fig. 19.

Habitat.—Taken by the surface-net, after sunset, in Sanda Bay, near the Mull of Kintyre; only a single specimen was obtained, and it is the only one that I remember of meeting with in the Firth of Clyde. I had lately, from Dr. John Murray of the *Challenger* Expedition, some gatherings taken by the tow-net in the Firth of Forth, where this species was in great abundance at the surface, and at depths of 30 and 40 fathoms.

Family CAPRELLIDÆ.

Genus PROTO, Müller.

PROTO VENTRICOSA, Müller.

Squilla ventricosa, Müller, Prodr. (1776), p. 360. ♀.

? Squilla ecaudata, Gronovius, Act. Helv. (1781), p. 439, pl. iv., fig. 8-10.

Gammarus pedatus, Abildgaard, Zool. Dan. (1789), Fasc. iii., p. 33, lvi., fig. 1-3, ♀; tab. ci., fig. 1, 2, ♂.

Cancer (Gammarus) pedatus, Montagu, Linn. Trans., xi. (1815), p. 6, pl. 2, fig. 6.

Proto pedata, Leach, Linn. Trans., xi. (1815), p. 362.

Proto pedatum, Desmarest, Consid. sur les Crust. (1825), p. 276, pl. 28, ♂ ♀.

Leptomera rubra, Lamarck, Hist. Nat. des Anim. sans Vertebr. (1818).

Leptomera pedata, Latreille, Règne Anim. (1817), iii., p. 51.

Leptomera ventricosa, Desmarest, Consid. sur les Crust. (1825), p. 276, ♀.

Proto ventricosa, A. Boeck, Crust. Amph. Bor. et Arct. (1870), p. 188.

Habitat.—Male and female taken off Fairland Point, in 17 fathoms, bottom mud, gravel, and shell-debris; off the south of the Allans, in 6 fathoms; and between the Allans, in 2 fathoms, among weed and sandy gravel—Cumbrae. Also in Campbeltown Loch, in the surface-net, after sunset. It has been taken on the southern coast of Devonshire; in the Moray Firth by the Rev. Mr. Gordon, Mr. Gregor, and Mr. Edward; in the Shetlands by the Rev. A. M. Norman; and off the coast of Cornwall by Mr. R. O. Couch.

PROTO GOODSIRII, Spence Bate.

Proto Goodsirii, Spence Bate, Ann. Nat. Hist., 2nd Ser. xix. (1857), p. 151.

Habitat.—Dredged off Muggie Point, Little Cumbrae, in 20 fathoms, bottom mud, gravel, and *Laminaria saccharina*; in the Moray Firth by the Rev. G. Gordon; in the Shetlands, and on the Durham coast, by the Rev. A. M. Norman.

Genus PROTELLA, Dana.

PROTELLA PHASMA, Montagu.

Cancer phasma, Montagu, Linn. Trans., vii. (1806), p. 66, pl. vi., fig. 3.

Astacus phasma, Pennant, Brit. Zool., iv. (1812), p. 27.

Caprella phasma, Leach, Edin. Encyc., vii. (1814), p. 404.

Caprella spinosa, Goodsir, Edin. New Phil. Jour. (1842), p. 183, pl. 3, fig. 1-3.

Caprella longispina, Kroyer, Nat. Tidsskr. (1845), 2 R., 1 B., p. 403.

Ægina longispina, Kroyer, Nat. Tidsskr. (1845), 2 R., 1 B., p. 476.

Protella longispina, Spence Bate, Ann. Nat. Hist., 2nd Ser., xix. (1857), p. 151.

Protella phasma, Spence Bate, Cat. Amph. Crust. Brit. Mus. (1862), p. 351, pl. lv., fig. 4.

Ægina phasma, A. Boeck, Crust. Amph. Bor. et Arct. (1870), p. 191.

Habitat.—Dredged off the "Hawk's Neb," near the south end of Bute, in 12 fathoms, adhering to zoophytes; off the Garrochhead, Bute, on *Plumularia*; west of Tan, Cumbrae, in 7 fathoms, at the roots of *Laminaria saccharina*; off Fairlie, in 8 fathoms, sandy mud: and off Ardrossan, in 16 to 20 fathoms. It has also been obtained on the coast of Devonshire by Col. Montagu; Plymouth, Bate and Westwood; Moray Firth, Mr. Gregor; Firth of Forth, Mr. Goodsir; Cullercoats, Northumberland, Rev. A. M. Norman; Cornwall, Mr. R. A. Couch; and Isle of Man, Dr. Fleming.

Genus Caprella, Lamarck.

caprella linearis, Linné.

Cancer linearis, Linné, Sys. Nat. (1767), Ed. xii., p. 1056.

Squilla lobata, Müller, Zool. Dan. Prodr. (1776), p. 197, No. 2359.

Squilla quadrilobata, Müller, Zool. Dan., fasc. ii., p. 21, p. lvi., fig. 4, 5, ♂.

Gammarus quadrilobatus, Müller, Zool. Dan. (1789), fasc. iii., p. 58, t. cxiv., fig. 11, 12, ♀.

Caprella scolopendroides, Lamarck, Hist. Nat. d. Anim. sans Vertebr. (1818), p. 174.

Caprella linearis, Leach, Edin. Encyc. (1813-14), p. 404.

Caprella lobata, Guerin, Icon. Crust. (1829), pl. xxviii., fig. 2.

Caprella lævis, Goodsir, Edin. New Phil. Jour., xxx. (1842), p. 189, pl. iii., fig. 4.

Caprella phasma, Rathke, Beitr. z. Fauna Norwegens (1843), B. xx., p. 94.

Caprella acuminifera, Rathke, Beitr. z. Fauna Norwegens (1843), B. xx., p. 86.

Habitat.—Dredged off Fintry Bay, bottom sand and *Corda filum*; by the dip-net, male and female, among weedy stones at low-water, Cumbrae; and off Garrochhead, Bute, in 15 fathoms, on *Plumularia*. It has also been taken in Moray Firth by

Mr. Edward; at Cullercoats, by the Rev. A. M. Norman; Plymouth, Bate and Westwood.

CAPRELLA HYSTRIX, Kroyer.

Caprella hystrix, Kroyer, Nat. Tidsskr. (1842), 1 R., 4 B., p. 603, pl. viii., fig. 20-26; Voy. en Scand., p. 124, fig. 1.

Caprella hystrix, Norman, Rep. on the Shetland Crust. (1868), p. 288.

Caprella hystrix, Bate and Westwood, Brit. Sessile-eyed Crust., vol. ii., p. 63.

Caprella hystrix, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 197.

Habitat.—Dredged at the Tan, Cumbrae, bottom Melobesia; on Northumberland coast by the Rev. A. M. Norman; and in the neighbourhood of Plymouth, Bate and Westwood.

CAPRELLA ACANTHIFERA, Leach.

Caprella acanthifera, Leach, Edin. Encyc., vii., p. 404.

Caprella calva, Spence Bate, Cat. Amph. Crust. Brit. Mus., p. 359. pl. lvi., fig. 11.

Caprella acuminifera, Latreille, in Nouv. Dict. d'Hist. Nat., 2nd Edit., vi., p. 433.

Habitat.—In tide pool, about half-tide, on Outer Allans, Cumbrae. This was a female, with the body red, and closely studded with dark dots. This species was dredged plentifully between the Allans, male and female, in 1 to 2 fathoms, amongst *Zostera* and fragmentary sea-weeds. There were more females than males, the proportion being perhaps two to one. They vary much in colour, particularly the females. Taken also in February by the dip-net, a little south from bathing-shade on the east side of Kames Bay, among stones and sea-weed at low-water; in this case all obtained were females in ova. It has also been taken at Plymouth at low spring-tides by Mr. Barlee; Banff, Mr. Edward;

Northumberland, Rev. A. M. Norman; Spring Vale, County Down, amongst *Corallina officinalis* in shallow pools between tide-mark, Mr. W. Thompson; and Firth of Forth, Rev. J. Gordon.

CAPRELLA TUBERCULATA, Guerin.

Caprella tuberculata, Guerin, Icon. R. An. Crust., pl. xxviii., fig. 1.

Caprella acuminifera ♀, Johnston, Mag. Nat. Hist., vi., p. 40, fig. 7a. (Not of Latreille and Desmarest.)

Caprella acanthifera ♀, Johnston, Mag. Nat. Hist., viii., p. 671, fig. 70.

Habitat.—Taken by the hand-net among stones and sea-weed at low spring-tides, Cumbrae; it has, however, seldom come under my notice. Recorded from the coast of Polperro by Mr. T. L. Couch, and from Guernsey by the Rev. A. M. Norman. Specimens from the Firth of Forth are in the collection of the British Museum.

Genus PODALIRIUS, Kroyer.

PODALIRIUS TYPICUS, Kroyer.

Podalirius typicus, Kroyer, Nat. Tidsskr. (1845), 2 R., 1 B., p. 283.

Caprella typica, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 354, pl. lvi., fig. 2.

Habitat.—Males and females dredged in 17 fathoms off Fairland Point, Cumbrae, in the month of August. Three years after, in the same month, I again obtained both males and females from off the same point in 17 fathoms, bottom gravel and the small zoophyte *Campanularia dumosa*; also one male and female between the Allans in two to three fathoms, bottom *Zostera*, sand, gravel, and fragmentary weeds.

This species has also been recorded from the Firth of Forth by the Rev. J. Gordon.

Order ISOPODA.

Group ABERRANTIA.

Tribe VAGANTIA.

Family TANAIDÆ.

Genus Tanais, Andouin and Milne Edwards.

TANAIS VITTATUS, Rathke.

Crassurus vittatus, Rathke, Nov. Act., 20, pl. i., fig. 7.

Tanais vittatus, Lilljeborg, Bidr. t. Känn. om de in. Sver. och Norr. Förek. Crust. af Isop. underord. och Tan. fam. (Upsala, 1864), p. 24.

Habitat.—Taken on the wood piles of Millport pier among algæ. Of the four specimens obtained, two were with ova, and the young had only newly left the egg-sacs of the other two. On the rocks among sea-weed *(Cladophora rupestris)* near low-water, Cumbrae; Berwick Bay, Dr. Johnston; and Polperro, Mr. Loughrin.

Genus Paratanais, Dana.

PARATANAIS RIGIDUS, Spence Bate and Westwood.

Paratanais rigidus, Spence Bate and Westwood, Hist. Brit. Sessile-eyed Crust. (1868), vol. ii., p. 141.

Habitat.—Taken at the roots of *Laminaria saccharina*, in 7 to 8 fathoms, near the Tan Buoy, Cumbrae,

PARATANAIS FORCIPATUS, Lilljeborg.

Tanais forcipatus, Lilljeborg, Bidrag Isop. Tan. fam., p. 25.

Tanais Savignyi, Gosse, Mar. Zool., i., fig. 246.

Zeuxo Westwoodiana? Templeton, Trans. Ent. Soc. Lond., ii., 203, pl. xviii.

Habitat.—Taken on stones between tide-mark, Cumbrae. They are most readily got by putting the stones into a pail of water, when the animals soon appear and float on the surface. Being quite white they are easily seen, though very small.

It has been taken in Plymouth Sound by Bate and Westwood, and at Banff by Mr. Edward.

Family ANCEIDÆ.

Genus ANCEUS, Risso.

ANCEUS MAXILLARIS, Montagu.

Cancer maxillaris, Montagu, Trans. Linn. Soc., vii., p. 65, t. 6, f. 2 ♂.

Gnathia maxillaris, Leach, Enc. Brit. Suppl.; Encyc. Méthod. Crust., pl. 336, fig. 25.

Anceus maxillaris, Lamarck, Anim. sans Vert., v., p. 168.

Gnathia termitoides, Leach, Edin. Encyc., vii., p. 402 ♂.

Oniscus cæruleatus var., Montagu, Trans. Linn. Soc., xi., p. 16 ♀.

Praniza Montagui, Westwood, Ann. des Sci. Nat., vol. xxvii., p. 327.

Praniza cæruleata, Desmarest, Cons. Crust., p. 284, t. 46, f. 8.

Habitat. — Dredged in 12 fathoms, Inverkip Bay, bottom shells, mud, and gravel; half a dozen were taken in this haul. At Balloch Bay, Cumbrae, males and females occurred in Zostera-beds near high-water. Mr. John Smith, Kilwinning, has sent me both male and female from the mouth of the Garnock, among muddy grass, a little below high-water mark, where the water is brackish. In this situation, during floods, they must be subjected to nearly pure fresh-water. Montagu found two females adhering to the body of a Father-lasher *(Cottus scorpius)*.

This species has been taken at Polperro, Plymouth Sound, Devonshire, Falmouth, Bangor (Ireland), and Isle of Man.

ANCEUS HALIDAII, Spence Bate and Westwood.

Anceus formica? Hesse, Mém. Etrang. Acad. Sci., t. xviii., p. 39, pl. iii., figs. 5, 6, 7.

Anceus Halidaii, Spence Bate and Westwood, Hist. Brit. Sessile-eyed Crust. (1868), vol. ii., p. 203.

Habitat.—Dredged off Kames Bay, Cumbrae, in 10 fathoms, bottom stony soft clay.

Common on the clayey shores of Strangford Lough, Ireland.—Mr. A. H. Haliday.

ANCEUS EDWARDII, Spence Bate.

Praniza Edwardii, Spence Bate, Ann. Nat. Hist., 3rd Ser., vol. xxi., pl. vi., fig. 1, 2, and details.

Anceus Edwardii, Spence Bate and Westwood, Hist. Brit. Sessile-eyed Crust. (1868), vol. ii., p. 201.

Habitat.—Taken on stones at low-water, Portloy, Cumbrae; and at Banff by Mr. Edward.

Family ÆGIDÆ.

Genus ÆGA, Leach.

ÆGA BICARINATA, Leach.

Ægа bicarinata, Leach, Dict. Sci. Nat., xii., p. 349.

Habitat.—Dredged in Loch Fyne, in 15 fathoms, bottom mud, shells, and gravel. It measured $1\frac{3}{4}$ inch, exclusive of antennæ.

Recorded from Plymouth by Bate and Westwood, and coast of Durham by Rev. A. M. Norman. It also inhabits the Mediterranean.

ÆGA TRIDENS, Leach.

Ægа tridens, Leach, Trans. Linn. Soc., xi., p. 370. —Spence Bate and Westwood, Hist. Brit. Sessile-eyed Crust. (1868), vol. ii., p. 281.

Habitat.—Taken on a cod-fish, off south end of Cumbrae. The fisherman, from whom I obtained it, informed me that he had taken five or six on one cod. He stated that he has frequently met with them on large cod, taken off the Cock of Arran, and most frequently in the spring of the year.

Genus CIROLANA, Leach.

CIROLANA CRANCHII, Leach.

Cirolana Cranchii, Leach, Dict. Sci. Nat., xii., p. 347.

Habitat.—Dredged off Fairland Point, Cumbrae, in 14 fathoms, mud, shells, and gravel. Rare.

It has been taken at Falmouth by Mr. J. Cranch, and dredged near the Knap Buoy, outside Plymouth breakwater, by Bate and Westwood.

CIROLANA SPINIPES, Spence Bate and Westwood.

Cirolana hirtipes? Milne Edwards, Crust., iii., p. 226, t. 31, f. 25.

Cirolana spinipes, Spence Bate and Westwood, Hist. Brit. Sessile-eyed Crust. (1868), vol. ii., p. 299.

Habitat.—On two different occasions after a storm a single specimen was found in small pools near low-water, west side of Kames Bay, Cumbrae. Both were alive when taken, but in a very weak state, having most likely been brought in from deeper water by the storm. Also dredged at the mouth of Loch Fyne, in 37 fathoms, bottom mud and small gravel; and off north side of Little Cumbrae, in 29 fathoms, mud and dead shells; and on a dead fish in a bait-pot—leaving no doubt that this species is another of the scavengers of the deep.

The bodies of those taken from the shallow and deeper water were smooth, and closely studded with small dendritic-like markings. The eyes are subquadrate, with large facets placed in rows. The middle tail-plate (telson) has three spines on each side; the inner tail-plate has three or four on each side, with one terminal spine; the outer plate has four on the outside, with one terminal bent spine. All the plates are fringed with plumose ciliæ, and all the fingers are tipped with dark brown.

It has been taken in Dublin Bay by Mr. Warren, also off the Yorkshire coast, and at the Moray Firth by Mr. Gregor.

Genus CONILERA, Leach.

CONILERA CYLINDRACEA, Montagu.

Oniscus cylindraceus, Montagu, Trans. Linn. Soc., vii., p. 71, t. 6, f. 8.

Conilera cylindracea, White, B. M. Cat. Brit. Crust., p. 80.

Conilera Montagui, Leach, Trans. Linn. Soc., xi., p. 370.

Anthura cylindrica, Leach, Trans. Linn. Soc., xi., p. 366.

Habitat.—Dredged between Bute and Cumbrae in 50 fathoms, bottom mud. Taken by the Rev. A. M. Norman in the Firth of Clyde; Falmouth, Dr. Leach; Cornwall, Mr. Cranch.

Genus EURYDICE, Leach.

EURYDICE PULCHRA, Leach.

Agaat Pissebet (Oniscus), Slabber, Natur. Verlust., p. 149, pl. 17, f. 1, 2.

Eurydice pulchra, Leach, Trans. Linn. Soc., xi., p. 370.

Slabberina agata, Van Beneden, Rech. sur la Faune Litt. Belg. (1861), p. 88, pl. 15.

Habitat.—Common in sand and muddy pools near high-water mark, where it is often subjected to more or less surface and rain water. Balloch Bay and Fintry Bay, Cumbrae; Castle Bay, Little Cumbrae; Hunterston, Ayrshire; Langbank, on brackish mud and in the surface-net; on Ayr Sands at half-tide, in a pool adjoining a sewer-pipe. Devonshire, Dr. Leach; South Wales, S. Bate and Westwood; Larne, Mr. W. Thompson; Coast of Durham and Northumberland, Rev. A. M. Norman; Coast of Brittany, burrowing in sand, M. Hesse.

Family ASELLIDÆ.

Genus JÆRA, Leach.

JÆRA ALBIFRONS, Montagu.

Oniscus albifrons, Montagu, MSS. in Brit. Mus.

Jæra albifrons, Leach, Edin. Encyc., vii., p. 434.

Jæra nivalis? Kröyer, Grönlands Amfip., p. 75, pl. 4, fig. 21a-k.

Oniscus marinus? O. Fabricius, Fn. Grœnl., pp. 252, n. 229.

Habitat.—Common under stones between high and low water. When the stones are turned up, the

animals seem to depend more for their safety on lying motionless than on trying to escape. I have seldom failed to find them on the pier at Millport by brushing the wall with a hand-net. I have also met with them among the legs of a dead crab. This species has been taken at Falmouth by Mr. W. P. Cocks; Plymouth Harbour, under stones, Bate and Westwood; coast of Berwick, the late Dr. Johnston.

JÆRA NORDMANNI, Rathke.

Janira Nordmanni, Rathke, Mém. des Sav. Étrang. de St. Petersb. (Fauna der Krym.), t. iii., pl. 6, figs. 1-5, p. 388.

Jæridina Nordmanni, Milne Edwards, H. N. Crust., iii., 150.

Jæra Nordmanni, Spence Bate and Westwood, Hist. Brit. Sessile-eyed Crust. (1868), vol. ii., p. 320.

Habitat.—Taken under stones between high and low water, Portloy, Cumbrae; and among algæ scraped off the pier at Millport. These small animals can be best searched for by taking the stones home and putting them into a shallow vessel, with sufficient water to cover them and admit of their surface being viewed through a pocket-lens. After remaining a few hours, small animals come out of the crevices and creep along the stone, or swim through the water, or crawl up the side of the vessel, where they can at leisure be readily detected and picked up.

Plymouth and South Wales, S. Bate and Westwood.

Genus MUNNA, Kroyer.

MUNNA WHITEANA, Spence Bate and Westwood.

Munna Whiteana, Spence Bate and Westwood, Hist. Brit. Sessile-eyed Crust. (1868), vol. ii., p. 329.

Habitat.—In the month of March no fewer than nine were taken on stones near low-water at Portloy, Cumbrae. My captures of this species had hitherto been chiefly at the roots of *Laminaria saccharina*,

or among the fibres of the nest of the mollusc *Lima hians*; and then only one or two could be obtained when carefully searched for, or more frequently none at all. I may remark that although got plentifully at the time above referred to, the stones have at other times been examined without any being found. A few were floated out from dry mud that was dredged in 35 to 40 fathoms between Cumbrae and Kilchattan. Taken also at Weymouth by Professor Williamson.

MUNNA KRÖYERI, Goodsir.

Munna Kroyeri, Goodsir, Edin. New Phil. Jour., xxxiii. (1842), p. 365, t. 6, f. 6.

Habitat.—Taken among the fibres of the nest of *Lima hians*, Cumbrae. This species seems to be much rarer here than *Munna Whiteana*; perhaps it may be that the habitat of *M. Kroyeri* is less accessible. It has been taken in the Firth of Forth by Mr. Goodsir, and at Cullercoats and Seaham by the Rev. A. M. Norman.

Genus LEPTASPIDIA, Spence Bate and Westwood.

LEPTASPIDIA BREVIPES, Spence Bate and Westwood.

Leptaspidia brevipes, Spence Bate and Westwood, Hist. Brit. Sessile-eyed Crust. (1868), vol. ii., p. 333.

Habitat.—Off Cumbrae in mud. Very rare.

Genus JANIRA, Leach.

JANIRA MACULOSA, Leach.

Janira maculosa, Leach, Edin. Enc., vii., p. 434.

Oniscoda maculosa, Latreille, Règne An., iv., p. 141.

Habitat.—Taken on stones at low-water, Portloy, Cumbrae. Dredged at the mouth of Loch Fyne in 40 to 60 fathoms, inside a sponge; and on a piece of coal dredged off Dunoon in 13 fathoms, bottom mud and gravel. When taken they often want their terminal stylets, a circumstance which at first sight is apt to mislead. This species has also been taken off the coast of Devonshire by Montagu; Polperro,

Mr. Couch; the coast of Durham, Rev. A. M. Norman; and Berwick Bay, the late Dr. Johnston.

Genus ASELLUS, Geoffrey.

ASELLUS AQUATICUS, Linné.

Oniscus aquaticus, Linné, Sys. Nat., ii., p. 1061.
Cymothoa aquatica, Fabricius, Ent. Sys., ii., p. 505.
L'Aselle, Geoffrey, Ins. Paris., ii., p. 672, t. 22, f. 2.
Asellus aquaticus, Olivier, Enc. Méth., iv., p. 252.

Habitat.—Common everywhere among the marginal vegetation of ponds, canals, and slow-running streams.

Genus LIMNORIA, Leach.

LIMNORIA LIGNORUM, Rathke.

Cymothoa lignorum, Rathke, Skrivt. af Naturh. Selsk., vol. 101 (1799), t. 3, f. 14.
Limnoria lignorum, White, Pop. Hist. Brit. Crust., p. 227, pl. 12, f. 5.
Limnoria terebrans, Leach, Dict. des Sci. Nat., art. Cymothoadées; Edin. Encyc., vii., p. 433.

Habitat.—Abundant in the piles of Millport Pier. This little creature is one of the most destructive animals to marine submerged timber. It is very small, measuring not more than $\frac{1}{8}$ inch in length, and less than one-half that in breadth, yet in a very short time a number of them will destroy the whole timber of a pier. It appears that these animals, whether from choice of material or facilities in working, are partial to particular layers of the wood, which they remove with such economy that the divisional walls are barely left standing. In completing this part of their work of destruction, they indiscriminately drive their burrows in all directions. The only time when their operations show a tendency to order is when they enter the solid wood; then in general they cut either obliquely upwards or obliquely downwards. Yet though they seem to be in a great measure guided in the direction of their course by the layers of the wood, they evidently endeavour to avoid cutting through or

into their neighbour's shaft. Tracing their course, we see that as soon as they find themselves approaching the burrow of another, they dip down below it or go above it. Where the straight onward course is found impracticable, they curve round and work outwards. As two of these animals are sometimes found in one bore, it may be inferred that they may not be altogether solitary workers; but whether they are there for mutual assistance or as sexual associates I have not had the opportunity of determining.

Family ARCTURIDÆ.

Genus ARCTURUS, Latreille.

ARCTURUS LONGICORNIS, Sowerby.

Oniscus longicornis, Sowerby, Brit. Misc., t. 19.

Arcturus longicornis, Westwood, Trans. Ent. Soc. Lond., i., 72, t. 16.

Astacilla longicornis, Fleming, Edin. Enc., vii., p. 502.

Leachia lacertosa, Johnston, Edin. Phil. Jour., xiii., p. 220.

Habitat.—Taken frequently in the dredge at various depths; off Fairland Point, in 15 fathoms, bottom mud and gravel; off the Tan Buoy, towards Bute, in 20 fathoms, mud and dead shells; off Skelmorlie Point, in 39 fathoms, mud and gravel; off Gantloch Beacon, in 35 fathoms, mud, stones, and zoophytes; and off Skate Island, Loch Fyne, in 105 fathoms, bottom soft mud. I have also had this species from a fisherman, brought up on his long line. It has been taken in the Firth of Forth by Mr. H. Goodsir; off Cullercoats, coast of Northumberland, Dr. Clarke; Plymouth, Bate and Westwood.

ARCTURUS GRACILIS, Goodsir.

Leachia gracilis, Goodsir, Edin. New Phil. Jour., xxxi., p. 310, pl. 6, f. 4.

Arcturus gracilis, White, Cat. Brit. Crust., p. 64.

Arcturus gracilis, Spence Bate and Westwood, Hist. Brit. Sessile-eyed Crust. (1868), vol. ii., p. 373.

Habitat.—Dredged off Muggie Point, Little Cumbrae, in 14 fathoms, bottom stones, small gravel, and *Laminaria saccharina*. Taken off Anstruther, Firth of Forth, by Mr. Goodsir.

Family IDOTEIDÆ.

Genus IDOTEA, Fabricius.

IDOTEA TRICUSPIDATA, Desmarest.

Idotea tricuspidata, Desmarest, Cons. Crust., p. 289.
Oniscus tridens, Scopoli, Ent. Carniolica.
Idotea Entomon, Pennant, Brit. Zool., iv., pl. 18, f. 5.
Idotea Basteri, Audouin, Descr. of Savigny, Egypt. Crust., pl. 12, f. 6.
Idotea tridentata, Latreille, Con. Crust. et Ins., i., p. 64.
Idotea variegata, Roux, Crust. Mediter., pl. 30, f. 1-9.
Armida bimarginata, Risso, H. N. l'Eur. Mérid., 5, 109.

Habitat.—Common among sea-weed brought up in the dredge, especially on dead weeds, and sometimes occurring in great abundance. A large patch of *Halidrys siliquosa*, brought up on a fisherman's line at Cumbrae, was swarming with hundreds of this species. They are occasionally taken in the surface-net, on floating sea-weed. Bate and Westwood state that the largest they have seen "measures one inch and five lines, and another one inch and a quarter: the former from the Cheshire coast, the latter off the Dudman on the coast of Cornwall." * One I have from Loch Fyne measures $1\frac{1}{2}$ inch.

Common round the sea-board of England, Scotland, and Ireland.

IDOTEA PELAGICA, Leach.

Idotea pelagica, Leach, Trans. Linn. Soc., xi., p. 365.
Idotea marina, Fabricius, Ent. Sys., Suppl., p. 303?
Oniscus balthicus, Pallas, Spic. Zool., ix., t. 4, f. 6?
Rhœtia pelagica, Leach, MSS.

* *Brit. Sessile-eyed Crustacea*, vol. ii., p. 382.

Habitat.—Taken among sea-weed at low-water, Cumbrae. It has been taken at various localities on the English, Scottish, and Irish coasts.

IDOTEA EMARGINATA, Fabricius.

Cymothoa emarginata, Fabricius, Ent. Sys., ii., p. 508.

Idotea emarginata, Fabricius, Ent. Sys., Suppl., p. 303.

? Squilla marina, De Geer, Ins., vii., p. 522, t. 32, f. 11, 14.

Idotea excisa, Bosc, Hist. Crust., ii., p. 181.

Idotea peloponesiaca, Roux, Crust. Med., t. 30, f. 10.

Idotea œstrum, Pennant, Brit. Zool., iv., pl. 18, f. 6.

Habitat.—Taken at low-water among sea-weeds, Cumbrae. Also off the coasts of Durham and Northumberland by the Rev. A. M. Norman; and at Port Patrick, Ireland, by the late Mr. W. Thompson.

IDOTEA LINEARIS, Pennant.

Oniscus linearis, Pennant, Brit. Zool. (Edit. 1777), iv., t. 18, f. 2.

Stenosoma lineare, Leach, Linn. Trans., xi., p. 366.

Idotea linearis, Latreille, Hist. Nat. Crust. et Ins., vi., p. 371.

Oniscus entomon, Baxter, Opusc. Subs., ii., t. 13, f. 2.

? Squilla marina, De Geer, Ins., vii., t. 32, f. 11.

Idotea diodon, Latreille, Nouv. Dict. d'Hist. Nat., xvi., p. 105.

Idotea viridissima, Risso, Crust. de Nice, p. 136, pl. 3, fig. 8.

Idotea hectica, Leach, Edin. Enc., vi., p. 404.

Stenosoma hecticum, Leach, Linn. Trans., vii., p. 433.

Oniscus ungulatus, Pallas, Spic. Zool., ix., 62, tab. 4, f. 11 (antennis falsis?).

Habitat.—Taken in a sandy pool at low-water, Cumbrae. Guernsey, Falmouth, and the coast of Durham, Rev. A. M. Norman; and Bigbury, near Plymouth, Bate and Westwood.

IDOTEA PARALLELA, Spence Bate and Westwood.

Idotea chelipes, Costa, Faun. d. Regno d. Napoli. Crust., pl. 11, f. 2.

Idotea parallela, Spence Bate and Westwood, Hist. Brit. Sessile-eyed Crust. (1868), vol. ii., p. 391.

Habitat.—Dredged between the Tan, Cumbrae, and "Hawk's Neb," Bute, in 50 fathoms, bottom mud. They were only noticed in the dry floatings, but were sufficiently perfect to leave no doubt of the species. Taken also at Falmouth, Mr. Barlee; Polperro, Mr. Loughrin.

IDOTEA ACUMINATA, Leach.

Stenosoma acuminatum, Leach, Edin. Encyc., vii., p. 433.

Idotea acuminata, White, Brit. Mus. Cat. Brit. Crust., p. 66.

Idotea capito, Rathke, Faun. d. Krym., p. 384, pl. 6, f. 7-9 (?).

Habitat.—Taken among the scrapings of muddy sand-covered stones near low-water, Cumbrae; and in sandy pools, Kilchattan Bay. It swims or glides smoothly through the water. When hunted it makes little attempt to escape, allowing itself to be drawn up the side of the vessel with a hair-pencil without any struggle to get away. Devonshire, Dr. Leach; Falmouth, Mr. W. P. Cocks.

SUB-TRIBE SPHÆROMIDEA.

Family SPHÆROMIDÆ.

Genus SPHÆROMA, Latreille.

SPHÆROMA SERRATUM, Fabricius.

Oniscus serratus, Fabricius, Mant. Inst., i., p. 242.

Cymothoa serratum, Fabricius, Ent. Sys., ii., p. 510.

Sphœroma serrata, Leach, Edin. Enc., vii., p. 405.

Oniscus globatus, Pallas, Spic., Zool., ix., t. 4, f. 18.

Sphœroma cinerea, Bosc, Hist. Crust., ii., p. 186.

Sphœroma serratum, Spence Bate and Westwood, Hist. Brit. Sessile-eyed Crust. (1868), vol. ii., p. 407.

Habitat.—Taken on Ayr sands, in a pool formed by one of the drain-pipes, about half-tide.

Bate and Westwood *(Brit. Sess.-eyed Crust.)* state that "this species lives in numerous societies under

stones, amongst the pebbles and gravel of the coast, and is found on the English and French coasts of the English Channel, from Kent to Cornwall, and in the Mediterranean. We have dredged fine specimens in Plymouth Sound in the month of August. Dr. Kinahan obtained it in the River Lagan, Belfast, and in the River Dodder, Dublin. We have observed quantities in the brackish streams on Loughor Marsh, near Swansea, mixed with *Palæmon*, *Carcinus*, and *Talitrus*."

SPHÆROMA RUGICAUDA, Leach.

Sphæroma rugicauda, Leach, Edin. Enc., vii., pp. 405, 433.

Habitat. — Plentiful in a weedy brackish pool; bottom soft mud, a little above ordinary high-water mark, Hunterston, Ayrshire. When put into spirits, they rolled themselves up into a round ball. Taken abundantly on the island of Ulva, Mull; and at the mouth of the River Tamar, Devonshire, Dr. Leach; Berwick-upon-Tweed, Dr. Johnston; Belfast Bay, Dr. Kinahan.

SPHÆROMA CURTUM, Leach.

Sphæroma curtum, Leach, Dict. Sci. Nat., xii., p. 345.

Var. *Sphæroma Griffithsii*, Leach, MSS. in Brit. Mus.

Habitat.—Dredged off the Ayrshire coast west of Portincross, 6 fathoms, bottom sand and stones. Torbay, Mr. Griffiths; several were found in a *Balanus* shell in Belfast Bay by Mr. W. Thompson.

Genus DYNAMENE, Leach.

DYNAMENE RUBRA, Montagu.

Oniscus ruber, Montagu, MSS.

Dynamene rubra, Leach, Dict. Sci. Nat., xii., p. 344.

Cymodocea rubra, Milne Edwards, Crust., iii., p. 216.

Habitat.—Taken at Cumbrae, Firth of Clyde, by the Rev. A. M. Norman; Bangor, Mr. W. Thompson; south-west coast of England, Montagu; Firestone Bay, near Plymouth, Bate and Westwood.

DYNAMENE VIRIDIS, Leach.

Dynamene viridis, Milne Edwards, Crust., iii., p. 344.
Cymodocea viridis, Milne Edwards, Crust., iii., p. 216.

Habitat.—Taken between tide-mark, Portloy, Cumbrae, in a small hole in one of the loose boulders. There were six in the hole, all females, and all in ova, some in a more advanced stage than others. Some of the young were well formed, and could move about slowly, but the parents showed little aptitude for walking. In the mouth of the hole there was a stout *Næsa bidentata*; but whether this was the male occupant guarding his harem, or an intruder on the privacy of the fair sex, I am not prepared to say. If we incline to the belief that he was guarding his own, this view would to some extent be corroborated by another couple found close together in a crevice on the same boulder. In this case the *Næsa bidentata* was much smaller than his brother above alluded to. The fact of his having only one female companion might be due to his youth: but as time advanced he might add more to the number, as he found himself in a better position to protect and support them. On the other hand, as he has been seen with *Dynamene Montagui*, he may be a rover, and not too particular as to the companions with whom he may associate. Taken at Lahinch, Co. Clare, Ireland, by Mr. W. Thompson.

Genus CYMODOCEA, Leach.

CYMODOCEA TRUNCATA, Montagu.

Oniscus truncatus, Montagu, MSS. in Brit. Mus.
Cymodocea truncata, Leach, Edin. Enc., vii., p. 433.

Habitat.—Dredged by the Rev. Canon Norman in Lamlash Bay, Isle of Arran; Devonshire coast, Montagu and Leach; Belfast Bay, W. Thompson; St. Andrews, Dr. Macintosh.

CYMODOCEA EMARGINATA, Leach.

Cymodocea emarginata, Leach, Dict. Sci. Nat., xii., p. 433.

Habitat.—Dredged off north side of the Clach rock, Cumbrae, in 6 fathoms, sea-weed, sand, and gravel. Plymouth, Leach; Falmouth, Mr. John Cranch; Belfast Bay.

Genus NÆSA, Leach.

NÆSA BIDENTATA, Adams.

Oniscus bidentatus, Adams, Trans. Linn. Soc., vol. v., p. 8, t. 2, f. 3, 4.

Næsa bidentata, Leach, Dict. Sci. Nat., xii., p. 341.

Habitat.—Taken between tide-mark in holes and crevices of stones, Portloy, Cumbrae. South-west coast of England, Leach; Polperro, Cornwall, Mr. J. Cranch; in various localities, Ireland, Dr. Kinahan, Professor J. R. Greene, and Mr. W. M'Calla; rocky stones of South Wales, South Devon, and Cornwall.

Family ONISCIDÆ.

Sub-family LIGIINÆ.

Genus LIGIA, Fabricius.

LIGIA OCEANICA, Linné.

Oniscus oceanicus, Linné, Sys. Nat., ii., p. 1061.

Ligia oceanica, Fabricius, Ent. Sys. Suppl., p. 301.

Oniscus aquaticus, Baxter, Opusc. Subs., ii., t. 13, f. 4.

Var. *Ligia scopulorum*, Leach, Edin. Enc., vii., p. 406.

Habitat.—Common all along our coast between tide-mark, generally at and above high-water, running on the dry rocks or concealed under decaying sea-weed, and often occurring in large numbers crowded under damp stones. I have taken the young on stones at low-water.

Although they are fitted to run about for a time in the open air, and even to bask on the rocks in sunshine, where I have seen them, yet most of their time seems to be spent under damp stones. As the young are found at low-water, they at least are capable of passing the greater part of their time in a state of submersion.

To try how long the adult animal could live submerged, I put half a dozen, together with two amphipods, into a glass vessel, covering them to a depth of an inch with sea-water. On the third day one of them was dead, but all the others seemed to be in good condition; on the eighth day one or two of them looked feeble; on the tenth day three of the *Ligiæ* and one of the amphipods were dead; on the twelfth day the other amphipod was dead; and on the fifteenth day they had all succumbed. As the dead had not been removed, or the water changed, these circumstances may have hastened their death; but whatever the cause of death may have been, it is evident that they can live for a considerable time under water. The one that died on the third day may have been injured in being captured; and the want of proper food to sustain life may have been the chief cause of the others not surviving longer. Neither the dead nor the living amphipods were touched, but some of the dead *Ligiæ* were lying in pieces — whether from decay or the work of their companions I could not decide. As the amphipods and *Ligia oceanica* live numerously together under stones, it can scarcely be suspected that they prey on each other. From further experiments I should say that they do not seem to touch their dead neighbours or brethren.

They do not live so long in fresh water, but the length of time depends much on the character of the water. In hard water one lived three hours and another four hours, and in rain-water two lived eight hours and another twenty-four hours.

Sub-family ONISCINÆ.

Genus PHILOSCIA, Latreille.

PHILOSCIA MUSCORUM, Scopoli.

Oniscus muscorum, Scopoli, Entom. Carniol., p. 1145.

Philoscia muscorum, Latreille, Hist. Crust. et Ins., vii., p. 43.

Oniscus sylvestris, Fabricius, Ent. Sys., ii., p. 397.

Ligia melanocephala, Koch, in Herrick-Schaffer Contin. of Panzer Ins. Deutschl., 162, 18.

Zia melanocephala, Koch, sub. Ins. D., 180, 1, and D. Crust., 40, 1.

Habitat. — Taken under stones, near the shore towards Fairland Point, Cumbrae. I have received this species from Mr. John Smith, Kilwinning, where he found it under old railway sleepers that had been thrown out on the embankments, and under the boles of trees carried down by the floods and left stranded along the banks of the Garnock. He states that when disturbed it rapidly scampers off, and frequently succeeds in making its escape. When caught it curves itself slightly up, and after remaining motionless for a second or two, it scampers away again.

It is found abundantly throughout the southern part of England, and in the Irish counties of Dublin, Wicklow, Meath, Wexford, Cork, Waterford, and Tyrone.

Genus PHILOUGRIA, Kinahan.

PHILOUGRIA RIPARIA, Koch.

Itea riparia, Koch, in Cont. Panz. Ins. Deutschl., 162, 17.

Philougria celer, Kinahan, Nat. Hist. Rev., vol. iv., p. 281, pl. 22, fig. 1-4.

Habitat. — Under boards in damp, shaded places, Cumbrae. Taken near the Aquarium, Rothesay, by Mr. Thomas Scott, Greenock.

Genus ONISCUS, Linné.

ONISCUS ASELLUS, Linné.

Oniscus asellus, Linné, Sys. Nat., ii., p. 1061.

Oniscus murarius, Cuvier, Jour. d'Hist. Nat., ii., t. 26, f. 11.

Habitat.—Common under stones along the side of an old stone dyke in a plantation, east side of

Kames Bay, Cumbrae; but none were found under the stones on the higher ground outside of the plantation. Mr. John Smith informs me that they are common under stones, and between the wood and the bark of fallen trees; but they are much more common under 30 feet above sea-level than higher up. On the 26th of January last, immediately after the snow had melted, I searched under the stones in the same locality in Cumbrae where I had found them so plentifully in summer and autumn, but not one was to be seen. They must have deeper quarters where they retire during the cold of winter.

Bate and Westwood state that this species is very common throughout England, Scotland, and Ireland, under decaying vegetable and animal matter, not only in damp but also in the driest localities.*

Genus PORCELLIO, Latreille.

PORCELLIO SCABER, Latreille.

Porcellio scaber, Latreille, Hist. Nat. Crust. et Ins., vii., p. 45.

Oniscus granulatus, Lamarck, Hist. Anim. sans Vertèbr., v., p. 261.

Porcellio dilatatus, Brandt and Ratzeb., Arzn. Thiere, t. 12, f. 6.

Oniscus asellus, Fabricius, Ent. Sys. Suppl., p. 300.

Porcellio Brandtii, Milne Edwards, Crust., iii., 168 (var.).

Porcellio dubius, Koch, in Cont. Panz. Heft. 180, n. 8.

Porcellio affinis, Koch, in Cont. Panz. Heft. 180, n. 13 (var.).

Habitat.—Common round the shores of Cumbrae, near and above high-water mark, under stones and decaying sea-weed, a dozen or more often occurring under a stone. Mr. John Smith has sent me specimens from the sand-hills at Stevenston, and from

* *Brit. Sessile-eyed Crustacea*, vol. ii., p. 468.

the neighbouring shore, where they occur under stones well sunk in the earth. The species is common throughout England and Ireland.

In experimenting how long it could live in fresh-water, I found that one died after eight hours' immersion; and on another occasion one lived forty-three hours in that element.

PORCELLIO ARMADILLOIDES, Lereboullet.

Porcellio armadilloides, Lereboullet, Mem. Soc. Nat. Hist. Strasbourg, iv. (1853).

Oniscus convexus, De Geer, Mem. Ins., vii., p. 553, pl. 35, f. 11.

Oniscus saxatilis, Hartmann.

Habitat.—This species has been sent to me from Kilwinning by Mr. John Smith, who states that it is moderately common in that neighbourhood, where it occurs under stones which are sunk an inch or two in the sandy soil. He has found it in situations varying from a few feet above sea-level up to an elevation of about 30 feet, and has also met with it two miles inland. It has also been taken near London by Mr. Francis Walker.

Genus ARMADILLO, Latreille.

ARMADILLO VULGARIS, Latreille.

Oniscus armadillo, Linné, Sys. Nat., ii., p. 1062.

Armadillo vulgaris, Latreille, Hist. Nat. Crust. et Ins., vii., p. 48.

Armadillidium vulgare, Milne Edwards, Crust., iii., p. 184.

Oniscus cinereus, Zeuker, in Panzer, Heft. 62, n. 22.

Var. *Armadillo variegatus*, Latreille, Gen. Crust. et Ins., i., p. 72, n. 2.

Armadillidium Zeukeri, Brandt, Consp. Mon. Crust. Onisc., Bull. Mosc., vi., 185.

Var. *Armadillo opacus*, Koch, Cont. Panz. Heft. 180, n. 3.

Var. *Armadillo Willii*, Koch, Cont. Panz. Heft. 186, n. 1.

Armadillo pulchellus, Schnitzler, Onisc. Bonn., p. 26 (?).

Habitat.—This species was sent to me by Mr. John Smith, Kilwinning, from the estuary of the Garnock, where it occurred in groups of about a dozen. Bate and Westwood state that the species is widely dispersed and very common. Its recorded localities are near London and Kent, and generally throughout Ireland; and it is very abundant in the midland counties, as well as in Devonshire and Cornwall.

APPENDIX.

AMPHIPODA.

EUONYX CHELATUS, Norman.

Euonyx chelatus, Norman, Brit. Assoc. Report, 1866, p. 202.

Habitat.—Taken by the steam-yacht *Medusa* off the Mull of Kintyre, in 49 fathoms, bottom mud.

METOPA AFFINIS, A. Boeck.

Metopa affinis, A. Boeck, Skand. Arkt. Amphip. (1876), p. 459.

Habitat.—Dredged in from 15 to 25 fathoms, west of Tan Buoy, Cumbrae; and at Mull of Kintyre by the steam-yacht *Medusa* of the Millport Marine Zoological Station.

There are some doubts of the affinities of this species to *Metopa Alderii*.

METOPA ALDERII, Spence Bate.

Montagua Alderii, Spence Bate, Brit. Assoc. Rep. 1855.

Montagua Alderi, Spence Bate and Westwood, Brit. Sessile-eyed Crust., vol. i. (1863), p. 61.

Probolium Alderi, Norman, Rep. on the Shetland Crust. (1868), p. 273.

Metopa Alderii, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 61; Skand. Arkt. Amphip. (1876), p. 456.

Habitat.—Dredged between Cumbrae Lighthouse and Arran, 50 fathoms, bottom mud; Firth of Forth, by the staff of the Scottish Marine Station; Mull of Kintyre, in 49 fathoms, by Mr. Murray; and Cullercoats, by Mr. Joshua Alder and the Rev. A. M. Norman. Those taken in the last-mentioned locality have the facets of the eye radiated.

METOPA CLYPEATA, Kroyer.

Leucothoe clypeata, Kroyer, Nat. Tidsskr. (1842), 1 R. iv., p. 157; 2 R. i., p. 545.

Montagua clypeata, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 58, pl. ix., fig. 4.—Spence Bate and Westwood, Brit. Sessile-eyed Crust., vol. ii. (1868), App., p. 499.

Metopa clypeata, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 60; Skand. Arkt. Amphip. (1876), p. 451.

Habitat.—Dredged in 60 fathoms between Little Cumbrae and Garroch Head (Bute); two only were taken.

ANONYX LONGICORNIS, Spence Bate.

Anonyx longicornis, Spence Bate, Cat. Amphip. Brit. Mus., p. 72.—Spence Bate and Westwood, Brit. Sessile-eyed Crust., vol. i. (1863), p. 91.

Habitat.—Dredged in 5 fathoms, Loch Ranza Bay (Arran), bottom mud full of short broken vegetation. Taken on the Haaf Fishing-ground, off Shetland, by the late Mr. George Barlee.

AMPELISCA SPINIPES, A. Boeck.

Ampelisca spinipes, A. Boeck, Skand. Arkt. Amphip. (1876), pl. xxxi., fig. 5.

Habitat.—Dredged off Cumbrae Light-house, in 60 fathoms, bottom mud; off Holy Isle, in 36 fathoms, mud; and near Skate Island, Loch Fyne, in 100 fathoms and 80 fathoms. Also dredged in the Minch, off Barra, in 40 fathoms, by Mr. A. Somerville.

LEPIDEPECREUM CARINATUM, Spence Bate and Westwood.

Lepidepecreum carinatum, Spence Bate and Westwood, Brit. Sessile-eyed Crust., vol. ii. (1868), p. 509.

Habitat.—Dredged on the south-east side of Bute, in 10 to 12 fathoms, bottom gravelly mud.

The Rev. T. R. R. Stebbing and Messrs. Spence Bate and Westwood think this species may be the female

of *Anonyx longicornis*, in which case, as Mr. Stebbing points out, the name would have to be *Lepidepecreum longicorne*, Spence Bate.

TRYPHOSA HÖRINGII, A. Boeck.

Tryphosa Horingii, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), s. 38; Skand. Arkt. Amphip. (1876), p. 182.

Habitat.—Cumbrae, taken on the back of a cod-fish.

TRYPHOSA NONOIDES, Lilljeborg.

Anonyx nonoides, Lilljeborg, On the Lysianassa magellanica, &c. (1865), p. 25.

Anonyx nanus, Bruzelius, Skand. Amphip. Gammar. (1859), p. 42.

Tryphosa nonoides, A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 38; Skand. Arkt. Amphip. (1876), p. 186.

Habitat.—Cumbrae, taken on the back of a cod-fish.

HAPLOOPS CARINATA, Lilljeborg.

Haploops carinata, Lilljeborg, Öfv. af Kgl. Vet.-Akad. Förh. (1855), p. 89.—Bruzelius, Skand. Amphip. Gamm. (1859), p. 89.—Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), App., p. 372.—A. Boeck, Crust. Amphip. Bor. et Arct. (1870), p. 147; Skand. Arkt. Amphip. (1876), p. 539.

Habitat. — Taken in 60 fathoms between Little Cumbrae and Garroch Head (Bute), bottom mud. New to Britain.

GRAYIA IMBRICATA, Spence Bate.

Grayia imbricata, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 101.—Spence Bate and Westwood, Brit. Sessile-eyed Crust., vol. i. (1863), p. 152.

Habitat.—One specimen taken in the surface-net, after sunset, in Sanda Bay. Recorded from Falmouth Harbour by Mr. W. Webster, and taken by the Rev. A. M. Norman and Mr. Alder off the coast of Northumberland.

There is some doubt that this species may be *Amathilla Sabini*, Norman.

ŒDICEROS PARVIMANUS, Spence Bate and Westwood.

Œdiceros parvimanus, Spence Bate and Westwood, Brit. Sessile-eyed Crust., vol. i. (1863), p. 161.

Habitat.—Taken N.W. of Cumbrae Light-house, in 60 fathoms. Some of the mud was put into a pail with sea-water, and after standing a few hours this amphipod was found swimming on the surface.

MONOCULODES GRUBEI, A. Boeck.

Monoculodes Grubei, A. Boeck, Skand. Arkt. Amphip. (1876), p. 269.

Habitat.—Taken in Kames Bay, Millport, about two fathoms beyond low-water, and also at low-water. New to Britain.

LAFYSTIUS STURIONIS, Kroyer.

Lafystius Sturionis, Kroyer, Naturhist. Tidsskr., 1 R. B. iv. (1842), p. 157.—Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 110.—A. Boeck, Skand. Arkt. Amphip. (1876), p. 252.

Darwinia compressa, Spence Bate, Brit. Assoc. Rep. 1865, p. 58; Cat. Amphip. Crust. Brit. Mus. (1862), p. 108, pl. xvii., fig. 7.—Spence Bate and Westwood, Brit. Sessile-eyed Crust., vol. i. (1863), p. 184.

Habitat.—Taken on the back of a cod-fish. A few of *Tryphosa nonoides* were taken from the same fish. The fishermen state that these amphipods are never met with on what they call a "clean" fish (that is, a fish in good condition), but that large cod in poor condition are seldom free from them. These, with a few others, particularly *Callisoma crenata*, appear to be scavengers of the sea.

The yacht *Medusa* had a net put at a depth of 37 fathoms in Kilbrannan Sound. When taken up on the following day, the net was found to contain a dog-fish which had been eaten into by great numbers

of this species. These, when turned out, were nearly sufficiently numerous to fill a tea-cup. The sense of smell possessed by these animals must be very acute to enable so many of them to find the dead fish in so short a time. This is all the more remarkable when it is considered that sufficient time could not have elapsed for any strong smell to have arisen from the decomposition of the fish; yet, by apparently no other means, the death of the fish had become known, not merely to one or two, but to hundreds of these small creatures. It is also remarkable that this species is seldom taken in the dredge unless in connection with dead animal matter.

Mr. Thomas Scott has also taken it on the back of a cod-fish.

PHÆDRA ANTIQUA, Spence Bate.

Phædra antiqua, Spence Bate, Quart. Jour. Geol. Soc. (1858), p. 137, pl. vi., fig. 8.—Spence Bate and Westwood, Brit. Sessile-eyed Crust., vol. i. (1863), p. 209.

Habitat.—Taken in the surface-net, after sunset, off the Allans, Millport Bay.

PARAMPHITHOË ASSIMILIS, Sars.

Paramphithoe assimilis, Sars, Översigt af Norges Crust., p. 99, tab. 5, fig. 1-1a.

Habitat.—Taken off Cumbrae in 15 to 25 fathoms. This may be what Boeck refers to as *Pleustes glabra*, sometimes called *Paramphithoe glabra*.

GOSSEA MICRODEUTOPA, Spence Bate.

(See page 39.) As this comes near *Calliope* in many particulars, including its habitat and occurrence with eggs, it may perhaps be the female of that species.

GAMMARUS EDWARDSII, Spence Bate.

Gammarus Edwardsii, Spence Bate, Cat. Amphip. Crust. Brit. Mus. (1862), p. 208, pl. xxxvii., fig. 2.—Spence Bate and Westwood, Brit. Sessile-eyed Crust., vol. i. (1863), p. 386.

Gammarus marinus, Milne Edwards, Hist. des Crust. (1840), t. 3, p. 46 (not Leach).

Habitat.—Taken in the sand at very low water, Kames Bay, Millport. Bate and Westwood record it from Devonshire.

EISCLADUS LONGICAUDATUS, Spence Bate and Westwood.

Eiscladus longicaudatus, Spence Bate and Westwood, Brit. Sessile-eyed Crust., vol. i. (1863), p. 412.

Habitat.—Two specimens dredged in 10 fathoms, Millport Bay, Cumbrae; both were small and probably immature, and one was larger than the other. Also obtained in 16 fathoms off the south end of Bute.

This species has been taken by the Rev. A. M. Norman and Dr. J. Gwyn Jeffreys in the Outer Skerries Harbour, Shetlands, in from 2 to 5 fathoms.

DULICHIA TUBERCULATA, A. Boeck.

Dulichia tuberculata, A. Boeck, Skand. Arkt. Amphip (1876), p. 655.

Habitat.—Taken in the dredging of the yacht *Medusa* near the Mull of Kintyre, at a depth of 49 fathoms. Only one imperfect specimen was obtained which leaves a little doubt as to its specific identity.

A few amphipods, little known or new to science, together with some doubtful species that are reserved for further investigation, are intended to form the subject of another small supplement to the list of the Amphipoda of the Firth of Clyde.

I cannot conclude without acknowledging my great obligations to Mr. D. A. Boyd for the great care he has taken with each page as it passed through the press.

II.

OBSERVATIONS ON SOME WEST-COAST FISHES.

LOCHBUIE MARINE INSTITUTE *per* W. ANDERSON SMITH.

[Read 26th April, 1887.]

PHYCIS BLENNOIDES, Gmel.—A fine specimen of this fish was obtained off Portree, in August, 1886, by the Expedition to investigate the West-Coast Fisheries, under the auspices of the Highland and Agricultural Society. It seems to be more solitary than rare, as single individuals are taken every season around the coast, and the captors of this had seen two others taken on the West of Scotland.

PRISTIURUS MELANOSTOMUS, Yarr.—These dog-fish, in place of being so rare as is generally supposed, proved to be the most common captured by the liners off Portree, in August, 1886, and were then throwing their egg-cases. These are distinguished by being devoid of spiracle attachments for fixing to sea-ware, and are, besides, of a brilliant, rich, golden-syrupy appearance.

CALLIONYMUS LYRA, Lin.—I have taken these fish on the lines, or from the stomachs of cod-fish, from the West Coast of the Lewis to Loch Killisport. They seem to be a favourite prey of the cod, both male and female—the so-called "gemmeous" and "sordid" dragonets.

NOTIDANUS GRISEUS, Cuv.—A specimen of this shark was taken in Lochbuie on 26th March. It measured 2 ft. 10 in., and was a young male with claspers. Like the skate-fish, it renews its teeth; and two rows of its saw-like lower teeth were ready to come forward and replace the others, should they break

away or be worn out. As the cartilaginous framework of the sharks and rays does not offer great opposition to a struggling victim caught by the outer row of teeth, these are frequently lost, as many as half-a-dozen rows of fresh teeth, completely formed, being ready to come forward in large skates. This fish was a very young specimen, the ordinary size being from 9 to 12 feet, while a specimen measuring upwards of 26 feet has been taken. As it is a sluggish ground-shark, the presumption is that it did not travel far, but was thrown originally off the coast.

Rhombus megastoma, Donov. (*Sail Fluke*).—A specimen of this fine flat-fish was taken in Lochbuie in the early part of April. It was in bad condition, and bore evidence of having been assaulted by crustacea whilst on the hook. I have previously met only two specimens of this northern fish in the West of Scotland, both taken in Lochnell Bay. They may be numerous enough, but the very large mouth and membranous jaws render it easy for them to break away from the hook. They are known to the fishermen, but are not common amongst their captures.

Zeugopterus unimaculatus, Day (*Top-knot*).—In my paper on the "Topknots" in the *Transactions* of the Society for 1884 (vol. i., p. 88), this fish was described as *Rhombus punctatus*, on the authority of Dr. Day, to whom the coloured drawing had been submitted in 1882. I then desired information as to its capture in the Clyde district, but received none. In the last *Report of the Fishery Board*, a similar fish is figured from the Clyde, where it is captured, as well as the ordinary species with which it is commonly associated as a variety. With us, in Lochs Linnhe and Creran, the *unimaculatus* is the only species known, and on rocky ground it is not uncommon comparatively. The spot on the lateral line is, in our specimens, much more marked and brilliant than that figured in the *Report of the Fishery Board*, 1886, pl. ix.

Liparis Montagui, Cuv.—Since I first called attention to the presence of this little fish on the West Coast, I have, at certain seasons, found them by no means uncommon. During last month (March) they were quite numerous on the shores of Lochbuie, and heavy with ripe ova. They are then so distended that the least rough treatment bursts them and allows the ova to extrude. All varieties, from the lace-work sucker of Couch to the richly-coloured *picta*, are procurable at that time; but should the day be exceptionally calm, these delicate fish seem to proceed further to sea, and not to hover around their accustomed pools.

Conger vulgaris, Cuv.—The young of this eel have been supposed to constitute the species *Leptocephalus Morrisii*, Anglesea Morris. I believe that the figure in Couch has been taken from a spirited specimen, which is much altered from the original. In life, the young of these eels, about three inches long (as taken for the Institute in the fresh water of a stream flowing into Loch Spelvie, and again on the shore at Lochbuie), were strips of transparent gelatine, but yet unmistakable offspring of the old *Conger* in movement and appearance. They differ *in toto* from the young of the fresh-water eel, which are never transparent, and are more robust and vigorous at the same size. It was interesting to find this peculiarly sea-fish freely entering fresh water at this stage, at a time when the fresh-water eels are breeding in sea-water, as if invading each other's territory?

Raia clavata, Lin. (*Thornback Skate*).—Professor M'Intosh is in error as to the habits of this fish, as recorded in last *Fishery Board Report*. The Thornback throws its purses in the months from May to July, affixing them to sea-ware in shallow water, on rocky ground, by means of a mucus that surrounds them at exit, and stiffens in the sea-water. I have taken these egg-cases from the females when

they came inshore to spawn, and hatched them out in my ponds after a period of six months. The purses are never deposited on sandy ground, but may be driven there by the gales from their attachment on the sea-ware. The egg-cases are by no means such secure protection as one would suppose from their tough texture, seeing that I have found them in scores, as well as those of the nurse-hound, all punctured by the well-drilled hole of a borer that had thence emptied the contents.

GADUS MINUTUS, Flem. (*Power-Cod*), and GADUS LUSCUS, Lin. (*Bib or Whiting Pout.*)—If the former is but the immature form of the latter, as has been suggested, it is remarkable that I have taken the *minutus* over a great extent of the West of Scotland; but so local is the Whiting-Pout that I have never once met with it myself. The extreme prevalence of the one and rarity of the other seem scarcely consistent with their being different stages of the same fish.

GADUS MORRHUA, Lin.—Lochbuie is during the month of April largely frequented by spawning cod, a male and female frequently coming up alongside in the cod-nets, when they can be readily spawned artificially in the boat. At this time their food consists, to a large extent, of Norwegian Lobsters (*Nephrops norvegicus*), and, in a minor degree, of other crustacea, such as *Corystes cassivelaunus*. The cod does not throw all its ova at once, but from time to time as they ripen, so that the same fish may be for a considerable period in this condition, getting steadily softer in the flesh and deteriorated with the exhausting process of maturing and casting free such a multitude of ova.

TRACHINUS DRACO, Lin. (*Greater Weever*).—Professor M'Intosh seems to conclude that this is merely a larger specimen of *T. vipera*, Cuv., or that *T. vipera* is the young stage of the other. Having some

years ago taken *T. draco* in the dredge (this being, so far as I am aware, the only recorded specimen of the fish from the West of Scotland), and my specimen being a young one, I was able to compare it with *T. vipera.* This left no doubt on my mind that there was a marked distinction between the two, as the small *T. draco* had none of the short bunchy appearance of *T. vipera*, but the more lengthened and elegant shape of the full-grown fish. *T. vipera* is not so very uncommon on the West of Scotland, from districts as wide apart as the Lewis and the Clyde, but the larger species does not seem to have been noted before our specimen.

Blennius pholis, Lin. (*Shanny*).—While other blennies are not infrequent on the shores of the inner lochs, we have not met with this little fish, which is yet so common on the shores of the islands of Mull and Canna. While frequenting rock-pools, and apparently able to endure long exposure to the air, as well as change to fresh water, it seems thus to avoid those waters that are distant from the stronger seas.

III.

ON THE DEVELOPMENT OF SYNGNATHUS ACUS, *LINN.*

BY W. ANDERSON SMITH.

With one Plate [I].

[Read 26th April, 1887.]

ONE of the most interesting of our families of fishes is that of the *Syngnathidæ*, and it has the further advantage of belonging to an order readily procurable, not being at all pelagic in its ways, although instances of its occurrence in quantity at sea have been recorded. Anyone who has been in the habit of frequenting the beach where *Zostera marina* abounds, or wandering along the rocky shore at low-tide and searching amongst the sea-ware, or sitting in a small boat on a fine day in June or July and peering down amongst the wealth of life that haunts the foreshore, must have seen some specimens of this so-called "sea-adder," our most common species, *Syngnathus acus*, Linn. They may be thrusting their long, woodcock-like snout slowly and leisurely amongst the ware, their large simple eyes looking upwards; or they may be twined around some sea-weed stem, with the strange head seeking in a childish sort of way for the wherewithal to sustain their existence, for they cannot be looked upon as a remarkably wise family. They are by no means a swift one; and their continued existence in comparative plenty may be mainly attributed to the armour of tough chitinous plates, which completely protects a body that, from a gastronomic point of view, is unworthy of protection. Perhaps no class of fishes has such strange relations at the present

day in all parts of the world, and some of these are remarkable among the denizens of the water as the most striking instances of security from assault through resemblance to inanimate objects. The Australian species, *Phyllopteryx eques*, Gunth., as figured in Gunther's *Fishes*, would scarcely have led us to suppose that it could be devoured, even if it had not chosen to assume the appearance of a ragged bit of sea-ware. We have never taken any of the *Syngnathidæ* from the stomachs of other fishes, and, according to authorities, they are not supposed to be at any time food for other fishes; but yet they must be defended against some foe, and we suspect, from their comparatively limited number, that they must, at one time or other, be a prey. For although the number of ova in the pouch of the male averages, perhaps, 120, and of these a small proportion, from some cause or other, do not incubate; yet, as they are carried, through the care of their parent and the especial provision of a pouch, through the most dangerous days of infancy, until, by the absorption of the umbilical sac, they are prepared to start on their own career, this small number may in reality represent as great a reproduction as the more lavish supply of larger fishes, of whose ova not one per cent., and frequently not one per thousand, can arrive at maturity.

It would be a matter of interest if observers would note whether at any time these fishes are found in the stomachs of our more voracious fishes. Even in their first exit, after the absorption of the sac, they are of a chitinous nature, and could scarcely titivate the ordinary fish appetite. But how are they kept down? Great shoals have appeared off the English coast at various times, and their disappearance requires to be accounted for. Accordingly, while giving great weight to Dr. Day's authority, we are disposed to consider that such fish as the cod or the haddock (that unhesitatingly devour large crabs and buckies, shell and all, as well

as the least nutritious of starfish) would not hesitate to allay the wolf at their vitals if a shoal of *Syngnathidæ* gave them the opportunity.

The pouch of the male fish is merely external, as in the kangaroo, and is in reality two pouches, formed by the softer integument of the belly folding around the adhering ova as a still more efficient protection. In the case of our common species, *S. lumbriciformis*, Kröyer, the ova simply adhere externally, the skin cupping slightly to receive each ovum individually. And here a very interesting fact is worthy of note, in connection with the discussion as to the presence of oil globules in the pelagic ova having relation to their flotation. The presence of oil globules, indeed plentifully, in certain ova, with a little-transparent *zona radiata*, affixed to objects at low-water, so far settles this question; but the supply of oil globules in plenty to these ova carried about by the fish until incubated, may either be looked upon as settling this question or as raising others!

Are these globules of special utility during the formation of the embryo within the ovum, or are the shore species of fishes that deposit their ova in a glutinous mass, adhering to stones or sea-ware, and those deposited on the breast of the parent, both adaptations from an original pelagic condition? If this were the case, the presence of the oil globules would partly explain the fact that some shore fishes, as the rocklings, throw still pelagic ova, while others, like the lumpsucker, throw ova of a more opaque kind, that develop more rapidly, are surrounded by a somewhat tenacious *zona radiata*, containing sometimes a liberal supply of colouring pigment, and are thus less capable of floating. We find, then, that purely pelagic transparent ova, richly coloured adhesive ova, and ova carried about by the parent, have a supply of oil globules more or less; so that, whatever their use may be, it does not seem to have any reference to additional float-

ing power. It may well be that all these fishes originally cast free their ova, and only gradually developed the instinct that now leads them to place it in safe keeping. It may have been a simple accident that caused the ova of the *Syngnathus* to adhere to its breast, as that of other fishes, throwing mucus-clad ova, always threatens to do until driven away by the ventrals.

As it is, we find the young of *Syngnathus acus* hatched in the long pouches, whence they can be withdrawn and examined by the observer, who will find that, as was to be expected from unduly coddled young, they are greatly behind other young fishes in taking care of themselves. When a young fish breaks the *zona radiata* and starts forth on its own account, even with a considerable umbilical sac, it displays an amount of intelligence, and capacity for taking care of itself, far greater than the same fish when matured. This is not the case with the fostered *Syngnathus*, which, even when all the sac is absorbed, will return to the paternal pouch with the complacency of a scapegrace.

It may be worth noting how the mouth, in the youngest forms in our possession, has the soft, sucking, turned-up lips of a young mammal. In the next stage the lips are more prominent, but still of the same sucking character. This character it continues to display as it advances; and, dropping all but the smallest approach to jaws, it lengthens its sucking, siphon-like mouth in homogeneity with its lengthening body, and reduces its gills to a puncture anterior to the eyes. The accompanying outlines (Plate I.) will best explain the character of the change that takes place in the mouth as the creature advances towards maturity.

Here also may be observed the differentiation that takes place in the advancing alevin, which, with quite as much development of external jaws as other less coddled youngsters at the same stage, continues through disuse to allow them to lose their

comparative importance. Their sluggish existence in this external womb, where they do not require or receive rapid aeration of the blood, obviates the necessity for that constant action of the jaws that even in the young alevin with unabsorbed sac, in other families of fishes, aids in the development of the muscles of the jaws when there is yet no need for using them for procuring food. We are strongly tempted thus to suggest, that the siphon-tube mouth is the direct consequence of the attempt to keep the young fish too long in leading-strings, more especially as the *S. lumbriciformis* (whose mouth, and head in advance of the eye, have no such excessive development as the pre-orbital portion of *S. acus*) has only external attachment and no pouch.

That the pouch may be of comparatively recent development in the family may also be suggested from the great development of eye in the young of *S. acus*, as in other youngsters whose sight is more necessarily acute than in this nursed alevin. The large eye and brain is a marked characteristic in most young creatures, but here they seem to be developed for a totally different set of conditions from those to which the young *Syngnathus* is exposed.

Explanation of the Plate.

Plate I.

Fig. 1-4. Progressive stages of development of siphon of *Syngnathus acus*, Lin.

5. Head of Adult, life size.

IV.

ON CAREX SPIRALIS, *A SPECIES NEW TO SCIENCE.*

BY PETER EWING.

[Read 29th March, 1887.]

Carex spiralis, sp. nov.

Stems often solitary, 10 to 15 inches high, *describing one turn of a spiral when growing*, acutely triquetrous, rough from a little way below the lower spike. Leaves narrowly linear, very slightly recurved on the edge. Spikes erect, male 1, fusiform or cylindrical; females 2-5, ¾-1 inch long, exserted on short stalks, cylindrical, narrowed and laxly flowered towards the subfusiform base. Bracts strict without sheaths, but having dark purple auricles; lower bract leaf-like, overtopping the stem. Glumes dark brown with a light brown midrib; those at base of male spike spathulate, but ovate-lanceolate towards its apex; those of female spikes ovate-lanceolate. Stigmas 2. Fruit obovate, planoconvex, without veins.

Hab.—Alpine rills.

Loc.—Near the ridge between Forfarshire and Aberdeenshire (*Ewing*, 1884).

I have found it a matter of considerable difficulty to determine the precise position of this plant. Its affinities seem to be partly with *C. rigida* and partly with *C. aquatilis*; but the constant exsertion of the spikes, and the conspicuous leafy bracts, distinguish it from the former species, while its triquetrous stem shows it to be distinct from the latter. As it seems to possess characteristics of both plants, I consider its place to be between them; and its remarkable habit of growth is in my opinion a sufficient warrant for its description as a new species. This view is supported by the fact that the plant seems unknown to some of the best authorities on *Carices* in Britain and on the Continent. A plant identical with the one now exhibited has been sent to Kew, and these may be regarded as illustrating the typical form of the species.

V.

ON SOME SCANDINAVIAN FORMS OF SCOTTISH ALPINE PLANTS.

BY PETER EWING.

[Read 29th March, 1887.]

HAVING become thoroughly tired of searching for known plants in known localities, I made an effort, during the last two or three days of my stay in North-East Perthshire this year, to discover some forms unknown or hitherto unrecognised as forming part of our Scottish Flora. In this I have been more successful than I can at present show, as I have not yet been able to get identified some of the plants then gathered.

The close resemblance between our alpine Flora and that of Norway and Sweden has long been recognised by botanists; and as the Flora of these countries has been much better wrought out than our own, a comparison of unusual forms of Scottish alpine plants with forms known only as Scandinavian has frequently enabled their identity to be established. It has accordingly become a matter of course to call these forms "Scandinavian species."

While I do not wish to deny that Britain and the extensive tract of country termed Scandinavia were at one time a continuous continent, I object to the theory that for our alpine plants we have been indebted to Norway. On the contrary, it seems to me more likely that the disappearance of the snow and ice of the glacial epoch would gradually extend from the south northwards, and that a similar northward movement of plants would follow the melting of the ice. With this reservation, the term

"Scandinavian species" may be used with reference to plants described in the Scandinavian Floras but not hitherto included in our own.

CERASTIUM ALPINUM, L., var. GLABRATUM.—Judging from the appearance of the foliage and size of the flowers of this the most beautiful of all the forms of *C. alpinum*, it seems to occupy an intermediate position between vars. *pubescens* and *Edmonstonei*. I have no description of the plant, having been indebted to Mr. A. Bennett, F.L.S., of Croydon, for its identification; and as the specimen now shown is unfortunately the only one in my possession, I do not care to destroy it in order that the materials for a description may be obtained.

I may remark that I have always believed the plant formerly described as *C. latifolium*, Smith, to be an unhealthy form of one or other of the varieties of *C. alpinum*. I have, for a good many years, put it in my exchange-list as a desideratum, but have only got *C. alpinum* vars. *lanatum* and *pubescens* sent me for it. This view seems to be supported by *The London Catalogue of British Plants* (Eighth edition, 1886), from which *C. latifolium* has been excluded.

According to my experience, *C. alpinum* var. *pubescens* is simply the form *lanatum* grown in a shady or moist situation, and therefore with greener leaves and shorter pubescence.

C. triviale, Link., var. *alpestre*, an alpine form of an allied species, is distinguished from the typical *C. triviale* by its more woolly pubescence and much larger petals, which in well-developed specimens are always longer than the sepals. It is a much more straggling plant than any of the forms which *C. alpinum* usually assumes, although I have specimens of var. *lanatum* from Ben Laoigh and Ben Lawers which seem in this respect to approach var. *alpestre*.

CAREX PALLESCENS, L., var. UNDULATA, Kunze.—In general appearance this variety closely resembles the type, but is distinguished by having the first bract shorter than in the normal form and undulate at the base.

This appears to be the most common form in alpine and subalpine localities.

CAREX VAGINATA, Tausch, var. BOREALIS, Andersson.—*C. vaginata* is one of the rarer of our British *Carices*, and is often confounded with *C. panicea*, L., one of the commonest, to which it bears a considerable resemblance.

In the normal form of *C. vaginata* the stem is quite straight; but in the var. *borealis* the male spike is geniculate at the base, thus presenting a very characteristic appearance.

This variety is often found growing with the type.

CAREX CAPILLARIS, L., var. ALPESTRIS, Andersson.—The usual height of *C. capillaris* is from two to five inches; but in this form named var. *alpestris* we have to all appearance a new species.

In a former paper on the Flora of Glen Shee,* I referred to *C. capillaris* attaining a height of from 12 to 16 inches. The specimen now shown measures 16 inches, and some even larger have been sent by me to correspondents.

This variety grows in similar situations to those in which the type occurs, and is a beautiful plant when growing.

POA ALPINA, L., vars. LAPPONUM, Laestad, and ALPESTRIS, Andersson.—The following short description of this species and its Scandinavian forms is based on Andersson's *Plantæ Scandinaviæ*:

POA ALPINA, L.—Root fibrous. *Base of the stem more or less thickened by the persistent withered sheaths of former leaves.* Leaves broadly linear, apex constricted and mucronate; upper ligule long, acute. Panicle equally diffused, branches in

* *Transactions*, i., 158.

pairs, glabrous; spikes broad, ovate, 3 9 flowered; flowers sometimes connected by woolly hairs, lower paleæ slightly one-nerved, nerve densely pubescent on back.

Hab —Common in alpine localities.

Var. a. LAPPONUM, Laestad.—Root small. *Leaves elongated, soft.* Panicle lax; spikes large, lower glumes subrotund, often growing solitary; colour variable, pale and obscure green or purple violet and flavescent.

Hab.—On rich soil in subalpine localities.

Var. b. ALPESTRIS, Andersson.—Stems laxly cæspitose, robust. Leaves short, *horizontally spreading.* Panicle oval or oblong, contracted; spikelets largely ovate or broadly oblong; often viviparous.

Hab.—On rocky places at great elevations.

Var. c. AUSTRALIS, Andersson (*P. alpina* var. *collina* (Hort.) Whg.; *P. badensis*, Willd., Reich.; *P. brevifolia*, Waller & Schech).—Stems slightly digitate, *very cæspitose*, base straight and densely leafy. Leaves rigid, subglaucous. Panicle condensed, often small, oval or oblong; spikes oval, of a beautifully variegated violet-green, glumes long.

Hab.—Dry subalpine localities.

It will be observed that the plants now shown agree perfectly with the vars. *lapponum* and *alpestris.* I hope that some of us may be able, before the end of this season, to compare var. *australis* with the description given above, as I am sure it is to be found growing on the south-western slopes of Ben Laoigh.

VI.

ON THE ORAL APPARATUS OF THE LARVA OF WORMALDIA, *A GENUS OF* TRICHOPTERA.

BY KENNETH J. MORTON.

With one Plate [II].

[Read 22nd February, 1887.]

My chief object in giving some account of the larva of *Wormaldia* is to direct attention to the structure of the mouth parts, especially of the labrum, which has no parallel amongst the larvæ of *Trichoptera* that have hitherto come under my notice. It may be well to say the determination of the genus is based on evidence more collateral than direct, as I have not yet succeeded in rearing the perfect insect.

Usually where the waters of small springs find their way with rather rapid and shallow flow over rocks into larger streams, these larvæ are to be found. In a locality of this nature in our neighbourhood, I have met with them very commonly in April, when they live in webs loosely spun amongst stones. Later, in cases formed of small stony fragments heaped together and fixed to larger stones, I have found the same larvæ evidently ready for metamorphosis, and from such a case I have reared *Wormaldia occipitalis*, Pictet. As no other Hydropsychid seems to frequent the spot, the chance of error as to the species is not great.

The general appearance of the larva of *Wormaldia* is quite similar to the figure Pictet gives of that of his *Hydropsyche montana* (=*Philopotamus montanus*, Don.), *Recherches*, 210, pl. xviii., fig. 5; but by this I do not mean to imply a possible error on Pictet's part, as *Philopotamus* and *Wormaldia*, being allied genera, may well have larvæ agreeing in facies.

The head and prothorax are orange, the latter margined with black posteriorly; legs and claws yellowish, the legs having dark streaks on the coxæ; rest of body whitish. Head elongate, rounded anteriorly, the antennæ very minute and, when viewed with a high power, apparently *biramous.* Prothorax almost quadrate, slightly contracted posteriorly. The other segments increase in breadth gradually to about the middle of the abdomen, and then fall off in size to the posterior end; the meso- and meta-thorax being, however, longer than any of the abdominal segments; anal limbs long and slender, terminating in a much-curved claw. From the anal cavity proceed filaments which have no doubt a respiratory function; they are retractile, and in an alcoholic specimen before me are exserted in stellate form. The legs are short, and not markedly different in length amongst the pairs. The whole larva is sparsely covered with hairs.

When the labrum is fully exserted, it is seen to be broadened out, and to terminate in two large fleshy transverse lobes having a close regular fringe on their margins and a row of cilia on their under side. Many larvæ possess soft parts under the plate of the labrum-bearing fringes; but in *Wormaldia* there does not appear to be a hard plate at all, or, at least, if there is, it is concolorous with the soft white parts, which is unusual. The lobes can be withdrawn out of sight into the cavity of the mouth in such a way that I believe the fringed margins then face each other. The mandibles are large, falcate, ending in a large tooth; they have also one or two smaller teeth, and a row of indistinct denticulations. First maxillæ with lacinia ending in several spines and with a strong fringe internally; palpi four jointed, first almost transverse, second about twice as long, third longer still and more slender, fourth very slender and terminating in two or three minute processes; the other parts modified to form the

spinneret, at whose sides appear minute projections which probably represent the palpi of the second pair of maxillæ. On the upper side of this composite part may be the tongue, with a somewhat concave centre, punctate space behind and hairy space in front; but all the inner mouth parts I have had difficulty in making out satisfactorily. The strong falcate mandibles are much used in the building of the fixed case, but they also suggest a predatory existence; on the other hand, the form and fringes of the labrum seem to me to point to minute organisms being the usual food.

Reverting to the retractile abdominal filaments, Pictet claimed these as the exclusive property of what is now considered the typical genus of *Hydropsychidæ*, viz., *Hydropsyche*; but they are by no means confined to one group, for, in addition to *Wormaldia*, they are found amongst *Hydropsychidæ*, also in *Tinodes*, but not, so far as I have seen, in the group containing *Plectrocnemia* and allies. Of *Rhyacophilidæ*, *Agapetus* has them. While there is little doubt that they are breathing organs, it is strange they should be so prominent in *Hydropsyche*, which is so richly provided with lateral filaments. Nor can they well be the sole organs of respiration in such larvæ as possess no lateral filaments. I suspect larvæ in the latter condition must have tracts of the integument modified to subserve respiration, as Mr. Eaton has indicated is probably the use of the spaces thickly overrun with tracheæ found on the head and prothorax of the nymphs of *Ecdyurus*, &c., in the *Ephemeridæ*.

Explanation of the Plate.

Plate II.

Fig. 1. Head above, showing labrum much exserted.
2. Mouth parts from beneath; (a) labrum, (b) 1st maxillæ, (c) spinneret.
3. Antennæ.
4. Apex of 1st maxilla.
5. Apex of mandible.

VII.

A GLANCE AT THE JULY FLORA OF ALYTH.

BY R. S. WISHART, M.A.

[Read 26th April, 1887.]

Geographically, Alyth is situated on that bend of Perthshire which may be described as pushing itself into the county of Forfar. It is built at the foot of the hill of the same name, and commands a pleasant view across the valley of Strathmore to the Sidlaw Hills on the south. The leading local river is the Isla, into which the Alyth Burn flows about two miles to the east of the burgh, carrying with it the waters of many little tributary streams from the slopes within its basin. With considerable diversity of hill and dale, varied by woodland, moorland, marsh, and meadow—all within easy access,—Alyth affords a good field to the botanist who may chance to alight there for a few days.

In a walk along the burn-side, the variety and luxuriance of the grasses, on either side of the stream, are at once noticeable. Of the eighty-eight species which I collected from widely spread localities in 1885, over fifty were gathered within a short distance of the Alyth Burn. Among those that strike us most at this spot are *Festuca pratensis*, var. *loliacea*, *Avena pratensis*, *A. pubescens*, *Bromus secalinus*, *B. racemosus*, and *Lolium italicum*; while at the shingly places there sometimes appear stray specimens of *Poa alpina*, *Phalaris canariensis*, and more rarely *Sesleria cærulea*. A little further down I have gathered *Phleum pratense* with heads 7½ inches long. At a little marshy spot on the left *Carex hirta* prevails, while *C. fulva*, *C. flava*, *C. stellulata*, &c., also make their appearance. After crossing the burn, on the way towards the moor

of Piterockney, *Lepidium Smithii* may be seen by the side of a sandy broom-topped hillock; and *L. campestre* is also found at various places in the district. On entering the moor by the side of the railway bridge, we soon come upon *Gentiana campestris*, *Genista anglica*, *Galium boreale*, and the two pretty grasses *Briza media* and *Kœleria cristata*. These two grasses are quite a feature of this district from the great abundance in which they occur, while we know that in Clydesdale we might walk for days without chancing to see either of them.

Of orchids this moor has a large share. *Orchis mascula*, *O. latifolia*, *O. maculata*, *Habenaria bifolia* and *H. chlorantha*, are all very abundant; and large patches of *Gymnadenia conopsea* occur here and there, sending a delightful fragrance along with the breeze. Of the less-common orchids, it may be noticed that *Neottia Nidus-avis* and *Listera ovata* both occur of very large size in the Den of Airlie, a few miles to the north-east; the former is found sparingly and the latter abundantly, growing side by side with *Paris quadrifolia*.

In the marsh near the side of the railway there is a great supply of *Menyanthes trifoliata*, which I here observed to be dimorphous—an important fact not referred to in the books I consult.* While watching many species of *Parnassia palustris*, to see the well-known way in which the stamens rise singly to shed their pollen near the stigma, I have noticed that the systems of little shining balls on the non-pollen-bearing stamens contain nothing for the nectar-seeking insects which they exist to allure. They are, on the contrary, hard in consistence, and only succeed in attracting the insect-workers by appearing to be what they are not.

By the side of the marsh there is a carpeting of *Drosera rotundifolia*, mixed with the contrasting yellow flowers of *Narthecium ossifragum*. At several

* I find that Sir John Lubbock notes that *Menyanthes* is "said to be dimorphous."

spots there is a pure-white variety of *Epilobium palustre*; while, among many other interesting plants, *Alisma ranunculoides* and *Sagina nodosa* may be found at one or two places. *Pinguicula vulgaris* is plentiful in this and all similar places.

Beyond the next moor is the River Isla, by whose banks there is a great display of *Epilobium angustifolium* and *Lonicera Periclymenum*. On the wooded bank the ground is covered with *Luzula sylvatica*, almost to the exclusion of rivals; but at some spots the slender panicles of *Poa nemoralis*, and other grasses, are waving above the stiff leaves of the wood-rush. Down by the edge of the river, *Bromus giganteus* is in fine condition; while along the banks, a little higher up, *B. asper*, *Carex sylvatica*, and others such, take an important place.

Across the mouth of the Alyth Burn, on a high precipice above the Isla, stand the ruins of the old castle of Inverquiech, supposed to have been originally a royal hunting-seat. The interior of this castle is converted into a garden, and the walls are almost destitute of vegetation, so that for the botanist there is nothing here of unusual interest. Tradition tells of a golden kettle hid somewhere in the ground below, and also of a subterranean passage between the cave-mouth which is seen here and that on Barry Hill, a mile to the north-west at a considerably higher elevation.

Before reaching Barry Hill, plenty of *Linaria vulgaris*, *Sedum Telephium*, *Galium cruciatum*, *G. verum*, *Hypericum perforatum*, *H. pulchrum*, *H. humifusum*, *H. hirsutum*, and the white variety of *Prunella vulgaris*, may be observed, while *Lycopsis arvensis* is very abundant as a weed in corn-fields. Along the sides of Barry, *Polygala vulgaris* is found pink, blue, and white, and various species of *Viola* form striking displays on the barer portions of the ground. *Pteris aquilina*, *Sarothamnus scoparius*, and *Ulex europæus*, are the most prominent plants here, and above them frequently rise tall stems of *Digitalis*

purpurea bearing numerous showy flowers. At some places *Saxifraga granulata* occurs, and more sparingly *S. oppositifolia* in fruit. At the top there is plenty of *Polypodium Dryopteris* among the loose stones that there lie in heaps. Here it may be well to pause and see what remains of the ancient fortification which once stood on this hill. It is said that Modred, who had taken away Guinevere, the wife of King Arthur, kept her here for some time after having defeated her husband in battle at Dunichen in Forfarshire. Guinevere was buried at Meigle, where a curious old stone, elaborately wrought with hieroglyphical characters, long stood to mark her grave; but this relic, with other similarly interesting stones, has recently been removed to the old school-house for better preservation.

On the wooded hill to the west, as in all similar places in the district, *Trientalis europœa* grows in great abundance; and in this and other woods I have found plentifully an apparently undescribed and unnoticed form, having the axis prolonged beyond the usual whorl-like system of leaves, and bearing a second whorl-like system at a higher level. In plants of this form, flowers arise in the axils of the lower or the higher leaves, or of both. Here, too, as well as in other woods, I have found plants with the leaf-bearing axis lengthened so as to present the leaves separated by considerable internodes, and consequently without the usual whorled appearance. This, I think, may be clearly regarded as a reversion to an earlier type.*

On the heather and furze-clad hill beyond the wood *Erica tetralix* and *E. cinerea* are both abundant; and among the herbaceous plants not already mentioned may be noticed a pink form of *Euphrasia officinalis*, and some plants of *Meum Athamanticum* which is so abundant near the Kirkton of Glenisla.

* I have already dealt with this plant in *Science Gossip* for April, 1887.

All over the hill, *Antennaria dioica*, *Polygonum viviparum*, *Carex ovalis*, and *Festuca vivipara*, grow plentifully; and on the way down to Alyth I have got *Festuca sciuroides*, this being the only place in the district where I have seen that grass.

In addition to the plants noticed as occurring within the circuit above described, a few notes may be added to enable a general view to be obtained of the Flora of the district.

The more common species of *Compositæ* are very much the same as are generally met with all over the country. But it may be noted, *inter alia*, that *Gnaphalium uliginosum* and *G. sylvaticum* are both much more abundant than in Clydesdale—especially the former, which is common at road-sides, and as a garden weed it seems to hold a place second to no rival. *Carduus heterophyllus* is also quite common in nearly all the shady woods in the district. *Filago germanica* and *Centaurea Cyanus* are rather rare; *Tragopogon pratensis*, *Arctium lappa*, *Tanacetum vulgare*, and *Doronicum Pardalianches*, are occasional —the last, as well as the less-common *D. plantagineum*, and *Onopordon Acanthium*, being no doubt escapes from cultivation.

The most noticeable feature about the district *Umbelliferæ* is perhaps the scarcity of *Chærophyllum temulentum*, which is so abundant around Glasgow. I have seldom noticed it about the neighbourhood, except in some hedges near Meigle. *Æthusa Cynapium*, *Conium maculatum*, *Daucus Carota*, and *Peucedanum Ostruthium*, are very rare and local. *Carum Carui* and *Astrantia major* are occasionally found as escapes from gardens, and *Pimpinella Saxifraga* takes a place with the most common species in being particularly abundant.

Leguminous plants are very prominent all around in July. The Broom is particularly abundant and rich. Vetches occur in great variety, and *Vicia sylvatica* deserves special notice for its abundance in all shady dells. Knowing that while this plant is

rare about Glasgow, it is abundant in Wigtownshire on the one side and in Strathmore on the other, I have sometimes wondered if the coal district had an influence in causing the scarcity of this beautiful and conspicuous flower. *Anthyllis Vulneraria*, *Genista anglica*, and *Ononis arvensis* are common; *Ornithopus perpusillus* is found occasionally on dry banks: and *Trifolium arvense* is plentiful in various parts of Forfarshire, although I have not seen it near Alyth.

Of the Grasses less common about Glasgow, besides those already mentioned, *Melica uniflora* and *M. nutans* are found in the Den of Airlie; *Aira brevifolia* occurs on rocks and at shingly places by the Isla; *Triodia decumbens* is on all the moors; *Festuca sylvatica* is plentiful at some places in the Craighall Den, near Blairgowrie; and *Brachypodium sylvaticum* appears in large masses in shady woods. The late Rev. Mr. Simpson of Glenisla, whose botanical knowledge was both wide and accurate, told me that *Lolium temulentum* was occasionally met with by the edges of fields in Glenisla, and that it was called "sleepy grass," a name which doubtless arose from its narcotic qualities.

To complete our glance, a few more particulars may be given without reference to classification. *Silene inflata* and *Helianthemum vulgare* are quite common in their respective habitats, and *Geranium sylvaticum* is often strikingly abundant in shady woods. *Pyrus Malus*, *Berberis vulgaris*, *Viburnum Opulus*, *Carpinus Betulus*, *Cytisus Laburnum*, *Castanea vulgaris*, and *Æsculus Hippocastanum*, are frequently seen in woods; and *Spiræa salicifolia*, *Sambucus nigra*, and *Symphoricarpus racemosus*, in hedges and bushy places. As escapes from cultivation, *Spiræa Filipendula*, *Hesperis matronalis*, *Lunaria biennis*, *Aconitum Napellus*, and *Aquilegia vulgaris*, turn up occasionally. *Agrimonia Eupatoria*, *Galium Mollugo*, *Chenopodium Bonus-Henricus*, and *Origanum vulgare*, are frequently met with; while *Verbascum Thapsus*, *Lychnis vespertina*, *Campanula latifolia*, and

Vinca minor, are less common. On Mount Blair, and other hills, there is abundance of *Alchemilla alpina* and *Rubus Chamæmorus*; in the district the succulent fruit of the latter is called "averns." *Mimulus luteus* occurs at some parts of the burn; *Convallaria majalis* grows in the Dens of Airlie and Craighall; *Vaccinium Oxycoccos* is sometimes abundant in bogs; and *Linaria Cymbalaria* occurs on the wall of the Meigle church-yard. The scarcity of the genus *Symphytum* strikes a visitor from Glasgow; although *S. tuberosum* is occasionally found—*e.g.*, in the Bamff Wood just beyond the Alyth quarry. *Pyrola minor* is very common in all dry woods; but *P. secunda*, as well as *Echium vulgare* and *Solanum Dulcamara*, are rare for miles around, just as is the case in the Glasgow district. I once saw *Typha latifolia* in the Marlee Loch, nearly two miles west of Blairgowrie. In this loch *Phragmites communis* is the prevailing plant; and in the other loch beyond there is plenty of *Nymphæa alba* and *Nuphar luteum*, both of which also occur in standing waters by the Isla, not far from Alyth.

These notes have been taken from the point of view of a Glasgow botanist; and no particular reference is here made to many of the plants that are common or abundant in both districts, because the design has been to afford the means of a general comparison of the July flowers of Clydesdale with those of Central Strathmore.

VIII.

NOTES ON SOME SPECIES OF LAND AND FRESH-WATER MOLLUSCA AND LAND ISOPODA FROM BUTE.

BY THOMAS SCOTT.

[Read 29th March, 1887.]

Mollusca.

Planorbis glaber, Jeffreys (=*P. parvus*, Say).—This fresh-water snail has, according to Dr. Jeffreys, a distribution co-extensive with Great Britain, or, in his own words, "from Burra Fiord in Unst to Penzance"; but according to the same author "it is not generally diffused." In Scotland its distribution seems to be very restricted. It has been found in Unst, one of the Shetland Islands, as recorded by Dr. Jeffreys; and its occurrence in West Sutherland is recorded by Messrs. J. W. Taylor and W. Denison Roebuck, F.L.S., in the "Census of the Authenticated Distribution of British Land and Fresh-water Mollusca" (See *Journal of Conchology* for 1885). So far as I can discover, however, these are the only authentic records of its occurrence in North Britain; and it is the more interesting, therefore, that we are now able to add it to our list of Clydesdale molluscs.

The only place where I have found it, as yet, is in Greenan Loch, near Rothesay, and there it seems to be somewhat scarce. I first noticed it on the 28th of January, 1887, and have since obtained additional specimens from the same loch. The specimens are not very large, but better may be found further on in the year. It is, however, a small species, for Dr. Jeffreys refers to one "nearly a quarter of an inch in diameter" as being the largest he had ever seen.

Besides this species of *Planorbis*, I have got other four near Rothesay, viz.: *P. nautileus* (L.), from marshy ground by the side of Loch Ascog; *P. albus* (Mull.), from Greenan Loch, Loch Fad, and Loch Ascog; *P. contortus* (L.), from Loch Fad, where it is a common species; and *P. spirorbis* (Mull.), from a little loch or dam on the hill immediately above the quarry at Ascog, on the south side of Ascog Burn.

VERTIGO ANTIVERTIGO (Drap.).—This species has been previously recorded as occurring in Bute and also in Arran.* The specimens now exhibited were found, along with one or two more of the same species, in a somewhat marshy hollow by the side of Loch Ascog, on the 10th of last month. To judge from the few records of its occurrence, it appears to be one of the rarer species of this genus occurring in Scotland.

PISIDIUM NITIDUM, Jenyns.—I find this species in all the lochs already mentioned, and it is not rare in any of them.

Pisidium pusillum (Gmelin) and *P. fontinale* (Drap.) are also found near Rothesay—the first occurring at Loch Ascog and Greenan Loch, and the second in Loch Fad.

The *Pisidia* are a rather difficult group to work up, owing to the obscurity of the specific characters, and to their great tendency to variation through being readily reacted on by their surroundings. There is no way of getting over the difficulty but by the examination and comparison of large numbers of specimens. Referring to his investigation of this group, Dr. Jeffreys says: "My own cabinet contains no less than 274 parcels of *Pisidia*, which have been, in the course of the last thirty or forty years, collected from different localities and sources, and comprise many thousands of specimens. . . . I have collected these tiny shells in many parts of

* *Fauna and Flora of the West of Scotland*, p. 42.

Holland, Germany, France, Switzerland, and Italy, for the sake of comparison with British forms."

Land Isopoda.

Porcellio armadilloides, Lereboullet.—This is a well-marked and easily distinguished species of "sclater"; and one characteristic by which it may readily be identified, even by the uninitiated, is its habit of rolling itself into a perfect ball when alarmed. It need not be mistaken for *Armadillo vulgaris*, which it somewhat resembles in this habit of rolling itself together, for, if the tail appendages be examined, they will be found to differ very much from those of the *Armadillo*.

In Bate and Westwood's *History of the British Sessile-eyed Crustacea*, the only reference to the occurrence of this species in Britain is in these words: "Specimens taken near London (at Highgate?) by Mr. Francis Walker are in the cabinet of the British Museum." It would therefore appear to have been at that time considered rare in Britain.

It seems to be comparatively common in the vicinity of the Royal Aquarium at Rothesay; and in looking over my collection I observe that an Isopod found near Dalry, Ayrshire, in June, 1885, is undoubtedly of this species. Its distribution in the West of Scotland may therefore be regarded as fairly wide.

Philougria riparia, Koch.—This species has also occurred in the vicinity of the Aquarium. I have, as yet, only secured three specimens, and it may therefore prove to be scarce; but its small size and inconspicuous appearance may be a reason for its having been less frequently recorded than it might have been if carefully looked for. Although no Scotch locality is given by Bate and Westwood, a number of places, both in England and Ireland, are mentioned where it occurs. It should be looked for in damp rather than dry situations.

It does not appear that the Land Isopods of Scotland have been worked up so thoroughly as many of the other groups of our land Fauna. They are generally looked upon with a certain amount of repugnance; and yet they are a very harmless and very useful class of animals, and certainly by no means uninteresting when either they or their habits are made the subject of examination. The absurd and almost superstitious prejudice with which many of these lowly organisms are viewed forms a great hindrance to the study of them; and if one could throw such notions aside, and consider them all as made and cared for by the same great and beneficent Power whom we reverence as our Creator and Preserver, one's interest and pleasure in their examination and study would be greatly enhanced.

> Know . . . that he who feels contempt
> For any living thing, hath faculties
> Which he has never used; that thought with him
> Is in its infancy.—*Wordsworth.*

IX.

REMARKS ON SOME LAND AND FRESH-WATER MOLLUSCA FROM TARBERT, LOCH FYNE.

BY THOMAS SCOTT.

[Read 26th April, 1887.]

So far as could be ascertained during the time at my disposal, the specimens now exhibited are fairly representative of the Land and Fresh-water Mollusca occurring about Tarbert, Loch Fyne. When compared as a whole with those from other districts in Clydesdale, they present some rather interesting points of difference. It will be noticed that aquatic species are but poorly represented—one or two *Pisidia*, the same number of *Limnææ*, and an *Ancylus*, exhausting the list. Of the *Planorbi*, which have a wide distribution, no fewer than five species are found within a short distance of Rothesay, but none were observed at Tarbert. This scarcity of fresh-water forms is probably due to the rugged and hilly nature of the district, which does not admit of conditions very favourable to the propagation of these molluscs. The land molluscs, on the other hand, are well represented both as regards genera and species; and among them, especially in the larger *Helicidæ*, a rather unusual number of varieties have been observed.

Helix aspersa, Mull., showed a good deal of variation in the number and arrangement of the bands; and three distinct varieties of form were observed. The following are some of the band variations:

(12345)—unicoloured;
(12)(345), 12(34)5—bands partly united and partly free;
12345—all the bands distinct.

The three varieties of form comprise the type, the variety *conoidea*, Picard, and a variety which I have named *depressa*. This last form I believe to be new, and the following is a short description of it.

HELIX ASPERSA, Muller, var. DEPRESSA, mihi.

Spire much more depressed than usual (not from injury, but the result of natural growth); diameter 32 mm., altitude 25½ mm.

This form seems to be rare about Tarbert, but I have observed two specimens near Rothesay that are even more depressed than the one now described. Their dimensions are respectively (1st) diam. 37 mm., alt. 28 mm.; (2nd) diam. 32½ mm., alt. 26 mm.

Of *Helix nemoralis*, L., there were observed several varieties both of form and colour. These included the type form; the variety *minor*, Moq. (diam. 19½ mm., alt. 17½ mm.); variety *major?* Fer. (diam. 24mm., alt. 19½mm.): varieties *roseolabiata*, Taylor, *albolabiata*, Von Mart., *libellula*, Risso, and *carnea*, as well as several variations in the number and arrangement of the bands.

Of *Helix rotundata*, Mull., the two varieties *alba*, Moq., and *Turtoni* Flem., were also found; but both appeared to be rather rare, especially the former. The latter is distinguished by its almost flat spire.

Of *Helix arbustorum*, L., there were also several varieties observed in addition to the typical form, the most distinct of these being varieties *marmorata*, Taylor, of the usual colour but without a band; *flavescens*, Moq., yellowish or yellowish-white, also without a band; *cincta*, Taylor,* of the same

* According to this arrangement, the variety of *H. arbustorum* mentioned in my List of the Greenock Land and Fresh-water Mollusca as var. *flavescens* (see *Transactions*, vol. i., p. 285), should be var. *cincta*. When preparing that list I followed Jeffreys in considering both forms as included in var. *flavescens*. I may here state, however, that owing to the interest taken in conchology by my son Andrew, I am now able to include a typical *flavescens* among the Greenock molluscs, a specimen having lately been found by him in the vicinity of that town, at a place which I have long known as a habitat of *H. arbustorum*.

colour as the last, but having a band of a darker hue: and *alpestris*, Ziegl. All these varieties, with the exception of vars. *roseolabiata* and *albolabiata* of *H. nemoralis*, were found in the vicinity of the old castle at Tarbert.

The very neat form of *Zonites radiatulus*, Alder, known as variety *viridescenti-alba*, Jeff., was also occasionally noticed, but for a more complete list see *Journal of Conchology*, vol. vii. (1886), pp. 75-78.

Among the molluscs collected by me were a number which had been more or less injured, but had afterwards been able to some extent to repair their shells. Where a piece of the original shell had become detached, the space was covered over with new shelly matter, but in no instance had the original colours been replaced. One specimen showed that the mollusc had been injured in such a way as to cause the formation of a concentric band of unfinished shell, while on each side of this band the shell was of the normal structure and colour. Another specimen showed that the mollusc had from some cause been unable to cover its shell with the usual epidermal layer, though otherwise the shell was comparatively perfect.

Among the injured shells were two—one a specimen of *Helix aspersa*, the other of *Helix nemoralis*—which showed in a very striking manner the remarkable vitality of these creatures. The specimen of *H. aspersa* referred to (the shell of which is included in the collection now exhibited) had been so badly injured as to assume a very unshapely appearance; and yet, on examining it when living, I found that the mollusc had not only survived the serious crush it had received, but had patched up its sadly damaged shell so as to make it fairly habitable. It was crawling about with its dilapidated tenement, evidently—to some extent, at least—enjoying life like its more fortunate neighbours, and acting on the principle of "making the best"—not simply "of a bad job," but of a *very* bad one.

In the case of *H. nemoralis*, the injury seems to have been equally serious; and there is evidence of an equally heroic attempt, not only to endure, but to repair as far as practicable the sad misfortune that had overtaken itself and its shelly domicile. When found it was browsing on the dewy grass, seemingly striving

"To share the pleasures of the genial feast."

X.

NOTES ON A SMALL COLLECTION OF NEUROPTERA FROM THE ISLAND OF COLL.

BY JAMES J. F. X. KING.

[Read 25th January, 1887.]

DURING the summer of 1886, my friend Mr. William Watson of Newfield spent some time on the Island of Coll, and at my desire he collected all the *Neuroptera* which he observed. As so little is known regarding the geographical distribution of these insects in the Western Islands, it has occurred to me that the information derived from working up this small collection, if put upon record, might prove of some value as a contribution to the Fauna of Coll. Of the insects collected, two-thirds are *Trichoptera*, some of the other families being merely represented.

It is, of course, to be understood that the following list is by no means exhaustive, as Mr. Watson, who is a lepidopterist, did not pay special attention to this group, but only collected such species as came in his way.

ODONATA.

Sympetrum striolatum, Charp.—Both sexes of this species were taken.

Pyrrhosoma minium, Haw.—Common at a pond where water-lilies were in profusion.

Agrion, Sp.—Very common with the last. I have not seen specimens, and cannot, therefore, ascertain the species.

PLANIPENNIA.

Chrysopa flava, Scop.—The only species of this family which occurred.

Trichoptera.

Phryganea varia, F.—A very small male represents this species.

Limnophilus lunatus, Curt.—The two males which I have seen are remarkable as having the characteristic lunate spire almost obliterated.

L. centralis, Curt.—Male and female of the ordinary form.

Leptocerus aterrimus, Ste.—One male of this common species.

Triænodes bicolor, Curt.—Two males of a very pale, mealy form were taken.

Mystacides azurea, L.—Specimens of the ordinary form.

Œcetis ochracea, Curt.—Four males of a pale ochreous colour.

Polycentropus flavomaculatus, Pict.—A very small but characteristically-marked male of this species was taken.

XI.

BOTANICAL NOTES FROM PORTPATRICK, 1886.

BY JAMES M'ANDREW.

[Read 28th December, 1886.]

During last summer I spent three weeks at Portpatrick, a sea-bathing resort in Wigtownshire, situated on the North Channel. As I was recovering from a sprained ankle, I could not ramble far in search of plants, but managed, nevertheless, to see a little of the botany of the neighbourhood. I was rather disappointed with the result. The surrounding country is almost entirely agricultural, and to a great extent arable, and has the common weeds of cultivation in abundance. The only wood and glen of any size are at Dunskey, where I found no species of mosses, hepatics, lichens, or flowering-plants, except what are found in almost every glen. The fern vegetation was very luxuriant, and consisted almost entirely of forms of *Athyrium Filix-fœmina* and *Nephrodium Filix-mas*, intermixed here and there with large patches of *Equisetum maximum*. I saw no plants of *Polypodium Dryopteris*, *P. Phegopteris*, or *Scolopendrium vulgare*. In this moist glen of the West Coast I had hoped to find such a moss as *Ulota calvescens*, but with the exception of a profuse growth of *Ulota phyllantha*, this genus of mosses was nearly absent. The coast both north and south of Portpatrick is very rocky, with the rocks of hard whinstone, and very unsuitable for mosses and lichens. These plants, therefore, were very scarce, with the exception, of course, of *Grimmia maritima*, which was abundant. The only new lichen I gathered was *Lichina pygmæa*, growing to the south of the harbour on low rocks washed by the

tide. This lichen must be rare along the coasts of Galloway, for I had not previously seen it. The other British species, *Lichina confinis*, was more plentiful, and is found all along the shore. On the shore of the West Lake at Dunskey, I found a hepatic which I had once previously gathered near New Galloway, and which is almost without doubt *Riccia bifurca*.

Until quite recently, West Galloway was almost a *terra incognita* as regards its botany. The late Professor Balfour and a few others had taken runs through the county, chiefly to the Mull of Galloway, and recorded some of its plant rarities.* About twelve years ago, while staying at Port Logan, considerably south of Portpatrick, I gathered some of its plants, and embodied a list of the rarer species in the appendix to my *List of the Flowering Plants of Dumfriesshire and Kirkcudbrightshire*. In 1873, Mr. C. Bailey visited the county and recorded some of its plants; and in 1883, Mr. Druce of Oxford supplied a very full list of both common and rare plants of Wigtownshire in the *Botanical Record Club Report* for 1883. In his introductory remarks to this list, Mr. Druce's first sentence is: "The accompanying catalogue of Wigtownshire plants fills up the only gap in the counties of Britain for which no list of common plants has been supplied to Mr. H. C. Watson or to the Record Club." A perusal of these lists shows that Wigtownshire has some very good and rare plants.

During my stay at Portpatrick, I gathered the following plants not hitherto recorded for the county of Wigtown, No. 74: *Veronica hederifolia*, *Fumaria confusa*, *Leontodon hirtus*, *Beta maritima*, and *Euphorbia Paralias*. Concerning the last-named plant, Mr. Arthur Bennett writes me: "New to Scotland. Balfour reported it from Fife, but it was only

* A goodly list of Wigtownshire plants is given in the *Transactions of the Philosophical Society of Glasgow*, vol. i. (1841-44).

as an introduced plant, and Watson so places it. I suppose it is on this record that Babington in his *Manual* gives Scotland for it, as there seems to be no other record."

From the rocky nature of the west coast of Wigtownshire, there are very few bays suitable for the growth of plants. In this respect Luce Bay has the advantage, and consequently more plants are found along its shores. In the immediate vicinity of Portpatrick, on each side of the hollow in which the town is situated, I saw such plants as *Senebiera Coronopus*, *Cerastium tetrandum*, *Lychnis vespertina*, *Honckenya peploides*, *Anthyllis Vulneraria*, *Conium maculatum*, *Daucus Carota*, *Glaux maritima*, *Samolus Valerandi*, *Plantago Coronopus*, *Hippophae rhamnoides* (evidently planted), and other common shore plants. At the mouth of Dunskey Glen I found *Geranium sanguineum*, *Vicia sylvatica*, *Mimulus luteus*, and *Carex hirta*. To the south of Portpatrick, near the old castle of Dunskey, I saw *Trifolium arvense*, *Œnanthe Lachenalii*, *Orchis latifolia*, *Empetrum nigrum*, and *Schœnus nigricans*; and further south, in Morroch Bay, I gathered some very good plants, as *Crambe maritima*, *Cakile maritima*, *Glaucium luteum*, *Beta maritima*, *Lamium intermedium*, *Helianthemum vulgare* (a scarce plant in Wigtownshire), *Echium vulgare*, *Verbascum Thapsus*, *Eupatorium cannabinum*, *Polygonum Raii*, *Mertensia maritima*, and *Euphorbia Paralias*. At Port Logan, still further south, on its sandy bay, I formerly gathered *Eryngium maritimum*, *Convolvulus Soldanella*, *Carduus tenuiflorus*, *Erodium cicutarium*, not seen above Portpatrick. All along the heughs grows *Scilla verna*, which must make a fine show of purple blossoms in spring. It is strange that this plant does not apparently grow further along the Solway than the mouth of the River Dee. On the west side of Luce Bay I have gathered *Vicia lutea*, *Vicia sylvatica*, *Orchis pyramidalis*, and *Raphanus maritimus*. The typical plants of the county are *Lepidium Smithii*, *Carum verticil-*

latum, *Œnanthe crocata*, and *Jasione montana*, and the most common *Hypericum* is *H. dubium*. Some of the plants recorded for Wigtownshire are *Artemisia maritima*, *Bartsia viscosa*, *Erodium maritimum*, *Isolepis Savii*, *Brassica monensis*, *Apium graveolens*, *Scutellaria minor*, *Inula crithmoides*, *Pulicaria dysenterica*, *Hieracium inuloides*, *Crithmum maritimum*, *Hypericum Androsæmum*, *Isoetes lacustris*, *Pilularia globulifera*, *Zostera marina*, *Potamogeton Zizii*, *Orchis incarnata*, &c.; but I have no doubt that several of these rare plants require reconfirmation. As there are no hills in Wigtownshire of any great elevation, no alpine plants are found in the county, except such as are also found along the shore.

XII.

JOTTINGS FROM MY NOTE-BOOK.

BY DAVID ROBERTSON, F.L.S., F.G.S.

PURPURA LAPILLUS, *Lin.*

[Read 8th June, 1886.]

I FIND among some of my jottings made fourteen years ago, that on the shores of the Clyde at Langbank, where the river has a great admixture of fresh water, very large sized shells of this mollusc were found; and although not one was found living, the dead shells were moderately plentiful among the stones near high-water mark.

When, it may be asked, did these molluscs live? Neither Forbes nor Jeffreys makes any mention of this species occurring in brackish water; and it was therefore thought that it must have lived at a time when that part of the river was less subjected to the influence of fresh water than it is now.

As the post-tertiary fossiliferous clays stretch along the side of the river both above and below this point, it was thought possible that these shells might have been washed out from some of the older clays. The post-tertiary beds of the Clyde, however, contain very few examples of this shell; and it is a rare occurrence to find even one of them in the clays. It is also to be remarked that none of the other shells belonging to the clays were seen strewn along the shore at this point, whereas they might have been expected to occur in a much greater number.

Some time afterwards I examined the shore near the dry-dock at Cartsdyke, a few miles further down the river, and found *Purpura lapillus* in abundance and living. The shells were large, many of them

having the ventral whorl much expanded. Although the water must contain more of the saline element at Cartsdyke that at Langbank, still there is a great admixture of fresh water, the water at the time of my visit being quite brown with sediment.

Last summer, while spending a few days at Helensburgh, I noticed that on the shore east from the pier *Purpura lapillus* was large and strong, like those seen at Langbank and Cartsdyke, and much more so on an average than those found on the shores of Cumbrae and Arran, where the water is purer and less mixed. Thinking it possible that the brackish water might influence the size of the shells, I wrote to my friend Dr. J. R. Henderson, of Granton Marine Station, asking him to send me a few examples of that species from the neighbourhood of Granton, where I thought the water would be brackish to a degree similar to the Clyde at Helensburgh. I explained the object of my request, that he might better understand what I wanted, and he kindly complied.

The difference in size, however, was not so marked as at Helensburgh. I had specimens from the four localities—Arran, Cumbrae, Helensburgh, Granton—mounted side by side, the better to illustrate the difference between them; but unfortunately, during removal, the little case containing the specimens has gone amissing, and I have since been unable to find it. These facts, however, many of you may have an opportunity of verifying for yourselves; and the subject is worthy of being followed up with the view of ascertaining what is the cause or condition that disposes these changes to take place, often within a very small radius. On one part of Belfast Lough, the whelk *(Littorina littorea)* is found having the spire elongated and very much turreted. At Roundstone Bay, Ireland, the calcareous sea-plant *Melobesia agariciformis* is confined to one or two small patches only; and although these have been there for a long series of years, the plant has never

been known to spread beyond its limited area. Many other similar instances might be adduced of plants and animals persistently clinging to a particular spot, without any very obvious reason for their so doing.

Observed Depths in Loch Lomond.

[Read 3rd August, 1886.]

Some years ago I was desirous to ascertain at what depth of fresh water *Ostracoda* were to be found; and the great depth of Loch Lomond offering a good opportunity for observation, my son and I proceeded to Tarbert, which is near that portion of the loch marked on the chart as having a depth of 105 fathoms. We were fortunate to find at the hotel a boatman who had assisted in taking the soundings of the loch many years previously. Under his guidance, and without much trouble, we reached the 105 fathoms, the area of which depth we found not to extend to any great distance.

No *Ostracoda* were met with, nothing being found but a few *Foraminifera* of the genus *Defflugia*; but *Ostracoda* were moderately common further down the loch, the species being chiefly *Candonæ*. Whether their range was determined by the depth of water, or the want of circulation in that deep part, it may be difficult to decide.

In connection with this point, a somewhat similar result was experienced when dredging in Millroy Lough, County Donegal, Ireland, in company with Dr. G. S. Brady of Sunderland. The lough, according to my recollection, is about 7 or 8 miles long, by 3 or 4 broad; the sea enters by a narrow channel, and the general depth is about 6 or 7 fathoms. It is rich both in animal and vegetable life; but at one end there is a deep portion of 25 fathoms, where life appears to be almost absent. This we attributed to the want of circulation, in consequence of a barrier of shallow water between the deep trough and the inlet and outlet channel.

What interested us most in Loch Lomond, however, was that not very far from the 105 fathoms trough the dredge was let down; and when the depth of 105 fathoms was reached, the bottom could not be found. More and more line was let out, till at last our supply was exhausted at 180 fathoms. The day was quite calm; the bearings that we had taken showed that the boat had not drifted in the least; and the line, so far as could be seen, was stretching straight down from the stern, and quite tight.

The line was a new small Manilla twist, light and buoyant. At other places, when the dredge was let down, it was at once felt when it had reached the bottom; and accordingly, when the requisite amount of additional line was thrown out, it floated on the surface till the slack was taken up by the boat being pulled along. In the deep trough referred to, however, the line was carried away straight down as fast as it could be given out; and when all the rope had been exhausted, the dredge still hung heavily on the hand. None of us had the slightest doubt that the dredge had not reached the bottom.

At that time the late Mr. James Napier, F.R.S.E., was staying at Tarbert Hotel. I informed him of the deep hole we had discovered in the loch; and we arranged to go at another time, provided with other appliances, to endeavour to place the depth beyond all doubt. Mr. Napier did go, along with some Edinburgh gentlemen who were interested in the matter, but unfortunately other engagements prevented me from joining the party. Although accompanied by the same boatman, they did not succeed in finding the deep trough. Mr. Napier admitted, however, that they could not find even the 105 fathoms depth, which is marked on the chart; and this fact of itself throws great doubt on the thoroughness of the search. It is quite likely that the hole or depression may be of very limited circumference, and may therefore be readily enough passed over; but, taking every circumstance into

account, there can be no room for doubt as to its existence.

Corystes cassivelaunus, *Penn.*

[Read 30th November, 1886.]

I brought some of the doings of this crab before the Society a long time ago*; but as the history of many of these obscure animals cannot be gathered in one day, it has often to be taken piecemeal as opportunities may occur.

This species, although it may not be considered rare (at least, so far as my experience goes) on the sandy habitat which it frequents, is seldom met with in the dredge, as sandy ground is generally avoided by the naturalist. In Bell's *History of the British Stalk-eyed Crustacea* (p. 161), he gives as its habitat the deep-sea between Holyhead and Red-wharf, Anglesea, and states that "it is generally a deep-sea species." I find it, however, in the shallow water of Kames Bay, Cumbrae, and occasionally cast ashore on the sands along the side of a little fresh-water stream that passes through the bay, where specimens are to be obtained either dead or in a dying state. As this is the only place in the whole bay where I have found them, it may be that the fresh water kills or disables them from going back with the tide; or perhaps there may be a bank opposite the mouth of the stream more suitable for their requirements than any other part of the bay. From thence they might readily be brought ashore by tide or storm, and perhaps only when they become sickly or are too enfeebled to resist the action of the waves.

The males are generally covered with green algæ, but the females are usually free from such growth, with the occasional exception of a tuft of algæ attached to the points of the antennæ.

**Proceedings of the Natural History Society of Glasgow*, vol. i., p. 1; *Proceedings of the Philosophical Society of Glasgow*, vol. v., p. 55 (with a plate).

I have kept the female for months at a time, and found that it burrows, posterior end downwards, remaining for weeks with the points of the antennæ just above the sand, which may account for the algæ found only on that part of the animal.

The abdominal plates of the female of this species are smaller and less fitted to cover the ova than is generally the case among the *Brachyura* or short-tailed family, but the burrowing habits compensate for the small abdominal plates in protecting the uncovered ova.

Mr. Bell mentions that he took ten in one day in the shrimp-trawl, all females; and we may reasonably infer, from their having been taken in the trawl, that they were captured on the surface. As the habits of the young crustacea, however, often differ greatly from those of the adults, it may have been that these females were all young, or not in ova, and therefore not in a condition requiring their concealment under the sand.

In reference to the habits of the male, it may be asked whether, like the female, it too may habitually burrow in the sand; but the growth of the algæ on the body and legs proves that sometimes at least it must remain on the surface for a considerable time.

This species is by no means common at Cumbrae; but it will be of interest when a living male should occur, to ascertain whether he burrows and spends as much of his time under the sand as the female seems to do. It will also be interesting to know whether the barren female continues to burrow, keeping herself free of algæ.

MYTILUS EDULIS, *Lin.*

[Read 30th November, 1886.]

LAST summer I had a walk along the shores of the Clyde at Cardross. The water there, at that season, is decidedly brackish; but during winter the fresh water must greatly prevail. Opposite the Railway

Station, the tide retires a long way, leaving a soft, bare, clay shore, which is irregularly covered by stretches of small gravel and green algæ, chiefly *Ulvæ* and *Enteromorphæ*, with numerous fronds of *Porphyra* and tufts of *Ceramium rubrum*. The variety of shells is not great. *Hydrobia ulvæ* may be said to be plentiful amongst the green *Ulvæ*; on the stones left by the tide *Littorina littorea* and *L. obtusata* are moderately common; and there appeared to be no scarcity of *Mya arenaria*, if sought for a short depth down in the muddy clay.

What attracted my attention most, however, was the large size of the mussels, which were often anchored to each other in little bundles, among the stones near and at low-water, where the tide affords them protection from the children who seem to swarm over the shore at that season gathering all sorts of shell-fish that come in their way.

The question has occurred to me — could these mussels not be turned to some economic use? There have been many attempts to establish musselries in various parts of the kingdom, with more or less success; but the greatest difficulty seems to have been to get suitable ground for the healthy development of the molluscs, and their protection on the sea-ward side from vagrant boats that might choose to come and plunder.

Cardross appears to be eminently suited to meet all the requirements of this industry. The profusion of well-grown mussels showed that the place is well fitted for an abundant development of the molluscs; and, as the estuary of the Clyde at this place is private property, privileges of protection could be obtained such as are seldom possible on the sea-shore.

There can be little doubt that a profitable market would at all times be open for the disposal of the mussels, not only for esculent purposes but as bait. The statement of the total quantity and value of sea-fish landed on the coasts of Scotland during last month (October), as reported by the Fishery Board

of Scotland, shows the value of the mussels landed during that period to have been £1,959, of which the greater portion was landed at the port of Greenock.* From this statement it appears that the industry is not so insignificant as most people are ready to think.

Some years ago (if not also at the present time) the mussel was fished between Port-Glasgow and Langbank, and sent to the East Coast for bait. In this industry there seemed no want of demand, but a want of facilities for proper culture to keep up the supply. If a few acres of the foreshore were staked off with rows of wood piles for the spawn to adhere to, the enormous productiveness of the mussel would, with care and judicious arrangement, enable the supply to be rendered practically unlimited. In view of conditions so favourable for successful and economic working, there appears good reason for believing that, with no great expenditure of capital, mussel culture at this place might be made a profitable industry.

The Food of Fishes.

[Read 22nd February, 1886.]

In regard to the food of fishes, with them, as with other carnivora, there is a general dependence of one upon another. The fry must be supplied with food suitable for their tender organizations; in like manner the young fishes, in their successive stages of growth, must prey on such smaller forms as they can overpower; and so on. It does not follow, however, that the adults must at length abstain from feeding on the smaller organisms, as it often happens that some species, especially the herring, are found to be gorged with microzoa.

A close examination of the sea-water reveals the enormous quantity of microscopic life floating in its midst, not in any particular zone but from top to

* *Glasgow Herald*, November 17th, 1886.

bottom. Many species frequent particular depths, some being found at the bottom, others in mid-water, and not a few at the surface; but the last group, like the others, is by no means constant either in character or time of appearance. At night they are generally more abundant at the surface than during the day, but they are not always found on the same ground where they may have been met with the night before.

It is also a curious fact that a gathering from the surface is often found to differ from that obtained a foot or so beneath it. Last summer, when at Lochranza with Mr. Murray in the steam yacht *Medusa*, Professor Herdman and I were out in a row-boat after sunset. He had a tow-net, which was pulled behind the boat and kept about a foot under the surface, while I had what is called the "hand-net" fixed on the end of a short rod with which I held the tip of the net only a few inches under the surface. It was found that the two gatherings were not alike, but differed considerably in the proportion of species obtained. I have since repeated the experiment at Cumbrae with the same results. The hand-net, that was kept at the surface, contained more larval forms and amphipods than were captured in the tow-net at a foot or so beneath the surface; and when the two gatherings had been put into separate tubes, that obtained at the surface was seen to be much lighter in colour than the other, in consequence of the greater abundance of hyaline larval forms.

Although some of these surface animals are widely spread in the water, they are often found in shoals here and there, abundantly at one place, and all but absent at another, perhaps not 100 yards distant. These shoals consist chiefly of copepods, and can often be traced on the surface by the fishes that follow them, whose noses may frequently be seen in the water gobbling them up and keeping the water in a state of ebullition. If the net be drawn

through the shoal it will be found to be full of these entomostracans.

The surface groups do not appear to remain long above at any time during the day, but dip to some distance beneath; and there, too, they are no doubt followed by their enemies until the latter are gorged or the shoal becomes too attenuated for further pursuit. Those that most abound in the district appear to be *Calanus finmarchichus* and *Temora longicornis*, and over the deep parts of Loch Fyne *Euchæta norvegica* takes the place of *Temora longicornis*. *Peridinium tripos* was in great abundance last summer, at the surface and in trials of 20 fathoms. Some years ago the waters of Millport Bay were crowded for a few days with *Noctiluca miliaris*, which I have never seen since. *Evadne Nordmanni* is occasionally abundant, besides a great many others of less importance numerically, exclusive of the multitudes of larval forms of Crustacea, Echinodermata, Annelida, and Mollusca.

We may assume that in studying the habits and movements of fishes it is necessary that we should know something of the habits and movements of the animals on which they prey. In reference to the herring, as they do not seem to take material food during the formation of the roe and milt* (which is generally believed among fishermen to be about two-thirds of the year), I have examined scores of them and never found food in their stomachs when the milt or roe was more or less advanced. At that time the stomach is contracted to a small gut, which is often lined with a considerable amount of fat that may contribute to the increase of the roe and milt during their fasting-time. The gut-like stomach lies parallel to the roe

* Since writing the above, Mr. Turbene, of the yacht *Medusa*, tells me that he has seen large herrings taken off Campbeltown, full of roe or milt, with food in their stomachs. This may have arisen from their fat getting exhausted, and food becoming necessary to sustain them over the spawning period.

or milt, leaving little if any provision for an extension of the stomach such as is seen when the fish is in the condition called in some places "gut-poke" herring, *i.e.*, when its stomach is greatly enlarged with food while in the roeless and miltless state. This being the case, the source of their food supply can be no guide to their whereabouts, at least during their abstaining time of about two-thirds of the year. When we consider the multitudes of enemies that the herring have, both of land and water, that greedily feed upon them all the year, from the earliest stages till the adult condition, we may reasonably believe that the portion which goes to man's share must be but a small fraction of the whole. It therefore seems clear that any restriction which may be put on the mode or time of fishing can be of little avail. Perhaps the best protection the herring have from the ravages of man is their erratic habits. If the long-line fishing had more support it might be advantageous, as the fishes taken by that means are known to include such species as are most destructive to the herring. The herring, on the other hand, do not prey on the kinds of fish taken by the long-line (or, if they do, it can only be for a very short season), and their increase cannot therefore be injurious to these fishes; but the increase of the long-line fishes must be excessively destructive to the herring, which in all stages of growth are preyed upon by them.

It is, I believe, commonly supposed that herring, when after spawning they begin again to take food, retire to greater depths; and there can be no doubt that they do so, as they are often found with their stomachs packed full of the schizopod *Nyctiphanes norvegica*, a small crustacean whose habitat in the adult state is rarely less than 40 fathoms. In the Firth of Clyde this has been amply confirmed by the dredgings of the steam-yacht *Medusa* (of the Granton Marine Station), which seldom failed to

capture that species as well as others at depths of from 50 to 100 fathoms. We may assume that the herring, when their time of feeding comes, go where they will be abundantly supplied with food; and therefore, if the difficulty be not too great, there can be little doubt that the herring would be obtained there after they had left the ground from whence they are usually fished.

On some Marine Mollusca.

[Read 26th April, 1887.]

Of the shells which I now bring under your notice as rare or doubtful inhabitants of British waters, the most doubtful and least known was taken from the stomach of a Long-tailed Ice-Duck (*Harelda glacialis*, Lin.). The bird was killed in Skye, and given by the late Dr. Dewar to Mr. M'Culloch, Glasgow, to be skinned. On being opened it was found to contain a large quantity of shells, all *Lacuna divaricata* with the exception of the one under notice. As this remarkable shell was quite unknown to me, I sent it to the late Dr. Gwyn Jeffreys, who at once pronounced it to be *Cyclope neritea*, a Mediterranean species. Taking all the circumstances into account, particularly the northern habitats both of *Harelda glacialis* and *Lacuna divaricata*, Dr. Jeffreys acknowledged the probability to be very small indeed that the shell had been picked up by the Ice-Duck on the shores of the Mediterranean and carried thence in its stomach all the way to the North-West of Scotland, where the bird was shot. Still he had a lingering reluctance to admit the species as British on the evidence of a single specimen. No more was thought of the occurrence till last summer, when one of my grandchildren found another specimen of the same species at low-water in Kames Bay, Millport. The shell was empty when found, but

from its fresh appearance there could be no doubt that it had been voided in the bay by some bird.

We all know that many of our British shells are common to European seas far apart; and when we consider the many favourite molluscan retreats and pastures extending along the submerged weedy rocks, which form the rich feeding-ground of many sea-birds, but are never attempted to be touched with the dredge, we may reasonably expect that when suitable appliances are brought into use many valuable treasures will be brought to light which have never been supposed to exist in such places. The great facilities which have recently been afforded by Mr. Coulson's yacht, and the *Medusa* from the Granton Marine Station, both steam-vessels fitted up with the latest improvements for dredging purposes, have enabled new light to be thrown on the Fauna of the Firth of Clyde and West of Scotland.

Although many of the species have been taken sparingly and considered rare, we have hitherto had but an obscure idea of the precise location of their real home. *Pecten septemradiatus*, for example, was at one time thought to be rare in the Firth of Clyde, and brought a high price. I have been informed by Dr. J. R. Henderson (now of Madras) that some of the English dealers still ask half-a-crown for a single specimen. This species is said to frequent rough stony ground, but, so far as the dredgings of the *Medusa* have shown, its home is on a mud bottom. There, at a depth of 50 or 60 fathoms, it is not unusual to meet with a dozen or two at a haul. On one occasion, when in company with Mr. Murray in the *Medusa*, between Cumbrae Light-house and Arran, in 80 fathoms, bottom soft mud, we brought up at one haul above 300 living specimens of this shell.

Many years ago I dredged off Cumbrae the shell *Siphonentalis lofotensis*, which is noticed by Mr. Alfred Brown in his *Mollusca of the Firth of Clyde*. Last summer I found the same species moderately

common in material dredged by the *Medusa* in lower Loch Fyne at a depth of 100 fathoms, as well as in material that I have from Ireland.

On looking over material dredged by the *Medusa* off Skate Island, at the mouth of Loch Fyne, in 90 to 100 fathoms, I found a few specimens of *Siphonentalis affinis* (Sars) new to Britain. It may be readily mistaken for *S. lofotensis*, but the shell is thinner, smooth, pellucid, and wants the oblique striations of that species.

In the same material, among other shells not common, I found *Axinus croulinensis*. Having had specimens of this shell kindly given me by Mr. A. Somerville, Glasgow, I could readily satisfy myself of its identity.

On the shore between tide-mark we occasionally find shells and other animals hitherto unnoticed or doubtfully authenticated. *Littorina neritoides* was recorded by the Rev. A. M. Norman as having occurred on the rocks of the Outer Allans, Millport; but although carefully looked for, it had not been subsequently found until two years ago, when it was taken abundantly on rocks on the east side of Kames Bay, Millport, by Dr. J. R. Henderson, and on the rocks near the Battery by Mr. Cook, an English gentleman then visiting Cumbrae.

Mya arenaria var. *lata* has been taken in the Firth of Forth and at Oban; and although not recorded from the Firth of Clyde, it is quite abundant in a patch of small stones, mud, and sand, about half-tide mark, a short distance eastward from Mr. Charles Wallace's private pier, Cumbrae.

Last summer one of my grandchildren found a specimen of *Donax vittatus*, at low-water, Kames Bay, Cumbrae; the shell had the two valves connected, but was empty. A month or two later another specimen was found under precisely similar conditions. Although in both cases the animal was absent, yet the fact that the valves were connected together led me to believe that the species must

be living in the neighbourhood, especially as it had been previously recorded from the Firth of Clyde by Mr. Smith of Jordanhill, and the Rev. Dr. Landsborough; and although their evidence had been doubted, the shell is so characteristic that it could scarcely have been mistaken for any other species, particularly by two naturalists of so eminent a reputation. During the present month (April, 1887) I am again indebted to one of my grandchildren, who found another of these shells at low spring-tide on the sands not far from where the other two were found. The shell contained the live animal, leaving no doubt of its living in the bay. This is all the more remarkable, as in the same bay, which has been my hunting-ground for many years, I have never noticed a vestige of that shell dead or alive; and it should warn us from thinking that we had left nothing behind untouched, however long or diligently the ground may have been searched by us.

XIII.

THE NEW APOCHROMATIC MICRO-OBJECTIVES AND COMPENSATING OCULARS OF DR. CARL ZEISS.

BY ADOLF SCHULZE, F.R.S.E., F.R.M.S.

[Read 28th September, 1886.]

Dr. Carl Zeiss has had the kindness to send me for inspection four of his new aprochromatic objectives, and three of his new compensating eyepieces; and as a short notice of only one of these objectives has to my knowledge appeared in this country—viz., in the *Journal of the Royal Microscopical Society*, vol. vi., part 2, fol. 375-6, I trust that the following remarks, culled chiefly from Dr. Abbe's pamphlet *Ueber Verbesserungen des Mikroskopes mit Hilfe neuer Arten optischen Glases* ("On improvements of the microscope by the aid of new kinds of optical glasses"), may be acceptable to the members of our society.

Professor Dr. Ernest Abbe—who is "the first living authority on microscopical optics," and to whom we are indebted not only for the greatest recent improvements in the construction of micro-objectives, but also for the theory of the formation of microscopical images by diffraction spectra, and for lucid mathematical expressions of the relations of aperture, resolving power, focal depth, &c.—finding that the aperture of micro-objectives had been pushed to almost its theoretical limit, and foreseeing no adequate advantages in trying to increase the aperture with the means hitherto at our command, directed his attention to further improvements by an entirely different method.

In conjunction with Dr. Carl Zeiss, the eminent optician of Jena, and with the assistance of Dr.

Schott, Dr. Abbe began in 1881 to make experiments with the view of producing new kinds of optical glasses.

The relation of the optical properties to the chemical compositions of various kinds of experimentally produced glasses was first established by spectroscopical researches, and finally such glasses were produced as possessed the properties most desired. In this way, and by combining a far larger number of elements than formerly, especially by means of phosphoric and boric acids, besides silicic acid, two new and much desired results have been attained—viz.:

(1) The production of crown and flint glass in which the dispersion for the different regions of the spectrum shows approximately the same ratio, and which, therefore, in achromatic combinations permits of the almost complete elimination of the secondary spectrum.

(2) The increase of the number of optical media in such a way that with the same mean refractive index the dispersion, or with the same dispersion the refractive index, may be varied within considerable limits, especially so that high values of the refractive index can be obtained, not as hitherto only in combination with flint glass of high dispersion, but also with lower dispersive indices as in crown glass.

These new kinds of optical glasses are produced in the Glastechnisches Laboratorium in Jena, which has been supported in the most liberal manner by the Prussian Ministry of Public Instruction, and they are now being supplied to the trade.

Dr. Carl Zeiss, who constructs all his lenses on strictly scientific principles, and according to the formulas of Professor Abbe, is the first optician who has produced micro-objectives of these new glasses, and he has thus been able to correct two important defects which up to now could not be overcome with the means at the disposal of opticians

and which offered insurmountable obstacles to the further improvements in lenses. In consequence, namely, of the great disproportion of the dispersion of the various colours of the spectrum, a property inherent in crown and flint glass, our best so-called achromatic lenses have up to now been corrected for only two colours of the spectrum, and the hitherto unavoidable remnant of unachromatism, the so-called secondary spectrum, was always more or less perceptible. With the crown and flint glass used by opticians it was equally impossible to correct the spherical aberration for more than one colour. All objectives, although fairly well corrected for the middle of the spectrum, showed, nevertheless, a spherical under-correction for the red and a spherical over-correction for the blue and violet rays, which imperfection appeared as a more or less great inequality of the achromatic correction between the central portion and the peripheral zones of the objectives.

These defects caused an imperfect combination of the image-forming rays, and as a result objectives, especially those of large apertures, did not allow the employment of high magnifying oculars, because those deficiencies of spherical and achromatic corrections became more apparent with them than with the lower magnifying ones.

The practical advantages of Abbe's new objectives made by Carl Zeiss from the new optical glasses are the following :—

(1) The full value of the large apertures of objectives becomes now only apparent, because owing to their perfect corrections, the images formed by the new dry and water immersion objectives are scarcely distinguishable from those formed respectively by the water and homogeneous immersion objectives of perceptibly larger numerical aperture hitherto constructed.

(2) The largest magnifications for a certain aperture can be obtained by high eyepiecing and by

objectives of relatively long foci, thus obviating the necessity for objectives of extreme short focal lengths.

(3) By the correction of the secondary spectrum and the perfect spherical correction of these new lenses, the visual and actinic foci coincide, rendering them especially suitable for photo-micrography.

(4) The increased spherical and achromatic corrections of these objectives produce a larger concentration of light in the images projected by them.

Dr. Abbe calls these new lenses *Apochromatics* or *Apochromatic Objectives*, owing to their superior spherical and achromatic corrections, which represent an achromatism of a higher order than hitherto attained.

These apochromative objectives require special eyepieces in order to utilise their capabilities to the fullest extent, and Dr. Zeiss has constructed suitable eyepieces for them which he designates *Compensating Oculars*.

In objectives of short focal length or in high powers the front lens is generally a single crown glass lens, which is, therefore, unachromatic, the result being coloured outlines of the image in the marginal zone, as the lens is only well corrected for its central portion. The front lenses of the high-power apochromatic objectives are evidently also single ones, and the so-called compensation oculars have been constructed with a view to correct this residue of peripheral aberration, and to balance or compensate the chromatic differences of magnification, as the picture produced by the blue and violet rays is larger than that produced by red and yellow rays. In order, therefore, to make the compensation oculars available not only for the high objectives but also for the lower ones, the latter had to be so constructed that the difference of the chromatic magnifications of the marginal zone should be practically the same as in the former. These compensation oculars differ from the ordinary Huy-

ghenian and other eyepieces in this respect, that the eyelenses of even the strongest have relatively long foci, so that they can be used with almost as much comfort as the lower power oculars. The camera lucida can also be used with any of them save the highest, which magnifies 27 diam., and has 10 mm. focal length. These are great recommendations, and the wonder is that opticians have not long since constructed high magnifying eyepieces with large eyelenses of such focal lengths that comfort is insured thereby and undue straining of the eyes avoided.

Instead of naming the different eyepieces A B C, &c., or 1 2 3, &c., as other opticians do, Dr. Zeiss designates the compensating oculars by their magnifying power; thus the eyepieces No. 1, 2, 4, 8, 12, 18, 27 magnify the image produced by the objective 1, 2, 4, 8, 12, 18, 27 times respectively. Both the magnifying power or number and the focal length are engraved on each eyepiece, so that when the magnifying power of an objective at the end of a tube 160 mm. or 250 mm. long is known, one can at once find the magnifying power of the microscope by multiplying the initial magnification of the objective by the number of the ocular with which it is combined.

The compensating eyepieces are divided into three classes—viz.:

(1) *Search oculars* of great focal length. The one No. 1 constructed for the short or Continental tube does not magnify the initial magnification of the objective at all, and the two No. 2 magnify, both on the Continental and on the English tubes respectively, the image produced by the objective two diam. These objectives, as their name indicates, are intended to enable the observer to find rapidly an object in the field without employing another low-power objective, and perhaps a cumbersome nose-piece, which is so prejudicial to the centricity of the optical system and to the fine adjustment of the

microscope. A great saving of time, labour, and annoyance can thus be effected by these low-power eyepieces, especially when using immersion lenses.

(2) *The ordinary working oculars*, magnifying respectively 4, 8, 12, 18, and 27 diam.; their focal lengths vary from 45 to 10 mm. for the Continental stand, and from 67 to 10 mm. on the English 10in. tube.

(3) *Oculars for projections*, magnifying 2 and 4 diam. for a tube of 160 mm. and 3 and 6 diam. for a tube of 250 mm. or 10 in. long respectively. These oculars have two diaphragms each, to reduce the effective apertures of the high-power lenses should such be desirable.

They are constructed for photo-micrography and for the lantern microscope, and yield an evenly illuminated flat field and a well-defined image at any screen distance. They can also be used advantageously with the ordinary achromatic micro-objectives.

The mountings of these oculars are so arranged that the lower foci of all those belonging to one series are lying in the same plane, so that when interchanging them no new focussing of the objective is required, the optical tube length remaining the same.

I subjoin tables of Dr. Carl Zeiss' new apochromatic objectives showing their numerical apertures, equivalent focal lengths in millimètres, and their magnifications at 250 mm. It will be seen from them that the whole series for both Continental and English tubes together consists of only 11 lenses, and that 3 dry, 1 water immersion, and 1 (or 2) homogeneous immersion lens, in all 5 apochromatic objectives, would constitute a complete series, and in conjunction with the new compensating eyepieces would do all the work for which hitherto often from one to two dozen objectives were required.

The homogeneous immersion lenses are constructed

without screw-collars, and they require to be used with thickened cedar-wood oil, having a refractive index of 1·5128. In spite of their large apertures, they will work through covers of about $\frac{1}{100}$ in. thickness.

The lenses kindly submitted to me for inspection are the following:

	mm.		focus.		mm. aper.
Apochromatic objective,	16	about	$\frac{4}{5}$ in.	and	0·30
,, ,,	4	,,	$\frac{1}{4}$ in.	,,	0·95
,, water immersion, ,,	2·5	,,	$\frac{1}{10}$ in.	,,	1·25
,, homog. ,, ,,	2	,,	$\frac{1}{12}$ in.	,,	1·40

They are undoubtedly the finest objectives which I have ever seen, leaving far behind in their performances many lenses which I have hitherto considered as almost not to be surpassed. The pictures produced by these new lenses are remarkably achromatic and bright, and owing to the exquisite definition of these objectives structural details on surface markings come out with wonderful sharpness and distinctness. I am especially pleased with the lens of 4 mm. focus and the homogeneous immersion lens of 2 mm., which latter, owing to its enormous aperture and brilliant definition, resolves test objects, considered difficult, with the greatest ease. The facility with which high magnifications may be obtained without loss of definition, and without discomfort to the eyes by using high eyepieces, is most agreeable. I have no hesitation in saying that these apochromatic objectives are destined to supersede the present achromatic objectives, and that as Dr. Carl Zeiss offers his new optical glasses to the trade, and, with his usual liberality, places no restrictions, by patents or otherwise, on the making of these lenses, other opticians will soon enter into wholesome competition with him, with the result that apochromatic objectives will shortly be supplied by all good makers. Meanwhile the high prices of the apochromatics are standing in the way of their general adoption, the lower powers costing almost

double the price that our best English opticians charge for theirs, whilst the prices of apochromatic homogeneous immersion lenses are, considering their great aperture, probably the same as those of our first English makers. Meanwhile many microscopists, especially students, have to content themselves with a microscope stand and objectives of 1 in. and a $\frac{1}{4}$ in. focus, costing altogether not more than one of the new apochromatic 1 in. objectives, and a good working instrument can be had nowadays at a very small cost. In conclusion, I express the hope that other optical apparatus besides the microscope will derive important benefits from the invention of these new optical glasses.

Table I.

Apochromatic Objectives.

	Num. apert.	mm.	
Dry system,	*0·30	24·0	equivalent focal length.
,,	0·30	16·0	,,
,,	*0·60	12·0	,,
,,	0·60	8·0	,,
,,	*0·95	6·0	,,
,,	0·95	4·0	,,
Water immersion,	1·25	2·5	,,
Homog. ,,	1·30	3·0	,,
,,	1·30	2·0	,,
,,	1·40	3·0	,,
,,	1·40	2·0	,,

* These are manufactured only for the English tube.

Table II.

Magnifications of the Apochromatic Objectives and Compensation Oculars for 250 mm. Screen Distance.

Screen distance of the objective, 250 mm.	Search oculars.		Working oculars.				
Equivalent focal lengths.	1	2	4	8	12	18	27
24·0		21	42	83	125	187	281
16·0	15·5	31	62	125	187	281	
12·0		42	83	167	250	375	562
8·0	31	62	125	250	375	562	
6·0		83	167	333	500	750	1,125
4·0	62	125	250	500	750	1,125	
3·0	83	167	333	667	1,000	1,500	
2·5	100	200	400	800	1,200	1,800	
2·0	125	250	500	1,000	1,500	2,250	

N.B.—Since the above paper was read, the author of it has gained additional experience in the use of these apochromatic objectives which fully bears out the high opinion he formed of them when first he began to employ them. Above all would he recommend them when the best possible definition is required, and, especially in conjunction with the projection eyepieces, for photo-micrography, as in consequence of the coincidence of their visual and actinic foci the operator can with certainty obtain a sharp image on the sensitized plate.

Dr. Roderick Zeiss, of Jena, has succeeded in photographing even the longitudinal lines on *Amphipleura pellucida* with one of Zeiss' homogeneous apochromatic objectives of 2 mm. focus and of only 1·30 mm. aperture—a feat which has not been accomplished hitherto with any other lens of the same aperture. Numerous imitations of these lenses have been placed of late in the markets, and some no doubt of excellent quality and great resolving power, but, so far as the author has been able to learn, none truly apochromatic in the sense in which Professor Abbe has introduced this appellation.

XIV.

NOTES ON THE FORAMINIFERA OF THE FAROE CHANNEL AND WYVILLE THOMSON RIDGE, WITH A DESCRIPTION OF A NEW SPECIES OF HYPERAMMINA.

BY FRED. G. PEARCEY, OF H.M.S. *CHALLENGER* EXPEDITION.

With one Plate [III].

[Read 23rd March, 1888.]

It may at first appear superfluous to publish a second list of the Foraminifera found in the Faroe Channel, after the excellent paper by Dr. H. B. Brady, F.R.S.;* but when it is considered that this locality offers such an exceedingly interesting and rich field for investigation in both physical and biological science, as will readily be seen by the earlier publications of the late Sir Wyville Thomson, and Dr. W. B. Carpenter, and the recent ones by Dr. John Murray, V.P.R.S.E., and other eminent scientific gentlemen,† no further apology is here needed.

I have since had the privilege of examining minutely the whole of the material obtained by H.M.SS. *Knight Errant* and *Triton*, as well as a portion of that obtained by H.M.SS. *Lightning* and *Porcupine* expeditions, taken in the same locality,

* *Proc. Roy. Soc. Edin.*, vol. xi., pp. 708-717, 1882.

† *Proc. Roy. Soc. Edin.*, vol. xi., pp. 638-720, 1882, "On the Physical and Biological Conditions of the Seas and Estuaries about North Britain," *Proceedings of the Philosophical Society of Glasgow*, vol. xvii., p. 306, 18 86.

the two former of which I had the honour of accompanying; and as the result of my investigations has been to add considerably to the list published by Dr. Brady, I have received Dr. Murray's permission to bring this communication before the Society.

On examination of the various deposits obtained, special care has been observed in selecting twelve samples from the cold area and twelve from the warm area. All these have been carefully examined microscopically, with one object in view—namely, to determine approximately the distribution of the Rhizopod fauna of these two areas, which are doubtless the richest Rhizopod ground outside the tropics, and have a great inequality of temperature.

The study of the organisms found in these areas will therefore be of considerable interest, and no less importance, in throwing some light upon the now general question of the geographical distribution of this interesting group of organisms, due to the great differences of temperature.

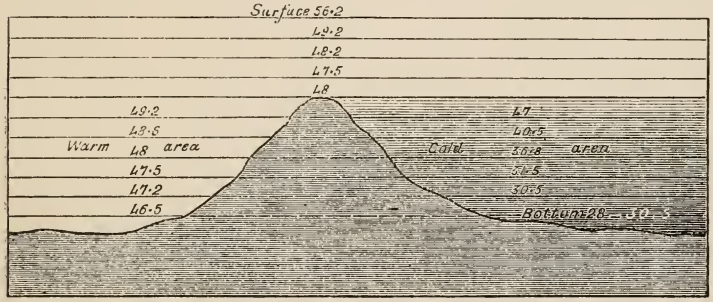
The region known as the Faroe Channel is that portion of the Atlantic Ocean to the north of the mainland of Scotland, which is bounded on the north-west by the Faroe Islands, and on the south-east and south by the Shetland and Orkney Islands, the shores of Caithness and Sutherland, and Hebrides.

It was shown by the results of H.M.SS. *Knight Errant* and *Triton* expeditions that a submarine ridge exists right across this channel, separating the cold water of the Arctic Seas and the warm water of the Atlantic, the greatest depth on the crest of which is 380 fathoms. The average depth over this ridge, which has been named after the late Sir Wyville Thomson, is from 250 to 280 fathoms; in one part, however, there is a gap with a depth of 380 fathoms, as mentioned above. It is 100 miles in length by 10 miles wide. On each side of the ridge the depth increases to 600 fathoms or more.

The channel to the northward of the Wyville Thomson Ridge is filled up to the top of the ridge with ice-cold water, but none of it appears to pass over into the Atlantic.

The cold water at the top of the ridge is met by the stream of warm Atlantic water, which flows steadily to the north-east. A mixture takes place, and the whole passes on to the coasts of Norway; thus we see that this ridge forms a barrier or boundary-line between two regions, so to speak, each having its own peculiar climate.

The annexed diagram gives a good idea of the two areas, and also shows that although the water on the one side of the ridge is warmer at depths exceeding 200 fathoms than that on the other side, yet on both sides the minimum temperature is only reached at the bottom. This warm salt Atlantic



water, as it becomes cooled in passing to Norway, sinks and carries heat down with it, in the same way as the Gulf Stream water was found to sink as it approached our own coasts, so that while we find ice-cold water at a depth of 250 fathoms in the Faroe Channel, it is also found at a depth of 400 to 600 fathoms off the coasts of Norway.

In the cold area of the Faroe Channel the temperature of the water at depths exceeding 350 fathoms is under 32° F., whilst in the warm area the temperature at similar depths is above 42° F.

The track of the warm tropical waters of the Gulf Stream can be traced along the floor of the

ocean, from the West Indies across the Atlantic to our own coasts and on to Norway, by the dead shells * which are strewn upon it all along their course.

In the tropics there are about forty species of Foraminifera, Pteropods, and other carbonate-of-lime-secreting organisms, which live in or near the surface-waters of the ocean, whose dead shells make up at times 80 to 90 per cent. of the deposit at the bottom.

As the Gulf Stream waters are cooled in passing northwards, many of these organisms die out or become greatly dwarfed in form as they approach the colder waters of the north; still, in mid-ocean, between this country and Newfoundland, these shells make up often 70 to 80 per cent. of the deposits.

In the Faroe Channel, only seven or eight species are found living on or near the surface; but south of the Wyville Thomson Ridge, and to the north of this ridge in the central parts of the Norwegian Sea, not much affected by the Arctic surface currents, they make up 30 to 40 per cent. of the deposit. The influence of the Arctic currents moving from north to south can be traced in like manner on the floor of the Atlantic. By an examination of a deposit, Dr. Murray has shown that it is possible to tell approximately, from the character of the dead shells of the surface organisms found in it, its latitude and the depth from which it came; while its longitude can in many instances be approximately determined by careful microscopical examination of the fragments, organic and inorganic, of which it may be composed. The warm Atlantic water, passing over the Wyville Thomson Ridge to the north-east, sweeps the crest of the ridge with considerable force, regulated by the state of the tides; so great is this force that no mud or ooze is deposited on the ridge, the small mineral particles

* Chiefly the dead shells of Globigerinidæ, Pulvinulinidæ, Pteropods, Heteropods, and other pelagic Mollusca.

and rock fragments being swept into the deep water to the north-east.

It is now well known that temperature is the most important factor in the distribution of marine life, and it might well be expected that there would be a considerable difference in the character of the fauna on either side of the Wyville Thomson Ridge. This is clearly shown by the number of animals collected in this locality by the various expeditions.*

By an inspection of the tabulated list appended to this paper, it may be seen that the Foraminifera found in the Faroe Channel show a marked difference of species and numbers obtained in the two areas; it includes representatives of the typical deep-sea forms as well as those taken at intermediate depths.

A striking illustration of this was shown by the use of the tow-nets, which, in the warm area, gave great quantities of very large and fine specimens of the beautiful *Hastigerina pelagica* (d'Orb.), while none of these were obtained either in the surface or sub-surface waters of the cold area, neither has any trace of their dead shells been found in the deposits of the cold area.

It will be observed that, with two or three exceptions, the soundings taken on the Wyville Thomson Ridge have an average depth of 250 fathoms, and the bottom temperature varies from 55° F. on the surface, to 46°·4 F. at 280 fathoms.

On examination of a number of the samples of deposits taken on the ridge, a striking difference in the variety of species presents itself. Here *Truncatulina refulgens* and *Rupertia stabilis* flourish in abundance, and are taken attached to nearly all the small stones and rock-fragments which appear to cover the crest of the ridge, the base and aperture

* See Dr. John Murray "On the Physical and Biological Conditions of the Seas and Estuaries about North Britain," *Proc. Philosophical Society of Glasgow*, vol. xvii., p. 306, 1886.

of each individual being in most cases surrounded with masses of dark-green or greenish-brown sarcode.

Truncatulina variabilis was often found living in company with *Truncatulina refulgens*. It would appear that these two species are to be found in the living state on the ridge only. I have examined upwards of one hundred samples of deposits taken in the vicinity of the Faroe Channel, but I have never found living specimens of these two species—that is, with their shells filled with sarcode—either in the warm or cold area. As a fact, they are absent from the warm area, although one or two dead and decayed shells were found on the warm side close up to the ridge, with a bottom temperature of 41°·2 F., and these I take it have been carried there by the strong currents which sweep the ridge. *Miliolina seminulum* is also found living more abundantly on the ridge than on either side of it, and in many instances was obtained firmly attached to stones by the sarcode which was protruding from the aperture. Of course, as might have been expected, a few of the pelagic and bottom-living Foraminifera were found on the ridge; but on the whole they are exceedingly rare.

On referring to the table of classification, and comparing the Foraminifera obtained from both the warm and the cold areas, it will be seen that the Miliolinidæ are strongly represented in the warm area, numbering twenty-seven species, for the most part very large and finely-developed specimens; while in the cold area only fourteen species are found, and these are all poor, starved, and dwarfed, if we except *Cornuspira foliacea*, which is found to attain a larger size here than in any other known locality.

The larger arenaceous types—such as *Astrorhiza*, *Syringammina* (a new genus of arenaceous Rhizopods described by Dr. H. B. Brady *), *Saccammina*, *Bathysiphon*, *Storthosphæra*, *Sorosphæra*, *Rhabdammina*,

* *Proc. Roy. Soc.*, vol. xxxv., p. 155, pls. ii. and iii., 1883.

Jaculella, *Hyperammina*, *Marsipella*, *Haplophragmium*, and *Webbina*—are conspicuous by their absence from the cold area, and are only very sparingly represented by the smaller varieties of Lituolidæ, with one exception, *Reophax scorpiurus*, which is comparatively rare in the warm area but is found abundantly and of very large size in the cold area.

From this we may safely conclude that *Cornuspira foliacea* and *Reophax scorpiurus* are natives of the colder waters of the ocean. Again, the genus *Bulimina* is found in its typical condition spread all over the warm area, while only a few starved varieties are found in the cold area.

The genus *Lagena* would appear to flourish best in the colder waters of the ocean, as is shown by the results of the *Challenger* expedition. In the great ocean basins, in depths greater than 1000 fathoms, where the temperature is below 30° F., this genus was found most abundantly. It is represented in the cold area by no less than twenty-eight species and varieties; and by eighteen only in the warm area.

Eight species of *Nodosaria* have been taken in the warm area, and but three in the cold.

The *Cristellariæ* also attain to a very large size in the warm area, where six species were taken, while in the cold area only one has been found.

With reference to the pelagic forms, these two localities show a peculiarly striking difference as to distribution. The Arctic varieties of Globigerinidæ, as *Globigerina pachyderma* and *Globigerina dutertrei*, have their home in the cold area; while *Globigerina bulloides* (typical form), *Globigerina inflata*, and *Globigerina (Orbulina) universa* flourish in the warm area, and are very sparingly found in the cold area. I am inclined to believe that the very minute and young forms of Globigerinidæ are carried by the warm currents from the localities where the surface-waters are of a high temperature, into the colder waters of the Arctic and Antarctic Seas; that they suit themselves to the change of climate for a

limited time only; and that they do not much increase in size afterwards, but remain dwarfed and stunted, all their energy being used in thickening their shells. It seems evident that their existence is of very short duration, as compared with those more fortunate individuals who spend the whole of their lives in the warm or tropical seas. That none of these Globigerinidæ live on the bed of the ocean, I feel convinced, having examined a very great number taken in the deposits from various localities all over the world, both in a fresh and dry condition; but in no instance have I been able to detect sarcode. I have, however, seen cases where at first I felt almost certain I had discovered sarcode; but on more minute and closer examination, what was thought to be sarcode turned out to be pale yellow and green glauconitic matter, with some fine argillaceous, and probably organic, material.*

Why these heavy Arctic varieties are not commonly taken in abundance by the tow-nets, or why they are not observed so often with other pelagic animals in the Arctic Seas, must be left for future investigations to solve.

The Globigerinidæ found in the deposits of the warm area are exceptionally small. The shells are notably thinner, but they have not the compact, dwarfed, or Arctic peculiarities, which are characteristic of those found in the cold area. From the most minute to the largest specimens, they are all well-formed typical *Globigerina bulloides;* on the other hand the Arctic varieties, *Globigerina dutertrei* and *Globigerina pachyderma*, are almost entirely wanting. All my observations go to show that both the last-mentioned forms diminish very rapidly in number

* It may here be noted, and is of importance, that on both sides of the ridge a considerable amount of glauconite is found in the deposits. Many of the Foraminifera-shells, and other organic remains, are found filled with this peculiar mineral; and after treatment with dilute hydrochloric acid, beautiful and perfect casts of these organisms remain.

after passing the Faroe Channel going south, and become nearly, if not quite, absent after passing south of latitude 55° N.

Amongst the arenaceous Foraminifera found in the Faroe Channel were many very interesting forms, among which may be mentioned *Syringammina* and *Bathysiphon*, one species of *Storthosphæra*, and three species of *Sorosphæra*, which, on further examination, may turn out to be new to science.

Of the genus *Hyperammina*, a very interesting form has been taken from the warm area, which I here describe under the provisional name of *Hyperammina palmiformis*.*

HYPERAMMINA, H. B. Brady.

HYPERAMMINA PALMIFORMIS, n. sp.

Test free, erect, elongate, subcylindrical, tapering somewhat sharply, straight till it becomes a cylindrical tube of nearly uniform diameter; distal extremity forming a tuft of fine branched chitino-arenaceous tubes, with a strong chitinous lining throughout, filled more or less with a greenish-brown sarcodic matter; primordial end closed and rounded; internal cavity commencing with a broad simple chamber, narrowing till it becomes a continuous tube, usually attaining about seven millimetres in height before dividing into numerous tubular branches of a uniform diameter internally, till near the ends, when they slightly taper off, each terminating in a minute rounded aperture; walls moderately thick; texture externally, coarsely arenaceous; colour reddish-brown or grey. In the dry state it has a grey colour, owing to the numerous *Globigerinæ* and fragments of other calcareous organisms it selects to ornament its test; especially is this the case in the branched arborescent distal extremity, where the *Globigerinæ*, &c., are much more numerous than on the base. Length, $\frac{10}{16}$ inch (16 or 17 mm.).

This form differs from all the other known species of *Hyperammina* in having a strong chitinous lining to which the extraneous material is firmly cemented; and instead of the marked subglobular primordal chamber characteristic of this genus, it is

* From the bulging out of the base, and its branched arborescent distal extremity, resembling several species of palms—*e.g.*, *Livistona chinensis*, Mart., or *Coryphas australis*, R.B.

simple and continuous, showing no trace of segmentation. It cannot be confused with any other species, its nearest allied form being *Hyperammina friabilis*,* the resemblance being confined to the external appearance of the base. The test altogether is much thinner, and the mineral particles are firmly cemented closely together.

A notable feature in this species is its selection of material for strengthening its test—*i.e.*, in coating the chitinous envelope with mineral particles of a nearly uniform size, having a mean diameter of 0·04 mm., chiefly composed of quartz grains, and afterwards, evidently for ornament, adding numerous *Globigerinæ*, *Uvigerinæ*, etc. Owing to the chitinous lining the test is somewhat flexible, and may be freely handled.

Dr. H. B. Brady, to whom this species was submitted for inspection, says that the most interesting feature is the branched arborescent distal extremity. The question one has to determine is whether the forms we know best by their wasted and dried tests were, when living, in the same condition. I quite agree with Dr. Brady on this point, and think it is just possible that further investigations on the deep-sea Foraminifera may prove *Hyperammina palmiformis* to be only a perfect form of *Hyperammina friabilis*, or an allied form. Should this turn out to be so, the specific name *friabilis* will take precedence.

Hyperammina palmiformis was obtained, with others, in the Warm Area, Station 10, lat. 59° 40′ N., long. 7° 21′ W.; surface temperature, 55°·5′ F.; bottom temperature, 46°·5′ F.; depth, 516 fathoms.

The deposit in which this interesting species was obtained is a grey, sandy, calcareous mud, homogeneous, earthy, and having a greenish tinge when wet.

* H. B. Brady. "On the Foraminifera dredged by H.M.S. *Challenger*, 1873-1876," *Zool. Chall. Exp.*, part xxii., p. 258, pl. 23, figs. 1, 2, 3, 5, and 6, 1884.

I here wish to thank Dr. John Murray, V.P.R.S.E., for allowing me to bring this paper before your Society. My thanks are also due to Dr. H. B. Brady, F.R.S., and Mr. David Robertson, F.L.S., F.G.S., for many useful suggestions.

List of Stations from which Deposits have been examined for Foraminifera from the Warm Area of the Faroe Channel.

Sounding No.	Latitude, N.	Longitude, W.	Depth in Fathoms.	Bottom Temperature.
26	59° 54′ 00″	6° 51′ 0″	460	46°·0 F.
52	60° 14′ 45″	89° 9′ 45″	306	44°·2 ,,
53	60° 12′ 00″	8° 7′ 50″	353	45° ,,
54	60° 8′ 25″	8° 5′ 30″	458	42°·8 ,,
55	60° 11′ 45″	8° 15′ 00″	433	43°·5 ,,
72	59° 56′ 20″	7° 8′ 00″	330	47°·4 ,,
73	59° 54′ 10″	7° 12′ 50″	409	47° ,,
118	59° 40′ 00″	7° 21′ 00″	516	46°·5 ,,
120	59° 29′ 30″	7° 13′ 00″	555	45°·5 ,,
122	59° 59′ 50″	7° 25′ 30″	310	47°·4 ,,
133	60° 10′ 30″	7° 39′ 00″	305	45°·7 ,,
135	59° 51′ 20″	8° 18′ 00″	570	45°·7 ,,

List of Stations from which Deposits have been examined for Foraminifera from the Cold Area of the Faroe Channel.

Sounding No.	Latitude, N.	Longitude, W.	Depth in Fathoms.	Bottom Temperature.
28	60° 29′ 14″	8° 23′ 30″	365	31°·8 F.
47	60° 28′ 15″	8° 15′ 30″	407	30°·8 ,,
48	60° 25′ 00″	8° 14′ 00″	385	30°·5 ,,
66	59° 56′ 15″	6° 8′ 00″	313	30°·5 ,,
67	60° 7′ 40″	6° 44′ 00″	630	30°·4 ,,
69	60° 3′ 00″	6° 54′ 00″	359	30° ,,
77	60° 9′ 00″	7° 16′ 30″	466	29°·5 ,,
95	60° 6′ 00″	8° 1′ 30″	455	30° ,,
97	60° 12′ 2″	7° 44′ 00″	328	30°·3 ,,
106	60° 18′ 00″	6° 15′ 00″	640	30° ,,
107	60° 5′ 00″	6° 21′ 00″	608	30° ,,
134	60° 31′ 00″	7° 34′ 00″	580	31° ,,

Synopsis.

Number of species and varieties found in the *Warm* Area,	180.
Number of species and varieties found in the *Cold* Area,	120.
Number of Miliolidæ found in the *Warm* Area, ...	28.
Number of Miliolidæ found in the *Cold* Area, ...	14.
Arenaceous types found in the *Warm* Area, ...	59.
Arenaceous types found in the *Cold* Area, ...	25.
Number of Lagenæ found in the *Warm* Area, ...	18.
Number of Lagenæ found in the *Cold* Area, ...	28.
Number of species abundant in the *Warm* Area, ...	17.
Number of species abundant in the *Cold* Area, ...	11.
Number of species of which a good many have been found in the *Warm* Area, ...	14.
Number of species of which a good many have been found in the *Cold* Area, ...	8.
Number of species and varieties found in the Warm Area and not found in the Cold Area, ...	108.
Number of species found in the Cold Area and not found in the Warm Area, ...	45.
Number of species and varieties common to both the Cold and Warm Areas, ...	70.
Number of species and varieties found in the Faroe Channel,	228.

Revised List of Foraminifera found in the Warm and Cold Areas of the Faroe Channel.

Species and Varieties.		Warm Area.	Quantity.	Cold Area.	Quantity.
Biloculina depressa,	d'Orb.	+	comparatively common.	+	few found.
ringens,	Lamk.	+	do.	+	rare.
irregularis,	d'Orb.	+	rare.	+	rare.
elongata,	d'Orb.	+	rare.	+	rare.
depressa, var. murrhyna,	Schw.	+	rare.		
depressa, var. serrata,	Brady.	+	few.		
sphæra,	d'Orb.	+	few.		
comata,	Brady.	+	comparatively common.		
bulloides,	d'Orb.	+	few.		
tubulosa (?),	Costa.	+	rare.		
Miliolina tricarinata,	d'Orb.	+	common.	+	few.
bucculenta, var. placentiformis,	Brady.			+	rare.
circularis,	Bom.	+	few.	+	very rare.
seminulum,	Linn.	+	common.	+	very rare.
trigonula, var.,	Lamk.	+	few.		
insignis,	Brady.	+	rare.		
valvularis,	Rss.	+	few.		
gracilis,	d'Orb.	+	rare.		
sp.		+	rare.		
Sigmoilina (Planispirina) celata,	Costa.	+	common.	+	one found.
sp.		+	rare.		
Planispirina contraria,	d'Orb.	+	few.		
Spiroloculina tenuiseptata (?),	Brady.	+	rare.		
tenuis,	Czjz.	+	rare.		
Cornuspira involvens (?) young,	Rss.			+	one found.
involvens,	Rss.	+	rare.	+	few.
foliacea,	Philip.	+	few.	+	few.
striolata,	Brady.	+	fragments.	+	rare.
crassisepta,	Brady.	+	one found.		
coronata,	Costa.	+	few.		
Ophthalmidium inconstans,	Brady.			+	few.
Astrorhiza arenaria,	Norm.	+	comparatively common.		
granulosa (?),	Brady.	+	few.		
sp.,	F. G. P.	+	several.		
Pelosina rotundata,	Brady.	+	common.		
Storthosphæra albida,	Schz.	+	many found.		
sp.,	F. G. P.			+	one found.
Dendraphyra (?) sp.,	F. G. P.	+	few.		
Syringammina fragilissima,	Brady.	+	2 imperfect (?) specimens, many fragments.		
Technitella legumen,	Norm.	+	few.		
Bathysiphon filiformis,	M. Sars.	+	few.		
Psammosphæra fusca,	Schz.	+	four found.	+	rare.
Sorosphæra confusa,	Brady.	+	four found.		
sp.,	F. G. P.	+	few.		
sp.,	F. G. P.	+	few.		
sp.,	F. G. P.	+	few.		
Saccammina sphærica,	M. Sars.	+	few.	+	few irregular forms.
socialis,	Brady.			+	one found.

Species and Varieties.		Warm Area.	Quality.	Cold Area.	Quality.
Jaculella obtusa,	Brady.	+	comparatively common.		
Hyperammina friabilis,	Brady.	+	very rare.		
arborescens,	Norm.	+	a few fragments.		
ramosa,	Brady.	+	many fragments.	+	rare.
elongata,	Brady.	+	many.	+	rare.
vagans (?),	Brady.	+	rare.		
palmiformis,	Pearcey.	+	few.		
Marsipella elongata,	Norm.	+	many.		
cylindrica,	Brady.	+	few.	+	2 or 3 fragments.
Rhabdammina cornuta,	Brady.	+	rare.		
abyssorum,	M. Sars.	+	comparatively common.		
discreta,	Brady.	+	few.		
sp.,	F. G. P.	+	fragments.		
Achemonella catenata,	Norm.	+	one found.		
catenata, var. (?),	F. G. P.	+	few.		
Botellina labyrinthica,	Brady.	+	very rare.	+	fragments.
Reophax fusiformis,	Willm.	+	few.	+	few.
scorpiurus,	Montf.	+	very rare.	+	common and large.
dentaliniformis,	Brady.	+	very rare.	+	very rare.
adunca,	Brady.	+	rare.		
guttifera,	Brady.	+	very rare.	+	few.
sp.,	F. G. P.	+	rare.		
difflugiformis,	Brady.			+	rare.
distans,	Brady.			+	very rare.
sabulosa,	Brady.			+	comparatively cm'n
Haplophragmium agglutinans,	d'Orb.	+	few.		
scitulum,	Brady.	+	few.		
tenuimargo,	Brady.	+	few.		
canariense,	d'Orb.	+	very rare.	+	few.
latidorsatum,	Bomm.			+	few.
mananum (?),	Brady.			+	very rare.
Placopsilina vesicularis,	Brady.	+	rare.	+	very rare.
Haplostiche soldanii,*	Brady.	+	one found.		
Thurammina papillata,	Brady.	+	rare.	+	rare.
compressa,	Brady.	+	very rare.		
Ammodiscus charoides,	J. & P.	+	very rare.		
Trochammina trullissata,	Brady.	+	few.		
squamata,	J. & P.	+	rare.		
Webbina clavata,	J. & P.	+	common.		
hemisphærica,	J. & P.	+	few.	+	one found.
Cyclammina cancellata,	Brady.	+	rare.		
Textularia sagittula,	Defr.	+	few.	+	very rare.
turris,	d'Orb.	+	very rare.		
aspera,	Brady.	+	few.		
trochus,	d'Orb.	+	rare.		
Verneuilina propinqua,	Brady.	+	few.		
pygmæa,	Eggar.	+	rare.	+	few.
Gaudryina pupoides,	d'Orb.	+	few.	+	very rare.
subrotunda,	Schw.	+	few.		
baccata (?),	Schw.	+	few.		
rugosa (?),	d'Orb.			+	very rare.
Valvulina fusca,	Willm.	+	rare.		
Bulimina elegans, var. exilis,	Brady.	+	rare.	+	few.
subteres,	Brady.	+	very rare.	+	few.

*This specimen may have got into this deposit by accident (?).

Species and Varieties.		Warm Area.	Quantity.	Cold Area.	Quantity.
Bulimina marginata,	d'Orb.	+	very rare.		
inflata,	Sequ.	+	rare.	+	rare.
aculeata,	d'Orb.	+	very rare.		
sp.		+	very rare.		
pyrula,	d'Orb.			+	few.
Virgulina schreibersiana,	Czjz.	+	rare.		
squamosa,	d'Orb.	+	rare.		
Bolivina punctata,	d'Orb.	+	few.	+	few.
pygmæa,	Brady.	+	rare.	+	few.
textilarioides,	Rss.	+	rare.		
dilatata,	Rss.	+	rare.		
porrecta,	Brady.	+	very rare.		
ænariensis,	Costa.			+	rare.
Pleurostomella subnodosa,	Costa.	+	very rare.		
Cassidulina lævigata,	d'Orb.	+	very rare.	+	common.
crassa,	d'Orb.	+	very rare.	+	few.
bradyi,	Norm.	+	rare.		
subglobosa (?),	Brady.	+	rare.		
Chilostomella ovoidea,	Rss.	+	rare.	+	very rare.
Lagena orbignyana,	Sequ.	+	rare.	+	few.
fimbriata,	Brady.			+	few.
pulchella,	Brady.			+	rare.
melo,	d'Orb.			+	rare.
gracilis,	Willm.	+	few.	+	rare.
gracilis, var.		+	very rare.		
vulgaris, var. striata,	Willm.			+	rare.
vulgaris,	Willm.			+	rare.
globosa,	Mont.	+	few.	+	few.
sulcata,	W. & J.	+	very rare.	+	few.
apiculata, var.,	Rss.			+	few.
apiculata,	Rss.			+	rare.
lineata, var.,	Willm.			+	very rare.
lineata,	Willm.			+	common.
lævis,	Mont.			+	few
hexagona,	Willm.	+	very rare.	+	very rare.
acuticosta,	Rss.			+	few.
acuticosta, var.,	Rss.			+	few.
striata,	d'Orb.	+	very rare.	+	few.
squamosa,	Mont.	+	few.	+	common.
squamosa, var.				+	one found.
marginata,	W. & B.	+	rare.	+	few.
stelligera (?),	Brady.			+	one found.
lævigata,	Rss.	+	few.	+	common.
hispida,	Rss.	+	rare.		
sp.				+	rare.
lagenoides,	Willm.			+	few.
exsculpta,	Brady.			+	very rare.
ampulla-distoma ?	R. J.			+	very rare.
distoma,	P. & J.	+	rare.		
orbignyana, var. (?)	F. G. P	+	very rare.		
sp.		+	very rare.		
quadricostulata,	Rss. (?)	+	very rare.		
elongata, var. (?)	F. G. P.	+	very rare.		
sp.		+	very rare.		
variata,	Brady.	+	very rare.		
gracillima,	Segu.			+	rare.
Nodosaria rœmeri (?),	Neug.			+	very rare.
rotundata,	Rss.	+	few.	+	very rare.
æqualis,	Rss.	+		+	rare.
lævigata,	d'Orb.	+	several.		

Species and Varieties.		Warm Area.	Quantity.	Cold Area.	Quantity.
Nodosaria communis,	d'Orb.	+	rare.		
pauperata,	d'Orb.			+	rare.
scalaris,	Bats.	+	rare.		
simplex,	Silv.	+	rare.		
soluta,	Rss.	+	common.		
inflexa (?),	Rss.	+	very rare.		
consobrina, var. emaciata,	Rss.	+	rare.		
scalaris, var. separans,	Brady.	+	very rare.		
Marginulina costata,	Bats.			+	very rare.
glabra,	d'Orb.			+	rare.
Vaginulina spinigera,	Brady.	+	few.		
linearis,	Mont.			+	rare.
Cristellaria cultrata,	Mon.	+	comparatively common.		
reniformis,	d'Orb.	+	common.		
reniformis, var.		+	common.		
gibba,	d'Orb.	+	rare.		
sp.		+	one found.		
rotulata,	Lamk.	+	rare.	+	rare.
Amphicoryne falx (?),	J. & P.	+	very rare.		
falx,	J. & P.			+	very rare.
Polymorphina scororia,	Rss.	+	few.		
sp.		+	one found.		
ovata,	d'Orb.	+		+	rare.
sp.				+	very rare.
lactea,	W. & J.	+	rare.	+	rare.
sp.				+	very rare.
Uvigerina pygmæa,	d'Orb.	+	common.	+	few.
angulosa,	Willm.	+	rare.	+	common.
asperula,	Czjz.	+	many.		
Globigerina bulloides (typ. form),	d'Orb.	+	abundant.	+	few.
pachyderma,	Ehrenb.	+	moderately common.	+	common.
dutertrei,	d'Orb.	+	moderately common.	+	very abundant.
inflata,	d'Orb.	+	common.	+	very few.
(Orbulina) universa,	d'Orb.	+	common.	+	very few.
Hastigerina pelagica,	d'Orb.	+	many.		
Pullenia quinqueloba,	Rss.	+	few.	+	few.
sphæroides,	d'Orb.	+	rare.	+	many.
Sphæroidina bulloides,	d'Orb.	+			
Spirillina vivipara,	Ehrenb.	+	very rare.		
tuberculata (?),	Brady.	+	very rare.		
Patellina corrugata,	Willm.			+	rare.
Discorbina vesicularis,	Lamk.			+	common.
sp.		+	very rare.		
Truncatulina lobatula,	W. & J.	+	moderately common.	+	common.
refulgens,	Montf.	+	rare.	+	common, attached to stones.
variabilis,	d'Orb.	+	rare.	+	common, attached to stones.
wuellerstorffi,	Schw.			+	rare.
Anomalina coronata,	P. & J.	+	common.	+	very rare.
polymorpha,	Costa.	+	few.		
ariminensis,	d'Orb.	+	few.		
Rupertia stabilis,	Wall.	+	very rare.	+	common, attached to stones.

Species and Varieties.		Warm Area.	Quantity.	Cold Area.	Quantity.
Pulvinulina canariensis,	d'Orb.	+	comparatively common.	+	very rare and dwf.
menardii,	d'Orb.	+	rare.	+	very rare.
micheliniana,	d'Orb.	+	common.	+	two found.
karsteni (?),	Rss.	+	few.		
sp., probably young of P. canariensis (?).		+	common.		
repanda,	F. & M.	+	rare.		
patagonica,	d'Orb.	+	rare.	+	rare.
Rotalia orbicularis,	d'Orb.			+	very rare.
soldani,	d'Orb.	+	few.	+	very rare.
Nonionina umbilicatula,	Mont.	+	moderately common.	+	common.
turgida,	Willm.	+	few.	+	few.
scapha,	F. & M.			+	common.
stelligera,	d'Orb.	+	rare.	+	rare.
Polystomella striato-punctata,	F. & M.			+	common.
arctica,	P. & J.	+	very rare.	+	very rare.
Operculina ammonoides,	Gron.	+	few.		

Explanation of the Plate

Plate III.

Fig. 1. *Hyperammina palmiformis*, n. sp., enlarged 12 diameters.

2. Basal portion of test, opened to show interior of primordial chamber, enlarged 12 diameters.

3. Portion of chitinous envelope filled with sarcode, enlarged 20 diameters.

4. Portion of the sarcode taken from fig. 3, enlarged 100 diameters.

XV.

NOTES ON THE TURNSTONE, STREPSILAS INTERPRES, *LIN.*

BY WILLIAM CRAIBE ANGUS.

[Read 28th December, 1886.]

THE example of this bird now exhibited is apparently the first to have been reported from the Loch Lomond district, where it was shot on 6th inst. It is an adult male in winter plumage, and was one of three birds killed at a single shot, the other two being immature. Its stomach contained portions of marine shells, identified by Mr. A. Somerville, B.Sc., F.L.S., as those of *Lacuna divaricata* (Fab.) and *Rissoa parva* (Da Costa); also an operculum of a species of *Trochus*—probably *T. cinerarius*, Lin.—and unrecognisable shell fragments.

Although not a very common species, the Turnstone is generally distributed along the East and West Coasts, and seems to be of more frequent occurrence in Scotland and Ireland than in the sister country. I have met with families at the Loch of Strathbeg, in Aberdeenshire; and in Buteshire I have seen it in far larger numbers feeding upon shells and tangle exposed at low water on the margins of the salt-water lochs.

The Turnstone, which may be called the Starling of the shore, is one of the strongest of our smaller wading-birds. It seems to be less shy, and to be fonder of special spots and less inclined to wander about, than the Sandpipers and other birds frequenting the same localities.

When feeding it is generally silent, but when a-wing it utters a loud note to which the neighbouring birds respond in what at times virtually becomes a Babylonic chorus, which is continued till

the Turnstones have again settled. Its piebald plumage and rather pronounced twittering note make it one of the most conspicuous of our shore-birds. Its presence may be calculated upon till about the middle of May, although stragglers, in partial summer dress (probably wounded birds), may occasionally be met with in June and July; and the return of the species may be expected not later than the first week in August. The Turnstone may be said to be the last of the shore-birds to depart and the first to return. It is plump and fat, ranking at table among the daintiest of coast-birds.

Its name is derived from its well-known habit of displacing small stones and debris that shelter sand-jumpers and other crustaceans. This it accomplishes with its beak, which is of great strength, and of a conical form, pointing upward rather than downward.

The narration of a circumstance witnessed by Mr. James Mitchell and myself will serve to illustrate the extraordinary strength of the Turnstone's mandibles, and to show that several birds, working in concert and with a common aim, can accomplish feats which would be beyond the strength of an unaided individual. The scene occurred on the sandy shore opposite the "Black Dog," on the north side of Don-mouth, when Mr. Mitchell and I were returning from the River Ythan, where we had gone in quest of a *rara avis* that had been reported the previous day. It was one of those sunny noons in August that make existence itself a luxury; everything around us seemed bathed in delight; and our thoughts were so elevated that nothing short of the great object of our excursion would have tempted us to fire a shot. The sky was at its unclouded best; the sun was clear and hot; and the whitish breakers that fringed the sea danced miniature rainbows of opalescent hues. The tide had begun to ebb, and we concealed ourselves among the bents, expecting that our prey might turn up with the return of the birds that had been driven from their

feeding-ground by the flow. We had not long enjoyed our sun-bath when a flock of Turnstones alighted so near us that even without the aid of a binocular glass we could distinctly see their movements. The birds gradually focussed themselves upon a dead salmon that was partially embedded in in the sand. They speedily removed the sand from the fish until the tail only remained covered; and those upon the lower side continued digging under the fish, while those upon the upper side kept pressing it upward, till they succeeded in overturning it. The fish fell upon some of the birds that were undermining it. Two, in a rather excited manner, managed to free themselves and escape; and my dog "Clyde," one of the gentlest creatures that ever carried a bird, ran in and caught another that was all but concealed by the fish. "Clyde" was in a playful mood; and having of her own accord secured the bird, she was hardly in a humour to voluntarily give it up. When we had proceeded about half-a-mile homewards, the object of our chase—a Skua, *Stercorarius crepidatus* (Gmel.)—made its appearance; and, with the view of getting the bird to come within range, I ordered "Clyde" to enter the water. She then relaxed her hold of the Turnstone, which flew, apparently uninjured, in the direction of its companions.

XVI.

NOTES ON THE FLORA OF THE ISLAND OF BARRA.

BY ALEX. SOMERVILLE, B.Sc., F.L.S.

[Read 27th December, 1887.]

THROUGH the enterprise of the Highland Fisheries Company, the Outer Hebrides have, during the last two seasons, been brought within easier reach of us, for it is now possible, travelling by Oban, to leave Glasgow at 6 in the morning, cross the Minch by the above Company's steamer, and land on Barra by half-past 8 same evening.

The Outer Hebrides, or "Long Island," as they are collectively called, consist of the series of larger isles, viz., Lewis, with its annexed Harris, North Uist, Benbecula, South Uist, and Barra, with a multitude of islets besides, of every conceivable dimension.

Barra is the most southerly island of consequence. It is oblong in form, 6½ miles in length, with a narrow-necked peninsula to the north which may be said to add two miles more.

I need hardly refer to the importance which Barra has recently acquired as a fishing station. Nature has endowed the island, as Miss Gordon Cumming has said, with one priceless boon in the excellent harbour of Castle Bay, a haven which affords secure anchorage in all conditions of the tide. This bay faces south, and is protected by the island of Vatersay, which, lying across the entrance, acts as a breakwater, the Sound of Vatersay furnishing an outlet to the Atlantic on the west and to the Minch on the east.

Barra has a population of fully 2,000; but during the six weeks from the middle of May till the end of June there is an influx of over 4,000 people,

consisting of the crews of the herring fishing-boats which centre there, and of those occupied on shore with the details of the great harvest of the sea. Further, the erection has just been completed of the factory of Mr. Nordenfeldt's Normal Company, for the working-up of fish-refuse, an industry which, at the Company's Aberdeen branch, has proved of a remunerative character.

The Island of Barra is the most fertile of the Hebrides. Though the Laurentian gneiss of which its rock-formation is composed crops out in all directions, it is emphatically a green isle, having excellent pasturage, and, together with Vatersay, furnishing luxuriant grazing for large numbers of sheep and cattle. As there is but little heather on the higher ground, grouse are scarce, and the island is free from the care of a gamekeeper.

I had the opportunity of being in Barra for a week at the beginning of July last. My object in particular was to have some marine dredging in the Minch, but the weather proved so stormy that only on two days could the intention be carried out. As the period was that of neap-tides, when little shore-work could be done, I decided on paying some attention to the botany of the Island, and on making as complete a catalogue as possible of its vascular plants.

Nowhere in Scotland, perhaps, is there to be found within so small a number of square miles, a greater variety of situation, with corresponding opportunity for a varied flora, than here. The Island may be said to be mountainous, its highest peak, Ben Heaval, attaining an altitude of 1,260 feet; but over its area and around its coast we have all the variety of grassy slope and rocky height, moorland and peat-bog, crofting patch and farm land, precipitous sea-cliff and sandy shore, marshy meadow and weedy loch—woodland and forest alone being conspicuous by their absence.

On the eastern side the crofts descend to the sea,

and the vegetation all about is rank. Here, a little above the shore, *Osmunda regalis* is seen in frequent patches, while *Nymphæa alba* adorns the lochlets and *Littorella lacustris* fringes their margins.

On the north—the seemingly more protected side—are two or three large farms, one held by the family of a brother of the late well-known naturalist, Professor Macgillivray of Aberdeen. The tide recedes here to a considerable distance.

The western exposure is of quite another character, for, excepting at the bold south headland of Doirlinn, which runs out in the teeth of the Atlantic, it consists of a stretch of sandhills and light pastoral land known as "machir land" where the crops are said to ripen a fortnight earlier than in Skye. The soil consists largely of minute fragments of sea-shells, and of the dust of two species of land shells—*Helix ericetorum* and *Bulimus acutus*—which are to be seen alive in myriads among the herbage and grass.

This sandy tract presented in July the appearance of a garden, so richly was it ornamented with such wild flowers as *Papaver dubium* in brightest scarlet, *Lotus corniculatus* in brilliant yellow, *Cakile maritima* in delicate purple, *Erodium cicutarium* in rosy red, *Lycopsis arvensis* in deepest blue, and *Matricaria inodora* in milk-white and gold. These, with many others, were all in abundance, while the elegant foliage of *Thalictrum minus* caught the eye here and there.

Close to the western side, and yet only a mile and a half from Castle Bay, is the Tangusdale Loch whose level is very little above that of the sea. It is more than half surrounded by a sandy shore, and has its surface so sheeted over with the reddish-green leaves of *Potamogeton natans* that from a neighbouring hill-top we seem to look down on a sandbank left bare. In the water, at one side was a belt of *Myriophyllum* of the two species *spicatum*

and *alternifolium*, while *Potamogeton perfoliatus* was also plentiful. In the ditches running up from the loch were fine plants of *Veronica Anagallis*, which species appears to take the place here of *V. Beccabunga* and to be as luxuriant as Mr. Thomas Scott lately found it to be in Coll.

In the marshy flats around, there were growing, more or less plentifully, such plants as *Potentilla Comarum*, *Hippuris vulgaris*, *Menyanthes trifoliata*, *Scirpus Tabernæmontani*, *S. maritimus*, and *Glyceria fluitans*.

Approaching Castle Bay from Tangusdale Loch, we pass through a stretch of wet meadow-land clothed in radiant colouring, the more sober yellows and whites being relieved by the deep-tinged heads of *Orchis latifolia*. These exhibited, in different specimens, greater extremes of purple and brick-red than we remember previously to have seen in plants growing together.

In the rocky knolls at Castle Bay itself it was interesting to find the ripe capsules of the Vernal Squill *(Scilla verna)*; and we were favoured by the Swedish engineer of the Normal Company with pressed specimens, gathered by him in flower some weeks earlier. This plant, though it has a distribution from Cornwall to the Shetland Isles, where Mr. R. Turner found it in plenty, is restricted to particular localities, and is stated in the 8th edition of the *London Catalogue* to have been met with in 26 vice-counties only, our record of it from the Hebrides, however, raising the number to 27.

As we climb the grassy steeps behind the town, where the exposure is towards the south, flowers are abundant in quantity and variety — *Erythræa*, *Plantago*, *Anthyllis*, *Centaurea*, *Linum*, *Thymus*, *Lotus*, *Polygala*, *Daucus*, *Bartsia*, *Rhinanthus*, *Spiræa*, &c.—all, at the time, suffering from the drought of last summer. Among grasses, of which there are many, that which perhaps most readily claims attention is *Kœleria cristata*, growing as plentifully

here as we had found it two years ago on the Island of Eigg.

As we pass upwards, by streamlet and rill, the Bog Pimpernel *(Anagallis tenella)* is in profusion, with here and there *Drosera anglica*, the pale *Pinguicula lusitanica*, and some nine species of *Carex*.

Descending again, over cliffs, where *Avena pubescens* is growing, and through upland wet meadows, we come on a plant new to us, and, as afterwards appeared, to the records of the vice-county as well. It is *Hypericum elodes*, the Marsh St. John's wort, its orbicular amplexicaul leaves forming cup-like receptacles for large globules of rain-water, which imparted to the plant the singular appearance of frosted silver. This species we have just again met with during October in Iona, where also it appears to be a new record for the vice-county (No. 103) to which that island belongs, while Mr. Symington Grieve states to me that he found it growing in abundance in Colonsay, among the Ebudes South.

The cataloguing I was enabled to do resulted in a list of 225 Phanerogamic and 13 Vasculo-cryptogamic plants, in all 238 species, indicating a floral variety of no mean order in what is but a fragment of the "peat floating in the Atlantic," as the Long Island has been humorously styled by the author of *Lewsiana*, Mr. Anderson Smith.

Of the above species, specimens of about 56 (including 2 afterwards got in South Uist) were pressed and brought away. These have been submitted to Mr. Arthur Bennett, F.L.S., of Croydon, our Corresponding Member, who reports that 15 of them are fresh records for vice-county No. 110—a fact showing what a field there is for those who have time and opportunity to visit these outlying regions.

The above 15 plants, named in accordance with

the 8th edition of the *London Catalogue*, are as follows, viz.:

From Barra.

Thalictrum minus, L., (a) maritimum, Syme.
Sagina apetala, L.
Hypericum elodes, Huds.
Hieracium vulgatum, Fr.
Mentha hirsuta, L.
Orchis latifolia L.
Scilla verna, Huds.
Potamogeton natans, L.
Scirpus pauciflorus, Lightf.
Scirpus Tabernæmontani, Gmel.
Scirpus maritimus, L.
Avena pubescens, Huds.
Kœleria cristata, Pers.

From South Uist.

Peplis Portula, L.
Sparganium affine, Schnizl.

XVII.

DREDGING OFF PORTINCROSS, AYRSHIRE.

BY ALEX. SOMERVILLE, B.SC., F.L.S.

[Read 28th February, 1888.]

To one who has had the opportunity of working with the dredge, it is a source of some satisfaction to visit a locality previously untried, or in which it is known that little has been done by others. I do not mean it to be inferred that only in previously undredged localities are marine organisms, interesting from their rarity, likely to be found. Experience proves the contrary, as, for example, in Lamlash Bay, where hardly anyone has worked steadily, even for a few days, without adding to its fauna-record.

As the Society is aware, an exhaustive dredging of the Clyde estuary was conducted in 1885, in the *Medusa*, by our Corresponding Member, Dr. J. R. Henderson, under the superintendence of Dr. John Murray of the *Challenger*. During that season very many parts of the Firth and adjoining lochs, from Kilbrannan Sound and the South of Arran to Loch Long and the Gareloch, were more or less carefully explored, the attention of the expedition being chiefly directed to the crustacea. Except, however, perhaps, in the case of Mr. Frank Coulson, the work of the occasional dredger in the Clyde has, during the last ten years, been mainly carried on in circumscribed areas, such, for instance, as off the Tan Spit (Cumbrae), in and about Rothesay Bay, in the Kyles, in Lamlash Bay, and off Tarbert. We are, in consequence, in possession of lengthy records of species from these selected spots, while of other places less frequented we know but little. It is doubtless the case that, where time for it could be given, systematic work in many of the less-visited localities would

bring to light invertebrate forms previously rare or of unknown occurrence in the Firth.

The waters washing the Ayrshire coast have not, of late at least, received great attention; and it was with this impression that last summer three members of our Society, Mr. D. A. Boyd, Mr. James Steel, and myself, formed the idea of trying the ground lying out from Portincross and due south of the Small Cumbrae—a locality situated in the upper reach of the outer portion of the Firth, and in which the depth, a short distance from the shore, gradually increases from 20 to 50 fathoms. The day of our expedition was 24th August. The dredging apparatus used was that belonging to the Society, and consisted of a 9-lb. dredge, with double cheese-cloth bag, 75 fathoms of 4-strand manilla rope, two sieves fitting into one other, and two iron buckets; while each of us, in addition, had his own receptacles for the gettings of the day. Our craft was an ordinary substantial rowing boat, and we had the presence and assistance of its owner. The day was all that could be desired—calm and not too bright, admitting of operations being carried on uninterruptedly, and without unnecessary fatigue during the hours we were at work. The direction taken was due west from Portincross Castle, and our first hauls were at about a mile from the shore, in 30-fathom water. We then proceeded farther out for half a mile, to a point where the chart indicated 44 fathoms, and here we had three hauls, the dredge working well, and coming up so filled as to tax our powers in lifting it in.

With regard to the bottom in this quarter, though in the chart it is only at 44 fathoms marked "M" meaning mud, the area worked over was entirely of a mud presenting the same appearance at all the points. We had fancied that, at the lesser depth at least, the tidal action here would have caused it to be muddy sand and gravel; but instead, what was brought to the surface was mud of the softest and

most impalpable kind. Never but once, when dredging off the mouth of Loch Broom, Ross-shire, had so little debris remained in the sieves after dipping them at the boat's side. One of our number had brought fine muslin bags in which to wash the dredgings for Ostracoda and Foraminifera; but the impalpable material, which must have been very barren of the minuter forms of life, almost entirely disappeared through the muslin mesh.

Our special object in the expedition was to gain some idea of the Mollusca of the locality. The siftings obtained during the day, which amounted to no more than a few ounces, were roughly examined at the time for the larger forms, and then the material was carefully bagged for after-examination, as it is profitless expenditure of time to attempt the picking out of minute species from wet sieves. The siftings have since been carefully gone over, first by myself, and then by Mr. J. T. Marshall, of Torquay, so that probably nothing has escaped notice. The interest of the day's work may be said to have centred in two species obtained, viz., *Rissoa abyssicola*, Forbes, and *Pleurotoma brachystoma*, Philippi; and I have the authority of Mr. David Robertson, our President, for saying that the former, so far as he is aware, is new to the eastern side of the Firth, and that the latter has not previously been recorded alive from the Clyde. *R. abyssicola* was discovered and named by the late Professor Edward Forbes, who, with Mr. M'Andrew, dredged it in Loch Fyne, where I also met with it last summer in 50 and 75-fathom water. Its habitat is an undisturbed muddy bottom at considerable depth, and I may say that I have taken it in Gairloch and Loch Broom, Ross-shire, in Loch Hourn, and between the Islands of Eigg and Rum, at all which places these conditions prevail. Nowhere, however, have I in one day taken so many examples as here, for, at the two depths, and between good, indifferent, and bad specimens, over 25 in all were obtained. None,

it may be mentioned, were alive, though 2 appeared to have been but recently vacated by the animal. The other species, *P. brachystoma*, named from its small mouth aperture, has a general West-Highland distribution, for I have taken it in various localities from Stornoway Harbour to Loch Killisport in Knapdale. It had not previously been met with alive in our Firth, and its admission into Mr. Alfred Brown's *Mollusca of the Clyde* was on the strength of a dead shell dredged in Rothesay Bay. Another interesting species was *Rissoa vitrea* (Mont.), excluded by Mr. Brown and not included by Dr. Jeffreys as a Clyde form, though Mr. Robertson tells me he has taken it with the dredge between Cumbrae and Largs. Four specimens in all were obtained, and of these one was living.

A feature of the ground of our operations was the large number of immature specimens of three of the bivalves, viz., *Nucula nitida*, G. B. Sow., *N. tenuis* (Mont.), and *Scrobicularia nitida* (Müll.), tiny examples of these occurring in some abundance.

Regarding the day's record of species met with, partly in the sieves and partly by subsequent examination of the dried siftings, I have to report as follows, viz.:

LIMA ELLIPTICA, Jeff.;—one fine live adult.

NUCULA SULCATA, Bronn;—one young live, and valves.

NITIDA, G. B. Sow.;—a few adult; young plentiful.

TENUIS (Mont.);—fairly numerous; young plentiful.

MONTACUTA BIDENTATA, Mont.;—rather common.

AXINUS FLEXUOSUS (Mont.);—several, both adult and young.

CARDIUM MINIMUM, Phil.;—4 young live examples of this rather local species.

SCROBICULARIA NITIDA (Müll.);—some at each haul; young abundant.

SCROBICULARIA ALBA (Wood);—18, half to full-grown, at one haul.

CORBULA GIBBA, Olivi;—a few very young.

PANOPEA PLICATA (Mont.);—valves at each haul; several perfect; none living.

DENTALIUM ENTALIS, L.;—2 or 3 small, living.

RISSOA ABYSSICOLA, Forb.;—some 25 obtained, mostly worn; one or two fresh; none living.

INCONSPICUA, Ald.;—one dead.

VITREA (Mont.);—4 obtained, somewhat encrusted; one living.

TURRITELLA TEREBRA (L.);—several small, living.

var. NIVEA, Jeff.;—one living.

ODOSTOMIA CONOIDEA (Broc.);—one dead and worn.

NATICA ALDERI, Forb.;—several very young, living.

APORRHAIS PES-PELECANI, L.;—one young, living.

PLEUROTOMA BRACHYSTOMA, Phil.;—3, all living.

CYLICHNA NITIDULA, Lov.;—several dead.

CYLINDRACEA (Penn.);—plentiful, living.

BULLA UTRICULUS, Broc.;—one dead.

PHILINE SCABRA (Müll.);—several living.

PUNCTATA (Cl.);—2 dead, but fresh.

The only other objects of interest got during the day were a live example of *Bryssus lyrifer*, Forbes, a deep-water species of heart-urchin, and a number of the foraminifer *Astrorhiza limicola*, Sandahl.

XVIII.

ON PARTHENOGENESIS IN THE HYMENOPTERA.

BY P. CAMERON, F.E.S.

[Read 24th April, 1888.]

In the very excellent book by Mr. F. R. Cheshire on the Honey-Bee (*Bees and Bee-keeping*, vol. i., p. 223), it is stated that if an Italian queen be mated with an ordinary English drone, the workers and queens will partake of hybrid characters, but the drones "will still be absolutely Italian, again showing that, although their mother was impregnated, her impregnation had in no way influenced *their* (*i.e.*, the drones') generation, or that they had, as before, a mother, but no father; so that the eggs whence they had come had in some way escaped fertilisation;"—in other words, that the drones had been produced parthenogenetically.

I am not going to deny that as a general rule the drones with the hive-bee are of parthenogenetic origin, for that fact is placed beyond dispute. What I dispute is that the drones may not sometimes be the result of sexual generation; and I am desirous of pointing out that the rule that the drone-eggs are never fertilised may not be absolute, and does not take the form of an invariable law as the strict upholders of Dzerzon's theory would have us believe. Not only is there no *a priori* reason why this should be so, but there are some facts which go far to prove that drones are not infrequently produced from fertilised eggs.

If in other species of insects it was the invariable rule that only males were produced parthenogenetically, there would then be some reason for concluding on *a priori* grounds that only males could be

produced from unfertilised eggs in the hive-bee; or that if one or the other sex were yielded by unfertilised eggs, that the sex so produced must of necessity be male. As a matter of fact, the phenomena of parthenogenesis in the Hymenoptera (not to go beyond the order to which the bee belongs) are very complicated. There are, in truth, four kinds:—

(First)—Species which only produce males parthenogenetically;

(Second)—Those which yield males and females;

(Third)—Those which have no known males, and consequently are only known in the female sex; and

(Fourth)—Species in which a sexual generation alternates with an unisexual generation.

With facts like these before us, we need not be surprised if it be found that the drones may frequently show signs of having had a father. I have just given an extract from Mr. Cheshire's book to the effect that, if (say) an Italian queen be mated with a black English drone, the drones born from her will be pure Ligurian. It is not clear, however, that this is always the case. In 1867, Mr. John Lowe read a paper before the Entomological Society of London,* in which he gave the results of numerous experiments conducted specially with the object of testing the truth of Dzerzon's theory. These consisted of mating *Apis mellifica*, *A. ligustica*, and *A. fasciata*, in order to find out if drone hybrids would be produced. He found that not only did the workers exhibit traces of their mixed parentage, but that the males were equally affected, bearing unmistakable evidence of having had a father. Mr. Frederick Smith,† who had made a special study of the species of honey-bees, testified that Mr. Lowe's drones bore unmistakable hybrid characters.

Since then, various other workers have recorded

* *Trans. Ent. Soc.* (Third Series), vol. v., pp. 547-560.

† *Proc. Ent. Soc.* 1867, p. xcii.

cases where the drones were hybrid; but it will be sufficient for my purpose if I mention the last I have noticed.

Without knowing anything of Mr. Lowe's researches, Professor Perez, of Bordeaux, a gentleman eminently qualified as our chief authority on European bees, and as an anatomist who has paid special attention to embryology, to offer an opinion on the matter, investigated the subject on similar lines.* An Italian queen, after being mated with a common drone, gave birth not only to workers of mixed characters, but also to drones which partook in various degrees of the characters of the ordinary drones and Italian queen. After having studied very attentively the specific characters of the common and Ligurian forms, he fixed upon what might be regarded as a normal standard of specific distinctness, and grouped out a larger number, 300 drones, accordingly. He found that

151 were Italians
66 were hybrids partaking of the characters of the Italian and common species
83 were of the common *mellifica* form.

Perez next reversed the experiment, that is, he fertilised a common queen by an Italian drone; and he found precisely the same result, viz., that the drones were of a mixed nature, and not all of the Ligurian type, as they ought to have been if the rule that the drones are invariably produced from unfertilised ova had been absolute.

Unless these facts can be explained away, we are, it appears to me, bound to modify Dzerzon's theory—in brief, to admit that the drone-eggs may sometimes be fertilised. I say "sometimes" because I am convinced that the bulk of the drones are of parthenogenetic origin. The mixed drones have been accounted for in two ways:

(First)—That they were bred from workers, that is, workers of three sorts—pure Italian, pure *mellifica*,

* *Bull. de la Soc. d'Agriculture de la Gironde*, 1878 & 1880.

and hybrid. As a matter of fact, there is no proof that three sorts of workers inhabited the hives; and further, we have no evidence that workers lay eggs so commonly as would be necessary to explain so large a number of mixed drones, especially where, as in Perez's experiments, the queen happened to be laying for the first time.

(Second)—It has been suggested that they are cases of atavism—of reversion to the original form. But which is the original form?—*mellifica*, or *ligurica*, or *fasciata*? The dubiousness of this theory becomes apparent when we remember that the same results happen whether an Italian queen be fertilised by a common drone or *vice versa*.

It has also been suggested by Lubbock that the mixed drones were actually produced parthenogenetically, but that the male of a different race may have so influenced the ovary as to affect the purity of the future progeny, just as when (say) a pure mastiff bitch is fertilised by a dog of another breed she ceases afterwards to have pure pups. There may, of course, be some truth in this; but I must confess that I cannot see, with our present knowledge of the modes of generation in insects, why we should pin our faith so strongly to the absolute uniformity of the parthenogenetic mode of reproduction of the drones in the hive-bee. Consider that the queen is not a cast-iron machine: she is a living being, subject to various troubles, and exposed more or less to the varying influences of her surroundings, whether meteorological or connected with the denizens of the hive; and surely it may be concluded that while the general rule is that the male does not fertilise the drone-eggs, yet, from various circumstances, more or less of them may be fertilised from time to time. To my mind that conclusion is more in harmony with the observed facts than any of the reasons I have just mentioned. That there is not invariable uniformity in the process of fertilisation might be proved by the

statement of Von Siebold, that the hermaphrodite bees, which occasionally occur in great abundance in hives, are due to imperfect fertilisation.

It is becoming abundantly evident that the phenomenon of parthenogenesis in the Insecta is much more complex and extended than was formerly believed. Von Siebold,* from his observations on *Polistes*, concluded (1) that the eggs bring with them from the ovary the capacity of differentiating themselves as males; (2) that they have the power of developing themselves, without male influence, into male individuals; (3) that the same eggs can be changed in these properties by the influence of the male sperm elements, and proceed to develop into female individuals.

We now know that the eggs can develop themselves, without male influence, into female individuals, even in species which ordinarily produce males and females after fertilisation. Until recently it was believed that there was no material distinction between parthenogenetic and sexual ova; but the remarkable researches of Weismann have demonstrated the incorrectness of that view. In most eggs there are certain spindle-shaped bodies usually called "polar globules." Before embryonic development can take place, it is essential that at least one of the polar bodies be thrown out. The first body takes away half of the nuclear substance called by Weismann "ovogenetic plasma," which appears to be detrimental to the development of the egg, for it is thrown out from all eggs. If a second globule be extruded, it takes away one-half of the remaining nuclear substance; but this latter part is different from that which was removed with the first polar body, being what Weismann calls "germ-plasma"—the germ-plasma being the principal agent in building up the embryo, and the bearer, as it were, of all the properties, physical or otherwise, which distinguish one animal from another.

**Beitr. zur Parth. der Arthr.*, p. 101.

Now, it is found that if both globules be thrown out no development can take place unless the egg be fertilised, the male sperm taking the place of the germ-plasma removed when the second globule was ejected, so that in this case the egg contains the same amount of germ-plasma as the egg from which only one globule has been thrown out, with the distinction that one-half has been contributed by the male sperm. Weismann discovered that eggs from which only one globule had been removed were parthenogenetic—in other words, the distinction between sexual and parthenogenetic eggs is that the former throw out two polar globules and the latter only one.

But while Weismann's observations are of fundamental importance in throwing light on sex, they do not enable us to comprehend the origin and meaning of parthenogenesis. In the case of the honey-bee, it may be explained by the necessity of economising the spermatozoa. Considering that a queen will lay a million-and-a-half eggs during her life, and that probably not much over four or five million spermatozoa are ejected into her spermatic-sac, the obvious benefit to the hive, if males can be produced without spermatozoa, becomes apparent. In the case of the aphides, I am inclined to believe that natural selection may have been a factor in producing parthenogenesis. A little consideration will show that the aphides maintain their existence entirely by their excessive fecundity; they are merely reproductive machines, their other faculties being to a more or less extent subordinated to reproduction. Certain wasps lay only 50 or 60 eggs; but by a highly-developed nervous system, by their nest-building instincts, by skill, boldness, and courage in finding food for their young, the species is preserved as effectively as the aphis with its unlimited powers of producing millions of young. I have just stated that there are four degrees of parthenogenesis in insects. In a work published six years ago,* I

Mon. Brit. Phyt. Hymen., i., pp. 25-30.

suggested that with insects like saw-flies, complete parthenogenesis—that is, leading to the production of females only—was of greater utility to the species than if males were produced. I pointed out that with species like the Gooseberry Saw-fly, large numbers of males might be born without there being any females with which they could mate; that if only females were produced, the reproductive power of the species was doubled; and further, that in those species where parthenogenesis existed, the males were rarer than usual, some being exceedingly rare, while other species appeared to be completely without males. As regards the first point, the following observation is of interest. In my garden the gooseberry-grub was tolerably common in the early summer last year. In due course numerous males appeared from this first brood; but careful observation, extending over two weeks, failed to reveal a single female, nor did a solitary larva show itself on the bushes, thus proving that the yield of this brood was entirely male. This observation is in harmony with others of a like nature, and tends to prove that parthenogenesis of this kind may be actually injurious to the species, which, if it is to live, must either revert to sexual generation, or get rid of the males entirely, as we know many species have done. But while I pointed out that agamic reproduction was of greater utility to the species than mixed parthenogenesis, yet at the same time I gave reasons for believing that parthenogenetic species had less vigour and vitality, and could not withstand so effectually the attacks of insect or fungoid enemies or climatic variations—in other words, they maintained their existence only by their greater reproductive power. If, on the one hand, we have abundant evidence of a higher development, which may be structural or mental or both, on the other hand there is equal evidence of a retrograde development in organic life. Parthenogenesis, in my opinion, in the case of most insects, must be

regarded as instances of retrograde development. That many species have lost their males is very evident. That, in getting rid of the males, they have lost in bodily vigour, in so far as they have become inert, sluggish, and, in fact, mere reproductive machines, might readily be shown if time permitted.

XIX.

ON THE OCCURRENCE ON BEN LAWERS OF ARENETRA PILOSELLA, *GR., A GENUS OF ICHNEUMONIDÆ NEW TO THE BRITISH FAUNA.*

BY P. CAMERON, F.E.S.

[Read 24th April, 1888.]

Last Easter Sunday (10th April) I went up Ben Lawers, and found in the centre of a large belt of snow, at an elevation of at least 2,500 feet, an ichneumon which was new to me. On examination I find it to be *Arenetra pilosella*, Gravenhorst. Gravenhorst describes it as *Tryphon pilosellus* from a single specimen he had received from Austria (*Ichn. Europ.* ii., 127, 73). The relationship of the species to the *Pimplides*, rather than to the *Tryphonides*, was pointed out by Holmgren, who formed a new genus for its reception, and described both sexes. Named first *Lasiops* (*Act. Holm.*, 1854, 69, 1), that name was discarded as it had been already used, and *Arenetra* was substituted (*Consp. Gen. Pimpl. Suec.*, 128). Unaware, apparently, of Holmgren's work, Giraud (*Ann. Soc. Ent. Fr.*, 1872, p. 412) referred *A. pilosella* to *Phytodietus*, and gave a description of the female.

The species, apparently, is rare, but its rarity may be more apparent than real, as, unlike other Hymenoptera, it is found very early in the year. Giraud found his specimens near Vienna, between the 26th of February and the 6th of March in one year, and on 7th April on another, the temperature being low. In Finland, Woldstedt collected it on 26-27 April. The localities from which it has been recorded are Austria, Finland, and Scandinavia. The genus is placed by Holmgren between *Schizopyga* and *Lampronota*, and Foerster relegates it to his "family" *Banchoidae*. I may state that the other species known of *Arenetra* (*A. tomentosa*, Gr.) was described by Gravenhorst as a *Banchus*. Both species have the body densely pilose.

XX.

ON A MONSTROSITY OF THE COMMON EARTHWORM, LUMBRICUS TERRESTRIS, *L.*

BY R. BROOM, B.SC. GLASGOW UNIVERSITY.

[Read 24th April, 1888.]

Some years ago I had the good fortune to pick up an earthworm which showed a rather interesting abnormality. I put it in spirit at the time, and it is only recently that I have made a careful examination of it. The whole length of the worm is about 4 inches; and at a distance of $3\frac{1}{4}$ inches from the mouth the body divides into two slightly unequal parts, each of which is furnished with a perfect anus. The longer of the two parts, which measures 8 lines, lies as nearly as may be in the same axis as the rest of the body; while the shorter, measuring about 5 lines, projects out on the left side almost at right angles to the main axis of the body.

In front the worm is perfectly normal, the clitellum occupying the 29th to the 35th segments as usual. Nothing abnormal is to be observed till the 120th segment is passed, when it will be seen that the 121st and 122nd segments are shortened, as are also the two following. On the right side the 122nd is joined in the normal way to the 123rd; but on the left side these two segments are, as it were, pushed apart, and the first segment of the shorter of the two posterior divisions is fixed in between them, so that this segment is joined in front to the displaced part of the 122nd segment and behind to part of the 123rd. Beyond the 122nd segment, the point where the body divides into the two posterior parts, there are 36 segments in the longer—that is, in the one which lies in the same axis as the front part of the body—and 22 in the shorter. It will

thus be seen that from the mouth to the one anus there are 158 segments, and from the mouth to the other, 144. Now, in the common earthworm there are normally about 140 segments, so that not only has there been increased activity in producing two posteriors instead of one, but there has also been an increase in the length of each of the two parts.

In order to attempt an explanation of such a monstrosity, it is necessary to look at the condition in the early stages of development. Balfour, in his *Comparative Embryology*, vol. i., p. 266, as the result of Kowalevsky's investigations on *Lumbricus agricola*, says, referring to the formation of the gastrula from the flattened blastosphere: "An invagination takes place, in the course of which the hypoblast becomes enclosed in the epiblast and a somewhat cylindrical two-layered gastrula is formed. The opening in this gastrula at first extends over the whole of what becomes the ventral surface of the future worm, but gradually narrows to a small pore—the permanent mouth—near the end." The gastrula elongates, an anus is formed, and after some further development we get the perfect worm.

Whilst this is the course of the early development of *Lumbricus agricola*, Kleinenberg* has shown that a different and very peculiar state of affairs exists in *Lumbricus trapezoides*, Dugès, which throws a considerable amount of light on double monsters. He has shown that in this worm two complete individuals are normally developed from one ovum. At a very early period, he states, it may be observed that the blastosphere is composed of two more or less distinct hemispheres. On the ventral surface a transverse furrow is formed, "the endoderm becomes invaginated, beginning at the lateral margins of the furrow in both the hemispheres, which are thus transformed into sacs with double walls. . . . Each of the lateral cavities will form the digestive cavity of an individual, their

* "The Development of the Earthworm, *Lumbricus trapezoides*, Dugès." Kleinenberg, *Quart. Journ. Micro. Sc.*, vol. xix. (1879), p. 206.

openings into the common groove will each become a mouth, and the single egg will thus produce two worms." The two worms remain for some time connected by their necks, but the connecting band gradually becomes weaker and ultimately breaks, leaving the two worms perfectly distinct. Although this is the normal progress of events in *Lumbricus trapezoides*, Kleinenberg points out that frequently the uniting cord does not relax in time to be able to be broken, or is too greatly developed, and thus numerous monstrosities occur; but as these have always two mouths well separated, as well as two ani, it will be seen that it will be quite impossible for them to live.

In the monstrosity of the common earthworm which I have described, I consider it most probable that during the early gastrula or blastosphere stage a division has taken place in the posterior part closely resembling that which gives rise to two complete individuals from the ovum of *L. trapezoides*, and that, as development has gone on, the two posterior parts have lengthened, become segmented, and each developed an anus. The resemblance is further borne out by the fact that the two posterior parts are attached by their sides, the ventral surface of each part being continuous with that of the front part of the body. This also holds good for other specimens that I have been able to get descriptions of.

In the catalogue of the teratological specimens in the Museum of the Royal College of Surgeons, published in 1872, prep. No. 20 is marked: "An earthworm with the posterior third of the body symmetrically double. Presented by W. Clift, Esq., 1810." On inquiring concerning this specimen, Prof. Charles Stewart, Conservator of the Museum, kindly writes informing me that in it "the abnormal ends are united by their sides: in other words, the condition is as if the worm had been divided by a mid-dorso-ventral plane." He further says that in

another specimen lately received from Prof. Bell the right division is rather less than half the length of the left. Prof. Bell has recently called attention to two other specimens exhibiting a similar condition.* In one of these the division took place about the union of the middle with the posterior third, and the left branch was slightly shorter than the right. He tried to keep this specimen alive; but after some time the left branch became less active, and ultimately both branches dropped off and the worm died. The other specimen which came under his notice was one of *Lumbricus fœtidus*, but unfortunately he was unable to describe it owing to its imperfect preservation. The only other case of the kind I have seen recorded is that of a worm described by Mr. C. Robertson,† and now in the University Museum, Oxford. In it the division takes place at the 85th ring, and the two hinder parts are equal and each is furnished with an anus. I think it better not to say anything of the remarkable little double worm recently found in New Zealand,‡ till a fuller description has been published.

Although in some of the above cases the posterior parts are unequal, it is probable that they were equal at an early stage, but for some reason or other developed unequally, as is known to be the case frequently in double monsters of the higher animals.

In conclusion, I may say that I consider that the division which has taken place in these abnormal cases represents that which occurs normally in *Lumbricus trapezoides*, and is probably an attempted reversion to an ancestral mode of development which is handed down in *L. trapezoides*. It may be that double monsters in the vertebrates are to be accounted for in a somewhat similar manner.

* "Notice of two Lumbrici with bifid hinder ends." By Prof. Jeffrey Bell. *Ann. Mag. Nat. Hist.* (5), vol. xvi. (1885), p. 475.

† "Note on a Double Earthworm, *Lumbricus terrestris*." By C. Robertson. *Quart. Journ. Micro. Sc.*, vol. vii. (1867), p. 157.

‡ "Note on a curious Double Worm." By T. W. Kirk. *Trans. New Zealand Inst.*, vol. xix. (1886), p. 64.

XXI.

BOTANICAL NOTES FROM WIGTOWNSHIRE AND KIRKCUDBRIGHTSHIRE.

BY JAMES M'ANDREW.

[Read 23rd March, 1888.]

Wigtownshire.

Last year I gave the Society a few notes on the Flora of Portpatrick and of Wigtownshire in general. As I spent a fortnight at Port-William, on the east shore of the Bay of Luce, in July, 1887, perhaps a continuation of these notes may prove of some interest as illustrating the Flora of Wigtownshire, so little known as regards its Flora before 1883, when Mr. G. C. Druce gave his list of Wigtownshire plants in the *Report of the Botanical Record Club.*

North and south of Port-William the coast is shingly and backed by ancient sea-cliffs. The only sandy bay of any size is Monreith Bay, two miles south of Port-William. Along the sea-coast of the Machars—the eastern peninsula of Wigtownshire—is some good arable land; but the interior and the north consist, in a great measure, of rather unprofitable and partially-drained boggy and marshy land, interspersed with numerous fresh-water lochs. Here the vegetation is uninteresting, consisting only of the commonest moor, marsh, and bog plants and mosses. Even *Juncus squarrosus* is rare, and the *Carices* are few and of the commoner species. On the arable land are found the common weeds of cultivation. As the highest hills are scarcely 1,000 feet, Wigtownshire is almost destitute of alpine and even of sub-alpine plants—*Galium boreale*, washed down by the River Cree, being almost the

only species. It must be to its extensive and varied seaboard that Wigtownshire must depend for its list of plants.

In addition to the plants new to Wigtownshire from Portpatrick, as given in my former paper, I now add the following from the neighbourhood of Port-William, also new records for the county:

(1) *Carex punctata*, at Craigs of Garchew. The only other Scottish station I know for this sedge is in Colvend, Kirkcudbrightshire.

(2) *Carex paludosa*, at Monreith Lake, where also grow in abundance *Lycopus europæus*, *Scirpus lacustris*, etc.

(3) *Sagina apetala*, on the roadsides about Port-William.

(4) *Astragalus glycyphyllos*, about four miles north of Port-William.

(5) *Chærophyllum temulentum*, east of Port-William.

(6) *Lysimachia vulgaris*, at Mochrum Loch.

(7) *Typha latifolia*, at Monreith Lake.

(8) *Scolopendrium vulgare*, about Monreith.

(9) *Ammophila arenaria*, and along with it *Carex arenaria*, north of Port-William.

(10) *Blysmus rufus*, in several places along the shore.

Along the shore, north of Port-William, I gathered such plants as *Torilis nodosa*; *Senebiera Coronopus*; *Malva moschata*; prostrate, dwarf, condensed forms of *Vicia sylvatica* and *Prunus spinosa*; *Carduus tenuiflorus*; *Glaucium luteum*; *Juncus Gerardi*; *J. maritimus*; *Euphorbia paralias*, which I also found, in 1886, at Morroch Bay, south of Portpatrick: *Scutellaria minor* and *Hypericum elodes*, found in damp places between Glenluce and Port-William; *Fumaria Borœi*; *Cakile maritima*; *Œnanthe Lachenalii*; *Mertensia maritima*; *Beta maritima*; and *Asplenium marinum* at Craigs of Garchew. North of Port-William I noticed a field almost covered with *Daucus Carota*, and another field had an abundance of *Lycopsis arvensis*. South of Port-William grow

Crambe maritima in fruit; *Honckenya peploides: Rubus cæsius; Equisetum maximum; Inula dysenterica: Carlina vulgaris: Verbascum Thapsus: Glaux maritima: Samolus Valerandi; Juncus glaucus: Orchis latifolia* and *Scilla verna.* At Monreith Bay and Lag Point there was a profuse display of such plants as *Convolvulus Soldanella: Ononis arvensis: Erodium cicutarium,* with occasional plants of *Erodium maritimum; Eryngium maritimum:* and *Galium littorale. Salsola Kali,* at Lag Point, was like a field of young whins. The woods at Monreith have a superabundant growth of *Lychnis diurna* and *Urtica dioica,* with occasional tall plants of *Conium maculatum.* I saw *Helianthemum vulgare* only twice. Mr. Druce mentions that *Habenaria chlorantha* was present to the exclusion of *Habenaria bifolia:* but as the season was late I could not verify this statement. *Osmunda regalis,* once common in some parts of Wigtownshire, is not yet extinct. I saw half-a-dozen seedling plants in the area of a few square yards.

The county is very bare of mosses, hepaticæ, and lichens. The most conspicuous new lichen I gathered was *Ramalina evernioides,* which grew in plenty on trees at Kirkmaiden churchyard, south of Monreith Bay.

The following plants recorded from Wigtownshire have not as yet been seen in the neighbouring county of Kirkcudbright: *Sagina maritima, Spergularia neglecta, Erodium maritimum, Carduus tenuiflorus, Bartsia viscosa, Thymus Chamædrys, Lamium intermedium, Euphorbia paralias, Equisetum maximum,* Isolepis Savii,* and *Torilis nodosa.* On the other hand, about 70 plants of Kirkcudbrightshire have not yet been found in Wigtownshire. Wigtownshire requires further work to make its list of flowering plants more complete, but from the paucity of workers this will require time.

KIRKCUDBRIGHTSHIRE.

Last September I gathered at West Risk, three-quarters of a mile from New Galloway, a *Juncus* which

* Since found south of Creetown, in July, 1888.

I could not determine. I sent it to Mr. Arthur Bennett, F.L.S., Croydon, who pronounced it to be *Juncus tenuis*, one of the late Mr. George Don's reputed discoveries. Having been found a few years ago in Herefordshire, it was re-admitted into the British Flora in the latest edition of Hooker's *Student's Flora*. The plant was growing in fair quantity at the roadside among grass and *Juncus squarrosus*, etc., about sixty yards from West Risk House. On the continent it grows in similar situations. The road is not much used, and the plants grew on the *water-table*, which had not been cleaned by the roadman for the past ten years. I cannot make up my mind as to its indigeneity, nor can I conjecture how the plant could have come there.

Among some plants sent to Mr. Bennett about the same time was *Rhynchospora fusca*, which the Rev. George M'Conachie, of Rerwick, and myself gathered in Auchencairn Moss, close to the Solway Firth, in 1882. This is the farthest north station in the British Islands for this plant, and its first record for Scotland. It has been reported from Yorkshire, but not confirmed. It is even rare in some of the counties round the Bristol Channel, where it is generally found.

XXII.

JOTTINGS FROM MY NOTE-BOOK.

BY DAVID ROBERTSON, F.L.S., F.G.S.

On the local distribution of Pennatula phosphorea, *Lin.*, Virgularia mirabilis, *Lam.*, and Pavonaria quadrangularis, *Pall.*

[Read 7th June, 1887.]

It scarcely need be said that some marine animals frequent particular portions of the sea-bottom where certain conditions prevail—as sand, gravel, and mud—while others seek the weedy shores both above and below low-water. Although the known habitat of an animal may be mud, it does not necessarily follow that the species will be found generally distributed over the whole mud area of the district. Some species are crowded together on particular spots; yet this may not always arise from the gregarious habits or social associations of the animals, but from other physical conditions. Some may have a great power of multiplying their kind, with little power of moving from one place to another; and when the place proves favourable for their healthy development, they seem to want the will or the power to wander from it. The habitat of the animals that I now bring under your notice is in mud, but they do not seem to have much (if any) power of locomotion. In early stages they may, like many others, have the power of floating away with the currents; but this power does not appear to manifest itself to any great extent in the case of these under consideration.

During the present spring, when a haul of the dredge was being taken by the yacht *Medusa* (of

the Granton Marine Station) four miles south-east from Davaar Island, off Campbeltown, *Pennatula phosphorea*, Lin., was brought up in great abundance from the muddy bottom. The dredgings of this yacht in the Firth of Clyde have been extensive; but this is the only place, over the whole area, where this species was met with.

Virgularia mirabilis, Lam., is less restricted in its distribution in the Clyde. It has been taken in the Gareloch by the late Mr. James Smith of Jordanhill; I have occasionally obtained it in Row Bay; and it has been dredged by the *Medusa* in Loch Ranza, and in Loch Striven, off Inveruga, in 30 fathoms, bottom soft mud. As is usually the case, nearly all the specimens that came up were folded across the blade of the dredge, and those contained in the dredge itself were very few in number and of small size. This confirms the recorded statement that one portion of the animal is inserted in the mud and the other portion extended above it, but how much is kept above or below cannot be easily ascertained. Although they were brought up mostly folded over the lip of the dredge, yet it would be difficult to determine with certainty whether the dredge had been working on the surface of the mud or at some depth beneath, or whether the dredge may not have slipped so far over the animals before they were caught by the blade.

Pavonaria quadrangularis, Pall., has not, so far as I can learn, been taken in the Firth of Clyde, but has on various occasions been obtained in the neighbourhood of Oban. This year, during the month of March, large numbers of them were dredged by the *Medusa* off Lismore Lighthouse, in 10 to 12 fathoms, mud; and off Kerrara, on the opposite side.

The Pike, *Esox lucius*, Lin.

[Read 16th August, 1887.]

This fish has long held a prominent reputation for its gastronomic capacity. It is said that its appetite

is insatiable, and that nothing comes amiss to it. Day, in his *British Fishes*, says that it will not refuse a frog, a rat, a plump puppy, a tender kitten, a duck, or a goose. Dr. Ienzek credited it with making a meal of a fox; while Dr. Crull, in his *Present State of Muscovy*, states that one of these fishes had an infant child in its stomach. It is said of the female that when she has received the service of the male she turns round and swallows him. The poet, too, has established in the minds of the people the bloodthirsty propensities of the "ruthless pike, intent on war," and his savage appearance, which no one can doubt, goes far to confirm all that has been said of him.

According to tradition, this tyrant has a long reign of terror. "A pike that died about fifty years ago in Russia dated its birth back to the good old age, to the fifteenth century, so, considering that it was born in 1450 and expired in 1830, it must have lived 380 years. But, as the old proverbs say, 'get the name of early rising and you may lie in bed all day.' When one good story is accepted it becomes a guarantee for those that may follow. There can be no doubt that many of the statements regarding the doings of the pike have to be taken with considerable allowance. If we again go back to tradition, it is stated how Frederick II., in October, 1230, inserted a brass ring into the gills of the pike, bearing a suitable inscription, and this fish was recaptured 267 years subsequently, 17 or 19 feet long and weighing 550 lbs. The skeleton was preserved in the Cathedral at Mannheim; but being examined by a German naturalist it was found that the length of its vertebral column was obtained by using the bones of several fish."

There are other reasons, however, that tend to modify some of the statements regarding the pike. Last June, while on a short sojourn at Loch Lomond, I had, through the kindness of Mr. Alfred Brown, an opportunity of examining some of these fish. In

one, measuring 21 inches, I found the stomach quite empty, with the exception of a little mucus and soft matter in the lower intestine. The stomach was long and narrow, a continuation of the gullet, 8 inches long, which joined the intestine by a narrow constriction, and turned upward for 5 inches till it reached within 3 inches of the throat. This convolution occupied a space about midway between the mouth and the anus. It again turned downward, reaching the vent at a distance of 8 inches, thus making the length of stomach and intestines about equal to that of the whole fish.

Another pike (length 29 inches, weight over 5 lbs.) was found to contain in its stomach a powan, *Coregonus clupeoides*, Lacep. The head was at the bottom of the stomach, and the tail, or caudal fins, were seen in the throat of the pike. I was informed by the fishermen that this was not an unusual occurrence. The powan seemed just to fill the stomach. When taken out, the head was found to be almost completely dissolved; the body was less and less affected as it neared the mouth of the pike; and for fully 2 inches, the tail (exclusive of the caudal fin) was free from the slightest marks of digestion.

It therefore appears that the active digestive power resides at the bottom of the stomach, which we may assume is equivalent to a small digestive organ; and it seems very doubtful that the pike can be such an insatiable glutton as he has been represented. He may like a good meal when he can get it, but he must have time to dispose of it before he can be ready for another, and judging from the comparatively small means at his disposal, he may require longer time than most of his brethren of less notoriety. For all the great gormandizing that he has done, or has been supposed to do, he is never represented with that rotundity consequent on an overloaded stomach, neither does the conformation of the body, stomach, or intestines, admit of such.

Isocardia cor, *Lin.*

[Read 16th August, 1887.]

This mollusc has been considered a doubtful inhabitant of the Firth of Clyde. In the dredgings of the yacht *Medusa*, fragments of *Isocardia* are often met with. On one occasion two valves, still connected by their ligament, were taken off the Holy Isle, Arran, by Dr. J. R. Henderson, Madras; but not till the 25th of last month were two taken in one haul, and three in another, in the same yacht, at a depth of from 90 to 98 fathoms between Cumbrae Lighthouse and Brodick Bay, bottom soft mud. One of the two shells obtained together is an adult, and the other a little smaller; both are of a dark-brown colour, approaching to black at the sides. The largest of the other three is about an inch in diameter, and the smallest about the size of a pea; all are of a yellowish-white colour, the largest having an irregular thin dash of reddish-brown along the anterior sides. Jeffreys states the habitat of this species to be "muddy ground in 4 to 40 fathoms," and Forbes "at a depth of 15 fathoms, and dead shells off Skye in 40 fathoms." I have one in my collection taken off the Mull of Galloway in 140 fathoms.

It is a curious fact that all the valves that were obtained in the Firth of Clyde, with the exception of the two taken together off the Holy Isle, were fragmentary and quite white, with no marks of attrition. How they were so broken in soft mud it is difficult to conjecture. If the catfish (*Anarrhicas lupus*, Lin.) had been an inhabitant of the Firth of Clyde (as it is not, so far as I know), it might have been suspected of damaging the shells, as its food consists chiefly of mollusca, which its strong teeth are well suited for crushing. In the absence of these fish, however, we must look to some other cause for the broken shells.

Hyas araneus, *Lin.*

[Read 27th December, 1887.]

This crab is not uncommon in the Firth of Clyde from low-water to 20 or 30 fathoms, mostly on a hard or gravelly bottom, and generally covered more or less with sea-weed and other organisms. There is a common belief that these organisms get attached to the crab by chance—a view favoured by the fact that the plants appear on the animal in their natural position;—and when we consider the multitude of spores floating in the sea and settling down to grow where they find suitable conditions for their development, it is plausible enough to think that the crabs may get their false covering in that way. There can, however, be no doubt that several of the crab family attach foreign matter to their carapace and limbs, and there seems to be as little doubt that this is done for a means of concealment from their enemies; but whether all the foreign matter found on the crabs is so placed through the intelligence of the animals cannot so certainly be determined. *Balani* and *Serpulæ* are often the prevailing extraneous organisms, especially on *Hyas araneus*, but we cannot well believe that they were placed there by the crab, as they cannot (if we may use the term) be transplanted; yet, as we shall see, the crab can, with its flexible limbs, pluck the weeds off all parts of its body, and it might therefore arrest the growth of the parasites if so inclined. It is accordingly just possible that these parasites may be tolerated by the crab from useful motives, viz., that they may settle down and grow, and so afford a means of protection similar to that secured by animals which assume the colour of the plants among which they harbour—*e.g.*, *Hippolyte varians*, Leach, that is found green among green *Zostera* and brown among brown *Halidrys*. As these *Balani* and *Serpulæ* are chiefly on the crab when located on hard or stony ground, it will in this garb simulate the stones and gravel among which it lurks, and possess a means of con-

cealment similar to that furnished by a coat of sea-weed. Old individuals of *Hyas araneus*, and some of its allies, are often so loaded with *Balani* and *Serpulæ* on their head, body, and legs, that their movements must be greatly impeded. In this state their eyes are frequently so built up with these organisms that only a small loophole is left to see through, yet these sight-openings are seldom closed up altogether. A question is here suggested: Does the crab maintain the openings for the eyes, or does the *Serpula* respect the wants of the crab?

In deep water, where the bottom consists of soft mud, this crab in most cases is free from parasitic adornment. Although under other circumstances it seems to encourage such vestments, the cause here may be that as the colour of the crab is so much like that of the mud, the resemblance affords a sufficient means of protection.

Many others of the crab family, inhabiting different parts of the sea-bottom, are altogether free from any such mask or false clothing. Among such are the *Portunidæ*, with whose swift-swimming habits so great an encumbrance would be incompatible. On the other hand, while so slow-moving a recluse as the common *Cancer pagurus*, Lin., could not feel much inconvenience from a little load on his back, on most occasions he enjoys the immunity of bearing a clean coat. It would therefore appear that these associations depend as much on the condition or peculiarity of the crab as on the choice of the parasite. The young *Hyas araneus*, up to about $1\frac{1}{2}$ inch in length, looks as if covered with a natural growth, but on closer examination this is found to be made up of small bits of sea-weed closely packed together. In others further advanced in size, the plants are larger and have a more ragged appearance, and sometimes grains of sand are thickly agglutinated to the carapace. The adult is often so covered with algæ, sponges, hydrozoa, &c., as to have a most grotesque appearance; but on the weedy bottom its presence must be difficult to detect.

One of this species, which was put into a shallow vessel with sea-water, had its body and legs covered with sea-weed of various kinds. Shortly after it had settled down it began to pluck off the plants and by next day the larger pieces were well cleared away. On the following morning I was surprised to find that all the plants which had been taken off on the previous night were again replaced, together with others which the crab had picked up in the vessel. Some were attached by the ends, as if growing; others were laid across and attached by the middle; and all were so firmly fixed that the animal could be gently drawn by them round the vessel. By whatever means the attachment had been effected, we cannot suppose that the plants took root and held fast on the animal in so short a time—some adhering by one part and others by another. We may therefore venture to say that the sea-weeds are placed in position by the crab, and held there by some adhesive matter secreted by the animal itself.

STENORHYNCHUS LONGIROSTRIS, *Fabr.*

[Read 27th December, 1887.]

Stenorhynchus rostratus, Lin., was not uncommon off the shores of Cumbrae about twenty years ago, but is now in a great measure replaced by *Stenorhynchus longirostris*, Fabr., which is generally found on a stony or gravelly bottom. I cannot say that I ever found it in pure mud.

The great length and thinness of the limbs of this animal readily suggest the idea of feeble action, members so thin and flexible seeming ill-adapted either for encounter or flight; and when there is taken into account the crop of algæ generally attached to the legs and other parts of the body, it is difficult to consider the crab to be much more than a fixture. On watching its movements for a short time, however, my ideas of its powers were somewhat modified by finding it to be very buoyant and well able to float with great ease. It seems to

hover lightly over the bottom, raising itself up by the slightest touches of its slender toes. When ascending, the limbs tread with the most graceful uniformity, and are endowed with an almost universal power of motion which enables them to be directed to the various parts of the body with the greatest precision.

Although the fore-arms, like those of carnivorous members of this family, are used for grasping, I have some doubt whether this species is carnivorous. I have tried it with a morsel of shell-fish tied to the end of a stick, but this it always rejected. I offered the same to *Portunus pusillus*, Leach, which greedily laid hold of it and held so fast that I towed it round the vessel, while it tugged and resisted like a bull-dog, allowing itself to be lifted some height out of the water before it let go its hold. I have often seen *Stenorhynchus* picking about its limbs (particularly the second pair, which are generally most invested with sea-weed), and conveying the produce to its mouth. At first I was inclined to think that it must be obtaining small organisms; but after observing that the detachment of the particles often required considerable force, I watched more closely and was satisfied that the plants were being cropped and conveyed to its mouth. I have watched the behaviour of the crab for some little time daily for weeks together, and still found it carrying vegetable matter to its mouth. If other observations confirm the view that this animal is a true vegetarian, we shall have one example at least of an independent agriculturist who is not only superior of his lands, but carries them with him when he removes.

This crab, as already stated, appears to be ill-adapted for warfare, yet I believe it to be one of the most wanton and cruel of its kind. I have seen it seize a small-sized individual of its own species—not to devour it, but in the most reckless way to commence to tear off its limbs. After being left for a

time to feel its helplessness, the victim was again seized by the beak, which was twisted in the most unmerciful manner; and its remaining limbs were taken hold of and wrenched in every direction until torn off. When no other limbs were left to be torn asunder, the denuded and lifeless trunk was dashed in the most savage manner.

On some differences between the Marine Faunas of the Firth of Clyde and Firth of Forth.

[Read 28th February, 1888.]

Through the kindness of Dr. John Murray, Director of the *Challenger* Expedition, I had lately the opportunity of examining some amphipods from the Firth of Forth. As these gatherings were few in number, and all taken about the same time and in one locality, they cannot show much, but may indicate what may be expected by further search. I may be best able clearly to show the result by giving a list of the species taken by one haul of the tow-net attached to the beam of a trawl, at a depth of 41 fathoms, 35 miles east of May Island, Firth of Forth, on 11th November, 1887. Taking them in the order of abundance, we have:

Parathemisto oblivia, Kroyer.—Very common.

Anonyx gulosus, Kroyer (=*A. Holbölli*, Bate).—Common and large.

Imphimedia obesa, Rathke.—Moderately common.

Bathyporeia Robertsoni, Bate and Westwood (=*B. pilosa*, Lindström, ♂).—A few.

Tryphosa longipes, Bate.—A few.

Monoculodes affinis, Bruzelius (=*M. carinatus*, Bate).—A few.

Halirages bispinosa, Bate.—Three.

Ampelisca tenuicornis, Lilljeborg.—Two.

Ampelisca Gaimardi, Bate (not Kroyer).—Two.

Kroyera altamarina, Bate and Westwood.—Two.

Orchomene serrata, Bate (not Kroyer).—One.

Halimedon Mülleri, Boeck.—One.

Metopa gregaria, G. O. Sars.—One.

Leaving out of account one or two imperfect and doubtful specimens, we have twelve genera and thirteen species represented.

I may remark that in all the tow-netting I have had the privilege of seeing in the yacht *Medusa* during two or three seasons, I do not remember of noticing an amphipod taken in the tow-net in the Firth of Clyde at a greater depth than a fathom or two under the surface. *Parathemisto oblivia*, as stated, is abundant in the Firth of Forth; in the above haul there were taken over 100 of that species, and in other hauls at various depths they were more or less abundant. In the Firth of Clyde I have only met with it at Sanda Bay, near the Mull of Kintyre, where a single specimen was obtained in a gathering by the surface-net after sunset. *Anonyx gulosus* and *Iphimedia obesa* also appear to be much more plentiful than in the Firth of Clyde, where the latter species is seldom if ever taken in the tow-net. *Ampelisca Gaimardi* is larger than I have seen it in the Firth of Clyde. *Halimedon Müllerí* is recorded in the Rev. Canon Norman's *Museum Normanianum*, but not in Bate and Westwood's *History of British Sessile-eyed Crustacea*. *Metopa gregaria* is new to Britain.

Remembering that in this result there is taken into account only one group obtained in one haul, I am doubtful if as many different species of amphipods (thirteen in number, representing twelve genera) were ever taken at one haul in the Firth of Clyde, either by the dredge or tow-net. We are therefore led to believe that that class of invertebrates is more abundant on the East Coast than on the West (at least within the limits mentioned), and their generally larger size seems to indicate a more northern character than on the West. This view is to some extent borne out by the fact that many of the post-tertiary fossils on the East Coast are of a more arctic character than those found on the West, and the same may be said both of the fishes and the sea-birds.

XXIII.

THE CADZOW HERD OF WHITE CATTLE.

BY ROBERT TURNER.

[Read 24th April, 1888.]

Among the living antiquities of Clydesdale, the old oaks and the herd of white cattle associated at Cadzow take the first place. The trees, in massiveness and stubborn hardihood of aspect, stand grim-set veterans from a wind-and-weather warfare of centuries; and they have an interest beyond as relics of the primeval forest. The cattle are attractive not only from their habits and curious beauty, but because the herd—amid gathering legend and tradition—appears to have had a browsing hold there, with an occasional break from the Middle Ages at least. Direct descent from the mighty Urus of prehistoric Britain has even been claimed for them, not without some facts in support.

Interested for many years in the herd and its obscure history, I had the pleasure in September, 1886, of conducting an excursion of the Society to the forest, when the members had an opportunity of seeing the cattle and of comparing the Cadzow bulls with the Chillingham one that had lately arrived. I then promised to prepare a paper on the subject of the herd, and now—after a lapse of time longer than I anticipated—I submit to you what I have gathered together.

This is not the first occasion on which the subject has come before the Society. In 1863, Dr. Dewar exhibited a head of one of them as of the species *Urus scoticus*, Smith; and the late Mr. Edward R. Alston, in the *Fauna of Scotland*, article "Mammalia," published by the Society in 1880, has a short note bearing on them, to which I shall again refer.

The Cadzow herd is the only one reputedly ancient now left in Scotland. Among old extinct herds were those of Stirling, Cumbernauld, Kincardine, Drumlanrig, Blair Athole, and Auchencruive. Of these, the Drumlanrig and Auchencruive herds appear to have become extinct about 1780, and the Blair Athole one in 1834. There were also several old herds in England, of which those at Chillingham and at Chartley Park are now the sole representatives.

On the 18th of last month—when the herd at Cadzow may be regarded as at its lowest for the year, calving not having begun—the total number of animals was forty-nine, exclusive of the Chillingham bull already mentioned, as follows:

Bulls, six years old and upwards, - -	2
„ two „ under six, - -	5
„ under two years, - - - -	4
Cows, four years old and upwards,- -	17
„ two „ under four, -	12
„ under two years, - - - -	9
	49

The total numbers of the herd I have noted at different dates are:

In October, 1885, - - - -	57 head.
„ September, 1886, - - -	68 „
„ August, 1887, - - - -	62 „

If twenty calves with proper markings are born this season, in autumn the herd should number about the same as in 1886.

The colour, markings, and characteristics of the cattle are very uniform, partly due to eccentric calves being killed or otherwise disposed of. Bulls and cows alike have all small, turned-up, black-tipped horns; are of good proportion, with straight back and fair underline; their bodies white, with black markings—the muzzles, the eyes, the whole of the ears, the hoofs, and the forelegs up nearly to the knee, being black. The roof of the mouth and

the tongue at its tip are of the same colour. The Chillingham bull differs in marking, has reddish ears, and its horns are brown in the lower part and white above.

The popular exaggeration that they are a distinct and untamable race has grown out of the eagerness of human nature after the unique. A *Bos* or *Urus scoticus* would be a singularity of much patriotic significance.

The most marked features about the cattle that may be considered as indicating wildness are, in my opinion, the sharp watchfulness of their quick black eyes and their peculiar restlessness and alert suspicion in the presence of intruders. They are mistrustful creatures, snuffing danger from afar, quick-eyed, quivering in ear, and alert in limb. A sense of danger is ever present with them. In feeding, they keep together and do not straggle, are not easily approached by man, scampering off on the least occasion, till, on being hard-pressed, they take panic and charge. The same shyness is seen in the calves. Late in the autumn they are separated from the herd and enclosed by themselves. Their behaviour differs markedly from that of the ordinary domesticated calf, which shows a playful pleasure in human pattings and scratchings. These white calves are as distrustful of man as their elders, retreating as far as they can, and keeping their suspicious black eyes fixed on any intruder. This shyness I take to be the salient feature of wildness in the herd. This gives meaning to all their actions, such as those described by the Rev. William Patrick on an occasion of a periodical shooting among them. He says, in an article in the *Quarterly Journal of Agriculture* (1839): "These animals are never taken and killed like other cattle, but are always shot in the field. I once went to see a bull and some cows destroyed in this manner—not by any means for the sake of the sight, but to observe the manner and habits of the animal under peculiar circumstances. When the

shooters approached they, as usual, scampered off in a body, then stood still, tossed their heads on high, and seemed to snuff the wind. This manœuvre was often repeated, till they got so hard pressed (and seemingly having a sort of half-idea of the tragedy which was to be performed), they at length ran furiously in a mass, always preferring the sides of the fences and sheltered situations, and dexterously taking advantage of any inequality in the ground, or other circumstances, to conceal themselves from the assailing foe, In their flight the bulls or stronger of the flock always took the lead. A smoke ascended from them which could be seen at a great distance, and they were often so close together like sheep that a carpet would have covered them. The cows, which had young, on the first 'tug of war,' all retreated to the thickets where their calves were concealed, where, from prudential motives, they are never, if possible, molested. These and other wild habits I can testify to be inherent in the race, and are well known to all who have an opportunity of acquainting themselves with them."

In this instance I do not think there has really been any wild habit shown. Gregariousness from fear of impending fate impels man as well as white cattle, and there is huddling together in panic and when serious danger is imminent. This stampede in which the most powerful animals are not seeking to defend the herd but are in the front of the flight; this flocking together like sheep, with the smoke of terror rising from them; this retreat of the cows to their calves—what peculiarly wild habits are there? I see only frightened animals, maternal instinct, and human savagery.

Beyond shyness and watchfulness, none of the habits of the cattle strikes me as in any way other than to be expected in animals not thoroughly domesticated. Can we not catch a glimmer in Patrick's description that may help to enlighten us as to the

cause of their avoidance of man? They are hunted and shot in the field, and all the survivors impressed with vivid facts for reminiscence, not as in the case of ordinary cattle taken away individually to shambles and slaughtered out of sight. For ages they have been subject to such recurrent barbarity, and the natural consequence is a hereditary distrust of man. They are untamable only under this treatment, and if handled like ordinary cattle their wildness would be quite gone in a generation or two. Just as in the case of the Chillingham cattle calves taken at an early age and treated gently have become "as tame as domestic animals," so with the Cadzow ones it is recorded on the authority of Mr. Brown, who was a former chamberlain of the ducal family, that they have "been taken when young and tamed and even milked." This account goes on further to say: "The milk like that of most white cattle is described as thin and watery. The present keeper of the park at one time possessed a cow, which he had taken when a calf in consequence of the death of its mother; it was gentle and was milked as a cow, and bred freely with the common bull." As it is, they are so far domesticated as to come readily in winter for food and shelter to the sheds erected for them.

The extreme fierceness of the bulls is a point of popular acceptance; but it does not appear that they are exceptionally fierce. Without presuming too much on their goodwill, there is no reason to treat them with special distrust. Bulls of the ordinary domesticated breeds, when over three years old, are mostly irritable and liable to irascible outbursts, and rarely show gratitude or goodwill for favours received. From familiarity with man, such bulls lack awe of him, and show an original aggressiveness such as does not exist to a like extent among the Cadzow cattle, which have had occasional experiences of man's bullet-power. Among themselves the bulls are savage enough. The law of battle

prevails; and though they are somewhat hindered from fighting by separate enclosure, they not unfrequently manage to settle the great herd question as to which is the most powerful bull. Unmitigated fierceness marks these conflicts, and they fight to the death. In this way four bulls perished in 1885 and two in 1886.

There are many tales of persons being hunted by them and taking to trees; but I cannot learn that anyone ever sustained serious injury, though that is due to no kindliness of theirs. Such incidents appear mirth-provoking in the recital, though the experience itself is more alarming than amusing. I have known of several cases of this kind, and Patrick among other instances gives that of a bird-catcher who was once "treed" by a bull, and naively adds: "here he had occasion to observe the habits of the animal."

With reference to the early history of such cattle in Scotland, little is known of a satisfactory kind.

Hector Boece or Boethius published (1526-7) his *Scotorum Historiæ*, which appears to have been written mainly to magnify the glory and wonderfulness of Scotland. He describes the wild cattle of the country; and probably influenced by reminiscences of Cæsar's description of the great, long-horned, wild, and untamable Uri of the Hyrcinian Forest, and confident that Scotland must possess bulls as good, he evolved an animal of the ox kind with a dash of the heraldic Scottish lion. He says that in the Caledonian Forest there were bulls of the purest white, having manes like the lion (*"boves candidissimos in formam leonis jubam ferentes"*); and that though in other parts of the body they resembled tame cattle, they were wild and untamable, shunning man. He relates that the Bruce was saved from an angry white bull by a powerful man, thereafter known as Turnbull from his feat in seizing the bull by the horns and throwing it down.

Bellenden reduced Boece's Latin into Scottish—it

would hardly be accurate to say "translated," as he curtailed, amplified, and altered as seemed good. As Boece wrote mainly for the world outside Scotland, Bellenden wrote for the Scottish themselves. His work is said to have been first printed in 1536, about ten years after the original. Bellenden seems to be conscious that the leonine mane had to be curtailed somewhat, so he quaintly gives a different turn to the passage with some original resemblance and much new sense, thus: "quhit bullis with crisp and curland mane like fiers lionis." It is no longer the mane that is leonine—as, indeed, how could it be if "crisp and curland?"—but the bulls themselves, and the expression may be as readily taken as referring to their temper as their appearance. Some things might pass in Latin which would be questioned if in the vernacular.

Leslie, in the first seven books of his history *(De Origine, Moribus, et Rebus gestis Scotorum*, etc., published at Rome, 1578), gives little more than an abridgment of Boece. He adds, however, to Boece's description of the mane, calling it thick and hanging down *("densam ac demissam").*

Continental naturalists followed Boece's description, identifying the animal with the bison of Central Europe; but this is undoubtedly incorrect, and there is not the faintest evidence that the *Bos Bison* ever existed in Britain in historic times.

There is an interesting reference to the white cattle of Cumbernauld Forest in a State paper of 1570, bringing certain charges against the Regent Lennox. The following is one of these charges: "And amonges others greite enormyties perpetrated be th' erles men of werre they have slayne and destroyed the dere in John Fleming's forest of Cummernald and the white kye and bulles of the saide forest, to the greit destruction of policie and hinder of the common wele, for that kinde of kye and bulles has bene thir mony yeres in the said forest, and the like was not maynteyned in any

other part of this Ile of Albion, as is well knowen." This doubtless means that a herd of the same extent, living in a considerable forest, was not to be found, and does not at all imply that no other herds of similar cattle existed elsewhere. The Cumbernauld cattle did not then, however, become extinct. When they did so it is impossible definitely to say, though the beginning of last century may be considered as an approximation to the date.

Sir Robert Sibbald, in his *Scotia Illustrata* (1684) quotes certain references as to the white cattle and the bison, and adds: "Quæ quidem ab historicis nostris petita sunt, sed confirmatione egent. In pluribus locis montanæ partis Scotiæ reperiuntur quidem boves feri, albi quoque: sed non ita truculenti neque formâ a domesticis differunt. An jubati bisontes nunc extent, nescio." [Such have indeed been claimed by our historians, but lack confirmation. In many places of the mountainous part of Scotland wild oxen are indeed found, and white also; but they are not so savage as this, nor do they differ in form from domestic cattle. Whether maned bisons may now be extant, I do not know.] Sibbald does not give any special localities for the white cattle; but of the forests in southern Scotland he says: "Celebriores sunt Hamiltonia; Kalendaria, propé *Varium Sacellum;* Torwood, propé *Sterlinum.*" [The more celebrated are Hamilton; Callendar, near Falkirk; Torwood, near Stirling.] Sibbald, we thus perceive, more than two centuries ago, held that these forest cattle did not differ from domestic ones, and were not so savage as represented, and states further that he knows nothing of maned bisons.

Of the early history of the Cadzow herd we know nothing definite. We do not even know when the forest was first enclosed. There is some probability that Cadzow was a hunting seat of the ancient British Kings of Strathclyde, and that the name is to be traced to their language. From a very remote antiquity it was undoubtedly the property of the

Crown; and during the twelfth and thirteenth centuries the Scottish Kings occasionally resided there. The planting of the oak trees is ascribed by tradition to David, Earl of Huntingdon, afterwards David I. of Scotland, and a date is surmised about 1140. We must remember, however, that the appearance and habit of the trees rather indicate natural sowing, and that at that remote period, in a country thickly wooded, clearing was a worthy work, while planting was not of much account. The estate passed from the Crown to the Hamilton family about the time of the Battle of Bannockburn. There is a tradition that when Bruce gave Cadzow to Walter Fitzgilbert de Hamilton for his services in the War of Independence, he stipulated that a certain number of white cows should be maintained and the oaks preserved; but there does not seem to be any authentic information as to this, and the story is told in several different ways.

During the tumultuous and troublous times of the Reformation, and after the Battle of Langside, when Cadzow Castle was twice besieged and taken and ultimately destroyed, when the power of the great Hamilton family was overthrown, and their chiefs were executed or "put to the horn," when the herd at Cumbernauld, as we have seen, was nearly extirpated, we know nothing of how it fared with the Cadzow herd, or how they survived amid the foraging of hungry armed men.

On the authority of Mr. Brown, the Ducal Chamberlain already referred to, Sir William Jardine, in the *Naturalists' Library*, says that "during the troubles consequent on the death of Charles I. and the usurpation of Cromwell, they were nearly extirpated, but a breed of them having been retained for the Hamilton family by Hamilton of Dalzell and by Lord Elphinstone of Cumbernauld, they were subsequently restored to their ancient purity."

In 1764, John Wilson published *Clyde, a Descriptive Poem*, a work at which he had been engaged for

several years. He refers to the cattle, so I think we may safely assume that about 1760 they occupied the same pastures as now. He says:

"Where these high walls round wide enclosures run,
Forbid the winter and invite the sun,
Wild strays the race of bisons, white as snow,
Hills, dales, and woods re-echo when they low.
No houses lodge them, and no milk they yield,
Save to their calves: nor turn the furrowed field:
* * * * *
But, mightiest of his race, the bull is bred;
High o'er the rest he rears his armed head,
The monarch of the drove, his sullen roar
Shakes Clyde with all his rocks from shore to shore."

Wilson's description of these white cattle appears to have influenced Sir Walter Scott. In his ballad of *Cadzow Castle* the pithy and powerful description of the cattle seems to arise naturally in finer poetic form from the germ of Wilson's verse:

"Through the huge oaks of Evandale,
Whose limbs a thousand years have worn,
What sullen roar comes down the gale,
And drowns the hunter's pealing horn?

Mightiest of all the beasts of chase,
That roam in woody Caledon,
Crashing the forest in his race,
The Mountain Bull comes thundering on.

Fierce, on the hunter's quiver'd band,
He rolls his eyes of swarthy glow,
Spurns, with black hoof and horn, the sand,
And tosses high his mane of snow."

Scott spent the Christmas of 1801 at Hamilton Palace. A morning ramble to the ruins of Cadzow Castle, and amid the remains of the forest, suggested the ballad, which is addressed to Lady Anne Hamilton, eldest daughter of Archibald, ninth Duke. Recollect how enthusiastic Scott was over all things ancient, and how keen was his antiquarian sense, and hear what he says of the cattle in his introduction: "There was long preserved in this forest the breed of the Scottish wild cattle, until their ferocity occasioned their being extirpated about forty years

ago"—that is, about 1760. "Their appearance was beautiful, being milk-white, with black muzzles, horns, and hoofs. The bulls are described by ancient authors as having white manes; but those of latter days had lost that peculiarity, perhaps by intermixture with the tame breed." Can we doubt that Sir Walter—a guest at the palace and a visitor to the forest, with a genius for old lore, for tradition and legend, and a heart brimming over with song responsive to these scenes suggestive of a heroic past—would not have been almost as eager to see these cattle as he would have been to look on a resuscitated band of ancient retainers? Can we imagine he would fail to inquire about them? For forty years or so they had then been extinct. This is an extraordinary statement, when we reflect that a similar herd of cattle is still there. From Wilson's poem we know that they were there about forty years before.

Pennant made a tour in Scotland in 1769. He says of Hamilton: "The park is now much enclosed; but I am told that there are still in it a few of the breed of the wild cattle which *Boethius* says were peculiar to the Caledonian forest, were of snowy whiteness, and had manes like lions: they were at this time in a distant part of the park, and I lost the sight of them." In a note he adds, "I was also informed that the same herd is found in the Duke of Queensberry's Park at *Drumlanrig*, but at present in no part of *North Britain* in an unconfined state." He again made a tour in Scotland in 1772. He saw the white cattle at Drumlanrig. He does not see them at Cadzow, but is told that there are still a few "of the same kind as those I saw at Drumlanrig."

Lightfoot accompanied Pennant in this tour in 1772, and in 1777 he published his *Flora Scotica*, prefixed to which is a sketch of Caledonian Zoology written by Pennant. Of these cattle he says: "None at present found unconfined. The offspring of the original breed still preserved in the parks of *Hamilton* and *Drumlanrig*; and also in that of *Chillingham*

Castle, in *Northumberland*. Are of a milk-white colour; have black ears, muzzles and orbits; horns fine, and bending out; slender legs; very wild; and fly like deer at the sight of man; generally on full gallop; very fierce, and dangerous when wounded, attacking their assailant with great fury. Never approach the cattle yards but when compelled by hunger in very severe weather; always lie out; their hides on that account tougher, and more valued by curriers than those of tame cattle. The carcase of an ox of this kind weighs 38 stones *English*, of a cow 28 stones." He then mentions the manes they formerly had, and refers to Boethius, Pliny, and Sibbald, adding: "Tame black cattle, in the Island of *Canay*, have still their staring manes along the top of their backs, which reach from the neck up part of the tail."

Though Pennant on neither of his visits to Hamilton saw the cattle, it would appear that they were still kept at Cadzow. In the case of both tours he uses nearly the same expression: "I am told there are still in it a few," which indicates a greatly reduced herd, I take it; and indeed in the case of his second tour, he seems so far as all that relates to Hamilton is concerned to have contented himself with much re-statement from his former narrative. While his observation as to the Drumlanrig cattle is definite, as to Cadzow his remark is wholly of a hearsay character, and, even if accepted, indicates a restricted herd. He published the 4th edition of *British Zoology* in 1786, and mentions having seen the cattle at Drumlanrig and Chillingham, but says nothing of Hamilton.

Bewick published his *General History of Quadrupeds* in 1790. He treats fully of the Chillingham Cattle—from Culley's *Live Stock* published 1786—and gives a spirited engraving of the Chillingham wild bull; but he does not mention Cadzow or Drumlanrig among the places where he says they then survived. "Numerous herds of them," he writes, "were kept at

several parks in England and Scotland; but they have been destroyed by various means, and the only breeds now remaining in the kingdom are in the park at Chillingham Castle" and other English localities. He gives no Scottish place whatever where they then survived, and I can only infer from this that he was quite aware that the herds had become extinct both at Cadzow and Drumlanrig. In the *Zoologist* for 1878, the editor, in some remarks preliminary to a paper bearing on white wild cattle, says as to Bewick's account: "the breed having been introduced (subsequently it is presumed to Bewick's notice) or reintroduced at Cadzow (Hamilton)." Were Bewick not supported by other evidence, such as I have adduced, I should hesitate to base such an inference on his statement as the extinction of the herd at Cadzow in his time; but I must, in face of all the other concurrent support, accept it as valuable confirmatory testimony. That these cattle were not introduced for the first time subsequent to Bewick's work is, however, quite established by Wilson's poem and other evidence, so that reintroduction is the fact to be recognised in the case.

The article on the Parish of Hamilton in Sir John Sinclair's *Statistical Account of Scotland*, published 1791, was written by John Naismith, of Drumloch, East Kilbride, a gentleman of literary ability and practical turn of mind, who published various works, chiefly on agricultural subjects. He carried out very extensive operations in reclaiming moss on his farm of Drumloch, and on the ground of his literary and agricultural services to his country he was admitted as a burgess of this city. Referring to the old oaks at Cadzow, he says: "Among these venerable trees grazed the white cows mentioned by naturalists as an untamed native breed. They seemed to differ in nothing from the domestic kind, excepting that they were all over white, with black or brown ears or muzzles; and from their manner of life very shy and

even fierce, when they had not room to fly. They were exterminated from economical motives about the year 1760." This is a quiet, careful note. He does not say that they were an untamed native breed, only that they were "mentioned by naturalists" as such. The next sentence shows that he did not consider them as in any important respect different from other cattle; and as to their wild habits, he adds: "from their manner of life very shy and even fierce, when they had not room to fly." A resident in the district and interested in these matters, his statement that they had been exterminated from economical motives about 1760 is, I hold, incontestable, and coincides with Sir Walter Scott's later remarks.

Heron, in 1793, says: "Here so late as the year 1770 were a remnant of those white cattle with black or brown ears or muzzles, which were once common in Scotland. Their shyness and ferocity of temper rendered them troublesome and little useful. They were therefore exterminated in the year above-mentioned." The date differs here, but Heron was only a passing stranger taking notes, and hence much accuracy in date is hardly to be expected. He agrees with Naismith, however, in saying they were *exterminated*, and as he fixes a date about twenty years before his visit, there is little room for doubt as to the completeness of this extermination.

Denholm, who visited Hamilton about the same time as Sir Walter Scott, says: "They had become so fierce that about 1760 they were exterminated."

Dr. John Walker, professor of Natural History in the University of Edinburgh, wrote his *Essays on Natural History and Rural Economy* towards the end of the eighteenth century, though they were not published till 1812 after his death. In this book is included his *Mammalia Scotica*. Under *Bos Scoticus*, he writes: "Pecudes feri, hujus generis, solum adhuc persistunt in sylvis circa Drumlanricum in Nithia, sedem ill. Ducis de Queensberry. Coloris sunt

candidissimi, auribus nigris." [Wild cattle of this race now remain only in the woods about Drumlanrig, in Nithsdale, the seat of his Grace the Duke of Queensberry. They are of the purest white colour, with black ears.] He says nothing of the Cadzow herd, and this quite agrees with the direct statements which I have quoted as to extirpation. It is usually assumed that the Drumlanrig herd was extirpated about 1780, but from this statement of Walker's the date may probably have been later, as Storer, too, in his *Wild White Cattle* seems inclined to assume on other evidence.

From what I have brought forward I think there is only one conclusion possible, viz., that about 1760 or a few years later the Cadzow herd became extinct, and that for the long period of thirty or forty years white cattle ceased to browse in Cadzow Forest. I think it is quite clear that towards the end of last century and the beginning of this there was only a memory of these having been there. The direct evidence of Sir Walter Scott, Naismith, Heron, and Denholm is, I hold, conclusive; while Bewick and Walker give negative support. Pennant did not see the animals; and mentioning them as few in his first tour, he appears merely to have reiterated the statement in connection with his second tour.

As the cattle are now found in this park, the question arises—when were they reintroduced? About the beginning of this century there was a great revival of interest in the past history of Scotland and in all that pertained to it, largely due to the influence of Sir Walter Scott and his friends. It is not perhaps too much to assume that the ballad of "Cadzow Castle" awakened the interest of the Ducal family of Hamilton in these cattle, and that after its publication they were reintroduced.

Whether this be so or not, it is clear that by the year 1809 white cattle are again browsing in Cadzow Forest. In that year Robert Burns, of Hamilton, published a ballad entitled *Cadzow Castle*, which he

dedicated to Sir Walter Scott. In a note at page 8 he says: "These cattle, fierce and untamed, carefully preserved from the breed that roamed wild in 'woody Caledon' in ancient times, are to be seen in the Duke of Hamilton's park at this day. They are beautiful milk-white, with black muzzles, ears, and hoofs. The author of this ballad counted to the number of nineteen, young and old, about the middle of January, this present year, 1809. Some of the cows have fine moony horns"—an expression evidently from Leyden's *Scenes of Infancy*—"but the bulls that have been kept for a number of years back, are mostly humble; they want that fierce majestic appearance that the horned ones have, but they are much safer." Safer certainly; as runs the proverb—"An illwilly coo sud hae short horns." Burns nowhere says that Sir Walter had been misinformed as to the cattle, and his note is guarded in expression and might apply to cattle reintroduced from some other place. He does not say that they were the breed that had been kept there for centuries; but from the breed that roamed in woody Caledon. He says also, evidently in connection with the descriptions of the cattle in former times, that "the bulls that have been kept for a number of years back are mostly humble." "A number of years" throws us back to the beginning of the century, to the time when the herd was undoubtedly reconstituted or reintroduced; and with this it is to be noted that the small number of the herd—nineteen, young and old—in Burns' time is also in accordance. Further, the fact of the bulls being hornless and the cows horned is most unusual, and clearly betokens a heterogeneousness such as would characterise a herd in process of formation from different sources.

When I first began some years ago to take notes as to the cattle, I had not the slightest suspicion that there had been any break in the continuity of the herd at so recent a period as the end of last century, and when the evidence began to force me

to that conclusion, I was at first inclined to assume that two or three had been left from which the herd might have been reconstituted. It appears (*Zoologist*, 1878) that there was some story that they were all killed off, but one, during last century, and that this was a bull, from which the herd was started again by breeding with the common cow. This seems to be an attempt merely to account for the disappearance and reintroduction of the herd, and the statement lacks confirmation. This single bull from which the herd was again reconstituted was almost certainly not kept about Cadzow, or Naismith would have known of it, and Sir Walter Scott have been eager to see it. It would, besides, be difficult to bridge over thirty or forty years of herd-history with this one bull.

I should have been much pleased if I had been able to establish a pure and unbroken record for the Cadzow herd from the remotest antiquity; but the evidence points all to an opposite conclusion. Without doubt the herd was practically reintroduced about the beginning of this century, either from a few survivors of the former herd that had been kept somewhere else, or from another distinct herd. Mr. Robert Service, in an article in the *Zoologist* of December last, says that the Drumlanrig herd is believed to have been "disposed of some time between 1770 and 1780; but where it was sent to remains a mystery." He adds that the tradition is that they were taken to Chillingham, but from the part of the country through which they are said to have passed, he thinks they were "more likely to have been going to Cadzow rather than Chillingham." If the herd at Drumlanrig was dispersed about 1770 or 1780, it was most certainly not taken to Cadzow, as the evidence just adduced clearly shows. That the herd at Drumlanrig did exist till 1780 or thereabouts appears to be established on satisfactory evidence, while there is a probability that it was not completely extirpated till some years later. If any

evidence could be produced that a remnant of this Drumlanrig herd survived to the beginning of the century, and that the tradition of their removal relates to that time, the matter would assume a different complexion. As it is, I must say there is not the slightest indication of Cadzow having been restocked from Drumlanrig.

So far as is known, there were extant at the beginning of this century only two herds of white cattle with markings similar to the Hamilton ones. One of these was the herd that had been formed at Ardrossan in 1750 by the Earl of Eglinton, which at the beginning of this century had dwindled to a few animals, and was in 1820 finally dispersed. The other was the Athole herd, which was sold in 1834. The markings of both herds appear to have been the same as those now at Cadzow—with one essential difference. The Athole herd was horned, the Ardrossan one humble. Now as Burns in 1809 says the bulls at Cadzow were hornless, what I suggest —as a mere presumption—is that the Cadzow herd may have been reintroduced from the Ardrossan one, which, so far as we know, may itself have been originally constituted from Cadzow cattle.

That the cattle about 1760 were horned is clear, if Wilson was not romancing when he writes of the "armed head" of the bull. In 1809 the bulls were humble, according to Burns, though the cows had horns. Later, the whole herd became humble. Youatt in his work on *Cattle* (published 1834), commences his account of *The Polled Cattle* by stating that the aboriginal cattle at Chillingham were middle horns, while those at Chatelherault were polled. I am assured by one who knew the cattle well about forty years ago that they were then all humble. It would appear that the influence of the hornless bulls of 1809, aided perhaps by selection, had brought about this change. In the *Report of the Committee appointed by the British Association on Existing Herds of Wild White Cattle*, read at Manchester, 1887, it is stated

that "Joseph Dunbar, a labourer who has been in the ducal service for about 50 years, says that 45 years ago (say 1842) the cattle were all hornless, and the present Duke's grandfather caused all shewing the least appearance of being horned to be killed." The latter statement may or may not be correct; but it is a fact that about that time they were all hornless. A specimen presented to the Edinburgh Museum in 1842 had horns; but it had probably been killed some years before. Dr. John Alexander Smith, writing about 1847, says that "they are all without horns or polled, and have been so for some time past." At a later date some of the cattle again became horned, and now all of them are so. This may be due to a Highland bull having been added to the herd, as Sir J. Powlett Orde of Kilmory was told, he says, that Mr. Lachlan Macneill had been employed to get a West Highland bull for the Cadzow herd; and he had heard, besides, many years ago, "that a Highland bull having got accidentally into the park, some horned calves were produced, and that by subsequent selection the herd had got horns generally."

In 1866 the herd came very near an abrupt conclusion. Rinderpest broke out among them, and the law of the land as to slaughter was imperative. A few young animals were hidden away in the deep gorge of the Avon, and from the survivors—some eight in all, and only one of these a bull—the present herd is descended.

As it was recently considered desirable that some new blood should be infused into the herd, a bull from Kilmory was added in 1884. I saw this bull, and though he had the same colour and markings as the cattle, there was something about him strikingly different. He seemed to be shorter in leg and heavier, but what struck me most was the absence of that restless manner and constant watchfulness so characteristic of the Cadzow herd. The experiment was not a success, as the calves born were off

the markings, one being entirely white and another entirely black, and so the bull and all his progeny were slaughtered.

In 1886, a bull of the Chillingham breed was obtained in order to effect a cross, and such action clearly commends itself as the proper course and of the utmost importance so far as strengthening the herd is concerned. Neither the Chillingham, Cadzow, nor any other restricted herd could continue to survive without the occasional infusion of new blood. All claims to utterly uncontaminated descent on the part of such herds are untenable. The proper course is occasional interchange between herds; and had this been recognised earlier, several English herds now extinct would probably still have been vigorous and flourishing. On the occasion of the visit of the Society to the High Parks, we saw this stranger bull and were enabled to compare him with the others. The opinion universally expressed was that while he was a very fine animal, he was inferior in size and symmetry to Cadzow bulls of the same age. His coat seems finer; but in my opinion his markings are not nearly so beautiful. The brown horns passing into white at the tips, the reddish ears and muzzle, do not contrast so well against the white coat as the jet-black tipped horns and the other black markings of the Cadzow herd. This is no doubt a matter of taste, and others may differ from me; but I have sought to guard myself in this, as in other points of comparison, from any bias in favour of either the Chillingham or Cadzow cattle, and to give an impartial estimate. In the spring of last year five calves were born off this bull, four males and one female. One of these bull-calves was, I understand, entirely black, and two others were off the markings, so the three were destroyed. The other bull-calf was according to the Hamilton pattern, while the quey-calf took after its sire, and both of them have been preserved.

As to the origin of these white cattle, I hold from

their habits that we are not warranted in concluding that they are truly wild animals. The tamest animals, if left to themselves, revert in a few generations to a wild state. The relapsed herds of cattle, originating in strayed domesticated animals, present, in some countries, a case in point, and in wild instincts and habits far out-do our British white cattle. If we reflect that such white cattle are undoubtedly of the same species as the domestic ones, with which they breed readily; that they go with young precisely the same time; and that they differ from every known wild species of cattle in not having the rutting restricted to any particular season of the year, we shall be led to conclude that they are descended from a domesticated race, and that they have relapsed so far into wildness that they avoid man. Considering, too, that they appear to have been formerly much commoner about the parks and hunting-seats of kings and nobles than now, I think that the opinion of Dr. John Alexander Smith, in his exhaustive *Notes on the Ancient Cattle of Scotland*, is probably correct, and that they are an instance of a beautiful and esteemed variety of our domesticated cattle, preserved artificially in a half-wild state. Mr. Edward R. Alston, in the *Fauna of Scotland*, coincides in this view. "To me," he says, "the evidence appears overwhelmingly to prove that the modern park cattle are *not* wild survivors of the Urus, but are the descendants of a race which had escaped from domestication, and had lived a feral life till they were enclosed in the parks and chases of the mediæval magnates."

According to the high authority of Professor Rütimeyer, based on his examination of a Chillingham skull, these cattle are to be regarded as closely allied to the *Bos primigenius*, though much smaller. "Putting aside the lesser size," he states, "the skull differs in no way from the wild *primigenius*. The Chillingham skull is an elegant diminished copy of the mightier and stronger diluvial oxen of Europe, and the historical descent of the first from the last cannot be

doubted." The "uncommon fineness and delicacy of the bones," he admits, "are never to be found in real wild cattle"; but he attributes these to confinement to limited areas and to close breeding. I do not pretend to question the decision of such an eminent specialist; but whatever may be the osteological characteristics of the cattle, there is little perceptible difference between the breeds except that the Chillingham cattle are white and the Highland Kyloes generally black and not so afraid of man. Occasionally, also, the Kyloe occurs of a pure white with a tendency to black like the park cattle on the ears, muzzles, hoofs, etc. That the park cattle may be more closely related to *primigenius* than the Kyloe is probable, but the black calves that are occasionally born at both Chillingham and Cadzow appear to betoken the original colour of the cattle from which the breed by selection has been derived. Youatt (1834) considers the Cadzow cattle as closely related to the Galloway and other polled breeds. Dr. Robert Knox, in his communication to the Royal Society on the *Wild Ox of Scotland* (1838), thinks it bears the strongest resemblance to the Galloway breed. The proper Galloway breed are black and polled, but up to the middle of last century most of them were horned. They are extremely tame and docile animals, however, even the bulls being seldom troublesome; and in these respects they differ from the white cattle, though much of this divergence is perhaps to be attributed to mode of treatment. Dr. Knox says: "The cranium of the wild ox of Hamilton differs very much from those of most domestic oxen, particularly in the breadth of the forehead, shortness of the nasal bones, and configuration of the interior of the nostrils." The measurements of this specimen are given in Dr. Smith's paper already referred to.

Boyd Dawkins has expressed his opinion that the park cattle are descended from anciently-domesticated and not truly wild animals, and that from the

occasional appearance of dark-coloured calves it is improbable that the aboriginal ancestor was white. Darwin observes (*Animals and Plants under Domestication*, vol. i., p. 88 of 2nd edition) that "it is curious what a strong, though not invariable, tendency there is in wild or escaped cattle to become white with coloured ears, under widely different conditions of life"; and, following Rütimeyer, is of opinion that our park cattle belong to the *primigenius* type. The late Edward Blyth, stated by the editor of the *Zoologist* (1878) to have been one of the ablest of modern zoologists, saw the head of the Chillingham bull shot by the Prince of Wales in 1872, and he thus wrote: "I was surprised at its small size, and also with its identity in every essential particular with the Highland 'Runt,' which I was not prepared to expect from the published descriptions. That it is a form of typical or unimproved *Bos Taurus*, unmodified by the modern cattle-breeder's skill, seems to me to constitute its chief claim to the attention of zoologists. . . . That it has any peculiar claim to be descended from *Bos primigenius* I fail to perceive, and should rather point to domesticated *Bos longifrons* as its immediate ancestor." And so doctors differ.

I am sorry that I have not been able to fix everything down with certainty. I think, however, that it may be taken as established that these white cattle have been about Cadzow from very remote times with an occasional break and reintroduction; that they are a fancy breed artificially preserved in a half-wild state; that they are descendants of a formerly domesticated race; that there have been from time to time infusions of fresh blood into the herd; and that their so-called wild habits are mainly the result of their treatment for centuries.

XXIV.

NOTES ON SOME OF THE RARER PLANTS OCCURRING IN THE VALLEY OF THE GARNOCK, AYRSHIRE.

BY J. SMITH.

[Read 29th November, 1887.]

THE Garnock Valley is situated in the northern division of Ayrshire, called Cunningham, and occupies the entire parishes of Kilwinning, Dalry, and Kilbirnie, with parts of the parishes of Irvine, Stewarton, Dunlop, Stevenston, Largs, Beith, and Neilston, the last being in the county of Renfrew. It extends in a northern direction from the sea at Misk, to Hill of Stake on the border of Renfrewshire, a distance of 15½ miles; and in an eastern direction to a little beyond Loch Libo, in Renfrewshire, a distance of 14 miles. Its greatest breadth of 10 miles, from Caldron Hill to Oldhall, is attained about the middle. On the west it is bounded by the high-lying ground north of Stevenston, and Knockewart, Ladyside, Caldron, and Kaim hills, and on the north by Knock, Irish Law, Stake, and Misty Law hills. Baidland and Cock Law hills lie in the north-west part of the district, between the Caaf and Rye Waters. Kilbirnie Loch is situated at the north end of the depression in which the River Garnock flows after leaving Kilbirnie; but it does not belong to the Garnock Valley proper, as its waters flow in the opposite direction towards Lochwinnoch. The Lochliboside hills bound it on the north-east, together

with the narrow pass beyond Loch Libo; and on the east a low ridge separates the Lugton drainage from that of the Garnock and Annick, which belong to the Irvine Valley.

In the southern part of the district, south of Kilwinning and onwards to the sea, the land is either sandy or consists entirely of drifted sand. Along the courses of the principal streams there are considerable tracts of alluvial soil; especially in the part of the course of the Garnock extending from Dalry to Kilbirnie, which is about half a mile wide and evidently occupies the position of an ancient filled-up lake; along the Caaf Water, at that part called Holms-of-Caaf; and on the Lugton, at Lugton-ridge and north of Waterland, apparently occupying ancient lacustrine sites. A few similar patches of alluvial soil occur along the courses of the Dusk, Bombo, and Rye Waters; but the great bulk of the cultivated soil is composed of improved boulder-clay.

The Garnock, which is the principal river in the valley, rises between Stake and East Girt Hills, respectively 1,711 and 1,673 feet in height, and for the first five miles its course runs over rocks of porphyrite and of volcanic agglomerate. The portion of the bed of the river between the Falls of Garnock and Glengarnock Castle is in many places very fine, being fantastically sculptured into smooth rocky pools. The scenery around the falls is highly romantic. A short distance below the falls the river receives on the left a small tributary which descends from Misty Law, and on the right the Surge Burn which flows from High Corby Knowe, a hill 1,615 feet above sea-level. In the lower part of its course, the latter stream cuts through thick boulder clay capped with a deep bed of peat-moss, which is the usual covering of the moors throughout the district. Away to the left of the Garnock, two miles from Misty Law, stretches Ladyland Moor with porphyrite hills rising respectively to the height of

1,177 and 1,267 feet. From the north side of Black Law, a felstone hill 1,525 feet high, a small stream descends to the Garnock opposite Ladyland Moor; and from the south side of the hill flows the Pundevon, which joins the Garnock at the town of Kilbirnie after a somewhat parallel course of three miles. About the middle of the town the river also receives the Paduff, another small stream flowing nearly parallel to the Pundevon for a distance of about 3½ miles. About a mile north from Kilbirnie these streams leave the porphyrites, of which the hills are mostly built, and cut into the lower carboniferous limestone strata. From its source to Kilbirnie the Garnock descends about 1,400 feet, giving an average gradient for its bed of about 1 in 23 feet; and for the rest of its course to the sea the gradient is about 1 in 363.

After leaving Kilbirnie the river meanders for about four miles through a comparatively level plain. This, as we have already indicated, occupies the site of a filled-up lake, and when the Garnock is in full flood it has all its lacustrine appearances for the time restored. From Dalry to the mouth of the Lugton, three-quarters of a mile below Kilwinning, where the tidal area commences, its course is a little more rapid, and for the most part over boulder-clay. The only place where rock is touched is at Dalgarven. Below the mouth of the Lugton, the Garnock is tidal for a distance of about four miles, expanding into a considerable estuary at Misk and Bogside. The characteristic plant of the Garnock is certainly *Senecio saracenicus*, L., which grows in great clumps, often from six to seven feet in height, here and there along the banks. This plant is rare in other parts of Scotland. On the Clyde it occurs only at one place, and equally sparingly on the Irvine.

The Powgree, which rises on Cuff Hill, two miles north-east from Beith, enters the Garnock near Kilbirnie Railway Station,

The Gowkhouse and Pitcon Burns rise in Langdyke moss, and, after uniting their waters, flow through the romantic and flowery Pitcon Glen, joining the Garnock at Kersland. The Swinlees Burn comes down from the once fortified Caerwinning Hill, and flows through the Swinlees Glen to the Pitcon Burn.

The Rye Water runs a rapid course from between the west sides of Knock and Irish Law, and passes through the deep and romantic Hindog Glen at Cunningham-Baidland, where it has exposed many fine geological sections. Thence it flows past Drakemire, and joins the Garnock at a place on the latter called "the Rack." The Routen Burn rises between Black Law (1,525 feet) and Irish Law (1,584 feet), crosses the Dalry and Largs road, and joins the Rye Water. From Green Hill (1,261 feet) and Cock Law (1,216 feet) the Rye also receives the North and South Burns. The former rises in the Blae Loch, a small tarn which may be said to be so situated on the very top of the hills as never to be seen until one has actually arrived at it.

The Potyan comes from the Baidland Hill (1,099 feet) and falls into the Garnock below Dalry.

The Caaf Water rises in the dolerite hill of Lairdside, little more than a mile from the sea-coast at Fairlie; and for the first three miles of its course it flows over the calciferous sandstone rocks which lie below the igneous rocky masses of the Dalry and Kilbirnie hills. On the right side, for the first mile, lies Kaim Hill (1,270 feet), remarkable for its thick post of quartz-pebble sandstone conglomerate, which comes out on the east and west sides, and is capped with porphyrite. Near Birket-Steel the Caaf receives the Drum Burn, which rises on the felstone Caldron Hill. On its right is Glenton Hill, and near its junction Ladyside Hill. At Birkhead the Caaf cuts through the porphyritic rocks, which here bound the beautiful Birkhead Glen, and enters on

lower carboniferous strata over which it flows for the rest of its course. At Giffertland the Caaf receives the Auldmuir Burn, which rises in the south end of Baidland Hill; and at Drumcastle the Munnock Burn enters, which flows from Gill Hill, passing Knockewart and Coalhill on the right. From Drumcastle to Linn the Caaf passes through a fine glen, about a mile in length, on which is situated the highly picturesque Falls of Linn (locally known as the "Linn Spout"), and enters the Garnock at "the Plumb" near Kilcush. The Bombo rises in the neighbourhood of Beith, and enters the Garnock on its left side a little below Kilcush. For the last three miles of its course it runs near the foot of the conspicuous outcrop of dolerite which divides the upper limestone strata from the base of the true coal measures.

The Dusk runs a long course of about eleven miles, and joins the Garnock opposite Dalgarven. Its first four miles are over porphyritic rocks south of Castlewalls, and the remainder over carboniferous limestone strata. From Lowhouse Loch, on the north side of Cuff Hill, a small stream descends to the Dusk. On its right side, for the last four miles of its course, the Dusk has the same dolerite rock which is so conspicuous along the left bank of the Bombo.

The Lugton rises a short distance north-east from Loch Libo; and after passing through the loch, it pursues a south-east direction for twelve miles, joining the Garnock at Dirrans, near Kilwinning. Here and there, for the first six miles of its course, it is rather a sluggish stream; and the farmers of former days have in many places confined it within stone walls with the view of keeping its waters within bounds, for evidently at one time it has flowed through a series of narrow shallow lakes. From Auchentiber downwards it flows more rapidly, exposing many fine sections of lower and upper carboniferous rocks. From Loch Libo to its junction

with the Garnock it has an average gradient of 1 in 165. There are no conspicuous hills in the neighbourhood of the Lugton, except the Lochliboside Hills near its source. On the south-east, as far as Auchentiber, it is separated from the Glazert by a low ridge. Near "the Man-trap" a small stream enters which flows from Blae Loch, three miles east of Beith; and in the Eglinton policies the waters of the Draff Burn, which drains the Doura district, are also received.

The Monkcastle Burn rises in Moss Mulloch; and after leaping over the Monkcastle dolerite (which is the same as that between the Bombo and Dusk, and has been cut clean through by the river Garnock opposite Monkcastle), and passing through a romantic glen, it enters the Garnock.

The Red Burn is conspicuous for the quantity of hydrated iron oxide carried in its waters, which is dissolved from the sand over which it flows in Eglinton policies.

The Penny Burn is only notable from flowing past the conspicuous "agglomerate necks" at Castlehill, which are nothing less than the filled-up throats of two ancient volcanoes.

In very ancient times this district appears to have been for the most part covered with forests of oak, as was the greater part of Scotland. The proof of this fact is to be obtained in the peat-mosses, where the large blackened stems and roots of those trees are frequently found. In that part of the district which may be described as lying at a middle elevation, a considerable area of moss has either been used for fuel or brought under cultivation. Still, considerable tracts of moss, in the Auchentiber and Whitespot districts, and on the high-lying moors, remain in a natural state.

The total number of Phanerogams, Ferns, Club-mosses, and Horsetails I have been able to catalogue from the Garnock Valley is a few over six hundred.

They may be tabulated as follows:

Ranunculaceae,	17	Gentianeae,	3
Berberideae,	1	Polemoniaceae,	1
Nymphaeaceae,	3	Borragineae,	14
Papaveraceae,	4	Convolvulaceae,	2
Fumariaceae,	2	Solanaceae,	2
Cruciferae,	24	Scrophularineae,	21
Resedaceae,	1	Lentibularieae,	3
Violaceae,	5	Labiatae,	22
Polygaleae,	1	Plantagineae,	5
Caryophylleae,	26	Paronychieae,	1
Portulaceae,	1	Chenopodiaceae,	7
Hypericineae,	5	Polygonaceae,	16
Malvaceae,	1	Aristolochiaceae,	1
Tiliaceae,	2	Elaeagnaceae,	1
Lineae,	3	Euphorbiaceae,	3
Geraniaceae,	9	Urticaceae,	3
Ilicineae,	1	Ulmaceae,	2
Aceraceae,	2	Myricaceae,	1
Leguminosae,	25	Cupuliferae,	6
Rosaceae,	46	Betulaceae,	2
Saxifrageae,	6	Salicineae,	13
Ribesiaceae,	4	Empetraceae,	1
Crassulaceae,	5	Coniferae,	2
Droseraceae,	1	Orchideae,	10
Halorageae,	2	Irideae,	2
Lythrarieae,	2	Amaryllideae,	2
Onagrarieae,	8	Liliaceae,	4
Umbelliferae,	26	Juncaceae,	14
Araliaceae,	1	Typhaceae,	4
Caprifoliaceae,	5	Aroideae,	1
Rubiaceae,	6	Lemnaceae,	1
Valerianeae,	3	Alismaceae,	3
Dipsaceae,	3	Naiadaceae,	9
Compositae,	44	Cyperaceae,	35
Campanulaceae,	4	Gramineae,	56
Vacciniaceae,	3	Hymenophylleae,	1
Ericaceae,	5	Polypodieae,	19
Plumbagineae,	1	Osmundeae,	1
Primulaceae,	6	Ophioglosseae,	2
Oleaceae,	2	Lycopodiaceae,	5
Apocynaceae,	1	Equisetaceae,	5

The habitats of the above plants may be tabulated as follows:

	Per Cent.
In the sea,	·16
On the sea-shore or estuary of the Garnock,	5·66
On the sands or sandy soils,	13·00
On alluvial or clayey soils,	12·16
Equally on sandy, clayey, or alluvial soils,	29·00
In woods and shady glens,	15·50
In water or marshes,	17·50
On moors, mosses, or hills,	6·33
On walls or rocks,	·66

The following is a list of the rarer and more interesting plants observed within the district, with particulars of the localities where they have been found. Species previously recorded for the Garnock Valley in the *Botany of Ayrshire*, published in 1872, are indicated by "*B. A.*" placed within brackets at the end of the specified localities.

Clematis Vitalba, L.—Woods at Blair, Dalry; and Eglinton, Kilwinning. Alien.

Thalictrum minus, L.—Border of a field east of Dalry Station.

Helleborus viridis, L.—Wood near Beith. Alien.

Trollius europaeus, L.—Lugton Water, Montgreenan to Auchentiber.

Ranunculus sceleratus, L.—Rare in the Garnock Valley; a few plants at Misk.

R. Lingua, L.—Ashgrove Loch; rare. *(B.A.)*

Berberis vulgaris, L.—A few bushes in a hedge near Bannock, Kilwinning.

Nymphaea alba var. minor, Syme.—Small plants, with fifteen stigmatic rays, collected in Lowhouse Loch, north-east from Beith.

Meconopsis cambrica, Vig.—A small patch in Eglinton Woods.

Papaver Argemone, L.—A few plants got on the railway, and on Garnock banks near Kilwinning.

P. Rhoeas, L.—Rarely got on the railway near Kilwinning.

Hesperis matronalis, L.—Sparingly on banks of Garnock, between Dalry and Kilwinning. Alien.

Nasturtium palustre, DC.—Sides of Dusk Water, near Barrmill.

N. officinale, Br.—At Byrehill, Kilwinning; Ashgrove Loch, Stevenston.

N. amphibium, Br.—Frequent along the sides of the Garnock, both above and below Kilwinning; and on the Dusk Water at Barrmill.

Cochlearia Armoracia, L.—Border of a field east from Dalry Station; Eglinton Woods, Kilwinning. Alien.

C. officinalis, var.?—In Allan's Glen, near the source of the Rye Water.

Teesdalia nudicaulis, Br.—On sandy lands at Kilwinning and Misk. *(B.A.)*

Lepidium Smithii, Hook.—Common on the sandy lands and rubbish heaps near Kilwinning. *(B.A.)*

Iberis amara, L.—Occasionally on the railway near Kilwinning. Alien.

Erysimum orientale, R. Br.—On the railway, Kilwinning; rare. Alien.

Diplotaxis muralis, D.C.—On the Ardrossan railway, near Kilwinning.

Reseda Luteola, L.—Not unfrequent about Kilwinning.

Agrostemma Githago, L.—Kilwinning and Beith, in the cornfields.

Saponaria officinalis, L.—Patch on the railway at Byrehill, Kilwinning. The flowers are single.

Silene inflata var. puberula, Ford.—Bartonholm, near Irvine, on sandy soil; and on the slag-hill, Kilwinning.

Lychnis vespertina, Sibth.—Common on the sandy lands south of Kilwinning.

Sagina—?.—Frequent on the railway at Kilwinning; and at Blair School, Dalry. Mr. Arthur Bennett, F.L.S., regards this form as intermediate between S. apetala and S. maritima.

Stellaria nemorum, L.—In a wood near Dalgarven, beside the Garnock; side of Lugton Water, Montgreenan.

Hypericum humifusum, L.—Rare, in Eglinton policies.

Malva moschata, L.—Formerly occurred at Smithstone, Kilwinning. Probably extinct.

Linum usitatissimum, L.—Frequent on the railway at Kilwinning. Alien.

Radiola Millegrana, Sm.—In damp places at Misk, near Stevenston.

Geranium phaeum, L.—Rare, in a wood near Redburn, Kilwinning.

G. lucidum, L.—Hindog Glen, Dalry.

Melilotus officinalis, L.—A fine plant grew on side of railway at Dubbs, Kilwinning, during the present year.

Ornithopus perpusillus, L.—Abundant in the fields at Bogside, and on the sandy lands south of Kilwinning.

Vicia sylvatica, L.—Rare; banks of Lugton at Montgreenan.

Lathyris aphaca, L.—Lugton Water, east of Kilwinning. Alien.

Spiraea salicifolia, L.—Banks of Dusk Water, at Barrmill. Alien.

Rubus saxatilis, L.—Hindog Glen, Dalry. (*B.A.*—Beith.)

Potentilla reptans, L.—Dirrans, Kilwinning.

Alchemilla vulgaris var. montana, Willd.—Frequent about Kilwinning; common at Kilbirnie.

A. conjuncta, Bab.—Side of field east of Dalry Railway Station.

Agrimonia Eupatoria, L.—Not common in the Garnock Valley. Birkhead Glen; at Sevenacres, Kilwinning

Rosa spinosissima, L.—Rare; Redburn, near Kilwinning; hedge bank, Irvine Moor.

R. rubiginosa, L.—In hedges near gardens.

Pyrus Aria, Sm.—Roadside near Barrmill.

Saxifraga umbrosa, L.—A patch on bank of the Lugton Water, below Bullerholes. Alien.

S. granulata, L.—Hindog Glen, Dalry; rare.

Parnassia palustris, L. — Wet roadside between Dalry and Ardrossan.

Ribes alpinum, L.—Abundant in the Eglinton Woods.

Sedum villosum, L.—In wet places near Camphill and Auldmuir, Dalry; Ashgrove Loch, Stevenston; Cuff Hill, near Beith.

S. reflexum, L.—Formerly grew on an old wall at Hullerhirst, near Stevenston. Probably extinct.

Hippuris vulgaris, L. — Bartonholm; Ashgrove Loch; Bowertrapping, Dalry. (*B.A.*—Beith.)

Lythrum Salicaria, L.—Byrehill, Kilwinning; Ashgrove Loch; and near Beith, in marshy places, and in water.

Peplis Portula, L.—On soft ground at Misk, near Stevenston.

Epilobium hirsutum, L.—Dalry and Kilwinning; not uncommon.

E. angustifolium, L. — Banks of River Garnock, below Glengarnock.

Oenothera biennis, L.—Rubbish-plant, Kilwinning. Alien.

Eryngium maritimum, L.—A few plants on the sands near the shore at Misk.

Cicuta virosa, L.—Ashgrove Loch, Stevenston; Blae Loch, east of Beith. (*B.A.*—Kilwinning.)

Carum Carui, L. — Occasionally on railway near Kilwinning. Alien.

Helosciadium inundatum, Koch.—Pond at Eglinton; and marshy ground at Misk.

Pimpinella Saxifraga, L.—Banks of the Lugton Water at Gree.

Oenanthe Lachenalii, Gmel.—Salt marshes, estuary of Garnock at Bogside; rare.

Aethusa Cynapium, L.—A few plants at Hullerhirst, Stevenston; and banks of Garnock, above Kilwinning.

Ligusticum scoticum, L. — A few plants on the sand-hills at Misk, near the sea.

Meum Athamanticum, Jacq.—Common to the east of Cuff Hill, Beith; and in plantation near School House, Auchentiber; and on side of Lugton, at Redwells.

Peucedanum Ostruthium, Koch.—Frequent in patches on banks of Caaf Water, Dalry; abundant at Glengarnock Castle, and on the banks of the Garnock between Kilbirnie and the Castle. (*B.A.*—Kilbirnie.)

Conium maculatum, L.—Rare, near Kilwinning.

Scandix Pecten-Veneris, L.—Rare on the railway and banks of Garnock, Kilwinning.

Viburnum Lantana, L.—Rare in the woods near Kilwinning.

Valeriana pyrenaica, L.—Abundant at an old ruin east of Cuff Hill, Beith. Alien.

Dipsacus sylvestris, L.—Rare about Kilwinning.

Knautia arvensis, Coult.—Rare, Bartonholm, Irvine; Redburn, Kilwinning; roadside east of Cuff Hill, Beith; railway near Barrmill. Only a few plants in each station. (*B.A.*—Beith.)

Taraxacum officinale var. palustre, DC.—Banks of Garnock below Kilwinning; moors above Kilbirnie.

Cichorium Intybus, L.—Single plant near Dirrans, Kilwinning.

Carduus acanthoides, L.—A few plants at Byrehill, Kilwinning.

Centaurea Cyanus, L.—A few plants in a field west of Kilwinning.

Tanacetum vulgare, L.—Dubbs, Kilwinning; Low Baidland, Dalry.

Senecio viscosus, L.—Abundant on blaes-bings at Blair No. 5 pit, Dalry, and near Kilbirnie.

S. sylvaticus, L.—Bartonholm; Bogend, on the right bank of the Garnock; Eglinton Woods.

S. saracenicus, L.—Abundant in large patches on banks of Garnock Water, from Kilbirnie to Kilwinning, and descending the estuary to the commencement of the seaweeds (Fucus). (*B.A.*—Kilwinning.)

Doronicum Pardalianches, L.—Rare, Eglinton Woods; at old ruin east of Cuff Hill, Beith. Alien. (*B.A.*—Beith.)

Anthemis nobilis, L.—Longford, Kilwinning, and near Kilbirnie.

Vaccinium Vitis-Idaea, L.—Common on the moors near sources of Garnock.

V. Oxycoccos, L.—Rare, on Kilbirnie Moors.

Pyrola minor, L.—Misk, Stevenston; banks of Lugton, near Auchentiber.

Primula veris, L.—Frequent, and spreading in the Fergushill district, east of Kilwinning. Alien.

Lysimachia vulgaris, L.—Rare; roadside at Blair, and Giffartland, Dalry. (*B.A.*—Kilwinning.)

Vinca minor, L.—Glengarnock Castle; Kilbirnie; Monkcastle Glen; Montgreenan; Kilwinning.

Gentiana campestris, L.—Sand-hills at Misk; Cuff Hill, Beith.

Polemonium caeruleum, L.—Abundant in old quarry at Ashgrove.

Echium vulgare, L.—Abundant on the rubbish heaps south of Kilwinning. Has spread rapidly within the last fifteen years. A large patch used to grow on the Ardeer Sands, but it was exterminated by the sand being blown over it. Alien.

Pulmonaria officinale, L.—Rare; Blair Woods, Dalry. Alien.

Anchusa sempervirens, L.—Rare; Auldmuir, Dalry. Alien.

Borago officinalis, L.—Rubbish plant, Kilwinning.

Hyoscyamus niger, L.—Rubbish plant, Kilwinning.

Solanum Dulcamara, L.—In a hedge at Bog, Stevenston.

Veronica Anagallis, L.—Rare; near source of Pundevon Burn, Kilbirnie.

Mimulus luteus, L.—Sides of River Garnock from Kilbirnie to

Kilwinning; abundant at Drakemire, Dalry, and on sides of Dusk and Lugton Waters. Spreading rapidly.

Scrophularia Ehrharti, Stev.—Rare, Lambridden, Dalry; sides of Dusk Water below Barrmill.

Linaria minor, Des.—Rare; a few plants on railway at Kilwinning.

Mentha sativa var. rubra, Sm.—In Caddel Burn, between Dalry and Saltcoats.

Galeopsis versicolor, Curt.—This frequent Clydesdale plant is rare in the Garnock Valley; field at Boreston, near Dalry.

Scutellaria galericulata, L.—Not common; Eglinton Woods, roadside north-east of Kilwinning.

Lamium maculatum, L.—Three patches on Garnock side, above Kilwinning; east of Cuff Hill, Beith.

Plantago maritima, L.—At Bullerholes and Redwells, three miles north-east of Kilwinning, and 230 to 250 ft. above sea level; high Smithston and Broomhill, respectively two and three miles north-east of Stevenston, and about 290 ft. above sea level. Frequent at each station.

Littorella lacustris, L.—At Misk and Loch Libo.

Polygonum Raii, Bab.—On railway at Longford, near Kilwinning, two miles from the sea.

P. Fagopyrum, L.—On the railway near Kilwinning, rare. Alien.

Asarum europaeum, L.—Small patch in Eglinton Woods.

Hippophaë rhamnoides, L.—Eglinton Woods, rare.

Euphorbia Peplus, L.—Rare, on railway at Dubbs, near Kilwinning.

Humulus Lupulus, L.—Kilwinning, Dalry, and Beith, occasionally in hedges. Alien. Flowers freely at Kilwinning.

Ulmus montana var. major, Sm.—A few small trees having branches with corky excrescences; road-side south-east from Kilwinning.

Carpinus Betulus, L.—Eglinton Woods, rare.

Neottia Nidus-Avis, L.—Wood north of Kilwinning, rare.

Gymnadenia conopsea, Br.—Rare on the moors above Kilbirnie.

Iris foetidissima, L.—Single patch in wood near Fergushill.

Convallaria majalis, L.—Eglinton Woods.

Polygonatum multiflorum, All.—Frequent in Eglinton Woods, Lugton Water, at Fergushill House.

Juncus compressus, Jacq.—Frequent along Garnock estuary.

Typha latifolia, L.—Loch Libo.

Sparganium minimum, Bank.—Lowhouse Loch, near Beith; Loch Libo.

Arum maculatum, L.—Wood at Montgreenan, rare.

Ruppia rostellata, Koch.—In the salt marshes estuary of Garnock, at Bogend, and Misk.

Potamogeton gramineus var. zosterifolius, Sch.—Stobbs pond, Kilwinning. Seeds have probably come from the Garnock.

Zostera marina, L.—Often cast up on the Ardeer shore.
Blysmus rufus, Link.—Estuary of Garnock, at Bogend.
Scirpus lacustris, L.—Dusk Water, at Auchenmade; old quarry, Auchenkist, Kilwinning; Ashgrove Loch.
S. maritimus L.—Estuary of Garnock, at Misk; rare.
Carex dioica, L.—Ashgrove Loch.
C. paniculata, L.—Loch Libo.
C. acuta, L.—Garnock Water, Kilwinning.
C. limosa, L.—Moors near Fichen.
C. pendula, Huds.—Montgreenan woods.
Alopecurus agrestis, L.—On railway below Kilwinning, rare. Alien.
Phalaris canariensis, L.—Rubbish plant; Kilwinning.
Milium effusum, L.—Hindog Glen, Dalry; Glengarnock, Kilbirnie.
Melica uniflora, Retz.—Monkcastle Glen; banks of Lugton Water, at Mavisbank; Hindog Glen, Dalry; Glengarnock.
Poa aquatica, Sm.—Bogs, Dalry.
Catabrosa aquatica var. littoralis, Parn.—In ditches at Misk; and Nethermains, south of Kilwinning.
Festuca bromoides, L.—Kilwinning and Kilbirnie; not common.
Phragmites communis, Trin.—Blacklands, Kilwinning; Blae Loch, Beith; Loch Libo.
Bromus sterilis, L.—Sides of Doura branch railway, near G. & S. W. Ry., Kilwinning.
B. asper, L.—Woods, Kilwinning.
B. commutatus, Sch.—Misk, Stevenston; and on the railway near Kilwinning; rare.
Triticum junceum, L.—Along the estuary of the Garnock.
T. caninum, Huds.—Banks of Garnock, at Dirrans, Kilwinning.
T. repens var. barbatum.—Near Monkredding, Kilwinning.
Elymus arenarius, L.—Railway at Longford, Kilwinning; near mouth of Garnock; large patch on the sand at north-west corner of railway bridge over Irvine Water, Bogside.
Hymenophyllum Wilsoni, Hook.—On wet rocks in the glen above Kilbirnie. (*B.A.*—Kilbirnie Hills.)
Aspidium aculeatum, Sw.—In the glens at Dalry and Kilbirnie, Montgreenan Woods.
Cystopteris fragilis, Bern.—Frequent in the glens about Kilbirnie.
Asplenium Adiantum-nigrum, L.—Not common on the Garnock and Lugton.
A. Ruta-muraria, L.—Abundant on walls near Irvine.
Scolopendrium vulgare, Sym.—Common twenty years ago, rare now.
Cryptogramme crispa, Br.—Kilbirnie Hills, rare.
Osmunda regalis, L.—A small patch grew at Shewalton Moss, on a part which has now been reclaimed. A few plants still in woods not far from Kilwinning.

Ophioglossum vulgatum, L.—Sevenacres and Clonbeith, Kilwinning; Ryefield and Birkhead, Dalry; near Barrmill.
Botrychium Lunaria, Sw.—Misk, Stevenston; Irvine Moor. (*B.A.*—Stevenston.)
Selaginella selaginoides, L.—Banks of Pundevon Burn, above Kilbirnie.
Lycopodium alpinum L.—Garnock Water near the falls and on the Kilbirnie Moors.
L. Selago, L.—Turfy places on sand-hills at Misk; Dalry and Kilbirnie Moors; Auchentiber Moss, Kilwinning.
L. inundatum, L.—Discovered by Mr. D. A. Boyd at Misk, Stevenston, in 1885.
Equisetum palustre var. polystachion.—Roadside east of Cuff Hill, Beith.

The following plants have been recorded for the Garnock Valley in the *Botany of Ayrshire* (1872), but have not yet been found there by me.

Circaea alpina, L.—Beith.
Campanula Trachelium, L.—Kilbirnie.
Lobelia Dortmanna, L.—Kilbirnie.
Pyrola rotundifolia, L.—Beith.
Calystegia Soldanella, Br.—Stevenston.
Utricularia vulgaris, L.—Stevenston.
Lysimachia thyrsiflora, L.—Stevenston.
Chenopodium Bonus-Henricus, L.—Kilwinning.
Parietaria officinalis, L.—Kilbirnie.
Zannichellia palustris, L.—Dalry.
Asplenium viride, Huds.—Kilbirnie Hills.

XXV.

A CONTRIBUTION TOWARDS A NEUROPTEROUS FAUNA OF IRELAND.

BY JAMES J. F. X. KING.

[Read 24th April, 1888.]

THE following Catalogue of the Neuroptera of Ireland is brought forward as a contribution to the Fauna of the country, and must necessarily be very incomplete on account of the scarcity of workers and the consequent paucity of records of the occurrence of the species. Indeed, it may be said that only within the last few years has any attempt been made to collect these insects systematically; but during this short period at least four species of Trichoptera have been taken which have not yet occurred in Great Britain—a result which seems to warrant the belief that much work in this direction has yet to be done in Ireland, and that many such interesting discoveries remain to reward the entomologist who may direct his attention to the investigation of this department of its Insect Fauna.

With the view of making the Catalogue more useful for future workers, I have adopted the following arrangement of the various known localities under the four provinces in which they are situated, viz.:

(C.)

CONNAUGHT.

County Mayo.

Brocka, Cushinsheen, Carrowbeg, Bleachyard, Cogaula, Croft, Aille, Kip, Knappabeg, Doogan, Mount Brown, Knappagh, Prospect, Broad, Ballin, Small and Doo Laoghs.

Cushinsheen, Carrowbeg and Newport Rivers.

Localities all near Westport and Newport.

County Galway.

Castlekirk, Ma'am, Ma'ammee Laogh and Shindilla Laogh, near the north end of Lough Corrib, Lough Derg.

Salthill and south end of Lough Corrib, near Galway.

County Sligo.

Lough Gill, Mackree Castle Grounds, near Sligo.

County Roscommon.

Summerhill and Yew Point, near Athlone.

(L.)

LEINSTER.

County Westmeath.

Coosan Point, Glasson, Bog of Allan, Ballykeeron, Twy River and Laogh, Hare Island, Killinure Bay, Wineport and Waterston Demesne, all within a few miles of the south end of Lough Ree, near Athlone.

Killucan.

County Dublin.

Hill of Howth, 8 miles from Dublin.

Lucan Demesne, 7 ,, ,,

River Tolka at Glasnevin.

County Louth.

Carlingford.

County Wicklow.

Enniskerry.

(M.)

MUNSTER.

County Kerry.

Ardagh Laogh, Boreen-a-morave, Cloghereen, Devil's Punch Bowl, Mangerton, Denough River, Dinish, Deer Park, Glena, Gap of Dunloe, Horses' Glen, Torc Cascade, Muckross Abbey, Ross Castle, Spa Well, Woodlawn, Coppagh Glen, Kilbrean Laogh, Garagarry Laogh and Flesk River.

All within a radius of ten miles from Killarney.

County Limerick.

Near Limerick.

County Waterford.

Lismore.

(U.)

ULSTER.

County Antrim.

Near Belfast.

County Armagh.

Churchill, 10 miles from Armagh.

Lough Gall, 4 ,, ,, ,,

County Monaghan.

Glaslough.

County Tyrone.
Altadiawan and Fovour Royal.
County Donegal.
Cloghan, near Stranorlar.
County Fermanagh.
Enniskillen.

To the following, who have kindly given me assistance by collecting and forwarding specimens, granting permission to visit their estates, or affording other valuable co-operation, my best thanks are due:

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Percy Russ, Esq.

PSEUDO-NEUROPTERA.

PSOCIDÆ.

ATROPOS
DIVINATORIA, Müll. — In houses.
C. Westport, near Sligo.
L.
M. Killarney.
U.

CLOTHILLA
PULSATORIA, L.
C. Westport.
L. Athlone.
M. Killarney.
U.

PICEA, Mots.
C. In a house at Westport.
L. ,, ,, Athlone.
M.
U.

PSOCUS

LONGICORNIS, Fab.

C. Yew Point.
L. Twy River—Hare Island—Lucan.
M. Denough River—Cloghereen—Torc Cascade—Dinish.
U.

NEBULOSUS, Ste.

C. Yew Point — Carrowbeg River — Mount Brown Laogh.
L. Wineport—Waterston—Lucan.
M. Denough River — Torc Cascade — Dinish — Deer Park—Ross Castle.
U.

VARIEGATUS, Fab.

C.
L. Lucan.
M. Denough River—Cloghereen.
U.

SEXPUNCTATUS, L.

C.
L. Lucan.
M.
U.

BIFASCIATUS, Latr.

C. Salthill — Carrowbeg River — Cogaula and Kip Laoghs—Castlekirk.
L. Waterston—Coosan—Twy Laogh—Lucan.
M. Ross Castle—Denough River — Cloghereen—Torc Cascade.
U.

STENOPSOCUS

IMMACULATUS, Ste.

C. Yew Point—Carrowbeg River.
L. Waterston.
M. Ross Castle—Denough River—Ardagh Laogh—Torc Cascade—Dinish—Boreen-a-morave.
U.

CRUCIATUS, L.

C. Carrowbeg River.
L. Coosan—Athlone—Waterston.
M. Ross Castle—Denough River—Torc Cascade.
U.

CÆCILIUS

PEDICULARIUS, L.

C.
L. Lucan—Athlone.
M. Ross Castle—Boreen-a-morave.
U.

FLAVIDUS, Ste.
C. Carrowbeg River—Near Ma'am.
L. Waterston—Lucan.
M. Ross Castle—Cloghereen—Muckross Abbey—Glena—Horses' Glen—Boreen-a-morave—Denough River—Torc Cascade.
U.

OBSOLETUS, Ste.
C. Salthill—Near Ma'am.
L. Waterston—Tolka at Glasnevin—Lucan.
M Denough River—Boreen-a-morave—Ross Castle—Dinish.
U.

BURMEISTERI, Brauer.
C. Carrowbeg River—Near Ma'am.
L. Lucan—Waterston—Howth.
M. Dinish—Ross Castle—Boreen-a-morave.
U.

PERLATUS, Kolbe.
C. Salthill—Carrowbeg River—Near Ma'am.
L. Killinure—Waterston—Tolka at Glasnevin—Lucan.
M. Dinish—Ross Castle—Denough River—Boreen-a-morave.
U.

DALII. M'Lach.
C.
L.
M. Cloghereen.
U.

FUSCOPTERUS, Latr.
C. Yew Point—Carrowbeg River.
L. Waterston.
M. Denough River—Boreen-a-morave—Torc Cascade—Ross Castle.
U.

PERIPSOCUS

SUBPUPILLATUS, M'Lach.
C.
L. Lucan.
M. Ross Castle—Denough River—Muckross Abbey—Boreen-a-morave.
U.

ALBOGUTTATUS, Dalman.
C.
L. Lucan.
M.
U.

PHÆOPTERUS, Ste.

C. Carrowbeg River—Cogaula Laogh.
L. Waterston—Glasson—Athlone—Moate—Lucan.
M. Ross Castle—Denough River—Boreen-a-morave—Muckross Abbey—Ardagh Laogh.
U.

ELIPSOCUS

UNIPUNCTATUS, Müll.

C. Salthill—Yew Point—Carrowbeg River—Mount Brown Laogh.
L. Coosan—Killinure—Twy Laogh—Tolka at Glasnevin.
M. Ross Castle—Denough River—Boreen-a-morave.
U.

WESTWOODII, M'Lach.

C. Salthill—Yew Point—Carrowbeg River—Mount Brown Laogh—Cogaula Laogh
L. Lucan—Coosan—Shannon at Athlone—Moate.
M. Ross Castle—Denough River—Boreen-a-morave—Cloghereen—Ardagh Laogh.
U.

HYALINUS, Ste.

C.
L. Lucan—Hare Island.
M. Ross Castle—Cloghereen.
U.

ABIETIS, Kolbe.

C. Salthill—Carrowbeg River—Mount Brown Laogh.
L. Lucan—Coosan—Twy River—Waterston—Moate.
M.
U.

FLAVICEPS, Ste.

C. Salthill—Carrowbeg River—Mount Brown, Kip and Cogaula Laoghs.
L. Lucan—Waterston—Shannon at Athlone.
M. Ross Castle—Denough River—Muckross Abbey—Torc Cascade—Boreen-a-morave—Gap of Dunloe.
U.

CYANOPS, Rostock.

C.
L.
M. Ross Castle—Denough River—Cloghereen—Dinish—Boreen-a-morave—Spa Well.
U.

PERLIDÆ.

DICTYOPTERYX

MICROCEPHALA, Pict.

C.
L.
M. Denough River.
U.

CHLOROPERLA

GRAMMATICA, Poda.

C. Carrowbeg River.
L. Enniskerry.
M. Denough River.
U.

ISOPTERYX

BURMEISTERI, Pict.

C. Carrowbeg River—Castlekirk.
L. Coosan Point.
M. Denough River—Torc Cascade—Woodlawn—Ross Castle—Ardagh Laogh—Devil's Punch Bowl—Deer Park—Gap of Dunloe.
U.

CAPNIA

NIGRA, Pict.

C.
L.
M. Devil's Punch Bowl, Mangerton.
U.

LEUCTRA

FUSCIVENTRIS, Ste.

C. Carrowbeg River—Mount Brown Laogh—Croft, Kip and Aille Laoghs—Ma'ammee Laogh—Ma'am—Castlekirk—Newport River—Yew Point—Summer Hill.
L. Lucan—Bog of Allan—Ballykeeron—Waterston—Hare Island—Tolka at Glasnevin.
M. Denough River—Ross Castle—Cloghereen—Torc Cascade—Horses' Glen—Spa Well—Gap of Dunloe.
U.

NIGRA, Oliv.

C.
L.
M. Ross Castle—Torc Cascade—Horses' Glen.
U.

NEMOURA
VARIEGATA, Oliv.
C. Carrowbeg River—Croft and Kip Laoghs—Yew Point.
L. Shannon—Coosan Point—Killinure—Twy Laogh—Bog of Allan.
M.
U.

LATERALIS, Pict.
C. Carrowbeg River.
L. Waterston.
M.
U.

CINEREA, Oliv.
C.
L. Killucan.
M.
U.

HUMERALIS, Pict.
C.
L.
M. Denough River—Torc Cascade—Ross Castle—Muckross—Horses' Glen.
U.

INCONSPICUA, Pict.
C. Carrowbeg River.
L. Waterston.
M.
U.

EPHEMERIDÆ.

EPHEMERA
VULGATA, L.
C. Near Sligo.
L.
M.
U. Churchill.

DANICA, Müll.
C. Near Sligo—Mount Brown Laogh.
L.
M. Ross Castle
U.

LEPTOPHLEBIA
MARGINATA, L.
C.
L. Twy Laogh.
M. Denough River—Woodlawn—Torc Cascade.
U.

CINCTA, Retz.

C. Mount Brown Laogh—Carrowbeg River—Summerhill.

L. Twy River—Shannon—Bog of Allan—Killinure—Glasson—Lucan.

M.

U.

CÆNIS

HALTERATA, Fab.

C.

L. Coosan Point—Killinure.

M.

U.

DIMIDIATA, Ste.

C.

L. Shannon—Coosan Point—Killinure.

M.

U.

EPHEMERELLA

IGNITA, Poda.

C. Yew Point—Summerhill.

L. Hare Island—Shannon—Coosan Point—Twy River—Glasson—Lucan.

M. Ross Castle—Denough River—Woodlawn—Cloghereen—Horses' Glen—Coppagh Glen—Spa Well—Gap of Dunloe.

U.

CLOEON

DIPTERUM, L.

C.

L.

M. Ross Castle—Denough River.

U.

SIMILE, Eat.

C. Knappabeg, Prospect, Aille and Doogan Laoghs—Newport River—Castlekirk.

L. Shannon—Coosan Point—Killinure—Waterston.

M. Ross Castle—Denough River—Glena—Horses' Glen—Gap of Dunloe.

U.

RUFULUM, Müll.

C. Knappagh and Mount Brown Laoghs.

L. Coosan Point.

M. Denough River—Gap of Dunloe.

U.

CENTROPTILUM

LUTEOLUM, Müll.

C. Yew Point—Summerhill.
L. Shannon—Coosan Point—Twy River—Glasson—Tolka at Glasnevin—Lucan—Bog of Allan.
M. Ross Castle—Woodlawn—Denough River—Glena—Torc Cascade.
U.

BAËTIS

BINOCULATUS, L.

C.
L
M. Ross Castle—Denough River—Woodlawn—Torc Cascade—Gap of Dunloe.
U.

SCAMBUS, Eat.

C.
L. Lucan.
M.
U.

RHODANI, Pict.

C. Summerhill.
L. Shannon.
M. Gap of Dunloe.
U.

VERNUS, Curt.

C.
L.
M. Denough River—Torc Cascade—Horses' Glen—Coppagh Glen—Gap of Dunloe.
U.

PUMILUS, Burm.

C. Summerhill.
L. Killinure—Glasson—Lucan.
M. Denough River—Woodlawn—Spa Well—Gap of Dunloe.
U.

SIPHLURUS

ARMATUS, Eat.

C.
L.
M. Killarney.
U.

LACUSTRIS, Eat.

C. Castlekirk—Ma'ammee Laogh—Kip Laogh—Yew Point.
L. Shannon—Coosan Point.
M. Gap of Dunloe.
U.

RHITHROGENA

SEMICOLORATA, Curt.

C.
L.
M. Denough River—Coppagh Glen.
U.

HEPTAGENIA

SULPHUREA, Müll.

C. Near Sligo—Mackree Castle—Lough Corrib, near Galway—Yew Point.
L. Bog of Allan—Shannon—Coosan Point—Ballykeeron—Killinure—Waterston—Lucan.
M. Woodlawn—Dinish—Horses' Glen—Gap of Dunloe.
U.

ECDYURUS

VENOSUS, Fab.

C. Yew Point.
L. Hare Island—Coosan Point—Lucan.
M. Denough River.
U.

INSIGNIS, Eat.

C. Mount Brown Laogh.
L. Glasson.
M. Woodlawn—Denough River.
U.

LATERALIS, Curt.

C.
L.
M Gap of Dunloe.
U.

ODONATA.

LIBELLULIDÆ.

LIBELLULINA.

DIPLAX

SCOTICA, Don.

C. Ma'ammee Laogh—Mount Brown Laogh—Yew Point.
L. Bog of Allan.
M.
U. Glaslough.

STRIOLATA, Charp.

C. Broad, Kip, Prospect, and Carrowbeg Laoghs—Carrowbeg River—Mackree Castle—Yew Point.
L. Killucan—Waterston.
M. Torc Cascade—Horses' Glen—Ross Castle—Dinish—Coppagh Glen.
U. Armagh.

LIBELLULA

CANCELLATA, L. "Ireland," De Selys.

CÆRULESCENS, Fab. "Ireland," De Selys.

C.
L.
M. Dinish—Gap of Dunloe.
U.

DEPRESSA, L "Ireland," De Selys.

QUADRIMACULATA, L.

C. Carrowbeg River—Mackree Castle.
L. Twy Laogh.
M. Ross Castle.
U. Churchill—Armagh—Glaslough.

CORDULIINA.

SEMATOCHLORA

ARCTICA, Zett.

C.
L.
M. Dinish.
U.

CORDULIA

ÆNEA, L. "Ireland (?)," De Selys.

GOMPHUS

VULGATISSIMUS, L. "Ireland," De Selys.

ÆSCHNIDÆ.

GOMPHINA.

CORDULEGASTER

ANNULATUS, Latr. "Ireland," De Selys.

ÆSCHNINA.

BRACHYTRON

PRATENSE, Müll. "Ireland," De Selys.

C. At a pool near the convent at Westport.
L. Twy Laogh.
M.
U.

ÆSCHNA

JUNCEA, L.

C. Kip and Shindilla Laoghs—Castlekirk—Mackree Castle.
L. Waterston.
M. Dinish—Muckross.
U. Armagh.

GRANDIS, L. "Ireland," De Selys.

C.
L. Waterston.
M.
U.

AGRIONIDÆ.

CALOPTERYGINA.

CALOPTERYX

SPLENDENS, Harr.

C. Carrowbeg River—Mackree Castle.
L. Twy Laogh.
M. Denough River.
U.

VIRGO, L. "Ireland," De Selys.

AGRIONINA.

LESTES

SPONSA, Hans.

C.
L.
M. Kilbrean Laogh.
U. Glaslough.

NYMPHA, Selys. "Ireland," De Selys.

BARBARA, Fabr. "Ireland (?)," De Selys. One specimen in the Dublin University Museum.

ISCHNURA

PUMILIO, Charp. "Ireland," De Selys.

C.
L.
M.
U. Belfast.

ELEGANS, Van. Lind.

C. Mackree Castle — Carrowbeg River — Knappagh, Kip, and Ma'ammee Laoghs.
L. Shannon Side—Coosan Point.
M. Ross Castle—Dinish—Denough River.
U.

AGRION

PULCHELLUM, Van. Lind. "Ireland," De Selys.

C.
L.
M.
U. Armagh.

PUELLA, L.

C. Carrowbeg River—Knappabeg Laogh.
L Killucan—Moate.
M. Ross Castle.
U.

ENALLAGMA

CYATHIGERUM, Charp.

C. Carrowbeg River—Small, Kip, and Knappagh Laoghs—Ma'ammee Laogh.
L. Twy Laogh—Coosan Point.
M. Ross Castle—Denough River—Ardagh Laogh.
U. Armagh.

ERYTHROMMA

NAJAS, Hansem. "Ireland (Haliday)," De Selys.

PYRRHOSOMA

MINIUM, Harr.

C. Carrowbeg River.
L. Killucan—Twy Laogh.
M. Denough River.
U. Armagh.

NEUROPTERA-PLANIPENNIA.

SIALIDÆ.

SIALIS

LUTARIA, L.

C. Mackree Castle—Carrowbeg River.
L.
M.
U.

OSMYLIDÆ.

SISYRA

FUSCATA, Fab.

C. Carrowbeg River—Prospect and Kip Laoghs.
L Wine Port—Waterston—Lucan.
M. Ross Castle—Gap of Dunloe.
U

DALII, M'Lach.

C.
L. Tolka at Glasnevin.
M. Ross Castle—Dinish.
U.

TERMINALIS, Curt.

C.
L. Lucan.
M Ross Castle—Denough—Cloghereen.
U.

HEMEROBIIDÆ.

MICROMUS

VARIEGATUS, Fab.

C. Carrowbeg River—Ma'am Burn.
L. Howth.
M. Torc Cascade.
U.

APHIDIVORUS, Schr.

C.
L.
M. Denough River.
U.

PAGANUS, L.

C. Near Sligo—Lough Gill.
L. Enniskerry.
M. Ross Castle.
U. Altadiawan.

HEMEROBIUS.

NITIDULUS, Fab.

C.
L.
M. Ross Castle—Torc Cascade.
U.

MICANS, Oliv.

C. Salthill—Carrowbeg River—Mount Brown Laogh.
L. Coosan Point—Waterston—Bog of Allan—Lucan.
M. Ross Castle—Cloghereen—Torc Cascade—Denough River—Deer Park—Boreen-a-morave.
U.

SP. NOV.

C.
L. Waterston.
M. Torc Cascade—Boreen-a-morave.
U.

OROTYPUS, Wallen.

C. Near Sligo—Carrowbeg River—Mount River—Salthill.
L. Coosan Point, Shannon Side—Wineport—Waterston—Lucan.
M. Cloghereen—Torc Cascade—Boreen-a-morave.
U.

HUMULI, L.

C.
L. Enniskerry.
M.
U.

MARGINATUS, Ste.

C. Carrowbeg River.
L.
M. Ross Castle—Torc Road.
U.

LIMBATUS, Wesm.

C. Castlekirk.
L. Wineport—Waterston—Bog of Allan.
M. Ross Castle—Denough River—Torc Road.
U.

ATRIFRONS, M'Lach.

C. Castlekirk.
L. Waterston.
M.
U.

SUBNEBULOSUS, Ste.

C. Near Sligo.
L. Coosan Point.
M.
U.

NERVOSUS, Fab.

C.
L. Waterston—Tolka.
M.
U.

CHRYSOPIDÆ.

CHRYSOPA

FLAVA, Scop.

C. Near Sligo—Carrowbeg River.
L. Coosan Point—Waterston—Lucan—Enniskerry.
M. Denough River—Torc Road—Boreen-a-morave.
U. Armagh.

VITTATA, Wesm.

C. Yew Point.
L. Killucan.
M.
U. Altadiawan.

ALBA, L.

C. Near Sligo—Carrowbeg River—Yew Point.
L. Enniskerry.
M. Torc Road—Boreen-a-morave.
U. Favour Royal.

FLAVIFRONS, Brauer.

C. Carrowbeg River.
L.
M.
U.

CONIOPTERYGIDÆ.

CONIOPTERYX

PSOCIFORMIS, Curt.

C.
L.
M. Ross Castle—Denough River—Muckross Abbey—Torc Cascade—Boreen-a-morave.
U.

TINEIFORMIS, Curt.

C. Salthill—Yew Point—Carrowbeg River—Mount Brown Laogh.
L. Coosan Point—Shannon—Waterston.
M. Denough River—Boreen-a-morave.
U.

TRICHOPTERA.

I n æ q u i p a l p i a.

PHRYGANEIDÆ.

NEURONIA

RUFICRUS, Scop.

C.
L. Bog of Allan.
M.
U.

PHRYGANEA

GRANDIS, L.

C. Mackree Castle.
L. Shannon, near Athlone.
M. Ross Castle.
U.

STRIATA, L.

C. Knappagh and Kip Laoghs—Yew Point.
L.
M.
U. Armagh—Loughgall—Glaslough.

VARIA, Fab.
- C. Cushinsheen and Prospect Laoghs — Carrowbeg River — Yew Point — Castlekirk — Ma'ammee Laogh.
- L. Waterston—Coosan.
- M. Ross Castle.
- U. Glaslough.

OBSOLETA, (Hag.) M'Lach.
- C.
- L. Shannon.
- M. Killarney, *(J. R. Hardy) Benjamin Cooke*—Limerick.
- U. Glaslough.

AGRYPNIA

PAGETANA, Curt.
- C.
- L.
- M.
- U. Glaslough.

LIMNOPHILIDÆ.

COLPOTAULIUS

INCISUS, Curt.
- C. Broad Laogh—Newport River—Castlekirk.
- L. Shannon.
- M.
- U.

GLYPHOTÆLIUS

PELLUCIDUS, Retz.
- C. Croft Laogh—In plantation near Convent, Westport.
- L. Waterston—Lucan.
- M.
- U. Loughgall—Glaslough.

LIMNOPHILUS

RHOMBICUS, L.
- C. Carrowbeg River—Mackree Castle.
- L.
- M.
- U. Armagh.

FLAVICORNIS, Fab.
- C. Carrowbeg River—Near Sligo.
- L. Moate—Bog of Allan—Lucan.
- M. Ross Castle—Dinish—Flesk and Denough Rivers.
- U. Armagh.

MARMORATUS, Curt.

C. Knappagh, Carrowbeg, Kip, Ballin, Brocka, Prospect, Broad, Small, Doogan, and Bleachyard Laoghs—Carrowbeg and Newport Rivers—Salthill—Yew Point—Castlekirk.

L. Shannon—Killinure—Waterston—Tolka at Glasnevin.

M. Ross Castle—Cloghereen—Coppagh Glen—Gap of Dunloe—Kilbrean Laogh—Dinish.

U. Armagh—"Gas lamps, Belfast," *C. G. Barrett*—Glaslough.

STIGMA, Curt.

C.

L. Waterston—Shannon.

M. Killarney.

U.

XANTHODES, M'Lach.

C.

L.

M. Killarney.

U. Enniskillen.

LUNATUS, Curt.

C. Doogan, Small and Ballin Laoghs—Newport and Carrowbeg Rivers—Castlekirk—Yew Point—Near Ma'am.

L. Shannon—Coosan—Twy River—Tolka at Glasnevin—Lucan.

M. Cloghereen—Glena—Horses' Glen—Denough River.

U. Armagh—"Gas lamps, Belfast," *C. G. Barrett.*

POLITUS, M'Lach.

C.

L.

M. Killarney.

U.

IGNAVUS (Hag.), M'Lach.

C. Ballin and Mount Brown Laoghs—Carrowbeg River.

L. Waterston—Shannon, near Athlone.

M.

U.

CENTRALIS, Curt.

C. Mount Brown Laogh—Carrowbeg River—Near Ma'am.

L.

M. Ross Coss—Gap of Dunloe.

U.

VITTATUS, Fab.

C. Mount Brown and Kip Laoghs—Castlekirk—Yew Point.
L. Shannon—Bog of Allan—Moate—Tolka at Glasnevin—Enniskerry.
M. Ross Castle—Ardagh Laogh—Denough River.
U.

AFFINIS, Curt.

C. Ballin Laogh—Yew Point.
L. Shannon—Coosan.
M. Boreen-a-morave—Denough River—Ross Castle.
U. Glaslough.

AURICULA, Curt.

C. Kip, Mount Brown, and Cogaula Laoghs — Carrowbeg River—Castlekirk—Near Ma'am—Salthill—Near Sligo—Mackree Castle.
L. Twy Laogh—Wineport—Shannon Side—Athlone—Ballykeeron — Waterston — Killinure - Enniskerry.
M. Boreen-a-morave—Ross Castle—Ardagh Laogh—Denough River—Cloghereen—Dinish—The Glen in Deer Park—Torc Cascade.
U. Armagh.

GRISEUS, L.

C. Kip Laogh—Carrowbeg River—Near Ma'am—Mackree Castle.
L. Coosan—Bog of Allan.
M.
U. Cloghan.

EXTRICATUS, M'Lach.

C. Summerhill.
L. Bog of Allan.
M.
U.

HIRSUTUS, Pict.

C. Knappagh Laogh—Carrowbeg River.
L. Shannon—Coosan Point—Dublin.
M.
U.

LURIDUS, Curt.

C. Mackree Castle.
L. Shannon—Coosan.
M.
U.

SPARSUS, Curt.

C. Croft, Kip, Mount Brown, and Doogan Laoghs—Carrowbeg River—Mackree Castle—Near Ma'am—Salthill.
L. Shannon — Killinure — Twy River — Waterston—Enniskerry.
M. Ross Castle—Denough River—Cloghereen—Torc Cascade—Deer Park.
U. Armagh — "Gas lamps, Belfast," *C. G. Barrett*—Cloghan.

STENOPHYLAX

STELLATUS, Curt.

C. Near Sligo.
L. Lucan.
M. Cloghereen—The Glen in Deer Park.
U.

LATIPENNIS, Curt.

C.
L. Carlingford.
M.
U.

CONCENTRICUS, Zett.

C. Near Sligo.
L. Killucan.
M.
U. "Gas lamps, Belfast," *C. G. Barret*

MICROPTERNA

SEQUAX, M'Lach.

C.
L.
M.
U. Favour Royal.

LATERALIS, Ste.

C. Near Sligo.
L. Howth—Shannon.
M. Torc Cascade.
U. Armagh—Favour Royal—Altadiawan.

HALESUS

RADIATUS, Curt.

C. Ma'am Burn.
L. Howth.
M. Cloghereen—Horses' Glen.
U.

Drusus

annulatus, Ste.

C. Castlekirk.
L.
M.
U.

Apatania

fimbriata, Pict.

C.
L.
M. Gap of Dunloe—Coppagh Glen—Garagarry Laogh.
U.

SERICOSTOMATIDÆ.

Sericostoma

personatum, Spence.

C. Mount Brown—Cogaula and Knappagh Laoghs —Carrowbeg River.
L. Shannon—Coosan—Enniskerry.
M. Ross Castle — Denough River —Muckross — Cloghereen—Gap of Dunloe.
U. Glaslough.

Goëra

pilosa, Fab.

C. Doo—Cushinsheen—Mount Brown and Kip Laoghs — Carrowbeg River — Castlekirk—Yew Point—Near Sligo.
L. Coosan Point—Shannon—Near Athlone.
M. Ross Castle—Flesk River.
U. Glaslough.

Silo

pallipes, Fab.

C.
L. Enniskerry.
M. Devil's Punch Bowl — Mangerton — Muckross—Denough and Flesk Rivers—Torc Cascade.
U. Colin Glen, Belfast.

nigricornis, Pict.

C. Mount Brown Laogh—Carrowbeg River.
L. Ballykeeron—Killinure.
M. Denough and Flesk Rivers—Dinish.
U.

CRUNŒCIA
IRRORATA, Curt.
C.
L.
M. Torc Cascade—Dinish.
U. Colin Glen, Belfast.

LEPIDOSTOMA
HIRTUM, Fab.
C. Carrowbeg River—Ma'ammee Laogh—Castlekirk —Near Sligo—Yew Point—Summerhill.
L. Shannon—Coosan—Wineport—Waterston.
M. Ross Castle—Dinish—Cloghereen—Denough River —The Glen in Deer Park.
U. Cave Hill, Belfast.

Æquipalpia.

LEPTOCERIDÆ.

BERÆA
PULLATA, Curt.
C. Carrowbeg River.
L.
M.
U.
MAURUS, Curt.
C. Carrowbeg River—Knappagh Laogh.
L.
M. Ardagh Laogh — Cloghereen — Dinish — Torc Cascade.
U. Cave Hill, Belfast.

MOLANNA
PALPATA, M'Lach.
C.
L. Shannon, between Athlone and Lough Ree.
M.
U.

ODONTOCERUM
ALBICORNE, Scop.
C. Mount Brown and Cogaula Laoghs.
L.
M. Denough River—Horses' Glen.
U.

LEPTOCERUS
NIGRO-NERVOSUS, Retz.
C.
L.
M. Ross Castle—Garagarry Laogh.
U.

FULVUS, Ramb.

C. Prospect Laogh—Carrowbeg River—Castlekirk—Ma'ammee Laogh—Yew Point.
L. Shannon—Coosan—Hare Island.
M. Ross Castle—Cloghereen—Denough River—Gap of Dunloe—Garagarry Laogh.
U. Glaslough.

SENILIS, Burm.

C. Knappagh and Prospect Laoghs—Newport River—Castlekirk.
L. Shannon—Coosan—Twy River.
M. Ross Castle—Denough River—Coppagh Glen.
U.

ALBO-GUTTATUS, Hag.

C. Knappabeg Laogh.
L. On the Shannon below Athlone.
M.
U.

ANNULICORNIS, Ste.

C. Shannon, near Athlone.
L. Shannon, near Athlone.
M. Ross Castle—Denough River.
U.

ATERRIMUS, Ste.

C. Knappagh, Knappabeg, Doogan, Ballin, Prospect, Carrowbeg, Bleachyard, Cushinsheen and Aille Laoghs—Carrowbeg and Newport Rivers—Yew Point—Summerhill.
L. Shannon—Coosan Point—Wineport—Twy Laogh.
M. Ross Castle—Coppagh Glen—Ardagh Laogh.
U. Armagh—Glaslough.

CINEREUS, Curt.

C. Knappagh, Doo, Cogaula, Cushinsheen, Kip, Ballin and Doogan Laoghs—Carrowbeg and Newport Rivers — Castlekirk — Ma'ammee Laogh — Yew Point.
L. Shannon—Bog of Allan—Coosan—Lucan—Talka at Glasnevin.
M. Ross Castle—Devil's Punch Bowl—Flesk and Denough Rivers — Muckross Abbey — Horses' Glen—Kilbrean Laogh—Gap of Dunloe.
U. Glaslough.

ALBIFRONS, L.

C. Mount Brown and Knappabeg Laoghs—Newport River — Lough Corrib, Galway — Castlekirk — Yew Point—Ma'ammee Laogh—Summerhill.

L. Lucan Demesne—Waterston - Coosan Point—Hare Island—Ballykeeron—Glasson.
M. Ross Castle—Deer Park—Denough River—Coppagh Glen—Gap of Dunloe—Dinish.
U. Glaslough.

COMMUTATUS (Rostock), M'Lach.
C. Castlekirk.
L. Lucan Demesne—Glasson—Coosan Point.
M. Ross Castle—Flesk and Denough Rivers—Cloghereen—The Glen in Deer Park—Gap of Dunloe.
U.

BILINEATUS, L.
C.
L. Shannon—Lucan.
M.
U.

DISSIMILIS, Ste.
C. Carrowbeg River - Castlekirk—Yew Point.
L. Lucan Demesne—Shannon side Coosan Point—Waterston Demesne—Wineport.
M. Ross Castle—Devil's Punch Bowl—Denough River—Glena—Boreen-a-morave.
U.

MYSTACIDES

NIGRA, L.
C.
L.
M.
U. River Lagan.

AZUREA, L.
C. Bleachyard, Knappagh, Kip, Doo, Mount Brown and Prospect Laoghs—Newport and Carrowbeg Rivers—Castlekirk—Ma'ammee Laogh.
L. Coosan Point — Lucan Demesne — Tolka at Glasnevin.
M. Ross Castle — Ardagh Laogh — Dinish — Horses' Glen—Denough River.
U.

LONGICORNIS, L.
C. Doogan, Knappagh, Mount Brown, Carrowbeg, Cushinsheen, Prospect, Cogaula and Ballin Laoghs—Summerhill.
L. Shannon — Coosan Point — Twy Laogh — Bog of Allan.
M. Ross Castle.
U. Armagh—Glaslough.

TRIÆNODES

BICOLOR, Curt.

C. Bleachyard, Knappagh, Prospect, Aille and Cushinsheen Laoghs — Newport River — Castlekirk—Ma'ammee Laogh.

L.

M. Ross Castle—Ardagh Laogh.

U. Glaslough.

ŒCETIS

OCHRACEA, Curt.

C. Knappagh, Ballin and Kip Laoghs—Yew Point.

L. Shannon—Coosan Point—Wineport—Waterston—Bog of Allan.

M. Ross Castle—Ardagh Laogh—Denough River.

U.

FURVA, Ramb.

C. Bleachyard, Doogan, Broad, Knappagh and Prospect Laoghs—Castlekirk—Ma'ammee Laogh.

L. Coosan Point—Killinure—Waterston Demesne.

M. Ross Castle — Denough River — Dinish — Ardagh Laogh—Gap of Dunloe.

U. Glaslough.

LACUSTRIS, Pict.

C. Doogan, Prospect and Knappagh Laoghs—Castlekirk—Yew Point.

L. Shannon—Coosan Point—Wineport—Hare Island.

M. Ross Castle — Denough River — Torc Cascade—Ardagh Laogh—Horses' Glen.

U. Glaslough.

NOTATA, Ramb.

C.

L. Lucan Demesne.

M.

U.

TESTACEA, Curt.

C. Mount Brown Laogh.

L. Shannon — Killinure — Twy Laogh — Waterston — Enniskerry.

M. Ross Castle—Flesk and Denough Rivers—Muckross Abbey—Dinish—Torc Cascade—Cloghereen.

U.

SETODES

ARGENTIPUNCTELLA, M'Lach.

C.

L.

M. Ross Castle—Muckross Abbey.

U.

HYDROPSYCHIDÆ.

HYDROPSYCHE

PELLUCIDULA, Curt.

C. Salthill.
L. Shannon.
M. Cloghereen—Denough River.
U.

INSTABILIS, Curt.

C. Mount Brown, Croft, Carrowbeg, Brocka, and Cogaula Laoghs — Carrowbeg River — Ma'am Burn—Lough Corrib, near Galway.
L. Shannon — Ballykeeron — Lucan — Carlingford — Enniskerry.
M. Denough River — Cloghereen — Torc Cascade—Horses' Glen - The Glen in Deer Park—Gap of Dunloe.
U.

ANGUSTIPENNIS, Curt.

C. Mount Brown and Knappagh Laoghs.
L. Twy River.
M. Near Lismore.
U.

GUTTATA, Pict.

C.
L. Shannon.
M.
U.

LEPIDA, Pict.

C. Lough Corrib, near Galway.
L. Shannon—Lucan.
M. Flesk and Denough Rivers—Muckross Abbey—Ross Castle—Cloghereen—Dinish.
U.

DIPLECTRONA

FELIX, M'Lach.

C. Ma'am Burn.
L. Enniskerry.
M. Torc Cascade—Horses' Glen—Coppagh Glen—Gap of Dunloe.
U. Cave Hill, Belfast.

PHILOPOTAMUS

MONTANUS, Donov.

C. Streams on Croagh Patrick—Carrowbeg River—Castlekirk—Ma'am Burn.
L. Howth—Enniskerry.
M. Devil's Punch Bowl—Torc Cascade—Horses' Glen—The Glen in Deer Park—Gap of Dunloe.
U. Colin Glen.

VAR. SCOTICUS, M'Lach.

C.
L.
M. Very common on the stream at Cloghereen.
U.

WORMALDIA

OCCIPITALIS, Pict.

C. Carrowbeg River in Westport Demesne.
L.
M. Torc Cascade—Cloghereen—Horses' Glen—Gap of Dunloe—Dinish.
U.

MEDIANA, M'Lach.

C.
L. Enniskerry.
M.
U.

SUBNIGRA, M'Lach.

C. Croft Laoghs—Carrowbeg River—Ma'am Burn.
L. Ballykeeron—Glasson—Lucan Demesne.
M. Cloghereen—Torc Cascade—Gap of Dunloe.
U.

NEURECLIPSIS

BIMACULATA, L.

C. Knappagh and Mount Brown Laoghs—Lough Corrib, Galway—Shannon, near Athlone.
L. Coosan Point—Twy Laogh—Dublin.
M. Horses' Glen—Dinish—Gap of Dunloe.
U.

PLECTROCNEMIA

CONSPERSA, Curt.

C. Carrowbeg River—Near Sligo—Lough Gill.
L. Ballykeeron—Shannon, near Athlone—Waterston Demesne—Killucan.
M. Cloghereen—Devil's Punch Bowl.
U.

GENICULATA, M'Lach.

C.
L
M. Horses' Glen.
U.

POLYCENTROPUS

FLAVO-MACULATUS, Pict.

C. Mount Brown and Broad Laoghs—Newport and Carrowbeg River—Castlekirk—Ma'ammee Laogh—Yew Point.

L. Lucan Demesne — Tolka at Glasnevin — Coosan Point — Ballykeeron — Waterston Demesne — Shannon at Athlone—Killinure—Hare Island —Twy Laogh.

M. Flesk and Denough Rivers—Ross Castle—Torc Cascade—Dinish—Horses' Glen—Coppagh Glen —Gap of Dunloe—Devil's Punch Bowl.

U. Armagh—Colin Glen—Glaslough.

MULTIGUTTATUS, Curt.

C. Knappagh, Prospect, and Mount Brown Laoghs—Carrowbeg River — Summerhill — Near Ma'am Post Office.

L. Lucan—Shannon—Ballykeeron.

M. Ross Castle—Denough River—Torc Cascade—Horses' Glen—Coppagh Glen—Gap of Dunloe.

U. Glaslough.

KINGI, M'Lach.

C. Carrowbeg River.

L.

M. Torc Cascade — Glena — Horses' Glen — Gap of Dunloe.

U. Colin Glen.

HOLOCENTROPUS

DUBIUS, Ramb.

C. Knappagh and Cushinsheen Laoghs.

L

M.

U. Glaslough.

PICICORNIS, Ste.

C. Cushinsheen, Prospect, Knappabeg, and Doogan Laoghs—Summerhill—Ma'ammee Laogh.

L. Shannon—Coosan.

M. Ross Castle—Horses' Glen—Torc Road—Kilbrean Laogh—Glena—Gap of Dunloe.

U. Glaslough.

STAGNALIS, Albarda.

C. Doogan Laogh.

L.

M.

U.

A ♀ Holocentropus, evidently of this species, was taken at Doogan Laogh.

CYRNUS

TRIMACULATUS, Curt.

C. Kip, Knappagh, Knappabeg, Ballin, Broad, Mount Brown, and Doogan Laoghs—Carrowbeg River —Yew Point—Summerhill—Castlekirk—Ma'ammee Laogh.

L. Coosan Point—Wineport—Bog of Allan—Lucan.
M. Ross Castle — Denough River — Torc Cascade—Dinish—The Glen in Deer Park—Devil's Punch Bowl—Horses' Glen—Coppagh Glen—Gap of Dunloe.
U. Glaslough—River Lagan.

FLAVIDUS, M'Lach.

C. Knappagh and Prospect Laoghs—Ma'ammee Laogh.
L. Coosan Point.
M. Gap of Dunloe.
U.

ECNOMUS

TENELLUS, Ramb.

C. Doo, Doogan, Prospect, and Knappagh Laoghs.
L. Wineport—Waterston.
M. Ross Castle—Ardagh Laogh.
U. Glaslough.

TINODES

WÆNERI, L.

C. Cushinsheen, Knappagh, Doo, Prospect, Ballin, Doogan, and Broad Laoghs—Carrowbeg River—Castlekirk—Ma'ammee Laogh—Ma'am Burn.
L. Shannon — Coosan — Wineport — Bog of Allan —Lucan.
M. Ross Castle—Cloghereen—Horses' Glen—Coppagh Glen—Kilbrean Laogh—Gap of Dunloe.
U. Glaslough.

MACULICORNIS, Pict.

C.
L. Coosan—Wineport—Glasson—Twy River.
M.
U. Glaslough.

AUREOLA, Zett.

C. Prospect Laogh—Ma'am Burn.
L. Shannon—Howth.
M. Flesk River—Torc Cascade—The Glen in Deer Park—Spa Well—Gap of Dunloe.
U.

LYPE

PHÆOPA, Ste.

C. Prospect Laogh.
L.
M. Ross Castle.
U. Glaslough.

FRAGILIS, Pict.

C. Lough Corrib, near Galway—Yew Point—Summerhill.
L. Coosan Point—Shannon Side—Hare Island.
M.
U.

PSYCHOMYIA

PUSILLA, Fab.

C. Summerhill.
L. Lucan—Wineport—Coosan Point—Ballykeeron—Enniskerry.
M. Flesk and Denough Rivers—Torc Cascade—Gap of Dunloe.
U.

RHYACOPHILIDÆ.

CHIMARRHA

MARGINATA, L.

C. Carrowbeg and Newport Rivers—Lough Corrib, Galway.
L. Lucan Demesne.
M. Ross Castle—Flesk River—Gap of Dunloe—Dinish.
U.

RHYACOPHILA

DORSALIS, Curt.

C. Carrowbeg River—Ma'am Burn—Lough Corrib, Galway.
L. Lucan Demesne—Ballykeeron—Enniskerry.
M. Flesk and Denough Rivers—Torc Cascade—Cloghereen—Horses' Glen.
U. Colin Glen—Altadiawan.

GLOSSOSOMA

VERNALE, Pict.

C.
L. Lucan.
M. Ross Castle—Flesk and Denough Rivers—Torc Cascade—The Glen in Deer Park.
U.

AGAPETUS

FUSCIPES, Curt.

C. Carrowbeg River—Near Sligo—Ma'am Burn.
L. Howth.
M. Flesk and Denough Rivers—Muckross—Torc Cascade—Horses' Glen—Spa Well—Gap of Dunloe.
U. Cave Hill.

COMATUS, Pict.
C.
L. Lucan Demesne — Ballykeeron — Coosan Point — Enniskerry.
M. Ross Castle—Denough River—Ardagh Laogh.
U.

DELICATULUS, M'Lach.
C.
L.
M. Denough River—Torc Cascade—Horses' Glen.
U.

HYDROPTILIDÆ.

AGRAYLEA

MULTIPUNCTATA, Curt.
C.
L. Coosan Point.
M. Ross Castle—Dinish.
U.

HYDROPTILA

SPARSA, Curt.
C. Carrowbeg River—Mount Brown Laogh—Cushinsheen Laogh—Sligo.
L. Tolka—Twy River.
M. Ross Castle—Denough River—Dinish.
U.

FEMORALIS, Eat.
C. Summerhill.
L. Glasson—Twy River.
M. Ross Castle—Denough River—Cloghereen—Horses' Glen—Gap of Dunloe.
U.

FORCIPATA, Eat.
C. Summerhill.
L. Glasson.
M. Flesk River—Horses' Glen—Gap of Dunloe.
U.

OXYETHIRA

COSTALIS, Curt.
C. Mount Brown, Cushinsheen, Knappagh, Prospect, and Ballin Laoghs — Castlekirk — Ma'anmee Laogh—Yew Point—Summerhill.
L. Glasson — Twy River — Tolka — Lucan — Shannon Side.
M. Ross Castle—Denough River—Cloghereen—Horses' Glen—Coppagh Glen—Gap of Dunloe.
U.

A Comparative Summary of the Genera and Species of Neuroptera recorded as occurring in Ireland, Great Britain, and Belgium.

	Ireland.		Great Britain.		Belgium.	
	Genera.	Species.	Genera.	Species.	Genera.	Species.
Psocidæ, - -	7	26	10	38	7	22
Perlidæ, - -	6	11	9	24	8	21
Ephemeridæ, -	11	23	13	37	16	28
Odonata, - -	15	25	22	45	24	64
Planipennia, -	6	23	14	51	15	56
Trichoptera, -	28	103	61	155	57	136
Total, - -	73	211	129	350	127	327

In compiling the foregoing list, I have availed myself of any records published in works of reference, magazines, &c., so far as I have been able to discover the existence of such information.

In conclusion, I would appeal to the generous forbearance of brother workers, in view of the many imperfections which I am conscious have arisen from the incompleteness of the information at my command; and I would ask them to remember that this list, so far from being in any sense intended as an exhaustive catalogue of the Irish Neuroptera, is designed rather as a first attempt to supply an outline of the local distribution of an order of insects which, in Ireland at least, has hitherto been almost entirely neglected. If it should awaken fresh interest in the Neuroptera, and stimulate further investigation by affording a basis from which much more extended work may yet be accomplished, the objects designed by its publication will have been fully attained.

As most of the foregoing information has been derived from individual work in the various localities mentioned, I should be very glad to have an opportunity of examining specimens which may be collected

in other districts of Ireland not included within the range of my observations. There can be no doubt that many additions might in this way be made to the number of species known to occur in Ireland; and should these anticipations be realised through the kind co-operation of other workers who may be willing thus to provide the means of extending our knowledge of these insects, I shall be glad to embody in a supplementary list the information so supplied to me.

XXVI.

ON THE OCCURRENCE IN NORTH AYRSHIRE OF THE WATER SHREW AND OTTER.

BY D. A. BOYD.

[Read 27th September, 1887.]

The Water Shrew, *Sorex fodiens*, Pall.

In August, 1885, when botanising on the Glen Burn, between West Kilbride and Fairlie, I had an opportunity of observing under very favourable circumstances an apparently full-grown example of this fine species. Nearly a mile above its entrance to the sea, the stream flows over a ledge of sandstone rock, and makes a considerable fall into a deep gorge, the sides of which are picturesquely wooded. Having descended into the bed of the stream immediately below the fall, I was engaged in examining some large moss-grown stones, when I observed the animal in the act of emerging from a hole beneath one of the largest. It raised its head, and stood for a few moments sniffing the air and looking towards me, apparently uncertain whether to advance or retire. It then retreated into the hole, and did not again make its appearance.

My close proximity, as well as the position assumed by the animal, afforded me a satisfactory opportunity of observing the elongated muzzle so characteristic of the genus, and the conspicuous white breast, which contrasts very strikingly with the brown fur of the sides and back.

The Otter, *Lutra vulgaris*, Erx.

In the summer of 1882, Mr. J. B. Ritchie, son of Dr. F. C. Ritchie of Kirktonhall, West Kilbride, captured a male otter under the following circumstances. When passing some bushes on the side of the Kilbride Burn, which flows through the Kirktonhall policies, Mr. Ritchie's attention was directed to his terrier dog, which had entered the bushes and was barking violently. On examining the bushes the otter was at once observed, and secured by throwing a hamper over its head. An attempt was made to tame it in confinement, but it survived only for about a week. The example appeared to be full-grown, and measured 4 ft. 2 in. in length from point of muzzle to tip of tail.

On 7th February last, Messrs. John and Thomas Dickie, West Kilbride, observed a female otter crossing the narrow stripe of cultivated ground between the rocky sea-shore and the wooded base of the cliffs near North Bank, Portincross. In its mouth the animal carried one of its young; but having observed that it was pursued, it dropped the cub, and with apparent reluctance returned to the sea. On finding itself deserted by its mother, the young otter uttered a plaintive cry. In being captured it appeared to have sustained some injuries, from the effects of which it died shortly afterwards.

On passing near the spot next day, Messrs. Dickie met an acquaintance who described to them a remarkable sound he had just heard among the rocks on the sea-shore. This they at once recognised as the cry of the young otter; and suspecting that some others might be concealed among the rocks, they proceeded to make a careful search, with the result that two cubs were observed in the act of leaving the water. Two large cans with lids having been obtained for their reception, one of the cubs was seized by the tail, when it made a fierce attempt to bite the hand of its captor, and was with some

difficulty secured. The other retreated beneath a narrow ledge of rock, where it defended its position with much boldness. It was at length drawn out by a wire-noose attached to the end of a long stick and so dropped on its neck.

The two cubs were kept for about a fortnight and were fed on fish, which they did not appear to relish unless fresh from the water. Mr. John Dickie, to whom I am indebted for the foregoing particulars, informs me that he regards the death of the young otters as probably due to the difficulty of supplying them with newly-caught fish of sufficient freshness to prove acceptable to their most fastidious palates.

One of the cubs was stuffed, and in that condition measures 27 in. from point of muzzle to tip of tail.

XXVII.

NOTES ON THE LAND AND FRESH-WATER MOLLUSCA OF IONA.

BY ALEX. SOMERVILLE, B.Sc., F.L.S.

[Read 24th April, 1888.]

On the occasion of a visit to the Island of Iona, in October, 1887, I devoted a short time to the investigation of its land and fresh-water mollusca; and though I cannot claim to have exhausted the species occuring on the island, it may be of interest to mention that sixteen rewarded search, one being aquatic, and the remainder, including three slugs, terrestrial.

The western and uninhabited side of Iona faces the Atlantic, and is rocky, excepting towards the middle, where there is an open bay, from which stretch up sandy, grass-covered undulations. Here *Helix ericetorum*, Müll., and *Bulimus acutus* (Müll.), were swarming, as they do in many similar places on the West of Scotland from the Butt of Lewis to the Mull of Cantyre and on the sandy Ayrshire coast. On the eastern, or inhabited side of the island, under stones near human dwellings, most of the species met with were found; and of these the most plentiful was *Helix sericea*, Müll., a local though widely-distributed form, so named from its epidermic covering of fine white silky hairs which do not easily rub off.

The following is a list of what were obtained,

examples of all of which have been submitted to Mr. J. W. Taylor, F.L.S., Leeds, for confirmation, viz.:

Limnæa peregra (Müll.).—Common in a stream in the middle of the island.

Arion ater (L.).—Our common black snail.

bourguinati, Mabille.

Limax agrestis, L.—The common pale-brown slug.

Vitrina pellucida, Müll.

Zonites cellarius (Müll.).

alliarius (Miller).

Helix aspersa, Müll.—Found on the eastern side, but also in some abundance on the faces and in the crevices of the high shore rocks on the western side, where it seemed to be meditating hibernation.

nemoralis, L.—On both eastern and western sides.

hortensis, Müll.—On both eastern and western sides.

sericea, Müll.—Common, as stated, under stones on the eastern side.

ericetorum, Müll.—Abundant in most parts of the island.

rotundata, Müll.

Bulimus acutus (Müll.).—Plentiful.

Pupa umbilicata, Drap.

Cochlicopa lubrica (Müll.).

Iona consists chiefly of schistose rocks of the middle Silurian period. It is one of the "Mid-Ebudes" (or central group of the Inner Hebrides) which form the British vice-county No. 103, and which, in addition to Mull, include Coll, Tiree, Ulva, and, in the words of Sir Walter Scott,

> "——all the group of islets gay
> That guard famed Staffa round."

XXVIII.

THE JAY, STARLING, AND KINGFISHER IN AYRSHIRE.

BY DAVID LANDSBOROUGH.

[Read 27th December, 1887, &c.]

THE JAY, *Garrulus glandarius*, Lin.

ABOUT seventy years ago the Jay was not uncommon in the Loudon and neighbouring woods, but was almost extirpated as being destructive to game by eating the eggs and young birds. The gamekeepers said of it that it was cunning as a monkey, and could rarely be surprised. They accomplished their object, however, by searching for and destroying the nests.

Mr. M'Queen, Mauchline, tells me he has seen the Jay years ago in the Barskimming woods. Mr. Scobie, Hurlford, informs me that he has several times seen it in Ayrshire. Mr. Crosbie, one of my elders, tells me that in the year 1829 his father brought a pair of young Jays from the woods of Coilton, near Tarbolton. Mr. Roderick Kennedy, Kilmarnock, about the same time found a Jay's nest in the Craufurdland woods, about three miles from Kilmarnock, containing two birds, which he took. One died while young from having been fed on unsuitable worms, and the other he had for years.

THE STARLING, *Sturnus vulgaris*, Lin.

THE Starling and the Jay are closely related; but while the Jay is much scarcer than formerly, the Starling has within the last sixty years multiplied in Ayrshire more than any other bird. It has indeed made an increase only to be paralleled

by that of the squirrel, but numerically much greater. In proof of this I notice that in the article "Stevenston" in the *New Statistical Account of Scotland* (published in 1837), my father, in a list of twenty-one of the "rarer birds found in the parish," mentions the Starling, along with the Quail, Turtle Dove, Roller, &c. So also in the article "Ayr," in the same volume, we read: "The Starling is a rare bird, but not altogether unknown here." My memories of Stevenston parish carry me back a few years farther, and I remember that I then knew of only one place where the Starling was to be seen. This was at the striking old ivy-clad castle of Kerelaw, interesting to Glasgow people as associated with the distinguished divine, Dr. Love, of Anderston Church, who, in the year 1775 lived in the castle as tutor to the Hamilton family. It continued to be occupied by this family till about the year 1787, when a new mansion was built and the old castle planted with ivy. The ivy became most luxuriant; and here it was that as a boy I was wont to listen to the pleasing and not unmusical chattering, and clear whistling of the Starling. Soon afterwards the bird had greatly increased and become so tame that it was only necessary to erect a suitable box for its selection as nesting quarters. These boxes, placed on the tops of chimneys, trees, or tall poles, were a source of much pleasure to almost all the boys in the neighbourhood.

But the question presents itself—at what date did the Starling first appear in Ayrshire as a permanent resident? Fortunately to this we can give a definite answer. Mr. M'Queen tells me that he was the first person in Mauchline to have a young Starling in his possession, having taken it from a nest at Barskimming, which act of his, he says, had almost caused a riot. This was in the year 1834.

The late Mr. Oliver Eaton, bird-stuffer, Kilmarnock, gave as definite a reply, which I present in his own words: "Fond as I am of birds, I had never seen a

Starling till I was thirty years of age (1835), when one day, between Galston and Loudon Castle, I beheld one on a tree. I shot—down it came. It fell on a bank: I rushed forward to it, but, when near, stopped to admire. It lay before me, its green and blue feathers shining and glancing as the morning sun played over them. I thought I had never seen a bird so beautiful. After a little I gently put down my hand to take it. Whir! The bird has flown, and I am madly pursuing it. I was so enchanted with it that I think I would have followed it in front of the windows of Loudon Castle. At length it fell, and I secured it. But for a considerable time I could not venture back to the place, as the folk in Galston heard that I had shot the bird."

With regard to the causes of the great multiplication of the Starling in Ayrshire in recent years, the fact first to be noticed is that for long the bird had been abundant both north and south of the county. That it was abundant in England appears from White's *Natural History of Selborne*, published in the end of last century. The testimony of Fleming *(British Animals)* is that in 1828, the date of the publication of his great work, "it abounds in Orkney and in the Shetland Islands." How is it, then, that sixty years ago it was almost unknown in Ayrshire, and that now it is to be seen in greater flocks than any other bird? The Squirrel has made its appearance and become abundant in our woods during the same period, and the Gold-crested Wren has also become much more common than formerly.

I would notice four changes which have come over the county during the period, all of which are in favour of the Starling. (First) Woods have been greatly extended, with suitable nesting-places in old trees. (Second) The increase of population, and proportionally much more of wealth, in the country has led to old mansions, castles, and churches being abandoned; while modern taste has led to many of these being planted with ivy, which forms homes

and nesting-places for innumerable numbers of these social birds. (Third) The Starling invariably frequents ground where there is much worm and insect life. Cold, sour, damp ground it abhors, as life of all kinds is there at a minimum. This was the condition of much of Ayrshire sixty or seventy years ago; but at that time tile-draining was introduced, and now the county is one of the best-drained in Britain. The result has been that the ground is in a more favourable condition for the existence of worms, snails, slugs, beetles, &c., the favourite food of Starlings. (Fourth) Nothing now pays so well in Ayrshire as pasturage. As far as possible land is now laid down in grass, kept without being broken up, and both frequently and heavily top-dressed. These rich old pastures, abounding in life of all kinds, furnish the favourite hunting-ground of the Starlings, which render incalculable service by keeping down the excessive increase of many insects, &c., that would otherwise prove most injurious.

I conclude by narrating a strange instance of late nesting which came under my notice last year. In October a pair of Starlings built their nest among the ivy at the Dean Castle, Kilmarnock; in November they were tending young, and in the beginning of December were still feeding them. They were seen by Mr. Joseph H. Turner, Factor to the Duke of Portland, and by many of the workpeople. I am glad to add that the venturesome birds were rewarded with success, as no casualty befell their young. They were last seen being fed by the old ones after they had left the nest.

The Kingfisher. *Alcedo ispida*, Lin.

No native bird is so gorgeous in its plumage, and so tropical in its appearance, as the Kingfisher. It is to be found in suitable localities in most parts of Britain, and the Kilmarnock district—a land of streams—is no exception. The Irvine is its favourite stream, but it is also to be seen on others. How it

glances in the sunshine, as it flits from place to place, or as from overhanging branch it dives for its finny prey! The pity is that a bird so rich in colour, and so interesting in its habits, should not be so numerous as to be a constant ornament of our streams. Its beauty, however, prevents this. No sooner does a fisher report that he has seen the bird, than on the following Saturday a dozen men with guns are in search of it; and the search is continued, Saturday after Saturday, till the beautiful bird is sacrificed. This has already occurred twice at Kilmarnock during the last winter.

Yet the Wild Birds Protection Act, if properly enforced, would do much to preserve the Kingfisher. This is apparent from the fact that during the earlier years after the Act was passed, and when instructions had been given to the police in all directions to look to its observance, the Kingfisher so increased in our neighbourhood that one person (the late Mr. Oliver Eaton) knew of five nests in the course of a single season. Alas! matters now are almost as bad as ever. Eggs and young birds are taken, the old ones shot, even in violation of the Act, and the Kingfisher has become as rare by our streams as it was before. It would be well if steps were taken for the vigorous enforcement of the Act; and if the Act were supplemented so as to prohibit, under a smart fine, this bird being shot, stuffed, or possessed at any season, except by public scientific institutions, then might we hope that our superb Kingfisher would become as numerous as I saw its far less brilliant representative, the Belted Kingfisher (*Alcedo Alcyon*), at Paget Sound, in the State of Washington, when I visited America last summer.

XXIX.

NOTES ON THE NEPENTHACEÆ, *OR PITCHER-PLANTS.*

BY GEORGE RUSSELL.

[Read 31st January, 1838.]

THE order *Nepenthaceæ* consists of the single genus *Nepenthes*, of which there are about 30 known species. This genus is one of great interest to botanists on account of the extraordinary formation of the leaves, in which a foliaceous extension of the midrib takes the form of a pitcher, hence the commonly applied name of "pitcher-plant."

The species first introduced was brought from Ceylon in the year 1789, and was named *Nepenthes distillatoria*. Its leaves and pitchers are green. In the same year *Nepenthes ampullaria* was introduced from Borneo. The pitchers of this species are green, but their bottle-like shape renders them very distinct from those of *N. distillatoria*. *N. Khasiana* was introduced from China during the year 1787.

The first species with spotted or marbled pitchers came from Singapore in 1815, and was named *N. Rafflesiana*. A marked improvement on this species was introduced from Sarawak in 1815. It is named *N. Hookeriana*, and is apparently a variety of *N. Rafflesiana* and one which is not excelled at the present time. Its pitchers are beautifully marbled and very freely produced.

A few fine hybrids have been raised by Messrs. Veitch of Chelsea, and these have been named *N. Courtii*, *N. Domineana*, *N. Sedenii*, &c. Messrs. Veitch have also introduced some very handsome species, *N. Northiana* being exceptionally beautiful. Mr. B.

S. Williams, Upper Holloway, has sent out some fine species which are remarkable for the brilliant colouring of the pitchers.

Although these plants have been pretty generally cultivated in nurseries and Botanic Gardens, they have not found their way into very many private establishments. The tropical temperature required for their successful cultivation may in some measure account for this; and as they are not very useful for home decoration, they are generally put aside for plants that more readily adapt themselves to this purpose.

We recently grew some small plants about a foot high and carrying a dozen pitchers. They were planted in small hanging baskets, suspended from the dining-room gasalier, and proved both novel and attractive for table decoration.

There is always a small quantity of fluid in the pitcher when the lid opens, and at this stage it is most attractive to insects. Its digestive powers are then most apparent. Ants, which prove indigestible later, are pretty well absorbed at this stage, as are flies, beetles, and snails, very little of them remaining after a few weeks' immersion in the secretion. I have found the pitcher a most excellent ant-trap. The house in which I grow the plants was swarming with Demerara ants, but by the time a few dozen pitchers had grown the number of the insects was considerably reduced. On emptying some of the pitchers I found the remains of hundreds of ants in them. While I find the ants still increasing in the other plant-stoves, they are nearly cleared out of the house occupied by the pitcher-plants.

Inquiries occasionally appear in horticultural journals as to the best manner of getting rid of ants. I have already recommended in the *Journal of Horticulture* that pitcher-plants should be cultivated both in the stoves and in the cool-houses, the North American Pitcher-plant, *Sarracenia purpurea*, being especially suitable for the latter. I have found them

to be very effective, while entailing no labour and being an additional ornament to the structures devoted to plant-culture.

While flies, ants, and beetles are devoured, the pitcher-plants seem to have no relish for beef. Any experiments I have tried in this direction have resulted in the destruction of the pitcher in a very short time, the bloody matter penetrating the pitcher and blackening it in a day or two. Fresh beef, while destroying the pitcher, is not left unacted upon, for the digestive power of the fluid is shown in a very marked and interesting manner. The beef, after a few days' immersion, becomes very rapidly putrid, and when taken out is found to be all honey-combed and as bloodless as though it had been boiled.

Dr. Hooker found by experiment that when the secretion was taken out of the pitcher it lost its digestive powers, thus proving that only when in direct contact with the secretive glands could the fluid perform its functions.

That the plant is benefited by this power of absorption is obvious, as the accumulation of insects in the pitcher would otherwise very soon destroy it. It cannot be said that the growth of the plant generally is improved, or that the pitchers are enlarged, by its insect food; but their preservation is secured, thus adding greatly to the beauty and interest of the genus. I have observed that the decay of the pitcher facilitates the destruction of the portion of the leaf nearest the stem. Regarding the duration of those leaves that are pitchered, as contrasted with those in which the pitchers are undeveloped, there does not appear to be much difference, although the chances of life are largely in favour of the undeveloped ones.

The varied forms assumed by the pitchers on the same plant at different periods of growth are due in some instances to cultivation of a particular kind. If the plants are dwarfed by pruning, they produce pitchers that are winged; and these wings, besides

affording an attractive feature, serve to strengthen the plant and prevent it overbalancing.

The North American Pitcher-plant *(Sarracenia purpurea)* affords evidence in support of this theory. While its pitchers lie almost on the ground, and would inevitably crush one another, a provision similar in nature to the wings in the *Nepenthaceæ* runs up one side of the pitcher.

When the *Nepenthes* is allowed to attain any considerable height, the pitchers assume a form that is much better suited to their more exposed position. Those formed lower down on the plants have no power of supporting themselves, while those higher up take the form of climbers, the elongated midrib invariably twisting itself in the form of a screw or spiral, which enables it to lay hold of any support within its reach. The shape is also much altered, and the wings are dispensed with, a much stronger form being now necessary. The midrib is so strengthened as to enable it to maintain a perpendicular position. This is very important, as its existence depends on the retention of the moisture derived from the atmosphere in the form of rain or dew. In the tropics the moisture at night, which is occasioned by condensation, saturates everything so completely that in Africa water-melons grow luxuriantly in the sandy wastes. This would be impossible without the drenching they receive during the night.

The rim round the mouth of the pitcher is much the same in both forms, and the formidable bristles that are arranged round its edge, pointing downwards, seem to suggest that it serves to keep its prisoners safely secured. It also prevents the pitchers being emptied when swinging about with the wind, for they are able to retain a considerable quantity of their contents even when hanging over at right angles. It is well known that by keeping them half-full of water they last several months

longer than if not so supplied. This I regard as the primary object of the foliaceous extension.

In their native swamps they are always replenished at night so that they may be able to undergo the effects of the heat to which they are subjected during the day. In our own country during summer we find it much better to water plants at night, so that they may be able to stand the heat of the following day without showing any signs of exhaustion. If this operation be left over till the morning it is not nearly so effective, as the plants suffer from the heat of the sun before they have had time to assimilate the amount of moisture necessary for their support. The pitcher-like leaf of this genus is a beautiful illustration of how a plant adapts itself to its environment.

According to some authorities, the purpose served by the lid is "for keeping the moisture that is stored at night from evaporating during the day, as the lid closes under the influence of the sun." This must be regarded as one of the many exploded fables related of the pitcher-plant. It should be quite evident to anyone who has examined a pitcher that the lid, after having been fully developed, could never close again, no matter to what degree of heat it might be subjected, whether by the sun's rays or from artificial application. In plant-stoves, where they are successfully cultivated, the temperature ranges from 65° to 85° F. with sun heat.

A very common belief is that the pitchers are the flowers; but the inflorescence is inconspicuous, and when fully expanded is of a greenish colour, gradually becoming brown, and remaining a long time in perfection. The flowers are diœcious, and it seldom happens that plants of the different sexes can be got in flower at the same time. This fact, as well as the very great preponderance of plants with male or pollen-bearing flowers, may account in a large measure for the comparative scarcity of new species, in view of the long period that has

elapsed since these plants were introduced to this country.

As pitcher-plants have been generally considered very difficult to propagate by cuttings, many growers have adopted the layering system as the safest method of obtaining roots. I find, however, that the best way to increase them is the simplest, and with ordinary care success is certain. The cuttings are stuck through the hole in an inverted flower-pot without any soil or moss, and are then put into a propagating case, the temperature of which should never fall below 65° or rise above 80°. The case should be kept close and be shaded most carefully from the sun. Under favourable circumstances the plants will root in about six weeks or two months, when they can be potted in the usual way and kept in the case till growth is assured. After the pots are filled with roots, the plants may with advantage be transferred to square teak baskets and suspended from the roof of the plant-stove, that position suiting them well, and showing to the best advantage their beautiful foliaceous character.

XXX.

A CONTRIBUTION TO THE TOPOGRAPHICAL BOTANY OF THE WEST OF SCOTLAND.

BY PETER EWING.

[Read 27th December, 1887.]

ALTHOUGH numerous papers have been published in scientific journals, *Proceedings* of societies, etc., regarding the occurrence of plants in various districts of the West of Scotland, much of the information derived from such sources cannot be accepted as satisfactory evidence on which to base scientific conclusions. Apart from the existence of obvious errors, which of course have the effect of vitiating the lists in which they occur, many reported "new records" suggest grave doubts as to the correct determination of species or varieties alleged to have been discovered in new localities. Accordingly, unless such lists have been compiled by botanists whose views are generally recognised as authoritative, or collateral evidence is afforded that all new or apparently doubtful records of plants have been supported by submitting specimens of the plants to competent authorities for verification, students of Topographical Botany can scarcely be expected to attach much value to such information.

That the botanists of the West of Scotland have not hitherto kept these facts sufficiently in view, is apparent from the imperfect information submitted to the Botanical Record Club and the editors of *Topographical Botany*. The second edition of that work (published in 1883) shows that many plants, including not a few common species, long known to grow in Clydesdale, either have not yet been re-

ported for the district at all, or have been reported on evidence which cannot be accepted as free from doubt. With regard to the more remote districts of the West of Scotland, the lists for the respective Vice-Counties are apparently so incomplete as to be of little value for scientific purposes. We may further see that owing to this neglect on the part of local workers, much of the topographical work of the West of Scotland has been accomplished by botanists from the Eastern Counties or from England.

With the view of placing our records on a more satisfactory basis, several local botanists have during the past year assisted me in commencing to work out the distribution of plants throughout the West of Scotland, which area, in the sense here employed, may be regarded as including the following Watsonian Vice-Counties or Provinces, viz.:

No.	No. in Watsonian arrangement	Geographical Position.
1.	75.	Ayrshire.
2.	76.	Renfrewshire.
3.	77.	Lanarkshire.
4.	86.	Stirlingshire.
5.	97.	Westerness (western portion of Inverness-shire).
6.	98.	Argyllshire (excluding Cantire peninsula).
7.	99.	Dumbartonshire.
8.	100.	Clyde Isles (Arran, Bute, and the Cumbraes).
9.	101.	Cantire (from Crinan Canal southwards).
10.	102.	South Ebudes (Islay, Jura, Colonsay, and Scarba).
11.	103.	Mid Ebudes (Mull, Tyree, and Coll).
12.	104.	North Ebudes (Muck, Eigg, Canna, and Skye).
13.	105.	West Ross (western portion of Ross-shire, including the detached parts of Cromarty).
14.	110.	Hebrides (Barra, South Uist, Benbecula, North Uist, Harris, and Lewis).

This area embraces very varied country—ground in the highest state of cultivation, as well as the most barren heaths; and fertile glens, as well as

barren peaks, some of these being at a considerable elevation.

Our first effort will be to record on trustworthy authority all Phanerogams, native or introduced, and Cryptogams down to and including the Hepaticæ, found in the above Vice-Counties or Provinces. As there are no proper records of Mosses and Hepaticæ available, it is proposed that entirely new data should be compiled of the distribution of these plants throughout the West of Scotland.

Vouchers, containing information as to localities, situation of growth, etc., of the plants reported on, will be filled up, and all new records will be verified by the production of specimens to be submitted to the referees of the Botanical Record Club for certification, and afterwards deposited in the Herbarium at Kew for preservation. While doing this work, we will also record the plants growing in the various Parishes in the Counties of Renfrew, Lanark, and Dumbarton, with the ultimate object of being able to show the distribution of plants in what may be termed Clydesdale proper. This may appear a heavy undertaking, as no doubt it is, but those who have taken an interest in its progress will support me in saying that it is a very pleasant one. We are anxious for helpers, and any who desire to assist may obtain all requisite information on applying to me.

In laying before the Society the result of our first year's work, I may state that over 10,000 stations for Flowering-plants, and nearly 1,000 for Mosses and Hepaticæ, have been reported, for nearly all of which vouchers have been filled up. The following extensive list comprises over 500 records previously unknown or insufficiently vouched, but now placed beyond doubt by the production and certification of specimens. A considerable number of introduced plants have been included, the names of these being printed in italics, but at least 300 of the species enumerated are unquestionably native. The more

critical genera and species have scarcely as yet been touched; and upwards of 100 additional vouchers for new records are meanwhile retained until corroborative specimens shall have been produced.

It will be observed that the Vice-Counties which have been best represented in this year's work are Ayr (75), Renfrew (76), Lanark (77), Stirling (86), Westerness (97), Argyle (98), Dumbarton (99), Clyde Isles (100), Cantire (101), and Mid Ebudes (103).

As the identification of Mosses and Hepaticæ usually requires more time and is accompanied with more difficulty than that of Flowering-plants, we do not at present append our Cryptogamic records; but it is expected that these will be published every alternate year.

My best thanks are due to Mr. Arthur Bennett, F.L.S., for his kindness in examining and reporting on the specimens submitted, also to all whose names appear in the list for the aid they have afforded me in providing the materials for its compilation.

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1 *Clematis Vitalba*, Linnaeus.—Dunbarton, Watt.
7 Anemone nemorosa, Linnaeus.—Westerness, Ewing.
14 Ranunculus pseudo-fluitans, Babington.—Lanark, Ewing.
16 Drouetii, Godron.—Stirling, M'Kay.
19 Baudotii, Godron.—Lanark, Ewing.
21 Lenormandi, F. Schultz.—Dunbarton, Watt.
27 Lingua, Linnaeus.—Stirling, M'Kay.
36 Ficaria, Linnaeus.—Argyle, King; Cantyre, Ewing.
37 Caltha palustris, Linnaeus.—Argyle, King.
40 *Helleborus viridis*, Linnaeus.—Renfrew, Lanark, Ewing.
43 *Aquilegia vulgaris*, Linnaeus.—Renfrew, M'Kay.
45 *Aconitum Napellus*, Linnaeus.—Mull, Ewing.
48 *Berberis vulgaris*, Linnaeus.—Stirling, M'Kay; Dunbarton, Watt; Mull, Ewing.
Nymphaea alba, Linnaeus.—Westerness, Ewing; Argyle, King.
55 Papaver dubium, Linnaeus.—Dunbarton, Watt.
62 *Chelidonium majus*, Linnaeus.—Dunbarton, Watt.
75 *Cheiranthus Cheiri*, Linnaeus.—Lanark, Ewing.

76 Nasturtium officinale, Robert Brown.—Argyle, King.
78 palustre, De Candolle.—Stirling, M'Kay.
79 amphibium, Robert Brown.—Ayr, Smith.
80 Barbarea vulgaris, Robert Brown.—Mull, Ewing.
92 Cardamine pratensis, Linnaeus.—Westerness, Ewing.
93 hirsuta, Linnaeus.—Westerness, Ewing; Argyle, King.
94 flexuosa, Withering.—Ayr, Smith; Stirling, M'Kay; Argyle, King.
111 *Hesperis matronalis*, Linnaeus.—Ayr, Smith; Lanark, Cantyre, Mull, Ewing.
125 *Brassica Rutabaga*, De Candolle.—Renfrew, Lanark, M'Kay.
126 *Rapa*, Linnaeus.—Lanark, M'Kay.
134 *Diplotaxis tenuifolia*, De Candolle.—Dunbarton, Watt.
135 *muralis*, De Candolle.—Ayr, Boyd.
144 *Lepidium Draba*, Linnaeus.—Ayr, Smith.
148 *Iberis amara*, Linnaeus.—Ayr, Smith.
154 Raphanus Raphanistrum, Linnaeus.—Stirling, M'Kay; Dunbarton, Watt.
164 Viola palustris, Linnaeus.—Dunbarton, M'Kay.
173 tricolor, Linnaeus.—Westerness, Ewing.
175 Curtisii, Forster.—Mull, Ewing.
177 Polygala vulgaris, Linnaeus.—Stirling, M'Kay; Dunbarton, Ewing.
179 serpyllacea, Weihe.—Lanark, M'Kay; Dunbarton, Watt; Westerness, Mull, Cantyre, Ewing.
191 *Saponaria officinalis*, Linnaeus.—Ayr, Smith.
192 Silene Cucubalus, Wibel.—Dunbarton, Watt.
204 Lychnis alba, Miller.—Dunbarton, Miss Henderson.
205 diurna, Sibthorp.—Westerness, Ewing.
209 Githago, Lamarck.—Argyle, King.
215 Cerastium glomeratum, Thuillier.—Argyle, King.
225 Stellaria Holostea, Linnaeus.—Argyle, King.
227 graminea, Linnaeus.—Westerness, Ewing; Argyle, King.
228 uliginosa, Murray.—Argyle, King; Cantyre, Ewing.
233 Arenaria trinervia, Linnaeus.—Ayr, Smith.
234 serpyllifolia, Linnaeus.—Argyle, King; Dunbarton, Watt.
240 Sagina apetala, Linnaeus.—Dunbarton, Watt.
249 Lepigonum salinum, Fries.—Westerness, Mull, Ewing.
250 marginatum, Koch.—Ayr, Smith.
253 *Claytonia alsinoides*, Sims.—Renfrew, Turner; Bute, M'Kay.
263 Hypericum perforatum, Linnaeus.—Dunbarton, Watt; Cantyre, Ewing.
267 humifusum, Linnaeus.—Argyle, King; Dunbarton, M'Kay.

284 *Tilia vulgaris*, Hayne.—Ayr; Renfrew; Lanark; Stirling; Westerness; Argyle; Dunbarton; Clyde Isles.
285 *cordata*, Miller.—Ayr, Smith.
290 *Linum usitatissimum*, Linnaeus.—Ayr, Smith; Dunbarton, Watt.
295 Geranium sylvaticum, Linnaeus.—Ayr, Smith; Dunbarton, Watt.
304 Robertianum, Linnaeus.—Westerness, Ewing; Dunbarton, Watt.
314 Ilex Aquifolium, Linnaeus.—Dunbarton, Watt.
317 *Rhamnus Frangula*, Linnaeus.—Stirling, Ewing.
318 *Acer Pseudo-platanus*, Linnaeus.—Ayr; Renfrew; Lanark; Stirling; Argyle; Dunbarton.
319 *campestre*, Linnaeus.—Ayr, Smith; Argyle, King.
323 Ulex europaeus, Linnaeus.—Mull, Ewing.
325 *nanus*, Foster.—Argyle, King.
331 *Medicago sativa*, Linnaeus.—Lanark, Ewing.
336 *maculata*, Sibthorp.—Dunbarton, Watt.
338 *Melilotus altissima*, Thuillier.—Dunbarton, Watt.
339 *alba*, Desroussaux.—Dunbarton, Watt.
340 *officinalis*, Desroussaux.—Ayr, Smith; Lanark, Ewing.
344 Trifolium medium, Linnaeus.—Ayr, Smith; Westerness, Ewing; Argyle, King.
357 *hybridum*, Linnaeus.—Lanark, M'Kay; Argyle, King.
361 agrarium, Linnaeus.—Lanark, M'Kay.
362 procumbens, Linnaeus.—Westerness, Ewing; Argyle, King; Dunbarton, Watt.
365 Anthyllis Vulneraria, Linnaeus.—Ayr, Smith; Westerness, Ewing; Argyle, King.
387 Vicia sepium, Linnaeus.—Ayr, Smith; Argyle, King.
392 angustifolia, Roth.—Ayr, Smith.
395 Lathyrus *Aphaca*, Linnaeus.—Ayr, Smith.
405 macrorhizus, Wimmer.—Ayr, Smith; Stirling, M'Kay.
407 Prunus communis, Hudson.—Ayr, Smith; Argyle, King.
408 insititia, Linnaeus.—Ayr, Smith.
410 Avium, Linnaeus.—Dunbarton, Watt.
412 Padus, Linnaeus.—Argyle, King; Dunbarton, Somerville; Cantyre, Ewing.
413 *Spiraea salicifolia*, Linnaeus.—Ayr, Smith; Renfrew, M'Kay; Westerness, Ewing.
416 Rubus Idaeus, Linnaeus.—Stirling, M'Kay.
455 Radula, Weihe.—Ayr, Ewing.
471 corylifolius, Smith.—Lanark, Mull, Ewing.
474 caesius, Linnaeus.—Westerness, Ewing.

479 Geum intermedium, Ehrhart.—Ayr, Smith; Dunbarton, Watt.
480 rivale, Linnaeus.—Cantyre, Ewing.
482 *Fragaria elatior*, Ehrhart.—Ayr, Smith; Renfrew, M'Kay; Lanark, Ewing.
489 Potentilla procumbens, Sibthorp.—Stirling, M'Kay; Dunbarton, Miss Henderson.
490 reptans, Linnaeus.—Renfrew, Turner; Dunbarton, Watt.
501 Agrimonia Eupatoria, Linnaeus.—Argyle, King.
503 *Poterium Sanguisorba*, Linnaeus.—Dunbarton, Watt.
509 Rosa mollis, Smith.—Lanark, Ewing.
509b var. caerulea.—Lanark, Ewing.
510b tomentosa, Smith, var. subglobosa.—Lanark, Ewing.
510d scabriuscula.—Westerness, Ewing.
514c canina, Linnaeus, var. sphaerica.—Lanark, Ewing.
514e dumalis.—Lanark, Ewing.
514v glauca.—Lanark, Ewing.
516 arvensis, Hudson.—Renfrew, Turner.
525 Pyrus *Aria*, Smith.—Lanark, M'Kay.
530 Aucuparia, Gaertner.—Argyle, King.
541 *Saxifraga umbrosa*, Linnaeus.—Lanark, Ewing.
553 Chrysosplenium oppositifolium, Linnaeus.—Argyle, King.
555 Parnassia palustris, Linnaeus.—Dunbarton, Watt.
556 Ribes *Grossularia*, Linnaeus.—Ayr; Renfrew; Lanark; Stirling.
557 alpinum, Linnaeus.—Ayr, Smith; Dunbarton, Watt.
558 *rubrum*, Linnaeus.—Lanark, Ewing.
559 *nigrum*, Linnaeus.—Ayr, Smith; Renfrew, Turner; Lanark, Ewing.
563 *Sedum Telephium*, Linnaeus.—Stirling, M'Kay; Dunbarton, Miss Henderson; Arran, Gregorson.
574 Drosera rotundifolia, Linnaeus.—Mull, Ewing.
576 intermedia, Hayne.—Mull, Ewing.
577 Hippuris vulgaris, Linnaeus.—Dunbarton, Watt.
579 Myriophyllum spicatum. Linnaeus.—Stirling, M'Kay; Westerness, Ewing; Argyle, King.
580 alterniflorum, De Candolle.—Argyle, King; Dunbarton, Watt.
582 Callitriche stagnalis, Scopoli.—Ayr, Smith; Mull, Ewing.
589 Peplis Portula, Linnaeus.—Argyle, King.
590 Epilobium *angustifolium*, Linnaeus.—Renfrew, M'Kay; Dunbarton, Watt.
592 hirsutum, Linnaeus.—Argyle, King; Dunbarton, Watt.
598 obscurum, Schreber.—Mull, Ewing.
600 palustre, Linnaeus.—Mull, Ewing.

607 Circaea lutetiana, Linnaeus.—Argyle, King.
610 Hydrocotyle vulgaris, Linnaeus.—Argyle, King.
613 *Astrantia major*, Linnaeus.—Renfrew, Turner; Mull, Ewing.
614 Sanicula europaea, Linnaeus.—Westerness, Cantyre, Mull, Ewing; Argyle, King.
630 *Carum Petroselinum*, Bentham.—Ayr, Smith.
632 *Carui*, Linnaeus.—Ayr, Smith; Renfrew, Turner.
637 Aegopodium Podagraria, Linnaeus.—Westerness, Ewing.
638 Pimpinella Saxifraga, Linnaeus.—Dunbarton, Watt.
640 Conopodium denudatum, Koch.—Argyle, King; Westerness, Cantyre, Ewing.
641 Myrrhis odorata, Scopoli.—Argyle, King; Mull, Ewing.
643 *Scandix Pecten-Veneris*, Linnaeus.—Dunbarton, Watt.
645 Anthriscus sylvestris, Hoffmann.—Westerness, Mull, Ewing.
646 *Cerefolium*, Hoffmann.—Westerness, Ewing.
658 Aethusa Cynapium, Linnaeus.—Dunbarton, Watt.
668 *Peucedanum Ostruthium*, Koch.—Ayr, Smith; Stirling, M'Kay.
669 *sativum*, Bentham.—Dunbarton, Watt.
670 Heracleum Sphondylium, Linnaeus.—Argyle, King.
672 Daucus Carota, Linnaeus.—Dunbarton, Watt.
681 *Cornus sanguinea*, Linnaeus.—Renfrew, M'Kay.
682 Adoxa Moschatellina, Linnaeus.—Argyle, King.
683 Sambucus nigra, Linnaeus.—Westerness, Ewing; Argyle, King; Dunbarton, Watt.
686 *Viburnum Lantana*, Linnaeus.—Ayr, Smith; Lanark, Ewing.
689 Lonicera Periclymenum, Linnaeus.—Argyle, King.
693 Galium Cruciata, Scopoli.—Cantyre, Ewing.
694 verum, Linnaeus.—Argyle, King.
705 Asperula odorata, Linnaeus.—Argyle, King.
712 *Valeriana pyrenaica*, Linnaeus.—Ayr, Smith; Lanark, Ewing.
715 Valerianella olitoria, Moench.—Argyle, King.
742 Gnaphalium uliginosum, Linnaeus.—Argyle, King.
747 *Inula Helenium*, Linnaeus.—Lanark, Ewing.
759 Achillea Ptarmica, Linnaeus.—Arran, Gregorson.
764 *Anthemis nobilis*, Linnaeus.—Ayr, Smith.
765 Chrysanthemum segetum, Linnaeus.—Argyle, King.
769 *Matricaria Chamomilla*, Linnaeus.—Dunbarton, Watt.
770 *Tanacetum vulgare*, Linnaeus.—Mull, Ewing.
777 Petasites vulgaris, Desfontaines.—Westerness, Ewing; Argyle, King.
779 *Doronicum Pardalianches*, Linnaeus.—Ayr, Smith; Lanark, Ewing.
780 *plantagineum*, Linnaeus.—Lanark, Ewing.
788 *Senecio saracenicus*, Linnaeus.—Ayr, Smith; Renfrew, M'Kay.

796 Arctium minus, Schkuhr.—Cantyre, Mull, Ewing.
798 Carduus pycnocephalus, Jacquin.—Dunbarton, Watt.
800 crispus, Linnaeus.—Ayr, Smith; Argyle, King.
813 Saussurea alpina, De Candolle.—Mull, Ewing.
817 *Centaurea Scabiosa*, Linnaeus —Dunbarton, Watt.
823 *Cichorium Intybus*, Linnaeus.—Ayr, Smith; Dunbarton, Watt.
825 Lapsana communis, Linnaeus.—Mull, Ewing.
831 Crepis virens, Linnaeus.—Westerness, Ewing.
835 paludosa, Moench.—Mull, Ewing,
836 Hieracium Pilosella, Linnaeus.—Argyle, King.
837 *aurantiacum*, Linnaeus.—Lanark, M'Kay; Argyle, King; Dunbarton, Watt.
863 vulgatum, Fries.—Argyle, King.
874 Eupatorium, Grisebach.—Westerness, Ewing.
877 Hypochaeris radicata, Linnaeus. — Argyle, King; Mull, Ewing.
879 Leontodon hirtus, Linnaeus.—Lanark, M'Kay.
880 hispidus, Linnaeus.—Cantyre, Ewing.
886 *Lactuca muralis*, Fresenius.—Argyle, King.
890 Sonchus asper, Hoffman.—Argyle, King.
891 arvensis, Linnaeus.—Argyle, King.
894 *Tragopogon porrifolius*, Linnaeus.—Lanark, Ewing; Argyle, King.
910 Vaccinium Oxycoccos, Linnaeus.—Argyle, King; Dunbarton, Watt.
918 Calluna Erica, De Candolle.—Mull, Ewing.
931 Pyrola secunda, Linnaeus.—Westerness, Ewing.
942 Primula veris, Linnaeus.—Lanark, Ewing.
946a hybridae.—Ayr, Smith.
948 Lysimachia *thyrsiflora*, Linnaeus.—Renfrew, M'Kay.
953 nemorum, Linnaeus.—Mull, Ewing.
956 Anagallis arvensis, Linnaeus.—Argyle, King.
957 *caerulea*, Schreber.—Dunbarton, Miss Henderson.
962 *Ligustrum vulgare*, Linnaeus.—Argyle, King; Dunbarton, M'Kay; Cantyre, Ewing.
979 Menyanthes trifoliata, Linnaeus.—Westerness, Ewing; Dunbarton, M'Kay.
985 Symphytum officinale, Linnaeus.—Dunbarton, Watt; Mull, Ewing.
986 tuberosum, Linnaeus.—Ayr, Smith; Stirling, M'Kay; Argyle, King.
987 *Borago officinalis*, Linnaeus.—Ayr, Smith; Lanark, M'Kay.
992 *Pulmonaria officinalis*, Linnaeus.—Ayr, Smith.
995 Myosotis palustris, Withering, var. strigulosa, Mert and Koch.—Dunbarton, Watt.
996 repens, George Don.—Dunbarton, Miss Henderson.
999 arvensis, Hoffmann.—Westerness, Ewing.

1001 Myosotis versicolor, Reichenbach.—Westerness, Ewing; Argyle, King; Dunbarton, Watt.
1006 *Echium vulgare*, Linnaeus.—Argyle, King.
1008 Calystegia Sepium, Robert Brown.—Argyle, King; Dunbarton, Watt.
1010 Convolvulus arvensis, Linnaeus.—Argyle, King; Dunbarton, Watt.
1015 Solanum Dulcamara, Linnaeus.—Dunbarton, Watt.
1021 Verbascum Thapsus, Linnaeus.—Dunbarton, Watt.
1028 Linaria Cymbalaria, Miller.—Lanark, Ewing.
1043 Scrophularia vernalis, Linnaeus.—Lanark, Ewing.
1044 *Mimulus luteus*.—Ayr, Smith; Argyle, King.
1051 Veronica *persica*, Poiret.—Argyle, King; Mull, Ewing.
1054 arvensis, Linnaeus.—Westerness, Ewing.
1056 serpyllifolia, Linnaeus.—Mull, Ewing.
1064 montana, Linnaeus.—Ayr, Smith; Argyle, King.
1065 scutellata, Linnaeus. Dunbarton, Watt.
1067 Beccabunga, Linnaeus.—Argyle, King.
1068 Euphrasia officinalis, Linnaeus.—Mull, Ewing.
1076 Melampyrum pratense, Linnaeus.—Argyle, King.
1076d var. montanum.—Dunbarton, Watt.
1105 Mentha viridis, Linnaeus.—Mull, Ewing.
1108 hirsuta, Linnaeus.—Stirling, M'Kay.
1120 Calamintha Clinopodium, Bentham.—Dunbarton, Watt.
1129 Nepeta Glechoma, Bentham.—Dunbarton, Watt.
1134 *Marrubium vulgare*, Linnaeus.—Dunbarton, Watt.
1139 Stachys sylvatica, Linnaeus.—Westerness, Ewing.
1140 arvensis, Linnaeus.—Dunbarton, Watt.
1142 Galeopsis Ladanum, Linnaeus.—Dunbarton, Watt.
1148 Lamium amplexicaule, Linnaeus.—Argyle, King.
1150 hybridum, Villars.—Argyle, King.
1152 *maculatum*, Linnaeus.—Ayr, Smith; Stirling, M'Kay.
1154 *Galeobdolon*, Crantz.—Renfrew, M'Kay.
1160 Ajuga reptans, Linnaeus.—Argyle, King.
1170 Littorella lacustris, Linnaeus.—Renfrew, Stirling, M'Kay; Mull, Ewing.
1187 *Chenopodium rubrum*, Linnaeus.—Dunbarton, Watt.
1191 *Beta maritima*, Linnaeus.—Dunbarton, Watt.
1193 Atriplex patula, Linnaeus.—Ayr, Smith; Mull, Ewing.
1194 hastata, Linnaeus.—Westerness, Ewing.
1200 Salicornia herbacea, Linnaeus.—Mull, Ewing.
1205 Polygonum Convolvulus, Linnaeus.—Argyle, King.
1214 lapathifolium, Linnaeus.—Dunbarton, Watt.
1217 *Bistorta*, Linnaeus.—Argyle, King.
1219 *Fagopyrum esculentum*, Moench.—Ayr, Smith; Westerness, Ewing.

1221 Rumex conglomeratus, Murray.—Ayr, Smith.
1222 sanguineus, Linnaeus.—Stirling, M'Kay; Argyle, King; Mull, Ewing.
1226 obtusifolius, Linnaeus.—Mull, Ewing.
1229 crispus, Linnaeus.—Argyle, King.
1232 *alpinus*, Linnaeus.—Argyle, King.
1237 *Asarum europaeum*, Linnaeus.—Ayr, Smith.
1241 *Hippophae rhamnoides*, Linnaeus.—Ayr, Smith.
1245 Euphorbia Helioscopia, Linnaeus.—Argyle, King.
1264 *Ulmus campestris*, Smith.—Ayr; Argyle; Arran; Cantyre.
1265 *Humulus Lupulus*, Linnaeus.—Dunbarton, Watt.
1269 Parietaria officinalis, Linnaeus.—Dunbarton, Watt.
1272 Betula glutinosa, Fries.—Mull, Ewing.
1275 *Carpinus Betulus*, Linnaeus.—Argyle, King.
1277a *Quercus Robur*, Linnaeus, var. *pedunculata*.—Ayr, Smith.
1277c *sessiliflora*.—Ayr, Smith.
1278 *Castanea sativa*, Miller.—Ayr, Smith; Lanark, Cantyre, Ewing; Dunbarton, Watt.
1279 *Fagus sylvatica*, Linnaeus.—Dunbarton, Watt.
1280 Salix pentandra, Linnaeus.—Stirling, M'Kay; Dunbarton, Somerville.
1281 fragilis, Linnaeus.—Westerness, Ewing.
1282 alba, Linnaeus.—Mull, Ewing.
1285 purpurea, Linnaeus.—Mull, Ewing,
1295 cinerea, Linnaeus.—Argyle, King; Mull, Ewing.
1296 aurita, Linnaeus.—Argyle, King; Dunbarton, Watt.
1297 Caprea, Linnaeus.—Argyle, King.
1311 *Populus alba*, Linnaeus.—Ayr, Smith; Arran, Gregorson.
1314 *nigra*, Linnaeus.—Ayr, Smith; Lanark, Ewing; Stirling, M'Kay.
1320 *Taxus baccata*, Linnaeus.—Stirling, M'Kay; Dunbarton, Watt.
1321 *Pinus sylvestris*, Linnaeus.—Ayr; Renfrew; Lanark; Stirling; Westerness; Argyle; Dunbarton; Arran; Cantyre.
1323 *Elodea canadensis*, Michaux.—Lanark, M'Kay.
1330 Listera cordata, Robert Brown.—Dunbarton, Watt.
1340 Epipactis latifolia, auct.—Dunbarton, Watt.
1352 Orchis mascula, Linnaeus.—Mull, Ewing.
1355 latifolia, Linnaeus.—Dunbarton, Miss Henderson; Cantyre, Ewing.
1367 Habenaria bifolia, Robert Brown.—Stirling, M'Kay; Dunbarton, Watt.
1368 chloroleuca, Ridley.—Ayr, Smith; Cantyre, Ewing.
1380 *Narcissus Pseudo-narcissus*, Linnaeus.—Ayr, Smith; Renfrew, Ewing.
1385 *Galanthus nivalis*, Linnaeus.—Ayr, Smith.

1389 *Ruscus aculeatus*, Linnaeus.—Renfrew, Turner; Lanark, Ewing.
1392 *Polygonatum multiflorum*, Allioni.—Ayr, Smith.
1395 *Convallaria majalis*, Linnaeus.—Ayr, Smith.
1407 Allium ursinum, Linnaeus.—Argyle, King; Dunbarton, Watt.
1411 Scilla nutans, Smith.—Stirling, M'Kay; Argyle, King; Mull, Ewing.
1413 *Ornithogalum umbellatum*, Linnaeus.—Lanark, Ewing.
1418 *Tulipa sylvestris*, Linnaeus.—Lanark, Ewing.
1429 Juncus Gerardi, Loiseleur.—Mull, Ewing.
1433 glaucus, Ehrhart.—Renfrew, M'Kay; Lanark, Westerness, Ewing.
1434 diffusus, Hoppe.—Cantyre, Ewing.
1436 conglomeratus, Linnaeus.—Dunbarton, Watt.
1443 acutiflorus, Ehrhart.—Mull, Ewing.
1449 Luzula pilosa, Willdenow.—Argyle, King.
1450 maxima, De Candolle.—Arran, Gregorson.
1453 campestris, De Candolle.—Argyle, King; Mull, Ewing.
1454 multiflora, Lejeune.—Ayr, Smith; Mull, Ewing.
1457 Sparganium ramosum, Curtis.—Westerness, Ewing; Argyle, King.
1462 *Arum maculatum*, Linnaeus.—Dunbarton, Somerville.
1467 Lemna gibba, Linnaeus.—Ayr, Smith.
1476 Triglochin palustre, Linnaeus.—Stirling, M'Kay; Mull, Ewing.
1479 Potamogeton natans, Linnaeus.—Stirling, M'Kay; Westerness, Mull, Ewing.
1487 heterophyllus, Schreber.—Dunbarton, Ewing.
1495 perfoliatus, Linnaeus.—Stirling, Ewing.
1522 Eleocharis acicularis, Smith.—Cantyre, Ewing.
1525 multicaulis, Smith.—Lanark, M'Kay.
1531 Scirpus setaceus, Linnaeus.—Stirling, M'Kay; Dunbarton, Watt.
1539 sylvaticus, Linnaeus.—Stirling, Ewing; Dunbarton, M'Kay.
1545 Eriophorum latifolium, Hoppe.—Cantyre, Ewing.
1560 Carex disticha, Hudson.—Dunbarton, Watt.
1564 paniculata, Linnaeus.—Stirling, M'Kay.
1570 remota, Linnaeus.—Lanark, Ewing; Stirling, M'Kay.
1584 rigida, Goodenhoug.—Mull, Ewing.
1585 aquatilis, Wahlenberg.—Renfrew, M'Kay.
1587 Goodenowii, J. Gay.—Argyle, King.
1590 limosa, Linnaeus.—Westerness, Ewing.
1598 praecox, Jacquin.—Dunbarton, M'Kay.
1600 pallescens, Linnaeus.—Renfrew, M'Kay; Cantyre, Ewing.

1609 Carex sylvatica, Hudson.—Cantyre, Ewing.
1612 distans, Linnaeus.—Westerness, Ewing.
1616 flava, Linnaeus.—Westerness, Ewing; Dunbarton, Watt.
1619 hirta, Linnaeus.—Argyle, King.
1622 riparia, Curtis.—Dunbarton, Watt.
1636 *Phalaris canariensis*, Linnaeus.—Ayr; Lanark; Argyle.
1642 Alopecurus agrestis, Linnaeus.—Ayr, Smith.
1648 Milium effusum, Linnaeus.—Ayr, Smith; Dunbarton, Watt.
1650 *Phleum pratense*, Linnaeus,—Argyle, King.
1670 Aira caryophyllea, Linnaeus.—Argyle, King.
1671 praecox, Linnaeus.—Dunbarton, Watt.
1674 Deschampsia alpina, Roemer and Schultes.—Mull, Ewing.
1679 *Trisetum flavescens*, Beauvois.—Dunbarton, Watt.
1686 Sieglingia decumbens, Bernhardi.—Stirling, M'Kay; Cantyre, Ewing.
1687 Phragmites communis, Trinius.—Argyle, King.
1692 Molinia caerulea, Moench.—Westerness, Ewing; Dunbarton, Watt.
1693 Catabrosa aquatica, Beauvois.—Ayr, Smith.
1694 Melica nutans, Linnaeus.—Ayr, Smith.
1695 uniflora, Retzius.—Dunbarton, Watt.
1702 Poa alpina, Linnaeus.—Mull, Ewing.
1707 nemoralis, Linnaeus.—Ayr, Smith; Cantyre, Ewing.
1714 Glyceria aquatica, Smith.—Dunbarton, Watt; Cantyre, Ewing.
1715 maritima, Wahlenberg.—Mull, Ewing.
1726 Festuca rubra, Linnaeus.—Cantyre, Mull, Ewing.
1733 Bromus asper, Murray.—Dunbarton, Watt.
1740 *racemosus*, Linnaeus.—Ayr, Smith.
1744 Brachypodium sylvaticum, Roemer and Schultes.—Dunbarton, Watt.
1782 Scolopendrium vulgare, Symons.—Dunbarton, Watt.
1785 Cystopteris fragilis, Bernhardi.—Dunbarton, Watt.
1789 Polystichum lobatum, Presl.—Dunbarton, Watt.
1798 Lastraea spinulosa, Presl.—Cantyre, Ewing.
1800 aemula, Brackenridge.—Westerness, Ewing.
1802 Phegopteris Dryopteris, Fée.—Dunbarton, Watt.
1806 Osmunda regalis, Linnaeus.—Cantyre, Ewing.
1809 Botrychium Lunaria, Swartz.—Dunbarton, Watt.
1811 Equisetum maximum, Lamarck.—Argyle, King
1814 sylvaticum, Linnaeus.—Argyle, King; Cantyre, Mull, Ewing.
1815 palustre, Linnaeus.—Westerness, Ewing.
1822 Lycopodium Selago, Linnaeus.—Dunbarton, Watt.
1823 inundatum, Linnaeus.—Ayr, Smith.
1825 clavatum, Linnaeus.—Dunbarton, Watt.

XXXI.

REPORT ON EXCURSIONS, 1887.

During the Summer Session of 1887, 10 excursions were made by the Society, as follows:

1.	21st May, - -	Milngavie.
2.	4th June, - -	Dalry.
3.	18th „ - -	Wemyss Bay.
4.	2nd July, - -	Lochwinnoch.
5.	16th „ - -	Ben Lawers.
6.	30th „ - -	Greenock.
7.	13th August, -	West Kilbride.
8.	20th „ - -	Dalry.
9.	27th „ - -	Caldwell.
10.	10th September, -	Port-Glasgow.

1. Milngavie.

Route.—From Milngavie to Mugdock Reservoir, thence through the Mugdock woods; returning to Milngavie by the banks of the Allander.

Notwithstanding the comparatively early time of year, no fewer than 83 plants were observed in flower.

Flowering Plants,	148,	-	*Richard M'Kay.*
Ferns,	8,	-	„
Equisetaceæ,	2,	-	„

2. Dalry.

Route.—From Dalry to Drakemire, thence by road to Hindog Glen on the Rye Water; returning by Cunningham-Baidland.

113 plants observed in flower.

Mollusca,	20,	-	*James Steel.*
Flowering Plants,	179,	-	*Richard M'Kay.*
Ferns,	14,	-	„
Equisetaceæ,	3,	-	„
Characeæ,	1,	-	„
Mosses,	80,	-	*D. A. Boyd.*

3. Wemyss Bay.

Route.—Kelly Glen, lower part; afterwards seashore at Wemyss Bay.

As the Kelly Burn forms the boundary between the counties of Renfrew and Ayr, separate lists were compiled of the plants observed on either side of the stream.

122 plants were seen in flower.

Renfrewshire.—	Flowering Plants,	182,	*Richard M'Kay.*
	Ferns,	16,	„
	Equisetaceæ,	2,	„
	Mosses,	50,	*P. Ewing.*
	Hepaticæ,	25,	„
Ayrshire.—	Flowering Plants,	126,	*J. Smith.*
	Ferns,	14,	„
	Equisetaceæ,	1,	„
	Mosses,	80,	*D. A. Boyd.*

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4. Lochwinnoch.

Route.—By the kind permission of Mr. J. W. Shand Harvey of Castlesemple, access was obtained to the shores of Castlesemple Loch, which were followed for some distance eastward from Lochwinnoch Railway Station.

185 plants were observed in flower.

Flowering Plants,	215,	-	*Richard M'Kay.*
Ferns,	5,	-	*P. Ewing.*
Equisetaceæ,	4,	-	„
Mosses,	42,	-	„
Hepaticæ,	10,	-	„

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5. Ben Lawers, etc.

Mr. P. Ewing reports as follows:

Owing to the exceptional heat during the month of June, the state of development of the plants mentioned is not to be taken as an indication of the usual condition of the same plants about the end of July. In many cases rocks which are usually dripping with moisture were found to be dry, and the vegetation on them withered up. The bottoms

of many of the wells and pools were caked, and the best streamlets looked as if water had not run in them for months.

The following are some notes on the principal alpine plants observed:

Arabis petræa, Lam., var. *hispida*, DC.—The form which occurs not uncommonly on the Breadalbane range must be referred to this variety. The distinction between it and the typical *A. petræa* can be best seen when the plants are growing. I have gathered specimens of the latter, which is perfectly glabrous, in the Island of Mull.

Draba incana, L.—Very abundant, and in good condition.

D. rupestris, R. Br.—This plant appears to be getting rarer, but the dry weather of June may partly account for its disappearance.

Erophila inflata, Hook.—Certainly spreading. I saw more dried stems and remains of stronger plants than I had ever seen before. After carefully sowing all the seeds left in the dried pods, I removed all traces of the plant for this year.

Cerastium alpestre, Lindbl.
C. lanatum ("Lam.").
C. pubescens, Syme.
} In good flower, although the plants were very small.

Arenaria sulcata, Schlecht. (*A. rubella*, Hook.)—In very fine condition.

A. sedoides, Schultz.—Also in fine condition.

Sagina Linnæi, Presl.—I am not at all sure that our knowledge of this plant is completely satisfactory, as I have frequently observed that *S. procumbens*, *S. nivalis*, and *S. subulata* seem all to grow mixed with *S. Linnæi* in places where the last-named is plentiful.

S. nivalis, Fr.—I am fully convinced that I was right in supposing that the snow in 1884 had nearly killed this plant in its favourite station on Ben Lawers. It is reappearing, however, but is much

more abundant on another mountain west from Ben Lawers, where, in a very few minutes, I counted over 100 specimens.

Potentilla maculata, Power.—Plentiful, but past its flowering stage.

Potentilla Sibbaldi, Hall. f.—Plentiful and well-grown, but past flowering.

Rosa subglobosa (Sm.).—This is often named "*R. Sabini*" by collectors of alpine roses.

Saxifraga nivalis, L.—Plentiful, but plants small.

S. cernua, L.—Very few plants seen.

Epilobium alsinifolium, Vill.—Dried up.

E. alpinum, L.—Plentiful, but plants small.

Cornus suecica, L.—As we crossed the chief habitat of this plant during a drenching rain, I cannot say much about it; but I saw a good many plants here and there in the course of our wanderings.

Erigeron alpinum. L.—This is being driven up into inaccessible places. All the plants I saw were past their best.

Gentiana nivalis, L.—Of this I can say very little, as I saw none of it this year. It is not easily seen amid rain such as fell when I passed its favourite rocks. I believe that it was past flowering; but this plant is certainly much rarer now than it was when I first visited Ben Lawers.

Myosotis alpestris, Schmidt.—Plentiful, but all past or nearly so.

Veronica humifusa (Dicks.).—Plentiful; in good fruit.

V. saxatilis, L.—Still plentiful, although being removed from the lower rocks; in good fruit.

Salices. — Plentiful, but not in a condition for identification.

Tofieldia palustris, Huds.—Plentiful; in good fruit.

Juncus trifidus, L.
J. biglumis, L.
J. triglumis, L.
} Very much dried up.

J. castaneus, Sm.—Almost extirpated on Ben Lawers, and now only to be got in outlying marshy ground. I had the pleasure, however, of discovering this plant in abundance in a new station on a mountain west from Ben Lawers.

Eriophorum angustifolium, Roth., var. *elatius*, Koch.—I have often gathered this plant, believing it to be an unusual form, but was unable to identify it. I have now, however, been able to assign it to the variety named, which is a Scandinavian form included in the 8th edition of the *London Catalogue*.

Carex rigida, Good.—This plant had suffered by the drought.

C. vaginata, Tausch.—Only a few dried-up plants seen.

C. capillaris, L.—The plants were very small and not easily detected.

C. pulla, Good.—I thought that I had made a "find" when I obtained a specimen with light-coloured glumes and fruit. The glumes appeared white and the perigynia of a light-green colour when gathered, otherwise it seemed to agree with the general description of *C. pulla*. After having received a few remarks on a specimen sent to Mr. Arthur Bennett, F.L.S., I am quite willing to look on it as an albino form of *C. pulla*.

Phleum alpinum, L.—A large patch of this grass proved the most gladdening sight during the course of my wanderings this year. I have always found this to be a rare plant on Ben Lawers, and, in fact, all along the Breadalbane range. As I do not suppose one could collect six flowering-stems on Ben Lawers and Ben Ghlas together, the sight of about a hundred proved a most agreeable one.

Avena alpina (Sm.).—Stunted, but plentiful, and the specimens in nice condition for mounting.

Sesleria cærulea, Scop.—Plentiful, but nearly past.

Poa spp.—In very poor condition, owing to the drought.

Festuca barbata, Haeck.—A good deal of this grass seen.

Woodsia hyperborea, R. Br.—This plant, which grows on moist rock ledges or crevices in exposed situations, was in a very pitiful state. All its haunts were so dry that I hardly thought it worth while to go to look for it; but as two gentlemen of our party were very anxious to get plants, I went on their account. As I did not take time to work the rocks on which it grows, I cannot say whether it is holding its place or not. I saw none of it on Ben Lawers, and, in fact, never did.

Cystopteris montana, Bernh.—As plentiful as ever on Ben Lawers, but does not appear to be coming out of the inaccessible crevices.

Polystichum Lonchitis, Roth.—This seemed one of very few plants which had thriven during the heat of June. The fronds, in many cases, were very large and well-developed.

We collected some very fine Mosses and Hepaticæ, and these I may show at some future time.

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6. Greenock.

Route.—From Upper-Greenock Station to Rottenburn, at the south-western end of Loch Thom.

Owing to extremely unfavourable weather, few observations could be made. Living specimens of *Acme lineata* (Drap.) were obtained; and among the rarer plants seen were *Saxifraga hypnoides*, L., *Epilobium angustifolium*, L., and *Asplenium viride*, Huds.

7. West Kilbride.

Route.—From West Kilbride Railway Station to Knockewart Loch.

One or two members of the party reached West Kilbride by an early train, and spent some time in examining the seashore between Seamill and Chapelton, where *Ruppia rostellata*, Koch, *Lepturus filiformis*, Trin., and other maritime plants were obtained.

On the arrival of the main party at the railway station, a visit was made to Law Castle, a ruined tower which occupies a conspicuous and picturesque site on a hill overlooking the village of West Kilbride. Here a halt was made, while Mr. D. A. Boyd read a paper descriptive of the castle, its history, and the fortunes of its former owners. After examining the building, an old road was followed up the eastern slope of Law Hill (551 ft.), from which beautiful and extensive views were obtained of the Firth of Clyde. At Blackshaw Hill the party inspected the prehistoric sculpturings which there occur on a surface of sandstone rock. These are very numerous, and consist of incised cups (some of which are surrounded with concentric circles and furnished with radial grooves), pitted spirals, and other figures. Having passed into Ardrossan parish and ascended Knockewart Hill (794 ft.), the party reached Knockewart Loch, a small sheet of water which is now almost wholly covered with a growth of surface vegetation. A visit was afterwards made to Knock Jergon (757 ft.), from the summit of which a very extensive view was obtained of the Garnock Valley, Ayrshire Coast, Arran, and other parts of the Firth. The hill is of some archæological interest as affording a very good example of the "hill forts" which are common in this part of the country. Here the party was divided into two portions. Some of the members returned to the village by the same route as had

been followed in the ascent, and afterwards inspected the parish churchyard which contains some gravestones with quaint and curious inscriptions; while others descended by a road along the western slope of the Law Hill.

154 plants were observed in flower:

Flowering Plants,	191,	-	*Richard M'Kay.*
Ferns,	10,	-	„
Equisetaceæ,	3,	-	„

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8. Dalry.

Route.—Cleaves Cove and Blair Policies.

"Cleaves Cove" is a remarkable limestone cavern situated on the Dusk Water about two miles from Dalry. This cave, which is of considerable extent, was explored some years ago by Mr. John Smith, Kilwinning, and found to contain a quantity of the bones of various species of mammalia, and some interesting relics of human occupation in prehistoric times. After having been conducted by Mr. Smith through the numerous recesses and passages of the cavern, the party visited the beautiful policies of Blair, and spent some time in examining the contents of the private museum, which is well stocked with interesting objects of natural history and archæology. Numerous fungi were observed in the woods.

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9. Caldwell.

Route.—Lochlibo and adjacent woods.

Although flowering plants were numerous, fungi were found to be very scarce, the only noteworthy species observed being *Russula fœtens*, Pers., *Agaricus semiorbicularis*, Bull., and *Paxillus involutus*, Fr.

Mollusca,	22,	-	*James Steel.*
Flowering Plants,	175,	-	*Richard M'Kay.*
Ferns,	4,	-	„
Equisetaceæ,	3,	-	„

10. Port-Glasgow.

Route.—Devol's Glen.

On account of very unfavourable weather, the attendance was small; and as little work could be undertaken, no attempt was made to compile lists of the plants, etc., observed.

The following is a tabulated list of the species and varieties of Mollusca, Flowering Plants, Ferns, Mosses, etc., identified at the Excursions at which such observations were made. With very few exceptions, the nomenclature respectively followed is that of *The Conchological Society's List of British Land and Freshwater Mollusca* (1883), *The London Catalogue of British Plants* (8th Edition, 1886), and *The London Catalogue of British Mosses and Hepatics* (2nd Edition, 1881).

The figures opposite the name of each species or variety indicate that it was observed at the excursions which bear corresponding numbers in the list given on page 322. Thus, for example, *Helix nemoralis*, L., was found at Dalry and Caldwell, these excursions being respectively numbered 2 and 9 in the list on page 322. For purposes of comparison, the reports of excursions within each County have been placed side-by-side, in preference to arrangement in chronological order.

This list cannot be regarded as indicating exhaustively, or even approximately, the number of species to be found in the localities visited; it rather shows what may be observed in the course of afternoon rambles in places within easy access from the city. In cases where the data have resulted from unaided search by the compiler alone, many species and varieties have no doubt been passed unnoticed which would readily have been detected by a numerous party of workers. This has obviously occurred in the case of several common

plants, such as *Viola tricolor*, etc. Notwithstanding these acknowledged defects, however, the list has been deemed worthy of publication for the following among other reasons: (first) it shows how, by concentrated work, excursions may be made to afford the means of compiling local information of permanent interest and utility; and (second) it may prove useful to visitors and beginners by indicating what is good collecting-ground, and showing what species are likely to be there obtained.

LAND AND FRESH-WATER MOLLUSCA.

	Ayr.	Renfrew.
Pisidium fontinale, Drap.,	...	9
pusillum, Gmelin,	...	9
nitidum, Jen.,	..	9
Valvata piscinalis, Müll.,	...	9
Planorbis albus, Müll.,	...	9
contortus, L.,	...	9
Limnæa peregra, Müll.,	2	9
palustris, Müll.,	2	...
truncatula, Müll.,	...	9
Ancylus fluviatilis, Müll.,	..	9
Arion ater, L,	2	9
Limax maximus, L,	2	...
agrestis, L,	2	...
lævis, Müll.,	...	9
Succinea putris, L,	...	9
Zonites cellarius, Müll.,	2	9
alliarius, Miller,	2	...
nitidulus, Drap.,	2	9
radiatulus, Alder,	2	9
fulvus, Müll.,	2	9
Helix nemoralis, L,	2	9
arbustorum, L,	2	9
rufescens, Penn.,	...	9
hispida, L,	2	9
rotundata, Müll,	2	...
Pupa umbilicata, Drap.,	2	...
Vertigo antivertigo, Drap.,	2	...
substriata, Jeff.,	2	...
edentula, Drap.,	2	...
Clausilia rugosa, Drap. var. Everetti, Miller,	2	...
Cochlicopa lubrica, Müll.,	2	9
Carychium minimum, Müll.,	..	9

PLANTS.

PHÆNOGAMIA.

PHÆNOGAMIA.	Ayr.			Renfrew.			Stirling.
Thalictrum minus, L, ...	2	...	...	...	...	...	...
Anemone nemorosa, L, ...	2	...	3	3	...	...	1
Ranunculus hederaceus, L, ...	...	...	...	...	..	...	1
Flammula, L, ...	2	7	...	...	4	9	1
Lingua, L, ...	...	...	...	...	4	...	...
acris, L, ...	2	7	3	3	4	9	1
repens, L,...	2	7	3	3	4	9	...
Ficaria, L, ...	2	...	3	3	...	...	1
Caltha palustris, L	2	7	3	3	4	9	1
Trollius Europæus, L	...	...	...	...	...	...	1
Berberis vulgaris, L, ...	...	...	...	...	...	...	1
Nuphar luteum, Sm., ...	...	...	...	...	4	9	...
Nymphæa alba, L, ...	...	...	...	...	...	9	...
Papaver dubium, L, ...	...	...	...	...	4	...	...
Fumaria pallidiflora, Jord., var. Boræi, Jord., ...	...	...	...	...	4	...	...
Fumaria officinalis, L,...	...	...	...	...	4	..	...
Nasturtium officinale, R. Br., ...	...	...	..	...	4	9	...
Barbarea vulgaris, R Br., ...	2	...	...	3	..	...	...
Cardamine amara, L, ...	2	...	3	3	..	..	1
pratensis, L, ...	2	7	3	3	4	9	1
hirsuta, L, ...	2	7	...	3	4	9	1
flexuosa, L, ...	2	...	3	3	...	...	...
Erophila vulgaris, DC., ...	2	...	...	...	...	...	1
Cochlearia officinalis, L, ...	...	...	...	3	...	...	...
Armoracia, L, ...	...	...	...	...	4	...	...
Sisymbrium Alliaria, Scop., ...	...	...	...	3	...	...	1
Brassica Rutabaga, DC., ...	...	...	...	3	..	...	...
Sinapis, Vis , ...	2	7	...	3	4	9	...
Capsella Bursa-pastoris, Mœnch, ...	2	7	...	3	4	9	1
Raphanus Raphanistrum, L, ...	...	7	...	..	...	...	...
Viola palustris, L.	...	7	...	...	...	9	1
sylvatica, Fr., ...	2	7	3	3	4	9	1
tricolor, L, ...	...	...	...	...	...	...	1
lutea, Huds., ...	...	...	...	...	...	9	1
Polygala vulgaris, L.	2	7	...	3	...	...	1
Silene Cucubalus, Wibel, v. puberula, Syme, ...	...	...	...	3	...	...	...
Lychnis diurna, Sibth., ...	2	7	3	3	4	9	1
Flos-cuculi, L, ...	2	7	...	3	4	9	...
Cerastium glomeratum, Thuill., ...	2	7	...	3	...	9	1
triviale, Link., ...	2	7	3	3	4	9	1
Stellaria nemorum, L,...	...	...	...	...	...	..	1
media, Cyr., ...	2	7	3	3	4	9	1
Holostea, L, ...	2	...	3	3	4	...	1
graminea, L,...	...	7	...	3	4	..	1
uliginosa, Murr., ...	2	7	3	3	4	9	1

PILÆNOGAMIA.—*Continued.*	Ayr.			Renfrew.			Stirling.
Arenaria trinervia, L, ...	2	...	3	..	4	...	1
Sagina procumbens, L, ...	2	7	3	3	4	9	1
nodosa, Mey., ...	...	7	...	...	...	9	...
Spergula arvensis, L, ...	...	7	...	3	4	9	...
Lepigonum rubrum, L, ...	...	7	...	..	..	...	...
Montia fontana, L, ...	2	...	...	3	4	9	1
Hypericum Androsæmum, L, ...	...	...	3	...	...	...	...
perforatum, L, ...	...	...	...	...	4	...	...
quadrangulum, Fr., ...	...	...	..	3	...	...	...
var. dubium, Leers., ...	...	...	...	...	4	...	...
quadratum, Stokes, ...	2	7	..	...	4	9	...
humifusum, L, ...	...	...	...	3	...	9	...
pulchrum, L, ...	2	7	3	3	4	9	...
Malva sylvestris, L, ...	...	...	...	.	...	9	...
Tilia vulgaris, Hayne, ...	2	7	...	3	4	...	...
Linum catharticum, L, ...	...	7	...	...	4	9	...
usitatissimum, L, ...	...	...	..	...	4	...	...
Geranium sylvaticum, L, ...	2	...	...	3	4	...	...
pratense, L, ...	2	...	...	...	4	...	...
molle, L, ...	...	...	...	...	...	..	1
dissectum, L, ...	2	...	...	...	4	...	...
Robertianum, L, ...	2	7	3	3	4	9	1
Oxalis Acetosella, L, ...	2	7	3	3	4	9	1
Ilex Aquifolium, L, ...	2	...	3	3	...	...	...
Acer Pseudo-platanus, L, ...	2	7	3	3	4	9	...
Ulex europæus, L, ...	2	7	3	3	...	9	1
Cytisus scoparius, Link., ...	2	7	3	3	4	9	1
Medicago lupulina, L, ...	2	...	...	...	..	...	1
Trifolium pratense, L, ...	...	...	...	3	...	9	...
medium, L, ...	2	7	...	...	4	...	...
hybridum, L, ...	...	7	...	...	...	...	...
repens, L, ...	2	7	3	3	4	9	...
procumbens, L, ...	...	...	...	3	...	...	...
dubium, Sibth., ...	2	...	...	...	...	...	...
Lotus corniculatus, L, ...	2	7	...	3	4	9	1
pilosus, Beeke, ...	2	7	...	3	4	9	...
Vicia Cracca, L, ...	2	7	...	3	4	9	...
sepium, L, ...	2	...	...	3	4	9	...
angustifolia, Roth., ...	2	...	...	...	...	...	...
Lathyrus pratensis, L, ...	2	7	...	3	4	9	...
tuberosus, L, ...	...	...	...	...	...	...	1
macrorrhizus, Wimm., ...	...	...	...	3	...	...	...
Prunus communis, Huds., ...	2	7	...	3	...	9	1
Avium, L, ...	2	...	...	...	..	...	1
Padus, L, ...	2	...	...	3	...	...	1
Spiræa salicifolia, L, ...	...	...	...	...	4	...	...
Ulmaria, L, ...	2	7	3	3	4	9	1
Rubus Idæus, L, ...	2	7	3	3	4	9	1
saxatilis, L, ...	...	...	3	3	...	...	...
Geum urbanum, L, ...	2	...	3	3	4	9	1
rivale, L, ...	2	...	3	3	4	...	1
Fragaria vesca, L, ...	2	...	3	3	4	9	1
elatior, Ehrh., ...	2	...	3	3	...	...	...
Potentilla Fragariastrum, Ehrh., ...	...	...	...	3	...	...	1
Tormentilla, Neck., ...	2	7	3	3	4	9	1
procumbens, Sibth., ...	...	7	...	...	4	9	...

PHÆNOGAMIA.—*Continued.*	Ayr.			Renfrew.			Stirling.
Potentilla anserina, L, ...	2	7	3	3	...	9	1
Comarum, Nestl., ...	...	7	...	...	4	9	...
Alchemilla arvensis, Lam., ...	2	...	3	...	...	...	1
vulgaris, L, ...	2	7	3	3	4	9	1
var. montana, Willd., ...	...	...	...	...	4	...	1
conjuncta, Bab., ...	2	...	...	...	...	..	...
Rosa canina, L.	...	...	3	...	...	...	...
Pyrus Aucuparia, Gært., ...	2	7	3	3	4	9	1
Malus, L, ...	2	...	...	...	...	9	...
Cratægus Oxyacantha, L, ...	2	7	3	3	4	9	1
Saxifraga granulata, L, ...	2	...	...	...	...	...	...
hypnoides, L, ...	2	...	...	...	4	...	...
Chrysosplenium oppositifolium, L, ...	2	...	3	3	...	...	1
alternifolium, L, ...	2	...	...	...	...	...	1
Ribes Grossularia, L, ...	2	...	3	...	..	...	1
nigrum, L, ...	...	...	...	...	4	...	...
Cotyledon Umbilicus, L, ...	...	...	3	...	...	...	...
Sedum Telephium, L.	...	...	..	...	4	..	1
villosum, L	...	..	...	..	..	...	1
anglicum, Huds., ...	...	7	3	...	...	...	...
Drosera rotundifolia, L, ...	...	7	...	...	...	..	1
Hippuris vulgaris, L.	...	7	...	...	4	9	...
Myriophyllum spicatum, L, ...	...	...	...	...	4	...	...
alterniflorum, DC., ...	...	...	...	...	4	...	...
Callitriche vernalis, Koch, ...	...	7	...	...	4	9	...
Lythrum Salicaria, L, ...	...	...	...	...	4	...	...
Epilobium angustifolium, L, ...	...	...	...	...	4	...	...
hirsutum, L, ...	2	...	...	...	...	...	...
montanum, L, ...	...	7	3	3	4	9	...
palustre, L, ...	2	7	3	3	4	9	...
Circæa lutetiana. L.	2	...	3	3	4	...	...
Hydrocotyle vulgaris, L, ...	...	7	...	...	4	...	...
Astrantia major, L, ...	...	...	...	...	4	...	...
Sanicula europæa, L, ...	2	...	3	3	...	...	...
Conium maculatum, L, ...	...	7	...	...	...	...	...
Cicuta virosa, L, ...	...	...	...	...	...	9	...
Carum verticillatum, Koch, ...	...	7	...	...	...	...	...
Ægopodium Podagraria, L, ...	2	7	3	3	4	9	1
Pimpinella Saxifraga, L, ...	...	...	...	...	...	...	1
Conopodium denudatum, Koch, ...	2	7	3	3	...	9	1
Chærophyllum temulum, L, ...	...	7	...	...	...	...	...
Anthriscus sylvestris, Hoffm., ...	2	7	3	3	4	9	1
Œnanthe crocata, L, ...	2	...	...	3	4	...	...
Angelica sylvestris, L, ...	2	7	3	3	4	9	1
Heracleum Sphondylium, L, ...	2	7	3	3	4	9	1
Daucus Carota, L, ...	...	...	...	3	...	..	...
Caucalis Anthriscus, Huds., ...	...	...	...	...	...	9	...
Hedera Helix, L, ...	2	7	3	?	..	9	1
Cornus sanguinea, L, ...	...	...	...	...	4	...	1
Adoxa Moschatellina, L, ...	2	...	...	...	...	...	1
Sambucus nigra, L, ...	...	7	...	3	4	...	...
var. laciniata, L, ...	...	...	...	...	...	...	1
Viburnum Opulus, L, ...	...	...	...	...	4	...	...
Lonicera Periclymenum, L, ...	2	...	3	3	4	...	1
Galium Cruciata, Scop., ...	...	..	...	...	4	...	...
verum, L.	...	...	...	...	4	9	1

PHÆNOGAMIA —*Continued.*	Ayr.			Renfrew.			Stirling.
Galium saxatile, L, ...	2	7	3	3	4	9	1
palustre, L, var. Witheringii, Sm., ...	...	7	...	...	4	9	..
Aparine, L, ...	2	7	3	3	4	9	1
Asperula odorata, L, ...	2	...	3	3	...	..	1
Valeriana officinalis, L, ...	2	...	...	3	...	9	1
var. sambucifolia, Mikan,	...	...	...	...	4	...	...
Valerianella olitoria, Mœnch, ...	...	...	...	3	...	...	...
Scabiosa succisa, L, ...	...	7	3	3	4	9	1
Solidago Virgaurea, L, ...	...	...	3	3	4	...	...
Bellis perennis, L, ...	2	7	3	3	4	9	1
Antennaria dioica, R. Br., ...	...	...	...	...	...	...	1
Gnaphalium uliginosum, L, ...	...	7	...	...	4	...	...
sylvaticum, L, ...	...	...	...	...	...	9	...
Achillæa Millefolium, L, ...	2	7	...	3	4	9	1
Ptarmica, L, ...	2	7	...	...	4	9	1
Chrysanthemum segetum, L, ...	...	7	...	...	...	...	...
Leucanthemum, L, ...	2	...	...	3	4	...	1
Matricaria inodora, L, ...	2	7	...	3	4	9	...
v. maritima, L, ...	...	...	...	3	...	...	...
Artemisia vulgaris, L, ...	...	...	...	...	4	...	...
Tussilago Farfara, L, ...	2	7	3	3	4	9	1
Petasites vulgaris, Desf., ...	2	...	...	...	4	9	.
Senecio vulgaris, L, ...	2	7	...	3	4	9	1
viscosus, L, ...	2	...	...	...	...	...	...
Jacobæa, L, ...	2	7	3	3	4	9	1
aquaticus, Huds., ...	2	7	3	...	4	9	1
Arctium minus, Schk., ...	...	...	3	...	4	..	...
Cnicus lanceolatus, Hoffm., ...	2	7	...	3	4	9	1
palustris, Hoffm., ...	2	7	3	3	4	9	1
arvensis, Hoffm., ...	2	7	3	3	4	9	...
Centaurea nigra, L, ...	2	7	3	3	4	9	1
Lapsana communis, L, ...	2	7	...	3	4	9	1
Crepis paludosa, Mœnch, ...	2	...	3	3	4	9	1
Hieracium Pilosella, L, ...	2	7	...	...	4	...	1
vulgatum, Fr., ...	2	...	3	3	4	9	...
Hypochæris radicata, L, ...	2	7	3	3	4	...	1
Leontodon hispidus, L, ...	...	7	...	...	...	...	...
autumnalis, L, ...	...	7	...	...	...	9	...
Taraxacum officinale, Web., ...	2	7	3	3	4	9	1
v. palustre, DC., ...	...	...	...	...	...	...	1
Sonchus asper, Hoff., ...	...	7	...	...	...	...	...
Jasione montana, L, ...	...	7	...	...	...	...	...
Campanula latifolia, L, ...	2	...	...	...	4	9	...
rotundifolia, L, ...	2	7	...	3	4	9	1
Vaccinium Oxycoccos, L, ...	...	7	...	...	...	...	...
Myrtillus, L, ...	2	7	3	3	...	9	1
Calluna Erica, DC., ...	...	7	3	...	...	9	1
Erica Tetralix, L, ...	...	7	...	...	...	...	...
cinerea, L, ...	...	7	...	...	...	...	1
Pyrola minor, Sw., ...	...	...	...	3	...	...	...
Armeria maritima, Willd., ...	...	...	...	3	...	...	...
Primula vulgaris, Huds., ...	2	..	...	3	4	...	1
Lysimachia thyrsiflora, L, ...	...	...	...	...	4	...	...
vulgaris, L, ...	...	...	...	...	4	...	...
Nummularia, L, ...	...	...	...	...	4	...	...

PHÆNOGAMIA.—*Continued.*	Ayr.			Renfrew.			Stirling.
Lysimachia nemorum, L, ...	2	7	3	3	4	9	...
Glaux maritima, L, ...	...	...	...	3	...	...	...
Fraxinus excelsior, L, ...	2	.	3	3	4	9	...
Ligustrum vulgare, L, ...	2	...	3	...	...	...	...
Menyanthes trifoliata, L, ...	...	7	...	...	4	9	1
Symphytum officinale, L, ...	...	...	...	...	4	...	1
tuberosum, L, ...	...	...	...	3	...	...	...
Myosotis cæspitosa, Schultz., ...	...	7	3	...	4	9	...
palustris, With., ...	...	...	3	...	...	9	...
var. strigulosa, Reichb.,...	...	...	...	...	4	..	...
repens, Don, ...	...	7	...	3	4	9	...
arvensis, Hoffm., ...	2	7	3	3	4	9	1
versicolor, Reichb.,... ...	2	...	...	3	4	...	...
Convolvulus arvensis, L, ...	2	...	...	...	4	...	...
Scrophularia nodosa, L, ...	2	7	...	3	4	9	1
Mimulus luteus, L, ...	2	...	...	..	...	...	...
Digitalis purpurea, L, ...	2	7	3	3	4	9	1
Veronica agrestis, L, ...	...	...	...	3	...	...	...
arvensis, L, ...	...	...	...	3	4	...	...
serpyllifolia, L, ...	2	...	3	3	...	9	1
officinalis, L, ...	...	...	3	3	...	...	1
Chamædrys, L, ...	2	7	3	3	4	9	1
montana, L, ...	...	...	...	3	...	...	...
Beccabunga, L, ...	2	7	...	3	4	9	...
Euphrasia officinalis, L, ...	...	7	3	...	4	9	...
Bartsia Odontites, Huds., ...	...	7	...	...	...	9	...
Pedicularis palustris, L, ...	...	7	...	...	4	...	...
sylvatica, L, ...	...	7	...	...	4	9	1
Melampyrum pratense, L, ...	..	7	...	3	...	...	...
Rhinanthus Crista-galli, L, ...	2	7	...	...	4	9	1
Utricularia vulgaris, L, ...	...	7	...	...	...	...	...
minor, L, ...	...	7	...	...	...	...	...
Pinguicula vulgaris, L, ...	...	7	...	...	...	...	1
lusitanica, L, ...	...	7	...	...	...	...	...
Mentha sativa, L, ...	...	7	...	...	...	...	...
aquatica, L, ...	...	7	...	..	...	9	...
Thymus Serpyllum, Fr., ...	...	7	3	...	...	9	1
Calamintha Clinopodium, Benth., ...	...	...	...	...	4	...	...
Nepeta Glechoma, Benth., ...	2	...	3	3	4	9	...
Scutellaria galericulata L, ...	...	...	...	3	4	9	...
Prunella vulgaris, L, ...	2	7	3	3	4	9	1
Stachys palustris, L, ...	...	7	...	...	4	...	...
sylvatica, L, ...	2	...	3	3	4	9	1
Galeopsis Tetrahit, L,...	...	7	...	...	...	9	...
Lamium maculatum, L, ...	...	...	...	...	...	...	1
Teucrium Scorodonia L, ...	2	...	3	3	4	9	1
Ajuga reptans, L, ...	2	...	3	3	4	...	...
Plantago major, L, ...	2	7	3	3	4	9	1
lanceolata, L, ...	2	7	3	3	4	9	1
maritima, L,...	...	...	...	3	...	...	...
Littorella lacustris, L, ...	...	...	...	...	4	9	...
Polygonum aviculare, L, ...	2	7	...	3	4	9	...
Hydropiper, L, ...	...	...	...	...	4	9	..
Persicaria, L, ...	2	7	...	...	4	9	...
amphibium, L, ...	...	...	...	...	...	9	...
v. terrestre, Leers, ...	...	7	...	...	4	9	...

PHÆNOGAMIA.—*Continued.*	Ayr.			Renfrew.			Stirling.
Polygonum Bistorta, L, ...	2	...	...	...	...	...	...
Rumex conglomeratus, Murr., ...	...	...	3	...	...	..	...
sanguineus, L, var. viridis, Sibth.,	2	...	...	3	4	9	...
obtusifolius, L, ...	...	7	3	...	...	9	...
crispus, L, ...	2	7	3	3	4	9	...
Acetosa, L, ...	2	7	3	3	4	9	1
Acetosella, L, ...	...	7	3	3	4	9	1
Mercurialis perennis, L, ...	2	...	3	3	4	9	1
Urtica dioica, L, ...	2	7	3	3	4	9	1
Betula alba, L, ...	2	...	3	3	...	9	1
glutinosa, Fr., var. pubescens, Wallr., ...	...	...	...	...	4	...	...
Alnus glutinosa, L, ...	2	...	3	3	4	...	1
Corylus Avellana, L, ...	2	...	3	3	...	9	1
Quercus Robur, L, ...	...	7	3	3	4	9	...
Castanea sativa, Mill., ...	..	...	...	...	...	9	...
Fagus sylvatica, L, ...	2	7	3	3	4	9	1
Salix pentandra, L, ...	...	...	...	...	4	. .	...
fragilis, L, ...	...	...	...	...	4	...	...
cinerea, L, ...	2	...	...	...	...	...	...
aurita, L, ...	2	7	3	...	...	...	...
ambigua, L.	...	...	...	...	4	...	...
repens, L, ...	...	7	...	...	...	...	...
Populus nigra, L, ...	...	...	...	...	. .	...	1
Empetrum nigrum, L, ...	...	7	...	...	...	...	...
Juniperus communis, L, ...	...	...	...	...	...	...	1
Taxus baccata, L, ...	...	...	...	...	...	...	1
Pinus sylvestris, L, ...	2	...	...	3	4	9	...
Listera ovata, R. Br., ...	...	...	...	3	4	...	...
Epipactis latifolia, Sw., ...	...	...	...	...	4	9	...
Orchis mascula, L, ...	...	...	...	...	...	...	...
latifolia, L, ...	...	...	...	...	4	...	...
maculata, L, ...	2	7	...	...	4	...	1
Habenaria viridis, R. Br., ...	...	7	...	...	...	...	...
chloroleuca, Ridley, ...	...	...	...	...	4	...	...
Iris Pseudacorus, L, ...	2	...	...	3	4	...	...
Allium ursinum, L, ...	2	...	3	3	...	...	...
Scilla nutans, Sm., ...	2	...	3	3	4	...	1
Narthecium ossifragum, Huds., ...	...	7	...	...	...	...	...
Juncus bufonius, L, ...	...	7	...	...	...	9	...
squarrosus, L, ...	...	7	...	...	...	...	...
effusus, L, ...	...	...	3	...	...	...	...
conglomeratus, L, ...	...	...	...	...	...	9	...
supinus, Mœnch, ...	...	7	...	...	...	9	...
lamprocarpus, Ehrh., ...	...	7	...	...	4	9	...
acutiflorus, Ehrh., ...	...	7	...	...	...	9	...
Luzula pilosa, Willd., ...	2	...	3	3	...	...	1
maxima, DC., ...	2	7	3	3	4	...	1
campestris, DC, ...	2	...	3	3	4	9	1
multiflora, Lej., ...	2	7	...	3	...	...	...
var. congesta, Koch, ...	...	...	...	...	4	...	...
Typha latifolia, L, ...	...	...	...	...	...	9	...
Sparganium ramosum, Curtis, ...	...	7	...	...	...	9	...
simplex, Huds., ...	...	...	...	...	...	9	...
minimum, Fr., ...	...	...	...	...	4	9	...

PHÆNOGAMIA.—*Continued.*	Ayr.			Renfrew.			Stirling.
Alisma Plantago, L, ...	...	...	...	...	4	9	...
Triglochin palustre, L, ...	...	7	...	...	...	...	...
maritimum, L, ...	...	...	...	3	...	...	...
Potamogeton natans, L, ...	...	7	...	...	...	...	...
polygonifolius, Pour., ...	...	7	...	...	...	...	...
Ruppia rostellata, Koch, ...	...	7	...	...	...	...	...
Eleocharis acicularis, Sm., ...	...	...	...	...	4	...	...
palustris, R. Br., ...	2	...	...	...	4	...	...
multicaulis, Sm., ...	...	..	...	...	4	...	. .
Scirpus cæspitosus, L, ...	...	7	...	...	...	...	...
setaceus, L, ...	...	7	...	...	...	...	...
lacustris, L, ...	...	...	...	...	4	...	...
Eriophorum vaginatum, L, ...	...	7	...	...	...	...	...
angustifolium, Roth., ...	2	...	...	...	...	...	1
Carex pulicaris, L, ...	...	7	...	...	4	...	...
echinata, Murr., ...	...	7	...	...	4	...	...
remota, L, ...	2	...	3	3	4	...	...
curta, Good., ...	...	7	...	...	...	...	...
ovalis, Good., ...	2	7	...	...	4	...	...
acuta, L, ...	...	...	...	...	...	...	1
aquatilis, Wahl., ...	...	...	...	...	4	9	...
Goodenowii, J. Gay, ...	2	7	...	3	4	9	1
glauca, Murr., ...	2	7	...	3	...	...	1
irrigua, Hoppe, ...	...	7	...	...	...	...	...
præcox, Jacq., ...	...	...	...	...		...	1
pallescens, L, ...	...	...	...	...	4	...	...
panicea, L, ...	...	7	...	3	4	...	1
sylvatica, Huds., ...	2	...	...	3	...	...	...
binervis, Sm., ...	...	7	...	3	...	...	...
flava, L, ...	...	7	...	...	...	9	...
rostrata, Stokes, ...	...	7	...	...	...	9	...
Phalaris canariensis, L, ...	...	...	...	...	4	...	...
arundinacea, L, ...	...	...	...	...	4	9	...
Anthoxanthum odoratum, L, ...	2	7	3	3	4	9	1
Alopecurus geniculatus, L, ...	2	7	3	...	4	...	...
pratensis, L, ...	2	...	...	...	4	...	...
Milium effusum, L, ...	2	...	...	3	...	...	...
Phleum pratense, L, ...	...	7	...	...	...	9	...
Agrostis canina, L, ...	...	...	...	...	4	9	...
alba, L, ...	...	7	...	...	...	...	...
vulgaris, With., ...	...	7	...	...	4	9	...
Aira caryophyllea, L, ...	...	7	...	...	...	9	...
præcox, L, ...	...	7	...	...	...	...	1
Deschampsia cæspitosa, Beauv., ...	2	7	3	3	4	9	...
flexuosa, Trin.,... ...	2	7	3	3	...	...	...
Holcus mollis, L, ...	...	7	3	3	4	9	...
lanatus, L, ...	...	7	3	3	4	9	...
Arrhenatherum avenaceum, Beauv., var. nodosum, Reichb., ...	...	7	...	...	4	9	...
Sieglingia decumbens, Bernh., ...	...	7	..	...	...	...	...
Phragmites communis, Trin.,... ...	...	...	...	...	...	9	...
Cynosurus cristatus, L, ...	2	7	3	3	4	9	1
Molinia cærulea, Mœnch, ...	...	7	...	...	...	9	...
Melica uniflora, Retz., ...	2	...	3	3	...	...	...
Dactylis glomerata, L, ...	2	...	3	3	4	9	1
Poa annua, L, ...	2	7	3	3	4	9	1

PHÆNOGAMIA.—*Continued.*	Ayr.			Renfrew.			Stirling.
Poa nemoralis, L, ...	...	...	...	3	...	...	..
pratensis, L, ...	2	7	3	3	4	9	1
trivialis, L, ...	2	7	3	3	4	9	...
Festuca pratensis, Huds., ...	2	...	...	...	4	...	...
duriuscula, L, ...	...	...	...	3	...	...	...
sciuroides, Roth., ...	...	...	3	3	...	...	...
ovina, L, ...	2	...	3	3	4	...	1
Bromus asper, Murr., ...	...	...	...	3	...	...	...
commutatus, Schrad., ...	...	...	...	...	4	...	...
mollis, L, ...	2	7	...	3	4	...	...
v. glabrescens, Coss., ...	...	7	...	3	...	...	...
Lolium perenne, L, ...	2	7	...	3	4	9	...
Agropyron repens, Beauv., ...	...	7	...	...	...	9	...
Lepturus filiformis, Trin., ...	...	7	...	...	...	...	...
Nardus stricta, L, ...	...	7	...	...	...	...	1
CRYPTOGAMIA.							
FILICES.							
Pteris aquilina, L, ...	2	7	3	3	4	9	1
Lomaria Spicant, Desv., ...	2	7	3	3	..	...	1
Asplenium Adiantum-nigrum, L, ...	...	7	3	3	...	...	...
Trichomanes, L, ...	2	7	3	3	...	...	1
Athyrium Filix-fœmina, Roth., ...	2	7	3	3	4	...	...
Scolopendrium vulgare, Symons, ...	...	...	...	3	...	...	...
Cystopteris fragilis, Bernh., ...	2	..	...	3	...	...	...
Polystichum lobatum, Presl, ...	2	...	3	3	..	...	...
var. aculeatum, Syme,	2	...	3	3	..	...	...
angulare, Presl, ...	...	...	3	3	...	...	...
Lastræa Oreopteris, Presl, ...	2	7	3	3	...	...	...
Filix-mas, Presl, ...	2	7	3	3	4	9	1
spinulosa, Presl, ...	...	...	...	...	...	9	...
dilatata, Presl, ...	2	7	3	3	4	9	1
Polypodium vulgare, L, ...	2	7	3	3	4	...	1
Phegopteris Dryopteris, Fée, ...	2	...	3	3	...	...	1
polypodioides, Fée, ...	2	7	3	3	...	...	1
Ophioglossum vulgatum, L, ...	2	...	...	...	...	...	...
EQUISETACEÆ.							
Equisetum maximum, Lam., ...	...	...	3	...	...	...	...
arvense, L, ...	2	7	...	3	4	9	...
pratense, Ehrh., ...	...	...	...	...	4	...	..
sylvaticum, L, ...	2	7	...	3	4	9	1
limosum, Sm., ...	2	7	...	...	4	9	1
CHARACEÆ.							
Nitella opaca, Ag., ...	2	...	...	...	...	...	...

CRYPTOGAMIA.—*Continued.*	Ayr.		Renfrew.	
Musci.				
Sphagnum acutifolium, Ehrh., ...	...	...	3	4
Gymnostomum rupestre, Schwg., ...	...	3	...	...
Anœctangium compactum, Schl., ...	...	3	...	..
Weissia viridula, Brid., ...	2	3	...	4
Dichodontium pellucidum, L, ...	2	3	3	...
var. serratum, Schpr., ...	2	3	...	...
Dicranella Schreberi, Hedw., var. elata, Schpr., ...	2	...	...	...
squarrosa, Schrad., ...	2	...	...	4
varia, Hedw..	2	...	...	...
heteromalla, Hedw., ...	2	3	3	4
Dicranum scoparium, L, ...	2	3	3	4
majus, Turn., ...	2	3	3	4
Seligeria recurvata, Hedw., ...	...	3	3	...
Blindia acuta, Hedw., ...	...	3	...	...
Didymodon rubellus, B. & S., ...	2	3	...	4
Eucladium verticillatum, L, ...	2	...	...	...
Ditrichum homomallum, Hedw., ...	...	3	...	...
Trichostomum tophaceum, Brid., ...	2	...	...	...
mutabile, Bruch., ...	...	3	...	...
Barbula muralis, L, ...	2	3	..	4
var. rupestris, Schultz, ...	2	3	...	...
unguiculata, Dill., ...	2	...	...	...
fallax, Hedw., ...	2	...	...	...
convoluta, Hedw., ...	2	...	...	...
subulata, L, ...	2	...	...	..
Ceratodon purpureus, L, ...	2	3	3	4
Encalypta streptocarpa, Hedw., ...	2	...	3	...
Grimmia apocarpa, L, ...	2	...	...	4
var. rivularis, Brid., ...	2	...	...	...
maritima, Turn., ...	...	...	3	...
pulvinata, Dill., ...	2	...	3	...
Rhacomitrium aciculare, L, ...	2	3	3	4
heterostichum, Hedw., ...	...	3	...	...
fasciculare, Schrad., ...	...	3	...	4
lanuginosum, Hedw., ...	...	3	...	...
canescens, Hedw., ...	...	3	...	...
Ptychomitrium polyphyllum, Dicks., ...	2	3	3	4
Amphoridium Mougeotii, B. & S., ...	...	3	3	...
Zygodon viridissimus, Dicks., ...	2	3	3	...
Ulota crispa, Hedw., ...	2	3	3	...
phyllantha, Brid., ...	...	..	3	...
Orthotrichum rivulare, Turn., ...	2	...	...	...
Funaria hygrometrica, L, ...	2	...	3	..
Bartramia pomiformis, L, ...	...	3	...	...
Philonotis fontana, L, ...	2	...	...	4
Webera nutans, Schreb., ...	...	3	3	4
albicans, Wahl., ...	...	3	...	4
Bryum cæspiticium, L, ...	2	...	...	...
argenteum, L, ...	2	...	...	...
capillare, L, ...	2	3	3	4
pallens, Swartz, ...	2	3	...	4
pseudo-triquetrum, Hedw., ...	2	3	...	4
filiforme, Dicks., ...	...	3	3	...

CRYPTOGAMIA.—*Continued.*	Ayr.		Renfrew.	
Mnium affine, Bland.	2	...	...	...
undulatum, Hedw., ...	2	3	...	...
rostratum, Schrad., ...	2	3	3	..
hornum, L, ...	2	3	3	4
serratum, Schrad., ...	2	3	...	...
punctatum, Hedw., ...	2	3	3	4
Tetraphis pellucida, L, ...	...	3	3	...
Tetrodontium Brownianum, Dicks.,... ...	2	3	3	...
Atrichum undulatum, L, ...	2	3	3	...
Pogonatum aloides, Hedw., ...	...	3	...	...
urnigerum, L, ...	2	3	...	4
Polytrichum formosum, Hedw., ...	2	3	3	4
juniperinum, Willd., ...	...	...	...	4
commune, L, ...	...	...	...	4
Fissidens bryoides, Hedw., ...	...	3	...	...
adiantoides, Hedw., ...	...	3	...	...
Fontinalis antipyretica, L, ...	2	...	3	...
Neckera crispa, L, ...	2	3	3	...
complanata, L, ...	2	3	3	...
Homalia trichomanoides, Schreb., ...	2	...	...	4
Pterygophyllum lucens, Sm.,...	...	3	...	...
Leskea polycarpa, Ehrh., ...	...	...	...	4
Anomodon viticulosus, L, ...	2	...	...	..
Heterocladium heteropterum, Bruch, ...	...	3	...	...
Thuidium tamariscinum, Hedw., ...	2	3	3	4
Thamnium alopecurum, L, ...	2	3	3	...
Climacium dendroides, L, ...	...	...	...	4
Homalothecium sericeum, L, ...	2	3	...	...
Brachythecium rutabulum, L, ...	2	3	...	4
rivulare, B. & S., ...	2	3	3	...
populeum, Hedw., ...	2	3	3	4
plumosum, Swartz, ...	...	3	...	...
Eurhynchium myosuroides, L, ...	2	3	3	...
striatum, Schreb., ...	2	3	...	...
piliferum, Schreb., ...	2	3	...	...
Swartzii, Turn., ...	2	3	...	...
prælongum, Dill., ...	2	3	...	...
Hyocomium flagellare, Dicks., ...	...	3	3	...
Rhynchostegium tenellum, Dicks., ...	...	...	3	...
confertum, Dicks.,... ...	...	...	3	4
ruscifolium, Neck., ...	2	3	3	...
Plagiothecium denticulatum, L, ...	2	3	3	...
Borrerianum, Spruce, ...	2	3	...	...
sylvaticum, L,...	2	3	3	...
undulatum, L,...	...	3	3	...
Amblystegium serpens, L, ...	2	...	...	...
fluviatile, Wils., ...	2	...	...	...
riparium, L, ...	...	...	...	4
Hypnum uncinatum, Hedw.,...	2	3	3	4
filicinum, L, ...	2	...	3	4
commutatum, Hedw., ...	...	3	3	...
falcatum, Brid., ...	...	...	...	4
cupressiforme, L, ...	2	3	3	4
var. ericetorum, Bry. Eur., ...	2	...	...	...
resupinatum, Wils., ...	...	3	...	...
patientiæ, Lindb., ...	...	3	...	...

CRYPTOGAMIA.—*Continued.*	Ayr.		Renfrew.	
Hypnum molluscum, Hedw.,	2	3	...	...
palustre, L,	2	3	3	4
stellatum, Schreb.,	...	...	...	4
var. protensum, Brid.,	2	...	...	...
giganteum, Schpr.,	...	...	...	4
cuspidatum, L,	2	3	3	4
Schreberi, Ehrh.,	...	3	...	...
Hylocomium splendens, Dill.,	2	3	...	...
brevirostrum, Ehrh.,	2	...	...	...
squarrosum, L,	2	3	3	4
loreum, L,	2	3	3	...
triquetrum, L,	2	3	...	...

HEPATICÆ.	Renfrew.	
Marchantia polymorpha, L,	3	4
Preissia commutata, Nees,	3	4
Conocephalus conicus, L,	3	...
Riccia glauca, L,	...	4
Frullania dilatata (L) Dum.,	3	4
Tamarisci (Mich.) Dum.,	3	...
Radula complanata, L,	3	...
Porella platyphylla, L,	3	...
Lepidozia reptans, L,	3	...
Cephalozia divaricata, Sm.,	3	...
connivens, Dicks.,	3	...
Lophocolea bidentata, L,	3	4
Chiloscyphus polyanthos, L,	3	4
Kantia Trichomanis, L,	3	...
Scapania compacta (Roth.) Dum.,	3	...
undulata, Dill.,	3	...
nemorosa, L,	3	...
Diplophyllum albicans, L,	3	4
Plagiochila asplenioides, L,	3	4
spinulosa, Dicks.,	3	...
Eucalyx obovata, Nees,	3	...
hyalina, Lyell.	3	...
Nardia scalaris, Schrad.,	3	...
Pellia epiphylla, L,	3	4
Aneura multifida (Dill.) Gray,	3	4
Metzgeria conjugata (Dill.) Lindbg.,	3	...

PROCEEDINGS

OF THE

NATURAL HISTORY SOCIETY OF GLASGOW.

SUMMER SESSION, 1886.

THE SOCIETY'S ROOMS, 207 BATH STREET.

11TH MAY, 1886.

Mr. Thomas King in the Chair.

Mr. P. Cameron exhibited specimens of 15 species of British and Foreign *Hymenoptera*, including representatives of the genera *Tenthredopsis*, *Mesostenus*, *Elis*, *Strumigenys*, *Aphanogaster*, *Aulacus*, *Cimbex*, *Monomorium*, *Cryptus*, *Leucopsis*, *Myrmica*, &c. Several of the insects were apparently new to science.

Mr. P. Ewing made some remarks on Alpine plants as affected by cultivation, and exhibited a specimen of *Draba rupestris*, Br., from Ben Lawers, which had for some time been grown indoors as a pot-plant. Under this treatment it had shown a considerable departure from its usual character, and was much enlarged in every part.

An exhibition of microscopic objects afterwards took place.

25TH MAY, 1886.

Mr. Robert Turner, Vice-President, in the Chair.

Mr. David Gregorson, F.E.I.S., reported on an excursion made to the Port-Glasgow district on 22nd inst. After ascending through Devol's Glen, the party proceeded over the hill-side to Greenock. Although many flowering-plants were observed in the course of the excursion, none were discovered which had not already been recorded for the district.* In referring to the state of vegetation, Mr. Gregorson remarked that a large proportion of the plants observed were only beginning to flower, many being much later than usual.

* See *Proceedings*, vol. i. (n.s.), p. xxix.

Mr. D. A. Boyd submitted the following list of the principal mosses observed at the excursion, viz.:

Andreæa petrophila, Ehrh.†
Gymnostomum rupestre, Schwg.†
Anœctangium compactum, Schl.
Dichodontium pellucidum, L., var. *serratum*, Schpr.
Dicranella squarrosa Schrad.
Dicranum majus, Turn.
Campylopus atrovirens, De Not.
Blindia acuta, Hedw.†
Barbula fallax, Hedw.† *tortuosa*, L.
Amphoridium Mougeotii, B. & S.
Splachnum sphæricum, L. fil.†
Bartramia ithyphylla, Brid.† *pomiformis*, L.† *Œderi*, Gunn.†
Breutelia arcuata, Dicks.
Webera nutans, Schreb.† *cruda*, Schreb. *albicans*, Wahl.†
Zieria julacea, Schpr.
Bryum pallens, Sw.† *filiforme*, Dicks.
Mnium undulatum, Hedw.† *rostratum*, Schrad.† *serratum*, Schrad. *subglobosum*, B. & S.†
Aulacomnium palustre, L.†
Tetraphis pellucida, L.†
Tetrodontium Brownii, Dicks.†
Oligotrichum hercynicum, Ehrh.†
Pogonatum alpinum, L.†
Polytrichum gracile, Menz.†
Neckera crispa, L.
Homalia trichomanoides, Schreb.†
Pterygophyllum lucens, Sm.†
Heterocladium heteropterum, Bruch.
Eurhynchium striatum, Schreb. *piliferum*, Schreb. *pumilum*, Wils.
Plagiothecium pulchellum, Hedw.†
Hypnum revolvens, Sw.† *cupressiforme*, L., var. *ericetorum*, Schpr. *molluscum*, Hedw.† *stellatum*, Schreb. var. *protensum*, Brid. *sarmentosum*, Wahl. *stramineum*, Dicks.
Hylocomium loreum, L.†

Mr. Boyd reported that several specimens of the beetle *Geotrupes sylvaticus*, Fab., had been captured in the glen. He also exhibited specimens of *Zygodon viridissimus*, Dicks., in fruit, from Kirkland Glen, West Kilbride, and *Fontinalis squamosa*, L., from the River Calder, between Lochwinnoch and Muirshiel.

Mr. William Goodwin exhibited specimens of *Doronicum Pardalianches*, L., from a wood at Garscube, and *Ophioglossum vulgatum*, L., from Waterfoot, Busby.

Mr. Joseph Sommerville showed a fruit of an Orange containing a smaller one embedded in its centre, and made some remarks on the probable cause of the abnormal development.

Mr. David Robertson, F.L.S., F.G.S., sent for exhibition specimens of the following species of Isopods from Cumbrae:

Ligia oceanica, L.
Philoscia muscorum, Scop.
Oniscus asellus, L.
Porcellio scaber, Latr.
P. armadilloides, Lereb.

† With fruit.

In some notes on these crustaceans, Mr. Robertson stated that they belong to that section which contains species that frequent dry land and are consequently air-breathing animals. *Ligia oceanica*, however, can live under water for days without experiencing any apparent discomfort. Those that inhabit dry land are but a small group, not numbering more than 15 or 16 British species; most of them are common, and may be obtained by a few hours' searching in such places as they frequent. One species, *Platyarthrus Hoffmannseggii*, Brandt, is found in ants' nests; others in moss about the roots of trees; but generally they are found under stones, old timber, decaying straw, and dead leaves, especially in damp places near the shore. In Spence Bate and Westwood's *History of the British Sessile-eyed Crustacea* (including Isopods) only one of the air-breathing section is recorded as having occurred in Scotland; and, so far as publicity shows, we are about as free from Isopods as our sister country is said to have been from Toads and Frogs in former days. To relieve them from such obscurity is the excuse for bringing these common things before the Society. It may be readily admitted that at first sight their rather repulsive appearance offers little inducement for taking an interest in them, and, like many other objects of Natural History, they are often neglected because they are common; yet these Isopods, when closely examined, will be found not wanting either in beauty or interest.

Mr. James J. F. X. King made some remarks on *Anchomenus Sahlbergi*, Chaud., a beetle recently exhibited by him, of which several specimens had been captured many years ago on the banks of the River Clyde near Bowling, but which had not been taken in Europe either before or since. He exhibited a second specimen of the insect, taken at the same time as the one formerly shown.*

Mr. King also exhibited a specimen of *Capnia nigra*, Pict., a rare neuropterous insect recently captured by him at Loch Voil, Perthshire.

8TH JUNE, 1886.

Mr. Robert Turner, Vice-President, in the Chair.

Mr. William Goodwin reported on an excursion made to the Irvine district on 5th inst. After leaving the town, the party proceeded for about two miles southwards along the sandy ground adjoining the sea-shore, and afterwards visited Shewal-

* See *Proceedings*, vol. i. (n.s.), p. lxxxvii.

ton Moss. The following were the most noteworthy plants observed:

Brassica monensis, Huds.
Teesdalia nudicaulis, Br.
Silene maritima, With.
Cerastium tetrandrum, Curt.
Erodium cicutarium, Herit.
Vicia lathyroides, L.
Saxifraga granulata, L.
Vaccinium Oxycoccos, L.
Lamium album, L.
Myrica Gale, L.
Salix repens, L., several varieties, notably *argentea*, Sm.
Asplenium Ruta-muraria, L.
Botrychium Lunaria, Sw.
Brachythecium albicans, Neck.
Hypnum cupressiforme, L., var. *ericetorum*, Schpr.

Mr. Thomas King exhibited specimens of *Cerastium arvense*, L., from Milngavie. He also showed a Primrose, *Primula vulgaris*, L., with abnormal sepals, illustrating the teratological development known as "phyllody."

The Chairman (Mr. Turner) showed a specimen of *Symphytum tuberosum*, L., having nearly all the corolla-tubes bitten through by a small bee which is probably unable to reach the nectar in the usual way.

Mr. Robert Broom exhibited a very lively specimen of the Green Tree-Frog, *Hyla arborea*, L., from the North of France; also preserved specimens of *Euprepes rufescens*, Shaw, and *Gecko guttatus*, Daud., two Lizards from Siam, on which he made some interesting remarks.

Mr. George Watson exhibited a large collection of pieces of timber from British Guiana, and described the quality and uses of the wood of the various species of forest-trees represented. Although many of these produce timber of superior quality and fine appearance, few of them are known in this country, as the cutting of timber in British Guiana has been restricted on account of its influence on the rainfall.

Mr. Thomas King made some remarks on the formation of the fruit in the *Coniferæ*; also on recently observed facts regarding the fructification of Ferns, which show that the cycle of reproduction is sometimes interrupted, when it approaches more nearly to that of the flowering-plants. Mr. King's remarks were illustrated by means of diagrams and specimens.

Mr. David Robertson, F.L.S., F.G.S., communicated some notes on the enlargement of the shell of *Purpura lapillus*, L., in brackish water.*

22ND JUNE, 1886.

Mr. Robert Turner, Vice-President, in the Chair.

Mr. Richard M'Kay reported on an excursion made to Cleghorn and Lanark on 19th inst. The valley of the Mouse was

* *Transactions*, vol. ii., p. 139.

followed from Cleghorn Mill to Cartlane Crags; and as the day was extremely fine, the walk proved a most enjoyable one. Among the plants observed were the following:

Ranunculus auricomus, L.—A few flowers—mostly past.
Trollius europæus, L.—Frequent; in full flower.
Cardamine amara, L.—Common on left bank.
Helianthemum vulgare, Gærtn.—Plentiful; a few flowers.
Arenaria trinervia, L.—Abundant; very large.
Geranium lucidum, L.—A few plants.
sylvaticum, L.—Common; in flower.
Vicia sylvatica, L.—A few large patches.
Carum Carui, L.—A few plants; in flower.
Viburnum Opulus, L.—Frequent; in bud.
Galium boreale, L.—Common; not in flower.
Carduus heterophyllus, L.—Plentiful; in bud.
Crepis paludosa, Mœnch.—Common; not in flower.
Campanula latifolia, L.—Common; not in flower.
Vinca minor, L.—Local; in flower.
Melampyrum pratense, L.—Common; in flower.
Calamintha Clinopodium, Benth.—Frequent; not in flower.
Polygonum Bistorta, L.—Frequent; in flower.
Listera ovata, L.—Frequent; in flower.
Paris quadrifolia, L.—Sparingly in one place.
Melica uniflora, Retz.—Abundant; in flower.
nutans, L.—Local.
Cystopteris fragilis, Bernh.—Frequent.
Equisetum hyemale, L.—Local.

The Chairman (Mr. Turner) exhibited some plants collected during an evening ramble at Gartcosh, near Glasgow, among which were *Sedum villosum*, L., *Vaccinium Oxycoccos*, L., *Andromeda polifolia*, L., and *Empetrum nigrum*, L.

Mr. D. A. Boyd exhibited some mosses from the neighbourhood of West Kilbride, Ayrshire, including *Dicranella Schreberi*, Hedw., var. *elata*, Schpr.; *Didymodon flexifolius*, Dicks. (in fruit); *Hypnum cordifolium*, Hedw. (in fruit); and *Hypnum stramineum*, Dicks. (in fruit).

Mr. Peter Ewing exhibited specimens of *Grimmia anomala*, Hampe, from Killin, Perthshire.

Dr. James Stirton, F.L.S., exhibited specimens of *Myriangium Duriæi*, Mnt., a lichen recently found by him on ash trees at Brodick, Island of Arran, but not previously detected in the West of Scotland. In Britain it has hitherto occurred only in the South of England, and in Ireland.

An exhibition of microscopic objects afterwards took place.

3rd August, 1886.

Mr. Robert Turner, Vice-President, in the Chair.

Mr. D. A. Boyd reported on an excursion made to Portincross, Ayrshire, on 31st ultimo. Many of the rarer plants recorded for the district had been met with, but no additions to the list had been noted.* He exhibited specimens of *Agrimonia Eupatoria*, L., *Vicia sylvatica*, L., *Scirpus Savii*, Seb. & Maur., and *Hypnum polygamum*, B. & S., which had been obtained at the excursion.

Mr. Boyd also showed specimens of the following mosses:

Dicranella subulata, Hedw.—Road-side on Kaim Hill, West Kilbride; in fruit.

Eucladium verticillatum, L.—On wet sandstone rocks, Kirkland Glen, West Kilbride; in fine fruit.

Bryum concinnatum, Spruce.—Porphyritic rocks on Ardrossan Hills, occurring sparingly within a small area; barren.

Mnium cinclidioides, Blytt.—Knockewart Loch, Ardrossan, growing in abundance with stems sometimes eight inches long, and forming large patches of a bright green colour; barren.

Hypnum falcatum, Brid.—Haplands Moor, West Kilbride: in fruit.

H. sarmentosum, Wahl.—Knock Jergon Moor, Ardrossan; barren.

H. vernicosum, Lindb.—Knockewart Loch, Ardrossan; barren.

Along with these were shown, for comparison, specimens of allied and more common species, and the characteristics of each were pointed out and explained.

The Chairman (Mr. Turner) gave an account of a visit to the Orkney and Shetland Isles, and exhibited specimens of *Arenaria norvegica*, Gunn, and *Cerastium latifolium*, L., var. *Edmonstonii*, Wats., two plants peculiar to Shetland. He also showed specimens of *Primu lascotica*, Hook., from Orkney, and made some remarks on the features by which that species is distinguished from *P. farinosa*, L.

Mr. David Robertson, F.L.S., F.G.S., communicated some notes on Observed Depths in Loch Lomond.†

17th August, 1886.

Mr. David Gregorson, F.E.I.S., in the Chair.

Mr. Richard M'Kay reported on an excursion made to the Bridge of Weir district on 14th inst. After leaving the railway station, the party proceeded in a south-western direction,

*See *Proceedings*, vol. v., pp. 242, 244; *Transactions*, vol. i., p. 151.

† *Transactions*, vol. ii., p. 141.

visiting the banks of the Locher Water, and returning by way of Howwood. Mr. M'Kay gave a report on the flowering plants observed, and Mr. D. A. Boyd on the cryptogams—these being respectively as follows:

Lepidium campestre, R. Br.
Smithii, Hook.
Meum Athamanticum, Jacq.
Senecio saracenicus, L.
Aspidium aculeatum, Sw.
Andreæa petrophila, Ehrh.
falcata, Schpr.
Amphoridium Mougeotii, B. & S.
Bryum alpinum, L.
Hypnum fluitans, L.
exannulatum, Gümb.
uncinatum, Hedw.
patientiæ, Lindb.
Agaricus (Amanita) rubescens, P.
Ustilago urceolorum, Tul.

Mr. D. A. Boyd exhibited specimens of the following plants:

Nasturtium amphibium, Koch. — River Garnock near Kilwinning.

Centunculus minimus, L.—Gravelly sea-shore near Millport.

Carex ovalis, Good., "var. *bracteata*, Syme."—Growing from the same root with typical stems of *C. ovalis*, in an old quarry at Bridge of Weir.

Arena pubescens, L.—Millport.

Mr. R. Turner made some remarks on *Nasturtium amphibium*, Koch, which appears to have been common in Clydesdale at the time when Hopkirk's *Flora Glottiana* was written, but has gradually disappeared from the district. A similar disappearance of this plant from its former stations in Dumfriesshire and Kirkcudbright has also been reported.

Mr. William Stewart exhibited *Polyporus frondosus*, Fr., a fungus found growing on a tree-stump in front of Albany Place, Sauchiehall Street, Glasgow.

Mr. William Goodwin reported that he had seen a Kingfisher, *Alcedo ispida*, L., on the Clyde at Bothwell, on 14th inst.; and Mr. James Steel made some remarks on instances of the recent occurrence of this bird on the Clyde above Glasgow.*

31st August, 1886.

Mr. Thomas King in the Chair.

Mr. Peter Ewing exhibited specimens of *Tragopogon pratensis*, L., and *T. porrifolius*, L., from the sides of a railway embankment between Uddingston and Cambuslang.

Mr. Ewing made some remarks on the resemblance between the Flora of Scotland and that of Scandinavia, as shown by the occurrence in this country of varieties which have been described by Scandinavian botanists. As examples of these varieties, he exhibited specimens of *Carex aquatilis*, Wahl.,

* See *Proceedings*, vol. v., p. 289.

var. *virescens*, Andersson, gathered on the River Isla by Dr. F. Buchanan White, F.L.S., in February, 1884; *C. aquatilis*, var. *epigejos*, Laest., gathered at Methven, Perthshire, by Dr. Buchanan White, in September, 1885; and *Carex frigida*, All., from the original plant found by Sadler in Cor Ceann-mòr.

Mr. R. Turner, Vice-President, showed specimens of *Lobelia urens*, L., from Axminster, Devonshire.

Mr. D. A. Boyd exhibited specimens of the following plants:

Polypodium vulgare, L. var. *semilacerum*.—West Kilbride.

Boletus edulis, Bull.—West Kilbride; of unusual size, measuring 36 inches round the margin of the pileus, and 8 inches round the thickened base of the stipes.

Puccinia malvacearum, Corda.—West Kilbride; parasitic on the Hollyhock, *Althæa rosea*, the leaves, stems, and flower-buds being much disfigured by the brown clusters of this fungus.

Uredo armeriæ, Duby.—Kilwinning; parasitic on the leaves of a garden variety of *Armeria* at Stobs, where it was recently detected by Mr. John Smith, Corresponding Member.

The Chairman (Mr. King) exhibited specimens of *Radiola millegrana*, Sm., *Lactarius fuliginosus*, Fr., *L. piperatus*, Fr., *L. vellereus*, Fr., *L. glyciosmus*, Fr., and *Nyctalis parasitica*, Fr. These, he stated, had all been recently gathered by him at Innellan.

Mr. Robert Broom showed living tadpoles of the common Toad, *Bufo vulgaris*, Laur., hatched from eggs found in Possil Marsh. These were all deformed, having a twist below the tail which rendered them unable to swim straight.

14TH SEPTEMBER, 1886.

Mr. Robert Turner, Vice-President, in the Chair.

Mr. Peter Ewing exhibited specimens of *Sagina nivalis*, Fr., from an additional station recently discovered by him on the Breadalbane range of mountains.

Mr. D. A. Boyd made some remarks on the flora of Noddsdale, Largs, a district which is apparently little known to botanists. Among the plants recently observed by him when visiting the district were *Stellaria nemorum*, L., *Saxifraga hypnoides*, L., *S. stellaris*, L., *Sedum villosum*, L., *Epilobium angustifolium*, L., *Cnicus heterophyllus*, Willd., *Campanula latifolia*, L., *Vaccinium Vitis-Idæa*, L., *Gentiana campestris*, L., *Carex pallescens*, L., *Melica uniflora*, Retz., *M. nutans*, L., *Hymenophyllum unilaterale*, Willd., and *Equisetum maximum*, Lamk. A much greater degree of interest, however,

is attached to the moss-flora of the district, on account of the unusual number of subalpine and alpine species which grow luxuriantly at a comparatively low elevation. A range of lofty hills extends between the River Calder, Lochwinnoch, and Noddsdale Burn, Largs; from these numerous small streams descend, passing through deep and narrow ravines, the moist sides of which afford a congenial place of growth to many interesting species of mosses. As examples of these were shown specimens of *Anœctangium compactum*, Schl., growing in large masses and fruiting freely; *Meesia uliginosa*, Hedw., in fine fruit; and *Zieria julacea*, Schpr., in fruit. *Hypnum vernicosum*, Lindb., from the same district, was also exhibited.

Mr. Boyd showed specimens of *Neckera pumila*, Hedw., from the Kelburne Woods, near Largs. He also exhibited about 30 species of Fungi from West Kilbride, and stated that nearly all the specimens had been gathered in the course of an hour's ramble in the woods—a proof of the great abundance of these plants this autumn. Among the species shown was *Hydnum auriscalpium*, L., a small but very beautiful fungus which grows attached to decaying fir cones; also a remarkable form of the common mushroom, *Agaricus (Psalliota) campestris*, L., with the margin and upper surface much thickened and bearing resupinate masses of gills. Mr. Thomas King, Vice-President, made some descriptive remarks on the various specimens.

Dr. James Stirton, F.L.S., President, exhibited specimens of *Glyphomitrium Daviesii*, Sm., and other mosses, from Harris, Outer Hebrides.

Mr. James J. F. X. King distributed specimens of *Ceterach officinarum*, Willd., which he had collected at Westport, County Mayo, Ireland.

WINTER SESSION, 1886-87.

28TH SEPTEMBER, 1886.

Dr. James Stirton, F.L.S., President, in the Chair.

The Chairman referred in feeling terms to the loss which the Society has sustained in the death of Mr. Alexander Noble; and it was unanimously resolved that a notice of Mr. Noble's death should be recorded in the minutes, and an extract therefrom sent to the relatives of the deceased, with an expression of the sympathy of the members of the Society with them in their bereavement.

Mr. Noble was admitted as a member in 1879. He took a warm interest in the work of the Society, and was very often present at the meetings and excursions. As a naturalist, he was especially attached to the study of Botany, in which he took a keen pleasure. His geniality and kindness of disposition secured for him a wide circle of friends in the Society, by whom his loss is deeply regretted.

Mr. Robert Turner, Vice-President, gave an interesting account of the closing excursion of the Summer Session, made to the Hamilton district on 25th inst., when there was a large attendance of members and their friends. The party proceeded to Barncluith, and inspected the fine old terraced gardens, which were laid out during the sixteenth century. In Cadzow Forest, which was next visited, the old oaks, with their gnarled trunks, tortuous branches, and attendant fungi, afforded much interest to the botanists of the party; while the White Cattle, including the Chillingham bull recently added to the herd, received a large amount of attention. Proceeding from thence to the ruined castle of Cadzow, a magnificent view was obtained from the lofty bridge which spans the post-glacial gorge of the Avon amid scenery of much picturesque beauty. A visit was made to Chatelherault on the way back to Hamilton.

Mr. D. A. Boyd exhibited a remarkable example of phyllody of the floral organs of the Common Sunflower, *Helianthus giganteus*, L. The whole of the florets of the capitulum were abortive, the floral organs being apparently transformed into bracts, forming a densely-compacted green mass. Mr. Boyd stated that in a garden at Seamill, West Kilbride, where the specimen was obtained, several plants of sunflower had this season produced similarly abortive flowers.

Mr. A. Somerville, B.Sc., F.L.S., made some remarks on this specimen, which he regarded as an interesting example of the

vegetative force developed to the check of the reproductive, involving a retrograde movement on the part of the whorls. Such a movement is well illustrated in the case of the daisy, another composite flower. In the double-flowered daisy there is a conversion of the perfect (bisexual) florets of the disc into the imperfect (pistilliferous) florets of the ray. In the sunflower there had been a conversion into an entirely vegetative condition, and this was especially interesting as showing that the whorls of the inflorescence are really circles of modified leaves. In the double cherry the stamens are converted into beautiful flat petals; and the pistil, composed of two carpels, is reduced to two simple green leaves—one of the clearest proofs we can find of the leaf-type of the floral organs. Professor Henfrey mentions that in the *Leguminosæ* the parts of the flower are often degraded from a higher to a lower whorl,—stamens, pistils, &c., appearing as green leaves, as may frequently be observed in the flowers of the clover. With regard to the cause of such abnormal forms, Mr. Somerville remarked that it is well known that a rich soil has a tendency to effect a change from reproductive into vegetative organs, thus illustrating the view of Mr. Herbert Spencer that partial starvation is more favourable to reproduction than a state of abundance.

Rev. A. S. Wilson, M.A., B.Sc., made some remarks on the heliotropic movements of the sunflower, ox-eye daisy, coltsfoot, and other plants.

Mr. D. A. Boyd exhibited specimens of the following plants from Noddsdale, Largs, viz.: *Vaccinium Vitis-Idæa*, L., bearing conspicuous clusters of its bright red berries; *Equisetum Telmateia*, Ehr.; *Encalypta ciliata*, Hedw., in fruit; and *Bryum alpinum*, L., in fruit. He also showed specimens of *Hirneola Auricula-Judæ*, Berk., from West Kilbride.

Mr. Peter Ewing stated that when visiting Ben Lawers he had frequently observed an alpine grass which did not correspond with the description of any of the forms known to occur on that mountain; and although specimens had been submitted to not a few botanists acquainted with the Flora of the Scottish Alps, the plant remained undetermined. During a recent visit to Glen Shee, Mr. Ewing again observed this grass on Glas Tulchan, one of the mountains in that district; and his interest in its re-discovery having been awakened, he sent specimens to Mr. A. Bennett, F.L.S., who pronounced them to be *Festuca rubra*, L., sub-var. *barbata*, Haeck. This form may readily be distinguished from var. *grandiflora*, Haeck, to which it bears some affinity, by the copious woolly down on the glumes, which renders them lanate rather than pubescent. The glumes are also ovato-acuminate, while those of var. *grandiflora* are lanceolato-acuminate. A series of specimens of both grasses, from the districts mentioned, was exhibited by Mr. Ewing.

The Chairman (Dr. Stirton) exhibited specimens of *Mnium riparium*, Mitten, from the neighbourhood of Auchterarder, Perthshire.

Mr. Peter Cameron, Corresponding Member, exhibited specimens of *Figites anthomyiarum*, Bouché, from Possil, and *Diceræa urticeti*, Dbm., from Bishopton. On looking over some duplicate *Cynipidæ* in his collection he had found these species, which are not recorded in his Catalogue of the Scottish *Cynipidæ* recently published by the Society. Both insects, however, have been found by him in England, and may therefore be regarded as not uncommon.

Mr. Adolf Schulze read a paper descriptive of the new apochromatic micro-objective and compensating ocular lenses of Dr. Carl Zeiss, Jena.* At the close of the meeting a number of test objects, such as *Amphipleura pellucida* (half-a-dozen valves in one field showing all their cross-markings most distinctly resolved), *Navicula rhomboides*, *Surirella gemma*, *Pleurosigma angulatum*, *Heliopelta*, *Podura*-scales &c., were exhibited under the new apochromatic lenses; and as a proof of the photographic excellence of these objectives, negatives of most of the above-mentioned objects (including *Amphipleura pellucida*), all taken by ordinary lamp-light, were placed upon the table.

THE THIRTY-FIFTH ANNUAL GENERAL MEETING.

26th October, 1886.

Mr. R. Turner, Vice-President, in the Chair.

The Secretary (Mr. D. A. Boyd) read the Report of the Council on the business of last Session:

Report of the Council.

The Council beg to report that since last Annual General Meeting 26 new members have been added to the Roll of the Society, the total number on the Roll being 12 Honorary, 32 Corresponding, and 235 Ordinary Members—Total Membership, 279.

The obituary record for the past year contains the names of several members distinguished for their scientific attainments and respected for their individual worth. The Council have especially to deplore the loss of Mr. M. C. Duff, who died on 28th December last, after a long and painful illness. Mr. Duff's duties, as Treasurer of the Society, were discharged with much ability and acceptance; and his kindness of disposition and integrity of character will dwell in the remembrance of those

* *Transactions*, vol. ii., p. 154.

who were privileged to be his colleagues in the Council or associated with him as members of the Society. Among the other names to be noticed are those of Dr. Thomas Davidson, F.R.S., F.G.S., &c., one of the Honorary Members, who was especially distinguished for his researches in the Fossil and Recent *Brachiopoda*, of which he published many valuable monographs; Mr. Thomas Edward, A.L.S., one of the Corresponding Members, the well-known incidents of whose remarkable career are fitted to afford encouragement to all workers for Science, especially those whose lot has been cast amid the humbler paths of life; and Messrs. John C. Dougall, John Pesqué, John Dron, and Alexander Noble, Ordinary Members. Mr. Noble was well known to many of the members; and his genial disposition, and keen interest in all that pertained to the welfare of the Society, will not readily be forgotten.

During the past Session the usual number of meetings were held; at these the average attendance was good, and the work accomplished compares very favourably with that of previous years. At the Summer Meetings and Excursions a fair amount of work was done, but the small attendance at these meetings was somewhat disappointing. The Council trust that the members will more fully realise the important advantages which the Summer Meetings and Excursions afford for the study of Natural History.

Part ii. of the Society's *Proceedings and Transactions* was issued at the close of last Session; and part iii., containing the work of last Session, is rapidly approaching completion. The separate issue of Professor J. R. Henderson's valuable paper on the *Decapod and Schizopod Crustacea of the Firth of Clyde* has enabled its contents to be made sooner available to workers interested in the department of Zoology to which it refers.

Several additions to the Botanical and Zoological Collections for the Kelvingrove Museum are in an advanced state of preparation; and the Council beg, on behalf of the Museum Committee, to solicit the assistance of all Members who may be able and willing to help the formation and extension of these collections. Donations of species will be received by the respective Members of Committee.

A collection of British *Sphagna*, comprising 149 species, varieties, and forms, has been presented to the Society by Mr. James M'Andrew, Corresponding Member; and the Council have resolved that this important gift shall form the nucleus of a collection of mosses, to be mounted in the form of fasciculi and placed in Library for the use of the members. Messrs. Thomas King, Richard M'Kay, Peter Ewing, and D. A. Boyd, have been appointed a Committee to superintend the preparation of this Collection; and these gentlemen will be glad to

receive the help of the members of the Society, and other friends, by the contribution of specimens.

The thanks of the Society are also due (1) to Mr. Alexander Somerville, B.Sc., F.L.S., for the gift of a marine dredge, with complete dredging apparatus. The dredge is fitted with the most approved appliances, and will prove a valuable aid to the pursuit of Marine Zoology. (2) To Dr. Alexander Hamilton Howe, of Hullerhirst, Stevenston, for the gift of a copy of *Travels in the Interior of Brazil* by Mr. George Gardner. The book is especially interesting and valuable as the copy presented by the author to the distinguished general Sir Colin Campbell, afterwards Lord Clyde. (3) To Dr. John Grieve, F.R.S.E., F.L.S., for the gift of a copy of the Plates of Dillenius' *Historia Muscorum*, with annotations by the late Mr. Alexander M'Kinlay on the nomenclature of species, &c.

In conclusion, the Council beg to express the hope that the Session now commenced will prove to be one of increasing interest and diligent work; and that the individual efforts of the members will be directed to the extension of the Society's usefulness, and the more complete attainment of the objects for which it was instituted.

The Treasurer (Mr. John Renwick) submitted his annual Financial Statement, which showed a balance of £23 16s. 8d. at the credit of the Society.

The Librarian (Mr. James J. F. X. King) reported as follows:

The Books are in good condition, with the exception of the binding of some of the volumes of Sowerby's Botany (as reported last year), which has given way. It is recommended that these volumes should be bound in pigskin leather, seeing that they are more used than any other books in the Library.

Upwards of 600 separate publications, contributed by our various corresponding Societies, Magazines, &c., have been added during the past Session.

The Library now contains 756 bound volumes, being an increase of 80 volumes since last report.

We are sorry to report that there has been a falling off as regards the number of books taken out by Members, as compared with former Sessions, 167 books having been lent out (of which half were issued during the summer), as compared with 194 in 1884-85, and 189 in 1883-84.

The Reports were all unanimously approved and adopted.

The Society then proceeded to the election of Office-Bearers, when Mr. Thomas King was elected a Vice-President; Mr. Robert Broom, a Secretary; Mr. John Renwick, Treasurer; and Messrs. A. Somerville, B.Sc., F.L.S., Peter Ewing, James Steel,

and William Stewart, Members of Council,—the Council being as follows: President, James Stirton, M.D., F.R.C.S. Ed., F.L.S.; Vice-Presidents, Robert Turner, James Dairon, F.G.S., and Thomas King; Secretaries, D. A. Boyd and R. Broom; Treasurer, John Renwick; Librarian, James J. F. X. King; Members of Council, William Stewart, John Kirsop, F.S.A. Scot., Richard M'Kay, George R. Alexander, W. Craibe Angus, James Barrie Low, M.A., A. Somerville, B.Sc., F.L.S., Peter Ewing, and James Steel.

Messrs. W. J. Milligan and David Pearson were appointed Auditors for the ensuing year.

Messrs. Peter Cameron, Beech Road, Sale, Cheshire, and Robert Kidston, F.G.S., 24 Victoria Place, Stirling, were elected Corresponding Members.

Mr. Thomas King, Vice-President, gave an account of the recent meetings and excursions of the Cryptogamic Society of Scotland at Aberdeen and district. He also exhibited some Fungi collected by him at Dollar, which included the following species:

Agaricus (Tricholoma) columbetta, Fr.
A. (Tricholoma) portentosus, Fr.
A. (Clitopilus) prunulus, Scop.
A. (Psalliota) campestris, L.
Hygrophorus coccineus, Fr.
Boletus variegatus Fr.
Hydnum repandum, L.
Helvella crispa, Fr.

Mr. Thomas Scott, Corresponding Member, exhibited a beautiful specimen of *Palmipes membranaceus*, Retz., obtained near Skipness, in September last, by Mr. Angus Johnstone, Tarbert, Loch Fyne. In the course of some remarks, Mr. Scott stated that the species is one of the most remarkable of the British *Asteriadæ*, being so thin as to have been mistaken more than once for the "skin of a starfish," or the upper part of a starfish that had somehow got torn off. It does not seem to be of very frequent occurrence in the West of Scotland, but according to Forbes (*British Starfishes*) it is not regarded as uncommon off the Isle of Man. It also appears to have a fairly wide distribution in the British seas, having been recorded from the East, South, and West of England, as well as from Ireland. With regard to its distribution in the West of Scotland, it has been recorded from the "Coast of Ayrshire," by Landsborough; two or three times from Girvan by Mr. Thomas Anderson, Corresponding Member;* and from Ettrick Bay, Bute, by Mrs. Mowbray. Mr. A. Somerville, B.Sc., F.L.S., obtained two specimens—an adult and a small one—in 1880, when dredging immediately beyond the Maiden Isle in the Firth of Lorne; and what makes this find the more interesting is the fact that these were got on *Melobesia* ground, whereas a muddy bottom is usually considered to be

* See *Proceedings*, vol. i., p. 148; ii., pp. 6, 17.

the proper habitat of this species. It is believed to have been found in several other localities in the West of Scotland; and accordingly, although it may not be a gregarious species, it may, if carefully sought for, be found to have a more extensive distribution and to be more common than was formerly supposed.

Mr. A. Somerville, B.Sc., F.L.S., made some remarks on the British *Asteriadæ*, and gave a short sketch of their classification.

Mr. D. A. Boyd exhibited specimens of the following mosses from Noddsdale, Largs:

Dicranella rufescens, Turn., in fruit.
Mnium stellare, Hedw., barren.
serratum, Schrad., in fruit.
Hypnum giganteum, Schpr., barren.
Hylocomium triquetrum, L., in fruit.

Mr. R. Robertson read an interesting paper, entitled "Some of my experiences in Bee-keeping," in which an account was given of the appliances and treatment of stock necessary for successful apiculture. Original observations were made on the habits of bees, especially during the periods immediately before and after swarming; and specimens of the insects and their products were exhibited.

30th November, 1886.

Mr. Thomas King, Vice-President, in the Chair.

Messrs. Johnston Shearer, 29 Dixon Avenue, Crosshill, and William S. Tait, 38 Morrison Street, Kingston, were elected Ordinary Members.

Mr. Peter Cameron, Corresponding Member, exhibited specimens of *Nematus pallipes*, Fallén, and *Phyllotoma ochropoda*, Klug, two species of *Tenthredinidæ* recently taken at Aviemore, Inverness-shire, by Mr. G. C. Champion. The former insect is found in Scandinavia, Holland, and Germany, and is probably not uncommon elsewhere, although it has not hitherto been observed in Britain; while the latter, which is new to the Scottish list, is of rare occurrence in England, where, in the larval condition, it has been found mining the leaves of the Aspen.

In evidence of the remarkable effect which the recent mild weather has had on vegetation, Mr. Cameron submitted a list of wild flowers observed by him in bloom near Sale, Cheshire, on 28th inst. These numbered 49 species, representing the following genera: *Ranunculus* 4, *Fumaria* 1, *Sinapis* 1, *Nasturtium* 1, *Capsella* 1, *Sagina* 1, *Cerastium* 2, *Geranium* 2, *Trifolium* 2, *Pyrus* 1, *Rubus* 1, *Potentilla* 1, *Cicuta* 1, *Angelica* 1, *Heracleum* 1, *Hedera* 1, *Scabiosa* 1, *Sonchus* 1, *Crepis* 1,

Taraxacum 1, *Lapsana* 1, *Carduus* 1, *Centaurea* 2, *Solidago* 1, *Bellis* 1, *Chrysanthemum* 1, *Senecio* 1, *Campanula* 1, *Euphrasia* 1, *Mentha* 1, *Lamium* 1, *Plantago* 1, *Polygonum* 2, *Rumex* 2, *Euphorbia* 1, *Chenopodium* 1, *Urtica* 1, with 3 grasses.

Mr. Cameron stated that in the gardens near Manchester the Primrose, Wallflower, and other spring flowers were coming into bloom, and Roses had not yet stopped flowering. Apple and Pear trees were also reported to be in flower, and even promising a second crop of fruit.

Mr. D. A. Boyd exhibited specimens of the following Mosses and Fungi from Ayrshire:

Philonotis fontana, L., var. *falcata*, De Not.—Noddsdale, Largs.

Barbula ruralis, L, var *arenicola*, Braith.—Sandy ground adjoining the sea-shore, West Kilbride.

Schizophyllum commune, Fr.—Seamill, West Kilbride.

Sphærobolus stellatus, Tode.—Seamill, West Kilbride.

Mr. Peter Ewing stated that the specimens of *Philonotis fontana*, var. *falcata*, from Largs, seemed exactly to correspond with a moss gathered by him on Ben Laoigh, and included as variety *falcata* in his List of the plants found on that mountain.* While some of our leading bryologists regard this form as identical with the *falcata* of De Notaris, others maintain that the genuine *falcata* does not occur in Britain. Mr. Ewing also remarked that *Barbula ruralis*, L., var. *arenicola*, Braithwaite, which is common on sandy ground along the shores of the Firth of Clyde, is equally plentiful on the East Coast of Scotland.

Mr. William Stewart exhibited numerous species of Fungi, which had been obtained by him in a shipbuilding yard on the Clyde at Yoker, four miles below Glasgow—a proof of the remarkable abundance of these plants this season, even in places most unlikely to afford a profitable field for the botanist. Among the species shown were the following:

Agaricus (Clitocybe) aggregatus, Schæff.
A. (Clitocybe) dealbatus, Sow.
A. (Pholiota) terrigenus, Fr.
A. (Flammula) sapineus, Fr.
Lenzites sæpiaria, Fr.
Polyporus fragilis, Fr.
P. adustus, Fr., including a very dark resupinate form.
P. radiatus, Fr.
Polyporus velutinus, Fr.
P. versicolor, Fr.
P abietinus, Fr.
P. vaporarius, Fr.
Merulius lachrymans, Fr.
Hydnum coralloides, Scop.
Stereum hirsutum, Fr.
Corticium puteanum, Fr.
Crucibulum vulgare, Tul.
Sphærobolus stellatus, Tode.

Mr. Stewart made some remarks on *Hydnum coralloides*, which is an interesting addition to the list of Scottish species. The specimen shown was the largest of three obtained at Yoker, and was found on a log of white pine that had been 8 or 10

* "The Flora of Ben Laoigh;" *Proc. Nat. Hist. Soc. Glasg.*, vol. v., p. 284.

years in this country. A photograph of this beautiful fungus, as it appeared when newly gathered, was handed round for inspection.

Mr Stewart also showed a specimen of *Helvella infula*, Schæff., from the same shipbuilding yard. The fungus is very rare in Britain. Rev. Dr. Keith, Forres, reports that he has found it in only one place in Scotland, viz., Rothiemurchus, but that it has occurred in the same spot in successive seasons. It has only once been found in England, viz., at King's Lynn.

Mr. David Gregorson, F.E.I.S., showed an abnormal specimen of *Erica tetralix*, L., having, in addition to the usual cluster of flowers, a prolongation of the stem bearing a second cluster at its apex.

Mr. A. Somerville, B.Sc., F.L.S., made some remarks on *Neæra*, a genus of lamellibranch Mollusca. After referring to the interest which these shells possess on account of the elegance of their form and tints, and the comparative inaccessibility of their haunts, he gave an account of their distribution in space and time, and described the morphological characteristics of the family *Corbulidæ* to which they belong. A coloured diagram, illustrating on an enlarged scale the distinctive features of each species, was exhibited, along with specimens of the following species dredged by him last summer in the West of Scotland:

Neæra abbreviata, Forb.—Loch Hourn, in 75 fathoms; also in Loch Alsh; and off the Island of Rum, in 54 fathoms. It also occurs sparingly in Loch Fyne.

N. costellata (Desh.).—Lamlash Bay, in 20 fathoms; also off Tarbert, Loch Fyne

N. cuspidata (Olivi).—Occurs throughout the Firth of Clyde district and the West Coast of Scotland generally.

Mr. D. A. Boyd read a paper on some allied species of marsh *Hypna*, of the subgenera *Harpidium* and *Cratoneuron*, in which reference was made to the characteristics by which these mosses may readily be distinguished. An ample series of specimens was exhibited, illustrating the numerous and perplexing variations in form to which some of the species are subject. Among these were included the following species from the North Ayrshire district:

Hypnum exannulatum, Gümb.
H. vernicosum, Lindb.
H. Cossoni, Schpr.
H. revolvens, Sw.
H. fluitans, L.
H. filicinum, L., type and var. *vallisclausæ*, Brid.
H. falcatum, Brid.

Mr. David Robertson, F.L.S., F.G.S., communicated some notes on *Corystes cassivelaunus*, Penn.,* and *Mytilus edulis*, L.†

* *Transactions*, vol. ii., p. 143. † *Ibid.*, p. 144.

28TH DECEMBER, 1886.

Mr. James Dairon, F.G.S., Vice-President, in the Chair.

Mr. W. Craibe Angus exhibited a specimen of the Turnstone, *Strepsilas interpres*, L., shot at Loch Lomond on 6th inst., on which he made some remarks.* He also showed a fine example of the Great Crested Grebe, *Podiceps cristatus*, L., shot near Balloch on 8th inst.

Mr. W. R. Baxter exhibited specimens of *Meta Menardi*, Latr., a spider which does not appear to have been previously observed in Scotland. It frequents caves, and dark vaults in ruined castles, &c. The specimens under notice were recently found in vaults under Craignethan Castle, Lanarkshire.

Mr Baxter also showed specimens of *Asagena phalerata*, Panz., another rare species, taken near Troon, Ayrshire, by Mr. Fred. W. Robertson.

Mr. A. Somerville, B.Sc., F.L.S., exhibited specimens of *Axinus croulinensis*, Jeffreys, one of the smallest British marine bivalve shells. This mollusc was discovered 40 years ago by Dr. Jeffreys, off Croulin Island, Ross-shire, and has been taken by Canon Norman in Shetland waters and in various of the Norwegian Fiords. Since its discovery by Jeffreys, however, it was not known to have been taken in what may properly be termed British waters until dredged by Mr. Somerville last August in 30 fathoms water, on a muddy bottom, in Gairloch, Ross-shire, and also in Loch Broom. Specimens of *Axinus flexuosus* (Mont.), and *A. ferruginosus* (Forbes), the other two British species, were shown for comparison, also an enlarged diagram illustrating the minute characteristics by which the species are distinguished.

Mr. James J. F. X. King exhibited specimens of the following neuropterous insects from the West of Ireland, all previously unrecorded for that country, viz.:

Leptocerus senilis, Burm.	*Glyphotælius pellucidus*, Retz.
L. commutatus, M'Lach.	*Limnophilus hirsutus*, Pict.
Œcetis furva, Ramb.	*Silo nigricornis*, Pict.

Mr. James Steel exhibited specimens of *Amalia gagates* (Drap.), a rare slug found by Mr. Thomas Scott, Corresponding Member, near the Royal Aquarium, Rothesay. He also showed leaves and flowers of the Pitcher-plant *(Sarracenia)*, sent by Mr. Marshall Reid, Eel River, New Brunswick, for exhibition to the Society.

Mr. R. S. Wishart, M.A., exhibited a beautiful specimen of *Apera Spica-venti*, Beauv., from the French Coast near Boulogne, also a number of plants from Forfarshire, including:

* *Transactions*, vol. ii., p. 179.

Thalictrum minus, L.
Dianthus deltoides, L.
Cerastium arvense, L.
Astragalus hypoglottis, L.
A. glycyphyllos, L.
Campanula glomerata, L.
Vaccinium Oxycoccos, L.
Mertensia maritima, Don.
Linaria Cymbalaria, Mill.
Trientalis europæa, L.
Chenopodium Bonus-Henricus, L.
Neottia Nidus-avis, L.
Alisma ranunculoides, L.
Avena pubescens, L.
Kœleria cristata, Pers.
Festuca sylvatica, Vill.
Lolium temulentum, L.
Elymus arenarius, L.
Hordeum murinum, L.

Mr. D. A. Boyd exhibited specimens of *Cinclidotus fontinaloides*, Hedw., in fruit, from the Dusk Water, Dalry.

Mr. James J. F. X. King, on behalf of the donors, presented to the Society a framed photograph of the large party present at the excursion to Cadzow Forest on 25th September. The print, which was a fine example of photographic art, had been produced on a much enlarged scale by Mr. William Goodwin; and an elegant frame, provided by Mr. W. Craibe Angus, added considerably to the attractiveness of its appearance. On the motion of the Chairman, a cordial vote of thanks was awarded to Messrs. Goodwin and Angus for their valuable gift.

A paper by Mr. James M'Andrew, Corresponding Member, entitled "Botanical Notes from Portpatrick, 1886," was read.*

25th January, 1887.

Dr. James Stirton, F.L.S., President, in the Chair.

Mr. Robert Broom exhibited a specimen of *Epicrium glutinosum*, L., an apodous amphibian, from Siam, and described the characteristics of the remarkable group of Asiatic reptiles to which the species belongs.

Mr. A. Somerville, B.Sc., F.L.S., exhibited specimens of the nine British species, and six of the named varieties, of the molluscan genus *Pecten*, Bruguière. An interesting account was given of the morphology of the genus, the characteristics of each species and variety, and the area of their distribution, special reference being made to their occurrence in the West of Scotland.

Mr. James J. F. X. King exhibited a specimen of *Stenophylax concentricus*, Zett., a rare neuropterous insect, captured last August near Sligo by Mr. Percy Russ. The species is common in France, but has occurred only very sparingly in the South of England.

Mr. D. A. Boyd exhibited specimens of several Mosses (in fruit) and Fungi from the neighbourhood of West Kilbride. These included the following species:

* *Transactions*, vol. ii., p. 135.

Thuidium tamariscinum, Hedw.
Thamnium alopecurum, L.
Rhynchostegium tenellum, Dicks.
Hylocomium squarrosum, L.
H. loreum, L.
Peziza aurantia, Fr.
P. coccinea, Jacq.
P. firma, P.
Helotium citrinum, Fr.
Hypoxylon coccineum, Bull.
H. fuscum, Fr.
Comatricha Friesiana, De Bary.

Mr. Boyd reported the occurrence of *Badhamia capsulifera*, Bull., at Seamill, West Kilbride. The fungus was recently found by him on decaying wood, and forwarded to Dr. M. C. Cooke, by whom it was identified.

Mr. William Goodwin exhibited a branch of *Arbutus Unedo*, L., grown in the open air at Innellan, and bearing abundance of flowers and fruit.

Mr. A. Somerville, B.Sc., F.L.S., showed some beautiful botanical specimens, collected and preserved by a young lady who had obtained the first prize in an herbarium competition. These were remarkable for the perfect manner in which even the most fugacious tints had been preserved. Mr. Somerville stated that the plants had been enclosed in sheets of drying-paper, and a number of these sheets placed between two smooth boards, which were then tightly strapped together and allowed to remain overnight as near a hot fire as possible without burning. In this way the moisture was rapidly dissipated before the colours of the leaves and flowers had in any way been affected by the drying process.

Mr. John Trotter exhibited some improved microscopic apparatus, including a method of illumination by electricity by means of a very small lamp of special construction placed close to the stage, thus obviating the inconvenience of a large battery and the use of condensers. By this method a very small battery would be found to afford ample illumination even for the highest powers. Very oblique light could readily be obtained for resolving diatoms or opaque objects, or for dark ground illumination, without any of the expensive sub-stage appliances required with the ordinary lamp-light. The small electric lamp could be fitted to any stand without interfering with the use of the ordinary lamp, when its employment might be desired.

A microscopic demonstration was given by Mr. Trotter at the close of the meeting.

Mr. James J. F. X. King read a paper entitled "Notes on a Small Collection of Neuroptera from the Island of Coll."*

* *Transactions*, vol. ii., p. 133.

22ND FEBRUARY, 1887.

Mr. R. Turner, Vice-President, in the Chair.

The Chairman referred to the loss which the Society had sustained in the death of Mr. Robert Gray, F.R.S.E., one of the Honorary Members. He moved, and it was unanimously resolved, that a memorial notice of Mr. Gray should be recorded in the minutes, and an excerpt therefrom transmitted to the family of the deceased, with an expression of the sympathy of the Members of the Society with them in their bereavement.

IN MEMORIAM—ROBERT GRAY, F.R.S.E.

ROBERT GRAY was a native of Dunbar, Haddingtonshire. When a young man, he entered the service of the City of Glasgow Bank, where his marked business capacity was soon recognised. He received the appointment of Inspector of Branches, which he held for a number of years, and afterwards acted as Agent in the West-end Branch of the Bank in Glasgow. About twelve years ago he was appointed Superintendent of Branches of the Bank of Scotland, and since that time he resided in Edinburgh. A few years ago he was promoted to the office of Cashier of the Bank of Scotland, which he continued to hold until the time of his death. He died on 18th inst., at the age of 62.

Although so closely and so successfully devoted to business, Mr. Gray was a keen observer of Nature. His favourite study —ornithology—was pursued with unflagging earnestness; and during the period when he acted as Inspector of Branches of the City of Glasgow Bank, frequent visits to the West Coast of Scotland, where the City Bank was well represented, afforded him very favourable opportunities for acquiring much original information regarding the distribution of the birds of the hores and waters. His power of observation was remarkable, and nothing that he noticed seemed to be forgotten. His enthusiastic devotion to Natural History, and unusual abilities as an accurate observer, soon marked him out as a leading ornithologist. This reputation was further established on the publication, in 1871, of his *Birds of the West of Scotland*, a standard work which has long been out of print. At the time of his decease, he was, along with Mr. William Evans, engaged in the preparation of a companion work on the Birds of the East of Scotland.

Mr. Gray's connection with the Natural History Society of Glasgow dates from its commencement. He was present at the meeting held on 2nd July, 1851, at which the formation of the Society was agreed upon. From 1854 to 1856 he acted as Treasurer; and in September, 1858, he was appointed to the office of Secretary, which he continued to hold until April, 1871.

He was appointed a Member of Council in September, 1871; and on 25th September, 1877, he was elected an Honorary Member of the Society.

To his eminent scientific attainments, and energetic business habits, were united a uniform courtesy of manner and kindness of disposition which secured for him the friendship and respect of his associates in this Society; and his untiring personal efforts and wide influence, exerted during the long period in which he acted as Secretary, were largely instrumental in promoting the success which has attended the course of the Society's existence.

Mr. Gray was a Vice-President of the Royal Society of Edinburgh, the Secretary of the Royal Physical Society of Edinburgh, and a prominent member of the Botanical Society of Edinburgh.

Mr. D. A. Boyd exhibited specimens of the following Mosses from North Ayrshire:

Brachyodus trichodes, W. & M.—Noddsdale, Largs; in fruit.
Ditrichum flexicaule, Schwg.—Greeto Glen, Largs; barren.
Barbula aloides, Koch.—Glenhead, West Kilbride; in fruit.
Barbula tortuosa, L.—Greeto Glen, Largs; barren.
Fontinalis squamosa, L.—Greeto Glen, Largs; barren.
Neckera complanata, L.—Southannan Glen, West Kilbride; in fruit.
Brachythecium Mildeanum, Schpr.—South Kilrusken, West Kilbride; in fruit.

Mr. Thomas King, Vice-President, showed a specimen of the Jew's-ear, *Hirneola Auricula-Judæ*, Berk., found on an elder bush at Crookston Castle.

Mr. King also read an interesting paper entitled, "A comparison of the views of Darwin and of Vines on the irritability of plants." He remarked that on the publication of Mr. Darwin's work *On the Power of Movement in Plants*, the views which it contained, based on the author's original observations and experiments, were regarded by naturalists as so remarkable as to be admissible only after a careful process of examination and verification. These views, however, had now been tested, especially by the experiments of German botanists, and were generally accepted. Mr. Vines, in his recently published *Lectures on the Physiology of Plants*, while agreeing with most of Darwin's conclusions, differs from him on certain points. From the constant motion of the young growing parts of plants (such as leaves, twigs, radicles, &c.), Darwin infers that the growing parts of all plants are in motion. The movements of the growing points of shoots, &c., was described by Sachs under the name of "revolting nutation"; but Darwin applies to it the term "circumnutation," and bases upon it his com-

prehensive theory having a direct bearing on the doctrine of evolution—the theory that there is always movement in progress, and its amplitude, or direction, or both, have only to be thus modified for the good of the plant in relation to internal or external stimuli. Vines, although he describes circumnutation and all the other movements mentioned by Darwin, never once refers to this theory, but seems to go a step back and refer all movements directly to the irritability of the protoplasm in the cells when acted on by stimuli internal or external, without calling in the aid of this intermediate movement of circumnutation. Again, Darwin regards twining as an amplification of the ordinary movement of circumnutation, but points out in his work *On the Movements and Habits of Climbling Plants* that the twiner does not circumnutate and turn at the same rate. This difference of rate he ascribes to the continued disturbance of the impelling force by the arrestment of the movements at successive points through friction. Vines, on the other hand, while agreeing that circumnutation may contribute to the twining movement, takes into account the sensitiveness of the stem to contact. Mr. King minutely described Darwin's experiments on the sensitiveness of radicles to external stimuli, and expressed his concurrence in the view that the curvature produced by artificial stimuli must be regarded as a pathological rather than a natural phenomenon. The question of the nature of the force behind the mechanism of movement is fully discussed by Vines but not by Darwin. A single remark by the latter, however, seems to indicate a general agreement. The chemical decompositions and combinations which are constantly taking place in the protoplasm of the living cell result in the liberation of energy which manifests itself in the movement. Of course, behind all this there is the unexplained mystery of life itself. In conclusion, Mr. King described the experiments made by Knight in 1806 to determine the force of gravity on the geotropic movement of growing radicles.

The following papers were also read:

"The Food of Fishes," by Mr. David Robertson, F.L.S., F.G.S.*

"On the Oral Apparatus of the larva of *Wormaldia*, a genus of *Trichoptera*," by Mr. Kenneth J. Morton.†

29TH MARCH, 1887.

Dr. James Stirton, F.L.S., President, in the Chair.

Messrs. John M'Cabe, M.A., 47 Quarry Street, Hamilton, John Clark, Gushetfaulds Railway Depot, and John Armour, 58 Hospital Street, were elected Ordinary Members.

* *Transactions*, vol. ii., p. 146. † *Ibid.*, p. 115.

Mr. James J. F. X. King exhibited a beautiful specimen of the King Bird, *Cincinnurus regius*, L., from the Malay Archipelago.

Mr. Thomas Scott, Corresponding Member, exhibited a collection of Land and Fresh-water Mollusca and Land Isopoda from Bute, and communicated some interesting notes on the various species and their distribution.*

Mr. Peter Ewing exhibited a specimen of a *Carex*, apparently new to science, found by him near the ridge between Forfarshire and Aberdeenshire in 1884, and submitted a description of the plant, which he had named *Carex spiralis*.† He showed a complete series of specimens of the British species of *Pottia*, mounted for microscopic examination, also specimens of the following mosses:

Grimmia torquata, Grev.—Glenshee.
atrata, Miel.—Canlochan.
Tetraplodon angustatus, (L. fil.) Hedw.—Glenshee.
Mnium affine, Bland., var. *rugicum*, Laur.—Lochnagar.

The Chairman (Dr. Stirton) exhibited specimens of the following mosses:

Didymodon cylindricus, Bruch.—Campsie; in fruit.
Daldinianus, Schpr.—Dunoon.
turgescens, Stirton.—Ben Lawers; new to science.
Zygodon ptychophilus, Stirton.—Bowling, 1864; new to science.
Stirtoni, Schpr.—Cherbourg *(M. Le Jolis)*.
Grimmia sublurida, Stirton.—Harris, 1886; new to science.

Mr. D. A. Boyd exhibited specimens of the following plants from North Ayrshire:

Saxifraga aizoides, L.—Towergill Glen, Largs.
hypnoides, L.—Kaim Hill, West Kilbride.
Chrysosplenium alternifolium, L.—Towergill Glen.
Vaccinium Vitis-Idæa, L.—Kaim Hill.
Hymenophyllum unilaterale, Willd.—Kaim Hill.
Andreæa alpina, Turn.—Noddsdale, Largs: in fruit.
Gymnostomum tenue, Schrad.—Kirkland Glen, West Kilbride.
Pottia minutula, Schwg.—Portincross, West Kilbride; in fruit.
intermedia, Turn.—Portincross; in fruit.
Barbula tortuosa, L.—Kaim Hill.
Encalypta ciliata, Hedw.—Noddsdale; in fruit.
Zieria julacea, Schpr.—Kaim Hill.
Bryum alpinum, L.—Noddsdale; in fruit.
roseum, Schreb.—Towergill Glen.
Mnium undulatum, Hedw.—Towergill Glen; in fruit.
Fissidens osmundoides, Hedw.—Greeto Glen, Largs.
Neckera crispa, L.—Towergill Glen; in fruit. Kaim Hill; sterile.
Rhynchostegium depressum, Bruch.—Portincross.

* *Transactions*, vol. ii., p. 125. † *Ibid.*, p. 110.

Mr. Boyd also showed specimens of *Orthodontium gracile*, Wils., recently discovered by him on sandstone rocks in the neighbourhood of West Kilbride; and he stated that this moss has hitherto been found in only one other station in Scotland—viz., the woods near Lennox Castle, Stirlingshire, where, as at West Kilbride, its growth is apparently restricted to a small area of the rock-surface, measuring only a few yards in circumference. It is equally rare in England; and since its discovery at Helsby and Frodsham, Cheshire, by Wilson in 1833, and subsequently at Wharfdale, Yorkshire, by Spruce, only two or three additional stations have been reported. It has been found on the mountains of Abyssinia by Professor Schimper; but until 1881, when it was discovered in Finisterre, France, by M. Tanguy, it was not known to occur in any part of Europe outside of the British Isles.

Mr. Peter Ewing read a paper on some Scandinavian forms of Scottish alpine plants recently discovered by him on the mountains of North-East Perthshire.* The characteristics of the various forms were described, and specimens exhibited, along with examples of the typical species for comparison.

26TH APRIL, 1887.

Mr. Thomas King, Vice-President, in the Chair.

Messrs. Norman W. Dougall, 23 Gordon Street, and Henry M'Culloch, 154 Sauchiehall Street, were elected Ordinary Members.

Mr. Thomas Scott, Corresponding Member, exhibited an extensive series of Land Shells collected by him in the neighbourhood of East Loch Tarbert. Among these were some remarkable examples of damaged shells which had been repaired by their occupants. Mr. Scott submitted some interesting notes on the various species and varieties represented in the collection, including a description of a new variety of *Helix aspersa*, Müll., recently discovered by him, and named var. *depressa*.

Mr. D. A. Boyd exhibited a specimen of Asarabacca, *Asarum europæum*, L., recently found by Mr. John Smith, Corresponding Member, in the woods near Eglinton Castle. He also showed specimens of *Eurhynchium pumilum*, Wils., from West Kilbride, and *Eurhynchium Teesdalii*, Sm., from the neighbourhood of Largs.

Mr. David Gregorson, F.E.I.S., exhibited a fine collection of Marine Algæ from Drumadoon, Arran.

Mr. A. Somerville, B.Sc., F.L.S., reported that he had obtained *Axinus croulinensis*, Jeff., among material dredged by him in 15 fathoms in Lamlash Bay, in September, 1886.

* *Transactions*, vol. ii., p. 111.

The following papers were read:

"A Contribution towards a Catalogue of the Amphipoda and Isopoda of the Firth of Clyde"; by Mr. David Robertson, F.L.S., F.G.S.*

"On Some Marine Mollusca": by Mr. David Robertson, F.L.S., F.G.S.†

"A Glance at the July Flora of Alyth"; by Mr. R. S. Wishart, M.A.‡

"Meteorological Notes for 1886, with remarks on the State of Vegetation in the Public Parks of Glasgow"; by Mr. Duncan M'Lellan.

"Notes on the Neuroptera of Mayo and Galway"; by Mr. James J. F. X. King.

"On the Development of *Syngnathus acus*, Lin."; by Mr. W. Anderson Smith, Corresponding Member.§

"Observations on Some West Coast Fishes"; from the Lochbuie Marine Institute, *per* Mr. W. Anderson Smith, Corresponding Member.¶

* *Transactions*, vol. ii., p. 9. † *Ibid.*, p. 150. ‡ *Ibid.*, p. 118. § *Ibid.*, p. 105. ¶ *Ibid.*, p. 100.

ABSTRACT STATEMENT OF ACCOUNTS.—SESSION 1885-86.

To Balance in Bank and on hand,			£74	13	7	By Rent and Attendance,	£8 8 6
,, 1 Life-Member's Subscription,			5	5	0	,, Postages, Stationery, &c.,	7 12 10
,, 184 Annual Members' Subscriptions @ 7s. 6d.,			69	0	0	,, Printing *Proceedings*, Circulars, &c.,	116 4 6
,, 17 New Members' Entry-money @ 7s. 6d.,			6	7	6	,, Library—Additions,	3 13 1½
,, 10 Members' Arrears,			4	12	6	,, ,, Binding,	7 12 10
,, Bank Interest,			1	10	3	,, ,, Postages, Carriage, &c.,	7 6 5
,, *Proceedings*, &c., sold, per Librarian,			14	0	6½	,, ,, Painting Bookcase,	0 18 6
,, Subscription received for printing *Proceedings*,			0	10	0	,, ,, Insurance,	0 6 0
						,, Balance in Bank and in Treasurer's hands,	23 16 8
			£175	19	4½		£175 19 4½

20th October, 1886.—We have this day examined the Books, and compared the Vouchers, and find the same to be correct—the Balance in National Security Savings Bank and in the Treasurer's hands being Twenty-three Pounds Sixteen Shillings and Eight Pence.

WILLIAM STEWART.
JOHN RHIND.

SUMMER SESSION, 1887.

10TH MAY, 1887.

Mr. Thomas King, Vice-President, in the Chair.

The Chairman exhibited specimens of *Scilla verna*, Huds., from Portpatrick, Wigtownshire.

Mr. D. A. Boyd exhibited specimens of the following Mosses from Ayrshire:

Dicranum fuscescens, Turn.—A remarkable form with falcate-secund leaves, and almost circinate habit. It resembles *D. fuscescens*, var. *falcifolium*, Braithwaite, but the leaves are longer than in that variety. This, however, may be due to the comparatively shaded situation in which the moss was grown. There were also shown, for comparison, specimens of typical *D. fuscescens*, in fruit, from West Kilbride and Largs, the former gathered on rocks adjacent to the spot where the variety with falcate-secund leaves was obtained.

Seligeria setacea, Jacq.—On sandstone rocks, Portincross, West Kilbride.

Barbula lævipila, Brid.—A stunted form, occurring in small round cushions on dry sandstone rocks on the sea-shore at Portincross, West Kilbride.

Zygodon viridissimus, Dicks.—Portincross; in fine fruit.

Hyocomium flagellare, Dicks.—Crosbie Hills, West Kilbride.

Mr. R. Broom exhibited a specimen of *Trimeresurus erythrurus*, one of the *Crotalidæ*, from Siam.

A number of Microscopic Objects were next exhibited. Among the more important specimens submitted were a series of magnificent fossil diatoms from the Oamaru deposit, New Zealand, exhibited by Mr. Robert Kidston, F.R.S.E., F.G.S.; a series of specimens illustrating the development of the embryo of the Shepherd's Purse (*Capsella Bursa-pastoris*, Mœnch), exhibited by Mr. Thomas King, Vice-President; and a number of living specimens of the trochosphere and veliger larvæ of *Limnæa peregra*, Müll.

24th May, 1887.

Dr. James Stirton, F.L.S., President, in the Chair.

Mr. David Gregorson, F.E.I.S., reported on an excursion made to Milngavie on 21st inst.*

Mr. Thomas King, Vice-President, referred to the loss which the society had recently sustained in the death of Mr. Thomas Ballantyne, one of the Ordinary Members.

The President exhibited specimens of *Barbula convoluta*, Hedw., in fine fruit, from Bridge of Weir, and remarked that although the moss is exceedingly common in a barren state, it is not very often found with well-developed capsules. He also showed specimens of *Pilophoron fibula*, Tuck., from the same district, and of *Grimmia Stirtoni*, Schpr., from Glen Ogle, Perthshire.

Mr. D. A. Boyd exhibited fruiting specimens of *Mnium hornum*, L., having the calyptra attached to the seta immediately below the capsule. He stated that instances of a similarly abnormal position of the calyptra in *Atrichum undulatum*, L., had formerly been brought before the society by Mr. Alexander M'Kinlay.† In that case, however, the shape of the capsule was apparently affected by the position of the calyptra, as it was described as short, approaching an ovate form as in *A. tenellum*, and with a much shorter lid than usual. In reference to this point Mr. M'Kinlay, when exhibiting the specimens of *A. undulatum*, had stated that although the calyptra not infrequently takes up this abnormal position, he was astonished at the altered shape of the capsule, and suggested the following explanation of its change of form: "Can it be that the peculiar shape of the capsule is dependent on the peculiar position of the calyptra? Not improbably it is so, seeing we find the same correlation of growth existing in specimens from different localities. What more likely than that the calyptra in its normal position, by covering the nascent capsule and thus protecting it from various adverse circumstances, should exercise a beneficial influence on its growth into the normal shape. Such I take to be the function of the calyptra, and to the absence of it in its proper position may be attributed the abnormal shape of the capsules in question." In accordance with this view, however, we should expect to find a similar modification in the shape of capsules of *M. hornum* which had not had the protective covering of the calyptra; but as these did not appear to differ either in size or

* See *Transactions*, vol. ii., p. 322. † *Proceedings* (First Series), vol. i., p. 108.

shape from capsules of this moss produced under ordinary conditions, we might accordingly infer that in some cases, at least, the calyptra is not necessary for the perfect development and normal growth of the capsules.

Mr. James Steel exhibited several preserved specimens of Fungi from British Guiana.

On behalf of Mr. Thomas Scott, Corresponding Member, Mr. Steel exhibited specimens of the following Mollusca, Land Isopoda, and Cumacea, from Bute:

Zonites alliarius, Müll., var. *viridula*, Jeff.
Philoscia muscorum, Scop.—A remarkably dark-coloured variety.
Philougria riparia, Koch.—Not previously recorded for Bute.
Campylaspis costata, G. O. Sars.—New to Britain.
Iphinoe serrata, Norman.

Mr. C. Sherry exhibited a specimen of *Ataccia cristata*, and stated that the remarkable genus *Ataccia* belongs to the *Taccaceæ*, a small order of monocotyledonous plants. The species under notice has a short conical underground caudex or rhizome, from which are produced three or four large oblong-acuminate leaves. The scape is about as long as the leaves, erect, stout, angled, dark-purple, and terminated by a large four-leaved involucre, of which the two outer leaflets are dark-purple, opposite, sessile, and spreading, while the two inner are much larger, placed side-by-side, and green with a deep-purple base and stalk. The numerous flowers form a drooping one-sided umbel; the perianth is dark-purple with a turbinate hexangular tube, and a sexpartite limb which is suddenly reflexed, the segments being arranged in a smaller outer and larger inner series, and the rim of the mouth forming a crenated ring. The flowers contain six stamens inserted at the base of the segments of the ring, and having broad filaments which are concave above; the style is short, thick, and three-furrowed, with a capitate three-lobed stigma; the ovary is sub-trilocular, containing numerous ovules, and becoming a semi-trilocular many-seeded berry. The plant is a native of the Islands of the Malayan Archipelago, and one or two other species occur in India. These are of no known utility, but from a morphological point of view their curious structure presents features of considerable interest.

Mr. Richard M'Kay exhibited specimens of *Nitella opaca*, Agardh, from Possil Marsh.

Mr. R. Brown exhibited a very large specimen of *Emyda granosa*, an Indian Mud-tortoise ; a portion of the carapace of *Chitra indica*, another of the *Trionycidæ*; and specimens of various species of Land Tortoise, to illustrate the differences of structure of the carapaces.

7th June, 1887.

Mr. Thomas King, Vice-President, in the Chair.

Mr. D. A. Boyd reported on an excursion made to Dalry on 4th inst.*

Mr. Peter Ewing exhibited a beautiful specimen of *Gnaphalium norvegicum*, Gunn., from Lochnagar, which he had had for some time under cultivation. He also showed specimens of the following Mosses from the localities indicated, viz.:

Grimmia apocarpa, L., var. *crispula*.—Ben Lawers.

G. anomala, Milde.—Glen Shee.

Splachnum sphæricum, L. fil.—Killin.

Plagiothecium nitidulum, Wahl.—Killin.

Dr. James Stirton, F.L.S., President, exhibited specimens of *Campylopus Shawii*, Wils., and *Grimmia sublurida*, Strn., from Harris. For comparison with the latter were shown specimens of a closely allied species of *Grimmia* from the Himalayas.

Mr. R. Turner, Vice-President, exhibited specimens of *Zasmidium cellare*, Fr., a fungus which grows in wine-cellars. It frequently spreads so as to form a mass of considerable size resembling a piece of black cloth.

Mr. Turner also showed a cabbage-stem from Jersey, measuring 8 feet in length, and a walking-stick made on that island from a stem of the same kind.

Mr. Johnston Shearer exhibited specimens of *Trientalis europæa*, L., *Myosotis collina*, Hoffm., and *Gagea lutea*, Ker, from the neighbourhood of Stirling.

On behalf of Mr. Thomas Scott, Corresponding Member, Mr. James Steel exhibited specimens of *Ranunculus sceleratus*, L., and *Hippuris vulgaris*, L., from the neighbourhood of Rothesay, and stated that these plants had not previously been recorded for the Island of Bute.

Mr. David Robertson, F.L.S., F.G.S., exhibited specimens of *Virgularia mirabilis*, L., *Pennatula phosphorea*, Lam., and

* See *Transactions*, vol. ii., p. 322.

Pavonaria quadrangularis, Pall., from the Firth of Clyde, and communicated a short paper on the local distribution of these species.*

21st June, 1887.

Dr. James Stirton, F.L.S., President, in the Chair.

Mr. Richard M'Kay reported on an excursion made on 18th inst. to Kelly Glen, Wemyss Bay. The excursionists were joined by parties from Paisley and Greenock, and there was altogether a large attendance. †

The Chairman referred to the loss which the Society had just sustained by the death of Mr. W. J. Milligan. It was resolved that a memorial notice of Mr. Milligan should be recorded in the minutes, and an excerpt therefrom transmitted to the family of the deceased, with an expression of the sympathy of the Members of the Society with them in their bereavement.

IN MEMORIAM.—W. J. Milligan.

William John Milligan was born in the North of Ireland, and passed his boyhood in Liverpool and afterwards in Glasgow. He was admitted a member of the Glasgow Society of Field Naturalists in 1873, and subsequently filled the offices of Secretary and Vice-President. To that Society he contributed several papers "The Theory of Spontaneous Generation," "Some of the Flowers mentioned by Shakespeare," etc. He devoted himself to some extent to the special study of mosses, and on various occasions exhibited series of specimens which he had collected. He was one of the prime movers in the amalgamation of the Field Naturalists with the Natural History Society of Glasgow, and signed the articles of agreement on behalf of the former. In 1879 he was elected a Vice-President of this Society, and took an active part in its affairs. In the following year he contributed a paper "On the Modes of Reproduction in Cryptogamic Plants." In 1884 he rendered valuable service in connection with the revision of the Constitution. On the whole, however, his activities were more literary than scientific. He was a member of the Ballad Club, the Pen and Pencil Club, and several other kindred associations. He had a rollicking flow of spirits; and his manly presence, beaming face, and the merry twinkle of his dark grey eye, impressed

* *Transactions*, vol, ii., p. 211. † *Ibid.*, p. 323.

all who knew him. He died suddenly on 14th inst., at the early age of 38, and was buried in Cathcart Cemetery. Among the verses written by his literary friends on the occasion of this sad event, the following by William Allan, of Sunderland, may fitly conclude this short notice:

"A kirkyaird lane, a grassy mound,
A mournfu' stane abune the ground;
A dweller there gane thro' the door,
Nae fret, nae care—For evermore.

"The grass will spring, the flowrets come,
The win's will sing abune his home;
O! happy spot, O! gowden shore,
Whaur freens pairt not—For evermore.

"His harp unstrung, nane will attune,
His sang is sung, his tale is dune;
In silence deep, a' sorrow o'er,
Sweet poet! sleep—For evermore."

Mr. D. A. Boyd exhibited specimens of *Corophium longicorne*, Latr., an amphipod crustacean found in muddy pools of brackish water on the sea-shore at Chapelton, West Kilbride. In the course of some remarks, he referred to the great length of the lower antennæ, which resemble a pair of legs, and are used by the animal for beating the surface of the mud on which it crawls in search of food. During the summer months these creatures may be found in abundance, but in autumn and winter they conceal themselves in cylindrical holes burrowed in the mud. M. D'Orbigny, who has studied the habits of these crustaceans, has remarked on the relentless warfare which they wage on annelids from ten to twenty times their own size, and they have even been known to attack and devour small fishes and molluscs.

Mr. Boyd also showed specimens of *Apthona cærulea*, Payk., a small beetle found on the leaves of *Iris Pseudacorus*, L., in the neighbourhood of West Kilbride. The insect appears to be rather locally distributed, but is usually abundant where it occurs.

Mr. R. Broom, B.Sc., exhibited a beautiful little echinoderm, *Rotula Rumphii*, one of the *Clypeastrida*, from Sierra Leone; also four species of Trunk-fish, viz., *Ostracion gibbosus*, L., from Bay of Bengal, *O. concatenatus*, Bl., from Cape Colony, *O. cubitus*, L., from Cape Colony, and *O. cornutus*, L., from Aden.

Mr. James Steel exhibited a specimen of *Helix hispida*, L., var *albida*, Jeff., found by Mr. Thomas Scott, Corresponding Member, in Bute.

A number of Microscopic Specimens were afterwards exhibited. Among the most important of these were two specimens of the primordial cartilaginous skull of the Frog, *Rana temporaria*, L., corresponding to stages 2 and 3 of Kitchen Parker, exhibited by Mr. R. Broom, B.Sc. In the earlier of the two, the trabeculæ, mandibular, and hyoid arches were seen distinct from the parachordal cartilages and from each other.

Mr. Thomas King, Vice-President, showed a series of tangential sections from the cambium-layer of various dicotyledonous angiosperms, showing secondary thickening.

2ND AUGUST, 1887.

Mr. R. Turner, Vice-President, in the Chair.

Mr. Richard M'Kay reported on an excursion made to Lochwinnoch on 2nd ulto.*

Mr. Ewing made some remarks on an excursion made to the Killin district during the Glasgow Fair holidays, and stated that he would afterwards report more fully on this excursion.†

Mr. James Steel reported on an excursion made to Rottenburn, near Greenock, on 30th ulto. ‡ He exhibited living specimens of *Acme lineata*, Drap., found at the excursion, and stated that this mollusc had not previously been obtained alive in the district.

On behalf of Mr. Thomas Scott, Corresponding Member, Mr. Steel showed specimens of *Hydra vulgaris*, Pallas, from Greenan Loch, Bute; and of *Cristatella mucedo*, Cuv., found on the leaves and stems of Water-lilies in the same loch. The latter is interesting as apparently the only hydrozoon which is locomotive, moving from place to place by means of its flattened disc. It possesses the horseshoe arrangement of the tentacles found in fresh-water polyzoa.

Mr. R. Broom, B.Sc., exhibited specimens of *Rumex Hydrolapathum*, Huds., from the neighbourhood of Drummond Castle, Perthshire.

Mr. D. A. Boyd showed a specimen of *Eurhynchium abbreviatum*, Schpr., a recent addition to the British Moss-flora, discovered at Ross, Herefordshire, by the Rev. A. Ley.

* *Transactions*, vol. ii., p. 323. † *Ibid.*, p. 323. ‡ *Ibid.*, p. 327.

16th August, 1887.

Mr. Thomas King, Vice-President, in the Chair.

Mr. D. A. Boyd reported on an excursion made to the West Kilbride district on 13th inst.*

The Chairman announced that *Ledum palustre*, L., a plant new to the Flora of Great Britain, had recently been discovered in the neighbourhood of Bridge of Allan by a local botanist, whose identification of the species has been confirmed by Sir J. D. Hooker and Mr. James Ramsay. This plant was once reported for the North-West of Ireland; but as the record has never been confirmed, and is now generally regarded as extremely doubtful, the species is excluded from recent works on British Botany.

Mr. James Steel exhibited a number of live specimens of *Anguis fragilis*, L., from Ailsa Craig, where these reptiles occur in some abundance.

Mr. D. A. Boyd showed examples of several interesting forms of hymenopterous oak-galls obtained at West Kilbride. These included the large spherical galls formed on the branches by *Cynips Kollari*, Gir.; the "artichoke galls" formed in the buds by *Andricus gemmæ*, L.; the "silk-button galls" formed on the underside of the leaves by *Neuroterus numismatis*, Oliv.; and the "oak-spangles" formed on the underside of the leaves by *N. baccarum*, L.

Mr. Boyd also exhibited specimens of *Tetramyxa parasitica*, Goebel, a fungus parasitic on the stems of *Ruppia rostellata*, Koch, and occurring plentifully on that plant in shore-pools at Chapelton, West Kilbride.

Mr. David Gregorson, F.E.I.S., exhibited specimens of *Carlina vulgaris*, L., and *Pulicaria dysenterica*, Gærtn., from Auchenhew, Arran.

Mr. John Wood exhibited a series of plants of *Paris quadrifolia*, L., having the leaves in whorls of three, five, and six respectively, and also showing variations in the parts of the flower.

Mr. David Robertson, F.L.S., F.G.S., communicated papers on "The Pike, *Esox lucius*, L.,"† and "*Isocardia cor*, L."‡

30th August, 1887.

Mr. Peter Ewing in the Chair.

Mr. D. A. Boyd reported on an excursion made on 20th inst. to Cleaves Cove and Blair Policies, near Dalry. §

* *Transactions*, vol. ii., p. 328. † *Ibid.*, p. 212. ‡ *Ibid.*, p. 215. § *Ibid.*, p. 329.

Mr. William Stewart reported on an excursion made to Lochlibo and district on 27th inst.*

Mr. D. A. Boyd exhibited specimens of *Scrophularia Ehrharti*, C. A. Stev., from Lambridden, Dalry, and *Elymus arenarius*, L., from the neighbourhood of Kilwinning, recently discovered in these stations by Mr. John Smith, Corresponding Member. Mr. Boyd also showed specimens of *Splachnum sphæricum*, L., found on the moor above Dumbarton by the Rev. J. E. Somerville, B.D., Corresponding Member.

13th September, 1887.

Dr. James Stirton, F.L.S., President, in the Chair.

Mr. R. Turner, Vice-President, reported on an excursion made to Port-Glasgow on 10th inst.†

The Chairman exhibited a few Mosses from Shetland, and remarked on the great scarcity of Lichens on the island.

A number of Microscopic Specimens were afterwards exhibited.

Mr. Thomas King, Vice-President, showed a series of sections illustrating the "puncta vegetationis" of phanerogams.

Mr. R. Broom, B.Sc., showed a series of preparations from the internal ear of a young Rabbit, including one or two very good sections of the organ of Corti, and of the cochlear ganglion. He also exhibited sections of *Grantia compressa*, one of the Calcispongiæ, showing numerous ova *in situ*, and various degrees of development from the unsegmented ovum to the pseudo-gastrula stage, together with a specimen of the mature sponge.

* *Transactions*, vol. ii., p. 329. † *Ibid.*, p. 330.

WINTER SESSION, 1887-88.

27th September, 1887.

Dr. James Stirton, F.L.S., President, in the Chair.

Messrs. James Macmillan, M.A., High School, and John Cairns, jun., 129 Renfrew Street, were elected Ordinary Members.

Mr. D. Corse Glen, C.E., F.G.S., the Society's delegate, gave an interesting account of the business at the Manchester meeting of the British Association.

The Secretary directed the attention of the members to the Annual Conference of the Cryptogamic Society of Scotland to be held at Greenock on 4th, 5th, and 6th prox., under the presidentship of the Rev. Hugh Macmillan, D.D., LL.D., F.R.S.E.

Mr. Thomas King, Vice-President, exhibited specimens of *Volvox globator*, L., found in great abundance in old quarry-holes at Barnhill, near Springburn.

Mr. William Stewart exhibited specimens of the following Fungi from Cadder Wilderness, viz.:

Agaricus (*Amanita*) *muscarius*, L.
A. (*Collybia*) *platyphyllus*, Fr.
A. *maculatus*, A. & S.
A. (*Hebeloma*) *glutinosus*, Lind.
A. (*Flammula*) *flavida*, Schæff.
A. (*Stropharia*) *æruginosus*, Curt.
A. (*Hypholoma*) *sublateritius*, Schæff.
A. (*Hypholoma*) *scobinaceus*, Fr.
Lactarius quietus, Fr.
torminosus, Fr.
deliciosus, Fr.
Lactarius glyciosmus, Fr.
serifluus, Fr.
camphoratus, Fr.
Russula cyanoxantha, Fr.
Cantharellus cibarius, Fr.
tubæformis, Fr.
infundibuliformis, Fr.
Lentinus cochleatus, Fr.
Boletus edulis, Bull.
luridus, Schæff.
Peziza (*Cochlearia*) *aurantia*, Fr.

He also exhibited specimens of *Agaricus* (*Lepiota*) *cristatus*, Fr., *A.* (*Tricholoma*) *flavo-brunneus*, Fr., and *A.* (*Clitocybe*) *fragrans*, Sow., from Torrance, East Kilbride; and he stated that *A. platyphyllus*, *A. glutinosus*, and *A. scobinaceus*, which occur at Cadder Wilderness, have not yet been noticed elsewhere in the district.

Mr. D. Corse Glen, C.E., F.G.S., exhibited a specimen of Elaterite, a flexible bitumen, in appearance much resembling a mass of india-rubber, found at Chapel-en-le-Frith, Derbyshire,

where it occurs in a stalactitic form in fissures of the limestone rocks. It has been detected only in two localities in Scotland. It contains about ·75 Carbon, ·13 Hydrogen, and traces of Oxygen and Nitrogen.

Mr. Peter Ewing exhibited a remarkably fasciated specimen of *Matricaria inodora*, L., var. *salina*, Bab., found on the sea-shore at Ayr. He also showed specimens of *Juncus tenuis*, Willd., a plant reported for Scotland many years ago by Don, but not rediscovered in this country till the present season, when it was found at New Galloway, Kirkcudbrightshire, by Mr. James M'Andrew, Corresponding Member; and of *Carex rostrata*, Stokes, var. *elatior*, Blytt, found at Dougalston, near Milngavie, by Mr. Richard M'Kay.

Mr. R. S. Wishart, M.A., in exhibiting some growing seeds extracted from a ripe fruit of Lemon, drew attention to the fact that formation of chlorophyll in the cotyledons and plumule had apparently been going on without their exposure to light—a process which is at variance with the generally accepted view that light is essential to the production of the green colouring-matter.

Mr. Thomas King, Vice-President, remarked that from one point of view it might appear strange that seeds did not usually begin to grow within such fruits as that of the Lemon where abundance of moisture was present. With regard to the production of chlorophyll, the statement that it is not developed unless in the presence of light does not explain such processes as the formation of the layer of green cells found under the brown outer-bark of many trees.

Mr. Peter Ewing made some remarks on the probable occurrence in Scotland of *Vaccinium intermedium*, Ruthe, which is regarded as a hybrid between *V. Myrtillus*, L., and *V. Vitis Idæa*, L. The leaves of *V. Myrtillus* change colour comparatively early in the autumn, and soon fall, while those of *V. intermedium* are almost evergreen and seem to remain quite fresh until about the end of November.

Mr. D. A. Boyd showed specimens of *Solanum nigrum*, L., from cultivated ground at Seamill, West Kilbride, and pods of *Glaucium luteum*, Scop., from Lesser Cumbrae.

Mr. Boyd read two papers, entitled "On the occurrence in North Ayrshire of the Water Shrew, *Sorex fodiens*, Pall., and Otter, *Lutra vulgaris*, Erx." * and "Notes on the *Collembola* and *Thysanura*."

* *Transactions*, vol. ii., p. 293.

THE THIRTY-SIXTH ANNUAL GENERAL MEETING.

25TH OCTOBER, 1887.

Mr. James Dairon, F.G.S., Vice-President, in the Chair.

The Secretary (Mr. D. A. Boyd) read the Report of the Council on the business of last session.

REPORT OF THE COUNCIL.

The Council beg to report that during the past year the names of 10 new Members have been added to the Roll, the present membership being as follows:

Honorary, ...	11
Corresponding, ...	33
Ordinary, ...	199
Total, ...	243

Among the names contained in the obituary record are those of two gentlemen who were intimately connected with the affairs of the Society and took an active interest in its welfare. Mr. Robert Gray, F.R.S.E., Honorary Member, was one of the original promoters of the Society, and for upwards of twelve years acted as its Secretary. To Mr. Gray's exertions much of the success which has attended the Society may be directly attributed. Mr. W. J. Milligan was formerly a Vice-President of the Society, and rendered important services at various times, especially in connection with the revision of the Constitution in 1884.

During the Winter Session the usual number of meetings were held, at which numerous important communications were read and specimens exhibited. At the summer meetings and excursions much valuable work was also done; but it is to be regretted that at these the attendance was scarcely up to the average of previous years. The interest and importance of the excursions have been much increased by an attempt which has been made to preserve, so far as practicable, a complete and systematic record of observations then made on the flora and invertebrate fauna of the districts visited. This work has been carried out at most of the excursions, and the result has proved highly satisfactory, a large amount of valuable imformation having been submitted.

Reports of the meetings were regularly supplied to the local newspapers, so that the work of the Society might be kept before the public.

Vol. i., part iii., of the Society's *Proceedings and Transactions* relating to the work of session 1885 86, was issued to the members early in the summer. In addition to the usual matter, this part contains an index to the species mentioned in the volume, which, it is hoped, will enhance its value for purposes of reference.

While the work of the past session compares very favourably, both in extent and importance, with that of previous years, the Council regret that the necessity has arisen for directing the attention of the Society to a considerable diminution which has taken place in the membership. While this is partly attributable to the large number of removals through death, resignation, and other causes, it must also be partly traced to the small number of additions made to the Roll of Members during the year. This will be seen from a comparative view of the accessions to the Society during the 10 years from session 1876-77 to session 1885-86 inclusive. During that period 243 new Members were added to the Roll (exclusive of the Members of the Glasgow Society of Field Naturalists, who were admitted without formal election), being an average enrolment of 24·3 per annum. During the past session, however, as already stated, only 10 new Members were elected.

In view of the great importance of increasing the annual income of the Society (which, being chiefly derived from the subscriptions of the Members, has last year fallen below the amount required to meet outstanding payments), and providing more adequately for the cost of printing *in extenso* the important communications submitted to the Society for publication, as well as for the other necessary expenses of management, a circular was recently issued by the Council, setting forth the immediate necessity of adding new Members to the roll. As a reduction in the amount of matter issued by the Society, or a delay in its publication, would inevitably be attended with serious disadvantages, the Council earnestly hope that the Members will cordially respond to the appeal which has been made for their assistance in placing the affairs of the Society in these respects on a more satisfactory footing, and enabling its work to be carried on uninterruptedly and with increasing success. In this effort all the Members individually may co-operate; and if each endeavour during the present session to introduce to the Society at least one new Member, the end in view shall without difficulty be fully attained.

The Treasurer (Mr. John Renwick) submitted his Annual Financial Statement, which showed a balance of £35 11s. 8d. at the credit of the Society. It was explained, however, that this apparent balance would be more than absorbed by outstanding liabilities, part of which would fall to be paid from the revenue of the ensuing year.

The Librarian (Mr. James J. F. X. King) reported as follows: During the year 423 separate publications have been added to the Library, which now contains 832 bound volumes, being an increase of 76 since last report. 205 volumes (120 during the Winter Session, and 85 during the Summer Session) were taken out by the Members, as compared with 167 during the previous year. Vol. i.,

Part 3, of the Society's *Proceedings and Transactions* has been forwarded to 144 Societies, Magazines, and Institutions. A Library Fund, started last Christmas, for the purchase of new Books, and in supplement of the annual grant from the Council for binding, now amounts to £6 14s. 0d., additional subscriptions being solicited.

The Reports were all unanimously approved and adopted.

The Society then proceeded to the election of Office-Bearers, when Mr. David Robertson, F.L.S., F.G.S., was elected President; Mr. Peter Ewing, a Vice-President; Messrs. D. A. Boyd and John Trotter, Secretaries; Mr. John Renwick, Treasurer; Mr. James J. F. X. King, Librarian; and Messrs. R. Turner, Joseph Sommerville, James Stirton, M.D., F.L.S., John Broom, and William Stewart, Members of Council—the Council being as follows: President, David Robertson, F.L.S., F.G.S.; Vice-Presidents, James Dairon, F.G.S., Thomas King, and Peter Ewing; Secretaries, D. A. Boyd and John Trotter; Treasurer, John Renwick; Librarian, James J. F. X. King; Members of Council, William Stewart, W. Craibe Angus, James Barrie Low, M.A., A. Somerville, B.Sc., F.L.S., John Broom, James Steel, R. Turner, Joseph Sommerville, James Stirton, M.D., F.L.S.

Messrs. David Pearson and Thomas G. Bishop were appointed Auditors for the ensuing year.

The following were elected Ordinary Members: Mr. J. L. Cowan, 136 Wellington Street; Mr. Robert Douglas, 41 Annette Street, Govanhill; Mr. Richard Kidston, Ferniegair, Helensburgh; Rev. Edward Walters, 31 St. Vincent Crescent; Mr. S. M. Wellwood, 128 St. Vincent Street.

Mr. R. Turner moved that the words "But ladies shall be exempt from entry-money" should be added to the first paragraph of Rule XVIII. of the Constitution. The motion was unanimously adopted.

Mr. Robert Broom, B.Sc., exhibited the skulls of *Herpestes brachyurus*, Gr., and *Cynogale Bennettii*, Gr., two Civets from Borneo; and he described the chief morphological features of the plantigrade and digitigrade carnivora, to the latter of which the *Viverridæ* or Civets belong. An interesting series of the skulls of typical species in both groups was shown for comparison.

Mr. Henry M'Culloch exhibited a partial albino example of the Hedge-sparrow (*Accentor modularis*, L.), from the neighbourhood of Inveraray.

Mr. James Steel showed a specimen of an apparently new variety of *Hydrobia ulvæ*, Penn., found by him last summer on the Ayrshire coast near West Kilbride.

Mr. Thomas King, Vice-President, exhibited specimens of Esparto Grass (*Stipa tenacissima*, L.), Bitter Apple or Colocynth Gourd (*Cucumis Colocynthis*, L.), and Barilla (*Salsola sativa*, L.), from the South of Spain; and he made the following remarks on these plants and their economic properties:

Esparto Grass, *Stipa tenacissima*, L.—In the South of Spain, and along the North Coast of Africa from Morocco to Tripoli, this grass grows more or less thickly in hassocks, on great tracts of hilly stony ground, where nothing else but short brushwood is found. It flowers in April and May, but the leaves are not ready to be gathered for commercial purposes till later in the year. The season for gathering extends from July to October, according to the locality. The leaves are not reaped, but are pulled out of the socket. The plant is perennial, and the roots are not injured by the pulling out of the leaves. It is very difficult to raise from seed, and accordingly the hassocks on the hills may be regarded as entirely due to natural growth.

After the leaves have been gathered, they are tied up into small bundles, and are dried by being exposed for a few days to the rays of the sun. They are then made up into large bundles weighing about 75 lbs., and brought down in carts, or on the backs of donkeys, to the shipping ports. There they are all opened out, carefully cleaned from roots, weeds, etc., and assorted into various qualities, after which they are made up into press-packed bales ready for shipment. The process is simple, but requires great care; and now that prices are low, buyers are ready to find fault with the least defect.

The plant has been known and used in the South of Spain, from at least the time of the Romans, for making matting, baskets, ropes, etc. Coarse ropes, somewhat like our straw ropes, are made from it in the raw state; but for the manufacture of finer sorts the grass is treated like flax or hemp, and the fibre only used.

It was first used as a raw material for paper-making about the year 1858. For its introduction we are indebted to Mr. Routledge of Sunderland, a gentleman who still takes a lively interest in fibre-yielding plants, especially those of India.

Since 1858 its use has gone on increasing, till now considerably

over 200,000 tons are imported annually into this country. Of this quantity 50,000 tons are received from Spain, and the remainder from Africa. That from Spain has the greatest proportion of fibre, and is consequently the most valuable; while the poorest quality comes from Tripoli. The annual value of the 200,000 tons exceeds £1,000,000. About one-third of the whole quantity is taken by Scotland. Its use for paper-making is almost wholly confined to Great Britain.

The Bitter Apple or Colocynth Gourd, *Cucumis Colocynthis*, L.—In the South of Spain this plant grows wild in great abundance on waste dry land. It has a trailing habit, and spreads for yards over the ground, producing a fruit about the size of an orange, with a smooth yellow rind when ripe. It is very pretty and tempting to the eye, but has an extremely acrid taste. It is gathered when it begins to turn yellow, peeled, and dried quickly in a store or by exposure to the sun. The dried pulp is the Colocynth of commerce, of which large quantities are exported from Southern Spain. The seeds are quite bland, and even form an article of food in the North of Africa.

Barilla, *Salsola sativa*, L.—The plant grows in great abundance along the sea-shore and also in salt marshes, where it forms thick tufts from 12 to 18 inches in height. It is gathered in autumn, dried in little heaps in the sun, and then set fire to in holes in the ground, much in the same way as kelp is or used to be burned on our own shores. The fires make a very dense smoke, and are very commonly seen in the South of Spain in September and October, when the people are making barilla for domestic use. The ashes left by these fires consist of a hard greyish stony substance which forms the Barilla of commerce. It is an impure carbonate of soda, and was formerly exported in large quantities from various parts of Spain. This trade, however, has now expired owing to the discovery of a process for extracting soda from common salt.

Mr. D. A. Boyd exhibited specimens of *Diplotaxis muralis*, DC., found growing on a railway embankment near West Kilbride.

29TH NOVEMBER, 1887.

Mr. Peter Ewing, Vice-President, in the Chair.

Messrs. Arthur Bennett, F.L.S., High Street, Croydon, Surrey, and Henry Boswell, 51 Woodstock Road, Oxford, were elected Corresponding Members.

Sir John Neilson Cuthbertson, 25 Blythswood Square, and Mr. John Fowler, 4 Kelvinbank Terrace, Sandyford, were elected Life Members.

The following were elected Ordinary Members: Sir William Collins, F.R.G.S., 3 Park Terrace, East; Mr. James M'Call, F.S.A. Scot., 6 St. John's Terrace, Hillhead; Miss M. Henderson 17 Belhaven Terrace, Kelvinside; Mr. Archibald J. M'Lellan, 5 Dowanvale Terrace, Partick; Mr. W. M. T. Yuille, 15 Woodside Quadrant; Mr. John Woodrow, Neilson Institution, Paisley; and Mr. James Barr, 55 East Howard Street.

The Secretary announced that intimation had been made to the Society of the death of Dr. Spencer Fullerton Baird, Secretary of the Smithsonian Institution and Director of the United States National Museum, which occurred on 19th August at Woods Holl, Massachusetts. Mr. Boyd moved, and it was unanimously agreed, that a notice should be recorded in the minutes expressing the regret of the Society at the announcement of Dr. Baird's death, and their deep sense of the loss which Science has sustained in the removal of one who occupied so important a position in her ranks. Further, that the Secretary should be instructed to transmit to the Board of Regents of the Smithsonian Institution an excerpt from the minutes containing a copy of the foregoing resolution.

Mr. Henry M'Culloch exhibited a very fine example of the Hoopoe, *Upupa epops*, L., in perfect plumage, from the neighbourhood of Campbeltown. He also showed a Grouse, *Lagopus scoticus*, Lath., with abnormal markings, kindly lent by Mr. Allan Gilmour of Eaglesham for exhibition to the Society.

Mr. A. Somerville, B.Sc., F.L.S., exhibited a specimen of the Hoopoe shot by the Rev. J. E. Somerville, B.D., Corresponding Member, at Thebes, in Egypt (lat. 38° 19′ N.), in the cold season of 1867. Mr. Somerville stated that he had also shot this bird in winter quarters in Bengal, where in some parts it is not uncommon during the months of December, January, and February; and he had met with it in January, 1871, in latitude 28° 35′ N.

Mr. D. A. Boyd read some notes on the Hoopoe and its affinities, and referred to some of the recorded instances of its occurrence in various districts of Scotland.

Mr. Charles W. White exhibited a fine series of shells of *Lucina borealis*, L., and varieties of *Littorina rudis*, Maton, from the Ayrshire Coast at Ardrossan.

Mr. James J. F. X. King showed specimens of *Emmelesia tæniata*, St., taken by him last summer in the neighbourhood of Killarney; and he stated that the Irish examples of this moth are remarkable for the brightness of the yellow bar, as compared with specimens obtained in Scotland.

Mr. King also exhibited specimens of *Cœcilius atricornis*, M'Lach., captured by him last August at Arundel. In the course of some remarks, he stated that this neuropteron was described about twenty years ago from specimens taken in the Isle of Wight at the end of October. Since that time it has remained exceedingly rare, and only one specimen was taken in 1884. This year, however, no fewer than five were secured by Mr. King at Arundel. As its specific name implies, the insect is distinguished by its strong black antennæ.

Mr. D. A. Boyd exhibited specimens of *Orchesella cincta*, L., *Entomobrya nivalis*, L., *E. multifasciata*, Tullb., *E. Nicoletii*, Lubb., *E. lanuginosa*, Nic., and *E. cincta*, Lubb., all obtained in the neighbourhood of West Kilbride, Ayrshire. In the course of some remarks on the group of *Collembola* to which these insects belong, he stated that the species shown were the only Scottish representatives of their respective genera which had as yet been reported.

Mr. John Kirsop exhibited some portions of timber from Carrick Castle Pier, Lochgoil, containing perforations of *Teredo navalis*, L., and stated that owing to the destructive ravages of this borer the repiling of the pier had recently being rendered necessary. He also exhibited a number of other interesting objects.

Rev. J. E. Somerville, B.D., Corresponding Member, exhibited a branch from a male and another from a female tree of the genus *Casuarina*. The specimens, which had recently been gathered at Cannes, on the Mediterranean coast of France, were in a fresh condition, and showed the foliage and inflorescence characteristic of the genus.

Mr. A. Somerville, B.Sc., F.L.S., stated that the foreign order *Casuarineæ*, which contains the single genus *Casuarina*, is remark-

able for having affinity with scarcely any group except the *Myriceæ* or order to which our Bog-myrtle belongs. The flowers are diclinous, but in some species they are monœcious, while in others they are diœcious. In one of the specimens shown, the long lax spikes were well seen; and it was stated that owing to the brown colour of thousands of these pendent spikes, the tree from which the specimens were taken presented a somewhat scorched appearance. The male flowers, as well as the female, are achlamydeous, and possessed of one stamen only. The female flowers are said to be capitate at the tips of the branches, being seated in the axil of a bract. The ovary is one-celled, containing two ovules, and there are two styles. The ripe fruit is a strobilus or cone, of woody bracts and bracteoles, each pair of bracts opening at maturity and discharging a samara-like caryopsis or grain. The species usually attain to the size of trees. They have a habit in some respects resembling that of the *Equisetaceæ*, as their branches are whorled, jointed, and furrowed. As in that order, too, the leaves are replaced by striate toothed sheaths surrounding the nodes of the branches. The timber is not of much value, being alike hard, heavy, and somewhat brittle; but it is used by the Pacific Islanders for making war-clubs. Mr. Somerville remarked that the trees, when growing in a tropical climate, remind one of some species of Pine; and many a time, when looking at the handsome examples growing in the Public Park at Calcutta, had his mind been carried from the sweltering heats of latitude 23° to the breezy hillsides of Scotland.

Mr. Peter Ewing, Vice-President, read a report on an excursion made to Ben Lawers, and other mountains of the Breadalbane range, on 15th-19th July, with remarks on the condition of the Alpine plants observed.*

He also exhibited specimens of the following plants from Ben Lawers and other mountains of the Breadalbane range:

Arabis petræa, Lam., var. *hispida*, DC. (along with a specimen of the type from the Island of Mull).
Draba rupestris, R. Br.
Erophila inflata, Hook.
Arenaria sulcata, Schlecht.
Sagina Linnæi, Presl.
S. nivalis, Fr.
Rosa subglobosa, Sm.
Juncus castaneus, Sm.
Eriophorum angustifolium, Roth, var. *elatius*, Koch.
Carex pulla, Good., a pale variety with whitish glumes and light-green perigynia.
Phleum alpinum, L.
Festuca capillata, Haeck.

Mr. John Smith, Corresponding Member, exhibited a dried

* *Transactions*, vol. ii., p. 323.

specimen of *Phallus impudicus*, L., and described the process employed in its preservation. The hollow stalk was filled with a strong solution of gum-arabic and sugar to which had been added a small quantity of carbolic acid crystals, until the gum-solution began to ooze through. The excess of gum was then emptied out and the interior of the stalk filled with fine dry sifted sand, in which the fungus itself was also embedded and placed in a box where it was allowed to remain for some weeks until quite dry, when it was taken out and the excess of sand carefully brushed off. Mr. Smith suggested that this process might be adapted to the preservation of other kinds of fungi. Large species might have their stems hollowed with a brass-tube cork-cutter, and agarics would require to have a little of the gum-solution placed between their gills. Delicate species might be soaked in gum-solution for a few hours, and the excess of gum washed off, before being placed in the sand.

The following papers were read:

"Notes on the Flora of the Island of Barra," with illustrative specimens, by Mr. A. Somerville, B.Sc., F.L.S.*

"Notes on some of the Rarer Plants occurring in the Valley of the Garnock, Ayrshire," by Mr. John Smith, Corresponding Member.†

27TH DECEMBER, 1887.

Mr. Thomas King, Vice-President, in the Chair.

The following were elected Honorary Members: Mr. William Carruthers, F.R.S., P.L.S., F.G.S., Keeper of the Botanical Collections in the British Museum, London; Sir Joseph Dalton Hooker, M.D., R.N., K.C.S.I., C.B., D.C.L., LL.D., F.R.S., etc., The Camp, Sunningdale, Berks.; Sir Richard Owen, K.C.B., D.C.L., LL.D., F.R.C.S., F.R.S., etc., Sheen Lodge, Richmond Park, East Sheen.

Professor D'Arcy W. Thompson, B.A., F.R.S.E., University College, Dundee, and Rev. David Landsborough, Kilmarnock, were elected Corresponding Members.

The following were elected Life Members: Sir James Watson, 9 Woodside Terrace; Mr. J. Campbell White of Overtoun, M.A., F.R.G.S., 7 West George Street; Mr. Duncan Mackinnon, 13 Austin Friars, London, E.C.

* *Transactions*, vol. ii., p. 183. † *Ibid.*, p. 245.

The following were elected Ordinary Members: The Hon. The Lord Provost, Sir James King of Campsie, LL.D., F.S.A.Scot., 12 Claremont Terrace; Professor Sir William Thomson, LL.D., D.C.L., P.R.S.E., 11 The University; Sheriff A. Erskine Murray, Sundown, Montgomerie Drive, Kelvinside; Sheriff D. D. Balfour, 2 North Park Terrace, Hillhead; Mr. W. P. Alexander, 203 West George Street; Miss E. W. Thomson, 3 St. John's Terrace, Hillhead; Miss C. T. Blackie, 1 Belhaven Terrace, Kelvinside; Mr. James G. Johnston, Crag Lodge, Carmunnock; Mr. Robert Boyd, 473 Eglinton Street; Mr. Thomas Duff, 11 Percy Terrace, Kelvinside; Mr. Thomas Miller, 91 St. Andrews Road, Pollokshields; Rev. John Smith, M.A., B.D., The Manse, Partick.

Mr. Robert Broom, B.Sc., exhibited a series of skulls of the Cat, Rabbit, and Hedgehog, illustrating the changes in form from the period of birth to that of adult life. He pointed out that in the early embryonic condition the brain is developed to a very great extent at a time when the parts which are to become the face are represented by only the merest rudiments. All through after-life, however, the brain and the face continue to develop at different rates, the facial region developing much more rapidly than the brain, so that, as life advances, the face projects more and more. The increasing development of the facial bones, as compared with those of the cranium, was very well seen in the series of Rabbits' skulls shown, of which the following measurements were submitted:

Ratio of Frontal, Parietal, and Interparietal, to length of Jaw.

In a Rabbit at Birth, ...	... 1 : ·70
In a Rabbit 14 days old,	... 1 : ·75
In an almost adult Rabbit,	... 1 : 1·06
In an old Rabbit, ...	... 1 : 1·20

Equally striking figures were also submitted regarding the skulls of the Cat and Hedgehog.

Mr. A. Somerville, B.Sc., F.L.S., showed specimens of *Pinna ramulosa*, Reeve, and *Spondylus americanus*, Lam., lent by Professor James Thomson, LL.D., F.R.S., for exhibition to the Society. These shells were obtained off the South Coast of Cuba, where they were found attached to a submarine cable which had been lifted for repairs after six years' immersion.

Mr. Somerville also exhibited two valves of *Barbala plicata*, Leach, a fresh-water bivalve of large size, found in the rivers of China. Attached to the inner surface of each specimen

were numerous small images of Buddha, which had been inserted within the shell of the living mollusc, and had afterwards been covered by the animal with pearly secretion. It was stated that the valves had been lent by Mr. G. B. Sowerby, London, for exhibition to the Society.

Mr. James J. F. X. King exhibited specimens of the three British species of *Apatania*, Kol., a genus of *Trichoptera*, which is represented in the Fauna of Europe, Asia, and America. *A. Wallengreni*, M'Lach., the only species which has as yet been taken in Scotland, occurs at many of the lakes and waterfalls in hilly districts. *A. fimbriata*, Pict., previously regarded as an alpine species, was taken last summer by Messrs. K. J. Morton and King in the Killarney district, where it occurred in profusion. *A. muliebris*, M'Lach., taken last August by Mr. King at Arundel, is remarkable as affording an apparent example of parthenogenesis. All the individuals hitherto obtained have been females; and although very careful search has been made for the male, it has not yet been discovered. As dozens of females may sometimes be taken in favourable localities, it is believed that the male either does not exist or appears only at very rare intervals.

Mr. William Stewart showed a very large cup-shaped Sponge from Florida. The specimen, which had been lent by Mr. Robert M'Adam for exhibition to the Society, was submitted to Mr. Edgar A. Smith, F.Z.S., for identification, and is believed to be one of the many varieties of *Euspongia officinalis*, the Sponge of commerce.

The Chairman (Mr. King) exhibited specimens of Hemp, *Cannabis sativa*, L., and Maize, *Zea Mays*, L., from the South of Spain, and made some remarks on the morphology, culture, and economic value of these plants.

Mr. D. A. Boyd showed some Potatoes produced from Chilian tubers after five years' cultivation in this country, and he referred to a series of experiments made with the view of determining whether tubers imported from the native country of the Potato, where the plants are not attacked by the fungus of the Potato-disease (*Phytophthora infestans*), would prove better adapted for agricultural purposes than those ordinarily grown in this country.* Although, as regards produce, quality, and disease-resisting powers, the early experiments with imported Potatoes had proved disappointing, a marked improvement was subsequently observed; and

* See *Proceedings*, vol. iv., p. 45; vol. v., pp. 166, 269; *Transactions*, vol. i., pp. 21, 141.

after the tubers had apparently become adapted to soil and climate, those now produced were of large size and superior quality, and seemed to be quite free from disease.

The following papers were read :

"*Hyas araneus*, L.," * and "*Stenorhynchus longirostris*, Fabr.," † by Mr. David Robertson, F.L.S., F.G.S., President ;

"A Contribution to the Topographical Botany of the West of Scotland," by Mr. Peter Ewing, Vice-President ; ‡

"On the Microlithic and Megalithic Structures and other Antiquities of County Donegal," with illustrative sketches, by Mr. J. A. Mahony, Corresponding Member.

31st January, 1888.

Mr. Thomas King, Vice-President, in the Chair.

Mr. D. A. Boyd referred to the loss which the Society had sustained in the death of Professor Alexander Dickson, Edinburgh ; and on the motion of the Chairman it was resolved that a memorial notice of Professor Dickson should be recorded in the minutes, with an expression of the deep regret of the Members of the Society at the announcement of his death.

IN MEMORIAM.

Alexander Dickson, M.D., LL.D., F.R.S.E., F.L.S.

Since last meeting a heavy loss has been sustained by the Society in the death of Professor Dickson, which took place on 30th December. Exactly a week previously he had left Edinburgh for his country residence of Hartree, there to spend the Christmas vacation. While he was engaged in his favourite winter pastime of curling, leading the winning side in a closely played match, entering with keen spirit into the excitement of the situation, and in the act of making a shot—in a moment he dropped on the ice, and immediately expired.

Alexander, second son of Mr. David Dickson of Hartree and Kilbucho, was born in Edinburgh on 21st February, 1836. His elder brother having predeceased his father, Alexander succeeded to the extensive family estates in Peeblesshire. After an early education at home, he was sent to the University of Edinburgh, where,

* *Transactions*, vol. ii., p. 216. † *Ibid.*, p. 218. ‡ *Ibid.*, p. 309.

in 1860, he graduated as a Doctor of Medicine. His early proficiency in Botany was shown by his obtaining a gold medal for a thesis on the "Development of the Seed-vessels of Caryophyllaceæ." After having obtained his degree, he abandoned the study of medicine and devoted his whole time to his favourite pursuits. In 1862, during the illness of Professor Dickie, he acted as deputy Professor of Botany in the University of Aberdeen; and in 1866 he received the appointment to the Chair of Botany in the University of Dublin. In 1867 he obtained the additional appointment of Professor of Botany in the Royal College of Science for Ireland. In 1868 he was appointed to the Chair of Botany in the University of Glasgow, vacant through the death of Professor G. A. Walker-Arnott. In 1879, on the resignation of Professor J. H. Balfour, Dr. Dickson was appointed Professor of Botany in the University of Edinburgh, and Regius Keeper of the Edinburgh Royal Botanic Garden. These offices he continued to hold till the time of his death.

In recognition of his eminent attainments, he received the honorary degrees of M.D. from the University of Dublin, and LL.D. from the University of Glasgow. He was, besides, a member of numerous scientific Societies, including the Royal Society of Edinburgh, Linnean Society, and Botanical Society of Edinburgh, of which last he was President. On 27th October, 1868, he was elected a Member of the Natural History Society of Glasgow. On 28th September, 1869, he was appointed one of the Vice-Presidents of this Society, and continued to hold that office till April, 1875. During that period he occasionally occupied the chair, and contributed to the business of the meetings. After his removal to Edinburgh he maintained an unbroken connection with this Society; and of his interest in its progress and welfare, continued to the last, we have evidence before us this evening.

As a botanist, Professor Dickson was keenly interested in morphology and organography. His work bore the impress of a cautious and logical mind, scrupulously exact in all details. He has been described as a representative of the old French school, of which Baillon is the most eminent living example. Amid the din of controversy and conflicting speculations of rival theorists, he maintained a calm and impartial position, only accepting as worthy of consideration those views which had withstood the assaults of a few years' criticism. Among the many subjects to the study of

which his attention was successfully directed may be mentioned phyllotaxis, vegetable embryology, the investigation of the true nature of the flowers of the Coniferæ, and the structure of the Hepaticæ (which may be described as the last work on which he was engaged). He wrote many valuable papers on these and other subjects, which appear in the *Transactions of the Botanical Society of Edinburgh* (vols. vi.-xvi.), *Transactions of the Royal Society of Edinburgh*, *Edinburgh New Philosophical Journal*, *Journal of Botany*, *Gardeners' Chronicle*, *etc.*

His artistic tastes were strongly developed. As an accomplished musician, he took a special interest in Gaelic airs; and of these he had collected a large number, which, at one time, he had some thought of publishing. As a skilful draughtsman, his accurate class demonstrations are vividly remembered by all who were privileged to listen to the lectures which were so ably illustrated.

His unassuming disposition and nobility of character were appreciated by a wide circle of friends; and among these are included many of his former students, who possess pleasing recollections of his painstaking instruction and sympathetic kindness. Affectionate tributes have been paid to his memory by the professors and students of Edinburgh University, and by his tenantry, by whom he was much beloved. Although, after an interval of nine years, there may be comparatively few among us who can remember Professor Alexander Dickson as an Office-Bearer and active Member of our Society, yet we can all heartily join in that expression of regret which has been called forth by the removal of one still in the vigour of manhood, possessing unimpaired those mental powers which have been so successfully devoted to the advancement of science, and extending around him the benign influences of his character and example.

The following were elected Corresponding Members: Professor W. A. Herdman, D.Sc., F.R.S.E., F.L.S., University College, Liverpool; Rev. Hugh Macmillan, D.D., LL.D., F.R.S.E., F.S.A. Scot., 70 Union Street, Greenock; Mr. Edgar A. Smith, F.Z.S., Keeper of the Conchological Collection, British Museum (Natural History), London; Professor James W. H. Trail, M.A., M.D., F.L.S., The University, Aberdeen.

The following were elected Life Members: Sir Charles Tennant

of The Glen, Bart., Innerleithen, Peebleshire; Colonel Sir Donald Matheson, K.C.B., 6 Park Terrace.

The following were elected Ordinary Members: Sir James Colquhoun of Luss and Colquhoun, Bart., Rossdhu, Luss; Sir Andrew Maclean, Viewfield House, Balshagray, Partick; Professor John G. M'Kendrick, M.D., LL.D., F.R.S., The University, Glasgow; Mrs. George Crichton, 8 Montgomerie Crescent, Kelvinside; Mrs. Henry G. Shepherd, Free Church Manse, Cambuslang; Miss C. Henderson, 17 Belhaven Terrace, Kelvinside; Mr. Gilbert Beith, 15 Belhaven Terrace, Kelvinside; Dr. James Colville, M.A., 14 Newton Place; Mr. George Russell, The Gardens, Redlands, Kelvinside; Mr. Joseph Riley, 8 Albany Place; Mr. Walter Easton, 125 Buchanan Street; Mr. Charles J. Easton, 205 Bath Street; Mr. Thomas Frame, 17 Union Street, Hamilton; Mr. John Sturrock, jun., Howard Street, Kilmarnock; Mr. George Macaulay Cruikshank, 62 St. Vincent Street; Mr. David Sturrock, 95 Bath Street; Mr. O. F. Bock, 1 Eton Terrace, Hillhead; Mr. J. Bruce Hunter, 103 St. Vincent Street; Mr. C. S. Bowe, 21 Wilton Terrace; Mr. Charles Eadie, 74 Hutcheson Street; Mr. Thomas Gentles, 338 Sauchiehall Street; Dr. C. Fred. Pollock, F.R.C.S.E., F.R.S.E., 1 Buckingham Terrace, Hillhead; Mr. William J. M'Ilwrick, 98 High Street, Paisley; Mr. Alfred T. Drysdale, 125 Buchanan Street.

Professor D'Arcy W. Thompson, B.A., F.R.S.E., Corresponding Member, exhibited a series of small Seals and Whales, measuring from 4 inches upwards.

Mr. Duncan Mackenzie exhibited an immature specimen of the Kiwi, *Apteryx australis*, Shaw, from New Zealand, kindly lent by Mr. Walter Campbell, Ormsary, for exhibition to the Society.

Dr. James Colville, M.A., exhibited a fine adult male example of the same species, lent by Mr. Timothy Bost; and he made some interesting remarks on the habits of the remarkable group of birds to which the genus *Apteryx* belongs. Mr. R. Broom, B.Sc., gave an account of the anatomy of the *Apteryx* and its allies.

Mr. James J. F. X. King exhibited a specimen of *Micromus aphidivorus*, Schrank, which he stated to be one of the rarest British species of *Hemerobiidæ*. The latest record of its occurrence appears to be 18th October, 1886, when it was taken at West Wickham, and it was captured at Worcester and Witherslack in 1863. The species has always occurred singly in this country

although on the Continent it is sometimes not uncommon, and its distribution is very wide. It has also been taken in North America at Mount Washington, New Hampshire. Mr. King stated that the specimen exhibited had been captured by him last summer by beating firs on the banks of the Denough River at Killarney.

Professor F. O. Bower, D.Sc., F.R.S.E., F.L.S., exhibited a fine series of Photographs illustrating vegetation in Ceylon; and in the course of some descriptive remarks he stated that many of the most striking features of woodland scenery in that island are due to the presence of plants which have been introduced and have now become thoroughly acclimatised.

Professor Bower also showed some examples of apospory in ferns, illustrating a direct transition from the asexual to the sexual generation without the intervention of the spore.

Mr. George Russell showed several species of Pitcher-plant (*Nepenthes*), and drew attention to the differences which exist between pitchers formed respectively on the upper and lower leaves. He also exhibited two pitchers of *Nepenthes Hookeriana*, Low, growing one within the other, and read some notes descriptive of the interesting genus to which these plants belong.*

Professor D'Arcy W. Thompson, B.A., F.R.S.E., Corresponding Member, addressed the Society on "Museum Methods." He referred to the small value which many extensive Natural History collections possess for purposes of reference through being rendered mere store-houses of specimens. To enable the educative value of such collections to be fully realised, the specimens should be so arranged as to afford a view of the life-history of each group. By such an arrangement, a visitor, in passing from case to case, would be able to acquire much information regarding the habits, as well as the form, of typical species in the various divisions of the animal kingdom. On the Continent, the establishment of local museums, illustrating the Fauna and Flora of a particular district, has afforded a strong incentive to the popular study of Natural History which has not yet been provided in this country.

Rev. David Landsborough, Corresponding Member, read a paper on "The Jay and Starling in Ayrshire." †

* *Transactions*, vol. ii., p. 303. † *Ibid.*, p. 298.

28TH FEBRUARY, 1888.

Mr. James Dairon, F.G.S., Vice-President, in the Chair.

The following were elected Ordinary Members: Mr. John Borland, jun., Etruria, Kilmarnock; Mr. William M'Alister, M.B., C.M., Struan Villas, Kilmarnock; Mr. Alexander P. Dickie, Wallace Bank, Kilmarnock; Mr. William Hodge, 5 North Albert Road, Pollokshields; Mrs. William Hodge, 5 North Albert Road, Pollokshields; Mrs. P. C. Hart, 25 Hamilton Park Terrace, Hillhead; Mrs. Charles W. White, 2 Woodrow Circus, Pollokshields; Mr. James Rigg, Cross Arthurlie, Barrhead; Dr. John Archibald, F.R.C.S.E., M.R.C.P.E., F.R.S.E., 7 Bruntsfield Place, Edinburgh; Mr. Malcolm M'Murrich, M.A., M.B., C.M., Riccartsbar Asylum, Paisley; Rev. Alexander Skene, M.A., 6 Knowe Terrace, Pollokshields; Mr. Alexander Hill, 13 Herriot Street, Pollokshields; Mr. Thomas Carlile, 2 Lancaster Terrace, Kelvinside; Mr. Fountain Clarbour, 7 Oxford Drive, Kelvinside; Mr. Alexander A. Fergusson, 11 Grosvenor Terrace, Kelvinside; Mr. Alexander Scouler, 6 Ailsa Terrace, Hillhead; Mr. John Cruickshank, 15 South Portland Street; Mr. Adam M'Murtrie, 7 Church Place, Anderston; Mr. Robert Pollok, M.B., C.M., Laurieston House, Pollokshields; Mr. John Dunlop, 4 Abbotsford Place.

The Secretary (Mr. D. A. Boyd) drew the attention of the Society to the meetings of the International Geological Congress to be held at London during the week commencing 17th September, 1888.

The Secretary announced that in view of the early necessity for reprinting the Constitution of the Society, certain alterations had been suggested by several Members of Council. He moved: "That the proposed alterations be remitted to the Council to be considered and reported on at next meeting of the Society." Dr. Thomas F. Gilmour seconded the motion, which was unanimously adopted.

Dr. Marcus Calder, Secretary of the Greenock Natural History Society, exhibited living specimens of the Black Rat, *Mus rattus*, L., a species which was at one time abundant in this country, but has become almost extinct within recent years, although single individuals are sometimes obtained in the vicinity of seaports. It is believed to have been extirpated by the common Brown Rat, *Mus decumanus*, L., a larger and more powerful species which has rapidly spread over the country. Dr. Calder stated that the specimens had

been captured in Greenock, where the Black Rat has been re-introduced, probably through the agency of shipping, and is at present rather abundant in one part of the town. There was also shown for comparison a large specimen of the Brown Rat, which, on being suddenly exposed to the light, gave audible demonstration of its terror and resentment at being made the object of general observation. Remarks on the specimens were made by Mr. W. Anderson Smith, Corresponding Member, Dr. James Colville, M.A., Mr. Thomas King, and others.

Mr. A. Somerville, B.Sc., F.L.S., exhibited a specimen of *Trophon truncatus*, Ström, var. *scalaris*, Jeffreys (= *T. clathratus*, L., var. *Gunneri*, Lovén), a gastropod shell dredged by him in 40 fathoms off the Soay Isles, Iona, in October last. He stated that the typical *T. truncatus* is commonly met with throughout the West of Scotland, and more sparingly farther south; but the variety *scalaris* has hitherto been regarded as a Norwegian or Arctic form, not occurring farther south than the Shetland Isles. There were also shown for comparison specimens of *T. truncatus* dredged by Mr. Somerville in Oban Bay; a fine series of examples of the var. *scalaris* from Norway, lent by Mr. Alfred Bell, London, for exhibition to the Society; and specimens of typical *T. clathratus* from the post-tertiary beds of Garvel Park and Dalmuir. With reference to the last-mentioned shells, which were exhibited by Mr. D. Corse Glen, C.E., F.G.S., Mr. Somerville stated that *T. clathratus* does not now exist in a living state in British waters.

Mr. Somerville also showed several large woody growths found at the root extremities of *Cupressus Lawsoniana*, Murray, at Glenoran, near Helensburgh, and made some remarks on the various causes which had been suggested for the appearance of these abnormal excrescences.

Mr. R. S. Wishart exhibited a collection of Flowering-plants, gathered in Switzerland in July and August, 1887, and comprising 52 specimens, arranged to illustrate the natural orders from *Ranunculaceæ* to *Compositæ* inclusive.

On behalf of Mr. John Kirsop, Mr. John Renwick exhibited a fine stem of *Lepidodendron* from the Victoria Park, Whiteinch, where a remarkable group of fossil trees has recently been discovered.

The following papers were read:

"Dredging off Portincross, Ayrshire," by Mr. A. Somerville,

B.Sc., F.L.S.;* "On some Differences between the Marine Faunas of the Firth of Clyde and Firth of Forth," by Mr. David Robertson, F.L.S., F.G.S., President.†

27TH MARCH, 1888.

Mr. Peter Ewing, Vice-President, in the Chair.

The following were elected Honorary Members: Rev. Canon A. M. Norman, Burnmoor Rectory, Fence Houses, County Durham; Professor C. C. Babington, M.A., F.R.S., F.L.S., The University, Cambridge.

The following were elected Corresponding Members: Professor W. C. M'Intosh, M.D., LL.D., F.R.S., F.L.S., The University, St. Andrews; Mr. George R. M. Murray, F.L.S., Botanical Department, British Museum (Natural History), Cromwell Road, London, S.W.

Dr. William Craig, F.R.C.S.E., F.R.S.E., 7 Bruntsfield Place, Edinburgh, was elected a Life Member.

The following were elected Ordinary Members: Mr. J. G. A. Baird of Muirkirk, M.P., 24 Grosvenor Gardens, London, S.W.; Mr. William Walls, 2 Belhaven Terrace, Kelvinside; Professor J. Cossar Ewart, M.D., F.R.C.S.E., F.R.S.E., F.L.S., The University, Edinburgh; Mr. David MacBrayne, Cardross Park, Dumbartonshire; Mr. Peter Hutchison, 3 Lilybank Terrace, Hillhead; Mr. N. Macmichael, 203 West George Street; Miss E. M. Gibson, 3 Florentine Gardens, Hillhead; Miss Kallenberg, 28 Belhaven Terrace, Kelvinside; Mr. R. Bruce Young, M.A., M.B., 8 Crown Gardens, Dowanhill; Mr. John Colville, Woodend, Helensburgh; Mr. A. Barclay Calder, M.B., M.R.C.S., 21 Woodside Place; Rev. William S. Fleck, M.A., Free Church Manse, Fairlie; Mr. Thomas Service, 79 Morrison Street; Mr. William Lang, jun., Cross Park, Partick; Mr. James Knight, M.A., B.Sc., 37 Kenmure Street, Pollokshields; Mr. James Saunders, 23 Windsor Terrace; Mr. Edward F. Roberts, 38 Keir Street, Pollokshields; Mr. William Milne, M.A., B.Sc., F.R.S.E., High School, Elmbank Street; Mr. Robert H. Read, C.E., 6 Osborne Villas, Cathcart; Mr. Robert Richmond, 16 Steven Street; Mr. Richard Gunn, 151 New City Road.

* *Transactions*, vol. ii., p. 189. † *Ibid.*, p. 220.

The Secretary (Mr. D. A. Boyd) submitted the Report of the Council on proposed alteration on the Constitution of the Society, and gave notice of motions which he would make at next meeting regarding the adoption of the revised Constitution.

Mr. J. H. Gurney, jun., F.L.S., F.Z.S., exhibited a Hybrid between a female Pied Wagtail (*Motacilla lugubris*) and hybrid male Wagtail (*M. melanopa* × *lugubris*), on which some remarks were made by Mr. James Barrie Low, M.A.

Mr. James J. F. X. King exhibited a specimen of *Eupithecia togata*, Hb., a moth captured by him last summer at Killarney, and stated that although the insect has been taken in Perthshire, Roxburghshire, and the neighbourhood of Glasgow, no instance of its previous occurrence in Ireland seems to have been recorded.

Mr. George Russell exhibited specimens of several exotic Orchids, including an aberrant form of *Odontoglossum crispum* with a fasciated stem and two additional stems abnormally developed from the base of the pseudo-bulb. He also showed a Hybrid *Azalea*, remarkable for the unusually fine development of the petaloid calyx.

Mr. R. S. Wishart, M.A., exhibited a collection of Flowering-plants gathered in Switzerland in July and August, 1887, and comprising 49 specimens, arranged to illustrate the natural orders from *Campanulaceæ* to *Gramineæ* inclusive.

Rev. David Landsborough, Corresponding Member, exhibited a specimen of *Polyporus squamosus*, Fr., found growing on an old anvil in a disused smithy near Kilmarnock.

Mr. Landsborough also read a paper entitled "Notes on the Occurrence of *Cephalanthera ensifolia*, Rich., in Arran and Ayrshire." He stated that this orchid was discovered in Arran by his father, the Rev. David Landsborough, D.D., who, in a poem on Arran, published in 1829, thus refers to the plant:

> "I 've oft explored thy glens and tangled brakes,
> Where every bank blooms with the primrose pale,
> And drooping hyacinth; and where amidst
> Her ensiformal leaves, on stately stem,
> Sweet *Epipactis*, rarest of thy plants,
> Builds up her pyramid of snowy gems."

He adds in a note:—"*Epipactis ensifolia*, found at Whiting-bay, Sliddery, and Sannox;" and he afterwards writes, in 1842: "We searched in vain the hazel copses of Knockingelly for *Epipactis ensifolia*—a rare and beautiful plant. I had often seen it in that locality, but the flowering season was over, and it had died down."

Mr. Landsborough stated that in 1829 the late Mrs. Craufurd, of Craufurdland Castle, after having read the poem on Arran, resolved to cross to the island—a much greater undertaking in those days than now—and search for the plant. She did so, and was successful in finding it. He then gave a graphic account of his own search for this orchid, and the discovery of it in a copse not far from Whiting-bay, where, in the shade, it grew and bloomed in perfection. Another specimen was afterwards found growing in a place where the copse had been destroyed, and through exposure to the glare of the sunlight its purity and tender beauty were gone. It was carefully taken up and planted in front of Mr. Landsborough's house at Kilmarnock, in a situation partially shaded by a wall, where it lived for a few years but never bloomed. Years afterwards, when visiting Whiting-bay, Mr. Landsborough found that a patch of half-a-dozen plants of the orchid had been discovered by a little daughter of the Rev. W. Stewart, Free Church minister, as well as by her cousin, who, knowing nothing of the rarity of the flowers, yet struck with their beauty, had together dug them all up and planted them in the garden. Seeing at a glance that the plants were doomed, Mr. Landsborough asked and obtained one which he took home to Kilmarnock and planted in front of his house. It was placed in a spot thoroughly drained and with sufficient light, yet partially shaded by a large plant of ivy. It recovered from the effects of the double transplanting, but did not bloom the following year. Since then, however, it has bloomed every summer, but owing to the smokier atmosphere its flowers have not the same beauty and purity as in the Arran woods.

Mr. Landsborough remarked that he did not wonder that a plant apparently so delicate as *Cephalanthera ensifolia* should grow at the coast in Arran, where the lowest temperature last winter (1887-88) was 26° F., as compared with 8° at Kilmarnock, and where also he had known Camellias to bloom in the open air in January, and such trees flourish as the Blue Gum, Acacia, Pittosporum, Cabbage Palm, Tree Fern, and Grass Tree. He did not expect, however, that this orchid would grow in Ayrshire, unless, perhaps, in one of the mildest spots. Great, then, was his surprise to learn that in 1879 a patch of more than a dozen plants had been discovered by Mr. Harper, Gardener at Annick Lodge. His surprise was much increased on visiting the spot, which was in a beech wood so close to the public highway that the plants could easily be seen from it.

The situation was also in other respects one of the most unpromising that could be imagined, for the soil was very stiff clay, and there were no plants around of a nature to indicate that so delicate a flower might love the place—yet here the beautiful *Cephalanthera ensifolia* was apparently quite at home. Mr. Harper was greatly pleased with his discovery, and, to prevent its being made by others, he not only exacted from Mr. Landsborough a promise not to disclose the spot, but was himself in the habit of plucking the flowers as soon as they came into bloom. As no one else knew the place, this state of matters might long have continued; but last year a third party found the plants, and Mr. Harper at once took alarm. Accordingly he, in whose eyes the plants had been so sacred that he did not lift even a single one for his own garden, removed six of the roots, planting four of them in the Annick Lodge Garden, and two in another wood. The part of the garden where they have been planted is admirably suitable, being shaded by trees, while care has been taken that the soil should be appropriate. There can therefore be little doubt that they will thrive and continue to bloom, and it will be very interesting to notice if they increase in number. It should be mentioned that spikes of the flowers were sent by Mr. Harper to the Editor of the *Gardeners' Chronicle*, by whom they were pronounced to be the finest specimens he had ever seen. This Mr. Harper attributes to the stiffness of the clay in which they had grown. A spike was also sent by Mr. Landsborough to the late Mr. H. C. Watson, author of *Cybele Britannica*.

The following additional papers were read:

"Notes on the Occurrence of the Kingfisher (*Alcedo ispida*, L.) near Kilmarnock," by the Rev. David Landsborough, Corresponding Member.*

"Notes on the Terrestrial Isopoda (*Oniscidæ*)," by Mr. D. A. Boyd.

"Notes on the Foraminifera of the Faroe Channel and Wyville Thomson Ridge, with a description of a New Species of *Hyperammina*," by Mr. Fred. G. Pearcey, of H.M.S. *Challenger* Expedition, Corresponding Member.† Mr. Pearcey's paper was illustrated with diagrams and a fine series of microscopic specimens.

"Botanical Notes from Wigtownshire and Kirkcudbrightshire," by Mr. James M'Andrew, Corresponding Member.‡

* *Transactions*, vol. iii., p. 301. † *Ibid.*, p. 207. ‡ *Ibid.*, p. 163.

24TH APRIL, 1888.

Mr. Peter Ewing, Vice-President, in the Chair.

Mr. John Burns of Castle Wemyss, F.R.A.S., F.R.G.S., Wemyss Bay, was elected a Life Member.

The following were elected Ordinary Members: Dr. Charles Cameron, M.P., 14 Park Circus; Mr. Alfred Bell, 140 Lower Marsh, Lambeth, London, S.E.; Miss F. R. Tait, 21 Woodlands Terrace; Mr. John Drysdale, M.A., C.A., 37 Berkeley Terrace; Mr. Hugh H. Browning, M.A., B.D., 14 Newton Place.

In accordance with notice given by him at last meeting, Mr. D. A. Boyd moved: (I.) "That the Report of the Council on the alterations proposed to be made on the Constitution of the Society be approved." This was seconded by Mr. John Blackwood and unanimously agreed to. (II.) "That the Revised Constitution be adopted as the Constitution of the Natural History Society of Glasgow." This was seconded by Mr. P. Ewing and unanimously agreed to. (III.) "That the new Constitution, so far as relating to the Summer Session, shall come into operation at the close of the present Session, and, so far as relating to the Winter Session, at the commencement of Session 1888-89." This was seconded by Mr. R. Turner and unanimously agreed to.

The Constitution, as adopted by the Society, is as follows:

CONSTITUTION

OF THE

Natural History Society of Glasgow.

I.

Name of the Society.

The Society shall be called the "Natural History Society of Glasgow."

II.

General Views and Objects of the Society.

The attention of the Society shall be directed to the whole range of Biological Science; and its objects shall be to foster and encourage the study of Natural History, and to stimulate biological research in the West of Scotland. The objects shall be cultivated—

(1) By holding Meetings for the exhibition of specimens and interchange of information—for the reading of original Papers, or translations, abstracts, or reviews of works regarding any branch of biological knowledge—and for the application of such knowledge to the Sciences and Arts.

(2) By making excursions for practical work.

(3) By publishing annually Proceedings and Transactions.

(4) By the formation of a Library for the use of the Members, and of Zoological and Botanical Collections for public reference.

(5) By printing from time to time Catalogues of Animals and Plants, with the view of facilitating the study of their local distribution and the exchange of specimens.

III.

Members of the Society.

The Society shall consist of Ordinary Members, Associates, Corresponding Members, and Honorary Members.

IV.

Ordinary Members.

1. Every candidate for admission shall present an application, with a recommendation annexed, signed by at least two Ordinary Members.

2. The names of such candidates, whose applications shall have been lodged with one of the Secretaries, shall be printed in the circular calling the first meeting thereafter, at which the vote shall be taken.

3. Upon election each Ordinary Member shall sign a Minute of Agreement to the Rules, and shall thereupon receive the Diploma of the Society.

4. Any such Member, upon written application showing a sufficient reason, shall, with the express permission of the Council, become entitled to suspend membership, with power to resume its privileges on any subsequent Session on payment of the annual subscription then due.

V.

Associates.

1. Persons interested in the study of Natural History, who may not wish to possess the full privileges of membership, may be admitted as Associates. Every candidate for admission shall present an application, with a recommendation annexed, signed by two Ordinary Members. If approved by the Council, the names of such candidates shall be printed in the circular calling the first Meeting thereafter, at which the vote shall be taken.

2. Associates shall be entitled to attend the Meetings and Excursions of the Society. They shall not enjoy any other privileges of membership, unless these be specially granted by the Council; but the Council shall not have power to allow them to vote or hold office.

3. Associates, who have been enrolled for not less than three consecutive Sessions, may, on written application addressed to the Council, and with its express approval, have their names transferred to the roll of Ordinary Members; and on payment of the annual subscription then due they shall become entitled to all the privileges of membership.

VI.

Corresponding Members.

1. Persons from whom information concerning Natural History may be expected shall be eligible for election as Corresponding Members. They shall be recommended by three Ordinary Members at any Meeting of the Society at which general business can be transacted, and their names shall be printed in the circular calling the ensuing Meeting, at which the vote shall be taken.

2. They shall be entitled to the same privileges as Associates.

3. They may, on written application addressed to the Council, and with its express approval, have their names transferred to the roll of Ordinary Members; and on payment of the annual subscription then due they shall become entitled to all the privileges of membership.

VII.

Honorary Members.

1. Eminent Naturalists shall be eligible for election as Honorary Members. Having been recommended by the Council, and the recommendation announced at any Meeting of the Society at which general business can be transacted, their names shall be printed in the circular calling the ensuing Meeting, at which the vote shall be taken.

2. They shall be entitled to the same privileges as Associates and Corresponding Members.

VIII.

Council—Office-Bearers.

1. The business of the Society shall be managed by a Council of twenty, consisting of a President, three Vice-Presidents, twelve Councillors, two Secretaries, a Treasurer, and a Librarian, who shall take office for three years. One of the Vice-Presidents, and four Councillors shall retire annually by rotation.

2. Office-Bearers retiring after a full term of three years shall not be eligible for re-election to the same office till after the interval of one year; but this regulation shall not apply to the Secretaries, Treasurer, or Librarian.

3. All nominations of Office-Bearers shall be made in writing, signed by two Ordinary Members, and sent to the Secretaries at least eight days before the General Meeting in October. They shall then be submitted to the Council, and shall be printed, with the names of proposers and seconders, in the circular calling the General Meeting.

4. The Council shall submit annually, at the General Meeting, a report on the work of the Society during the previous year.

5. The Council shall have power to settle all disputes arising from the business of the Society; to enact Bye-Laws on points not provided for by the Constitution; to fill up vacancies in the Council occurring during the Session; to appoint Committees to take charge of particular departments of the Society's business; to appoint Local Secretaries from amongst the Members of the Society, from whom, in their respective districts, all information regarding the Society's objects and work may be obtained; and generally to superintend and govern the affairs of the Society.

6. Five Members of Council shall form a quorum.

IX.

President and Vice-Presidents.

1. The President shall be Chairman of all Meetings of the Society and of the Council at which he may be present; in his

absence one of the Vice-Presidents shall take the Chair, and failing them, any Member of Council who may be elected by the Meeting.

2. It shall be the duty of the Chairman to conduct the Meetings of the Society according to the Order of Business and the Laws of the Society.

X.

Secretaries.

The Secretaries shall act both for the Society and Council, and shall give intimation of all Meetings of the Society and the Council, record the proceedings in the Minute-Books, prepare abstracts thereof for publication in the newspapers and in the Proceedings of the Society, keep a register of the names and addresses of Members and Associates, and conduct the general correspondence of the Society.

XI.

Treasurer.

1. The Treasurer shall collect all subscriptions and moneys due to the Society, and make all payments. In no case shall any payment exceeding £2 be made by him without the approval of the Council having been previously obtained. He shall keep an account of his intromissions in the Cash-Book of the Society, and shall strike a balance at the end of August in each year.

2. He shall prepare annually, at the commencement of the Winter Session, a certified statement of the receipts and expenditure for the past year; and the statement shall be duly audited, and printed in the circular calling the General Meeting, at which it shall be submitted.

3. He shall open an account with one of the Glasgow Banks, and shall pay into it all funds of the Society, whenever these accumulate in his hands to £2 or upwards. The Bank Account shall be kept in name of the Society, and all drafts thereon shall be signed by the Treasurer and one of the Secretaries.

4. He shall also keep a register of the names and addresses of Ordinary Members and Associates.

XII.

Librarian.

1. The Librarian shall take charge of the Books belonging to the Society, and shall keep a Catalogue of them in a book provided for the purpose.

2. He shall issue books to the Members, and register the names of the borrowers.

3. He shall take charge of the distribution of the Society's publications, and shall account to the Treasurer for such sums of money as may be received from their sale.

4. He shall submit annually, at the General Meeting, a report on the state of the Library, the circulation of the Books, and the distribution and exchange of the Society's publications during the preceding year.

XIII.

Meetings—Ordinary and Special.

1. The Winter Session of the Society shall extend from September of each year to the following April; and Ordinary Meetings, of which intimation shall have been previously given by circular, shall be held on the last Tuesday of each month, at Eight p.m., at which any competent business of the Society may be transacted.

2. The Summer Session shall extend from May to September; and Meetings—for scientific work only, at which no general business of the Society shall be competent—shall be held, and Excursions shall be made, at such times as may be arranged by the Council, and intimated by a Syllabus that shall be issued to the Ordinary Members and Associates at the beginning of each Session.

3. Alteration of the date of any Ordinary Meeting, and arrangements for Special Meetings and Excursions, may be made by the Council; but of these due notice shall be given to the Ordinary Members and Associates by circular, if during the Winter Session, or by intimation at the previous Meeting, if during the Summer Session.

4. At any Meeting of the Society seven Ordinary Members shall form a quorum.

XIV.

Order of Business.

The Order of Business at the Ordinary Meetings of the Society shall be as follows:

(1) The Minutes of the previous Meeting shall be read, amended if required, approved of, and signed by the Chairman.

(2) Members and Associates proposed shall be voted for.

(3) Miscellaneous business shall be brought up.

(4) Specimens shall be exhibited, with remarks.

(5) Papers and communications shall be read and discussed.

XV.

Annual General Meeting.

1. The Annual General Meeting of the Society shall be held on the last Tuesday of October in each year, being the second Meeting of the Session.

2. The Order of Business at this Meeting shall be as follows:

(1) The Minutes of the previous Meeting shall be read, amended if required, approved of, and signed.

(2) One of the Secretaries shall read the Report of the Council on the business of the past year.

(3) The Treasurer shall read a Statement of the financial affairs of the Society.

(4) The Librarian shall report on the state of the Library, the circulation of Books, etc.

(5) The Society shall proceed to the election of Office-Bearers, as far as there may be vacancies, and shall also appoint two Ordinary Members to audit the Accounts for the ensuing year.

(6) Members and Associates proposed shall be voted for.

(7) Miscellaneous business shall be brought up.

(8) Specimens shall be exhibited, with remarks.

(9) Papers and communications shall be read and discussed.

XVI.

Intimations of Meeting, Circulars, etc.

1. The business of each Meeting of the Winter Session shall be intimated to the Ordinary Members and Associates by circular issued at least three clear days previously.

2. These circulars shall not be sent to Corresponding or Honorary Members, unless on their written application to the Secretaries, or by the authority of the Council.

3. The circular calling the Annual Meeting shall be sent to every Member and Associate on the roll, including Corresponding and Honorary Members.

4. The Meetings and Excursions of the Summer Session shall be intimated by a Syllabus to be issued not later than the beginning of such Session; and this shall be held to be sufficient intimation, but any further special notice may be given that the Council shall deem requisite.

XVII.

Removal of Members and Associates from the Roll.

1. If a written notice of motion for the removal of the name of any Member or Associate from the Roll of the Society, signed by five or more Ordinary Members, shall be received by the Secretaries, such notice shall be read at the first Ordinary Meeting thereafter, and shall be printed in the circular calling the ensuing Ordinary Meeting. The motion shall at that Meeting be put to the vote, and if supported by three-fourths of the Members voting, it shall be declared carried.

2. This Rule does not apply to the removal from the Roll of the names of Members and Associates who may be in arrear of their Subscriptions.

XVIII.

Voting.

1. All votes, whether of the Society or the Council, when not unanimous, shall be taken by ballot when demanded. Any motion supported by a majority of the Members voting (unless when otherwise provided for in the Rules) shall be declared carried.

2. All votes shall be tendered personally.

3. The Chairman shall have a deliberative and a casting vote.

XIX.

Subscriptions.

1. The Entry-Money payable by Ordinary Members shall be 7s. 6d., and the Annual Subscription 7s. 6d.; but no Entry-Money shall be payable by Ladies, or by Members admitted in accordance with Chapter V., Section 3, and Chapter VI., Section 3.

2. Associates shall be exempt from Entry-Money, but shall pay an Annual Subscription of 2s. 6d.

3. The Annual Subscription shall become due on election, and thereafter on the 1st September of each year.

4. Should a Member or Associate be a second year in arrear of his subscription, the Treasurer shall twice send him notice to that effect, and, if payment be not then made, his name may be removed from the roll.

5. Members and Associates shall be liable for their Subscription up to the date at which they shall give written notice of their resignation to the Secretaries, or obtain suspension in terms of Chapter IV., Section 4.

6. Members whose Subscriptions are in arrear shall not be entitled to hold office, to vote, to nominate, to use the Library, or to receive the printed Proceedings and Transactions of the Society.

7. The Composition for Life Membership, in lieu of the Annual Subscription and Entry-Money, shall be £5 12s. 6d., or £5 5s. if Entry-Money shall have been previously discharged by payment or exemption.

XX.

Publications of the Society.

1. The Proceedings and Transactions of the Society shall be printed and issued as soon as practicable after the close of the Session to which they relate.

2. The Publications of the Society shall be edited by a Publishing Committee, to be elected annually by the Council; and this Committee shall decide as to all Papers or Abstracts of Papers that shall be printed, and the extent to which they shall be illustrated.

3. Ordinary Members shall be entitled to receive, free of charge, a copy of the Part of the Society's Proceedings and Transactions issued for each year of their membership; but should sufficient funds not be available for the purpose, the Council shall have power to fix a charge for each Part, not exceeding the cost price thereof.

4. Duplicate and back Parts shall in all cases be charged for.

5. The Publications of the Society shall be on sale to Members at 25 per cent. below published prices.

6. Authors of Papers shall be entitled to receive, free of charge, 25 copies of their Papers. Extra copies shall be charged cost price.

XXI.

Motions Affecting the Constitution.

Notices of Motion affecting the Constitution of the Society shall be made at an Ordinary Meeting, and shall be printed in the circular calling the ensuing Meeting, at which they shall be brought up for discussion. If supported by two-thirds of the Members voting, they shall be declared carried.

XXII.

The Library.

1. The Council shall have power to add suitable books to the Library, and to reject books presented if they shall be judged unsuitable.

2. Members desirous of recommending additions to the Library may do so by inserting in a book provided for the purpose the titles of the works recommended to be added. These recommendations shall be submitted to the Council, whose decision shall be final.

3. The Library shall be open for the issue of books on the nights of Meeting (the final Meeting of the Winter Session excepted); and books may be borrowed by Members either before or after the Meeting. The Librarian shall enter in the Register of the Library the number and title of every volume issued, and the entry shall be signed by the borrower.

4. No volume shall be retained for a longer period than one month; but the loan may be renewed for a similar term, if no other application shall have been made for the work. No Member shall be entitled, unless with the special permission of the Council, to borrow more than two volumes at one time, or to borrow any unbound publication, map, plate, drawing, manuscript, or fasciculus.

5. To admit of an annual scrutiny of the Library, all books, etc., shall be returned to the Librarian at the final Meeting of each Winter Session, and the issue shall not be resumed until the first Meeting of the ensuing Summer Session.

6. In the event of failure to return a book, etc., after application therefor shall have been made by the Librarian, or of damage or defacement to any volume, etc., before its return to the Library, the Council shall have power to replace it, charging the borrower with its cost, or, if it form part of a work, with the cost of the whole work thus rendered imperfect.

XXIII.

Donations to the Society.

Any donation to the Society, except money, books, and MSS., may, if approved by the Council, be presented to one of the local Museums. In the event of the Society deciding to form a collection in any special branch of Natural History, suitable donations may be retained for that purpose. All donations accepted shall be acknowledged in the Society's circular.

On the motion of the Chairman (Mr. Ewing) a vote of thanks was awarded to the Secretary (Mr. Boyd) for his services in the preparation of the revised Constitution.

Mr. R. Broom, B.Sc., exhibited the shoulder-girdle and pelvis of the Emu, and made some remarks on the characteristics and affinities of the *Ratitæ*. These he illustrated with an ample series of specimens.

Mr. D. A. Boyd exhibited specimens of the following Mosses from the localities mentioned:

Grimma Hartmanni, Schpr.—Crosbie, West Kilbride.

Orthothecium intricatum, Hartm.—Rottenburn Glen, Loch Thom; Gogo Glen, Largs.

Amblystegium irriguum, Wils.—West Kilbride.

Hypnum Wilsonianum, Schpr.—Cumbrae.

The following papers were read:

"The Cadzow Herd of White Cattle," by Mr. R. Turner.*

"Notes on the Land and Fresh-water Mollusca of Iona," by Mr. A. Somerville, B.Sc., F.L.S.†

"On Parthenogenesis in the Hymenoptera," by Mr. P. Cameron, F.E.S., Corresponding Member.‡

* *Transactions*, vol. ii., p. 222. † *Ibid.*, p. 296. ‡ *Ibid.*, p. 194.

"On the Occurrence on Ben Lawers of *Arenetra pilosella*, Gir., a Genus of Hymenoptera new to the British Fauna," by Mr. P. Cameron, F.E.S., Corresponding Member.*

"A Contribution towards a Neuropterous Fauna of Ireland," by James J. F. X. King.†

"On a Monstrosity of the Common Earth-worm, *Lumbricus terrestris*, L.," by Mr. R. Broom, B.Sc.‡

* *Transactions*, vol. ii., p. 202. † *Ibid.*, p. 259. ‡ *Ibid.*, p. 203.

ABSTRACT STATEMENT OF ACCOUNTS.—Session 1886-87.

To Balance in National Security Savings Bank and in Treasurer's hands from last Session,	£23	16	8	By Rent and Attendance,	£8	11	0
,, 155 Members' Annual Subscriptions @ 7s. 6d.,	58	2	6	,, Postage, Stationery, etc.,	8	7	10
,, 9 New Members' Entry-money @ 7s. 6d.,	3	7	6	,, Printing *Proceedings*, Circulars, etc.,	25	16	0
,, 6 Members' Arrears,	2	12	6	,, Library—Additions,	6	12	5½
,, *Proceedings* sold, per Librarian,	3	19	7	,, ,, Binding,	8	10	0
,, Subscriptions for Library,	6	14	0	,, ,, Fire Insurance,	0	6	0
,, Bank Interest,	0	11	5	,, ,, Postage, Carriage, etc.,	5	9	2½
				,, Balance in Bank and in Treasurer's hands,	35	11	8
	£99	4	2		£99	4	2

Glasgow, *17th October, 1887*.—We have examined the Books and compared the Vouchers, and find the same correct—the Balance in National Security Savings Bank and Treasurer's hands being Thirty-five Pounds Eleven Shillings and Eight Pence.

DAVID PEARSON,
THOS. G. BISHOP, } *Auditors.*

LIST OF SOCIETIES, ETC., WITH WHICH PUBLICATIONS ARE EXCHANGED.

Alnwick.—Berwickshire Naturalists' Field Club.
Amsterdam.—Koninklijke Akadamie van Wettenschappen.
Barrow.—Naturalists' Field Club.
Basel.—Naturforschende Gesellschaft.
Bath.—Natural History and Antiquarian Field Club.
Belfast.—Naturalists' Field Club.
Natural History and Philosophical Society.
Bergen.—Museum.
Birmingham.—Philosophical Society.
Bonn.—Naturhistorischer Verein der Preussischen Rheinlande und Westfalens.
Bordeaux.—Société Linnéenne.
Boston.—Society of Natural History.
Braunsweig.—Verein für Naturwissenschaft.
Bremen.—Naturwissenschaftlicher Verein.
Brighton.—Brighton and Sussex Natural History Society.
Bristol.—Naturalists' Society.
Brüun.—Naturforschender Verein.
Brussels.—Société Entomologique de Belgique.
Société Malacologique de Belgique.
Société Royale de Botanique de Belgique.
Budapest.—Királyi Magyar Természettudományi Társulat.
Cambridge, Mass.—Entomological Club.
Museum of Comparative Zoology of Harvard College.
Nuttal Ornithological Club.
Cardiff.—Naturalists' Society.
Cassel.—Verein für Naturkunde.
Chapel-Hill, N.C.—Elisha Mitchell Scientific Society.
Cherbourg.—Société Nationale de Sciences Naturelles et Mathématiques.
Chester.—Society of Natural Science.
Christiania.—Royal University of Norway.
Cincinnati.—Society of Natural History.
Cordoba.—Academia Nacionale de Ciencias.
Danzig.—Naturforschende Gesellschaft.
Davenport.—Academy of Natural Sciences.
Dresden.—Naturwissenschaftliche Gesellschaft "Isis."
Dublin.—Royal Dublin Society.

Dumfries.—Dumfriesshire and Galloway Natural History and Antiquarian Society.
Dundee.—East of Scotland Union of Naturalists' Societies.
Durham.—Tyneside Naturalists' Field Club.
Eastbourne.—Naturalists' History Society.
Edinburgh.—Botanical Society.
Field Naturalists' and Microscopical Society.
Geological Society.
Royal Physical Society.
Scottish Geographical Society.
Elberfeld.—Naturwissenschaftlicher Verein.
Essex.—Epping Forest and Essex Naturalists' Field Club.
Florence.—Società Entomologica Italiana.
Frankfurt.—Senckenbergische Naturforschende Gesellschaft.
Gent.—Natuurwettenschappen.
Glasgow.—Archæological Society.
Faculty of Physicians.
Geological Society.
Industrial Museum.
Mitchell Library.
Philosophical Society.
Stirling's Library.
University Library.
Giessen.—Oberhessische Gesellschaft für Natur und Heilkunde.
Gorlitz.—Naturforschenden Gesellschaft.
Granville, Ohio.—Denison University.
Graz.—Naturwissenschaftlicher Verein für Steiermark.
Griefswald.—Naturwissenschaftliche Vereine von Neu-Vorpommern und Rügen.
Halifax.—Nova Scotian Institute of Natural Science.
Halle.—Naturforschende Gesellschaft.
Leopoldina.
Hamburg.—Naturwissenschaftlicher Verein für Hamburg-Altona.
Heidelberg.—Naturhistorisch-medicinisher Verein.
Helsingfors.—Societas pro Fauna et Flora Fennica.
Kiew.—Société des Naturalistes a l'Université Impériale de St. Wladimie.
Landshut.—Bavarian Botanical Society.
Leeds.—Naturalists' Club and Scientific Association.
Yorkshire Naturalists' Union.
Leipzig.—Naturforschende Gesellschaft.
Leicester.—Literary and Philosophical Society.
Liége.—Société Royale des Sciences.
Liverpool.—Naturalists' Field Club.
Biological Society.
London.—British Museum Library.
British Museum (Natural History Department).
British Association.

London.—Editors, Entomologists' Monthly Magazine.
Entomological Society.
Royal Geographical Society.
Geologists' Association.
Hampstead Naturalists' Club.
Linnean Society.
Quekett Microscopical Club.
Royal Microscopical Society.
London, Ontario.—Entomological Society of the Province of Ontario.
Lyons.—Société Linnéenne.
Madrid.—Sociedad Española de Historia Natural.
Manchester.—Field Naturalists' and Archæologists' Society.
Geological Society.
Literary and Philosophical Society.
Microscopical Society.
Scientific Students' Association.
Melbourne.—Library and Museum of Victoria.
Meriden, Conn.—Scientific Association.
Metz.—Société d'Histoire Naturelle.
Mexico.—Sociedad Cientifica "Antonio Alzate."
Moscow.—Société Impériale des Naturalistes.
Münster.—Westfälischer Provinzial-Verein für Wissenschaft und Kunst.
Neuchâtel.—Société des Sciences Naturelles.
New Brunswick.—Natural History Society.
Newhaven, Conn.—Academy of Arts and Sciences.
New York.—Academy of Sciences.
Linnæan Society.
Microscopical Society.
Journal of Comparative Medicine and Surgery.
Northampton.—Natural History Society.
Norwich.—Norfolk and Norwich Naturalists' Society.
Nürnberg.—Naturhistorische Gesellschaft.
Odessa.—Society of Naturalists of New Russia.
Osnabrück.—Naturwissenschaftlicher Verein.
Ottawa.—Geological and Natural History Survey.
Padua.—Società Veneto-Trentina di Scienze Naturali.
Paisley.—Free Library.
Paris.—Société Entomologique de France.
Société Zoologique de France.
Passau.—Naturhistorischer Verein.
Penzance.—Natural History and Antiquarian Society.
Perth.—Perthshire Society of Natural Science.
Scottish Naturalist.
Philadelphia.—Academy of Natural Sciences.
Wagner Free Institute of Science.

Plymouth.—Plymouth Institution, and Devon and Cornwall Natural History Society.
Poughkeepsie.—Vassar Brothers Institute.
Prague.—Königl. Böhm. Geselleschaft der Wissenschaften.
Rio de Janeiro.—Museum Nacional.
San Francisco.—California Academy of Sciences.
St. Louis, Miss.—Academy of Science.
St. Petersburg.—Comité Géologique
Entomological Society of St. Petersburg.
Salem, Mass.—Essex Institute.
Santiago.—Deutschen Wissenschaftlicher Verein zu Santiago.
Schaffhausen.—Société Entomologique Suisse.
Sgravenhage.—Nederlandsche Entomologische Vereeniging.
Staffordshire.—North Staffordshire Naturalists' Field Club.
Stettin.—Entomologische Zeitung.
Stuttgart.—Verein für Vaterländische Naturkunde in Würtemberg.
Tokio.—Japanese University.
Toronto.—Canadian Institute.
Trenton, N.J.—Natural History Society.
Trieste.—Società Adriatica di Scienze Naturali.
Truro.—Royal Institution of Cornwall.
Venice.—Notarisia.
Vienna.—Kaiserlich-Königliche Zoologisch-botanische Gesellschaft.
Ornithologischer Verein.
Naturhistorische Hofmuseums.
Warwick.—Naturalists' and Archæologists' Field Club.
Washington.—Smithsonian Institution.
United States Geological and Geographical Survey.
Watford.—Hertfordshire Natural History Society and Field Club.
Wellington, N.Z.—New Zealand Institute.
Winnipeg.—Historical and Scientific Society.
Wisconsin.—Natural History Society.

February, 1890.

Natural History Society of Glasgow.

SESSION XXXIX.—1889-90.

LIST OF OFFICE-BEARERS.

President.

DAVID ROBERTSON, F.L.S., F.G.S., Fern Bank, Millport.

Vice-Presidents.

PETER EWING, The Frond, Uddingston.
A. SOMERVILLE, B.Sc., F.L.S., 4 Bute Mansions, Hillhead.
ROBERT TURNER, 18 Westbank Terrace, Hillhead.

Hon. Secretaries.

D. A. BOYD, Seamill, West Kilbride.
JAMES STEEL, 104 Renfrew Street.

Hon. Treasurer.

JOHN RENWICK, 49 Jamaica Street.

Hon. Librarian.

JAMES J. F. X. KING, 207 Sauchiehall Street.

Members of Council.

C. Fred. Pollock, M.D., F.R.C.S.E., F.R.S.E.
Johnston Shearer.
Joseph Sommerville.
Prof. James Stirton, M.D., F.R.C.S.E., F.L.S.
Prof. F. O. Bower, D.Sc., F.R.S.E., F.L.S.
Robert Broom, M.B., C.M., B.Sc.
Thomas F. Gilmour, M.D., L.R.C.P.E.
William Stewart.
Prof. Thomas King.
James Barrie Low, M.A.
David Pearson.
R. S. Wishart, M.A.

LIST OF MEMBERS.

** Life Members.*

HONORARY.

1851 William Ferguson of Kinmundy, F.R.S.E., F.L.S., F.G.S., etc., 21 Manor Place, Edinburgh, and Kinmundy, near Mintlaw, Aberdeenshire.

1880. John Obadiah Westwood, M.A., F.L.S., F.E.S., Professor of Zoology, Oxford.
1880. Professor Gustav Mayr, 75 Haupt Strasse, Vienna.
1880. Rev. John Stevenson, LL.D., F.R.S.E., The Manse, Glamis, Forfarshire.
1881. James Murie, M.D., LL.D., F.L.S., F.G.S., F.Z.S., Burlington House, Piccadilly, London, W.
1881. Osbert Salvin, M.A., F.R.S., F.L.S., F.Z.S., F.R.H.S., Hawksfold, Fernhurst, Haslemere, Surrey.
1884. David Sharp, M.B., C.M., F.L.S., F.Z.S., P.E.S., Wilmington, Dartford, Kent.
1884. Robert M'Lachlan, F.R.S., F.L.S., F.Z.S., F.E.S., West View, Clarendon Road, Lewisham, London, S.E.
1885. John Murray, LL.D., Ph.D., F.R.S.E., F.L.S., F.S.A.Scot., Director of the *Challenger* Expedition Commission, 32 Queen Street, Edinburgh.
1887. William Carruthers, F.R.S., P.L.S., F.G.S., Keeper of the Botanical Collections, British Museum (Natural History), Cromwell Road, London, S.W.
1887. Sir Joseph Dalton Hooker, M.D., R.N., K.C.S.I., C.B., D.C.L., LL.D., F.R.S., F.L.S., F.G.S., etc., The Camp, Sunningdale, Berks.
1887. Sir Richard Owen, K.C.B., D.C.L., LL.D., F.R.C.S., F.R.S., F.L.S., F.G.S., etc., Sheen Lodge, Richmond Park, East Sheen.
1888. Rev. Canon Alfred Merle Norman, M.A., D.C.L., F.L.S., Burnmoor Rectory, Fence Houses, Co. Durham.
1888. Charles Cardale Babington, M.A., F.R.S., F.L.S., F.G.S., Professor of Botany in the University of Cambridge, 5 Brookside, Cambridge.
1889. The Duke of Argyll, K.G., K.T., D.C.L., LL.D., F.R.S., Inveraray Castle, Argyllshire.

CORRESPONDING.

1861. John Shaw, Ph.D., F.L.S., South African College, Cape Town, South Africa.
1863. Rev. H. W. Crosskey, LL.D., F.G.S., Birmingham.
1866. The Earl of Haddington, F.R.S.E., F.S.A.Scot., Tyninghame, Prestonkirk.
1866. Robert Macdowal, Surgeon, Panama Steam Navigation Company, Panama.
1867. John Buchanan, F.L.S., of the Government Survey, Wellington, New Zealand.
1868. Rev. Paton J. Gloag, D.D., Galashiels.
1869. George Stewardson Brady, M.D., M.R.C.S., F.L.S., C.M.Z.S., Sunderland.
1869. Rev. James Keith, LL.D., The Manse, Forres.

1869. Major W. H. Feilden, C.M.Z.S., West House, Wells, Norfolk.
1869. Rev. John Fergusson, The Manse, Fearn, Brechin.
1870. James Hardy, Old Cambus, Cockburnspath.
1871. Alexander Gray, Chartered Bank of India, Batavia.
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1889. Wood, John, Levern Schoolhouse, Hurlet.

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The references to the Pages of the *Transactions* are indicated by figures, and to those of the *Proceedings* by Roman numerals.

New Species, etc., described in the *Transactions* are distinguished by an asterisk.

MAMMALS AND BIRDS.

ZOOLOGY.

BOTANY.

FIG. 1.

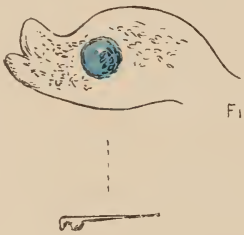


FIG. 2

FIG. 3.

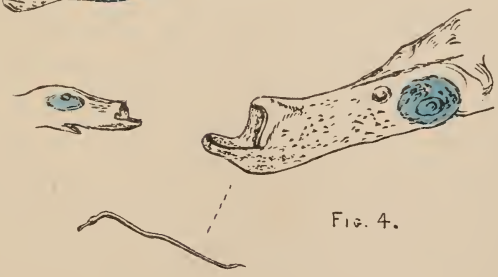


FIG. 4.

FIG. 5.

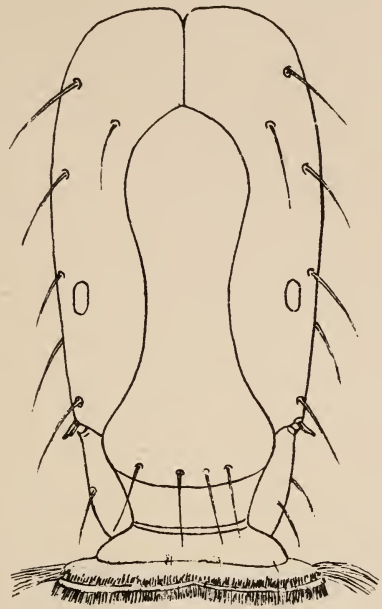


FIG. 1.

FIG. 3.

FIG. 4.

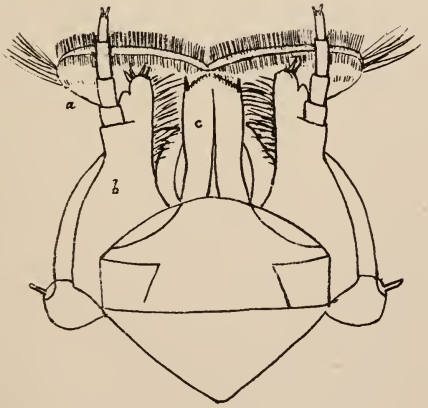
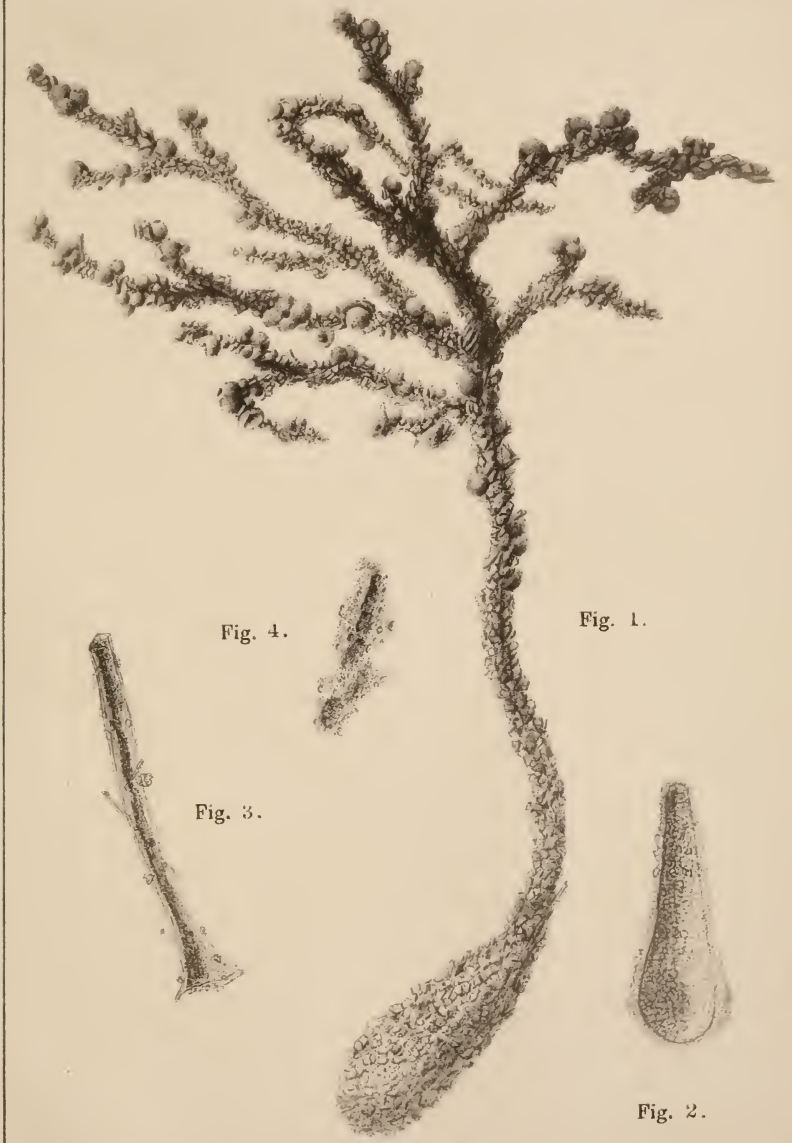


FIG. 2.

FIG. 5.



HYPERAMMINA PALMIFORMIS, N. SP.