



PROCEEDINGS

OF THE

NATURAL HISTORY SOCIETY OF GLASGOW

PROCEEDINGS

OF THE

NATURAL HISTORY SOCIETY

OF GLASGOW

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PROCEEDINGS

OF THE

NATURAL HISTORY SOCIETY OF GLASGOW.

SESSION 1859-60.

THE EIGHTH ANNUAL GENERAL MEETING, ANDERSON'S
UNIVERSITY BUILDINGS, SEPTEMBER 27TH, 1859.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected office-bearers for the session:—John Scouler, M.D., LL.D., F.L.S., etc., President; Alexander Lindsay, M.D., Vice-President; Robert Gray, Secretary; Matthew P. Bell, Treasurer; John Grieve, M.D., Messrs John Black and David Robertson, Members of Council.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited a living specimen of *Corystes Cassivelaunus*, which had been in his possession upwards of seven months, during which time he had favourable opportunities of observing its habits. In bringing these under the notice of the society, he remarked that this crab, in burrowing into the sand, lies buried for weeks without seeking to change, and that the antennæ clasp into each other when the creature is so situated, forming a tube through which it breathes, and otherwise maintains a communication with the surface. Mr Robertson also stated that he had seen the ova cast up through this opening—the inference being that the animal had placed it, by means of its claws or pincers, within the influence of the current. Mr Robertson likewise exhibited specimens of *Nereis bilineata*, and made some remarks upon its habit of living in univalve shells, in company with hermit crabs.

Some facts were then stated, and a discussion ensued respecting the excessive mortality which had occurred last month amongst the sea birds of the Firth of Clyde, Belfast Lough, and several other places chiefly in the West of Scotland. From information communicated by one or two gentlemen connected with the society, it would appear that the stricken birds were found floating literally in thousands—dead or in a dying state—many parts of the coast being strewn with their bodies. An opinion seemed to prevail among the members that the epidemic—if such it could be called—had set in about the time of the birds leaving Ailsa Craig, and the breeding places off the coast of Ireland; and that, during the course of the few intervening weeks, they had, probably from a diminution or entire absence of their usual food, fallen into a condition favourable to the development of a species of entozoon—the common tapeworm, for example—which, as in the case of the grouse some years ago, would, no doubt, on dissection, be found to be the ultimate cause of death.

OCTOBER 25TH, 1859.

John Scouler, M.D., LL.D., F.L.S., President, in the chair.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited the following specimens:—

Pagurus Forbesii.—Dredged off the Cumbræ Islands.

Cuma unguiculata.—A new crustacean, from Cumbræ, and named by Mr C. Spence Bate.

Sepiola Rondeletii.—Dredged by himself off Cumbræ.

Podocerus fulcatus.—Dredged by himself off Cumbræ.

Mr Robertson also made some remarks upon the additions made to the list of crustacea found in the Firth of Clyde, for 1857, '58, and '59, enumerating 24 species, besides referring to others which were doubtful.

The subject of the recent mortality among the sea-fowl of the Firth of Clyde having been resumed at this meeting, the following facts were elicited from some of the members present who had been engaged in its investigation:—

The birds which had fallen victims to the so-called epidemic were of four species, viz., the common guillemot (*Uria troile*), the

puffin (*Mormon fratercula*), the razor-bill (*Alca torda*), and the common gull (*Larus canus*). It would, therefore, appear that the larger species of gull, and the solan goose—birds of vagrant habits, and possessing strong powers of flight, have been exempt. The razor bill was found in extraordinary numbers, being in the proportion of ten to one of the other species included in the mortality list; while the guillemot predominated over the puffin, and the species of gull referred to. They were all found much further up the Firth than usual—as if in search of food, many birds being obtained even at Renfrew, and other places, in waters at a distance from the sea. In these situations they darted eagerly at any food which came in their way, rushing at baited hooks on a hand-line, and otherwise exhibiting a tameness more like the result of starvation than the effects of disease. They were all in a wasted condition, being almost reduced to skin and feathers, and were found floating in thousands over a wide extent of sea from the mouth of the river Clyde to the Irish coasts.

PAPER READ.

On the Physiology of Reproduction. By Dr ALEXANDER LINDSAY.

NOVEMBER 29TH, 1859.

Alexander Lindsay, M.D., Vice-President, in the chair. The following gentlemen were elected members:—Messrs Roderick A. Couper, Thomas Russell, Stuart Manford, W. D. Hall, and James Carsewell.

SPECIMENS EXHIBITED.

Dr Dewar exhibited a specimen of the black-throated diver (*Colymbus arcticus*), and its eggs, from a loch in Argyleshire.

Mr David Robertson exhibited specimens of *Pagurus cuanensis*, from Cumbræ.

Dr John Grieve exhibited specimens of *Tomopteris Scolopendra*, of Eschscholtz, three of which he had obtained during the past summer, along with *Sagitta bipunctata*, and also exhibited sketches of parts of the animal. The largest was about an inch in length, and one-third of an inch at its greatest breadth, whence it gradually became narrower to the tail. The colour is a clear white, with red and orange dots scattered all over. The smallest was of

a pink hue. The anterior antennæ are very like those of a mollusc—the posterior are as long as the animal, and the basal end projects into the lobe, where it receives the insertion of a levator and depressor muscle, by which they are moved. The body shows no signs of segmentation, but there are fourteen or sixteen lateral lobes, and six undeveloped pairs of tubercles on the caudal extremity. Each lobe is divided into two lobules, which pass off more or less obliquely, so that the one is anterior to the other; and by means of these it is propelled backwards or forwards with equal velocity, as it swims with a curious wriggling motion.

PAPERS READ.

I.—*Report on the Mortality amongst the Clyde Sea-Fowl during the month of September last.* By Mr DAVID ROBERTSON.

In this paper it was shown that nothing unusual was observed among the birds until a few days after the storms in the early part of the month; and that they were then in a state bordering upon starvation, may be proved from the fact of so many hundreds—even thousands, resorting to estuaries, heedless of danger, and contrary to their usual shyness. The testimony of the fishermen of various places showed that the common dog-fish was uncommonly abundant, while the small herring-fry, and other fishes constituting the food of sea-birds, had entirely disappeared. Favouring the hypothesis of death by starvation, Mr Robertson observed that no traces of organic disease could be found on examination, and that, moreover, an epidemic does not attack indefinitely, but is confined to one species—the prominent symptoms of which, viz., disturbance of organic functions, loss of appetite, etc., being opposed to what had been observable in the birds—an empty stomach, keen appetite, heedlessness of danger to secure food, tameness, feebleness, and death occurring at the extreme point of emaciation;—in other words, the universal symptoms of hunger. The mortality, therefore, not being confined to one species, as is constantly the case in epidemic diseases, and which have been known to occur in other sections of the animal kingdom, the author of the report stated his belief that it was attributable to the extreme scarcity of food, causing an emaciation resulting in death.

The Chairman took the opportunity of saying that Mr Robertson's ingenious and apparently satisfactory explanation, might be

looked upon as a final contribution towards the elucidation of the mystery which had lately attracted so much attention.

II.—*Notes on the Larivæ of Western Scotland.*
By Mr ROBERT GRAY.

DECEMBER 27TH, 1859.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected members of the society:—Messrs James Thomson, William Thomson, John Mollison, and John Coats, M.D.

PAPER READ.

Observations on some new Fossil Crustacea from the vicinity of Glasgow.
By Dr SCOULER.

JANUARY 31ST, 1860.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected resident members of the society:—Messrs James Hamilton, Alexander Dallas, and Dr James Morton. Mr John Levack, Millport, was elected a corresponding member.

Dr Scouler read a continuation of his paper entitled, *Observations on some new Fossil Crustacea from the vicinity of Glasgow.*

FEBRUARY 28TH, 1860.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. Mr Robert Mason was elected a member of the society.

PAPER READ.

On the Dredging Features of the Bay of Rothesay and adjacent Shores.
By Dr JOHN GRIEVE.

This paper was illustrated by a large series of starfishes and Echini, etc., the result of the author's experience in the various dredging grounds referred to.

MARCH 27TH, 1860.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The Rev. James Copeland, Tana, New Hebrides, was elected a corresponding member, and Mr Alexander Murray a resident member of the society.

PAPER READ.

On the Classification of Animals. By Dr ALEXANDER LINDSAY.

APRIL 24TH, 1860.

John Scouler, M.D., LL.D., F.L.S., President, in the chair.

SPECIMENS EXHIBITED.

Professor Walker Arnot exhibited a specimen of *Hypericum Anglicum* of Bertolini, along with one of the common *Hypericum Androsæmum*, in order that the difference between them might be appreciated. His attention had been drawn to it while preparing the eighth edition of the *British Flora*, and in his own herbarium he did not possess anything that agreed with *H. Anglicum*. He had also examined the British herbarium (now in his possession), which had been amassed by the late Mr Brodie, without any trace of this species; but in another herbarium which also belongs to him, and had been collected by his late friend, Mr D. Stewart of Edinburgh, he found one specimen so perfectly accordant in every respect with the characters given, that no doubt could exist that this was the plant he was in quest of. This specimen was mixed with specimens of *H. Androsæmum*, obtained from various parts of Scotland and Wales; it bore the station, "Hills behind Greenock," but whether it had been collected there by Mr Stewart himself, or presented to him by some friend, was not mentioned on the label. As Dr Balfour met with it, about five years ago, on the banks of the Crinan Canal, it may yet be detected in other places on the West of Scotland. The foliage and general appearance are very much the same as in *H. Androsæmum*, but the flowers were pointed out to be considerably larger, and the styles, instead of being short and recurved—in fact, buried among the stamens—were flexuose, but otherwise straight, and much elongated. As a species, it appeared to Dr Walker Arnot to be quite distinct from *H. Androsæmum*, but was, perhaps, a variety of *H. Elatum*, of Aiton, with larger flowers than usual. The native

country of *H. Elatum* itself is involved in doubt; for long it was supposed to have come from North America, but it is quite unknown there in a wild state. It is therefore not improbable that *Hypericum Elatum* is a cultivated form of *H. Anglicum*. On the other hand, it remains to be proved that *H. Anglicum* is not itself an escape from cultivation, so that the attention of collectors is earnestly called to this species.

MAY 26TH, 1860.

John Scouler, M.D., LL.D., F.L.S., President, in the chair.

SPECIMENS EXHIBITED.

Dr Grieve exhibited a specimen of *Conferva Ægrophila*, from the Outer Hebrides.

PAPERS READ.

I.—*Ornithological Notes from Ardrishaig.* By Mr HENRY D. GRAHAM, Corresponding Member.

The species chiefly dwelt upon in this paper were the Great Northern Diver (*Colymbus glacialis*) and the Slavonian Grebe (*Podiceps Cornutus*), respecting the habits of which the author gave an interesting account from personal observation.

II.—*Notes on the Naked-eyed Medusæ, with some Remarks on the more interesting points of their structure and economy.*
By Dr JOHN GRIEVE.

SESSION 1860-61:

THE NINTH ANNUAL GENERAL MEETING, ANDERSON'S
UNIVERSITY BUILDINGS, SEPTEMBER 25TH, 1860.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected office-bearers for the session:— John Scouler, M.D., LL.D., F.L.S., President; John Grieve, M.D., Vice-President; Robert Gray, Secretary; Matthew P. Bell, Treasurer; Messrs Thomas Chapman, John Gray, and John Black, Members of Council. Mr G. C. Smith was elected a resident member.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited specimens of *Chordaria divaricata*, from the Cumbraes.

PAPER READ.

On the Results of a Summer's Dredging. By Dr SCOULER.

This paper was fully illustrated by numerous specimens of the objects described, among which the following species may be considered worthy of enumeration:—

FISHES.

	<i>Localities.</i>	<i>Remarks.</i>
<i>Aspidophorus Europæus</i> , . . .	Ardrishaig, . . .	<i>Rare.</i>
<i>Gobius Ruthensparri</i> , . . .	Loch Fyne.	
<i>Lepidogaster bimaculatus</i> , . . .	Oban.	
<i>Motella quinquecirrata</i> , . . .	Oban.	
<i>Morrhua minuta</i> ,	Tarbet,	<i>Rare.</i>
<i>Raniceps trifurcatus</i> ,	Loch Fyne,	<i>One specimen.</i>

CRUSTACEA.

<i>Lithodes maia</i> ,	Loch Fyne,	<i>Common.</i>
<i>Hyas coarctatus</i> ,	Oban.	
<i>Inachus Dorynchus</i> ,	Oban.	
<i>Stenorhynchus phalangium</i> ,	Oban.	
<i>Porcellana longicornis</i> ,		<i>Very common.</i>
<i>Munida Rondletii</i> ,	Loch Fyne,	<i>Common.</i>
<i>Galathea nexa</i> ,	Oban and Loch Fyne.	
<i>Idotea tricuspudata</i> ,	Kyles of Bute,	<i>Rare.</i>
<i>Cymothoa vestrum</i> ,	Kyles of Bute,	<i>Rare.</i>

OCTOBER 30TH, 1860.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected members:—Messrs Paul Cognet Bertête, William Irwin, David Bowman, James Thomson, and John Pinkerton, M.D.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited specimens of *Sagartia nivea*, and *Portunus holsatus*, both from Cumbræ; also, specimens of *Triopa clavigera* from the same locality.

PAPER READ.

On the Results of a Summer's Dredging—Part II.

By Dr SCOULER, illustrated with specimens of rare Annelids and Nereids from Oban and Loch Fyne.

NOVEMBER 27TH, 1860.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected members of the society:—Messrs John Manford, James Miller, William Couper, Joseph Campbell, and Walter Gardner.

SPECIMENS EXHIBITED.

Dr Scouler exhibited a specimen of *Labrus trimaculatus*, from the Firth of Clyde.

Mr David Robertson exhibited a curious and interesting annelid, with its case, which he had dredged off Gourock. The tube, like that of many built by allied species, was composed of fragmentary pieces of shell, adhering together by a secretion of the animal; but on close comparison, this annelid, which Mr Robertson could not in the meantime refer to any British species, appeared to have selected these materials of a particular shape—being concave on the one side, and convex on the other, and arranged longitudinally, with each piece laid so as to cover the seam or joint of the preceding layer, thereby presenting a device in which we could recognize the soundest principles of architecture, as practised by animals of superior intelligence.

PAPERS READ.

I.—*On the Anatomical Structure of the Crocodile and Alligator.*

By Dr SCOULER.

II.—*Notes on the Raptorial Birds of the West of Scotland.*

By Mr ROBERT GRAY, the Secretary.

DECEMBER 18TH, 1860.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected members of the society:—Messrs John Wilson, James Morton, and John Graham.

SPECIMEN EXHIBITED.

Mr David Robertson exhibited a specimen of *Pagurus Prideauxii*, invested with its usual parasite, *Adamsia palliata*, to illustrate the difference existing between the size of the two hands amongst many of the crustaceans, particularly the *Paguridae*, or soldier crabs—a disparity in which we recognize some purpose subservient to the wants of the animal. The hermit crabs, as Mr Robertson observed, feed principally with their small hand, and hold their prey with the greater claw, which they also employ as a support to the body, thus allowing the little hand freedom for its operations—a series of quick movements in conveying atoms to the mouth, etc. The large hand is more powerful in itself than two moderately-sized hands would be, and appears to serve the double object of procuring prey, and forming a strong door of defence to the animal in its shell.

PAPER READ.

On the Results of a Summer's Dredging—Part III.

By Dr SCOULER.

This paper, like the two previously read on the same subject, was amply illustrated by specimens, including the following molluscoïd zoophytes from Shetland:—*Retepora retiformis*, *Molgula tubulosa*, and *Cyathia rustica*.

JANUARY 29TH, 1861.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. Mr Alexander Napier and Mr William Struthers were elected resident members.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited a large specimen of *Polyporus igniarius*, from the island of Cumbrae, where it had been found by Mr Levack, of Millport, one of the society's corresponding members.

Mr Thomas Chapman exhibited a box of *Lepidoptera*, from Calabar River.

PAPER READ.

Notes on some of the Nudibranchiate Mollusca.

By Dr JOHN GRIEVE.

The author of this paper took occasion to refer to the successful researches of Mr D. Robertson, in the Firth of Clyde, amongst this interesting class of animals, and notified the occurrence of two uncommon species dredged by that gentleman off Cumbrae, viz., *Hermia bifida* and *Triopa clavigera*.

Before the close of business, it was announced that Messrs John Black and Thomas S. Hutcheson had handed to the society upwards of one hundred volumes, as a donation from themselves and other gentlemen connected with the society. The secretary having read over the catalogue, the thanks of the society were tendered to Messrs Black and Hutcheson for their special efforts to secure the establishment of a library.

 FEBRUARY 26TH, 1861.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. Mr James Ramsay was elected a member of the society.

SPECIMEN EXHIBITED.

Mr D. Robertson exhibited an unusually large specimen of *Hyas Couretatus*, taken at Cumbrae.

PAPER READ.

On the Organography of Animals. By Dr SCOULER.

The Secretary announced the following donation to the library:—"Genera of British Moths." By H. Noel Humphreys. Presented by Dr Hugh Colquhoun.

 MARCH 26TH, 1861.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. Messrs Alexander M'Kinlay and William Sinclair were elected members of the society.

SPECIMENS EXHIBITED.

Dr Grieve exhibited a specimen of *Trifolium elegans*, found in the month of July last in a corn-field at Blairmore, Argyleshire. It had probably been imported with the seed, as it is not regarded as a British plant, being a native of the South of Europe.

Mr David Robertson exhibited a specimen of *Oniscodu maculosa*, from the Cumbræ Islands; the species being an addition to the list of crustacea found in that locality.

PAPER READ.

An account of Ailsa Craig and its Birds, from personal observation.

By Mr ROBERT GRAY, the Secretary.

APRIL 30TH, 1861.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. Mr Alexander Malcolm was elected a member of the society.

SPECIMEN EXHIBITED.

Dr Dewar exhibited a specimen of the Egyptian goose (*Anser Ægyptiacus*), which was recently shot on Loch Lomond. Five of these birds had been observed in a flock, apparently wild, and two of them were killed.

MAY 28TH, 1861.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. Messrs John Shaw and James Martin were elected members of the society.

SESSION 1861-62.

THE TENTH ANNUAL GENERAL MEETING, ANDERSON'S
UNIVERSITY BUILDINGS, SEPTEMBER 24TH, 1861.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected office-bearers for the session:—John Scouler, M.D., LL.D., F.L.S., President; Mr John Gray, Vice-President; Mr Robert Gray, Secretary; Mr Thomas Chapman, Treasurer; Mr Thomas S. Hutcheson, Librarian; Messrs James Ramsay, John Knox, and James P. Fraser, Members of Council.

OCTOBER 29TH, 1861.

John Scouler, M.D., LL.D., F.L.S., President, in the chair.

PAPER READ.

Notes on the Common Starling (Sturnus Vulgaris).

By Mr ROBERT GRAY, the Secretary.

In this paper it was shown that, from being a comparatively rare bird in many parts of Scotland, the starling had, in the course of the last twenty years, been gradually increasing, until in some localities it was now found in great abundance. This was in some measure accounted for by the wide-spread protection now given to the bird, especially in the vicinity of large towns, where it had become a recognized favourite. As one result of this undue protection, however, Mr Gray mentioned that starlings had become destructive to the skylark, and other birds building on the ground, the nests of which were rifled of their contents, even when the eggs were newly hatched, as had been repeatedly witnessed by trustworthy observers. The author of the paper likewise alluded to the myotherine habits of the starling. In frequent instances, especially in sultry weather, he had observed hundreds of these birds hawking for flies perseveringly for half an hour at a time without alighting, and snapping at their prey in the air in the same way as swallows.

NOVEMBER 26TH, 1861.

Mr J. Gray, Vice-President, in the chair.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited specimens of *Anomia Ephippium*, on which he remarked that many of the margins of the lower valves of this shell are turned up and lined by nacre, the same as the under surface; and that, frequently, this turned-up portion is laid closely down, as if done by pressure. But as this hole necessarily increases with the tooth that passes through it, Mr Robertson stated that he was not aware of any mention having been made of the process by which the widening of the hole takes place—whether by softening, absorbing, or by the friction of the increasing tooth; and he therefore appealed to the members in the hope of eliciting information on this question.

PAPER READ.

Investigations into the Distribution of the Algae of the Firth of Clyde.

By Dr JOHN GRIEVE and Mr DAVID ROBERTSON.

The result of an examination of the piers at Millport, Largs, Wemyss Bay, and Skelmorlie, appears in the following table:—

At Millport there were found,	. . . . .	19 genera and 26 species.
At Largs,	. . . . .	16 genera and 23 species.
At Skelmorlie,	. . . . .	12 genera and 18 species;
And at Wemyss Bay,	. . . . .	10 genera and 14 species;

thus showing a gradual decrease as the Firth becomes narrower.

JANUARY 7TH, 1862.

Mr J. Gray, Vice-President, in the chair. William Parker, M.D., Ningpo, was elected a corresponding member, and John Stuart Gentle, M.D., a resident member of the society.

SPECIMENS EXHIBITED.

Mr Thomas Chapman exhibited a small collection of North American *Lepidoptera*, chiefly *Bombyces*, which had been reared in this country, having been sent to Glasgow in the pupa state.

PAPERS READ.

I.—*The Limitation of the Area of Organic Beings from Cold.*

By Dr SCOUER.

II.—*Researches on the Ayrshire Coast—Irvine, Ayr, and Girvan.*
By Mr DAVID ROBERTSON.

This paper was illustrated by a series of beautifully-prepared specimens of algæ, and other marine objects described in it.

JANUARY 28TH, 1862.

John Scouler, M.D., LL.D., F.L.S., President, in the chair.

A communication from Mr Keddie, Secretary to the Philosophical Society of Glasgow, was read, submitting a proposal that a joint address of condolence to the Queen on the death of the Prince Consort, be presented by the various scientific societies of the city, and requesting the co-operation of the Natural History Society, by sending delegates to the general meeting of representatives, for the purpose of appointing a committee for the preparation of the address. It was therefore agreed to adopt the recommendation of the council—that Dr Scouler, Mr Robert Gray, and Mr Thomas Chapman, should attend the said meeting, and a notification be sent to Mr Keddie accordingly.

SPECIMENS EXHIBITED.

Mr James Hamilton exhibited two specimens, male and female, of Stellers' western duck (*Sonateria Stellerii*), a rare and interesting species obtained from North America. A specimen of this bird, killed in Denmark, was, at the time Mr Selby wrote his History of British Birds, considered the only one on record; and although it has since been occasionally found in Northern Europe and on the northern coast of America, collectors have still the greatest difficulty in furnishing their cabinets with a specimen. Mr Hamilton also exhibited the eggs of the following birds:—Egyptian vulture, honey buzzard, rough-legged buzzard, woodcock, Caspian tern, Sandwich tern, and fulmar petrel.

PAPERS READ.

I.—*On the Limitation of the Area of Organic Beings from Cold.*
By Mr ALEXANDER SUTHERLAND, being a reconsideration of Dr Scouler's paper on that subject.

II.—*On the Orthotricha of the Valley of the Girvan.*
By Mr JOHN SHAW, of the Free Normal Seminary.

The author described the above locality as a deep valley, well wooded, and of a south-west exposure—facts accounting for the humidity of its atmosphere—the valley, on summer evenings, being steeped in the bosom of dense fogs, having an important effect on vegetation. Nowhere are there seen larger trees and more luxuriant woods. Lichens, in endless profusion, cover wall, shrub, and tree, and fungi abound in every brake. The mosses are magnificent in size and strength; and the orchids, and other plants which delight in a moist soil, are everywhere in abundance. Of 28 British species, 19 are to be found in the parish of Dailly alone: of these, one is new—*Orthotrichum Shawii*—and two are new to Britain—*O. Sturmii* and *O. patens*—these having been confirmed by Professor Schimper, Mr Wilson, and Dr Wood, well-known authorities on the subject. In speaking, therefore, of this region of moss-covered trees, it may well be called the metropolis of the Orthotricha. After taking a general survey of the various species, from which it appeared that some of those accounted the rarest are found at Dailly in considerable abundance, Mr Shaw concluded by observing that great difficulties beset the student of this intricate genus, and that it is only after long experience many of the so-called species can be satisfactorily determined.

FEBRUARY 25TH, 1862.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected resident members:—William Leishman, M.D., A. K. Irvine, M.D., and Mr Alexander McDonald.

SPECIMENS EXHIBITED.

Dr Alexander Lindsay exhibited a small but carefully-prepared collection of serpents, and a species of mantis, from Trinidad; also, an unusually large specimen of *Arcturus longicornis*, procured from deep water off Cumbræ, by Mr David Robertson, and measuring in length two inches and a-half, the ordinary dimensions being rather less than an inch.

Mr James Hamilton exhibited fine examples of the following rare European birds, specimens of which have already been recorded as having been found in the British islands:—Surf scoter (*Edemia perspicillata*), spotted sandpiper (*Totanus macularia*), belted kingfisher (*Alcedo alcyon*), and the three-toed woodpecker (*Picus*

tridactylus). He likewise laid on the table the eggs of the purple sandpiper, avocet, turnstone, black tern, Baillon's crake, and little owl.

PAPER READ.

On the Distribution of the Vascular Plants of Britain, more particularly those of the East and West of Scotland. By MR JAMES RAMSAY.

I fear the following remarks, which are more suggestive than instructive, will prove anything but interesting, as I have confined myself almost entirely to an enumeration of facts, for the simple reason, that I find myself wholly unable to account satisfactorily for the distribution of the majority of the species I have mentioned.

The physical laws that regulate the distribution of plants over such a limited area as that of the British Islands, are in many instances easily understood, but they are as frequently involved in great obscurity. Observation has taught us that plants will increase only when growing under conditions that are favourable to them; and when these conditions are local in their character, they account in a satisfactory manner for the extremely limited distribution of some species. The character of the vegetation on the lofty range of the Grampians, compared with that of the fertile valleys of the lowlands, is not greater than we might reasonably expect, and the mind is satisfied that elevation and other concomitant circumstances sufficiently account for all the differences existing in the natural productions of localities marked with such strong features of contrast. The variety of climate, resulting from the few degrees of latitude that intervene between the northern and southern extremities of our island, also afford a satisfactory solution of the problem why certain species are found in the north and not in the south, and *vice versa*. But besides these there are a good many species confined to one or a few localities at most, the unequal distribution of which cannot always be satisfactorily accounted for, either by difference of soil, climate, elevation, or exposure. The number of species that abound in East Lothian, for instance, and rarely, if at all, to be met with in Ayrshire, is very great, if we consider how closely the one locality resembles the other in most of the conditions that we would suppose necessary to the production of a similarity of vegetation. Climate appears to be the most powerful, if not the only influence, in determining the habitat of such plants as *Sibthorpia Europea*,

Arbutus Unedo, *Erica ciliaris*, *Trichomanes radicans*, *Gymnogramma leptophylla*, etc. These are found with us only in the south and south-west of England and Ireland, and as they are all natives of the warmer parts of continental Europe, they may be regarded as having reached their utmost northern limit in the southern parts of Britain. On the other hand, *Linum borealis*, and the beautiful little *Primula Scotica*, both denizens of a colder climate, appear to have reached their southern limit in the northern half of Scotland. There are others, such as the orchids of the chalk counties, the distribution of which appears to be regulated wholly by the nature of the soil. *Digitalis purpurea* furnishes us with a more common illustration of the influence of soil in determining the habitat of a species. It abounds on all the trap-hills of Scotland, but entirely disappears wherever the substratum is composed of limestone. Proximity to the sea appears to be a powerful element in regulating the distribution of a large number of plants. *Gluux maritima*, *Salsola Kali*, *Brassica monensis*, *Calystegia Sollandella*, *Eryngium maritimum*, and many more, may be looked for in vain anywhere else than in the immediate neighbourhood of the sea. *Armeria maritima*, *Cochlearia officinalis*, etc., likewise grow abundantly on our shores, but they entirely disappear a few yards beyond high water mark, and, strange to say, make their appearance again on the tops of our highest mountains—as Benlawers, for instance, a locality as far removed from the sea as any within the bounds of Scotland. Is it not possible they may be more under the saline influence of the ocean, on the mountain tops, than they would be anywhere else, except on the shore? The mountains, too, have their own peculiar flora. *Saxifraga cernua*, *nivalis*, *stellaris*, *oppositifolia*, *Veronica saxatilis*, *Alchemilla alpina*, etc., etc., never descend from their elevated position of their accord; yet they all bear transplanting well, and will flourish in any garden without the least care being bestowed on them. The distribution of all these—and many more might be added—is pretty satisfactorily accounted for, either by soil, climate, exposure, or elevation, with the exception of the few anomalous sea-side species that are likewise to be met with on the mountain tops. There are others, however, the distribution of which can be satisfactorily explained neither on the principle of latitude, temperature, climate, or soil, but which appear to depend on some other law or laws not easily to be perceived or understood. *Scandix Pecten-*

veneris and *Hordeum murinum* are both common plants in England; the former an annual weed in every corn-field, the latter a wayside grass. How does it happen that both of these plants penetrate into Scotland on the east coast and not on the west? Latitude would appear to have nothing to do with it, for the small difference that is between the latitude of Ayrshire and East Lothian is in favour of the former, and the climate of the west coast is milder than that of the east, the cold east winds being neither so frequent nor so severe. All these taken together, should, one would think, be in favour of such plants penetrating farther north on the west than on the east side of our island; but the very reverse is the truth. Can it be possible that these plants, having nearly reached their utmost northern limit, are arrested in their farther progress by such apparently trifling impediments as the Solway on the one side and the Forth on the other? *Hordeum murinum* is not found in Ayrshire, although it is common all along the south side of the Firth of Forth, and forms a large proportion of the vegetation on the Calton Hill at Edinburgh, which appears to be about its northern limit in the east. We are almost forced to believe that these two arms of the sea, penetrating into the very centre of the island—one on the east, and the other on the west—form a sufficient barrier to prevent their farther progress northward. *Malva Sylvestris*, *Knautia arvensis*, *Silene inflata*, etc., all abound in the Lothians, but occur only sporadically in the west, and other species of the genus *Silene*, as *nutans*, *noctiflora*, and *conica*, are, as regards Scotland, confined to East Lothian alone. *Carduus tenuiflorus* abounds along the Firth of Forth, but you will look for it in vain along the Firth of Clyde. As a set-off against this, we have *Cotyledon Umbilicus* plentiful on the shores of the Clyde, but wholly unknown in the east. Why does this plant abound on Ailsa Craig, while it is not to be found on the Bass? Why does it frequent every crevice in the cliffs of Culzean, and yet refuses to grow on the cliffs of Tantallan? These are questions much easier asked than answered. An eastern exposure will not account for it, because it is common enough on the east coast of Ireland. Again, in the east every wheat-field is gay with *Papaver Rhæas*, a species all but unknown in the west, where its place is usurped by a nearly allied species, *P. dubium*, which is as rare in the east as the other is in the west. I have been astonished, when in the Lothians, where so much care is bestowed in keeping the fields clear of

useless and noxious weeds, to find almost every oat-field sprinkled round the border with *Avena fatua*, a plant that I have never seen in the west, except in a poor, ill-cultivated patch of oats in Arran. The eastern counties rejoice in the presence of *Centaurea Cyanus*, which, in the west, never gladdens the eye with its bright blue blossoms, unless from the flower-plot of the cottage garden. To balance this we have in the west *Chrysanthemum segetum*, a plant that I never observed in the east but once, and that was as an ornament in a garden at North Berwick. The Lothian farmers say that *Chrysanthemum segetum* abounded in their fields at one time, and they boast that they extirpated it by high farming; but how does it happen that they have been so successful with this pest, while the *Papaver* and *Centaurea* still defy them? *Papaver*, *Chrysanthemum*, and *Centaurea*, are essentially corn-field genera; and when we consider the frequent transportation of seed corn from one side of the island to the other, we are astonished that the plants of the one district make their appearance so seldom in the other. In reality they do appear here and there every season, but they fail in effecting a permanent settlement, a sure proof that there are causes at work which we, as yet, have been unable to detect, and telling us plainly that we have much to learn before we can understand those physical laws that regulate the distribution of species over such a limited area of the earth's surface as that comprehended within our own little island.

MARCH 25TH, 1862.

Mr John Gray, Vice-President, in the chair.

SPECIMENS EXHIBITED.

The Secretary exhibited a specimen of *Megalophus regius* (the Royal Great Crest of Swainson), an inhabitant of Guiana and north of Brazil, accompanied by a beautifully executed drawing of the bird, in an attitude of life, by Mr Wm. Sinclair. This specimen, it was observed, was possessed of an unusually fine crest, besides being in other respects a desirable example of a rare species, respecting the habits of which nothing appears to be known. There were also exhibited two other birds, natives of Brazil, not of common occurrence, namely, *Agelaius striata* (figured in the "Zoology of the Beagle" as *Tanagra Darwinii*), and

Phibalura flavirostris, a very curious species allied to the swallows, cotingas, and tyrant fly-catchers.

Dr Alexander Lindsay exhibited some specimens of gold from the gold-fields of Otago, and a cranium of the four-horned antelope (*Tetracerus quadricornis*) from Guzerat.

Some nardoo seeds, from the interior of Australia, were exhibited by Mr Gray, to whom they were forwarded by a correspondent as possessing an interest, on account of their having been almost the sole subsistence of Messrs Burke and Wills and their party during their perilous and unfortunate exploring expedition.

Dr D. Dewar exhibited a large specimen of the marten cat (*Martes foina*) which had been killed near the banks of Loch Lomond.

Mr Thomas Chapman laid on the table for the inspection of the members two boxes of lepidopterous insects, chiefly obtained by himself around the shores of Loch Lomond. The collection embraced specimens of the following moths, all regarded as scarce species in Scotland:—*Penthina praelongana*, *P. ochromelani*, *Ceropacha or*, *Notodontia camelina*, *N. dromedaria*, *N. dictwa*, *N. dictwoides*.

PAPERS READ.

I.—*On the Marine Zoology and Botany of Loch Ryan, Bay of Luce, and Portpatrick, from observations made during a recent excursion.*
By Dr JOHN GRIEVE and Mr DAVID ROBERTSON.

Having made an excursion for a few days to Loch Ryan, in the beginning of November, 1861, a short account of observations made on the shores of the loch, and on the oyster fishery, was submitted to the society, from which the following abstract has been made:—

Loch Ryan, like many of our Scottish valleys, belongs to the N.W.—S.E. system, and lies nearly due north and south. Its length is between eight and nine miles, and its breadth varies from two to five. At the mouth it is three miles across, with a depth of from 4 to 5 fathoms of water; the general depth over the oyster ground is 8 fathoms.

Steep precipitous cliffs guard the entrance—those on the northern shore extending round to Ballantrae. In the high rocky promontory on the south are a number of caves, tenanted by the rock-dove, and in which the *Asplenium marinum* grows to a large size. At the base of these cliffs the shores are rocky, with numerous

boulders lying around, piled here, and scattered there, where left by the last storm which rolled them. For seven or eight miles up the loch the shore on either side is flat, and sandy, or gravelly, with numerous winding bays. On the west shore, at Kirkcolm, there is a long, narrow, shelving bank of sand, called the Scaur, running obliquely into the loch about a mile, and not entirely covered by the sea at spring-tides. Between the point of the Scaur and the opposite shore is the narrowest part. Looking down from Stranraer at the head, Ailsa Craig in the distance appears almost to block up the precipitous portals and shut in the loch.

One day was devoted to the eastern shore, and two to the western—at least, so long as the short hours of November afforded light, while the tide was by no means favourable, it being low water from 4-30 to 7-30—too early in the morning, and too late in the afternoon to permit of objects being distinctly visible; consequently, there was no opportunity of examining the shores beyond half tide, and our collections chiefly consisted of specimens floated in or washed ashore.

I.—MARINE ALGÆ.

The effect which a slight change of locality produces on their distribution was brought very prominently into notice on our first walk along the shore.

Laurencia obtusa, a plant hitherto unknown to us in the upper waters of the Firth of Clyde, was found in very great abundance floating in or washed upon the beach; hardly a piece of *Fucus serratus* was seen without more or less of this species growing upon it. When fresh, it is of a dark purple colour, which is apparently very soon lost on exposure to the light, assuming a pretty orange tint, which gradually fades into yellow and white as the bleaching process goes on. All the specimens we observed on the shore had been washed in; for, though very abundant on *Fucus serratus*, it was more rarely observed on *F. vesiculosus*—a plant growing at a higher level, and, at the same time, less common in the loch than *F. serratus*. It was also seen attached to stones, and most abundant on the oyster bed; hardly a shell came up without being ornamented with tufts of it. It was not so common at Kirkcolm, near the mouth of the loch, nor on the eastern shore—but this may have arisen solely from the strong north-easterly wind drifting all the

plants across to pile them up on the western shore. It is probable that this *Laurencia* is pre-eminently a Loch Ryan plant, growing in great abundance in the upper part; and though generally distributed on other shores, appears to be very rare on the Clyde.

On the small boulders, at half-tide level, *Porphyra vulgaris* and *P. luciniata* were very abundant, with tufts of *Euteromorpha ramulosa*, *Lipobyte majuscula*, and *Ectocarpus siliculosus*. Among the red plants floated in were *Ceramium rubrum*, *Callithamnion corymbosum*, *Delesseria alata*, and *Polysiphonia violacea*. On some stones and oyster shells *Gracillaria confervoides*, and *Chorda filum* were growing.

Great quantities of *Furcellaria fastigiata* were strewn on the beach, and presenting so many different forms, both in the young and full grown state, that we examined it carefully, in the hope of finding *Polyides rotundus*, but without success. These plants were frequently infested with *Sphacelaria nodosa*; those of the same size exhibited considerable difference in the thickness of the stem and branches—the stout stems of some contrasting remarkably with the slender forms of others. Along with these, the gale had washed ashore masses of *Chorda filum*, *Fuci*, and *Zostera*. The latter formed extensive meadows at the head of the loch, affording a rich harvest to the farmers, who were busily removing it from the beach.

The Scaur, which runs for a mile into the loch at Kirkecolm, forms an extensive bay on its southern shore, and here the *Zostera* was also piled up, while on the northern, or seaward side, the ordinary *Fuci*, and other algæ were washed ashore, so that either side of this spit presented quite a different aspect. In one spot, a great quantity of the little bladders of *F. vesiculosus* lay in a heap, just as if they had been hand-picked.

F. nodosus not being very common, *Polysiphonia fastigiata* was equally rare.

The absence of the common *Laminaria saccharina* was also striking—so far as we remember, not one plant having been observed. *Gigartina mammillosa*, *Desmarestia aculeata*, and *Chondrus crispus*—the latter large, and finely divided—were not uncommon.

On the pier at Stranraer, an old friend, previously found on the piles of several of the Clyde piers, *Ectocarpus crinitus* occurred; it was also got on the pier at Stairhaven, in the Bay of Luce.

At the head of the loch great masses of *Phyllophoru rubens* were washed ashore, and it was afterwards found growing abundantly on the oyster shells.

Rhodymenia bifida, in small quantity, *Rhodomela lycopodioides*, *Polysiphonia elongata*, in very robust condition, and *Halysiris siliquosa*, were also floated in. *Fucus ceramoides* was growing where a small burn entered at the head of the loch. The shore at this end was abundantly covered with *Enteromorpha compressa*, with tufts of *E. ramulosa*, *E. intestinalis*, *Ulva latissima*, and *U. Linza*.

Another rare plant, growing on an oyster shell, and also floated in, was *Spyridia filamentosa*. Professor Harvey says of this plant, that it is "interesting in a geographical view, being a native of warm latitudes, and reaching to its northern limit in this country. Until very recently, when Mr Ralfs discovered it on the Welsh coast, it had only been found in Britain, on the extreme southern shores." Its occurrence in Loch Ryan brings it still farther north. The uniform depth of the loch, its comparative shelter from storms, and other circumstances, may render it a suitable habitat for the growth of similar species of Algæ.

This slight examination of the shores would go far to prove that the loch would be well worthy of more exact and careful research at low water, and at more favourable seasons of the year.

II.—MARINE MOLLUSCA.

Loch Ryan is stated to be the only habitat in Scotland where *Tapes aurea* is found in any abundance. It is somewhat singular that all along the western shore of the loch this shell should be generally distributed—water-worn specimens lying scattered around in all directions; while on the eastern shore, on the other hand, it is comparatively rare, and *Tapes decussata* there takes its place. This may perhaps arise from the nature of the bottom on either side being more suitable for the one than the other. At all events, for one specimen of *T. aurea*, on the eastern shore, twenty of *T. decussata* may be picked up; while on the western, again, twenty of *T. aurea* may be collected for one of *T. decussata*. *Psammobia vespertina* is by no means uncommon. *Pecten varius* is very plentiful, and much diversified in colour; purple, orange, speckled, banded, and pure white specimens were observed. The living examples of this mollusc which came up in the dredge were constantly attached to some substance by their *byssus*. In Cumbrae we have not found them to be so uniformly attached.

Anomia ephippium, the lady-oyster of the dredgers, is brought up in quantities at every haul of the dredge, only to be thrown

overboard with other rubbish. They are not uncommon on the oyster shells. While generally moulded on the object to which they are attached, and similar in form, yet when adherent to small stones, or the edge of a stone, many have the upper valve most beautifully curved over at the edge, and often grooved and ribbed. The inner surface is brilliantly iridescent, as is conspicuously displayed in the numerous valves strewn on the beach. Many are also met with which appear to have become separated from the early object of their attachment, and, having been tossed about in many ups and downs, want the grace and elegance of those which have been well settled in life. In such, the perforation in the under valve is usually closed by a small scale of slate or stone.

The following list of shells collected by us contains 45 species. To these we are able to add 6 from a list kindly drawn out by the Rev. A. Urquhart, Portpatrick. We have marked all his species with an asterisk:—

- **Pholas candida*, . . . Very abundant, West shore.
- **Mya truncata*, . . . Common, . . East and West shores.
- *arenaria*, . . . Not uncommon, East most abundant.
- Solen ensis*.
- *siliqua*.
- **Psammobia vespertina*, . Common, . . West shore.
- **Tellina solidula*, . . . Not uncommon, ”
- **Maetra subtruncata*, . Common, . Abundant at Kirkcolm.
- *solida*, . . . ”
- **Tapes aurea*, ” . . West, abundant.
- * — *decussata*, ” . . East, abundant.
- * — *pullastra*, ”
- Artemis exoleta*, Kirkcolm.
- *lincta*.
- **Venus striatula*, . . . Not uncommon.
- **Cardium edule*, . . . Common, . . East, abundant.
- *echinatum*, Kirkcolm.
- *Norvegicum*, ”
- *pygmaeum*, Dredged.
- Pectunculus glycymeris*, ”
- **Modiola Modiolus*, . . Common.
- **Mytilus edulis*, ” . Head of loch, abundant.
- Crenella marmorta*, . . Abundant in *Ascidia mentula*.
- **Pecten maximus*, . . Rare.

- **Pecten opercularis*, . . . Common.
 * — *varius*, Frequent on oyster beds.
 **Anomia ephippium*, " "
 **Ostrea edulis*, Abundant.
 **Chiton fascicularis*, Rare.
Patella vulgata, Abundant.
Trochus magus, Finely coloured.
 * — *cinerarius*, Abundant on oyster beds, and small.
 * — *umbilicatus*, Common.
 * — *zizyphinus*, "
 — *tumidus*.
 **Littorina littoralis*, Common.
 * — *littorea*, "
 * — *rudis*, "
 **Turritella communis*, "
Natica nitida.
 **Purpura lapillus*.
Nassa reticulata.
 **Buccinum undatum*.
 **Fusus antiquus*.
 * — *Islandicus*.

The following are the six referred to:—

- **Diodonta fragilis*, Rare.
 **Tapes virginea*, Not uncommon.
 **Lucina borealis*, Rare.
 **Acmaea testudinalis*, Common.
 **Cerithium reticulatum*, Common.
 **Chiton marmoreus*, Rare.

In the Statistical Account of the parish of Kirkecolm, 24 of these species are named, along with the 5 following, not found by us:—

- Psammobea Ferroensis*.
Lutraria elliptica.
Littorina neritoides.
Aporrhais pes-pellicani.
Bulla lignaria.

III.—THE OYSTER FISHERY.

The oyster (*Ostrea edulis*) is by no means uncommon on the shores of our Firth, and may be found almost everywhere attached to the rocks about the low-water mark of spring tides. Usually a

single one here and there, sometimes of a large size, is seen; but in several situations more favourable to their growth in early life—as in Loch Goil, Loch Long, the Kyles of Bute, and Bulloch bay in Cumbræ,—they are found in small quantities attached to the rocks by the under valve, sometimes by its entire surface, where they attain a great age, as may be supposed from the thickness of the shells. While so far commonly distributed, the quantity is yet small, and the nature of the bottom, and, perhaps, of the currents, such as to prevent their increase to an extent that would repay the trouble of collecting them. Loch Ryan is the only loch in the West of Scotland where they are found in any abundance, and there oyster dredging is regularly prosecuted for the supply of the market.

Whether they are found on the rocks at low water, we are not in a position to say; but on the dredging ground, which is formed chiefly of small stones and gravel, they almost always occur perfectly free and isolated. Not unfrequently they are brought up adhering to each other in groups of three or four on some old *Buccinum* or *Fusus*, but very rarely are they attached to gravel or stones. They present no marks or scars of any adhesion which might have taken place in early life, and from which they had somehow been subsequently separated. Whether the shifting character of the small stones and gravel prevents the young fry from settling down to adhere, the currents must be such as to prevent them all being swept out of the loch to sea. It does not seem likely that they could voluntarily detach themselves like other byssiferous mollusks. On the gravel of the spit running out to the perch off Inellan we have picked up a few also quite unattached.

Oyster dredging is carried on from the first of September to the first of May. During the close time, spawning takes place, and the young fry are not disturbed. The chief beds begin about three or four miles down the loch, and extend across its entire area. At special times particular localities are prohibited, and each day the boats change their ground, so that the loch is equally dredged throughout. The oyster fleet consisted of 17 boats, each with four men, who were paid by the hundred of oysters. The number of boats varies with the supply dredged. They are also restricted to a size, and being large and heavy, require a main-sail and jib, so that a steady breeze is necessary for a successful fishing.

The loch being well sheltered, they are able to work in almost any weather. In November they went out about 7 A.M. and returned at sunset.

The dredge used is the old form, with the scraper on one side only, forming a triangle with the two side arms, which are connected by a ring for the rope. The under side of the bag is made of iron rings, all joined together, and attached to the scraper, and the upper side of corded network; its edge, however, is free, with corks placed at a small distance apart to keep the mouth of the bag open.

The stern being clear, the boat is put before the wind, and the dredge thrown over. After a run for some distance, she is brought to, and it is hauled up. The side arms are used as a lever, and the scraper tilted upon the gunwale, when the contents are emptied into the stern. After one or two hauls, the oysters are picked out from the rubbish, and thrown into the centre of the boat and sorted—the practised eye of the dredger at once recognising all that will not pass through the gauge. This is a two inch ring, and such as pass longways through it are returned to the water till they attain a more respectable size. All the crabs, anomias, shells, etc., go overboard with the stones and gravel, under the name of rubbish.

On returning to Stranraer, the inspector takes a look that none are below the minimum size, and fines are inflicted if such is the case. The oysters are then counted into baskets, get one farewell dip in the loch, and are hauled up to the pier, where they are emptied into barrels (1000 per barrel), and transmitted by railway and steamboat to the market.

The largest are obtained on the East, or Cairnryan side, but the most fertile ground is above the Scaur at Kirkcolm. Much larger oysters are obtained at Drummore, near the Mull of Galloway. The average breadth of a full-grown four-year-old oyster is four inches, and up to that age the animal growth is readily seen. The shell then begins to increase in thickness as well as size, and its age thereafter can only be approximated.

The rubbish brought up by the dredge consisted chiefly of stones of small size, and very seldom of gravel, or sand, or mud; the bottom therefore seemed to be tolerably smooth and firm. The great mass of sea-weed was *Laurencia obtusa*, variously attached to shells, stones, and other algae. *Fucus serratus* and

Chorda filum were not unfrequent, with occasional tufts of *Ceramium rubrum*.

In a bucket of the rubbish dredged on the west side of the loch we found few *Echinoderms*, or Zoophytes, only two star-fishes (*Uraster violacea* and *Cribella oculata*), one heart urchin (*Amphidotus cordatus*). The only Crustacea were the spider crabs, *Inachus Dorsettensis* and *Stenorhynchus phalangium*, and numbers of *Portunus arcuatus* and *Pagurus Bernhardus*. In a bucket off the Cairnryan side we found *Echinus sphaera* and *Solaster papposu*; and in addition to the crabs mentioned we obtained some large *Hyas araneus*. The zoophytes were *Flustra foliacea*, *F. truncata*, *Sertularia abietina*, *Gemellaria loriculata*, and *Antennularia ramosa*, of a reddish colour, with the horny egg-case of the spotted dog-fish (*Scyllium canicula*) attached to it. The only fish that had come up in the dredge was the armed bull-head or sea-poacher (*Aspidophorus Europeanus*). On the eastern shore we observed several large fishing-frogs (*Lophius piscatorius*) over four feet in length.

The *Anomus*, as already stated, were very abundant, *Pecten varius* of many colours, and *Trochus cinerarius* also; *Cardium pygmaeum* and *Turritella communis*.

Ascidia mentula was very abundant, and the tunic studded with *Crenella marmorata*. Another species, probably *Molgula tubulosa*, free and unattached, with the tunic covered with small pieces of shell and sand, also occurred. Such was the result of one or two examinations of dredgers' rubbish. With more time at our disposal, and more favourable weather, a larger list would easily have been made out.

No attempt has been made to increase the number of oysters by artificial culture. With the fishery in the hands of a single proprietor, Loch Ryan is well adapted for carrying out such a scheme; and if attended with that measure of success one would naturally expect, the benefits resulting therefrom would certainly be very great. Oyster culture might not be so easily carried out in the upper waters of the Firth, where there are so many small feuars attaching a right to everything that comes out of the sea; still, in the less frequented lochs of the west coast, there are doubtless many places where the experiment could be favourably made, and the supply of this nutritious shell-fish maintained when other natural banks have been exhausted. It is to be hoped that the success of oyster culture in France and England will be such as to

induce shore proprietors to lay down oyster beds and nurseries, and that not many years will elapse before real natives, raised on our own shores, appear in the market.

IV.—BAY OF LUCE.

Taking the train to Glenluce, situated about a mile from the head of the bay on the eastern side, we spent a few hours on the sands walking to Stairhaven, about two miles down on that shore.

The head of the bay embraces a sweep of perhaps five miles, presenting an extensive tract of sandy dunes, which appeared to extend along the western side. The river Luce enters at the eastern angle. Rocky and precipitous cliffs, with intervening bays, form the boundary on that side.

Crossing the shingly margin at the base of the rocks, we got on to the sands, from which the tide had receded to about half-ebb. When nearly opposite to the headland which opens out the curve in which Stairhaven is situated, we observed what seemed to be a low, flat reef of barnacle-covered rocks, enclosing numerous pools. At the base of this cliff, which rises nearly perpendicular, the upper margin of the barnacles was eight feet above the shore at the bottom, so that at high water the tide must cover this reef to a depth of eight or ten feet.

This reef was raised from six inches to a foot. On getting out to it we were surprised to find no barnacles, but a honey-comb looking surface on the sand. On breaking off a piece, it consisted of a mass of sand-tubes filled with annelids, and the reef, in fact, was one great colony.—A mass of sand, closely agglutinated together, surrounding and enclosing the boulders, and firm to walk upon, except where rock-pools or sand-pools at the base of boulders had been nearly filled up, and a treacherous hollow left below into which one's foot went down. In these pools the sand tubes were curved upwards from the margin, so that the surface became broader, and would gradually fill up the pool, leaving a conical hollow below. Around the orifice of each tube there is a finer and wider margin with a curved outline, which gives the honey-comb appearance to the surface of the sand. Perhaps this cup-shaped margin serves to collect the loose grains of sand washed over them, and which the annelid, stretching itself out of the tube by means of its bristles, lays hold of, and builds into the new margin, and so increases the height of

the mass of sand. The margin is quite thin and easily broken, crushing under the foot. On such an exposed position one would suppose them to be often buried, from the shifting nature of all sandy bottoms, but there was no appearance of any recent calamity, the margins of the tubes being all quite perfect. This annelid is the *Subellaria alveolata*. It is nearly allied to the *Pectinaria Belgica*, commonly found on our sandy coasts, each individual of which lives in a single tube formed of grains of sand—a self-contained marine villa. *Subellaria*, on the contrary, forms a colony of greater or less extent, each individual tube being joined to its neighbour, and so forming an extensive terrace, with fine crescents of self-contained houses. Each annelid has a double plume of golden-coloured bristles, and when, again covered by the advancing tide, each looks out at its own door, the reef must present a scene of great beauty, from the metallic brilliancy of their coronets.

This reef, in extent about 50 × 20 feet, interested us exceedingly. The *Subellaria* we had not previously seen, and so vast a multitude our reading had not led us to expect. But on rounding the headland, and finding that for half-a-mile the whole shore was tenanted by them, and the loose boulders, which became more numerous as we receded from the precipitous point towards the pier at Stairhaven, were all filled up by the sand driven among them, and, though worn into numerous pools, completely cemented and bound together by these annelids, our admiration was still more excited. It was a sand reef, formed by annelids, analogous, so far, to a coral reef formed by zoophytes, yet, of course, differing as to formation, the coral, or carbonate of lime, being secreted by the zoophyte, while the free shifting sand is only agglutinated by the sabellaria. When the animals are dead, and the sand becomes dry, we have found it very friable. Allotting four individuals to every square inch, some idea may be formed of the immense multitude in the half-mile over which we walked.

The following list of mollusca, found in the Bay of Luce, was furnished by the Rev. A. Urquhart, Portpatrick. A † is affixed to those obtained by us:—

Mya truncata,	Not uncommon.
† — arenaria,	„
Ceratisolen legumen,	Rare.
+Solen siliqua,	Common.
† — ensis,	„ ×

Donax trunculus,	Very abundant.
Diodonta fragilis,	”
Tellina fabula,	Not uncommon.
— solidula,	”
†Mactra solida,	Common.
— truncata,	”
† — sub-truncata,	”
† — stultorum,	”
†Tapes pullastra,	”
† — decussata,	”
†Artemis exoleta,	”
Venus striatula,	Not uncommon.
— fasciata,	”
Cyprina Islandica,	”
Amphidesma compressum,	”
†Cardium echinatum,	Common.
† — edule,	”
— Norvegicum,	Rare.
Modiola Modiolus,	Common.
†Mytilus edulis,	”
Ostrea edulis,	”
Bulla lignaria,	Not uncommon.
— aperta,	Common.
†Littorina littorea,	”
† — littoralis,	”
† — rudis,	”
†Turritella communis,	”
Scalaria, sp.	Rare.
Natica monilifera,	Common.
Trochus magus,	Common at Mull of Galloway.
Trochus umbilicatus,	Common.
— cinerarius,	”
— umbilicatus,	”
— zizyphinus,	”
Nassa reticulata,	”
†Purpura lapillus,	”
†Buccinum undatum,	”
†Fusus antiquus,	”
Aporrhais pes-pelicanii,	Rare.
Pileopsis Hungaricus,	”

To this list we add *Pectunculus glycymeris*, and *Pecten varius*.

Purpura lupillus was deeply striated, and beautifully marked—the striæ banded black and white, or brown and white, alternately.

V.—PORTPATRICK.

Driving over to Portpatrick from the placid waters of Loch Ryan, a great change has taken place; a bold, storm-beaten coast appears; steep cliffs, some rising perpendicularly to a height of 130 feet, deeply cut into narrow ravines and gullies, up which the waves rush in great fury, and rebounding at the top, are dashed into clouds of spray. Nestling at the base of these cliffs, where they recede a little back from the sea, lies the town, built to all appearance in an old quarry, a resemblance which the stones hewn out of the rocks, and the excavations made for the harbour works going on, do not lessen.

A little to the south stands Dunskey Castle on a precipitous cliff 100 feet above the sea, and accessible only by proceeding along the cliffs. Cautiously descending a steep grassy slope, a shingly bay at its base on examination yielded twenty-two species of algæ. Then going along the cliffs to the north of the town we descended to a fine sandy bay—Port Murray—at the head of which stands an iron-pillar—the exit of the Irish submarine cable, —and crossing a narrow cliff to the north of this we came to another bay—Port Kale—composed of shingle and fine gravel. On such an exposed coast, where boulders and gravel are constantly rolling, shells, algæ, and other organisms, are speedily pounded into a fragmentary condition.

Among the algæ washed ashore and scattered on the beach in these bays, we collected thirty-seven species, all common on rocky coasts. Some of the stems of *Laminaria digitata* were six feet in length, and one and a-half inches in diameter, and very few of them had the fronds attached.

The following zoophytes were obtained:—

Sertularia abietina.	Crisia eburnea.
— argentea.	Cellepora pumicosa.
Plumularia falcata.	Eudendrium ramosum.
— cristata.	Tabularia indivisa.
Flustra foliacea.	Laomedea geniculata.
Antennularia antennina.	Membranipora pilosa.

The Rev. A. Urquhart adds the following:—

Halecium halecinum.

Cellepora cervicornis.

Membranipora membranacea.

Flustra chartacea.

— *truncata*.

— *avicularis*. . . . Very abundant on
the iron plates of the "Orion."

— *hispida* (Fleming).

Of shells we obtained very few, but have much pleasure in inserting the following list found by the Rev. A. Urquhart, Free Church, Portpatrick, to whose kindness we are much indebted:—

<i>Teredo navalis</i> , . . .	In harbour works.	
<i>Pholas crispata</i> , . . .	Very abundant in the clay,	Harbour.
— <i>candida</i> , . . .	"	"
— <i>dactylus</i> , . . .	Rare—only one found.	
<i>Pholadidea papyracea</i> ,	"	
<i>Saxicava rugosa</i> , . . .	Not uncommon.	
<i>Tellina fabula</i> , . . .	Rare.	
<i>Venerupis irus</i> , . . .	Rare.	From deep water.
<i>Venus casina</i> , . . .	Not uncommon.	"
— <i>fasciata</i> , . . .	"	"
<i>Astarte sulcata</i> , . . .	Rare.	"
<i>Cyprina Islandica</i> ,	"	"
<i>Kellia rubra</i> , . . .	Common.	
<i>Tapes pullastra</i> ,	"	In harbour.
<i>Pectunculus glycimeris</i> ,	Rare.	Deep water.
<i>Modiola modiolus</i> ,	"	"
<i>Mytilus edulis</i> , . . .	Not uncommon.	
<i>Lima</i> , sp.		
<i>Pecten pusio</i> , . . .	Rare,	Deep water.
<i>Anomia ephippium</i> ,	Common.	
<i>Ostrea edulis</i> , . . .	Rare,	Deep water.
<i>Diodonta fragilis</i> , . . .	"	"
<i>Chiton ruber</i> , . . .	"	In harbour.
— <i>marmoreus</i> , . . .	"	In harbour and bays to north.
<i>Patella vulgata</i> , . . .	Common.	
— <i>pellucida</i> , . . .	"	

<i>Aemæa testudinalis</i> ,	Rare,	In harbour.
— <i>virginea</i> ,	„	„
<i>Pileopsis Hungaricus</i> ,	„	
<i>Emarginula reticulata</i> ,	„	
<i>Ianthina communis</i> ,	Once in Labrax Bay, 3½ m. to N.	
<i>Trochus cinerarius</i> ,	Common.	
— <i>magus</i> ,	Rare,	In deep water.
— <i>umbilicatus</i> ,	Common.	
— <i>zizyphinus</i> ,	„	
<i>Littorina littorea</i> ,	„	
— <i>littoralis</i> ,	„	
— <i>rudis</i> ,	„	
<i>Lacuna vineta</i> ,	Not uncommon.	
<i>Rissoa parva</i> ,	Common.	
<i>Aporrhais pes-pelicanis</i> ,	„	In deep water.
<i>Natica monilifera</i> ,	„	„
<i>Cypræa Europæa</i> ,	Not uncommon.	
<i>Purpura lapillus</i> ,	Common.	
<i>Nassa reticulata</i> ,	Rare,	In deep water.
— <i>incrassata</i> ,	Common,	„
<i>Buccinum undatum</i> ,	„	„
<i>Fusus antiquus</i> ,	„	„
— <i>Islandicus</i> ,	„	„
<i>Murex erinaceus</i> ,	„	„
<i>Cerithium reticulatum</i> ,	Rare.	

List of Land Shells:—

<i>Zonites cellarius</i> ,	Common.
<i>Helix sericea</i> ,	„
— <i>caperata</i> ,	„
— <i>aspersa</i> ,	„
— <i>arbustorum</i> ,	„
— <i>nemoralis</i> ,	„
<i>Bulinus acutus</i> ,	„
<i>Zua lubrica</i> ,	Rare.
<i>Vitrina pellucida</i> ,	„
<i>Pupa muscorum</i> ,	Common.
<i>Clausilia nigricans</i> ,	„
<i>Limnæus palustris</i> ,	„
— <i>truncatulus</i> ,	
— <i>pereger</i> ,	Common.

<i>Physa fontinalis</i>,	. . . . .	Not uncommon.
<i>Anechylus fluviatilis</i>,	. . . . .	Common.
<i>Cyclas cornea</i>,	. . . . .	„

II.—*On the Distribution of Mosses in the Valley of the Girvan, with notes on interesting and rare species.* By Mr JOHN SHAW.

Mr Shaw, in the course of his remarks, showed that this district, which was so famous for the special genus *Orthotrichum*, was very rich as a general moss region. There were 44 genera and 170 species represented. Of these there were new to Scotland—*Tortula recurrifolia*, *Bryum obconicum*, *Bryum murale* (Wilson MSS.), *Leskea pulvinata*, *Hypnum irriguum*, *Tortula papillosa*, *Tortula Hornschuchiana*, and the male plant of the not very uncommon *Hypnum undulatum*, was got there for the first time in Britain. These additions he stated on the authority of Wilson, the author of the “*Bryologia Britannica*.” He said, in examining a district it was necessary to know first its physical geography. In connection with this general statement it was indicated what might be expected from such a district as Dailly parish, with its streams, extensive woods, and glens, vieing with any in picturesque beauty in Scotland, and appearing to be rich in all forms of vegetation, but more especially in mosses, on account of the shade and moisture they enjoy.

APRIL 29TH, 1862.

Mr John Gray, Vice-President, in the chair. James Dunlop, M.D., was elected a resident member.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited the following specimens, with remarks upon their habits and occurrence:—

Luidia fragilissima.—From recent observations I am inclined to think that this starfish is not alike fragile at all seasons of the year. We all remember Professor Forbes’ very graphic description of *Luidia*’s disintegrations.

In the summer months I rarely bring one to the surface in the dredge entire. They have generally begun, or are beginning to break up, and all attempts to frustrate their suicidal purpose are of no avail. Occasionally in these months they may be found near

to the shore in shallow water, in which case I have never found any difficulty in drying them. Those found in this way are always thin, being probably in a sickly state.

This spring I have three in good full condition. The first I brought up in the dredge with a number of large urchins (*Echinus sphæra*), with strong sharp spines, no doubt causing considerable irritation to *Luidia*. It was placed in a little water in the bottom of the boat, and lay there fully two hours, then carried home exposed to the air, and finally paid the last debt of nature, and still remained whole. Another was brought me by a fisherman in a basket, having been several hours out of the water, with the same result. A third was brought in the same way, but it began to break up when being taken from the fisherman's basket. I learned that this one had been nearly seven hours out of the water, from which we may reasonably infer, that had I got it a little sooner, or had a little more tenderness been used by the fisherman, who handled it very roughly, it might also have been preserved whole,—showing that in some conditions or seasons they are not pre-eminently brittle. These were all above a foot across, and of the seven-rayed variety.

Cribella rosea.—The rays of this beautiful star-fish, in common with *Uraster glacialis*, have a tendency to break close off by the disk—a fact I have not seen noticed.

Solaster endeca.—A specimen with six rays—the usual number being from nine to eleven.

Gobius bipunctatus and *Crenilabrus rupestris*.—These are additions to our list of the fishes of the Clyde.

Pagurus Thompsoni.—Bell gives, as the habitat of this hermit crab, the entrance of Belfast bay at fifty fathoms, where it was dredged by Mr Hyndman. I have got two this season on a scallop bank off the Bute shore, opposite the south-west end of Cumbrae, and believe that they may be found common along the whole bank.

Inachus leptochirus.—This crab is also found moderately common on the Bute side on scallop banks, but is, I believe, rare on the Cumbrae side on similar banks, thus confirming the importance of investigating the *whole* shores of the Frith of Clyde in getting our lists of marine plants and animals completed.

Edwardsia carnea.—This small anemone, which is new to Scotland, I have taken at Cumbrae.

PAPERS READ.

I.—*On the Animals and Plants familiar to the Ancient Greeks and Romans, represented on their Coins as Types and Mint-marks.*

By Mr JOHN GRAY, Vice-President.

This paper was illustrated by a series of examples, civic and regal, of these ancient coins; and the remarks upon them were confined to the proof they afforded of the attention which the ancients directed to the natural objects which surrounded them. The coins of Velia, Thurium, and Agrigentum, were specially noted as evidencing the correct and spirited way in which the artists engraved the subjects represented; the whole subject tending to show that natural history was cultivated then, and that perhaps in a more general way than now, as at least a study of observation; and that the genius of a Landseer, a Swainson, or a Wolf, was not reserved for modern days alone.

II.—*On some of the rare Mosses recently detected in the West of Scotland.*

By Mr ALEXANDER M'KINLAY.

He commenced by stating generally that few branches of cryptogamic botany had made such strides recently as bryology. This was due not only to the greater zeal of its votaries, but also to the introduction of a more enlightened system of classification. In Scotland, however, which was wont to take the lead in this department, there has been very little done for many years. The present position of British bryology is almost entirely owing to the exertions of Englishmen. With the exception of districts surrounding large towns, the Breadalbane mountains, Airth rendered famous by Mr Lyle, and Dailly by Mr Shaw, there is no district in Scotland satisfactorily explored. The west of Scotland has fared worse than the east; indeed, bryology at its present stage seems altogether to be ignored by our botanists. Mr M'Kinlay, to cite an example of this, referred to a recent list of the plants of the Cumbraes, where the mosses represented are, with the exception of perhaps three, such as may be found in any maritime district. He stated that there were at least 30 found in these islands not named in the catalogue. Having introduced his subject by these remarks, he went on to name and describe some of the rarest species he had observed,—among others, *Sphagnum Mougeotii*, from Milngavie; *Neckera Philippiana*, from Lanrick Castle in Perthshire, with numerous forms linking that species to *Neckera Pumilus*.

Dicranodontium longirostre, known only formerly in British bryology to grow near the Lakes of Killarney, he had found in three different places. Among the interesting species alluded to besides the foregoing, there were an arboreal form of *Dicranum polycarpum*, *Bryum Duralii*, and a new variety of either *Orthotrichum crispum* or *Orthotrichum crispulum*, of such a nature as to lead to the union of these two species.

MAY 24TH, 1862.

Mr John Gray, Vice-President, in the chair. The following gentlemen were elected members:—Messrs James Bain and A. C. Millar, resident; and Mr Alexander Fisher, Galashiels, corresponding.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited a very remarkable specimen of *Halichondria Ventilabrum*, which he had procured from deep water off the Cumbrae Islands. It measured 12 inches across the mouth of the funnel. Another specimen of this fine sponge, perfect in condition and of unusual symmetry, was also laid on the table, both objects exciting a considerable share of attention.

Mr James Thomson exhibited several interesting specimens of sandstone, burrowed into by annelides. These specimens were procured from the neighbourhood of Bathgate, to the north of Bathgate Hill, the sandstone occurring in thin layers, in the midst of bituminous shale of 20 feet in thickness, overtopping several bands of limestone. The specimens showed the overlying bituminous shale deposited in the burrows of the creatures.

Mr John Gray, the vice-president, exhibited three species of cirripedia, two of them parasitic on the South Sea whale, namely—*Coronula balenaris*, and *Tubicinella balenaris*—the latter burrowing in the blubber; and *Chelonobia testudinaria*, parasitic on the back of turtles.

PAPERS READ.

I.—*An Account of Ailsa Craig and its Birds, from personal observation.*

II.—*Notes on the Grey Lag-Goose (Anser palustris), Fleming.*

By Mr ROBERT GRAY, the Secretary.

In concluding his notices of Ailsa Craig, a locality he had many times visited under the most favourable circumstances, Mr Gray gave an account of the mode of *fowling* practised there eight years ago,

when Ailsa was leased by a tacksman, as observed by Mr William Sinclair, a member of the society, who had lived night and day upon the rock during a part of that season; and enumerated, on the same authority, a list of the birds, visitors as well as those which breed, observed during his visit. Among the more important of these were the golden eagle and white-tailed sea-eagle, both of which are now but rarely seen. Mr Gray also dwelt at some length on the dates for the arrival and disappearance of the various sea-fowl frequenting the rock during the time of incubation, and contrasted the habits of some of these with the same species found on the Bass Rock—a bird-hive with which he was equally familiar.

Illustrative of his second paper, the secretary exhibited a well-preserved specimen of the grey lag-goose, and two of its eggs, which had been forwarded by a correspondent in the outer Hebrides, and expressed his belief that although recent writers on British ornithology stated the species to be rare, and that it no longer bred in any part of Britain, it still exists in considerable numbers in places suited to its habits. In former times, according to our older writers, it haunted the fens of Lincolnshire, and the moorland bogs of our own country in prodigious flocks, but had gradually retired, through the wide-spread improvements by drainage, etc., and fallen back upon countries yet undisturbed by these influences. In the Hebrides, however, as now found out, there is a safe asylum for this interesting species, as well as for other aboriginal water fowl. Through the courtesy of Mr Dugald M'Donald, of Nunton, he was enabled to state that on one of the Hebridean islands at least, it had the exclusive occupancy of the breeding places. He then read some interesting remarks on the habits of the bird, as observed by Mr M'Donald, to whom he (Mr Gray) acknowledged his obligations for assistance, by means of specimens and otherwise, in drawing up his account of the species.

Dr Dewar then stated to the meeting that he could bear testimony to the fact of the grey lag-goose being still a native bird in Britain, having found both birds and eggs during an ornithological tour he made to the Hebrides in 1858; after which the chairman declared the session of the society to be closed.

SESSION 1862-63.

THE ELEVENTH ANNUAL GENERAL MEETING, ANDERSON'S
UNIVERSITY BUILDINGS, SEPTEMBER 30TH, 1862.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected office-bearers for the session:—John Scouler, M.D., LL.D., F.L.S., President; Hugh Colquhoun, M.D., Vice-President; Robert Gray, Secretary; Thomas Chapman, Treasurer; Thomas S. Hutcheson, Librarian; Messrs James Thomson, David Robertson, and Donald Dewar, M.D., Members of Council.

SPECIMENS EXHIBITED.

Mr David Robertson drew the attention of the meeting to a series of star-fishes he had laid on the table, selected from various species, and presenting abnormal appearances in the number of rays, and their reproduction when lost by accident. One of the specimens of *Uraster rubens* showed a curious feature in having a newly developed limb bifurcated.

Mr Robertson likewise contributed the following notes on two specimens exhibited:—

Acantholeberis curvirostris (Müller).—This crustacean was gathered in a small tarn on the larger Cumbrae, the bottom of which was covered with confervæ and moss. It seems to be fond of the shelter of weeds, though it is often seen actively swimming with a jerking motion, occasionally mounting to the surface of the water, and then dropping slowly to the bottom, rarely making any motion when sinking, except when disturbed. I have also captured it in Arran, above Whiting Bay.

Asterina gibbosa (Pennant).—Found in a rock pool, adhering to the under side of stones, in the smaller Cumbrae, the only locality I am aware of in the Firth of Clyde.

The Secretary exhibited a fine specimen of the chough and its egg, which had been forwarded by James Stein, Esq., of Port-Ellen, accompanied by some interesting notes on the habits of the species as observed at Islay, where it is still found in small flocks. In the course of his remarks, Mr Gray mentioned its gradual disappearance from localities in this country where it formerly existed in great numbers. The majestic cliffs of St Abb's Head, and the high precipices of some parts of the Isle of Man, are now untenanted by this beautiful bird; and the abrupt coast of the south of Ayrshire cannot now boast of the flocks it once gave shelter to. Its scarcity, indeed, there and elsewhere, cannot well be accounted for. The inroads of man, which banish many other British birds from their accustomed haunts, can have no share in its extirpation, for it dwells in places too solitary and inaccessible to be affected by such influences.

Mr Gray likewise exhibited a specimen of the red-necked phalarope (*Phalaropus hyperboreus*) in the summer plumage, a bird which breeds commonly on shores within the Arctic Circle. It was at one time found on some of the Orkney Islands, nesting on the margins of fresh water lakes there in limited numbers. Of late years, however, it has become so scarce as to be difficult of acquisition—a result owing chiefly to the rapacity of dealers in natural history objects. This specimen was obtained from one of the outer Hebrides—a safe refuge, in the meantime, for refugees of a like rarity. It settles by the side of small inland lochs on the island referred to, and is known among the natives by the name *Dearg-an-allt*—the red bird haunting the stream. During the breeding time it swims lightly and gracefully on the smooth water, continually dipping its bill, and uttering a clicking note, without betraying any fear on the approach of an intruder. It is, consequently, a well-known favourite among those whose occupation leads them into its haunts, and at once arrests their admiration by the beauty of its movements when floating about and calling its diminutive young ones together, gathering them under its wings as a hen does with her chickens. Though but the size of a lark, it is easily observed on these moorland tarns, without a fringe of vegetation for concealment; and, as Mr Gray observed, it would be rash, indeed, to put any idle collector in the way of invading the solitude of the asylum it now inhabits.

OCTOBER 28TH, 1862.

Hugh Colquhoun, M.D., Vice-President, in the chair. Mr Henry Smith was elected a resident member.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited a new Entomostracan, and read the following note:—This little entomostracan, as far as at present known, is new to science. It was taken in the Paisley Canal, in September, and has been provisionally named by the Rev. Alfred Merle Norman, *Lynceus pectenatus*.

There is one particular connected with this little animal that may be worth noticing. In the gathering that they were found in there might be about a dozen. Suspecting that they were strangers, I went next day to the same place to procure more, but on examining over the gathering, I had not one. Day after day I searched diligently for them, but as yet without seeing another. Had I at first got but one, I would have had less hope in finding another, believing them to be rare and solitary animals; but they must have been in abundance at the place and the time that I got them, which leads me to infer that their sudden disappearance is connected with their natural habits.*

Mr Robert Gray exhibited a very fine specimen of the golden eagle, which was recently shot in Glencoe; also a specimen of the ring-necked loon, or great northern diver (*Colymbus glacialis*), in the brilliant summer plumage, from Benbecula. Examples in this state are rarely met with on our shores, as it is a species which is not known to breed in any part of Britain. Mr Gray thought it possible that in some of the Hebrides it might be found incubating, as many birds remained near these islands till the first week of June, a season when all other species had been some time at their breeding stations. It would appear, however, to be much later in retiring, as a body, than the usual summer migrants to colder latitudes, being found lingering around the extremities of Scotland generally until the end of May.

In the Firth of Forth it is usually seen in winter following the herrings, of which it destroys great quantities. In following such

* This crustacean is now (1868) named *Anchistropus emarginatus* by Herr G. O. Sars, who has found it in Norway, but as yet these are the only habitats known.

shoals into the sea lochs of the West Coast, it swims vigorously after its prey, and is in many instances overtaken by night at a great distance from where it set out. At the close of these expeditions it generally rises on wing to return to the open sea. It may then be seen flying at a great height in the air, with a direct, rapid flight, its comparatively small wings giving it a curious appearance when contrasted with the sea-gulls, which, although fast fliers, are soon overtaken and passed by the engine-like speed of the diver. When the birds return at the end of autumn, many of them are seen with the spotted plumage yet visible, but which falls off like flakes of snow on the hand being passed along the back. Mr Gray concluded his remarks by observing that the great northern diver would appear to be invested with a greater interest than most sea birds. At certain seasons it may be seen in small companies of four or five, fishing by day, which are heard shouting to one another at nightfall with loud, hoarse cries. At other times a single bird will startle the ear with a strange, melancholy cry, as of a man in distress—

“The wild scream of one whose life is perishing in the sea.”

It has also been likened to the howling of a wolf, when storms are approaching, portending disasters to seafaring men, among whom the bird is generally regarded with but little favour.

Dr Dewar stated to the meeting that this species of *Colymbus* is known to frequent the shores of North and South Uist all the year in limited numbers, and that, having made inquiries on the spot, he had no reason to doubt the accuracy of their information, although all writers on British birds agree in saying that the ring-necked loon is strictly migratory. As the nest, however, had not yet been found, it would be unsafe to infer that these stragglers had remained to breed, as their movements may have been influenced by other causes.

The Secretary likewise exhibited a specimen of *Sirex Juvenus*, from Aberdeenshire, an insect belonging to a genus especially destructive to plantations and forests, but happily of uncommon occurrence in our own country. This specimen had been captured during the present month.

PAPER READ.

On Zoological Classification. By Dr ALEXANDER LINDSAY.

NOVEMBER 22D, 1862.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. Mr William Mathieson was elected a resident member.

PAPERS READ.

I.—Dr Lindsay read a communication from the Rev. James Copeland, Aneitum, New Hebrides, one of the society's corresponding members, descriptive of the natives of that group of islands. In this paper Mr Copeland announced the singular fact, that among the albinos which had occurred within his observation, there were several piebald varieties, having their bodies covered with large black and white spots.

II.—*On the occurrence of Edwardsia callimorpha.*

By Mr DAVID ROBERTSON.

Last spring I exhibited a specimen from Cumbræ of a small anemone—*Edwardsia carnea*—which is new, as far as known, to Scotland. This last summer, in company with Dr Grieve and Mr Keddie, we dredged between the Cumbræ and south end of Bute another member of this interesting family—*Edwardsia callimorpha*—which I now exhibit. It is also new to Scotland, not having been known before further north than the south-western coast of England.

III.—*On the habits of some of the fishes of the Firth of Clyde, embracing facts in connection with those species frequenting shallow water.*

By Mr JOHN EATON REID.

In speaking of the common dab (*Platessa limanda*), Mr Reid mentioned having on one occasion, while becalmed in his yacht, observed a strange commotion in the water, and found it was caused by about a hundred of these "flounders"—many of them but the size of a man's hand—springing along the surface, and rushing confusedly from the spot where they first appeared. In a few seconds a large angler, or fishing-frog (*Lophius piscatorius*) rose also to the surface, from which circumstance it would appear that in capturing its prey it does not always resort to its well-known lure—stirring up the mud or sand at the bottom, and waving its dorsal fishing-rod, which has something like a bait at the end, till the inquiring fishes assemble over the obscured angler, and are quietly swallowed—but occasionally leaves the bed of the

sea, following a shoal of flounders, and obliging them even to spring out of their element in the heat of the chase.

IV.—*Notes on the Bernicle Goose (Anser Bernicla).*

By Mr ROBERT GRAY, the Secretary.

This species is much less frequent in occurrence than its ally the Brent goose (*Anser Brenta*); and in connection with the two species it is somewhat remarkable that on the East Coast the Bernicle should be rare, the other being common; while on the west side of Scotland the Brent goose is very scarce and the Bernicle well known. This fact appears all the more curious when we know that the geographical range of both species extends to latitudes much further west. The Bernicle is observed regularly to frequent the Hebrides at the beginning of winter, remaining near the sea shore till the middle of April, when it migrates. It feeds upon grasses growing for the most part in saline marshes; the Brent goose living almost exclusively on *Zosteru marina*, and algæ of various kinds, from which its flesh derives a rank taste.

The Bernicle has been found in Aberdeenshire, Sutherlandshire, and Forfarshire. It is also included in a catalogue of the “Birds of Haddingtonshire,” by John Nelson, Esq., Broomhouse, Dunbar, two specimens having occurred within that gentleman’s observation of late years.

In a curious work published about 300 years ago, this bird is noticed as frequenting the Firth of Clyde in large and noisy flocks, near Dumbarton Castle. The following quotation will be of interest to those who take pleasure in ancient chronicles:—

“In the northern seas of Scotland are great clogges of timber found, in the which are marvelously ingendred a sort of geese called clayk-geese, and do hang by the beake til they be of perfection; ofttimes found, and kept in admiration for their rare forme of generation.

“At Dumbartan, directly vnder the castle, at the mouth of the riuer of Clyde, as it enters into the sea, there are a number of claik-geese, blacke of colour, which in the night time do gather great quantitie of the crops of the grasse, growing upon the land, and carry the same to the sea. Then they assemble in a round, and with a wondrous curiositie, do offer euery one his owne portion to the sea-floud, and there attend vpon the flowing of the tide, till

the grasse be purified from the fresh taste and turned to the salt; and lest any part thereof should escape, they labour to hold it in, with labour of their nebbes. Thereafter orderly euery fowle eats his portion, and this custome they obserue perpetually. They are verie fatte, and verie delicious to bee eaten."

V.—*On the Darwinian Hypothesis of the Transmutation of Species.*

By Dr SCOULER.

He remarked that the doctrine was by no means a new one, but had occupied the attention of naturalists from the earliest times. In this respect there was nothing new in the views of Mr Darwin, although at the same time there was much both new and valuable in his work, which would be a permanent acquisition to science. The doctrine, however, respecting the transmutation of species was that of Lamarck, with the weak points skilfully eliminated; and the hypothesis of a prototype animal had been long ago proposed by Robinet and Dr Erasmus Darwin, author of the "Zoonomia." The basis of Mr Darwin's speculations was that animals pass, by insensible gradations, into each other, and consequently there is no such thing as a species. In opposition to this, it was shown that throughout nature there were abrupt transitions, and voids which cannot be filled up. It was also stated that, in opposition to Mr Darwin's views, there were arrangements and structures in the animal kingdom which had no relation to utility, nor were necessary to the existence of species, and consequently these were inexplicable on the principle of natural selection.

JANUARY 6TH, 1863.

John Scouler, M.D., LL.D., F.L.S., President, in the chair.

SPECIMENS EXHIBITED.

Dr Dewar exhibited a fine specimen of the Capercailzie (*Tetrao Urogallus*), from Breadalbane forest, where it was shot last month; also, a specimen of the Greenland falcon (*Falco Greenlandicus*), from Islay. This handsome bird, which is the *Falco Candicans* of Schlegel, is a species of very rare occurrence in the British islands, and sufficiently attractive to excite more than a passing notice. At various times white falcons are recorded as having been shot, and these chiefly in the north of Scotland, under the name of

Gyr Falcon. Such birds are for the most part referrible to the species now under consideration, the Greenland falcon being the only one which is white from the nest. Immature specimens are difficult to distinguish, the young of the Iceland, Norwegian, and Greenland falcons being closely alike in plumage and general markings. The adult birds, however, are easily recognised—*Greenlandicus* having white feathers with dark spots, while the general plumage of the Iceland bird, a specimen of which Dr Dewar had on the table, is dark, each feather having a white mark.

Mr J. Barclay Murdoch exhibited a storm-petrel (*Thalassidroma pelagica*), from Ailsa Craig, a species which, during the recent gales, was observed as far up the Firth of Clyde as Port-Glasgow. It was also noticed off Cumbrae. It was remarked by Mr Gray that in recording the occurrence of these birds, it was of great importance to ascertain the exact species—the name storm-petrel being a convenient term for at least four different species found on the British coasts. Petrels are of nocturnal habits, unless in rough weather, when they occasionally venture from their retreats; consequently it is difficult, under any circumstances, to observe species when on the wing. The secretary also stated that he had known the storm-petrel as a native of Ailsa Craig for many years; but from its habit of incubating under the large and immovable blocks of stone which lie scattered round the base of the Craig, the eggs have been taken in only a few instances. Three years ago he had seen several petrels issuing from their retreats under these large boulders in a dull day at the beginning of June. The morning was temptingly fine, but on the party nearing the rock, it became evident that a storm was at hand. At the moment, however, of observing the birds leaving their burrows, there was but a slight breeze stirring the sea, although to the south there were unmistakable signs of a coming storm. The sky darkened, and sea and cloud were observed to mingle in the distance. Half-an-hour afterwards, while the party were engaged in gathering eggs, the tempest broke out, and they hurriedly set sail for Girvan about mid-day. When about half way across, four or five petrels were observed following the boat, approaching so near as to be at once recognised as the bird now exhibited.

Mr Alexander M'Niven of Shemore, one of the society's corresponding members, exhibited two specimens of the Powan (*Coregonus Lacepedei*), from Loch Lomond. Sixty years ago this fish was first

discovered by Mons. Noel, and described as a distinct species by Lacepede in his "History of Fishes," under the name of *Coregone Clupeoide*. Dr Parnell has subsequently given a full account of it in the "Annals of Natural History," Vol. I., an account which has since been transcribed into the works of Mr Yarrell, Dr Hamilton, and others.

The powan is very common in Loch Lomond, and excites attention by its habit of approaching the shore towards nightfall, the shoal making a commotion in the water with their fins. On these occasions great quantities are taken with draught nets. Although Dr Parnell states that the powan will not touch a bait, Mr M'Niven has occasionally caught it with a common worm when fishing for perch. One of the most curious facts connected with this species is that of its being found in Loch Lomond and no where else.

Mr Alexander M'Kinlay laid on the table a valuable series of rare Breadalbane mosses, and others, from Ben Nevis, the specific differences of which he carefully described. Many of these specimens possessed considerable interest.

PAPERS READ.

I.—*On Light in its relation to the Colours of Marine Plants and Animals.* By Mr JOHN SHAW.

II.—*On certain species of Mosses undescribed in the "Bryologia Britannica," recently added to the Moss Flora of the West of Scotland, illustrated by the plants themselves and their varieties.* By Mr ALEXANDER M'KINLAY.

JANUARY 27TH, 1863.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected resident members:—Messrs William Euing, Robert Balloch, Rev. James Dodds, and Alexander Greenlees, M.D.; and Lieut. Edward William Hawes, R.N., a corresponding member.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited a specimen of *Caryophyllea Smithii*, from the lesser Cumbræ, an interesting species of coral

by no means common in Scottish seas, a few localities only being known for it. This specimen afforded an illustration of that curious reproductive power, spoken of by Mr Gosse, in the formation of a new disk, mouth, and tentacles at the lower end of the *corallum*, which had been broken at the base. Mr Robertson also exhibited a new sessile-eyed crustacean, discovered by himself at Cumbrae—*Stegocephalus celticus*. This communication acquired a double interest from the fact of the genus being new to Britain, and the species new to science, affording another proof of Mr Robertson's diligence and excellent powers of discrimination. He likewise brought forward a specimen of *Cypridina teres*, from the same locality, where it is not uncommon, and which he had recognised as a distinct species about four years ago. It remained, however, undescribed until 1861, when the Rev. A. M. Norman published an account of it in the "Annals of Natural History," from a specimen dredged at Oban.

Mr James Thomson exhibited a series of carboniferous Brachiopods, including *Streptorhynchus crenistria*, with all the varieties of that shell yet found in the carboniferous beds of Scotland, including *radialis*, *Kellii*, *senilis*, and *robusta*—the latter, which was found in the neighbourhood of Campbeltown, being new to this country.

The Secretary exhibited two specimens of the rotche or little auk; one from the collection of Mr J. B. Murdoch, the other forwarded by Mr John Nelson, from East Lothian, with remarks on the *Alcae* frequenting the shores of that county during winter; from which it would appear that the puffin (*Mormon fratercula*) is found at all seasons, the place of those which migrate southwards in autumn being supplied by flights of both young and old birds from higher latitudes. Mr Gray stated that he had observed puffins regularly frequenting the Firth of Forth during winter, in company with guillemots and razor-bills, for many successive seasons, and further remarked that these winter flocks never extended their flight beyond Berwickshire—a circumstance which may partly account for such an interesting fact in the migrations of this species being overlooked by Selby, Yarrell, and subsequent writers. Every year, throughout the winter months, the coast near Dunbar is frequented by the little auk, the puffin, guillemot, and razor-bill, specimens of which were procured during the present month by Mr Nelson to illustrate his remarks. The

locality, from its proximity to the Forth estuary, is unusually attractive to birds requiring shelter and abundance of their natural prey, the latter especially being obtainable even in the depth of winter.

Mr Clark exhibited, alive, a large and interesting spider—*Olios Castaneus* (Walek.)—which was found a few days ago in one of the plant stoves of the Botanic Garden, Glasgow, and explained that it must have been imported in a box of seeds from Old Calabar.

The Secretary read a communication from Mr Henry D. Graham, Lochgilphead, one of the society's corresponding members, in which he mentioned, as interesting additions to the Ornithology of the West of Scotland, the occurrence of the Gadwall (*Querquedula strepera*), on one of the outer Hebrides, and the red-crested whistling duck (*Fuligula rufina*) near his own residence. He also made the important announcement of having seen, recently, three specimens of the Greenland or harp seal (*Phoca Grænländica*, Müller), at the Island of Jura. The supposition of this seal being even a rare visitor to British waters, is grounded on the fact of two skulls of individuals captured in the Severn, upwards of forty years ago, appearing to belong to this species; and, also, that the cranium figured by Sir Everard Home, in the Transactions of the Royal Society of London, was taken from a seal shot in the Orkneys in 1822.

PAPER READ.

On the Darwinian Theory of the Transmutation of Species.

By Mr JAMES RAMSAY.

FEBRUARY 24TH, 1863.

Hugh Colquhoun, M.D., Vice-President, in the chair. The following gentlemen were elected resident members:—Messrs Edward Alston, James MacGregor, Edward Wünsch, George Stodart, William Kidston, and William G. Milne, Old Calabar, a corresponding member.

SPECIMENS EXHIBITED.

Lieut. Hawes exhibited a collection of ferns and algæ acquired by himself in New Zealand; and the Secretary exhibited a series of

ornithological drawings, by Mr William Sinclair. These drawings were distinguished for great beauty of colouring and accuracy of delineation, being original figures of interesting species, drawn with a skill seldom equalled.

Mr David Robertson exhibited specimens (male and female) of *Bodotria Goodsirii*, a species new to Britain, found by himself at Cumbrae.

Dr Dewar exhibited two specimens of the marsh harrier (*Circus aeruginosus*)—one of them in the chocolate-coloured plumage, with a cream-coloured head and chin; the other, which was shot by himself in the Crimea, being in the plumage figured by Gould and Yarrell in their respective works, but which is seldom, if ever, observed in specimens killed in this country. Respecting the latter, Dr Dewar observed that it appeared, on close examination, to be a younger bird than the British specimen—a fact at variance with Mr Gould's statement that all old birds (the species, as he says, being long in attaining maturity) are coloured as represented in his figure. The two birds, indeed, would appear to be distinct, inasmuch as Continental specimens, and those occurring in the British Islands, preserve, as a rule, their distinctive colours, without much variation; and Mr Gould's admission of the fact of this bird breeding before arriving at maturity is not sufficient to account for the entire absence, in this country, of specimens in the plumage of what is called the perfect livery.

The following plants were exhibited by Mr Peter Clark, of the Royal Botanic Garden:—*Ouvirandra fenestralis* (lattice leaf); *Goodenya discolor*, a beautiful specimen, with upwards of fifteen flowering stems, all in full bloom; and *Urostigma elastica* (India-rubber tree). Regarding the first named, Mr Clark informed the meeting that this remarkable plant—one of the most interesting which has been raised in the garden—was grown from seeds obtained from Mr Norman M'Leod, of Dalvey, to whom the garden has been much indebted for many rare and valuable donations, and quoted the following remarks from the Rev. William Ellis, who was first the means of bringing the species in a living state to this country, about eight years ago:—"The most rare and choice acquisition which I made in Madagascar during this visit was the beautiful aquatic plant *Ouvirandra fenestralis*, which I have been able, with much ease, to bring safe home. From the work of Du-Petit Thouars, in M. Bojer's possession, I copied the *Ouvirandra*, and,

by exhibiting the drawing to the natives, at length found one man who knew where it grew. His master, who had shown me many acts of kindness, allowed him to go and search for it, and, after two or three days, he returned, saying he found the plant growing in a stream of water, but could not get it, owing to the number of crocodiles in the stream. At last, however, the man brought me many fine plants, and I was happy to reward him for his trouble."

Professor Walker Arnott also made some observations to the members on the foregoing species.

PAPERS READ.

I.—*On the occurrence of the Harp Seal (Phoca Grænlandica) in Loch Turbert, Jura, with remarks on the habits of some other species frequenting the Western Islands.* By Mr HENRY D. GRAHAM, Lochgilphead, Corresponding Member. Read by the Secretary.

Mr Graham had seen three of these rare visitors to British waters in the above-named locality, while exploring the loch in company with a friend. The seals were observed among a herd of the common species, occupying a series of shelving rocks about 300 or 400 yards off shore. One of the keepers, who was of the party, having an excellent telescope used in stalking deer, Mr Graham and his friends could distinctly make out the markings which characterise the harp seal; and as the animals remained in full view for three hours, constantly watched, the utmost care was taken to note down the necessary particulars for after discrimination. Since observing these animals, Mr Graham, after repeated inquiries, satisfied himself of at least other three authentic cases of the capture of *white* seals of extraordinary size, one of these occurring in Loch Scridan, Mull, under the observation of Mr M^rKimmon; and as a result of these inquiries, he had besides acquired some highly interesting information respecting the habits of the larger species of seal to be found on the outer islands. These he communicated in his excellent paper, from which it would appear that, under the name of *Tapraist* or *Tabeist*, the islanders are familiar with at least three different species attaining a large size. Last spring he had received from a friend—a native of the Hebrides—the skin of a recently-killed young seal of about a month old. It was pure white, and measured four feet in length without the flippers. This skin was accompanied

by a few notes, stating that the species is well known, and that in an adult state it is seven or eight feet long, the body being fully thicker than a herring barrel. The female has her young in November, and it is found three or four yards above high-water mark, sometimes quite among the ferns and heather. The young do not take the water till six weeks old, when they weigh seventy or eighty pounds. If disturbed, however, the old one will make off with her calf, which she does by taking it up on her back, and so plunging into the sea. Even after a long dive, on rising to the surface, the young one remains securely on its mother's back. She comes to suckle it regularly at high-water; but her instinct teaches her to choose such spots as render it impossible for any one either to approach or lay in wait for them without being seen or scented. Mr Graham observed that the description of the markings of this white seal agreed exactly with that of the harp seal, which is not likely to be mistaken, at least in the adult state, for any other British species; but at the same time he expressed his belief that, among the islanders generally, there were three large seals confounded with each other—the grey seal (*Halichærus gryphus*); the great seal (*Phoca barbata*); and the Greenland seal (*Phoca Greenlandica* of Müller).

Mr Gray also communicated some facts of interest in connection with the cormorant and oyster catcher, selected from Mr Graham's correspondence.

II.—*Notes on the Natural History of Bute,*

From a manuscript of last century, written by Mr John Blain, Commissary of the Isles, communicated by Mr John Eaton Reid.

This paper contained many interesting records of the fauna and flora of that island, showing the changes that have taken place since the time of Mr Blain's researches, many of the birds especially being now either extinct as British, or driven to remote districts.

MARCH 31ST, 1863.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected resident members:—Messrs James Wingate, James McPherson, Mungo Campbell, Peter Clark, William Young, and Bruce Barclay, M.D.

SPECIMENS EXHIBITED.

Dr Colquhoun exhibited a specimen of the great snowy owl (*Surnia nyctea*), recently shot near Kilmarnock, and forwarded by Mr D. C. Gairdner. When this bird was shot, it was claimed by the master of a trading vessel at Ardrossan, who presumed it to be the same owl that had alighted on the rigging when off the coast of Newfoundland, and accompanied the ship part of the way across the Atlantic. There can be no doubt of this and other species being indebted, during their migratory flights, to vessels at sea for occasional rest; but there are some interesting facts in connection with the habits of the snowy owl which encourage the idea that the bird is more attracted by the novelty of a solitary ship on the waves, than from any desire for shelter or food, when they flutter round it, or alight in crowds on the spars. Instances have been recorded, by the late Mr Thompson, of as many as forty of these large and magnificent birds hovering about ships nearly 800 miles from the nearest land. At other times they have been observed in similar situations during severe storms, showing no signs of fatigue, but skimming the deep trough of the rolling waves, and cresting the billows with as much freedom as if merely coursing the surface of their native hills.

Dr Dewar also exhibited three fine specimens of this splendid owl, having selected them out of a consignment of upwards of twenty from Canada, where they had been shot during the past winter by a collector from this country; and he mentioned that this Kilmarnock bird was not the only one which had occurred in the West of Scotland, a specimen having been shot on the Isle of Skye by his friend, Captain Cameron. The species is a well-known winter visitor to the Orkney and Shetland Islands, and, being a day-flier, it preys upon hares, rabbits, and ptarmigan, which it hunts down, and clutches with its foot like a peregrine falcon.

A specimen of *Coronella lavis*, a new British snake, was exhibited by Mr Edward R. Alston, who made some interesting remarks on the species. It appears to have been first recorded in September last, by Mr F. T. Buckland, a specimen having been at that time taken in Hampshire by Mr Fenton, who presented it to the Zoological Gardens. It was there identified by Dr Günther, of the British Museum. Frequent examples of this snake have

since been taken in the same county, one of which, while in Mr Buckland's possession, gave birth to five living young, thus confirming the statement of Von Tschudi, and other Continental naturalists, who had asserted that this species is not oviparous, like the common ringed snake. Mr Alston observed, further, that it is a local, though not uncommon, species in many parts of Europe, preferring dry to marshy ground, and living mostly on lizards. It is found in Austria, and is indigenous to Switzerland, where Von Tschudi says it occurs on the Alps at an elevation of upwards of four thousand feet. He concluded his remarks by observing that all the specimens yet obtained in the British Islands had occurred in Hampshire, a peculiarity arising probably from its having been confounded with the ringed snake (*Natrix torquata*), but that further investigation might prove it to be a species more generally distributed.

Mr David Robertson exhibited specimens of *Doris planata*, *Eolis olivacea*, and *Eolis gracilis*, taken by himself at Cumbrae, under stones at low water. Dr Lindsay drew the attention of the members to an unusually large specimen of *Astrophyton scutatum* (*Euryale* of Lamarck), which he exhibited from the cabinet of Dr Thomas Paterson.

The following plants were exhibited by Mr Peter Clark, of the Royal Botanic Garden:—*Laurus camphora*, *Ficus religiosus*, *Cycas circinalis*, and *Oncidium graminifolium*, all in the finest condition; and Dr Scouler made some observations on each of the species. Mr Clark also exhibited a specimen of *Melopsittacus undulatus* (the warbling grass paraquet), a young bird which had been reared in Glasgow.

Dr Dewar exhibited a head of the white urus, or Caledonian ox (*Urus Scoticus*, Sm.), and read a short paper on the species as it at present exists in Cadzow forest, the only preserved habitat in Scotland. Old writers speak of these cattle, which, in their own time, haunted the ancient Caledonian forest, extending from Stirling to Athol and Lochaber, as large and furious animals; and, in more recent times, Gesner and Sir Robert Sibbald allude to them as either degenerated or extinct, except in the district of Cumbernauld. The breed at Hamilton, which is carefully preserved, is one of great interest, and is looked upon as directly descended from the herds of wild cattle kept by our ancient Scottish kings; and as the Cadzow enclosure yet retains much of

its original aspect, the white urus, now roaming over its 1300 acres, is presumed to be in the same state as when it ran wild in the primitive woods of our country at the time the Romans first visited it. Mr Alston also contributed some interesting information relative to the habits of the species.

Dr Dewar then made some remarks on a specimen of the Canada or cravat goose (*Anser Canadensis*), which was shot a few days ago within ten miles of Glasgow, and which he had brought to the meeting for exhibition. This bird was considered an important addition to the ornithology of the West of Scotland, as it presented no marks whatever of having at any time been in confinement.

The Secretary afterwards drew the attention of the meeting to a magnificent series of Himalayan raptorial birds from the collection of Mr Ludovick C. Stewart, Staff Surgeon-Major, which were arranged on the table. Mr Stewart, who was thereupon introduced to the members, gave a highly interesting account of the species forming his valuable collection, which included three specimens of the Lammergeyer (*Gypuætos barbatus*), *Falco Bonellii*, *Homatornis undulatus*, *Buteo Canescens*, *Falco chicquera*, *Syrnium monticolum*, *Ketupa flavipes*, *Bubo coromander*, *Athene Bramah*, and *A. Brodiei*, etc. On the motion of the President, a cordial vote of thanks was awarded to Mr Stewart for his communications.

PAPER READ.

Notes on some of the Marine Invertebrata of the Firth of Clyde, with a Notice of the most suitable localities for Dredging in the Bay of Rothesay. By JOHN GRIEVE, M.D.

Though unequal in zoological richness to Millport and Kames Bay, with its outlying islets, the Bay of Rothesay and the adjacent shores present some features worthy of attention, and would doubtless, on careful examination, yield some of those rarities which have hitherto been confined to the Cumbraes.

With a view to point out the most likely places in which additional species might be obtained, and so to facilitate the means whereby our knowledge of the marine fauna of the Clyde district might be increased, we propose to combine, with the following remarks on a few marine animals, a brief sketch of the localities in that bay we have found most favourable, noticing, in a general

way, what one might there expect to obtain. Our dredgings, however, have as yet been too few, and the results too incomplete, to enable us to enter into further detail, and to draw out such a list as one would desiderate.

The Bay of Rothesay is covered with an abundant deposit of soft bluish mud, which few at first sight would be inclined to interfere with; but on getting to the east of the Old Battery it will be found much harder, with stones and gravel; and upon dredging opposite to this shore, and down towards Huntly Place, among other objects which are generally distributed and usually brought up in every locality, one is pretty sure to obtain several ascidians. Of these the most common was *Ascidia mentula*, often occurring of large size, and clustered together in great numbers. In many of them the tunic was thickly studded with *Crenella marmorata*, set close to each other, and imbedded in its texture. The existence of such a crowd of parasites would lead one to suppose that they cannot be very injurious to the health of the ascidian, and proves the tunic to be very insensible to irritation; were it otherwise, so many large examples would be more rarely met with, and such would be more or less free of them, whereas the size of the ascidian seems only to offer more room for the accommodation of the *Crenella*. Though they may obtain sufficient aliment for themselves, it is possibly liberally increased by a portion of that which the powerful branchial currents of the ascidia brings in for its own use. With these dependants on its outer surface, this ascidia, like *Pinna* and *Modiola modiolus*, has occasionally a crustacean residing within its branchial sac, a little entomostracan, *Notodelphis ascidicola*. Whether or no the little *Pinnotheres* ever comes out from between the gills of the *Modiola*, our first acquaintance with *Notodelphis* was made on observing it emerge at the branchial orifice of this ascidia, and proceed on a tour of inspection over the surface of the tunic. Our desire to lay hold of it, however, was too urgent to wait till we saw whether it would return again within the sac. That its ova are hatched in this situation is highly probable.

On examining one of the compound ascidians, a species of *Amouroucium*, probably *A. proliferum* (common at low water, on stones and in crevices of the rocks on the islets off Millport), and on dissecting it under the microscope, the individual animals may be readily extracted. From the side of the branchial orifice a

curious process projects, beneath which is the common anal and genital orifice, and close to this process the nervous ganglion is situated. At the bottom of the branchial sac lies the mouth, stomach, and intestines, heart, and large vessels. The rectum passes up along one side of this sac to the orifice. Beneath the process, and in close proximity to it, one or two ova in an advanced stage of development may be frequently observed. The caudal portion of the animal contains the reproductive organs. In what part the ova are fertilized is not easily made out, but there could be no doubt of the presence of sperm cells. The more advanced ova contained the curious little tadpole-larvæ, ready to be extruded. They are of an orange-red colour; a dark triangular patch represents the stomach, and the tail is curved, on one side of the ovum, towards the head. Round this front portion of the larva is a semicircle of cells, with three button-shaped processes on the surface next to the outer membrane of the ovum, which are connected, in some examples, by processes extending towards the centre of the semicircle of cells. By these button-shaped processes the larva, after passing some time swimming about in the free state, is said to settle down on a shell, stone, or some other object, where, like its parent, it adheres firmly for life. Some of the ova are of a dark brown, with a white nucleus; others again are of a yellowish tint, with granules in the centre of an orange hue. A progressive development is observed in each as they ascend from the lower portion towards the common orifice.

In one or two of these animals what appeared to be an ovum was filled with a number of little ovules, in each of which was a bright red dot; or, in other words, in the same situation, and beside the other ova which contained the tadpole-larvæ, there was a cyst or sac of precisely similar size and form, filled with these red-dotted ovules; and in another animal we found the same cyst, with the ovules not so far advanced, and wanting the red spot. On slight pressure the sac gave way, and these ovules were discharged. Each of them was then found to present a red eye-speck, like an entomostracan, and there appeared to be a stomach-mass filled with reddish-yellow granules. When the envelope of the ovule burst, the limbs which had been previously pressed close to the side of the body were expanded; three pair were observed to be given off from the upper half of the body; of the first pair, each was terminated by two setæ; the number of articulations, how-

ever, could not be distinctly made out. The second pair were undoubtedly bifurcated—the upper one terminated by two, and the lower by four setæ. The third pair lay close to the side, each with one long seta. There were two little setæ given off from the tail.

In these instances the ovisac presented the same shape as the ovum of the *Amouroucium*, near which it was situated. One, however (observed by itself, on the slide), had the usual pyriform shape of the entomostracan ovisac, and contained some 200 ovules with the red eye-speck; so that probably in the former the pyriform shape was merely concealed by its position in the *Amouroucium*; but whether attached to the wall of the branchial sac at the side near the common orifice, or placed within the substance of the ovary, or in the oviduct, where the young could easily find their way out, could not be clearly ascertained. This entomostracan ovisac was found to occur in four of the animals we dissected. The species to which it belonged is, of course, unknown; but its presence in such a situation would seem to show that this little *Amouroucium*, like its larger relation, has also an attendant entomostracan.

Ascidia virginea.—In this species the tunic is crystalline, of a clear, transparent texture, through which the internal structure of the animal can be easily seen. The cells of the branchial sac are coloured with brilliant orange-red or scarlet pigment cells, not uniformly laid on, but rather in broken and scattered patches. Just below the stomach-mass the heart is situated, and through the transparent tunic the circulation of the blood is readily seen—more so on one side of the body than the other.

In most orders of mollusca the blood is propelled by the heart through the arterial vessels, and returns again by a system of veins and sinuses, thus completing a circle. In the tunicata, to which order the ascidians belong, the circulation bears a special interest. In them it is propelled through one set of vessels, and returns again through the same, the course of the circulation being reversed—the same vessels which fulfilled the function of arteries serving also as veins to carry it back to the heart. In none is this observed with such facility as in *Ascidia virginea*. At intervals the circulation is more rapid, but the time and number of the pulsations seem pretty uniform. After sixty waves have passed, the current gets slower, and gradually ceases about the seventieth.

Immediately on stopping the current is reversed, beginning again slowly, as if with an effort, then gradually increasing in rapidity. In this way the circulation is carried on, first in one direction, the blood flowing in one set of vessels, then stopping, and returning in the same; and so, now backward, now forward, every two minutes the flow of the current is reversed. Apparently the effort required to propel it towards the rectal side was much less than that required to propel it back; still the time occupied by the seventy pulsations was about the same in either direction.

Within dead bivalves, *Ascidia intestinalis* is usually found, apparently protected thereby, as it retreats within them whenever touched. Though at first sight appearing only about an inch in length, it will elongate about three or four times as much when fully distended and lying stretched out with its orifices open. In this species the number of pulsations before the current is stopped is far more numerous than in the preceding.

With the towing-net we once obtained what appeared to be *Appendicularia flagellum*, if this species is not probably the tadpole-larva of some other ascidian. It was in every respect very similar in appearance, though considerably larger than the larva in the ovum, and propelled itself by a wriggling motion of the tail, very like an ordinary tadpole.

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Dredging opposite the Bogany Farm and towards the Point, an extensive meadow of *Zostera marina* is crossed, the feeding-ground of numberless *Asteriula*, *Buccina*, and other mollusca, but more especially of the Brittle-stars. Here the dredge has frequently come up with the bag stuffed full of them, and with nothing else, just as if they had been gathered by some mermaid's fingers. Three species, *Ophiocoma granulata*, *O. bellis*, *O. rosula*, will be found—the first in greatest abundance. *Solaster papposu* is occasionally met with; and the common star-fish, *Uraster rubens*, is everywhere abundant. On the fishing-ground opposite the Catholic Church, beyond Ardbeg Point, very large *Urasters* have come up, and also the *Luidia fragillissima*. Two specimens of the latter had respectively seven rays; in one the rays were seven inches in length, in the other nine inches; and the breadth, from where it came off from the disc or central part of the body, was one and a-half inches; the length across, from the tip of one ray to the tip of the opposite, being nineteen inches.

Passing over any reference at present to the more common mollusca and dead valves, with their interesting contents, obtained in these and the following localities, and which are everywhere abundant, a more successful dredging-ground in the coralline zone will be found opposite Craigmore, the bottom there consisting of fine small gravel. Here there is more chance of obtaining crustacea. Several species of Hermit crabs will turn up—*Pagurus Bernhardus*, *P. tævis*, *P. cumanensis*, and *P. Prideauxii*, invested with the *Adamsia palliata*; besides the following—*Carcinus maenas*, *Portunus depurator*, *Platycheles longicornis*, *Hyas araneus*, and perhaps a Spider crab.

Masses of the gravel will be found matted into longitudinal balls, much longer than broad, and forming a tube, smoothly lined with byssal fibres. Within this tube or nest, as it is called, the beautiful *Lima hyans* resides, and probably never leaves it till disturbed by the dredge and brought to the surface, when some of them fall out accidentally, and the nest is left empty. In the aquarium they are easily kept; their swimming powers, and the process of constructing a new abode out of any kind of materials supplied to them, and even with byssal fibres only, affording considerable interest. Opposite Huntly Place, already referred to, these *Lima* nests are also occasionally brought up, made of gravel; but on the western shore of the bay, opposite the houses near Ardbeg Point, they are found in great numbers in the Nullipore coralline. This fine, small coral seems to suit, and the nest (or rather house, not being used as such in its ordinary acceptation) is, to outward appearance, not so coarse and chumsy as when constructed of gravel. To the west of Millport Bay, off the Tan Spit, they are very abundant in the same coralline; while to the east again, off the Fairland Point, they occur in gravel, as they do also off Gourock. The Ardbeg ground is not generally so rich as Craigmore, though yielding all the *crustacea* named. A little to the east of the rocks off Ascog Church there was an old bed of the *Pecten opercularis*, which should also afford good dredging, and might be tried with advantage.

On the outside of the *Lima's* nest, and among the loose gravel or coral brought up with it, an annelid with green bristles, *Flemingia plumosa*, is not unfrequently seen. Within the nest itself, another, a species of *Siphonostoma*, is almost constantly met with. It will be seen, on tearing open the

nest, and sometimes among the loose coral outside of it, but we do not remember ever observing it in any other situation. It always accompanies the *Lima*.

It is a greenish-yellow looking worm, the colour being derived from the green blood which is conspicuous in the gills. It does not form any tube of its own, but crawls over the inner surface of the nest. To the eye, it appears to be enclosed in a sort of loose bag, to which it is attached by narrow cross lines—these are the bristles of the feet, and are consequently opposite to each articulation. These bristles pass to this loose external integument, and project a little beyond it. The intervening space between each bristle, that is, between each pair of feet, is filled up by a close band of fine hairs, each of which is swollen at the extremity—the “poils renfès” of Quatrefages. They resemble filiform curled filaments, each attached to a fusiform body, and are not unlike a large thread-cell with the thread discharged. These peculiar hairs approach more or less towards the margin of the loose external envelope, some of them quite up to it, and are found in this situation all over the body of the animal, and even in the green concave fans. These are placed on each side of the head, and are composed of numerous bristles. When crawling over the nest of the *Lima*, the loose external skin gives it very much the appearance of being enclosed in some sort of jelly.

This species does not seem to be *S. uncinata*, which, according to Quatrefages, has the body naked, and without the “poils.”

In addition to the *Astroidea* already named as occurring in these localities, *Ophiura texturata*, often of a large size, will be found; also *O. albidu*, *Cribella oculata*, *Amphidotus cordatus*, *Echinus miliaris*, and *E. sphaera*. *Pentacta pentactes* and *Syrinx nuda* have been got, and the dead shells of *Dentalium* frequently contain a species of *Sipunculus*.

So far as one can see, the shell of the male *Echinus* does not present any perceptible difference from that of the female, but to the eye of an urchin some peculiarity must undoubtedly exist between the two. The curious larval form, *Pluteus*, somewhat resembling a painter's easel, and so remarkably dissimilar to the future spherical shell of the urchin, we have only seen by chance under the microscope, when examining some luminous or phosphorescent water taken near the shore. After observing several of the *Protozoa*, so abundant when sea water presents that appear-

ance, the next drops we placed on the slide were found to contain this *Pluteus*. From the great quantity of ova contained in an animal so generally distributed on all our shores as the *Echinus*, this larval form at certain seasons must be very abundant, and would probably be found on one of those brilliant nights, when the sea, shining with phosphorescence, is full of animal life—of luminous *Radiata* and *Protozoa*.

When out on the rocks off Millport at low water, in the month of July, we observed a pair of these urchins engaged in spawning. They were seated side by side on the rock-face in the water. Close at hand we could not distinguish whether ova were discharged by one only or by both, though at a little distance the impregnated ova, when more scattered, could be readily discerned as they floated away and sank. On removing both, the microscope soon revealed that the one seated to seaward was the male. Both, as to external appearance, size, and weight, were about similar, but the male had rather more purple spines, while those of the female were of a greenish yellow.

The fronds of *Laminaria saccharina* are often a great nuisance when the dredge is put down too close to them, as they stuff the mouth of the bag, and so prevent anything from going in. Still they are well worth an occasional inspection, for on them might be found the *Pentacrinus Europæus*, the diminutive representative of the stone lilies of former eras—the link connecting the crinoids of the present seas with those of the past. On one of these fronds a little stem may be seen rising from a small plate to about half an inch in height, and terminated by a minute, cup-shaped body, with five double pinnated arms. From this curious position, in course of time, the young *Pentacrinus* falls off, and growing in size as it moves more freely about, and perhaps obtaining a more liberal diet, it has changed its name and become, what at one time was considered a distinct species, the *Comatula rosacea*, the rosy feather star, usually of a fine rose colour, but sometimes tinted with yellow, and, in general appearance, by far the most beautiful star-fish that inhabits our seas. Though very apt to throw off portions of the arms and their pinnæ, it may be kept alive for some time in an aquarium, where its beauty alone would make it a welcome addition.

So long as it remains entire, few marine animals present more graceful and magnificent attitudes. Perched on some pointed

stone, as it did in early life on its stem, the rosy plumes are curled and waved in the water, backwards and forwards, in every direction. Sometimes a single plume alone is moved through it, at other times several. Now all are expanded to their utmost extent, as far as they can be stretched; again they are curled up close in over the back, in a little while to be slowly unfolded like the petals of a flower; and so, ever and anon, the position of one and all is constantly being changed, individually and collectively. Soon, unfortunately, they begin to break, and piece after piece falls off, till little more than the disk alone remains.

Our first *Comatula* was got below Gourock. On the coast of Bute we have never been so fortunate, not one having come up; but off the Cumbrae one or two were got at intervals. Lamash Bay alone has been considered their head-quarters, where they might readily be obtained in abundance. Though numerous at one time, it does not follow that such is constantly the case, for much depends on the chance of the moment. Probably in some seasons they are more common than others, or one's luck is greater at one time than another on such a narrow strip of the sea bottom as is touched by the dredge.

When off the north end of the Little Cumbrae, about the end of June, 1861, in company with our Secretary and Mr Robertson, we put the dredge overboard for a trial of the ground in from five to ten fathoms. On hauling it in, one or two *Comatulas* came up clinging to the rope, and though the net seemed empty, a few were found in the inside. Several hauls were made over the same ground, and each time the dredge brought up numbers of these beautiful creatures. They appeared to have been crawling over the *Laminaria*, as they came up adhering to the outside as well as the inside of the netting, and, by our remaining at that spot, they could have been got in hundreds. Hardly anything else of importance was obtained; an urchin or two, one *Uraster rubens*, one *U. glacialis*, some hermit crabs, and a *Trochus tumidus* completed the bag, so that, with the exception of the *Comatulas*, that spot did not offer much inducement for further operations. We set it down, however, as a sure place for obtaining them. In the month of September following, we went over again to the same ground, expecting to be equally fortunate, but not a single one came up, and, after some half dozen hauls, we gave up the attempt. Again in the following summer, on two different occasions, we dredged

most zealously over the same spot, with no better success.* These repeated failures, where we had at first been so successful, would appear to warrant the inference that this species may migrate in shoals, and live in societies, one of which had obviously been met with when they came up clinging in such numbers to the netting. Their occurrence on the *Luminaria*, on which the young *Pentacrinus* may be sought for, would seem further to point out the purpose for which this migration takes place.

A haul through the mud of Rothesay Bay, however disagreeable the process of examining it be, will repay the trouble. Such a habitat, from its unattractive nature, conceals many objects which are accounted rare, but which, on ordinary ground, would not long escape notice.

Tabularia indivisa, with its beautiful scarlet polypite and tentacles, will be found in considerable abundance. Sometimes the little heads, having dropped off, will be seen lying curled up, so as at first sight to resemble some small *Eolid*.

Ophiura texturata and *O. albida* also occur, but the most characteristic and most abundant star-fish is *O. filiformis*—the thread-rayed star. It is found only in the mud, and is common on such ground in the Gareloch, Gourock, Largs, and elsewhere in the Firth. When brought up, their long delicate rays will be seen moving through the mud, from which it is hopeless to extricate them, as they break into fragments on any attempt to pull them out; but if it is allowed to stand for some time in a bucket, then the most brittle of brittle-stars will all come to the surface, and may be lifted up very entire. An instantaneous plunge into a cold fresh bath is the only way to keep them so.

We were not so fortunate, in one or two trials, as to find *Bryussus lyrifer*, the Fiddle Heart-urchin, which was first described by Edward Forbes, from specimens found in this district. We obtained it, however, in the mud off Ashton, Gourock; and shortly after, in dredging with Messrs Robertson and Keddie in the Bay of Largs, several were brought up, and it would seem there to be very abundant. This species is the only British Heart-urchin inhabiting mud, in which it probably lies concealed, like the common Heart-urchin, *Amphidotus cordatus*, in our sandy bays.

* Since that, Mr Robertson has tried it several times, but not till last year, 1867, did the *Comatulas* re-appear, when they were abundant, as also was the *Pentacrinus*, one frond being thickly covered with them.

APRIL 28TH, 1863.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected resident members:—Messrs James Watson, James Rae, David Haire, William T. Wilson, James Horne; and, as corresponding members, Mr Ludovick Charles Stewart; Colin MacKinnon, Ardlamont; Rev. James Dewar, Glendaruel; and Norman A. MacLeod of Orbost, Isle of Skye.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited specimens of *Virgularia mirabilis*, which had been dredged by Mr Keddie and himself in the Gareloch—a locality previously recorded for this zoophyte. Its frequency and small size on this station, however, may be worthy of remark. A considerable number were dredged, none of which exceeded three inches in length, while many were not over half the dimensions. They were found in ten fathoms water on a mud bank, a habitat which, on the same occasion, yielded them *Cucumaria pentactes* in great abundance.

Dr Scouler exhibited a specimen of a rare crustacean, *Æga tridentata* of Leach, from Lochfine; also a number of specimens of the unctuous sucker (*Liparis vulgaris*), from the same locality, where it has recently been found in extreme abundance in rock pools, and mentioned that his attention had been drawn to this unusual circumstance by James Hamilton, Esq., a member of the society, resident on the banks of Lochfine.

Mr James Thomson exhibited a series of the genus *Lingula*, from the coal fields of the West of Scotland, embracing the following species:—*Lingula mytiloides*, Sow.; *L. squamiformis*, Phil.; *L. Scoticus*, Davidson; *L. marginata*; and *Lingula Thomsonii*, the last being a species new to science, and named by Mr Davidson in honour of Mr Thomson, who discovered it near Campbeltown. This locality, in which Mr Thomson has been prosecuting his researches, has furnished two species—*Thomsonii* and *marginata*; the others which were exhibited having been found in the coal fields of Dalry, Carluke, East Kilbride, Bishopbriggs, Castlecary, Beith, etc. A slab of shale from Dalry was also exhibited, showing a number of *L. Mytiloides*, embedded. The shells were in an erect position, instead of lying horizontally compressed; and, although of delicate structure, were seen to be in a beautiful state

of preservation, proving the habitat of these animals to have been quiet and shallow water.

Dr J. Grieve exhibited a species of *Serpula* provided with two opercula, each being as large as the normal single one; also various species of *Sabella*, with the leathery and calcareous tubes which they inhabit. Dr Grieve mentioned that the whole of the gills, around the head, after being thrown off, were completely regenerated in the space of a month, and explained how respiration was carried on during the progress of reproduction; at the same time describing in what manner the calcareous tube is extended, and repaired in cases of fracture.

A quantity of *Piussava* was exhibited by Mr Michael Connal, who made some interesting remarks on its introduction into this country, and the economic uses for which it is available.

PAPERS READ.

I.—*On Fossil Entomostraca from the ironstones and shales of the Luncashire Coal-field.* By Mr JOHN YOUNG.

Mr Young, who appears to have minutely studied these organisms, carefully described the numerous genera and species which had come under his notice while exploring the coal-fields around Glasgow, and closed his remarks with a few directions as to the best mode of extracting and preserving specimens for the cabinet—a method shown to be most successful by the perfect state of those which he exhibited. Mr Young had on the table a large collection of specimens illustrating the following genera:—*Cythere*, *Cythereopsis*, *Bairdia*, *Lepiditia*, *Beyrichia*, *Kirkbya*, *Daphnia*, *Entomocaulus*, *Ostheria*, and *Dithyrocaris*.

II.—*On some of the Scansorial Birds of the Himalayas.*

By Mr LUDOVICK C. STEWART, Staff Surgeon-Major, with illustrative groups of parrots, woodpeckers, etc., and some of the allied genera.

The series of specimens on the table illustrating this paper possessed considerable interest, the specimens having been selected out of a most extensive and carefully prepared collection; and the author made some very graphic observations on the structure and habits of the more interesting species. Mr Stewart also exhibited specimens of the spine-tailed swift (*Acanthylis nudipes*),

Alpine swift (*Cypselus melba*), and Himalayan tree swift (*Dendrochelidon coronatus*); giving, at the same time, an account of their habits, as observed by himself.

MAY 26TH, 1863.

Hugh Colquhoun, M.D., Vice-President, in the chair. The following gentlemen were elected members:—Messrs Robert Ker Watson, Robert Brodie, resident; and John Ferguson, Oak Bank, Mull, corresponding.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited a specimen of *Peachia hastata* (Gosse)—a somewhat rare species of sea anemone—which he had dredged off Cumbræ. It had not previously been obtained in Scotland, and Mr Robertson explained that it had probably escaped notice from the fact of its having no adherent base, and from its habit of burrowing, which made its capture difficult by the ordinary dredge. Mr Robertson also exhibited a specimen of *Bodotria concava*—probably a new species; and one of the *Diastylidæ*, with five spines, but whether a variety or a new species has not yet been decided.

Mr James Thomson exhibited an elaborate series of the following genera of carboniferous brachiopods, distinguished for the perfection and variety of the specimens forming the collection:—*Terebratulina* (recent and fossil), *Spirifera*, *Spiriferina*, *Athyris*, *Retzia*, *Rhynchonella*, and *Crania*. The recent specimens of *Terebratulina* and *Crania*, which are far from common on our shores, were dredged by Mr Thomson in Kilbrannan Sound, and near Oban; and respecting the fossil species of many of the foregoing genera, it was observed by Mr Young that some of them were extremely rare, especially those which had been found in the coal fields around Glasgow, and afforded the most satisfactory proofs of Mr Thomson's diligence and discrimination as a collector.

Mr John Shaw exhibited specimens of a very rare moss—*Glyphomitrium Daviesii*—from Kilpatrick Hills. He stated that, on account of the very meagre supply got from the north of Ireland—the only important station for the moss—during the last few years, it was becoming very scarce among bryologists. He was glad, however, to know that Messrs Galt and MacCartney had

gathered this species in great abundance near Bowling, a locality noticed by Dr Hooker and others. The specimens exhibited by Mr Shaw were from a new locality discovered by Mr M·Kinlay in August last year. Mr Shaw also exhibited *Hypnum egyptium* from Campsie Glen—the first notice of its occurrence in the West of Scotland. This moss was but recently discovered to be distinct from its ally *Hypnum palustre*, although it had been gathered some years ago by the late Dr Nichol.

Mr Peter Clark, of the Royal Botanic Garden, laid on the table several interesting plants for exhibition, including specimens of *Pinus halepensis*, *Artocarpus incisa*, etc., accompanied by remarks on each of the species.

A specimen of the eared shrew (*Sorex remijer*) from the Upper Ward of Lanarkshire, was exhibited by Edward R. Alston, Esq., who stated that he captured it near the banks of the river Nethan, in August, 1861. He had since taken another specimen of this rare shrew, on which the white spots on the ears were wanting—a character, however, which is variable, and may depend upon sex or age. The species has occurred but in a few instances in the British islands, and it is not improbable that Mr Alston's specimens are the only examples of its occurrence in the West of Scotland.

Dr Colquhoun exhibited a large centipede, alive, and measuring six inches in length, which had been recently taken from a ship at the Broomielaw, but he was unable to distinguish the species from Walckenaer's work on the Myriapoda—a group on which no comprehensive work exists, making it, therefore, a difficult matter to discriminate in a case like the present.

PAPER READ.

On the Gasteropod Mollusca of the Carboniferous Limestones of the West of Scotland. By Mr JOHN YOUNG, illustrated by a numerous series of genera and species from his own cabinet.

Mr Young, in introducing his subject, observed that, as a general rule, the gasteropoda of our Scottish coal formation are found only in the limestones, ironstones, and shales forming the true marine division of our coal measures. They are met with in greatest numbers and perfection, along with other marine shells, in certain shale beds that alternate with our limestones; and he had himself found in one locality (Craigenglen, Campsie) twelve genera

and upwards of forty species. In illustrating his paper, Mr Young brought forward, among others, the following genera:—*Naticopsis*, *Eulima*, *Loxonema*, *Macrocheilus*, *Euomphalus*, *Pleurotomaria*, *Murchisonia Platyceras*, *Dentalium*, *Chiton*, *Chitonellus*, *Porcellia*, and *Bellerophon*. These embraced a large number of species admirably preserved and mounted. In the case of *Naticopsis* it is interesting to find the colours yet visible in the shells; and among the *Euomphali*, Mr Young mentioned in connection with *Carbonarius*, that he had collected in one evening, at a quarry in Renfrewshire, one hundred and forty specimens. In concluding his remarks, he alluded to the necessity that exists for a thorough investigation of the British carboniferous univalves, as in their present state of classification it is not easy to fix the precise limits of many of the genera, and still more difficult to refer to doubtful species, owing to the varieties of form they often assume in different districts. Mr Young also drew attention to a specimen of *Comularia quadri-sulcatus*, in the collection upon the table, as a rare shell in Scottish districts.

Dr Lindsay then addressed the meeting at the close of the business, and made some remarks on the success which had attended the meetings of the session now concluded. He observed that since the formation of the society, twelve years ago, its prospects had never been in so satisfactory a state. While acknowledging the many valuable contributions of those gentlemen who had, by the exhibition of specimens and the reading of papers, aided the advancement of the society's interests, he would now state what he believed all the members already felt, that much of that success had resulted from the exertions of their Secretary, who had laboured successfully to place the society on a more satisfactory position than it had hitherto occupied. He begged, therefore, to move the following resolution:—"That the members of the Natural History Society of Glasgow, on this the last meeting of the Session 1862-3, unite in expressing a sense of their obligations to Mr Robert Gray, their Secretary, for the continued and sustained efforts he has made to secure and advance the Society's interests; in acknowledgment of which they tender him their cordial thanks, and further move that the same be recorded in the minutes of the society."

The resolution having been seconded by Mr Thomas Chapman, was cordially and unanimously agreed to.

SESSION 1863-64.

THE TWELFTH ANNUAL GENERAL MEETING, ANDERSON'S
UNIVERSITY BUILDINGS, SEPTEMBER 29TH, 1863.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected office-bearers for the session:—John Scouler, M.D., LL.D., F.L.S., President; Michael Connal, Vice-President; Robert Gray, Secretary; Matthew P. Bell, Treasurer; Thomas S. Hutcheson, Librarian; Hugh Colquhoun, M.D., John Grieve, M.D., and Alexander Lindsay, M.D., Members of Council.

SPECIMENS EXHIBITED.

Dr Dewar exhibited two specimens of Buffon's skua (*Lestris Buffonii*), from a small island off Benbecula, one of the Hebrides, and gave a short account of the bird, with a description of the locality whence it and other rare species have been obtained.

Mr Gray exhibited a specimen of the bee hawk or honey buzzard (*Pernis apicorus*), which was shot at Broxmouth Park, East Lothian, by Mr Henderson, and, at same time, mentioned several other recent instances of its occurrence in Scotland, the bird being considered a rare species in this country.

Mr David Robertson exhibited the following objects, with remarks:—

Cerianthus Lloydii.—This tube-inhabiting anemone, so far as I know, is new to Scotland. It was first obtained at Menai Strait by Mr Lloyd, in 1856, and again at the island of Herm, near Guernsey. I took the living specimens which I now exhibit at Cumbræ, at low water, and have observed that they are not confined to the margin of low tide, as I have occasionally brought up from deep water portions of their tubes cut off a few inches below the surface of the muddy sand. A piece of one of them was dredged this summer in Loch Goil by Mr Keddie and myself, and it is only by meshing such portions of their outer tunics that we gain a knowledge of their deep water habitat, as it is hardly possible to obtain

the animal itself from deep water, by any means at our command, owing to its habit of darting suddenly into its tube on the slightest alarm.

The precaution taken by Mr E. Edward, of Menai Bridge, for its capture, gives a good idea of the animal's vigilance. He says, "The plan I take is to surround it with two or three spades, each acting at the same moment, so as to undermine it in an instant, and press the ground, which makes its escape more difficult."

I believe the chief means by which the animal escapes from its pursuers is the great length of its tube. The great disproportion between the length of the tube and the animal has not, so far as I know, been hitherto noticed. The animal itself, in its contracted state, rarely exceeds two inches in length, and I have dug out more than fourteen inches of the tube without finding its termination.

Halcompa chrysanthellum.—This small anemone is also new to Scotland. It was taken at Cumbrae in the sand at low water. What makes the discovery of this little zoophyte in the Clyde province more interesting is, that it has not been met with before further north than Cornwall.

Ophiocoma brachiata.—I found this star-fish, in sand near low water, Little Cumbrae. The late Professor Forbes, in his work on British Star-fishes, gives no Scotch habitat for this species. Yet I believe it is by no means rare. Mr Keddie and I dredged it this summer on the north-east side of Cumbrae, and had several of its stray members from Loch Long and the Holy Loch.

Synapta inhærens I find between tide mark in muddy sand, Little Cumbrae, and in sandy gravel, Holy Isle, Arran. The Rev. Alf. M. Norman tells me that it is this species which is met with at Belfast. At Little Cumbrae I find it associated with *Synapta digitata* (*Chirodota digitata* of Montagu), which seems to be more widely distributed than *S. inhærens*. Previous to this summer, I had dredged two or three specimens of *Synapta digitata* when in company with Dr Grieve and Mr Keddie. Dr Scouler had it from Lochfine, and the Rev. A. M. Norman from Dublin and Shetland. Still they have been considered hitherto rather rare.

Professor E. Forbes, when speaking of this species, says, "he had never seen a living example." Nevertheless I found them this season at Little Cumbrae in great abundance, and of large

size, many of them measuring more than eight inches in length. I have since seen the fishermen at the same place filling their cans with them for bait, and have tried to find them in similar localities but without much success. I have, however, little doubt they will yet be found not uncommon round our coast.

Mr Robert Gray exhibited a number of specimens of a new amphipod, recently discovered by Mr Robertson, and named *Bathyporeia Robertsoni* by Mr Spence Bate, in his work now being published. This curious crustacean is found at Cumbrae on sand from two or three fathoms depth up to high water mark, and lives in spots over which streams of fresh water run into the sea, remaining for hours at a time subjected to their influence, a somewhat remarkable circumstance, as the animals are not wholly confined to within tide mark, but found at a depth of some fathoms. Besides its habit of burrowing, this amphipod is often found on a warm day darting about in the small sand ripple pools.

Mr John Young exhibited some fossil organisms, supposed to be the plates of two undescribed species of carboniferous chitons, obtained from strata in the neighbourhood of Glasgow, and read some very interesting notes on fossil chitonidæ, giving a history of their discovery in British strata. These specimens, which have been confirmed by Mr Kirkby, to whom they have been submitted, are entirely new to the carboniferous beds of Scotland.

A specimen of the palmated newt (*Lissotriton palmipes*) was exhibited, having been forwarded from Glenderar, near Stirling, by Roger J. R. Aytoun, Esq. This species is there found in considerable numbers; and, although it has been hitherto accounted rare, it will probably be found far from uncommon in various parts of the country.

PAPER READ.

On the Habits of the Cormorant (Phalacrocorax carbo).

By Mr ROBERT GRAY, the Secretary.

This communication contained many observations of interest connected with the two species to be found in the British islands. He gave an account of a visit to a fresh water loch in Wigtonshire, where, in the breeding season, the cormorants hatch in thousands on the banks, building their nests in the coarse heather. The distance from the sea is about eight miles, and Mr Gray was

attracted to the spot by observing great flocks of these birds flying from the sea in a straight line, at some height in the air, across the hills where the loch is situated. He also introduced a description of a line of sea caves and rocky platforms, another set of breeding stations, between Ballantrae and Loch Ryan. In some of the caves the cormorants enjoy the strange companionship of marten swallows and pigeons, birds whose gentle habits but ill harmonise with such dismal haunts. In one case the swallows swarmed round the mouth like bees at a hive, the rocky shelves of the interior being occupied by great numbers of rock pigeons and green-crested cormorants, the whole scene forming a somewhat unusual picture of bird life.

OCTOBER 27TH, 1863.

John Scouler, M.D., LL.D., F.L.S., President, in the chair.

Before the commencement of business, Dr Lindsay rose to observe that, since the last meeting, the society had sustained a loss by the death of one of its valued members, Mr James Hamilton, and moved that the Secretary be instructed to record in the minutes the high estimate which the members had formed of his talents and acquirements, and their deep and sincere regret at the loss which they, as a society, had sustained by his early and unexpected death.

The Chairman stated that no member of the society could feel more acutely this loss than himself, and passed a warm and deserved eulogy on his merits as a naturalist, as well as his individual worth, remarking that many of those who knew him would long remember the manly and kindly disposition for which he was distinguished.

Mr William Martin was elected a resident member.

SPECIMENS EXHIBITED.

Mr Alexander M'Kinlay exhibited specimens of the following rare mosses from new localities in Scotland:—*Didymodon recurvifolius*, from Ben Voirlich, the second known station; *Campylopus brevipilus*, var., from Doune, Perthshire, these having not been previously observed in Scotland; *Splachnum vasculosum*, *Mnium*

cinclidioides, and *Hypnum arcticum*, with fruit, from Ben Challum; *Neckera Philippeana*, gathered on a tree near Inverarnan; *Hypnum dimorphum*, *H. ochraceum*, with fruit, and *Hypnum molli*, with fruit, which Dr Stirton and he had found in various stations in Clova. He also intimated that he had discovered, on Ben Voirlich, *Dicranum circinnatum* (Wils.), which had not been anywhere observed since first found on that hill by Dr Greville many years ago. It occurs on Ben Voirlich in some quantity, assuming various forms, some closely approaching to *Dicranodonti*, numerous specimens of which he exhibited, some having male inflorescence.

Mr James Ramsay exhibited a specimen of *Lastrea cristata*, from a Renfrewshire locality, in connection with which the Secretary mentioned that he had received a communication from Mr Peter Clark, a member of the society, stating that he had discovered this plant in the same county in 1861.

Dr Dewar exhibited a specimen of Pallas' Sand Grouse (*Syrhaptes paradoxus*), from the outer Hebrides, an object of some interest, as showing that the flocks of this rare and interesting species, which have recently occurred in the British islands, have extended to all parts of the country. It has been found in Renfrewshire, Perthshire, the Lothians, and most of the north-eastern counties of Scotland; and as the present specimen was found on the 19th of this month, there is some reason to hope that the birds, having now been observed upwards of four months since their first arrival, will continue in their British habitats, and thus form a very important addition to our ornithological catalogues.

Mr John Young exhibited a fine specimen of the Porbeagle (*Lamna cornubica*), from the Minch, and made some observations upon fossil species of shark, illustrating his remarks with an extensive series of the teeth of these fishes. Mr Young likewise exhibited a grey phalarope (*Plularopus lobatus*), and a Hoopoe (*Upupa Epops*); the former having been shot near Gourrock, the latter at Langbank, both during the present month.

The Secretary (Mr Gray) exhibited a specimen of the short-nosed hippocampus (*Hippocampus brevirostris*), from Banffshire—a fish which has not hitherto been met with in Scotland, the localities quoted by Yarrell and other authors being the Channel Islands and the southern shores of England.

PAPERS READ.

I.—*On the Permanence of Species and the Limits of Variation.*

By Dr SCOULER.

The author of this paper remarked that when naturalists confined themselves to merely descriptive monographs, the tendency was to confound the distinctions of species and varieties. The true method to be adopted was the physiological, in which we begin by tracing the development of a species from its first formation, and observing all its changes in form and structure, from the ovum to maturity, and then taking a survey of the species in its relations to time and space. The study of the molluscous animals was by far the most favourable for this purpose, as many of them had existed from a remote geological antiquity, and were still living over wide geographical areas. This view was illustrated by exhibiting an extensive series of varieties of some of the more common species, and a comparison with the varieties of the same species from the tertiary strata. From an extensive series of comparisons, he inferred that there was no ground for presuming that species were transitory, or mere changing varieties.

II.—*A Short Account of Two Cyclones experienced on the Island of Anietyum.* By the Rev. JOSEPH COPELAND, one of the Society's Corresponding Members. Read by Dr Alexander Lindsay.

This communication contained minute and highly interesting details of the incidents connected with these hurricanes, besides being illustrated by an elaborate series of barometric observations.

NOVEMBER 24TH, 1863.

CONVERSAZIONE AND EXHIBITION.

On Tuesday evening, 24th November, 1863, a *Conversazione* and Exhibition took place in the Queen's Rooms.

In the lower halls a fine collection of British mosses was exhibited by Mr Alex. M'Kinlay. Mr John Shaw also exhibited a complete series of the genus *Orthotrichum*—a genus to which he had devoted special attention.

In another part of the room, Mr John Young exhibited a collection of the Carboniferous Fossils of the West of Scotland,

containing nearly four hundred species of the organic remains found in that formation.

In the same halls there was a large collection of beautifully preserved British plants, by Mr John Robertson, St Vincent Street, and a selection from the herbarium of the late Mr William Gourlay, chiefly *Leguminosæ*. On various tables there were excellent microscopes, and mounted objects of interest, exhibited by Mr White, Buchanan Street, and Mr John Stone, West Nile Street; and at other tables a number of those instruments belonging to the members were provided for the use of visitors. A display of plants from the Botanic Garden, including an interesting collection of Coniferæ from various parts of the world, was arranged by Mr Peter Clark, who had undertaken this section of the exhibition.

The upper room presented the appearance of a museum. One of the centre tables was wholly covered by a remarkably good collection of birds belonging to Dr Dewar, including fine examples of Raptorial birds, British and Continental. Conspicuous among these were the bald eagle and tawny eagle, the latter having been shot in the Crimea by Dr Dewar himself—a somewhat important capture, being the second instance of the bird's occurrence in Europe—the snowy owl, Iceland falcons, goshawks, buzzards of various species, ospreys, etc. Mr Thomas S. Hutcheson, the society's librarian, exhibited a number of relics of Alexander Wilson, the American ornithologist, including a folio volume of the plates of his celebrated work on the birds of that country. Mr J. Mossman contributed one or two elegant pieces of statuary, all bearing on natural history—one of which, a model for Wilson's statue intended for Paisley, was much admired. On the side tables were laid out an extensive collection of British and foreign lepidopterous insects and beetles, by Mr Thomas Chapman, whose cabinet is well known as the richest in the West of Scotland; a complete series of crustacæ, echini, and star-fishes from the Firth of Clyde, by Mr David Robertson; and a collection of foreign shells by Mr Thomas Gray, a gentleman whose cabinet is acknowledged to be one of the finest in Britain.

The Secretary exhibited three cases of objects somewhat novel—these being a striking collection of sea-fowls' eggs from Ailsa Craig, a number of birds' nests and their eggs, and cabinet skins of British birds, the last conspicuous for their beauty and perfec-

tion. The gallery was hung with a set of diagrams, kindly contributed by Mr Page of Edinburgh, representing extinct plants and animals; while at intervals there was suspended some noble heads of deer, and other ruminants, from Dr Dewar's collection.

Mr John Alexander contributed three cases of rare foreign birds; Dr Colquhoun a very fine series of mounted algæ from the West Coast—a department in which were also very conspicuous another series by Dr John Grieve. Mr M. P. Bell's collection of minerals created much interest by the large size and value of the specimens; and at the end of the room a large table was occupied by a selection from the geological cabinet of Mr James Thomson—a section of the exhibition which, in common with Mr Young's specimens, gave abundant proofs of the care and discrimination of both gentlemen.

At nine o'clock, the Council and some of the members having assembled on the platform—Mr Michael Connal, Vice-President, in the chair—the Secretary of the society, Mr Robert Gray, gave a short sketch of the society—its plans and progress.

The Natural History Society of Glasgow was instituted in 1851 by a few naturalists in this city who felt desirous of establishing in Glasgow a society for the pursuit of their mutual studies. The roll of members at that time included the names of two well-known citizens—Mr William Gourlay and Dr William Lorrain—whose loss the society still deploras. Both took a prominent share in its transactions, and, by their kind and genial manner, they enlisted many others into the study of subjects which have since been investigated with the most satisfactory results. By their influence and talents the society was enabled to take a place among the scientific bodies of this country; and while the members at this moment lament their untimely loss by death, they are proud to think that the sapling which they planted has now become a strong and vigorous tree. The objects of the society, as stated in its constitution, are—to meet for the exhibition of specimens, both native and foreign; the reading of communications; excursions for mutual improvement; and the encouragement, in all its branches, of the pursuit of natural history. During the twelve years it has been in existence, the proceedings have been characterised by many valuable papers on the fauna and flora of the West of Scotland, some of which have already appeared, through various channels, before the public. The geological,

entomological, ornithological, and botanical departments of this exhibition amply demonstrate the zeal of those whose collections have been displayed, and will prove to any one acquainted with these studies that the members have done well in their investigations. The committee venture to say that the collections are worthy of Glasgow, and do the city no discredit. In the marine section, the society refers with much satisfaction to the successful labours of one of its members who, by his own unaided efforts, has opened up, in a remarkable degree, the zoology of the Firth of Clyde. Many animals, hitherto accounted rare, are now known to exist as common objects, while the annals of science have received many important additions of animals altogether new to natural history records—discoveries which have caused the Firth of Clyde, and more particularly the Cumbrae Islands, to become one of the best explored and most widely-known districts of Britain. The society also points with pleasure to the extremely valuable collections of its geological members, whose recent researches have developed new fields of investigation, and who have earned for themselves well-merited honours. The numerical strength of the society is gradually progressing. About 150 diplomas have been granted to resident members, and there are now on the corresponding list about 30 members, five of whom are foreign, and two honorary. Finally, the Committee desire to make it known that the members have made full investigations into the natural history of the West of Scotland—materials of great importance to local students, and to those whose summer leisure may be employed in collecting objects for after study; and it will be at all times a pleasure to them to communicate, in their respective departments, the fullest information to those who desire to participate in the advantages to be obtained from the results of their labours.

Dr Scouler, the President of the Society, then came forward, and exhibited some fine remains of the moa or *dinornis*, from New Zealand, and gave an outline of the process by which the anatomist arrives at a knowledge of an extinct animal from the study of such fragments as have been preserved.

The exhibition, in compliance with a generally expressed wish, was continued throughout the following day and evening, and was attended by a large number of visitors.

DECEMBER 29TH, 1863.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected members:—Messrs William Hamilton, Geo. Hamilton, John B. Wingate, John Alexander, John Mossman, William Ker, James Sinclair, Robert Mason, Duncan M'Lellan, and George W. Rainey.

SPECIMENS EXHIBITED.

Dr Dewar exhibited a specimen of the tawny eagle (*Falco naevioides*), which had been shot by himself in the Crimea—the second recorded instance of its occurrence in Europe, a specimen having been obtained a few years ago from the same locality by Lieutenant Blakiston. Dr Dewar also exhibited the following rare birds, obtained during the present month from various localities in the West of Scotland:—The snowy owl (*Surnia nyctea*)—Renfrewshire; the hawk owl (*Surnia funerea*)—near Maryhill, its third occurrence in Britain; the fork-tailed storm petrel (*Thalassidroma Leachii*), two specimens—from Firth of Clyde and Benbecula; and the purple gallinule (*Porphyrio hyacinthus*), a species which has not hitherto been recognised as British—from near Campbeltown. The last-named bird bore no traces of having been in confinement; and as it is abundant in some parts of Europe, its occasional occurrence in this country should excite less surprise than that of many other species whose geographical range is not so extensive. The hawk owl, for example, being a native of North America, is more out of the limits of its distribution, and has a much wider distance to travel; while the purple water-hen, being found as near us as France and Germany, could easily perform a journey to the British islands, possessing as it does both powers of flight and swimming.

The Secretary, Mr Robert Gray, exhibited a specimen of the parrot crossbill (*Loxia pyliopsittacus*), from Wemyss Bay—a rare species, which has not occurred in Scotland for upwards of 30 years. The specimen formed one of a flock seen recently at the place mentioned. Mr Thomas Chapman exhibited a Bohemian wax-wing (*Bombycilla garrula*), from Tarbert, where it was found last month.

Mr David Robertson exhibited specimens of two rare fishes—Muller's topknot (*Rhombus hirtus*) and Bloch's topknot (*R. punctatus*), both from the Cumbraes; also, a recently described crustacean—

Galathea Andrewsii—from the same locality, where it is found plentifully. At same time, Mr Robertson exhibited an annelid, new to the British fauna—*Clymene lumbricalis*—from two different localities in the West of Scotland. This gentleman, one of the most successful investigators of our Scottish marine fauna, was especially thanked by the President and Members for his valuable contributions to the society transactions, and it was announced that among the results of his recent observations many new and important additions to the local lists would shortly be forthcoming.

PAPERS READ.

I.—*On the remains of a Fossil Elephant found at Airdrie.*

II.—*On the occurrence of a rare cetucean—(Hyperoodon bidentatus)—in the Gareloch.* By Dr SCOULER.

JANUARY 26TH, 1864.

Mr Michael Connal, Vice-President, in the chair. The Rev. Henry W. Crosskey was elected a resident member; and Tottenham Lee, Bynya, Narandra, New South Wales, corresponding.

SPECIMENS EXHIBITED.

Mr Duncan C. Brown exhibited a specimen of the pintail (*Dafila Candacuta*), from the River Cart, near Glasgow; and Dr Dewar exhibited a bittern (*Botaurus stellaris*), shot recently in Possil marsh, and a fine osprey (*Pandion haliaetus*), shot near Campsie. The society's ornithological records are now believed to be very complete as regards the West of Scotland—the additions of the past and present session having been not only numerous, but of great value and interest.

Mr Thomas Chapman exhibited a miscellaneous collection of insects from Porto Rico; and Mr John Young submitted to the meeting a curious variety of the shore pipit (*Anthus rupestris*), from Islay, the bird being of a rich cream colour.

Mr David Robertson exhibited specimens of *Hippolyte securifrons*, a crustacean new to the Firth of Clyde, on which he made the following remarks:—

This species was first dredged by Mr Jeffreys and the Rev. Alf. M. Norman, in the summer of 1861, in seventy or eighty fathoms of water, about sixty miles east of Shetland, and was briefly described in a paper read at the Manchester Meeting of the British

Association. It has since been taken, about sixty miles off Tynemouth, and also at Berwick Bay, and recently another specimen was obtained by Mr G. S. Brady from a fishing-boat at Sunderland. So far as the habits of the species have been observed, it would seem chiefly to frequent deep water, often at considerable distances from the shore.

As the species may readily be mistaken for *Hippolyte spinus*, of Sowerby, which it closely resembles, the following may be given as the prominent distinguishing characters of each:—

H. SECURIFRONS.	H. SPINUS.
Teeth on the carapace and upper margin of the rostrum all simple.	Teeth on the carapace and upper margin of the rostrum all double serrated.
Posterior eight teeth on the carapace and rostrum nearly alike in size.	Four posterior teeth on the carapace are greatly larger than the teeth anterior to them.
Posterior dorsal centre of the third segment obtuse.	Posterior dorsal centre produced backwards into a conspicuous tooth-like process.

I may here remark, however, that I find the spines of the carapace and rostrum are very unstable characters, requiring to be coupled to others of more permanence to give them reliable value.

In this same species the Rev. Alf. M. Norman gives figures of seven different conditions of the teeth in the rostrum and carapace. But with all the characters taken together, he establishes a good species in *Hippolyte securifrons*. The same inconstancy occurs in the spines of the carapace of some of the *Diastylidae*.

Some time ago I exhibited at one of our meetings a specimen of a five-spined *Cuma*; afterwards I found the same species with one spine only, and others having two, three, four, five, and up to seven spines, and individuals having, in addition to the larger spines, a very minute serration along the central ridge of the dorsal segments. Yet all these proved to be only variations of one species, *Cuma tri-spinosa*, of Goodsir—a name that the animal still enjoys on the good faith of the constancy of the three spines. These irregularities of the rostrum are not confined to the *Macroura* and *Stomopoda*, but are extended to the *Decapods*. In the case of the velvet swimming crab, *Portunus puber*, scarcely two will be found with the frontal armature of the carapace alike. Fortunately, in this instance, there are so many decided characters, that there is no way of getting wrong.

I may further remark, that I find the terminal tail plate and appendages in the *Macroura* and *Stomopods* much more constant

in their characters than the armature of the carapace or rostrum. Any deviation detected from the normal form in the caudal appendages of these animals is always a good reason for further scrutiny of all their parts.

Mr Robertson at same time exhibited a specimen of *Terebellides stremii*—an annelid new to the British fauna, also from the Firth of Clyde, where it is by no means rare. He had first dredged it, when in company with Mr Keddie, in the Kyles of Bute, in the summer of 1862, and found it last summer in Lochlong, Lochgoil, and off Cumbrae—the *habitat* in each case being a dark-coloured mud. Mr Robertson likewise gave a description of its habits, as observed by himself.

PAPER READ.

On the Fossil Shells, Anthracosia, Anthracomya, and Anthracoptera, found in the Lanarkshire Coalfield. By Mr JOHN YOUNG.

Specimens from his collection, belonging to various species of these genera, were exhibited; also specimens of the rock known as the Cambuslang marble, at one time worked in this district for ornamental purposes, and which is principally made up of shells belonging to this family, showing that they must have swarmed over certain tracts during the coal period, as thickly as the *Mytilidae* in our present seas. He stated that for many years these shells were regarded as nearly allied to the *Unios*, or fresh-water mussels of our present lakes and rivers, and that they were thought to indicate a fresh-water origin for the various coal strata in which they are found. But the investigations of the last few years have shown that they differ in several of their characters from true *Unios*; and, from the finding of marine shells associated with them in various districts, the strata in which they are found is now regarded as not so exclusively of fresh-water formation as was once supposed. He further stated that geologists had much to learn regarding the life of the coal period, before they could state definitely whether the beds in which these shells occur are truly of marine or fresh water origin. He, however, hoped that the day was not far distant when a more complete knowledge would be obtained of the varied conditions under which many of the beds connected with our coal strata were deposited—a result which could only be satisfactorily accomplished by a more careful study of the animals and plants found in these strata.

FEBRUARY 23D, 1864.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected as resident members:—Messrs William Henry Hill, Thomas Warden, James Pearson, and John William Burns, jr. of Kilmahaw.

SPECIMENS EXHIBITED.

The President drew the attention of the meeting to an interesting addition which had been made to the British *fauna* by Mr David Robertson, namely, *Onuphis Eschrichtii*, and exhibited the animal, with its ingeniously constructed tube. Mr Robertson had first found it when dredging in the Firth of Clyde in company with Dr Grieve of Glasgow.

Mr William Sinclair exhibited an eared grebe (*Podiceps auritus*) and a tree sparrow (*Passer montana*), both from East Lothian. The former is not uncommon at Dunbar, although it is considered one of the rarest species; the latter far from rare in many parts of the country where it breeds. It was first observed near North Berwick, and appears now to frequent many of the surrounding farms—a record of some interest, as it has not hitherto been recognised as a Scotch species in ornithological works.

Mr George Brown exhibited a red-necked grebe (*Podiceps rubricollis*), shot in the river Cart, near Glasgow; and the Secretary exhibited a specimen of *Podiceps minor*, which had been found breeding by Mr Sinclair on the summit of Ben Eadden, at an elevation of nearly 2000 feet.

Mr David Robertson exhibited specimens of a small star-fish, *Ophiura affinis* (Lütke), (*O. Norman* of Hodge,) from the collection of Mr George Hodge, Seaham Harbour, who first described it as a British species in the transactions of the Tyneside Naturalist's Field Club. Mr Hodge had dredged it at Seaham in 1861, on a sandy bottom from 6 to 26 fathoms water, associated with *Ophiura texturata* and *O. albida*, but a single specimen had been taken some years previous, by the Rev. A. M. Norman, in the Firth of Clyde; and by that gentleman a few specimens were taken at Shetland in the summer of 1861, but having given them only a passing glance, they had been laid aside as the young of *O. texturata* or *O. albida*, to which they bear a close resemblance. *O. affinis* is readily distinguished from *O. texturata* and *O. albida*, by a

crest of short spines at the base of the rays close to the disc.

Mr Robertson at same time exhibited a small crustacean, *Hippolyte pusiola* of Kroyer (*H. Andrewsii* of Kinahan, and *H. Barlii* of Sp. Bate), for the identification of which he had been indebted to the kindness of the Rev. A. M. Norman. It was taken at Cumbræ, on a sand and gravel bottom from ten to fifteen fathoms deep. *H. pusiola* is very like *H. Cranchii*, and may be readily mistaken for that animal, but is easily distinguished from it by having the apex of the rostrum simple instead of bifid.

Mr Robertson also exhibited a little auk (*Mergulus alle*), which had been captured at Millport, and forwarded to him by Mr Levack, one of the society's corresponding members.

Mr John Young made some remarks on the genus *Camarophoria*, a small group of bivalve shells, found as yet only in the Permian and Carboniferous formations, and stated that in Scottish strata they were so extremely rare that until the last few weeks only one specimen had been known, a single example, which was found in the limestone of West Lothian by the late Professor Fleming. Mr Young has lately identified three other specimens of these rare shells from the main limestone, Campsie, the species being *C. crumena*, in which he was fortunate in developing the internal characters on which the genus is founded. He also referred to another small species, *C. globulina*, discovered by Mr James Thomson, one of the society's members, at Brockley, near Lesmahagow.

The Secretary exhibited a slab from the Westbarns clay-field, near Dunbar, containing numerous remains of a recently discovered fossil star-fish (*Ophiolepis gracilis*), described as a new species by Professor Allman of Edinburgh. The slab excited some interest—the specimens of the star-fish being in excellent preservation. In the brickfield at Westbarns, they are found in great numbers; in a single horizontal bed, which extends about a 100 yards, as far as yet exposed, they are all of one species, and appear to have died suddenly, none of the rays being separated from the disc, or in any way mutilated. In dimensions, the specimens varied from one to four inches. Mr Gray mentioned that among the many thousands of these star-fishes, there did not appear to be a vestige of any other organism, a fact which leads to many curious speculations.

Mr Robertson then directed the notice of the members to a living *Doris* which he had on the table for exhibition, and which at present could not be referred to any British species.

PAPERS READ.

I.—*On the Skeleton of Oviparous Vertebrates.* By Dr SCOULER.

II.—*Observations on the Long-tailed Ice-Duck (Harelda glacialis).*
By the Secretary.

Two very beautiful specimens of the bird from Dunbar were exhibited, and an account given of the habits of the species as observed by Mr Gray, during the present month on the East Coast.

MARCH 29TH, 1864.

John Scouler, M.D., LL.D., F.L.S., President, in the chair.
Mr George Brown was elected a resident member.

SPECIMENS EXHIBITED.

Dr Dewar exhibited two specimens of the gadwall (*Anas strepera*), male and female, which had been shot during the present month on the Island of Benbecula, one of the outer Hebrides, a locality of very great interest to the ornithologist, as being the haunt of many rare species; also, a specimen of the spotted crake (*Crex porzana*) from Mid-Lothian.

Mr Edward R. Alston exhibited the eggs of a few rare British birds from various localities, and likewise made some observations on the eggs and breeding habits of *Uria Brunnichii* and *Uria Lachrymans*.

Dr Scouler exhibited a specimen of *Polyclinum constellatum*, a compound mollusc, and made some remarks on its structure. He also exhibited a cranium from an ancient tumulus in North America, and at same time directed the notice of the members to several other skulls on the table, showing the results of artificial pressure as practised by some of the tribes of that country.

Mr David Robertson exhibited a specimen of Montagu's Sucker (*Liparis Montagu*), from Cumbræ, with remarks on its distribution in the British islands. The same gentleman exhibited a very fine series of glacial shells from a new locality he had discovered in September last, at Langbank, and the shore at West Ferry, opposite Dumbarton Castle. This collection embraced several of

the rarer shells characterising the glacial deposits of the Clyde district, and contained about thirty species. The most abundant of these are *Cyprina Islandica* and *Pecten Islandicus*, the latter being extinct as a recent shell in the British seas. Mr John Young made some remarks on Mr Robertson's interesting discovery, stating that the collection exhibited was acquired during several visits to the locality by Mr Robertson, Mr R. Gray, and himself. The clay beds containing the shells had been found to extend a considerable distance along the shore, their existence being easily traced by the washed-out fragments on the beach for upwards of a mile east of the village. At some places the specimens are in excellent preservation, those of *Panopæa Norvegica* being quite entire. There were also numerous fragments of the plates and spines of an *Echinus*, which, so far as can be made out, appear to be portions of *Echinus lividus*—a species not now found alive in any part of Scotland.

Mr Young then drew the notice of the meeting to a series of beautifully preserved minute organisms from the glacial beds at Fairlie, near Largs. The material from which they were collected was found filling up the interiors of some of the larger shells—*Pecten maximus*, etc.—obtained from that locality by Mr Robertson. From these shells Mr Young had taken specimens of the following genera of Foraminifera:—*Polystomella*, *Rotalia*, *Lobatula*, *Numulina*, and *Miliola*; also, four or five forms of Entomostraca, and several species of univalve and bivalve shells, none of which have hitherto been recorded as occurring in the glacial deposits of the Clyde. He also referred to the discovery of other shells and minute organisms in the same beds by Mr Robertson, observing, in concluding his remarks, that the list of glacial shells was likely to be greatly augmented by a more minute investigation of the beds in all the localities where they occur. This section of the proceedings appeared to possess a great degree of interest.

Mr Thomas Chapman exhibited two cases of North American *Lepidoptera*, which he had just received from a correspondent, containing many species identical with those of this country, after which the President referred to three fine plants on the table which were exhibited by Mr Peter Clark, of the Royal Botanic Garden, the species being *Amaryllis Johnsoni*, *Aloe casia*, and *Vriesia speciosa*, all in flower.

APRIL 26TH, 1864.

Hugh Colquhoun, M.D., in the chair. The following gentlemen were elected members:—Mr Alexander B. Stewart, resident; and Mr John Jaffray, Dunbar, corresponding.

SPECIMENS EXHIBITED.

Dr Scouler gave an account of the remains of a whale found at Cornton, near Stirling. The remains belonged to genus *Balenoptera*, and were probably those of *B. rostrata*, a species still found in our seas. The specimen occurred in brick clay, at about eight feet below the surface. No part of the whale was found except the cranium, which Dr Scouler exhibited; whence it appeared that after being stranded and decomposed, the bones of the skeleton had been separated and scattered by the action of the tides or currents of the river. The whale had not been of great size, as the head was but seven feet in length, which would give about twenty-eight feet for the entire skeleton. The head had not been transported, but still remained in the place where it had been decomposed, for one of the small bones of the internal ear was found within the tympanic cavity of the temporal bone. The brick clay in which the bones occurred was not a glacial bed; at least no shell characteristic of the glacial beds was found in it. From the elevation at which it was found, the whale in this instance was probably of older date than the canoes found in the river deposits of the Clyde near the Broomielaw; but this remark applied only to these instances.

PAPER READ.

An account of a visit to the shores of Dunbar in February last, with Descriptive Notes on the Natural History of the District. Part I.
By the Secretary and Mr DAVID ROBERTSON.

This paper was illustrated by numerous specimens of the various objects collected. The zoological lists furnished by these gentlemen possessed great interest, as affording comparison with similar catalogues prepared in the West of Scotland, many striking differences being apparent. These will be more appreciated as the investigation proceeds, the present paper being but the commencement of a series from which, it is expected, much curious information will be elicited. In the Ornithological Sec-

tion they acknowledged their obligations to Dr C. Nelson, Pitcox, one of the society's corresponding members, resident near Dunbar, whose collection contains many rare species obtained by himself in Tyne Estuary, and elsewhere in East Lothian. The following birds have occurred recently in that county:—Rough-legged Buzzard (*Buteo lagopus*); Honey Buzzard (*Pernis apivorus*), four specimens; Grey Shrike (*Lanius excubitor*), three specimens; Great Spotted Woodpecker (*Picus major*); Black-throated Diver (*Colymbus arcticus*); Grey Phalarope (*Phalaropus lobatus*); the Snew (*Mergus albellus*), male and female; and the Shore Lark (*Alauda alpestris*), three specimens of this very rare British bird having been shot on the banks of the Tyne Estuary by Mr Evans, one of which is in Dr Nelson's collection. The latter gentleman also communicated the occurrence in the same place of the King Eider (*Somateria spectabilis*), another species of extreme rarity in this country.

Among the fishes exhibited were *Raniceps trifurcatus*, found on Belhaven Sands, and the Viviparous Blenny, (*Bleinius viviparus*), which is a common species in the tide pools at Dunbar. In the list were enumerated the greater weever (*Trachinus draco*); the green cod (*Merlangus virens*); the Ballan wrasse (*Labrus maculatus*) the sea horse (*Hippocampus brevisrostris*), a living specimen of which was found in the harbour of Dunbar by one of the society's corresponding members, Mr John Levack of Cumbrae.

MAY 31ST, 1864.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected members:—Messrs Walter Rutherford, and Louis C. Jarnaque, resident; John Mason, jun., Dunbar, corresponding.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited an extensive and carefully-prepared collection of *Entomostraca* and *Foraminifera* from the Paisley clay beds, nearly all of which are identical in genera and species with those found in similar deposits at Fairlie, Helensburgh, and Langbank. Their occurrence, however, at Paisley removes all doubt as to the time when they were imbedded, and affords satis-

factory evidence of the correctness of Mr Young's previous researches on the clay beds at present washed by the tides. At the same time, Mr Robertson exhibited several genera of *Polyzoa*, and numerous remains of crustacea, which he had also obtained at Paisley, associated in the same beds with these minute organisms.

Mr Horne had on the table a large collection of glacial shells from a portion of the Clyde beds, occurring between Cardross and Helensburgh, in connection with which it is somewhat remarkable that a large proportion of the shells are found quite entire, both valves being united in the case of the *Pectens*, *Cyprinas*, and *Panopeus*. Mr Horne had obtained hundreds in this state of preservation; and he remarked that the same fact could not be observed at any of the other beds he had visited.

Mr James Ramsay exhibited specimens of *Bromus secalinus* from Braidbar, near Pollokshaws, where he had gathered it apparently in a wild state; also an abnormal form of *Athyrium Filix femina* from Buchanan Woods, near Drymen, presenting a most extraordinary deviation from the usual form of the species. To illustrate the singular variety to which this fern is occasionally subject, Mr Peter Clark, of the Royal Botanic Garden, had on the table seven abnormal forms of a plant in a living state, one of the most interesting of which was from the banks of Lochfyne.

Mr Alexander McKinlay exhibited the following mosses from Ben Voirlich, by Loch Lomond:—*Fissidens rupestris*, Wils. MSS., a new species recently detected in North Wales, by Mr Wilson, author of the "Bryologia Britannica;" it is closely allied to, and has probably been confounded with, *F. adiantoides*, but is of much smaller size, grows in drier situations, and has more pellucid leaves, having the margins below distinctly thickened; also, a new species of *Campylopus* (*C. auriculatus*), which he had discovered in September last, and on a second visit to Ben Voirlich this month, had again found in many places profusely, particularly near the summit of the hill. This species is intermediate in many of its characters between *C. flexuosus* and *C. fragilis*, but more resembles the latter in habit, and sometimes also in colour; the nerve is generally very broad, and has a layer of large cells over the front, and is lamellated on the back, appearing in a cross section regularly and distinctly crenate; the alar cells, of a bright red colour, are expanded into articulate processes. It propagates itself by throw-

ing off the apices of the branches, which are often provided with rootlets, and even a branchlet before reaching the ground. Mr M'Kinlay stated that he had observed the same mode of propagation in *C. longipilus*, a species, like the preceding, not found with fruit, and communicated to the society a second locality for *C. auriculatus*—Ben Ledi, where he had gathered it a few days ago.*

PAPERS READ.

I.—*On Clay Beds of Ross Arden, on the banks of Loch Lomond.*
By Mr DAVID ROBERTSON.

A box of clay from Ross Arden was placed in my hands for examination a week or two ago by our Secretary, who obtained it from our corresponding member, Mr M'Niven, of Shemore, Loch Lomond. I found the mass chiefly composed of vegetable matter, packed with marine shells. Although the shells are in great numbers, I have not observed over four or five species in all. The common mussel, the common cockle, the common whelk; and, I may say, the common *Tellina solidula* and the common *Rissoa ulvae*. The mussels are very soft, and greatly crowded together, and scarcely one of them to be seen entire. The other shells are in a better state of preservation. Still they have suffered much, and are very brittle. I could not detect any entomostraca or polyzoa, although I looked for them with great care. I met with a few of one species of foraminifera in very fine condition.

Being desirous of seeing the beds, Mr Gray and I arranged to go to Loch Lomond on Saturday last. Mr M'Niven provided us with the means of transport from Balloch to the beds of Ross Arden, a distance of about eight miles up the Loch, and, with a workman and utensils, zealously superintended the operations himself. The shells are in a small bay, at Ross Arden, lying nearly north and south. They are covered by a soft vegetable mould about twenty inches thick; the shell bed itself is fully that thickness, and is resting on what seems to be vegetable mould; the shell stratum is said to extend thirty or forty feet into the loch. Mr M'Niven

* This species is the same as *C. Schwarzii*, Schimper, which was not then published. Has since been found in very many localities both in Scotland and Wales.

informed us that it was discovered many years ago by a fisherman when cutting a canal further into the bay, for the better accommodation of his boat. Mr M·Niven also told us that about eight years ago he procured a barrel full of the clay containing the shells, and forwarded it to our late Secretary, Mr Fraser, who appears to have altogether overlooked the circumstance.

There can be little doubt but the shells have been drifted to where they are found, but probably from no great distance. Although marine shells, they are met with in brackish water; the *Rissoa ulvae* and *Tellina solidula* are purely estuary shells. Perhaps the best mussel fishery we have in the West of Scotland is between Greenock and Port-Glasgow, where there is a great admixture of fresh water. Regarding the whelk and the cockle, I am not prepared to say what they could bear; but as all littoral shell fish are often exposed to heavy rains, it is most likely that they could also endure a considerable admixture of fresh water; and there is little doubt, at the time they lived, the tide supplied the salt water.

II.—*An account of a visit to the shores of Dunbar in February last, with Descriptive Notes on the Natural History of the District. Part II.* By the Secretary and Mr DAVID ROBERTSON.

Among the numerous objects exhibited in illustration of the paper, there were several slabs of clay from the Westbarns clay-field, containing very distinct tracks of some molluscous animal, or a crustacean. These tracks were distinguishable only on the thin layers of sand occurring in various parts of the bed, and, after the closest examination, no trace of any other animal could be perceived. Regarding the extreme abundance of the recently discovered fossil star-fish, *Ophiolepis gracilis*, in this clayfield, it was stated that Mr Robertson had, during a recent dredging excursion, in the Firth of Clyde, brought up two successive hauls of star-fishes—the dredge in each case being literally full of a single species of *Ophiura*, without a fragment of any other creature, showing the ground on which the dredge was acting to be completely covered by these animals alone. This fact, while suggestive of the gregarious habits of certain species, throws some light on the conditions under which these fossil remains are found in the brick clay; and it would appear their immense numbers contribute in

some way to the extirpation of other animals in their feeding ground and immediate neighbourhood.

III.—*On the Carboniferous Fossils collected on the Dunbar Coasts by Mr Robertson and the Secretary.* By Mr JOHN YOUNG.

Mr Young illustrated his remarks by many specimens of great interest, conspicuous among which were several slabs covered by the remains of a *Cidaris*—the *Archæocidaris Urei*, one of the oldest forms of sea urchin known to geologists. This organism, with its plates and spines (the latter often nearly six inches in length), are among the most valuable of the Dunbar fossils, and are there found in a greater state of preservation than has yet been observed in any other locality in Scotland. Several specimens of sandstone were exhibited, containing curious tracks, of various designs, so to speak, made by some animals; and several speculations were offered as to whether these were the marks of annelids, crustaceans, or molluses. Mr Young concluded his paper by stating that, from the variety of geological phenomena to be met with on the Dunbar coast, and from the abundance of organic remains in the strata, it was well worthy of a visit from the student of geological science.

SESSION 1864-65.

THE THIRTEENTH ANNUAL GENERAL MEETING, ANDERSON'S
UNIVERSITY BUILDINGS, SEPTEMBER 27TH, 1864.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected office-bearers for the present session:—John Scouler, M.D., LL.D., F.L.S., President; William Euing, Vice-President; Robert Gray, Secretary; Matthew P. Bell, Treasurer; Thomas S. Hutcheson, Librarian; Messrs Michael Connal, John Young, and Alexander M^cKinlay, Members of Council.

SPECIMENS EXHIBITED.

Mr John Young exhibited an interesting series of specimens of the genus *Fenestella*, a group of lace-like organisms which he had lately obtained in great perfection at Newfield Quarry, High Blantyre. One species, with its beautiful feather-like fronds, appears to be undescribed, and is almost peculiar to that district. From the same quarry he also exhibited a fine specimen of *Stenopora tumida* and *Ceriopora interporosa*, which showed the habit of growth in these organisms in a more complete state than any specimens which have yet been figured.

PAPERS READ.

I.—*On the various genera and species of brachiopod shells found in the main limestone of the Campsie Valley.* By Mr JOHN YOUNG.

In this paper Mr Young contributed the following list of species, some of which are very rare, and do not seem to have been recorded from Scottish carboniferous strata up to the time when he commenced his researches in that district:—

Terebratula hastata,	Sowerby.
— sacculus,	Martin.
Spirifera duplicicosta,	Phillips.
— bisulcata,	Sowerby.
— trigonalis,	Sowerby.

<i>Spirifera ovalis</i> ,	Phillips.
— <i>glabra</i> ,	Martin.
— <i>Urii</i> ,	Fleming.
— <i>lineata</i> ,	Martin.
<i>Spiriferina octoplicata</i> ,	Sowerby.
<i>Athyris ambigua</i> ,	Sowerby.
— <i>plano-sulcata</i> ,	Phillips.
— <i>Royssii</i> ,	L'Eveille.
<i>Rhynchonella pugnus</i> ,	Martin.
— <i>pleurodon</i> ,	Phillips.
<i>Camaraphoria crumena</i> ,	Martin.
<i>Strophimena analoga</i> ,	Sowerby.
<i>Orthis resupinata</i> ,	Martin.
— <i>Michelini</i> ,	L'Eveille.
<i>Streptorhynchus crenistria</i> ,	Phillips.
— (var.) <i>radialis</i> ,	Phillips.
<i>Chonetes Hardrensis</i> ,	Phillips.
— <i>Buchiana</i> ,	D'Koninek.
— <i>polita</i> ,	McCoy.
<i>Productus giganteus</i> ,	Martin.
— <i>latissimus</i> ,	Sowerby.
— <i>cora</i> ,	D'Orbigny.
— <i>semi-reticulatus</i> ,	Martin.
— (var.) <i>Martini</i> ,	Sowerby.
— <i>longispinus</i> ,	Sowerby.
— <i>undatus</i> ,	Defrance.
— <i>costatus</i> ,	Sowerby.
— <i>Youngianus</i> ,	Davidson.
— <i>scabriculus</i> ,	Martin.
— <i>spinulosus</i> ,	Sowerby.
— <i>fimbriatus</i> ,	Sowerby.
— <i>punctatus</i> ,	Martin.
— <i>aculeatus</i> ,	Martin.
— <i>mesolobus</i> ,	Phillips.
<i>Crania quadrata</i> ,	McCoy.
<i>Discina nitida</i> ,	Phillips.
<i>Lingula squamiformis</i> ,	Phillips.
— <i>mytiloides</i> ,	Sowerby.

Mr Young also pointed out the stratigraphical position of this

limestone in our coalfields, and the various districts where it has long been extensively worked for economic purposes. He stated that the Campsie district was not rich in fossils, yet it had yielded as great a variety of this class of shells as any other limestone with which he was acquainted.

II.—The Secretary read a communication from Mr John Mason, Dunbar, descriptive of a marine deposit extending from Belhaven to Hedderwick, accompanied by a carefully prepared section showing the various strata. The entire depth of the deposit is about sixty feet, and consists of alternate layers of sand and laminated clay. Mr Mason referred to the abundance of shells in these beds, and also to the occurrence of the remains of seals and other animals among the clay, concluding his paper with a few observations on the general features of the district.

III.—*On Alternate Generations.* By Dr SCOULER.

The author carefully illustrated his subject by diagrams and a large collection of specimens.

OCTOBER 25TH, 1864.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. Mr Alexander M. Lang was elected a resident member.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited an undescribed *Cuma*; and, as far as known, a species new to science. It is nearly allied to *Cuma Edwardsii*, but differs from it chiefly in having the carapace terminating in front, in an acute point; in the first joint of the caudal appendage being plain; in the internal terminal scale being single jointed; in the external terminal scale having a short and long joint; and in both the scales tapering to the base of the terminal spine.

Dr Scouler introduced to the notice of the meeting two casts of the ancient crania found at Engis, in Belgium, and Neanderthal, in Germany. These crania were interesting on account of the antiquity assigned to them, as well as from their remarkable

conformation. Omitting, however, the question of their antiquity, he confined himself to instituting a comparison between them and an extensive series of crania from different countries, which he had on the table. The peculiarities of the Neanderthal cranium were shown to exist in other crania, although not to the same degree, and there was no ground for admitting that it was anything but a genuine human cranium. With respect to the degree of intellect which the owner of this peculiar skull possessed, nothing could be inferred, as classification of the brains and nervous system of animals would never give a scale of intelligence. Dr Scouler also exhibited an interesting collection of fossil bones from Gibraltar.

PAPER READ.

On Porcellidium fimbriatum of Claus. By Mr DAVID ROBERTSON.

This entomostracan, which is new to Britain, and was only last year introduced as new to science, I have been well acquainted with for the last four or five years. The specimens which I now exhibit were mounted on the slide as far back as 1859. I had sent specimens to several parties who are interested in various branches of the small crustacea, but as little was known of the family in this country, and that scattered among periodicals, there was nothing conclusive come to regarding it till this autumn, when the Rev. Alf. M. Norman wrote me stating that he believed one which I had sent him was of this species. On referring to Claus' Fig. of the animal, there was no difficulty in identifying it. There is one feature in the arrangements of its segments I may notice, which seems to separate it from all the members of the family in which it is placed. That is, the *fourth* segment is prolonged into two hooks, one on each side; whereas in allied genera it is the *fifth* segment that is so prolonged. It is a tenacious sucker. When fixed to the side of the vessel in which I had it placed, I have had sometimes to rub a little spirits on the brush to get it removed. I take it with the dredge at Cumbræ, in a few fathoms of water, generally on *Melobesia* and old shells, among the roots of *Laminaria saccharina*.

NOVEMBER 29TH, 1864.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected resident members:—Messrs Walter Galt, George Rutherford, and Alexander A. Dennistoun, Row, Helensburgh.

SPECIMENS EXHIBITED.

Dr Dewar exhibited a male specimen of the Iceland falcon (*Falco Islandicus*), which was shot a few weeks ago, on North Uist. The occurrence of this fine species, which is not included in any published work on British birds, was remarked as a circumstance of considerable interest. Dr Dewar also exhibited a specimen of the Turnstone (*Streptopus interpres*) in summer plumage, from the Hebrides, where it probably remains all the year, specimens having been seen as late as the second week of June.

Mr David Robertson exhibited a specimen of the angel fish (*Squalina angelus*), which had been procured from a fisherman at Cumbrae, and forwarded by Mr John Levack, corresponding member. It is said to be plentiful on the southern coasts of England, and not uncommon in the Forth, and along the eastern coast. It has been taken on various stations in Ireland, and is included in Mr John Eaton Reid's list of the fishes of the Clyde. Still, it appears to be a rare fish on the west coast. Yarrell does not mention its occurrence in the West of Scotland. Couch alludes to it having been found at Shetland. But perhaps the best proof we have of its local rarity, is the opinion of some of the old and experienced fishermen of the place, who pronounced the fish to be a stranger.

Mr Robertson likewise exhibited an undescribed species of *Echinoderm* which he had dredged at Cumbrae. The Rev. Alf. M. Norman had previously taken a specimen of this animal on the coast of Durham. Barret referred it to *Amphidotus gibbosus* of Agassiz; but Mr Norman, finding that it does not agree with Agassiz's species, proposes to name it *Echinocardium pennatifidum*. The specific name refers to the remarkable form of the pedicellaria. It is clearly allied to *Amphidotus roseus* of Forbes, but differs from it especially in the pedicellaria, which do not bear the slightest resemblance to each other. *A. roseus* may be readily known from its smaller size. It also soon acquires a red tinge on

some parts of the dorsal surface soon after being taken out of the water and exposed to the air, which does not take place, so far as I have noticed, with *E. pennatifidum*, which may, in most cases, be distinguished from *A. roseus* the moment it is taken from the dredge by its darker colour.

Mr Alexander M'Kinlay exhibited the following mosses:—*Atrichum angustatum*, with fruit, not before observed in Britain, from Doune, in Perthshire, where it is not uncommon; and where he had first observed it in April last; *Cinclidium stygium*, an interesting species, from Ben Ledi, its first occurrence in Scotland; *Dicranum palustre*, with fruit; and also from near Doune; *Campylopus brevipilus*, from the Islands of Bressay and Unst, in Shetland. Regarding the last named Mr M'Kinlay observed that Perthshire hitherto had been considered the most northern limit in Europe for the species, and that its occurrence in the northern extremity of Shetland was a fact of much interest, proving its wide distribution in the British Islands. Mr M'Kinlay also laid on the table several scarce and interesting flowering plants from the same localities, whence he had procured them last summer, during a tour through Shetland in company with his friend Mr John Shaw—an excursion which had resulted in the accumulation of many important botanical observations.

PAPERS READ.

I.—*Observations in various branches of Natural History during the past Summer.* By Mr ROBERT GRAY.

The author referred to the occurrence of the shoveler duck (*Anas clypeata*) near Girvan, and the nesting habits of the common cross-bill in Ayrshire. He likewise exhibited, in illustration of his paper, an extensive variety of *Purpura lapillus*, collected in various parts of Scotland, and gave an account of the habits of the species, mode of preying on other molluscs, etc., as observed by himself. Among the specimens on the table were a number of beautiful striped and coloured varieties from the Bay of Luce, and some curious black and wide-mouthed varieties from a mussel bed in Fifeshire. Mr Gray had also obtained some very large examples of the shell from the claybeds at Langbank, contrasted with which those he had procured from Caitness were but pigmies, although representing the true characters of the species as they now exist in the northern districts of Scotland. In further illustration of

his notes, Mr Gray exhibited an interesting series of fossils, forming part of a large and valuable collection of specimens obtained during the present year, by himself and Mr Thomas Anderson, from the Silurian rocks of the Girvan valley, and embracing a number of rare organisms which have not yet been recognised. In referring to these, he remarked that as the collection included some thousands of specimens, it was impossible at present exactly to define its contents; but that as far as it had been examined the following genera were represented, viz.:—Univalve shells—*Bellerophon*, *Orthoceras*, *Murchisonia*, *Pleurotomaria*, *Turbo*, *Euomphalus*, *Platyceras*, etc. Bivalves, including the Conchifera and Brachiopoda—*Sanguinolites*, *Nucula*, *Pterinea*, *Axinus*, *Rhychonella*, *Pentamerus*, *Atrypa*, *Orthis*, *Leptæna*, *Lingula*, *Discina*, etc. Among Trilobites he had procured the following:—*Asaphus*, *Calymene*, *Cheirurus*, *Encrinurus*, *Illænus*, *Phucops*, *Agnostus*, etc. The collection also contained several species of corals and graptolites, and one or two slabs with annelid or molluscan tracks. The whole of the fossils exhibited were in excellent preservation.

II.—*On the Natural History of Serpents.* By DR SCOULER.

Illustrated by a numerous series of specimens.

DECEMBER 27TH, 1864.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected resident members:—Messrs Archibald Edmiston, William Edmiston, and William Lawrence Hislop.

SPECIMENS EXHIBITED.

Dr Dewar exhibited a specimen of the solitary snipe, (*Scolopax major*), from Ardrishaig—a species which is rarely met with in Scotland. It had been lately shot near that locality, and forwarded by Mr Colin M'Kinnon, corresponding member.

Mr Geo. Brown exhibited a specimen of the spotted crane (*Crex porzana*), from Stewarton, in Ayrshire.

Mr John Young exhibited various species of *Spirorbis* and an *Entomostracan*, from the carboniferous beds of the West of Scotland. He remarked that specimens of *Spirorbis* and of *Serpula*, some of

them undescribed, were occasionally found attached to the stems of crinoids, corals, and shells, but in general they were rare in the limestone series of our coal measures. Two of the species, however, to which he called the attention of the meeting, are much more abundant in our upper coal measures, viz., *Spirorbis carbonarius* and *S. helicteres*. Of the former, he exhibited upwards of 300 specimens attached to the stem of a coal plant from Airdrie coalfield, the portion of the plant being four inches in length by one inch in breadth. The latter species had not been recognised from this district before, and Mr Young stated that they occur in great abundance, along with shells of the genus *Anthracosia*, forming a thin mussel band at Newton, near Cambuslang. The large entomostracan which he exhibited belongs to the genus *Cypridina*, a rare form in our strata. From one fish coprolite, obtained by a friend from strata near Carluke, he had extracted upwards of 300 specimens of the shells, most of which were in a fine state of preservation, showing that many of our carboniferous fishes must have preyed largely upon these minute crustaceans.

Mr Colin Brown exhibited the lower jaw of an undescribed species of coal reptile, from one of the Airdrie blackband ironstones. This fine specimen was obtained about twelve years ago, but was thought to belong to a fish. The discovery, however, of undoubted reptilian remains in the same district within the last two years, has thrown much light on the specimen, which appears to be different from any that has yet been found. This jaw measures about nine inches in length, and has a closely set row of formidable curved teeth, seventeen in number, showing in their structure the same labyrinthic character in the teeth of the genus *Anthroco-saurus*, to which it is apparently very closely allied.

Mr Thomas Chapman exhibited a number of living specimens of a new species of *Acarus* found in the young flower buds of the black currant (Naples variety), and forwarded to him by Mr David Doig, Hafton, near Dunoon. Mr Doig had about twelve months ago submitted specimens of diseased buds to Mr David Bowman, through whose microscopic researches the existence of the *Acarus* was first made known.

Mr Chapman read a communication from Mr Doig, in which he stated that, although he had observed the effects of this so-called disease about thirteen years ago, he was unable to refer it to its true cause until Mr Bowman made his discovery. He likewise

remarked that the ravages committed by this minute insect were becoming wide-spread—so much so, indeed, as to cause most persons to root up their black currant bushes and abandon the cultivation of this fruit entirely.

Dr Scouler exhibited specimens of the *Crocodilus frontalis*—a species recently described by Mr Murray, from specimens sent home by the Rev. Mr Thomson, from Old Calabar, on the West Coast of Africa. Mr Murray's description chiefly referred to the external characters; but an attentive study of the cranium tended to bring out more clearly the distinctive marks of the species. The new crocodile differed from all the others which Dr Scouler had an opportunity of examining, in having a bony septum which divided the nostrils. This peculiarity existed, however, in the alligator of the Mississippi. The bones of the head were also very massive, especially those of the lower jaw. It is likewise remarkable from the shortness of the snout, and in this respect approaches more to that of an alligator than of a crocodile. Indeed, it is more obtuse than that of the *Alligator sclerops* of South America.

PAPER READ.

The Secretary then read a communication on the crab and herring fisheries at Dunbar, by Mr John Jaffray, one of the society's corresponding members. This paper contained a somewhat graphic description of the Dunbar *Drave*, and included many valuable and interesting statistics connected with the fisheries there, involving one or two questions of public utility.

JANUARY 21ST, 1865.

John Scouler, M.D., LL.D., F.L.S., President, in the chair.
Mr William Ellis was elected a resident member.

SPECIMENS EXHIBITED.

Mr Edward R. Alston exhibited a specimen of the Kittiwake gull (*Larus tridactylus*), which was shot, out of a flock near Girvan, on the 4th of January; and made some remarks on the occasional occurrence of the species on the Scottish coasts during winter. The Kittiwake has hitherto been considered a strictly migratory

bird; but Mr Alston observed that limited numbers remain in various Scotch localities both on the eastern and western shores, an opinion shared in by Mr Gray, the Secretary, who stated that he had observed this gull repeatedly in the Firth of Clyde in mid-winter.

Mr Thomas Chapman exhibited a small case of moths recently obtained from New York; and Dr Scouler exhibited specimens of the *Axolotl*, giving some account of the structure of that curious animal.

Mr Alexander M'Kinlay exhibited specimens of *Mnium spinosum*, a new British moss from Ben Lawers, where he had first gathered it in 1861.

PAPERS READ.

I.—*Notes on Corophium Longicorne, and on the occurrence of Aluthea Bopyroides.* By Mr DAVID ROBERTSON.

Mr Spence Bate, in his work now being published on the British Sessile-eyed Crustacea, says of *Corophium longicorne*:—"It dwells in tubular galleries, excavated in the mud over which the tide flows and ebbs. It has not, however, been ascertained whether the channels in the mud are perforated by these crustacea, or by the numerous annelids that they prey upon." He likewise quotes Quaterfages in his pleasant "Rambles of a Naturalist," where he says, at Saintonge: "About the end of April they come from the open sea in myriads to wage war with the annelids, which they entirely destroy before the end of May. They then attack the mollusca and fish, all through the summer, and disappear in a single night about the end of October, and return again the following year." In order to test the accuracy of these observations, I put a number of them in a vessel with mud, and soon saw that they had the power of burrowing. In doing so they bring the points of their long antennæ together, and push them into the mud; the fore feet help in widening the hole, and in turning the mud side-ways; the hind feet throw it backwards; the tail is placed nearly at a right angle downwards, which it presses against the excavated mud, and forces itself forward. Last summer, at Oban, I found them burrowing in stiff blue clay. On digging a portion of it up to ascertain the depth of their perforations, I discovered that each burrow was provided with two openings; the one shaft descending perpendicularly,

turning sharply at the bottom, and ascending near and parallel to the other. In no instance that came under my notice, out of hundreds, was any one of the excavations driven into another. Seeing this form of burrow, I question much whether they ever adopt or usurp the burrow of annelids.

There is another circumstance connected with the burrows of marine worms that goes far to identify them with their true owners; that is, the inner wall of their burrow is generally discoloured with an exudation from the body of the worm, which I have never seen in the burrow of corophium.

I have tried on several occasions to bring about one of those famous encounters said to take place between the corophiums and annelids, by placing them in a vessel together, but without ever observing the least attitude of aggression, defence, or fear on either side. I have tried them with the smallest worms I could find (always taking them from the same mud as the corophiums), as tit-bits fit to provoke the most indolent appetite, but not one of the corophiums seemed to take the least notice of them.

The truth of their migratory habits appears to be equally uncertain. I meet with them on our shores in all seasons of the year. Last year, about the end of January, Mr Robert Gray and I met with them plentifully at Langbank, where the ice sheets lay thickly packed along the line of high water; again, in February, we took them under the ice at Belhaven, and in the estuary of the Tyne at Dunbar.

From their reputed deep water habits in winter, we expected to find them more plentiful as we approached low water; but the very reverse was the case; not one was found at low water, while they were swarming near high water mark.

From what we have seen of their habits, and the specimens of their work before us, there can be little doubt of their burrowing powers; and whatever roving or warlike propensities they may have at Saintonge, we have much reason to believe that they are more staid and peaceful in their habits with us.

Alteutha bopyroides (Claus N.S.) Leipzig, 1863. The genus *alteutha* was first constituted by Dr Baird, and recorded in the transactions of the Berwickshire Naturalist's Club for 1845, and hitherto, in this country, contained only one species—*Alteutha depressa*. The occurrence now of *Alteutha bopyroides* adds another British species to the genus—the sole addition of the last twenty

years. This was taken by myself at Cumbrae in the dredge and dip net.

II.—*On the Ornithology of the Suburbs of Glasgow.*

By the Secretary.

Suburban ornithology, he remarked, was a subject less trivial than some naturalists might suppose, as many suggestive birds were still to be found within the bounds of the city itself; and although their occurrence so near the loud din of machinery, and in the midst of the smoke and bustle of one of the largest towns in this country, may be thought strangely out of place, yet it shows a hardihood among the birds themselves—a refusal, so to speak, to succumb under the inroads of man—which is by no means an insignificant feature in their history. To understand this more clearly, we had but to consider the disappearance of species from many places yet comparatively solitary—the chough being a well-known example. Thirty years ago this bird was abundant on almost all the rocky headlands of Scotland; also on the Isle of Man, and the rugged cliffs on some parts of the Welsh coast; but now it is known that it has entirely disappeared from these localities except a few pairs in the south of Ayrshire and Wigtonshire, and moderate flocks in the islands of Islay and Mull. It can hardly be supposed that the former haunts of this species are less retired at the present time than they were thirty years ago, there being no perceptible change to account for the bird's disappearance. While, therefore, we find rooks, jackdaws, and magpies clinging tenaciously to the town, subjected to the confusion, turmoil, and clamour of a city life, we have to bear in mind that one of their nearest allies—the chough—although not coming within the range of these influences of man's interference, is fast losing ground. In its structure it is even harder than its congeners, its feet being peculiarly adapted for perching on rough rocks such as form its chosen haunts. Yet these advantages apparently cannot save it from being hustled off the stage and sharing the fate of the great auk, another bird common at one time in Scotland, but not now found in any part of the world, the species being utterly extinct. Mr Gray then enumerated the various *genera* and species to be yet found in the suburbs—a list which included many interesting birds whose occurrence in and around the city furnished ample illustration of the remarks with which he introduced and concluded the subject.

FEBRUARY 28TH, 1865.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected resident members:—Messrs William Lorrain, James Robertson, James Brown, and James Stirton, M.D.; and Mr Adam Sutherland, Irvine Academy, corresponding.

SPECIMENS EXHIBITED.

Mr Alexander M'Kinlay exhibited an abnormal form of *Breutelia arcuata*, with two sessile capsules on one seta, and of *Atrichum undulatum*, with the calyptra attached to the seta. He remarked that abnormalities of any kind seemed to be of rare occurrence among mosses, and among the lower Cryptogams generally, the comparative simplicity of their structure not admitting of much variety of modification; whereas, among the more specialized forms of Cryptogamic plants—such as ferns—and among flowering plants, many interesting and instructive anomalies were frequently displayed.

Berkeley, in his "Introduction to Cryptogamic Botany," does not mention any abnormal forms whatever among mosses; but Hofmeister ("On the Higher Cryptogams," Ray Society, p. 181), quoting Bruch, who details the observations of GümbeL, records several instances of abnormal fructification.

Of the two additional instances brought forward by Mr M'Kinlay, the first, *Breutelia arcuata*, with two sessile capsules on one seta, is, in the meantime, chiefly interesting on account of the apparent rarity of the occurrence. Hofmeister records a similar one in *Mnium serratum*, and the deduction he draws from it is, that such occurrences "seem to indicate the possibility of a bifurcation of the growing upper end of the fruit rudiment." Mr M'Kinlay expressed the opinion that two sessile capsules on the same seta is simply a more developed form of two stalked capsules on one seta, the union being only of greater degree in the one than in the other. The union of two seta may be considered somewhat analogous to, though, of course, in origin widely different from, the union of two stems in flowering plants, and in such cases the common stem is invariably more or less flattened out. It is not stated that any peculiarity of that kind was observed in GümbeL's "double fruits." In the present instance, however, the seta carrying the two capsules is obviously thicker than that on the

same stem bearing one only. This latter fact would lead us to adopt, instead of the theory of the bifurcation of the fruit rudiment, rather that which supposes the cause of the abnormality to lie in the archegonium itself. But in the absence of the calyptra, as in the present case, it would be impossible to say whether such an abnormality was the production of two germinal vesicles in one and the same archegonium, or of twin archegonia. If there were but one calyptra covering both capsules, the former probability might be assumed, while if each of the twin capsules was provided with a perfect calyptra, we might reasonably believe them to have been produced from twin archegonia.

Referring to the specimen of *Atrichum undulatum* with the calyptra attached to the seta, Mr M·Kinlay observed that the calyptra not unfrequently takes up that anomalous position, especially in young plants of this species. In such cases, also, owing, no doubt, to the want of the protection afforded by the calyptra to the growing point, the capsule itself seems invariably to be abnormal in shape—short and ovate as in *Atrichum tenellum*, and with a much shorter lid than usual.

Mr M·Kinlay likewise exhibited specimens of a rare and little known moss—*Campylopus densus* (Schleicher), gathered by himself on Ben Challum in September, 1863, and again, in company with Mr Shaw, on the island of Unst, Shetland, in great profusion, in June last. This species has not hitherto been recorded as a native of Britain.*

Mr David Robertson exhibited, from Cumbrae, an entomostracan of the genus *Longipedia*, recently named by Claus, and read the following remarks:—This little entomostracan, taken at Cumbrae, is new to Britain. It belongs to a new genus, *Longipedia*, constituted by Dr Claus in his work recently published on the “Copepoda of Germany, the North Sea, and the Mediterranean.”

In this genus he has but one species, *L. coronata*, but whether this one from Cumbrae is identical, I am not quite sure, there being some slight difference of structure between them. Claus' figure is

* The specimens exhibited were afterwards found to be the same as *C. compactus*, Schpr., which was not then published. It has since been found in very many places in the Highlands of Scotland. *C. densus*, which was at this time believed to be a distinct species (Schimper's Synopsis, 1860, p. 99), is now united with *C. fragilis*.—A. M·K.

taken from a female, and I think my specimen is a male; the difference, therefore, may be sexual.

I have only met with two specimens, both occurring at the same time; one of these I have submitted to Mr Brady of Sunderland, whose intimate knowledge of these minute forms is well known, but have not yet had his opinion. I am unwilling, in the meantime, to break up this, the only specimen I possess, for closer examination, in the hope of meeting with a further supply, especially as one specimen might go only a very short length in fulfilling our purpose.

When captured, and in life, I took careful outlines of the animal, and characteristic parts of its structure. On comparing them with Claus' figure of *Longipedia*, I had no doubt in referring it to that genus; but finding the terminal setæ of the first and second thoracic feet in Claus' figure plain, and in this chiefly plumose, with other slight differences, I hesitate to refer it to *coronata*, until I have further confirmation.

I believe this little crustacean will be found to be rare on our coasts, unless it should turn out that it is difficult to dislodge from the roots of the plants among which it is found. I have searched such material from the same locality for years past, with care, without seeing one, till last autumn, when I found the two.

I may mention a circumstance connected with their capture that may not be without interest. The usual mode of searching for these small forms got amongst sea-weed and debris at the bottom of the sea, is to put the material that you expect them in into a vessel with water, and allow it to stand for a short time, when the small animals will be seen to crawl or swim out to the sides, where they may be easily laid hold of with a small camel-hair brush. The operation may be continued with more or less success for a few hours, but in the course of a day many of the more tender animals die, the water becomes putrid, and the whole has to be thrown out. However, in this state many of the animals live and survive the total extinction of their weaker companions. It was after the material had been kept over two days that I found the *Longipedia* emerging from their obscure retreats, doubtless in a state of suffocating oppression, to seek a purer element. If it should really turn out that they are difficult to dislodge, their apparent rarity may thus be accounted for.

Mr Robertson also made some remarks on the forms of the

spines of *Echinus sphaera*, showing that, instead of being, as is generally supposed, all of one form, they are, to a great extent, on the lower side of the animal, flat pointed. His attention had been drawn to this hitherto-overlooked character, by finding portions of similar spines in the glacial clay beds at Fairlie, and also among the debris brought up by the dredge in various parts of the Firth of Clyde. The peculiar form of these fragments had puzzled himself and other naturalists, a greater share of attention having been bestowed upon them as glacial fossils, in the belief they might prove to be portions of an unknown species. Subsequently, however, Mr Robertson discovered that these flat-pointed spines existed in constant numbers on the lower surface of *Echinus sphaera*, not accidentally, or on a single individual, but as a steady, specific character, although not noticed by Forbes or other writers on radiated animals.

Mr William Hamilton exhibited a specimen of the marsh warbler (*Calamoherpe palustris*) which was shot near Cambridge—the only recorded instance of the occurrence of the bird in Britain. The distribution of the species throughout Europe is extensive, ranging over Russia, France, Germany, Belgium, Italy, and Switzerland. It is also found in North and South Africa, and the south-west of Asia. From its resemblance in general characters to the other British sylvidae, its occurrence in this country may have been overlooked by ornithologists, and it is not unlikely that a closer observation, especially in the south of England, would result in the species being ranked among our regular summer visitants. It is a bird of shy habits, frequenting solitary marshes, fens, and slow rivers, on the banks of which its nest is usually found. It sings by night as well as by day, and delights the ear at all hours by its own natural notes, as well as its powers of imitating other birds—a faculty which it possesses in a remarkable degree, running over with great exactitude the notes of the goldfinch, the chaffinch, and the blackbird, as well as all the other birds which frequent its neighbourhood.

PAPERS READ.

I.—*Additions to the Bryology of Ayrshire.* By Mr JOHN SHAW.

The author of this paper mentioned having found in the Loch Doon district, plentifully, many species which had been previously considered rare. He drew special attention to

Orthotrichum calvescens (Wils. MSS.), recently discovered in the Killarney district by Dr Carrington; Ness Glen, where he gathered it, being the second extra Irish station for this moss. He further stated that he had found *Hypnum albicans*, in fruit; *Brentelia arcuata*, in abundant fruit, and several others of less rare occurrence, in Ayrshire. In illustration of his remarks, Mr Shaw exhibited specimens of all the mosses which he enumerated.

II.—*On the Recently Noticed Blight affecting the Naples Variety of the Black Currant.* By Mr DUNCAN M'LELLAN.

Mr M'LeLLan observed that the disease, which was now known to be caused by the ravages of a species of *Acarus*, was almost exclusively confined to this variety, and that in the West of Scotland, where it had been plentifully cultivated, the injury committed was very considerable. The so-called blight had been known for many years, and it was thought the variety referred to was unsuitable for growth in this country. Mr David Bowman remarked that he had been investigating, for some months, the nature of this blight, and had, by means of a microscope, discovered immense numbers of an unknown insect in each of the shrivelled buds. These had been submitted, through Mr Chapman, to Professor Westwood for examination, and he was unable to refer the new *Acarus* to anything he had ever seen. Further research, however, was necessary to make out the mature form of the insect, and both Mr Bowman and Mr Chapman expressed a hope of being able, in a few months, to trace the creature through all its various stages of development.

MARCH 28TH, 1865.

John Scouler, M.D., LL.D., F.L.S., President, in the chair.
Mr David Hay was elected a resident member.

SPECIMENS EXHIBITED.

Mr John Young exhibited an interesting slab of shale, enclosing five of the long terminal fingers belonging to the head of a crinoid—*Poteriocrinus crassus*—which he had found recently at Newfield Quarry, High Blantyre, a locality which has yielded many fine and well-preserved carboniferous fossils. He stated that the

remains of this crinoid are often found in a dismembered and fragmentary condition in the limestone quarries of the West of Scotland, but that this specimen which he now exhibited was the finest example of the serrated tapering fingers which he had yet seen, the species being very rarely procured in so perfect a state. The fingers averaged about five inches in length, and at their base showed a portion where they had been attached to the body of the animal. Mr Young also exhibited a large collection of other species of *Crinoidea* from the neighbourhood of Glasgow, belonging to the following genera:—*Actinoecrinus*, *Platycrinus*, *Rhodocrinus*, and *Hydreionocrinus*, and at same time drew the attention of the meeting to a series of bivalve entomostraca, from the same shales at Newfield Quarry, including a number of species, some of them being much more minute than he had yet observed from any other strata in the West of Scotland.

Dr James Stirton exhibited specimens of *Grimmia commutata*, a moss new to Great Britain, from Moncrieff Hill, near Perth. Its habitat is within very circumscribed limits, and apparently confined to one spot, where it spreads from a centre of growth. It was in a barren state, and, being dioicous, there is little likelihood of its fruiting, more especially as neither male nor female plants have been detected. On the same hill, Dr Stirton had discovered the beautiful *Hypnum Crista-Castrensis*, and also *Hypnum rugosum*. *Leucodon sciuroides* was also discovered in great profusion, and, after diligent search, two or three tufts were secured bearing capsules in an immature state—a fact of some interest, fertile specimens being very rare in this country. Lastly, *Tortula intermedia* (Bridel), which in several places covered the rocks in such dense tufts as to exclude every other form of vegetation.

PAPER READ.

On the Succession of Geological Changes in Scotland from the Glacial Epoch to the Present Day. By Rev. HENRY W. CROSSKEY.

The author stated that the object of his paper was to group together certain facts, the recognition of which is believed to be important for the determination of the modern series of geological changes in Scotland, rather than to elaborate any of those larger generalisations which, in the present state of investigation, must necessarily be tentative; and that the conditions of the problems involved would be more dwelt upon than their solution.

The oldest series of facts involved in the succession of changes to be considered was connected with the Elephant Bed at Kilmaurs, originally examined by Dr Scouler, and recently re-opened by Dr Bryce, and those beds of sand, with little doubt coeval with it, beneath the boulder clay at Chapelhall, described by Mr Geikie. Between this period when *Elephas primogenius* roamed over this district, and came to drink at the large rivers, in the gravels of which its bones are found at the present day, the land has been depressed beneath the sea and again uplifted, while varied climatic changes had taken place. At present, we have no measure in Scotland of this great depression of land. In Wales, an Arctic shell-bed has been found at Moel Tryfaen, at the height of 1360 feet above the sea, containing fifty-six species; but our highest known bed in Scotland is at Chapelhall, 510 feet. The height of the boulder clay is generally taken for the measurement of the depth of depression; but although some portions of boulder clay have certainly been sunk beneath the sea, and placed in a position in which they might possibly become the abode of a spare fauna, yet its original formation must be attributed to terrestrial rather than marine agencies; and it cannot be argued that wherever there is boulder clay there is a clear proof of submergence beneath the sea. With regard to the fauna of the clay beds, investigation intensifies the proof of its Arctic character. In conjunction with Mr David Robertson, he had been engaged in microscopic examination of the clays, with very curious results. Many species have been discovered—some new to science, and some identical with new forms discovered by Dr Brady in mud obtained from Baffin's Bay. Some species of a highly Arctic character have also been added to the general lists, such as *Cyclostrema costulatum*, which has never been found living south of the Arctic circle, and *Balanus carosus*, a Spitzbergen species described by Darwin. He added that he hoped to be able to complete a full list of the fauna classified according to the various beds, as we are now working upon this field. From the period of extreme depression, the rise of land has been very gradual. The proof of this is both physical and zoological. The physical condition and position of the glacial shell beds invalidates the idea of a violent upheaval. They rest in hollows of the old boulder clay, and these hollows occur so rapidly within a limited area that any sudden upheaving force would have almost uniformly covered the

shell bed with boulder clay debris. The consistency of the beds composing the series in any section is so different—the boulder clay, the fine laminated clay, the shell bed—are so unequal in resisting power to any pressure, that the immense strain of a sudden upheaval must have confused and contorted them in their relationship to each other. Passing from the physical argument, we find slow steps of upheaval distinctly traceable in the existence of littoral and comparatively deep water beds of shells, both in the glacial and more modern deposits. The older clays at various localities present fauna belonging to various depths. We have abundantly, for example, *Mya truncata*, and, in equal abundance, *Leda perula*. It is the same with many other forms. They represent various depths. While the upheaval of the land was gradual, there are some slight signs that it was possibly undulatory rather than persistent. This remark is not made positively, but as a hint for further observation. He had been surprised to find a *Mytilus edulis* bed, at the base of a shell bed, rich with *Trophon clathratus*, *Natica clausa*, and allied forms. In one or two cases, where this has been the case, it may have resulted from some accidental accumulation through currents and tides; but it is a point worth watching, as sections are opened at the different clay pits of one locality. The uplifting force was not exerted with a uniform power over even limited areas. Take the various heights, from Bute to Airdrie, at which glacial shells are found, and the uplifting force will be seen to have been exerted very variably. There is a littoral shell bed in the clay near the summit of Jordan Hill, 145 feet. The clay bed at Chapelhall, with *Tellina proxima*, is 520 feet above the sea, while the same shell bed occurs at Paisley, Kilcattan, and in the half-tide clays all along our coast. Now, the distance between Jordan Hill and Paisley, in direct line, is very slight, yet there is a difference of 145 feet of level in the height of the same littoral shell bed. The upheaval of the land being accompanied with a gradual amelioration of climate, this amelioration was subjected to those self-same seasonal variations which occur at the present day. These were oscillations of warmth and cold. One curious suspicion may be mentioned as a hint for further inquiry. Mr Jeffrey mentions that at an extensive deposit near Uddevalla, the upper bed gives a similar result. Mixed with the universal *Trophon clathratus* are many shells of rather a southern type, such as *Ostrea edulis*, *Tapes*

pallustra, *Corbula gibba*, *Aporrhais pes-pellicani*. Among the Clyde beds I have also found a layer containing shells, in which those of the more southern type appear to exist in greater profusion and perfection than even in our present seas. It is an open subject for inquiry whether our climate was not slightly warmer than it now is between the glacial epoch and the present day. Mr Crosskey concluded his paper by sketching a classification of the various clay beds according to their fauna, indicating the climatic changes of the several geological epochs.

APRIL 25TH, 1865.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. William Loch Stuart, M.D., was elected a resident member.

SPECIMENS EXHIBITED.

Mr John Shaw exhibited a collection of European Orthotricha, with remarks on some of the species.

Mr Alexander M'Kinlay exhibited specimens of the normal form of *Orthotrichum Sturmii*, from Stirling Castle rock and Abbey Craig. In the former place he had found it plentifully, sometimes intermixed with *O. rupestre*. Among other rare species from new localities, he likewise exhibited *Eurhynchium crassinervium*, with fruit, from the Abbey Craig, and *Amblystegium irriguum* from near Doune.

Mr David Robertson exhibited a new species of *Cuma*, which was discovered last month on the shores of the Isle of Man by Mrs Robertson, and for which the Rev. A. M. Norman now proposed the name of *Cuma pygmaea*.

Dr Scouler exhibited a specimen of *Thalassema Neptuni*, from the Kyles of Bute. This species, according to Forbes in his work on the British star-fishes, has been found hitherto only in the south of England.

PAPER READ.

On the Bryology of the Campsie Hills and Neighbourhood.

By JAMES STIRTON, M.D.

In illustration of this paper, the author exhibited specimens of *Orthodontium gracile*, from Lennox Castle woods. Hitherto this moss has been known to grow only in Abyssinia, and

in three or four places in England; the present is the only other known station. Also *Zygodon Mougeotii*, the only specimen, in a fertile state, detected in Great Britain, with the exception of Professor Walker Arnott's solitary capsule secured on the Glova Mountains; *Hypnum rugosum*, barren, which occurs very sparingly, and is apparently confined to one spot; *Bartramia calcurea*, fruiting freely, with abundance of male plants showing the distinguishing characteristics in the perigonal leaves; *Bartramia arcuata*, a fertile specimen; and several others of secondary importance, which, although deserving of notice, are yet to be met with sparingly throughout the country. Dr Stirton also exhibited, from the Trossachs, specimens of a rare and beautiful moss, *Dicranum spurium*.

MAY 30TH, 1865.

Mr William Euing, Vice-President, in the chair. M. Hunter, M.D., was elected a resident member.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited specimens of *Amphiura Chiuji* (Forbes) from Cumbrae, and remarked that, during his dredging expeditions, he had found the species off Largs, and at Wemyss Bay, Oban, Inveraray, Gairloch, Loch Long, Loch Goil, Holy Loch, Rothesay Bay, and west of Bute. He characterised it as the most common star-fish on all the mud banks, ranging from a depth of 20 to 40 fathoms, round the shores of the West of Scotland, and commented on the extraordinary fact of its being entirely overlooked by one of the keenest observers—the late Professor Forbes—in his numerous dredgings in the Firth of Clyde. This distinguished naturalist had, in all likelihood, passed it over as *Ophiocoma filiformis*, with which it is invariably found associated in the same habitat. Mr Robertson also exhibited specimens of *Tanais hirticaudata* (S. Bate) and *Priniza obesa*, both from Douglas Bay, Isle of Man, where they had been discovered by Mrs Robertson. He stated that this *Tanais* had long been familiar to him at Cumbrae, but he was unable to distinguish the species. He had, however, submitted his specimens to Mr Spence Bate for determination, and had now to record both these animals

as new to the British Fauna. *Praniza obsca* has not yet occurred in the Firth of Clyde, but was found in great abundance on Douglas pier, associated with *Praniza caruleata*, *Tanais hirticaudata*, and *Anceus maxillaris*.

PAPER READ.

On Recent Palæontological Discoveries in the Coalfields of the West of Scotland. By MR JOHN YOUNG.

Mr Young referred to the great importance of many of these discoveries to the palæontologists at present engaged in the investigation of the past life of our globe. He noticed in review the various classes—consisting of reptiles, fish, shells, crustacea, echinoderms, corals, plants, etc., remarking the excellent preservation in which many of them are found, and concluded by urging upon those who are occupied in the various fields of investigation not to cease in their labours while so much remains to reward the discoverer, so that our lists of by-gone races of life, which flourished during the deposition of our coal strata, may be made of equal interest to those obtained in similar strata from other localities.

SESSION 1865-66.

THE FOURTEENTH ANNUAL GENERAL MEETING, ANDERSON'S
UNIVERSITY BUILDINGS, SEPTEMBER 26TH, 1865.

Mr John Young in the chair. The following gentlemen were elected office-bearers for the session:—John Scouler, M.D., LL.D., F.L.S., President; William Euing, Vice-President; Robert Gray, Secretary; Thomas S. Hutcheson, Treasurer and Librarian; Matthew P. Bell, John Young, Alexander M'Kinlay, and Rev. Henry W. Crosskey, Members of Council.

OCTOBER 31ST, 1865.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. Mr Henry M'Donald was elected a resident member.

At this meeting it was agreed to increase the number of members of council to eight—the names of the following gentlemen being added to the list:—Dr Colquhoun, Dr James Stirton, Messrs John Shaw, James Horne, and David Robertson.

SPECIMENS EXHIBITED.

Mr Alex. M'Kinlay exhibited specimens of *Habrodon Notarissi* from the neighbourhood of Killin, in Perthshire, where, during a botanical excursion with Professor Schimper and others, in July last, he had found it on trunks of trees, especially sycamores, ash, and elms, extending over a wide area, and occurring in great profusion. This rare moss had been found previously only in Sardinia and in the south of Italy, and in but two localities, growing on olive and holly trees. It properly belongs to the region of the Mediterranean—the Meridional Zone of Schimper—where, and in the north of Africa, its nearest allies, *Anisodon* and *Fabronia*, are found. That region has a cryptogamic flora widely different from that of the middle of Scotland, which resembles the Scandinavian, and belongs, like it, to the third European Zone—

the Northern or Septentrional Zone. There is no parallel instance as yet among Scotch mosses of a species found in the Northern and Southern Zones without a locality also in the intermediate zone.* This species—new to Britain—is an addition also to our list of British genera. He also exhibited specimens of *Campylopus brevifolius*, Sch., and *Campylopus alpinus*, Sch., two recently published species new to Britain; but he remarked that the latter, though differing in some slight particulars, was probably identical with *C. intermedius*, Wils. MS., found some years ago in Wales. Both of these he had found on Succoth Hill, near Arrochar, in June last, and again in July, when in company with Professor Schimper—the localities being Craig-na-Gour and Glen Dochart. He had lately observed female flowers on the specimens of *Campylopus alpinus*, these having been previously unknown.

Mr David Robertson exhibited specimens of a *Thysanopoda*, and made the following remarks:—

I have just learned that this animal will likely turn out to be, not *Thysanopoda Couchii*, but *Thysanopoda Norvegica*, a species lately described by Prof. Sars. Strange to say, the same post that carried one of my packages of them to the Rev. A. M. Norman took other specimens of the same animal to him from the Moray Firth, this being, so far as I know, the first met with in Britain. Mr Bell's specific character of *Thysanopoda Couchii* quite agrees with this species, so far as his description goes, and might include a dozen more, it is so brief and vague.

Thysanopoda is placed in the family *Mysidae*, but differs from the *Mysis* proper in having well developed branchial appendages attached to the base of each pair of thoracic natatory legs, which places it closer to the *Squillidae*, especially as the last joints of the first thoracic feet are furnished with a mixed and complicated arrangement of spines, which gives these organs, in some degree, the prehensile character of the anterior feet of the *Squilla*.

The first that I observed was from the stomach of a sea bream, (*Pagellus centrodontus*), which was taken by Mr M. P. Bell at Cumbræ, on the 12th of July last. From one fish I took 121 *Thysanopods*,

* The late John Nowell, the well-known bryologist of Todmorden, to whose indefatigable exertions the English moss flora owes so much, had gathered this moss some years before in two localities in England, but his specimens having been referred, by mistake, to *Pterogonium gracile*, attention was only directed to the matter in consequence of the discovery at Killin.

besides a large bundle of *Comatula*. I examined other three of the same species of fish, taken in the same locality a few days afterwards, but found four or five in one only. Ten or twelve days later, I examined several others, but failed to find any *Thysanopods*, and further examinations a month later were followed by the same results.

Finding them only in the earlier part of the season, shortly after the bream had begun to make its appearance on our coast, I was beginning to suspect that the breams from which they were taken had just arrived, bringing the crustacean cargo with them, from what distance it might be difficult to say, as forty or fifty miles an hour might be only a very moderate speed for these finny navigators. Fortunately, about the middle of September, I captured a few in the surface net at Cumbrae, proving satisfactorily that they were at least visitors to our coasts, if not permanently inhabiting our shores.

It is most likely that the apparent rarity of this animal, and of many others, does not arise from their being thinly distributed round our coasts, but rather from our want of the knowledge of their habits. This season it occurred to me to try the surface net after dark, and I was surprised to find many species of *Amphipods*, *Cumus*, *Bodatrias*, etc., abundant, that I had never met with in the surface-net by day; many of them rare, and several that are likely to be new to the Clyde. I believe this is but one of the many obscure side tracts that are yet lying thickly around us unobserved, and while the sea rolls over her treasures, our progress in reaching them will ever be perplexing and slow.

Mr Young exhibited portions of the stem of a curious crinoid belonging to the genus *Platycrinus*, in which the anal stem reverses its axis in the course of every six joints from right to left. This form of crinoid stem is very rare in most localities, but is abundant in limestone shale at Muirkirk.

Dr Scouler exhibited specimens of *Halichondria ramosa* and *Atelecyclus heterodon* from Loch Eribol.

Mr John Shaw exhibited several interesting mosses, among which were *Orthotrichum pumilum*, *O. fastigiatum*, and *O. Rogeri*, from various Scottish localities besides Dailly in Ayrshire—all new to the British flora. *O. fastigiatum*, although a very distinct species, had hitherto been confounded with *O. affine*, specimens of that moss having been detected by Dr Schimper as representing

O. fastigiatum in British herbaria. Mr Shaw also exhibited *Orthotrichum Sturmii* and *O. calvescens*, the former from Bowling, the latter from Dailly; *Dissodon splachnoïdes*, from Ben Lawers; *Leskea pulvinata*, in fruit, from Dailly; *Leucolon morensis*, in fruit, from near Killin. He likewise laid before the meeting specimens of *Bryum Schleicheri* (a var. of *L. turbinatum*), from Unst, in Shetland, where he and Mr M'Kinlay had gathered it in June, 1864.

Mr David Bowman exhibited, under the microscope, specimens of the recently discovered insect infesting the buds of the black currant, showing an additional stage of its development; also, a species of *acarus* found on the same buds. Mr Bowman likewise submitted to the meeting a new form of an object-finder for the microscope, which is constructed by affixing to a glass slide-bearer, three inches long, four scales, each an inch in length, divided into 50 degrees. These are placed along the central portion of the upper and lower edges of the bearer, and across the bearer, half an inch distant from each end. Two lines are engraved on the stage of the microscope at right angles to each other, running across the aperture of the stage, these lines intersecting each other on the field of view. These form lines of longitude and latitude. The slide to be examined is then placed on the bearer, and put under the microscope; and if any minute object, such as a diatom, comes into the field which it may be desirable to see again, the points at which the degrees on the scales are cut by the intersecting lines on the stage may be recorded for future reference. This may be done in a fractional way. If, for instance, the perpendicular line on the stage cuts the horizontal scale at degree 32, and the horizontal line cuts the perpendicular scale at degree 34, they may be set down thus—32.34. At any future time the object may be found by placing the slide on the bearer, and bringing it to the position in which the lines on the stage cut the recorded degrees, and if the observation has been correctly taken and recorded, the object will be found in the field of view. Mr Bowman also explained another way of finding out an object when the stage of the microscope is fitted with intersecting lines as already described. In order to examine a slide, it is placed on the stage, and pushed up by the sliding bar on the stage, or lowered with it, as the case may be, so that the slide may be parallel to the horizontal line on the stage. When an object is found in the

field which, it is desirable to see at another time, a mark is made on the top edge of the slide where it is intersected by the perpendicular line upon the stage, and another mark on the end of the slide where it is intersected by the horizontal line. If the slide is not covered, this may be made on the glass with a writing diamond, or with ink, if covered with paper. Should a diamond not be at hand, narrow slips of paper could be put on the glass, and the marks made on them, and, by placing the slide exactly in the position indicated by these marks, the object can at any time be readily found in the field of view.

PAPERS READ.

I.—*Descriptive Notes on several new and rare forms of Entomostraca from the Carboniferous Limestones and Shales of the West of Scotland.* By Mr JOHN YOUNG.

This paper was illustrated by a large series of specimens and magnified drawings. The most of the species exhibited by Mr Young were new to science, and had been discovered by himself and his associates during the past year. From the limestone shales of Orchard Quarry, near Pollokshaws, he had obtained the following new species, in excellent preservation:—*Beyrichia rugata*, *B. symmetrica*, *Eichwaldia bipartita*, *Bairdia submucranata*, *Cythere cornigera*, *Cythere ventricornis*, and *Kirkbya Permiana*, the last species being new to carboniferous strata, having been first described from the Permian formation of England. From the limestone of Campbeltown he had procured *Eichwaldia Scotica*; from the shales of East Kilbride, *Beyrichia bituberculata*, *B. multiloba*, *Kirkbya Uriei*; and from the limestone of Craigenglen, Campsie, *Cythere Rankineana*, *C. pungens*, *C. secans*, and *C. fabulina*.

II.—*On the Ascidice found in the West of Scotland.* By Dr SCOULER.

This paper was illustrated by an extensive series of specimens obtained by the author when dredging in various localities. Among the species which he exhibited were the following:—*Clavellina Savigniana*, *C. lepadiformis* from Oban; *Botryllus polycyclus*, and *B. Schlosseri*, and an undescribed species of the same genus, from Loch Eribol; *Molgula tubulosa*, *Amæræcium argus*, and *A. albicans*; *Pelonea corrugata*, *Lepoclinum gelatinosum*, *Aplidium fallax*, etc., etc.

NOVEMBER 28TH, 1865.

Hugh Colquhoun, M.D., in the chair. Mr David Calderwood was elected a resident member.

SPECIMENS EXHIBITED.

Mr E. A. Wünsch exhibited a series of fossil trees recently discovered by himself in the island of Arran.

Mr John Young, in referring to Mr Wünsch's interesting discovery, stated that he had visited the district in company with Mr Wünsch, and made an examination of the strata in which the plant remains had been found. These, he observed, are distinctly stratified; and, although termed trappean ash, are completely different from the ordinary trap-rocks of Arran. They are, in fact, aqueous deposits, formed of materials derived from plutonic sources, and are largely developed in many districts of central Scotland. The present instance, however, is among the first in which they have been found enclosing organic remains, or entombing old forests of the coal period. Mr Young also stated his conviction that all these ash beds and ordinary bedded traps seen upon this portion of the Laggan shore were formed contemporaneously with our lower coal measures, and were overlaid by the carboniferous limestone series of the island. They are, therefore, of much greater age than the dykes and great sheets of igneous trap which cut through and overlie the upper red sandstone of the south end of Arran. All the trees which he saw in the ash beds referred to, retained their original erect position, showing that the material had accumulated around their trunks much in the same way as sandstones and shales are found enveloping erect stems of fossil trees in the coal measures of other parts of the world. It is probable, however, that the beds accumulated much more rapidly than ordinary sedimentary strata. The plants, as at present identified, belong to *Lepidodendron*, *Haloniu*, and *Sigillaria*; and as their original structure is wonderfully preserved, it is expected that these Arran fossil trees will help to throw much light upon some of the vegetable organisms of the coal period.

Dr James Stirton exhibited specimens of *Grimmia subsquarrosa*, Wils., which he had gathered in August, 1864, on Moncrieff Hill, near Perth, where it grows in considerable abundance. He stated that Dr B. White had also, in May of this year, found the same

moss on Kinnoul Hill and Balthayock. Although this is the first notice of the moss occurring in Great Britain, it is not unlikely to be found in other localities, as from its general resemblance to a form of *Grimmia pulvinata*, it is apt to be overlooked. Dr Stirton exhibited specimens of *Campylopus compactus* and *Bryum gracile*. In addition to these, Dr Stirton laid on the table specimens of *Stylostegium cæspiticium*, from Ben Lomond, the second locality in Great Britain, where it is found in great abundance, and *Trichostomum crispulum*, from near Cardross, Bowling, etc.—a very characteristic moss, apparently common on our seaboard, but strangely overlooked in Scotland.

Mr David Robertson exhibited specimens of *Cypridina maricæ* and *Philomedes longicornis*, both from the Firth of Clyde. Mr Robertson stated that he had procured the latter in great abundance in the surface net; and with regard to the former, although previously recorded as rare in the three localities where it had occurred, he noticed the fact of its being very common at Cumberae. He likewise mentioned a curious diversity in the habitat of these animals, namely—deep water at Plymouth, in tide pools at Herm, and on the surface in the Firth of Clyde.

Mr Alexander M'Kinlay exhibited the following mosses new to Britain:—*Didymodon dallinianus* (De Notaris), in fruit, from Ben Voirlich—a species closely allied to *D. cylindricus*; *Barbula fragilis* (Wils.), from near the summit of Ben Lawers—a very distinct species, first discovered by Drummond in the Rocky Mountains, and found in various localities on the Alps of Europe, from Switzerland to Scandinavia; and *Myurella apiculata* (Sch. Syn.) from Craig Challeach, growing sparingly, interwoven with *Encalypta commutata*. The latter has been overlooked as a form of its congener, *M. julucea* (*Leskea moniliformis*), but is distinct in its spreading, concave, papillose leaves, with long apiculus. It also is a Scandinavian species.

The Secretary exhibited a series of Silurian Brachipoda from the neighbourhood of Girvan, embracing about twenty-five species, one of which was undescribed. Among these were *Lingula Ramsayi*, and *L. attenuata*, *Discina perrugata*, and several others of equal interest.

DECEMBER 26TH, 1865.

John Scouler, M.D., LL.D., F.L.S., President, in the chair.
Mr James Dairon was elected a resident member.

SPECIMENS EXHIBITED.

Mr James Ramsay exhibited specimens of *Trisetum flavescens* and *Alopecurus agrestis*, both gathered by himself in the immediate neighbourhood of Glasgow during the past summer. He stated that he had never before seen the former within ten miles of the city. The latter he had observed in 1854 in great abundance on the south bank of the Clyde, a short way above Rutherglen Bridge, at a spot where the embankment had lately undergone repair; that he had examined the place the season following, and had found only one imperfect specimen. Since then he had failed to find it—although he had searched for it every season—till the past summer, when it again appeared in considerable quantity, though not so plentiful as in 1854.

Mr Ramsay likewise read the following list of plants that he had found during one visit to the old filters of the Water Company, beginning with those most common in the district:—*Jasione montana*, *Silene inflata*, *Anthyllis vulneraria*, *Myrrhis odorata*, *Tragopogon pratensis*, *Reseda luteola*, *Potentilla reptans*, *Papaver Argemone*, *Senecio viscosus*, *Echium vulgare*, and *Saponaria officinalis*. All these, he observed, were rare in the district, the two last named being unknown for many miles round Glasgow. The only explanation he could offer for so many rare plants being crowded into a space so confined, was the probability of sand having been brought from various and distant parts of the country to renew the filters when the works were in operation.

Dr Scouler exhibited specimens of *Nicotloe astaci* adhering to the gills of a lobster, and made some remarks on its structure and that of allied species.

 JANUARY 30TH, 1866.

John Scouler, M.D., LL.D., F.L.S., President, in the chair.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited specimens of *Bodotria longipes*, Norman, a species new to science, which he had secured in some plenty around the Cumbræ, in the Kyles of Bute, etc.

Mr Alexander M'Kinlay exhibited specimens of *Atrichum tenellum*, with fruit, gathered by him near the base of Ben Lawers in September last. Although this species has been of late several times reported as British, it is very doubtful, owing to the absence of fruit on the specimens, whether any of them be genuine. Two capsules, however, found in 1850 (?) by the late Dr Nicol, between Lochgoilhead and St Catherine's, appear undoubtedly to belong to this species.

Dr James Stirton exhibited specimens of *Bryum barbatum*, Wils. MSS., a new species gathered by him and Mr M'Kinlay on Ben Ledi in June, 1864. Dr Stirton then gave a brief outline of the bryology of Ben Ledi and neighbourhood, exhibiting, among others, specimens found by him in that quarter of *Campylopus compactus*, *Dicranum virens*, *Encalypta streptocarpa*, with a capsule, and *Leucodon scuiroides*, with abundance of male flowers.

FEBRUARY 28TH, 1866.

Mr James Horne in the chair. Dr W. P. Schimper, Professor of Geology, University of Strasbourg, was elected an honorary member.

SPECIMENS EXHIBITED.

The attention of the meeting was drawn to a collection of Zoophytes of various species, which had been forwarded from Girvan by Mr Anderson. Many of the specimens were distinguished for their luxuriant growth, showing a marked contrast to the same species found on the east of Scotland, those of the west coast generally being much larger. The most abundant zoophyte collected by Mr Anderson appeared to be *Antennularia ramosa*, a species which on the east coast is comparatively uncommon, its place there being occupied by *A. antennina*, which is closely allied to it. Some of the specimens exhibited were of a fine coral red, others yellowish, both varieties preserving their distinctive colours. The collection also embraced unusually fine examples of *Plumularia myriophyllum* and *Sertularia rosacea*, the former being twenty-four inches in height, the latter seven inches. In every instance—and numbers were obtained—*S. rosacea* was growing upon the *Plumularia* referred to, the habit in this locality being very noticeable. The other species exhibited belonged to

the genera *Flustra*, *Cellularia*, etc., etc., the whole collection having been gathered from a depth of eighteen to twenty fathoms off the coast, a few miles to the north of the town.

The following mosses were exhibited by Mr John Shaw, the species having been gathered by himself:—*Campylopus polytrichoides*, from the island of Unst, Shetland; *Campylopus compactus*, from the island of Bressay; and *Cinclidium stygium*, from near Balquhiddy. Mr Shaw also exhibited a series of flowering plants, mainly from the Channel Islands, the South of England, and South-West of Ireland.

PAPERS READ.

I.—*On the Raised Beaches at Irvine.* By Mr ADAM SUTHERLAND.

After giving a general description of these, the writer exposed the fallacious opinions expressed by a writer in the *North British Review*, who holds that the sea is making rapid approaches on the land in Ayrshire. There is the strongest evidence to the contrary. In the bay of Irvine several acres of land have been “added by the sea” to the farms adjacent within the memory of persons now living. The sea is known, too, to be retiring at the Links of Ayr. This is caused partly by upheaval, and partly by the silting up of the debris deposited from our rivers and oceanic currents on the shore; and hence the Irvine and the Garnock—the two rivers in the district—which must have flowed into the sea, at a period not long since, in a geological point of view, at least three miles apart, find now their exit into the ocean by the one channel. A mile inland, at a place called the Water Meetings, where the “Irvine” exposes a considerable part of the raised beach, no fewer than four beds of shells may be seen, the one immediately over the other, the highest and lowest being fully six feet apart. Bones of a huge whale (*Balenus mysticelus*), which must have measured, judging from the size of the occiput, about seventy feet in length, were dug up a few years ago in this spot. Here, then, we have proof not only that the waves dashed on this old shore, but that a *gradual* sinking of the land took place previous to its final emergence; for this is the only satisfactory way of accounting for the presence of so many seams of shells in the positions in which they are here found. Two seams of shells have occasionally been observed by Professor Jamieson near Micklewood, in the upper reaches of the

Forth. Skeletons of whales have also been found at Blair Drummond, and at various other places, generally twenty feet above the reach of the tide. At Blair Drummond and at Airthrey, lying beside the skeletons, were found rude spears of deer's horn, broken, and with a round hole through them, as if they had been used by the natives in their battles with the monsters of the deep, and had been broken in the encounter. This is the first evidence of the presence of man in this country.

Mr Geikie is of opinion that at least a great part of the old beaches have been raised within the Roman period of our island, and perhaps he is right; but that the upper reaches of the Forth, and this old beach at Irvine, had finally emerged from the water long before the Roman period began, hardly admits of doubt. If the sea has been steadily retiring at its present pace, we must allow a period of some 4000 years to have elapsed since the waves washed this part of the old Irvine coast. This would still bring us within the human, but far past the Roman period, and it is very improbable, to say the least of it, that the natives would have employed such rude instruments as the horns of a deer at a time when the Caledonians, as we are credibly informed, were already in their *iron age*.

The beds at Irvine seem to indicate that the climate has been gradually changing from the intense cold of an Arctic region to the mild summers and winters we now experience. In the first peat deposits which overlies the glacial clays are found the remains of a sparse vegetation, such as one might expect to meet with in the north of Russia, telling of long winters and short summers. The presence of the large Greenland whale on our shores, and the remains of those cetaceans we find in the beds above the peat, together with species of shells now extinct on our shores, but still met with in the Arctic regions, point to a climate much colder than we now have. In the Highlands, and other parts of the country, during the younger days of our fathers, the snow used to be level with the eaves of the house-tops; and then in spring all the ploughing had to be done early in the morning and late in the evening from the intense heat. It is remarkable, too, that the lapwing, which used to migrate before the winter set in, has, for some years, resided with us all the year round. This change in our climate is still further corroborated by meteorological observations made lately in sixty different parts of

Europe, and the conclusion come to is that our climate is approximating more and more to that of the steppes of Russia—the seat of the rinderpest.

II.—*Notes on the Habits of the Ermine or Stoat (Mustela erminea).*

By MR ROBERT GRAY.

He narrated occurrences, within his own observation, showing the extraordinary daring and rapacity of the species and its allies. His remarks were illustrated by a wild duck with one of these animals clinging to it in the position in which both were observed when shot by Mr Colin Ferguson, Kirriemuir, from whom he obtained the specimens. The duck was observed flying at a considerable height, but making erratic deviations from its course, which attracted the keeper's attention, and, on waiting until it came within reach, he found that the bird had been pounced upon by a stoat while on the ground, and had taken flight with the little savage holding on with its fore legs partly entwined round the neck, and its teeth fastened to the back of the head. Mr Ferguson had communicated to Mr Gray a somewhat similar instance which came under his notice a few years ago—the assailant in this case being a weasel, and the victim a heron. The weasel was observed, during the bird's flight, to be hanging by its jaws to the heron's neck, and, on after examination, it was found that a large hole had been torn in the neck, leaving the bone exposed. Several other well authenticated examples were given of the sanguinary habits of the weasels, and the writer of the paper concluded with some remarks on the distribution of the various species in Scotland, and the changes which take place in the colour of their fur in connection with their haunts, and occasionally under climatic influences.

MARCH 27TH, 1866.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. The following gentlemen were elected members of the society:—Messrs James Miller and William C. Crawford, resident; Mr Robert M'Dowall, surgeon, Panama Steam Navigation Company, Tobago, Panama, corresponding.

A proposal of amalgamation, from the members of the Glasgow Naturalists' Society, was submitted to the meeting, and accepted.

The following gentlemen were accordingly admitted resident members:—Messrs James Coutts, George J. Combe, Charles Eadie, A. R. Horn, William Milne, James A. Mahony, D. L. Macnab, J. C. McNair, W. Newton MacCartney, John Rae, R. N. Rae, M.A.; James Robertson, Arthur Sutherland, Robert Stevenson, James E. Somerville, M.A.; John Small, Theodore C. Walker, Thomas Walker.

SPECIMENS EXHIBITED.

Mr E. R. Alston exhibited two specimens of the bank vole (*Arvicola pratensis* of Baillon) from the Upper Ward of Lanarkshire. The most northern locality in Britain hitherto recorded in connection with this species appears to be Roxburghshire, where it is not uncommon, and Mr Wheelright states that it occurs in Scandinavia, reaching even to the Arctic Circle. Mr Alston had taken six specimens near Lesmahagow, and stated that this little animal would be found common in other parts of Scotland. He likewise made some interesting observations on the habits of the species, as observed by himself.

Mr David Robertson exhibited specimens of a new Entomostracan, which he had discovered in the Paisley Canal, near Glasgow, and for which Mr G. S. Brady had proposed the name *Candona simplex*.* These he had found to be common in the habitat referred to. As an instance showing how little this and nearly allied species are affected by the condition of the water in which they live, Mr Robertson mentioned the curious fact, that he had this season observed swarms of these minute organisms at the end of the wharf in Eglinton Street, where the water is hot by the refuse supplies from neighbouring factories, the surface clouded with patches of oil, and with foul gas from below. In the mud brought up, which was quite black and slimy, being mixed with every conceivable kind of rubbish, and having a very offensive odour, he had found great numbers of *Ostracoda*, particularly *Cypris compressa*, plump and clean, as if reared in a habitat of the greatest purity.

Dr Dewar exhibited an albino variety of the common guillemot (*Uria troile*) which had been shot last month in the Kyles of Bute. The specimen, which was perfectly white, was interesting from the fact of albinos being particularly rare among sea birds.

Mr John Young exhibited specimens of *Balanus vulgaris*, ob-

* Now named by Müller, *Candona detecta*.

tained by Mr James Dairon from a thick bed of brick clay recently cut through in St Enoch's Square. He remarked that this discovery, along with facts recently observed, proves clearly that the River Clyde down to the period of the deposition of our brick clays, must have been an arm of the sea at Glasgow, and of considerable width, as these recent marine shells indicated, possibly receiving (according to Mr Robert Chambers) the waters of the river not lower down than Bothwell Bridge.

PAPERS READ.

I.—*On some facts in the Physical Geography of British Plants, and their Geological Interpretation; with special reference to recent Botanical and Geological Investigations in Scotland.* By Mr JOHN SHAW.

He stated that although the flora of the British Islands did not rank as a separate botanical province, it was an extremely interesting one in its past history and general character. Europe was divided into three botanical zones:—*Zonæ septentrionalis*, *intermedia*, and *meridionalis*; Britain had plants belonging to all three. He pointed out the mistake Edward Forbes had been led to commit when he divided the south of Britain and Ireland into three assemblages of plants, viz.: in Kent, in the south-west of England and south-east of Ireland, and the south-west of Ireland. Although the last named had some more southerly and delicate forms than the others, their existence was probably owing to its very mild climate. The isotherm of 41° Fahr. in the month of January passes through the south-west of Ireland and south of France, Italy, and Greece. Mr Shaw therefore believed that all the southern forms found in the whole south of Britain, and in stray nooks throughout England, Scotland, and Ireland, came into the country at one period, and that they were all wanderers from the Mediterranean shores. The author then mentioned some particulars of the intermediate or German flora, and entered fully into the Alpine and Arctic floras of Great Britain. He showed that the latter were necessarily, from the lowness of our mountains, and the influence of the Gulf Stream, not fully represented. By far the most interesting feature, however, in the flora of Britain was the number of species it embraced in common with North America. The floras of Europe and America have a conspicuous community of species, but it was a noticeable fact that

the Mediterranean flora of Europe had little or nothing in common with America. Having thus given a cursory view of the physical geography of plants in Britain, Mr Shaw then attempted to give the geological history of their introduction. He showed that there must have been a land connection between Europe and America at some date or dates during the glacial epoch. The community of species could not be well referred to periods before or after that great age; for how otherwise could we understand why the mountains and plains alike of Northern and Central Europe, and the Alps and other mountain systems of the South, should have species in common with North America? When the ice had retreated from Britain, and the land had risen after the glacial epoch, so as to be connected with the continent, the Arctic and Alpine, the intermediate or German floras, and lastly, when the climate became very much warmer than at present, the Mediterranean flora entered. This last had travelled considerably to the north, for we find traces of it in the middle regions of Scotland. The climate of Britain was such then, that trees grew at a greater elevation by 1200 feet than they do at the present time, as is indicated by the remains of trees found in bogs on our mountains.

II.—*On the Natural History of some of our Scottish Oil Shales.*

By Mr JOHN YOUNG.

I have thought that a few remarks upon the Natural History of our Paraffin Oil Shales, illustrated by specimens, might be of some interest to members of this society, especially as these same shales are at present exciting, among certain classes of our commercial men, a considerable degree of attention, and are likely to prove of economic value to this country in the future.

Ever since the discovery of those rich paraffin products in the Boghead cannel coal, or Torbanehill mineral, certain parties have been investigating our other cannel coals for the purpose of obtaining similar products; but the present restrictions of Mr James Young's patent prevents those parties from distilling from these cannel coals. They therefore were driven to investigate some of the highly carbonaceous shales for these paraffin oils, to which Mr Young's patent did not apply.

The result of these investigations has led to the discovery of the very interesting fact that there are certain beds of strata in our

coal-fields at present not included under the acceptance of the term coal, which are charged to a greater or lesser extent with similar organic products to those in the Torbanehill land. These are our paraffin oil shales—and they are now being eagerly sought for in every district of our Scottish coal-field.

Every one knows that nearly all our ordinary seams of common coal—such as the free, cherry, and splint coals, are now acknowledged by geologists to have been formed from great accumulations of vegetable matter that has grown upon the spots where these coal beds now exist—somewhat like our present peat-mosses, only the vegetation of the coal period was of a totally different kind from that forming our present mosses. In our coal measures, however, we have other varieties of coal besides those above-mentioned. These are our cannel or gas coals. They differ in their structure from ordinary coal, and show that the vegetable matter of which they are composed did not always grow upon the spot where we now find them. They are the result, in fact, of deposits of fine macerated vegetable matter, which has been swept off from certain coal-tracks, and deposited in a sedimentary condition over the area of some old sea or lake bottom.

We find in our cannel coals what we hardly ever find in our ordinary free coals—that is, the remains of certain shells, fish, and fish-coprolites, clearly pointing to their sedimentary origin. Our cannel coals also contain a much greater proportion of volatile ingredients, and are, therefore, more valuable for oil and gas-producing purposes.

As the cannel coals during deposition were liable to get mixed with other earthy matter, such as sand and clay, we therefore find them of every degree of purity;—that is to say, we find them existing in every variety—from that formed of a nearly pure vegetable pulp, to ordinary bituminous shale, with a strong clayey or sandy base, and with but a small amount of carbonaceous matter. It is therefore very difficult, in some varieties, to say whether they should be considered as cannel coal, or bituminous shale—for the question is often one of degree as to the amount of hydrocarbon they may contain. It was this great difficulty that some years ago led to that great law-suit as to what should be considered a cannel coal, or bituminous shale; for the Torbanehill cannel—the disputed band in question—has a strong clay base. You all know that the evidence adduced on both sides was very unsatis-

factory, and must always be so wherever we have to deal with mixed sedimentary materials, for we have every amount of purity between what we consider a cannel coal, and bituminous shale, according to the presence or absence of earthy impurities in the deposit.

I have dwelt upon this point in order to show how impossible it is to draw a line between these coaly shales and the cannel coals themselves. Many of these shales, which owe their hydro-carbon to the presence of vegetable matter only, are at present being worked for the oil they contain, and afford a lighter and better paraffin oil than that distilled from some of the cannel coals.

This may be owing to the clay base of the shale retaining more of the original volatile products, which in the other case have escaped from the cannel coals, leaving in them only the heavier products obtained by distillation.

Besides these coaly shales of vegetable origin, we have another class in our Scottish coal-field which appears to owe its oil to the great amount of animal organisms that have died in the beds. They are in general of a dark grey, or brownish colour, and are known to the miners of the West Calder district as the Fern-spore, or seed-cake beds, from the immense number of minute shells which dot their surface. The organisms which make up the great bulk of these beds are *Entomostraca*—a family of small bivalve crustaceans—and a few scattered fish and plant remains. The *Entomostraca* of the West-Calder shales belong principally to one species—the *Cypris Scoto-Burdigalensis*; or, it has been more correctly determined by Professor Jones to be, the *Leperdita Okeni* of Count Münster.

These little crustacea seem to have swarmed in vast numbers in the seas of the carboniferous period, as their remains, in some cases, make up certain bands of these oil shale strata, which, on distillation, yield a paraffin oil of fine quality.

As far as I am aware, no one has hitherto noticed the animal origin of the soil in these shales. It was while I was engaged in the working-out of the *Entomostraca* of our other coal-strata, that I was struck by their very great abundance in the beds in question, and have come to the conclusion in my own mind that these shales owe their oil to the amount of these minute crustacea which have died upon the sea or lake bottom, and not to the decay of plants, as in the vegetable oil shales.

These Entomostracan oil shales, if we might so term them, are found principally in the lower coal measures, and carboniferous limestone series, and are often unassociated with any beds of coal. Their range extends from the horizon of the Burdiehouse limestone to the top of the lower limestone; they vary in thickness from a few inches to one or two feet; but in the West Calder district, where they are best developed, the beds are not all of one quality, there being layers of the shale less rich in oil than others.

The idea is not new to geologists that many beds of strata in other portions of the earth's crust, owe the bituminous ingredients with which they are now impregnated, to the various animal organisms that have died over those tracts during the formation of the beds. It is also well known that there are strata abounding in organic remains which now contain no oil, nor other bituminous ingredients—but these may have escaped from the strata by the action of heat, or otherwise, leaving us nothing to testify to their former abundance but their hard skeletons. It is surprising, however, to note how many strata in our carboniferous system still retain a portion of the organic substances by which they were once impregnated, many of the limestones being quite fetid from this cause; and from their odour on being struck, or breathed upon, are termed swine-stones, or stink-stones.

The only Entomostracan oil shale that I know of in the neighbourhood of Glasgow, occurs on the south hill at Campsie, in the Hosiery limestone series. There are two bands, varying from three to six inches in thickness, yielding, by distillation, from twenty to thirty gallons of oil to the ton of shale. The shale is of a very tough durable character, and was formerly worked near Craigen Glen, in connection with some clay-band ironstone. After the volatile matter is burned out of it, the residue yields some 50 per cent. of lime, and is found to consist of the minute calcareous tests or shells of the *Entomostraca*, felted closely together, the species of which the bands are composed being *Cythere fabulina*, *C. pungens*, and *C. secans*. They also occur in some of the limestone strata of that district.

I have in the foregoing remarks indicated what appears to me to be two distinct varieties of oil shales—vegetable and animal. Those of animal origin are said to yield an oil of lighter specific gravity than that found in the vegetable oil shales, or cannel coals,

and are, therefore, better adapted for the manufacture of paraffin products.

There are other shales in our coal measures which seem to have received their oil, or hydro-carbon, from a mixture of both vegetable and animal remains, the oil in these cases being of a mixed quality. To this class belongs the Kiltongue mussel-band shale, which is being worked in several localities for the purpose of distillation. This bed is of a brownish-black colour, like some of the vegetable oil shales, but contains, in one layer, a great abundance of bivalve mollusca belonging to the genus *Anthracosia*. I think there can be little doubt but that these shell-fish have yielded, during their decay, a considerable amount of the oil with which this bed is now impregnated.

The brown shales found in some parts of our coal measures, as well as some brown and black sandstones containing hydro-carbon, but with few traces of organic remains, incline me to the belief that they may, in many cases, have received their oil by absorption of the vegetable ingredients driven off by heat, or some other chemical agent, from beds of bituminous coal strata that may once have existed in their neighbourhood. The brown sandstone from one of the Cadder pits near Glasgow, of which I exhibit specimens, has all the appearance of having received the oil which it is seen to contain by the process of distillation, the oily particles lodging in the cold porous rocks, in their passage through the strata. As examples of this slow process of distillation still going on, in some of the coal strata, from the effects of internal heat, I have only to refer to the American oil-wells, and to the continuous escape of inflammable gases in the deeper mines or pits of our own country.

In Scotland, oil shales yielding from twenty to seventy gallons of crude oil to the ton occur in nearly all the various coal basins, and, as the search for them goes on, we may expect to hear of many valuable beds being discovered, because that in many tracts of country which may have been formerly explored for coal and ironstone, these entomostracan and other brown shales were not likely to be much noticed before the discovery of their oil-yielding qualities.

As the work of research goes on, I hope that our chemists may yet discover a means of utilising, to a greater extent, the heavier hydro-carbon with which many of these shales are charged, so

that this new branch of industry which is springing up in the midst of our coal-fields may yet prove a great source of prosperity and wealth to Scotland.

APRIL 24TH, 1866.

Mr James Horne in the chair. A letter to the Secretary, from Professor Schimper, the author of the "Bryologia Europæ," accepting the honorary membership of the society, was read to the meeting.

SPECIMENS EXHIBITED.

Mr Alex. M'Kinlay exhibited specimens of an unpublished species of sphagnum (*S. curvifolium*—Wils. MSS.) This species much resembles *S. subsecundum*, and as such has probably been overlooked, but is essentially distinct from that species in having the branch leaves entire and curved upwards, and in the structure of the stem, which has three or sometimes four layers of cortical cellules. The hyaline cells of the branch leaves are also much more elongated, and almost destitute of pores. It may be safely distinguished from *S. subsecundum* at first sight by the pale, reddish stem. The specimens exhibited were gathered by him in Glen Falloch, in September, 1863.

PAPER READ.

Notes on the Habits and Geographical Distribution of Trogon resplendens (of Gould). By Mr ROBERT M'DOWALL, Surgeon, Taboga, Corresponding Member.

The province of Chiriqui is the most northern part of New Granada, or the United States of Columbia, as it is now styled, forming, at the same time, the southern limit of the republic of Costa Rica. Its lands principally lie between the Chiriqui Lagoon on the Atlantic, and the coast of the Pacific on the west. The high range of Cordilleras, which, between Colon and Panama, becomes lowered so as to afford a summit level to the railroad of only 115 feet, here rises again from 6000 to 8000 feet above the sea, keeping, in its course through the province, nearer to the Atlantic than the Pacific coast. Between the base of these mountains and the latter, the land descends gradually to the sea, inter-

rupted near David, the capital town of the province, by a lower and nearly parallel range of hills. On these plains feed numerous herds of cattle and horses, forming the principal source of industry of the inhabitants. When the grass grows scanty during the dry season, the animals betake themselves to the valleys of the Cordilleras, returning, however, each one to his grazing ground on the approach of the rains. The whole aspect of the country, seen from an elevation near the Pacific coast, is very picturesque and beautiful. It is one of those spots so charmingly arranged by the hand of nature, that few travellers, having once passed through it, would soon forget it. In its zoological and botanical physiognomy it shows a great many forms similar to what we see in the warmer plains of Central America.

David, the capital of this province, is a small town of 5000 or 6000 inhabitants, about a league distant from the mangrove swamps and inlets of the Pacific; its latitude being $8^{\circ} 28'$ north, and longitude $82^{\circ} 28'$ west, about fifteen miles, in a direct line, from the sea coast. On arriving at this place, somewhere about 1845, I often heard the natives speak in high terms of the beauty of a bird in the Cordilleras, called *Guakitu de Montana*, literally mountain macaw, probably so called from having a long tail like the red and blue macaw, which is very common in the plains. It was not until M. de Warsenrtz, a Prussian naturalist, arrived there, and proceeded to the Cordilleras in search of Orchids, where he shot two or three specimens, that the bird was recognised to be the *Trogon resplendens* of Gould, a species which he had often seen in Guatemala, the only locality where it was supposed to be found. This indisputable fact I have not yet seen mentioned in any notice of the bird since published, yet it gives us a certain data as to the extent of the geographical distribution of the species. From the base of the volcano of Chiriqui in the Cordilleras, where we find it, to the high table lands of Quezaltenango in the republic of Guatemala, is a distance of at least 300 miles, or from eight degrees of latitude to fifteen degrees north. Lately, I have been informed that the bird has been found on some of the volcanic mountains of Costa Rica. A certain elevation on extinct volcanoes seems to be necessary for its favourite residence. In Chiriqui, as soon as you arrive at the oak region, about 3500 feet above the sea, you find them generally in pairs, flying from one tree to another. They seldom show themselves

in the clear, open air; and if so, only during a short flight from one clump of forest trees to another.

The volcano of Chiriqui is about 11,500 feet in height, and forms a very conspicuous object in the landscape. It stands out somewhat apart from the bulk of the Cordilleras. At the time of the conquest, there is some tradition about its being in a state of activity, but at present all appearances of activity have ceased. The distance from David to its base is about twenty miles. With a guide and a horse, the journey can be very comfortably made. You pass the night, if you choose, at a cattle farm, about half-way, where you will be treated to jerked beef, maize bread, milk, and sugar-cane. A few hours' journey next morning will take you up to another cattle farm, in a line with the base of the volcano. The plain gradually narrows as you ascend, and is bounded on each hand by a river, whose bed has been worn many fathoms deep. At last these two rivers come so near as to be within a hundred yards of each other. Now covered with long grass, and honeycombed rocks, the plain still ascends, and disappears at last behind the volcano, to be lost in the range of Cordilleras. From the plains, at a mean temperature of 80° Fahr., you find the air and water at about 56°, so that in the miserable cane hut of the cattle herd you would pass a bad night without a couple of blankets. In the short twilight come the lowings of the cattle, and the cries of the goat-suckers. Once dark, the air around seems alive with the chirps of innumerable insects, which seem to make audible, as it were, the loneliness of a great mountain region. Just before sunrise, our guide called out, "Don't you hear the *capachos* (*Caprimulgi*) telling you it is day-light;" and really we heard the repeated calls of a bird pronouncing clearly, *ya-es-de-dia—ya-es-de-dia*; but, above all, there was the clatter of many sounds, which we were told were made by the mountain partridges or quail. The deep valleys were filled with vapoury fog. When they had cleared away, the scene before us was very fine. Looking towards the Pacific, the great sea occupied nearly two-thirds of the horizon, sweeping away from Golfo Dulce and Punta Burica, on our right, towards the lands of the next province of Veraguas. The vast plains which intervened between us and the sea were mottled by large patches of meadow, and dark lines of forest. Having breakfasted on venison and roasted plantains, we travelled higher up, and soon came to the forest of oak trees which skirted the base of the volcano. The

guide listened, and said he heard the *Guaquitus*; and soon we were delighted at the sight of a magnificent male bird, with his long, graceful tail feathers, crimson breast, and metallic green plumage. With a sort of hurried flight, he crossed over before us, in the dim light of the oak trees, and alighted. When shot, we could not help regretting that so much beauty of colour and grace of form could not be taken alive. Next to the celebrated bird of Paradise, in the islands of the Eastern ocean, I know no sight more calculated to excite to its highest pitch the enthusiasm of the ornithologist. We always found them in pairs, and on the S.E. side of the volcano. The herdsman told us that for a time they disappear, and return about the time for incubation, in March, the time we were there. They lived, he said, on the fruit of a tree called *Almacigo*—but, I think, more on that of a species of *Fecus*, the fruit of which is about the size of a small cherry, and very good to eat. The seed was found on the stomach. The fact of these trees descending some five hundred feet towards the plain, may be a motive for the birds leaving their mountain solitudes in search of the fruit. Judging from the contents of the stomach, I should say this species, at least, was more frugiverous than insectivorous in its habits. They make their nest, we were told, in some old tree, well perforated by wood-peckers, and manage so that the hole should pass through and through, so that the male bird can enter and go out of the nest without endangering his long tail plumes. By seeing these feathers protruding, the Indians were led to discover the nest. They could tell us little about the eggs, or other particulars of their nidification. Their note is a short, harsh cry, easily distinguished when once heard. A gentleman in David had a young one brought to him by an Indian. It lived for some time, and seemed to thrive on ripe plantains. Unfortunately, it got stung by a scorpion, and died. While the *Trogons* of the plains court the sunlight, sitting, apparently uneasy, in an open branch, uttering now and then a short note, this species seeks rather the shade and retirement from the glare of the sun; it seems not to be timid, but sluggish, and so is easily approached and killed. In the plains near Panama, I have often seen the native paths under the trees strewn with the beautiful crimson and green feathers, the birds having evidently fallen a prey to the hawks. The *Trogons* have been described as “solitary nocturnal birds.” I have never seen anything in their habits to corroborate this opinion. In

Central America, the *Trogon resplendens* is known by the name of Quezal, or bird of the Incas, royalty alone being privileged to wear their tail plumes. In the aviaries of the Mexican Emperors, these birds were found by Cortez. Were they brought from Central America, or have they yet to be discovered in the forests of Mexico?

The ornithological details of both male and female of these fine birds are now well known. At Panama, we frequently see the male brought from Guatemala by the passengers of the steamships, though not very well preserved. I was told they were purchased at from five to eight dollars. I do not see why they might not be caught when young, and brought home, just as well and easily as the parrot-tribe.

The geographical distribution of this species is scarcely less interesting than the bird itself. It is at least curious that, not a representative, but identical species should be found at points so far apart. It evidently follows the line of the Cordilleras, and seems to affect the vicinity of volcanic mountains. The oak region, below which it is never found in Chiriqui, according to Humboldt's rule of decrease of temperature in the Cordilleras within the tropics, would give a mean temperature of $69^{\circ} 7'$, allowing 341 feet for each degree. The fact of its having lately been discovered near other volcanic mountains, somewhat farther north in the Cordilleras of Costa Rica, would point to some local cause other than mere isothermal limitation. It is probable that the state of the soil produced by remote volcanic action favours the development of its favourite food, besides maintaining a meteorological condition of the atmosphere favourable to its habitudes. At Nicaragua, where the great bulk of the line of the Cordilleras becomes broken up, giving rise to its large lake and detached ranges of hills, we have no notice of its presence, nor in the neighbouring States of Salvador and Honduras, although abounding in volcanoes of great violence and activity—conditions of the mountain systems, however, more naturally repugnant than attractive to the bird. Whether the wide distribution of this species along the line of the Cordilleras, and its absence in the immediate low lands, is to be explained on the views of Professor Forbes, as connected with the geological changes that have affected their area, is not for me to determine. The presence, however, of the species at points and intervals so

far apart go far to illustrate the law, "that climatical zones of animal and vegetable life are mutually repeated or represented by elevation and latitude," although, according to the author just named, the species in this case being *identical*, and not *representative*, proves an accident not necessarily dependant on the law. But how the transportation has been effected, and whether from north to south, or *vice versa*, further investigations alone can determine.

MAY 29TH, 1866.

John Scouler, M.D., LL.D., F.L.S., President, in the chair. Messrs William Muir and John Dougan were elected resident members.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited specimens of a new crustacean recently discovered by himself, and named by Mr Brady *Cytheridea Robertsoniana*.* He mentioned that he had first met with the species in the beginning of the present year, in the Glasgow and Paisley Canal, between Eglinton Street Wharf and Pollokshields Bridge, and had subsequently found it also in the Forth and Clyde Canal, near Bowling. He had never observed it among plants, where many of its allies are commonly met with, but always at the bottom, in mud, which is probably its proper habitat; and it appears to prefer sandy or gravelly mud to the very fine soft mud in which others of the same family are found abundantly.

The Secretary then drew the attention of the meeting to a collection of zoophytes forwarded from Dunbar by Mr John Jeffray, corresponding member—the most prominent species being *Thuiaria thuia*, *Antennularia antennina*, *Sertularia filicula*, *Plumularia falcata*, *Campanularia dumosa*, *Sertularia abeitina*, *Halecium muricatum*, etc.

PAPERS READ.

I.—*Notes of a Botanical Excursion to Canlochan and Glas Mhiel in July, 1865.* By Dr JAMES STIRTON.

He illustrated his remarks by a collection of mosses from Canlochan—a deep and narrow glen in Forfarshire, and the source of the River Isla. Amongst these *Splachnum vasculosum* was found

* Named by G. O. Sars *Cytheridea lacustris*.

in great abundance, and fruiting luxuriantly; *Mnium cinelidioides* in extensive patches, but barren; *Grimmia spiralis* with fruit in considerable abundance, and in excellent condition; *Hypnum catenulatum* (Schwaeg) at the head of the glen, covering the perpendicular face of a huge rock in such continuous masses as to exclude every other form of vegetation; *Hypnum atrovirens*, also in fruit, from rocks in the same locality. Above these rocks, and at a level of 3500 feet, was found *Hypnum albicans*—an unusual situation for the species, its habitat having been hitherto confined to sandy flats on the sea shore. On Glas Mhiel, the highest mountain in the district, Dr Stirton had found *Polytrichum sexangulare* occupying a site usually covered by a mass of snow, but which had last summer been thawed by the excessive heat. The moss was in great abundance. Dr Stirton also enumerated other rare mosses which he had gathered in the district, viz.: *Bryum Ludwigi* (Wils.) in fruit, *Tetraplodon angustatus*, *Hypnum umbratum*, *Amblyodon dealbatus*, *Bryum Wahlbergii* var. *glaciale*, etc. He likewise mentioned having seen on the same mountain the rare and curious flowering plant, *Mulgedium alpinum*, but in a station quite inaccessible, unless by means of ropes, etc.

II.—On the Birds of Prey mentioned by Greek Writers.

By Dr SCOULER.

The author referred particularly to the Natural History of Aristotle, with a view to ascertain, as correctly as possible, the species, and to reduce the names which occur in that author to their corresponding modern appellations. The subject is one which, since the restoration of learning, has occupied the attention both of scholars and naturalists; but the investigation is attended with extreme difficulty from the very brief and often unsatisfactory notices of the classic writers, and from the necessity of comparing and bringing together the passages bearing on the subject which are scattered through their works. As to this aspect of the inquiry, our labour was now greatly abridged, as, from the compilations of Gesner, Bouharet, and their successors, all that antiquity could afford had been brought together, and only required to be verified and illustrated by the criticisms of modern scholars. But even if the preliminary critical labour was accomplished, we have only arrived at the commencement of our task. We have to deal with things as well as words; we are

naturalists as well as philologists—and this latter quality is indispensable. Even the ablest scholar, when his author treats of physical science, will, in spite of his learning, find difficulties apparently insoluble, which can be readily solved by any one acquainted with natural history. What would perplex a Scaliger might be no difficulty to a Cuvier. Hence, besides an acquaintance with the ancient authors, a knowledge of the natural history of the south of Europe is equally indispensable, and it is to the absence of this that many failures are to be attributed. In the middle of the sixteenth century, Belon, the French naturalist, exhibited a fine example of the true method by which these inquiries should be pursued. With an adequate knowledge of the older authors, he undertook a journey to the Levant, studying the animals in the country where they had been described, and collecting the vernacular names used by the modern Greeks, which are not unfrequently the same as those which we find in Aristotle or Athenæus.

It may appear strange to some that the names of animals which occur in the Greek writers should be so obscure, and their true import so difficult to ascertain; but we must remember we are treating of the beginning of science, and not of its perfection, and as an ancient writer, as if in anticipation of such an objection, has remarked, “Nulleras consummata est, dum incipit.” The number of animals known to the Greeks was small, and they wrote as if their language was to last for ever, and required no definitions. There was no difference between the scientific and the common language. It is also to be remarked that the history of animals by Aristotle is not a work like that of Buffon, or the *Systema Naturæ* of Linnæus, and contains neither long dissertations, nor systematic arrangement and minute description. It is rather a philosophy of zoology based on comparative anatomy and physiology. It takes a survey of the animal kingdom as then known, and for that purpose institutes natural groups under which animals may be classified, but nowhere enters into the details of specific descriptions.

SESSION 1866-67.

THE FIFTEENTH ANNUAL GENERAL MEETING, ANDERSON'S
UNIVERSITY BUILDINGS, SEPTEMBER 25TH, 1866.

Mr John Young in the chair. The following gentlemen were elected office-bearers for the ensuing session:—John Scouler, M.D., LL.D., F.L.S., President; William Euing, Vice-President; Robert Gray, Secretary; Thomas S. Hutcheson, Treasurer; James A. Mahony, Librarian. Rev. Henry W. Crosskey, Hugh Colquhoun, M.D.; James Stirton, M.D.; John Shaw, James Horne, David Robertson, Walter Galt, and W. Newton MacCartney, Members of Council.

Messrs James Barclay, and Archibald Robertson, Garelochhead, were elected members.

SPECIMENS EXHIBITED.

Dr James Stirton exhibited specimens of *Timmia Megapolitana*—a moss new to Britain—from Ben Lawers, with remarks on the locality. Mr Arthur Sutherland exhibited a specimen of *Blechnum strictum* (a variety of *Blechnum boreale*) from Ross-shire; and Mr Peter Clark mentioned having found the same plant in Dumbartonshire four or five years ago.

OCTOBER 30TH, 1866.

Mr W. Newton MacCartney in the chair. The following gentlemen were elected members:—Messrs Alexander Donaldson and John A. Craigie, resident; Mr William P. Turnbull, Philadelphia, corresponding.

SPECIMENS EXHIBITED.

Mr John Young exhibited some slabs of carboniferous shale from the marine strata of Craigenglen, Campsie, containing numerous specimens of an interesting bivalve shell of the genus *Pteronites*. Being unable to identify it with any described species,

he had submitted it to Mr Etheridge, F.G.S., who considered it a new species, and, with Mr Young's consent, had provisionally named it *P. fluctuosus*, on account of the wavy character of the ribbed striae by which it is adorned. Mr Young made some remarks on the genus *Pteronites*, which, he said, was established by Professor M'Coy to designate certain wing-shaped shells found as yet only in carboniferous limestone strata, and which are intermediate in character between *Avicula* and *Moliola*, and distinguished from *Pterinea* by the absence of the cardinal teeth in the hinge. Four species of the genus occur in our Scottish beds, and are considered rare shells. The new species exhibited had as yet only been found in Craigen Glen, where it seems to be confined to a very thin band of shale not exceeding a quarter of an inch in thickness.

Mr Young also exhibited some specimens of a recent brachiopod shell, which had been found inhabiting the crevices of a coarse vesicular stone, brought to the harbour of Glasgow as ship's ballast. They were discovered by Mr James Bennie, an active member of the Glasgow Geological Society. Specimens of the shell had been submitted to Mr Davidson, F.R.S., etc., who referred them to *Discina ostreoides* of Lamarek—the typical species upon which that naturalist had founded the genus *Discina*. Among other remarks, Mr Davidson had stated that we possess no certain information as to the exact habitat of the species, and that, indeed, all we know of the shell is the curious fact of its being brought to England and Scotland among ballast, and probably in ships coming from the north-west of Africa.

Mr Thomas S. Hutcheson exhibited a specimen of the red-winged starling (*Sturnus predatorius*, Wilson) which had been shot near Banff, and forwarded by Henry Alex. Rannie, Esq., corresponding member. Not more than six specimens of this rare bird had previously been recorded as occurring in this country.

PAPER READ.

On the Birds of Scotland. By Mr ROBERT GRAY, the Secretary.

This paper showed the distribution of the rarer species throughout North Britain, from the southern counties to the Orkney and Shetland Island. The communication also included a critical examination of the accounts hitherto published on the occurrence and habits of certain birds for which new localities have been discovered, and which have been till now regarded as mere stragglers.

While almost every English county had been investigated, and a record given of its *avi fauna*, very little had been published about districts north of the Tweed. The field, therefore, promised a full reward to any one willing to undertake the task of describing the ornithology of the most attractive portion of the British Islands. Its firths, and forests, and lone sea-shores, were yet inhabited by many interesting birds, whose habits and history could nowhere else be studied with greater advantage. The author of the paper then gave in detail a notice of the occurrence in the various counties of upwards of thirty rare species, some of which he had traced to permanent habitats, especially in the West of Scotland, where he had for many years paid close attention to the subject.

NOVEMBER 27TH, 1866.

The Rev. Henry W. Crosskey in the chair.

The following donations to the library were announced:—
 “Description of *Calamoichthys*, a genus of ganoid fish from Old Calabar,” by John Alex. Smith, M.D. (from the author); and a quarto volume of original drawings of zoological objects, collected at Taboga, by Mr Robert M'Dowall, surgeon, Panama Steam Navigation Company (from himself).

SPECIMENS EXHIBITED.

The Rev. H. W. Crosskey exhibited a series of *Foraminifera*, obtained from the mud brought up from the Atlantic sea-bed in the soundings made by Captain Anderson, of the Great Eastern, at a depth of 2000 fathoms. The series embraced the following species, determined by Mr Brady:—

1. *Biloculina ungens*.
2. *Quinqueloculina agglutinans*.
3. *Uvigerina pygmœa*.
4. *Globigerina bulloides*.
5. *Cassidulina lœvigata*.
6. *Pulvinula canariensis*.
7. *Planorbulina ungeriana*.
8. *Rotalia Soldanii*.
9. „ *orbicularis*.
10. *Peneroplis pertusus*.

11. *Nonionina crassula*.
12. „ *umbilicatula*.
13. *Operculina ammonoides*.
14. „ *complanata*.
15. *Polystomella* „ (?)

Of these species, *Globigerina bulloides* was very abundant; two or three specimens only of each of the others was found.

The Secretary exhibited specimens of the Bird's-foot sea-star (*Palmipes membranaceus*), which were procured by Mr Anderson at Girvan, from thirty fathoms water, off the coast near that town, in the spring of the present year.

Mr John Young exhibited a large series of *Foraminifera* and *Entomostraca* obtained from the roots of *Antennularia*, dredged in the same locality. Among these, the genus *Textularia* seemed to be abundant. Mr Young, in his remarks, pointed out the geological range of this genus, and stated that two species had been found by him in the carboniferous limestones of the Lanarkshire coalfield. He likewise referred to its occurrence in the bed of the Atlantic, as shown by various soundings, at a depth of 2000 fathoms and upwards.

Mr John Shaw exhibited the following mosses:—*Myurium Hebridarum* (Schr. Syn.) from the first and only station—North Uist; *Campylopus Shawii* (Wilson MS.), from the outer Hebrides—a new species; *Campylopus brevipilus*, *fragilis*, from the same islands; *Hypnum chrysophyllum*, from the first Scotch station—North Uist; *Grimmia spiralis*, *Distichia inclinatum*, etc., from the outer Hebrides; also *Campylopus polytrichoides*, from Tigh-na-bruaich—the third British station; *Grimmia atrata*, from Ben Lawers; and *Glyphomitrium Daviesii*, from Skye.

PAPERS READ.

I.—*Notes on Specimens from Orme's Head.*

By Mr DAVID ROBERTSON.

A two quart bottle of mud was obligingly sent to me by Mr Moore, of the Liverpool Free Museum, which had been dredged by the trawlers about twenty miles off Orme's Head. About two-thirds of the bottle was filled with black, slimy mud; above that was a thick layer of light coloured muddy sand and shelly debris. This, again, was overgrown with a layer of sponge—the whole reaching within an inch or so of the neck of the bottle. The

bottle itself appeared, from organisms attached to it, to have lain in the sea for a considerable time.

The black mud of the lower layer was rich in *Ostracoda* and *Foraminifera*, but not so diversified in animal remains as the light coloured upper portion, which contained the spines of echini, the spines and plates of star-fishes in great profusion, beside the remains of other organisms of less frequency, as larval balani, the limbs and plates of two crabs (*Porcellana longicornis*), fragments of zoophytes, etc. Of the zoophytes, there were ten species met with, so far as they could be made out. They were:—

Endendrium ramosum.
 Sertularia abietina.
 „ filicula.
 Plumularia falcata.
 Antennularia ramosa.
 Cellularia scruposa.
 Gemellaria loricata.
 Membranipora membranacea.
 Bowerbankia imbricata.
 Lepralia. (?)

These species were all so fragmentary as to make it doubtful whether any of them had ever lived in the bottle, with the exception of *Bowerbankia*, which was in very pretty condition.

Along with these were a number of fish bones, seemingly belonging to the same animal. Some of the ribs that were attached to a portion of the vertebræ were nearly as wide as the mouth of the bottle, showing that the entrance was no more than sufficient to admit a fish of that size. It is most likely that it got in alive head foremost, and not having room enough to turn, and from the smallness of the bottle's mouth, and the elevation of the fins, it would be unable to get out backwards, and consequently perished in the trap.

The shells that had the appearance of having lived in the bottle were all young, and in the black mud. They were:—

Anomia ephippium,	-	-	-	-	(Linn.)
Pecten varius,	-	-	-	-	(Müller.)
Lucina flexuosa,	-	-	-	-	(Brog.)
Nucula nitida,	-	-	-	-	(Lamk.)
Cardium echinatum,	-	-	-	-	(Linn.)
Mya truncata,	-	-	-	-	(Linn.)

Eleven species of *Foraminifera* were met with; and I have no doubt, with further search, a considerable number more could be added. As I was pressed for time, I did not do them justice.

Ostracoda are more numerous represented. Eighteen good species have been identified, besides one or two less or more doubtful varieties.

There is one species very interesting, *Cytheridea Mülleri*, which I have hitherto never met with recent, if this be so. Brady gives Australia as its habitat, in his new, or imperfectly known species of marine *Ostracoda*. Jones figures it amongst his tertiary *Entomostraca*. It is not uncommon in the glacial clays in the east of Scotland, but rarely met with in the west. It is just possible that this may be a fossil waif; but from whence, or how it got there, may not be so easily accounted for. I believe that it is of exceedingly rare occurrence to meet with fossils in the dredge, except where it comes in contact with the deposit to which they belong; and that can seldom happen, considering the general covering of the sea bottom of mud, sand, gravel, and other debris. But as there has been only one example met with, and that only being one valve, it is yet wanting in sufficient reliable grounds to establish its recent character.

Perhaps some of the members will be able to throw some light on the probable source of *Ostracoda* in that district.

From these large numbers of species in such comparatively small space, we may be inclined to conclude that the bottle afforded more than usual protection, both from their enemies and the tumults of the sea; but I am inclined to think that it is no unusual proportion in ordinary favourable localities. In an ounce or two of mud from the bottom of the sea, I generally find a profusion of animal life; the same in our canals, and often in small patches of water only a few feet in extent, entomostraca may be met with in thousands.

II.—*On the Birds of East Lothian and Berwickshire.*

By Lord BINNING.

Several very interesting notices were given in this paper of the occurrence of rare species in both counties. Conspicuous among these were the sea-eagle (*Haliæetus albicilla*), shot at Tynninghame; the honey-buzzard (*Pernis apivorus*), also shot there—both birds being now in Lord Haddington's collection; the great spotted

woodpecker (*Picus major*), shot at Archerfield, and now in the possession of the Right Hon. R. C. Nisbet Hamilton, at that place; the smew (*Mergus albellus*), and the Egyptian goose (*Anser Egyptianus*), both shot by Lord Binning at Tynninghame; the shoveller (*Anas clypeata*); the gadwall (*Anas strepera*), etc. In connection with many of the species included in the list, Lord Binning communicated highly interesting notes on their occurrence and habits; and closed his remarks with a very spirited account of a live specimen of Pallas' sand grouse (*Syrhaptus paradoxus*) which he had kept in confinement about eighteen months.

III.—*On the Geology of Ailsa Craig.*

By Mr W. NEWTON MACCARTNEY.

According to the Ordnance Survey this island attains a height of 1114 feet. Dr Bryce makes its length 3300 feet, and its breadth 2200 feet. The circumference of the island is nearly three miles. The north and west faces are very steep; while the south and east assume terraced forms, and, to ordinary climbers, are very easy of ascent. On the steep faces vegetation is barren, and consists almost entirely of small wiry grass; while, on the sloping ascent, many wild flowers and mosses may be culled. The visitor, in climbing the rock, ascends a sloping pathway to the terrace, on which stands a ruined castle. Above this terrace is another called the Castle Walk, and again a larger terrace, having in wet seasons a little *loch* of water, and in all seasons a soft wet mossy patch, always kept moist by the surface-drainage of the rock, which is shrouded often in mist and cloud. From this terrace, a winding gorge makes the climb to the top comparatively easy, from which, on a clear day, a view may be had which will repay a few hours' sea sickness, and a good hour's stiff climb.

The rock is columnar syenite, composed of felspar, horn-blende, and small quantities of quartz. I am certain that there is no amorphous rock on the island, except the trap dykes, mentioned hereafter; and the errors made by MacCulloch and Bryce can easily be accounted for when we make allowance for the shortness of their visits, and the great difficulty there is in tracing out the columnar form under the heaps of stone which cover the southern and eastern slopes of the rock, but if such a particular examination is made, the columnar structure can easily be noticed. The rock

is very close-grained, and is capable of taking a high polish, and is, therefore, much sought after for curling stones.

The columns are said to be devoid of the ball-and-socket-like arrangement prevailing among those of the Giant's Causeway; but in the smaller columns I have seen it distinctly, though in the larger it is not noticeable; and, in my opinion, in these we might rightly expect it to be absent, for larger masses in the molten state would be more likely to present flat surfaces than concave and convex ones.

That this rock was thrown up molten there can be no doubt, for in the rock itself there are minute crystals of quartz, not found in "drusy" cavities, but really imbedded in the body of the rock, placing the matter past doubt that they were formed when the rock was protruded from the "fiery depths profound."

The columns into which the rock is formed attain to various proportions. The largest one which I measured was seven and a-half feet in diameter, and eighty feet in length, without visible break or joint. In some cases these immense monoliths are found lying upon the shore at the foot of the cliff, from which they have fallen, while as large masses would seem desirous of following their example, for some that I examined were supported only on the base, and had a distinct lean outwards. You may be assured this leaning appearance does not add either to the security or the comfort of the visitor, as he jumps from one rock to another on the beach below. The mass of the columns do not stand straight up. As far as I could judge, they have a lean outwards to the north; and at a place called the Barestack, where the cliffs start from the water's edge, and soar upwards for some 600 feet, the visitor is in momentary dread of being crushed by some huge column which overhangs the deep. At the base of the cliffs great masses of columns have fallen, and assumed in some cases grotesque forms.

The terraces and caves to be afterwards mentioned are both alike due, in a great measure, to trap dykes which intersect the island from north to south. Where the trap divides the columns, the character of the syenite is changed considerably, being more liable to crumble; in fact, by mere pressure of the hand it breaks down. Where these trap dykes traverse the length of the island, and penetrate to the surface, the terraces are formed, and in some cases, as in those seen by the map, their wear, by means of water,

ice, and other agencies, have produced gorges. At the places where they appear at the foot of the cliffs, caves are formed, some of but little extent, while others, two especially, penetrate to considerable distances. On the west, where the tide divides, and where the abrading action of the waves is at present going on, one cave, called the Water Cave, may be visited at low water. A trap dyke has been worn away, and into this the waters rush, wearing down and making further progress day by day; the height of the entrance at high water will be from fifteen to twenty feet. Rarely have I enjoyed a prettier sight than once, when pulling round to see the cave at high water, I rowed in between the two cliffs, and there lay in the boat as it heaved up and down on the breast of the sleeping ocean. Around and above me wheeled and screamed thousands of birds, beneath me waved tangles and weeds; but nothing gave me such delight as did two kittiwakes, who had built their nest on a broken column at the entrance to the cave, and there sat in peaceful security, displaying their graceful forms, and lending some living interest to that cave, into which, with long prolonged boomings, the sea dashed. This cave is above the low tide level, and is guarded during low tide by a reef of columns which are slowly wearing away.

On the opposite side of the jutting headland to the south, another cave of considerable dimensions may be seen. At present the entrance is more than fifty feet above the sea level, but in the interior it is much less, as waste of the cliffs falling from above, and the debris from the trap dyke, has almost filled up the entrance. The trap dyke that has been worn away to form this cave (M^rInall's) is more than twelve feet in breadth, and is joined, a little above the entrance to the cave, by another dyke which is nearly as broad; the column enclosed between these dykes is much changed in its character. On the south face, at what is called the Main Craig, a curious freak of a trap dyke was examined. For a considerable distance from the base of the cliff it keeps on one side—the east—of a column, and then abruptly bends, dividing the column, and continues on the other side—viz., the west—as far as the eye can reach. These dykes may be traced the whole length of the Craig from north to south, and make those natural terraces which add so much beauty to the eastern slopes of the island. The path of these dykes is always covered on the hill by immense heaps of stones and abrupt precipices, in some

cases of considerable height. On the top of the Craig there are some very large rocks, weather and water-worn, covered with lichens, and what caused my wonder was how they ever assumed the boulder shape. They cannot be erratic rocks, because they are at home, being part of the rock. If they belonged to some other formation, I could easily understand how they could be transported there, but they belong to the rock, and I cannot account for their presence, except that the various abrading agencies have performed their work, and kept them on their bed at the same time.

I particularly searched all over the island for any other rock than syenite and trap, but failed, except in two instances. I found on the shore, at the landing-place, some Irish lime, which must have come ashore from some wreck, as must have been the case with a small piece of copper sheathing.

The other rocks I found were brought to the island by a conveyance not made by human agency—a means of transit which has been of considerable use in our country before our race occupied it—I mean icebergs. On the north, at the height of about 600 feet, I came upon a deposit of boulder clay, which lay in a slight depression, guarded in some degree by a boss of rock from the currents which, when the Craig was submerged, set in from the north-west. In this red earth, composed of sand and clay, I gathered a goodly quantity of pebbles, both large and small, a considerable number of which, both from their form and markings, prove that their origin was such as I have hinted, fashioned by the ice-king, and carried by the iceberg. The pebbles were gathered indiscriminately, as I thought it better to do so than to pick them. About a third of them bear indisputable marks of glacial action, though these marks are, owing to the weathering action of winds and rains, and the careless turnings over of the conies, somewhat rubbed, and a good deal deficient of those finer striæ which pebbles gathered *in situ* would present. The coarser striæ are, however, remaining, to prove that they once upon a time were firmly planted in the ice that formed the bottom of a glacier, and were pushed and drawn by it as it slid over the rocky bed of the valley through which it flowed, and were thus scratched or scored by the surface over which they moved. Before passing from this part of my observations, I may mention that great heaps of stones of various sizes are piled up, and have streamed down from the lower face of the

terraces through openings, and strew the face of the eastern front of the island. All these stones are rough, sharp-edged, and belonging to the syenite of the Craig. In the deposit of boulder clay, I found only two pieces of this syenite, all the rest being specimens of other formations—some of pure quartz, others probably metaphorised sandstones, while a few of them are derived from shale, as they have the distinctive clay nodulite character of that formation.

These facts, in brief, are what I observed during my stay on the Craig, and from these, I think, we can justly draw some deductions which, when viewed with those theories which are generally received, will add some little interest to the solitary rock of Ailsa.

As you are aware, the relative positions of land and water have changed considerably during a comparative short period of geologic time. The Craig, like unto some monolith, marks in some degree those changes which I will try briefly to lay before you. Without any great stretch of imagination, we must suppose the Firth of Clyde to be filled with successive stratas of silurian, old red, and carboniferous ages; then from Ayrshire coast to Kintyre, the strata developed on either side will be continuous. From out these strata the peaks of Arran, and the silurian hills of the Southern Highlands will rise, and the centre, but as a boss of rock, Ailsa will be noticed. The formations in those parts, left exposed, fully bear out this arrangement, for in Arran the shale band is estimated to be 2000 to 3000 feet thick, while in that island, in Bute, Cumbræ, and along the coast, the old red, and the carboniferous are developed to considerable thickness. On the opposite coast of Kintyre, Mr Thomson has found the carboniferous strata. That these strata once filled what is now occupied by the waters of the Firth, we will take for granted, but a time came when the subsidence of the land took place; then began the action of those abrading agencies of water and ice, which gradually wore away the strata, and carried it out to be deposited in the "silences of the central sea." The powerful currents operating from the north-west tore against the peaks of what we call Arran, and, sweeping round, were carried in full force upon the intermediate land, and probably, aided by the uptilting of the strata, slowly but surely revealed the bluff, bare front of Ailsa. Successive years rolled on, and still the action of waves, aided by glaciers from the Highlands,

and icebergs, continued the work of abrasion. In process of time, the rock of Ailsa became solitary, and existed under the waves, often, no doubt, acting as an anchorage ground for some of those monster icebergs which floated along, laden with cargoes of waste lands. Nothing more easy to suppose that during the deposit of the boulder clay, one of these icebergs stranding upon the summit of Ailsa, dropped its cargo, which, deposited behind a boss of the rock, sank into comparative security. That the currents which operated were from the north-west, the summit of the Craig bears certain proof, for the length is from N.W. to S.E. After a time of great abrading agency, the land slowly began to emerge from the sea, and no sooner did the bare scalp of the rock rise above the surface, than nature crowned it with glaciers, which began their work in tearing down cliffs, and grooving great gullies, one of which, from near the summit to the first or uppermost terrace, is a very beautiful example of the glaciers' path. Contracted at the mouth, it emptied itself upon the plateau in an easterly direction, and then deflected right and left to the north and south, and probably threw off icebergs on each side.

Another elevation occurred, and over this new summit the glacier pushed itself till it met the sea, leaving great moraines of stones of various sizes, broken splinters of the protruding rock which the ice tore of and laid in its path. Elevation succeeded elevation, and still the glacier wore down, and sloped the eastern side, leaving evidence of its continued progress as it moved over the rocks. Each successive upheaval is registered on its sloping form, in the terraces with their moraine of stones, and the gorges with their narrow-throated embouchures. The last upheaval but one seems to have been followed by a long period of rest, for then the beach of rolled and polished stones was raised, and the largest caves hollowed out. Then came a time when the rock, with Kintyre, Arran, and all the surrounding land, rose about forty feet; a change in the temperature occurred; the glaciers left the Craig; the iceberg, "like the baseless fabric of a vision," vanished, and Ailsa was left a place for the sea bird to breed, while the perished land, with which it was once surrounded, now forms "the dust of continents to be." During this time the sea still continued its work, and bared the north-west face, wearing away both the surrounding strata, and making the cliffs steep and frowning.

Then stopped—and that during the time that our Scotland, risen from the waves, was peopled by our fathers—this period of elevation, whether to continue rising, or to perform a retrograde movement, who can tell. The Craig, monumental and solitary, marks some of the changes in our country's history which, if we could only picture to ourselves, would give such an estimate of the forces and powers at work in modifying the form of our earth as would excite our wonder and awe. How different would be the view presented to the spectator standing overlooking the scene before these changes began. A comparatively level plain, bounded on the north and east by hills of but small size, rising ground to the west, with long surging billows breaking the eternal silence; then, as he looks, the sudden subsidence of the land, and the rushing in of that sea which dashed against the Kintyre coast. Then, for long ages, those highlands to be covered with eternal ice, moving in slow, powerful force down the slopes, carrying clay and rock to the sea level, their avalanches breaking in upon the stillness of the scene, and possibly assisting the detachment of the landfloes and icebergs, which, floating away, carry with them remains of the denuded land, pebbles lop-sided and striated, which they drop into the depths beneath. One eternal scene of sea and ice presents itself, and nothing else; but these agents are doing great work, for when again the scene is changed, what was before-time solid earth is now gone for ever, and the only remnant of that perished land are the islands of Arran, Cumbræ, and the Craig. Still the scene is icebound, and continues so as successive upheavals take place, till a change again comes over the landscape. Warmer seas and brighter skies supervene, the glacier leaves our hills, the iceberg sails no more upon our seas, the scoring and grooving ceases, and soon the lowlands wave with forests, the heather covers the sides of the mountains, and, bathed in the glories of a summer sun, the peaks and passes of bonny Scotland appear.

How much truth, therefore, is contained in Keat's lines! how much sound geology when he addresses Ailsa!

“Dread rock, thy life is two eternities—
 The last in air, the former in the deep;
 First with the whale, last with the eagle skies;
 Drowned wast thou till an earthquake made thee steep,
 Another cannot bow thy giant size.”



IV.—*Remarks on the occurrence of Alpine and Sub-alpine Forms near the Sea Level in Insular Situations.* By MR JOHN SHAW.

The author of this paper first referred to the various facts which he had observed in such places as Lochgoilhead and the outer Hebrides. Some Alpine species there flourished at fifty or a hundred feet above the sea level. Negative evidence is, however, afforded by the entire absence, in such localities, of the delicate ephemerals of the plain. Only the more hardy species prevail. He then showed that the mean summer heat of such places was lower than that of inland regions, and that, from the nature of exposure to the sea, the climate was subject to greater vicissitudes, and was more severe—causes which undoubtedly brought about such apparent anomalies in distribution. After stating that island floras in any one region were less varied than inland floras in the same region, and speaking of the great paucity of forms in all insular places, Mr Shaw pointed out the application of the whole theory to some anomalous facts in the mountain distribution of plants. He thought it was possible to explain the occurrence of such plants as the sea pink (*Armeria maritima*), the scurvy grass (*Cochlearia officinalis*), on mountain summits in this way, by reference to the period when the area of Great Britain was considerably less. The theory also gave the best explanation of facts known to all practical botanists familiar with mountain floras, such as the occurrence of species belonging properly to the plain being found in the neighbourhood of springs far up the mountain side, in the tracts occupied by Alpine forms, and the correlative fact of the descent of Alpine species to the plain in the immediate vicinity of, or in contact with, water.

DECEMBER 18TH, 1866.

Mr John Shaw in the chair.

SPECIMENS EXHIBITED.

Mr James Coutts exhibited a series of eggs of the common lap-wing (*Vanellus cristatus*), showing many curious deviations from the ordinary shape and colouring, with a selection of other species from his own cabinet, on which he made a few remarks, pointing out the necessity of having oological collections properly authenti-

cated. The Secretary also laid on the table a number of specimens bearing on the same subject, among which was a cream-coloured variety of the merlin's egg, besides a few others of like interest.

PAPER READ.

Notes on the Botany of the Windmillcroft Beds.

By Mr JAMES A. MAHONY.

Much has been done of late in extending our knowledge of the fauna of the local sands and clays, and many hitherto deemed quite azoic, are shown to contain abundant remains of minute life. Little or nothing, however, has been done for the botany of these local strata; and it is with the hope of inducing further research in that direction that I now call attention to the subject.

Glasgow is built on a series of sand, gravel, and clay beds, which are referred to three groups—the boulder drift, the boreal clay, and the Clyde drift. Of the lowest of these—the boulder clays—I have little to remark. Full of interest as that epoch is for the geologist, it has little attraction for the botanist. In some of the sections exposed there were remains of roots in abundance, but as these were clearly traceable to recent plants which had merely made the clay a place of growth, this fact has no significance. During the excavations at Windmillcroft, the two latter groups were well exhibited; and I now propose to describe the botanical remains found in them during a series of visits.

In the boreal clay, which, with a deep bed of fine white sand interposed, overlies the boulder clay, there were great numbers of strange root-like forms, the exact nature of which I have been recently trying to determine. They do not occur in the clay proper, but in an upper stratum composed of sand and clay, which seems to be merely a continuation of the clay bed beneath. Whenever a natural face of this sandy clay was exposed, numerous examples of these roots were sure to be seen standing out, sharp and distinct, against the grey matrix in which they were placed. They were of nearly uniform calibre, about a line in diameter, and were not traceable to any distinct ending, for both upwards and downwards they merged indefinitely into the sand. In length they were very various, the greatest being about 2 feet 9 inches, while some showed a small fragment only. They were all disposed vertically, or nearly so, and many had offshoots here and there equal in diameter to the main root, and often inserted at right-angles to it.

In the absence of recognisable characters for determining the nature of these objects, I had recourse to the microscope, and compared the tissue with that of many plants, terrestrial and aquatic, but generally selecting root fibres. I was led, as a result of these examinations, to regard them as fibres of the rhizome of some species of *Equisetum*, the elongated cells being well marked, and of the usual brownish colour. Similar vegetable tissue—sometimes in a comminuted state—was revealed on an examination of clay from West-thorn, from Paisley, and from a cutting at the head of Eglinton Street.

There is nothing in the geological history of the sandy clay in which these roots are found to militate against their equisetal origin; on the contrary, such an idea is confirmatory of the supposed conditions under which this stratum was formed. It marks the last day of a glacial epoch, when the land was slowly rising, and although the clay beneath is clearly shown to have been of marine origin, from the discovery of a few species of shells, we have no data to indicate a similar origin for this *upper* deposit. It must be remembered, too, that the plants themselves existed only very near to the surface of the bed, where the waters would be only slightly, if at all brackish, and forming extensive shallow marshes. There is abundant evidence that considerable denudation followed the completion of those strata, and this would account for the disappearance of the stems of the *Equisetæ*, while the roots beneath remained.

How long this process of denudation continued, caused, as it probably was, by considerable alterations of level, no one can tell. Consequent on it, however, the Clyde seems to have assumed its present course, flowing in a much wider channel, and much more rapidly, than now. The coarse gravel which represents this period contains nothing of botanical interest beyond a few decayed branches, which lie here and there throughout its extent. The land would as yet be naked and bare, but slowly preparing for that abundant vegetation which we find in the later strata. Animal life is represented solely by the fresh water mussel, *Unio margaritifera*, the epidermis of which was first discovered by Mr Bennie, and he has, in a limited area of Windmillcroft, found seventy of these skins, thus indicating a notable abundance of the species. In many instances a sandy cast in the gravel showed where the mollusc had lived and died—the position of the

epidermis proving that it had lain with the umbone lowermost, as we find them to-day.

The remaining strata of sand, mud, and gravel, nine to ten feet in depth, are most interesting, alternating, as they do, with layers of vegetable *debris* of thicknesses varying from a quarter of an inch to twelve inches. The most prominent vegetable remains found in these strata were great trunks of trees, which occurred at different depths, and all bearing evidence of having been long knocked about in the water before finally sinking. In every specimen I examined the wood was of oak, and always denuded of the bark; but I am informed that willow and Scotch fir have also been exhumed. The inner wood of these old trees was invariably sound—only an inch or two on the outside being decayed.

The lower bed of vegetable drift contained very few leaves, being mostly composed of worn twigs, hazel nuts, and acorns. The larger twigs were rounded and worn to a greater extent than would seem possible from mere floating about as drift wrack; and I believe their present pebble-like form was attained only after much rolling about at the bottom of the river, subsequent on their sinking from over-saturation. The hazel nuts, which were found in great plenty, had sometimes distinct marks of the incisor teeth of some rodent, probably the squirrel. I found one worn fruit in this bed that seemed to be the seed of the alder—*Alnus glutinosa*. In a similar deposit at Hutchesontown Mr Bennie found a cone of the *Pinus sylvestris*.

A noteworthy *chemical* action was observed in connection with these plant remains. When they lay in little pools, the iron with which the water was impregnated had combined with the tannic acid of the vegetable tissues, and formed tannate of iron, or ink, which not only dyed the nuts and twigs of a deep black colour, but also blackened the water in which they lay. Where this phenomenon was observed, the drift generally lay in a “nest,” or shallow basin, formed seemingly by an eddy in the swollen river.

It was in the largest of the leaf beds that, resting on a bed of sand and gravel, the mosses were found in greatest abundance, and in best preservation. On separating the layers, the mass was seen to be composed in great measure of decayed leaves, with a notable proportion of sand intermixed, and generally a sprig of moss would show itself, fresh and green, between the laminae. After exposure to the air and drying, the mosses lost this verdure,

although some of the specimens now shown retain much of their original hue. The leaves, with few exceptions, were too much decayed to present any recognisable features, but from those somewhat more perfect, I was able to determine the presence of oak, ash, birch, hawthorn, wych-elm, and hazel. A further acquaintance with the old Clyde drift will doubtless extend this number. It has been observed that no remains of the beech, either leaves or nuts, have been found, although they form a considerable proportion of the modern drift. This, however, is not remarkable; for the beech can scarcely be recognised as an indigenous Scottish tree, and these relics of old Clydesdale vegetation are of an age long anterior to the time when its *introduction* was possible. There are other plants, however, which we might expect to be represented, but which we look for in vain, such as sloe, ivy, mountain ash, the poplars, etc.; but even in the drift of to-day, many trees that we know to be common in the upper reaches of Clyde are represented only by a leaf at long intervals. The great bulk of withered leaves brought down by spates consists of oak, beech, ivy, and rhododendron.*

The mosses found in the leaf beds were:—

- Brachythecium rivulare.
- Mnium serratum.
- Neckera pumila.
- „ complanata. (?)
- „ crispa.
- Hypnum tamariscinum.
- „ filicinum.
- „ uncinatum.
- Isoetium myosuroides.
- Climacium dendroides.
- Philonotes fontana.
- Nomialia trichomanoides.
- Polytrichum commune.
- Fontinalis antipyretica.

* In Lyell's "Antiquity of Man," the following plants are named as having been found in the forest beds *below* the glacial drift of the Norfolk cliffs, and therefore must have existed long before the Clyde vegetation:—

Scotch fir, Spruce, Yew, Oak, Birch, Alder, Nuphar lutea, Nymphaea alba, Prunus spinosa, Menyanthes trifoliata, Ceratophyllum demersum, and a species of Potamogeton.

The first of these, *B. riculare*, existed in greatest abundance, and its tissue seemed better adapted for resisting decay than any of the others. Being strictly an aquatic species, its presence here is easily accounted for. *Mnium serratum* is a more fragile species, and sub-alpine in its character, like *Neckera crispa*. *N. pumila*, and *N. complanata*, luxuriate in moist places by the side of streams.*

N. pumila is not a common species, although I found it to be pretty abundant in the leaf bed. *Hypnum tamariscinum* is found abundantly in shady places at the roots of trees, and is correspondingly frequent here. *Climacium dendroides* and *Philonotes fontana* are also moisture-loving species; indeed, it is to be remarked of all the mosses yet found, that they are such as grow at the present day by the banks of Clyde, and such as would be torn from their bed by every winter flood.

There are other aquatic species, the non-appearance of which is not remarkable, such as the *Sphagna*, which prefer inland boggy situations; but such mosses as *Isoeteceum alopecurum*, *Hypnum palustre*, etc., are conspicuously absent; as are also the *Hepaticæ* and *Ferns*.

In order to ascertain the relative proportions of leaves and sand in this three-inch bed, I operated on a known quantity, and found it to consist of:—

			PER CENT.
Organic matter,	-	-	32·0
Sand, -	-	-	49·5
Water,	-	-	18·5
			<hr/>
			100·0

I have hitherto spoken only of the Windmilleroft beds, but the same botanical relics are found at numerous other localities around Glasgow. In digging for the foundation of the railway arch at Salisbury Street, a bed of sand was laid bare, seemingly the equivalent of the root-bed in Windmilleroft. There was very little clay in its composition, and it was darker in colour than that at Windmilleroft, but the same equisetal roots were found. It contained in addition, however, numerous pieces of drift-wood, and I got two mosses after some searching, viz., *Climacium dendroides* and *Neckera complanata*.

Again, in digging graves at the Southern Necropolis, they came on beds of nuts, acorns, and twigs, at certain places, clearly water

* I am indebted to Mr A. McKinlay for revision of these names.

deposited. Similar deposits have been found at Barrowfield, Crownpoint, Port-Eglinton, and many other localities. I would point out that this vegetable *debris* has nothing of the character of *peat* about it, but is a true drift, carried along a stream till, oversaturated by water, it sank, and became covered up by sand, only to be exhumed after the lapse of centuries.

I conclude, from the preceding observations on the river drift—first, that the Clyde at one time flowed over a much wider channel than it does now. This is *demonstrated* by the occurrence of these plant remains over the wide area that I have indicated. Indeed, all the evidence yet gathered goes to show that the old Clyde we speak of was somewhat of an estuary, widening gradually from the gorge at Blantyre Priory; and the conformation of the land above that at Hamilton and Dalsersf would indicate that Blantyre was the base of another great delta which overspread the plain above. I content myself with merely referring to this view in the meantime.

I infer, secondly, that the conditions that existed during the formation of the leaf beds were persistent over a very long period. Many of those localities spoken of are much higher than Windmillcroft. Some are ten feet, some forty-five feet higher, so that here we have evidence of a withdrawal of the waters from that high level, which, even at a moderate computation, would take many centuries.

I conclude, thirdly, that the flora of the Clyde, as represented in the leaf beds, was of a distinctly Scottish or British type. *None* of the trees that are regarded as introductions from England are to be found; all are of that primitive type that exhibit nature as perfectly natural—no aliens or introductions being yet visible.

The fact of objects of human workmanship being found in these same strata, lends a peculiar interest to this subject, and incites us to recall the probable condition of things then existing. The untutored Caledonian roamed through the old forests of Clydesdale untroubled by Roman invaders, or any thought of a country beyond his own. He made his stone anchors, worked the rude armlets and ornaments, or laboriously fashioned a boat out of an oaken log. He hunted the denizens of the wood that then roamed in numbers; he fished in the broad waters of the Clyde many a long summer day—and then, as the rays of sunset illuminated the spreading foliage of the oaks, and birches, and

alders of that time, he paddled his canoe homeward, to be welcomed by the smiles of his little ones.

JANUARY 29TH, 1867.

Mr Walter Galt in the chair. Dr John Young, Professor of Natural History, Glasgow University, was elected a resident member; and the Hon. Lord Binning, Burntisfield House, Edinburgh, and Mr John A. Harvey Brown, Dunipace, Falkirk, corresponding members.

SPECIMENS EXHIBITED.

Dr James Stirton exhibited specimens of *Dicranum longifolium* from Ben Lawers, the first authenticated occurrence of the species in Britain, and also made some remarks on the botanical features of the district.

The Secretary exhibited two specimens of the Bohemian wax-wing (*Bombycilla garrula*) from the neighbourhood of Lanark. He remarked that about the beginning of December, before there were any signs of such weather as we have recently experienced, large flocks of waxwings were observed in various parts of Britain. These migratory flocks had greatly exceeded in numbers those of recent years, and had spread themselves over a large tract of country.

PAPER READ.

On the Latent Vitality of a species of Equisetum from the Blairdardie Clayfield. By Mr W. NEWTON MACCARTNEY.

In the Blairdardie claybeds, roots of an *Equisetum*, probably *Equisetum palustre*, are found at depths varying from three to fifteen feet. These roots, where embedded in the clay, retain their freshness, and, when placed in water, throw out buds and grow. When a section is made, the starch cells retain their normal form, and, on the iodine test being applied, starch in quantity is apparent. The same root, if traced as it lies horizontally in the deposit, will be found fresh and perfect where the clay is comparatively pure; but where it passes through sand, nothing but the dark-coloured epidermis remains. From this fact it is inferred that the clay retards the process of decay, which takes place when the root is in sand. The siliceous matter entering into the

composition of the epidermis, and an adventitious crust containing iron, derived from the clay which surrounds the rhizome as it lies in the deposit, contribute to the retention of that vitality at once observable when the roots are placed in the fit condition for growth. The fact of their resuscitation has been placed beyond doubt; but the age of the plants is a more difficult matter to determine.

FEBRUARY 25TH, 1867.

Hugh Colquhoun, M.D., in the chair.

SPECIMENS EXHIBITED.

The Secretary drew the attention of the meeting to a specimen of the common pheasant, a female, showing the complete assumption of the plumage of the male bird, which had been forwarded for exhibition by Lord Binning, one of the society's corresponding members. This remarkable specimen had been shot last month at Tynninghame, in East Lothian, and now belonged to the Earl of Haddington's collection. Placed in contrast with other specimens of a like character, it presented some unusual features—the whole of the plumage being as brilliant as in many males, and the white ring surrounding the neck especially well defined, being, in fact, much broader than what is observable in most male pheasants. The scarlet patch encircling the eyes, however, was of small extent, but in almost every other respect the bird would, at first sight, have deceived even an experienced eye. Dr Dewar had also on the table three specimens of female pheasants from his own collection, one of which showed the darker plumage of the male faintly perceptible through its own normal colouring; a second having this change still more developed; while the third approached completion. None of these, however, showed any spot of white on the neck. Mr John Young, at same time, brought forward two examples from the Hunterian collection; one with the change apparent only on the head and neck, the other much more complete, and having also a few white feathers on one side of the neck. Yet the whole of these specimens, although highly interesting, had an expression, so to speak, clearly indicating the female bird in an assumed garb; while the specimen sent by Lord Binning was so completely transformed as to distinguish it at once from ordinary examples.

The Secretary remarked that since the time of Aristotle the fact of female birds assuming the plumage of the male bird had been well known, and that the recorded instances had chiefly occurred among the gallinaceous birds. Mr Gray also stated that this change would, in all likelihood, be observed in other families of the feathered tribes, if proper attention were directed to the subject.

Mr George J. Combe exhibited a very beautiful and interesting collection of hardy ferns, principally from the lake district. The collection embraced specimens of *Athyrium filix-fem.* var. *Victoriæ*; *Lastrea thlypteris*; *L. f. m. remota*, *L. Barnesii*; *Scolopendrium vulgare*, var. *excurrens*, etc., on all of which Mr Combe made some remarks.

Mr Alexander M'Kinlay exhibited specimens of a lichen, *Thelopsis rubella*, and of a moss, *Aulreæa alpestris*, both new to Britain, having been gathered by himself in the West of Scotland.

PAPERS READ.

I.—*Notes of Geological Excursions to the Bathgate District.*

By Mr JOHN YOUNG.

Mr Young referred to the Boghead cannel coal, which he considered as only a local variety, and pointed out the changes it undergoes in its mineral composition as it passes out of the district, becoming the middle slaty blackband ironstone of the Lanarkshire coalfield. He likewise remarked that it could be nearly matched in all its important characters by other varieties of cannel now known to exist in our Scottish coalfield—the amount of hydro-carbon which they contain being only one of degree, and even this is shown to be variable in the Boghead coal itself. Mr Young next referred to the richly fossiliferous limestones of the Bathgate hills, and noticed the important lessons which the student of geology might learn from the careful study of the organic remains in the limestone strata, which are associated with volcanic ash and other interbedded trap rocks. He also indicated the relation which the Bathgate limestone holds to other strata of the same nature in the Lanarkshire and Ayrshire coalfield, and stated his belief that the thick-bedded limestones of the district around Beith in Ayrshire, and of Corrieburn on the Campsie hills, belong to the same geologic period, as is indeed evident from the organic remains of the strata.

II.—*On Ancient Canoes recently found at Renfrew.*

By Mr W. NEWTON MACCARTNEY.

Mr MacCartney gave an account of the discovery of two of these interesting relics on the banks of the Clyde, near the ferry, in 1863. Both were found at a depth of fourteen feet in the sandy gravel. The largest specimen was about twenty-five feet long, and was in excellent preservation. These two canoes had remained on the river bank uncared for till the workmen broke up the remains for firewood and other uses. Several pieces had been taken to Renfrew and converted into walking sticks. Mr MacCartney suggested that the society should memorialise the Clyde Trustees, with a view to the future preservation of those or similar objects of interest, should they be discovered. Various animal remains had from time to time been obtained during the excavations carried on at different parts of the river, and these, under proper instructions, might in future be made to serve the purposes of science, instead of being destroyed by the hands of the careless or ignorant. It was, therefore, agreed that a representation should be made to the Trustees on the subject.*

MARCH 26TH, 1867.

Mr James Horne in the chair. The following gentlemen were elected members:—Rev. James T. Graham, Govan; Rev. Robert Small, Caddenfoot Manse, Galashiels; Rev. John R. Scoular; and Mr Thomas H. Turnbull, resident; Dr John Alston, late of the Province of Maranam, Brazil; and Mr Thos. Edward, Banff, corresponding.

SPECIMENS EXHIBITED.

The Secretary exhibited a beautiful specimen of the ivory gull (*Larus eburneus*) which was shot near Campbeltown last month, and preserved by Mr Martin, Buchanan Street. The species is one of great rarity in the British Islands, and is known to have occurred only in a few instances in Scotland. Mr Gray, however, remarked that solitary birds might probably be found lingering occasionally on Ailsa Craig, as pure white gulls had been oftener than once observed there.

Mr Alexander M'Kinlay exhibited specimens of *Jungermannia*

* In July, 1868, near Dunglass, on the Clyde, other two canoes were found.

saxicola, Schrader, which had been gathered by himself on Rona's Hill, Shetland, in July, 1864. This very distinct species had not previously been known as a native of the British Islands, although not rare in subalpine regions on the Continent from Switzerland to Lapland, and found also in Greenland. The deeply bifid leaves having the lobes conduplicate, give the plant the appearance of the genus *Scapania*, a species of which (*S. irrigua*) was sparingly intermixed with the specimens shown.

Mr John Young made some remarks on four species of Silurian Brachiopoda, new to Ayrshire, which had been found by Mr Robert Gray—*Siphonotreta micula*, *Orthis galea*, *O. alata*, and *Lingula Ramsayii*.

PAPERS READ.

I.—*On New Forms of Crustacea, from the Silurian Rocks at Girvan.*

By Professor J. YOUNG, M.D., F.G.S.

PLATE I., FIGS. 4, 5, 6a, 6b.

Among the crustacea placed in my hands by Mr Robert Gray, more than one form has been added to the previous lists; and several specimens, whose description follows, are new, specifically, if they have not subgeneric value.

The parts for determination are the glabella and fixed cheeks. No body rings nor pygidia can be as yet connected with the heads. It is, therefore, probable that the posterior portions of the body have been wrongly referred to other species. This, however, cannot at present be ascertained. The following are the measurements of the best preserved specimens, in fortieths of an inch:—

	1.	2 (fig. 4).	3 (fig. 5).
Glabella, length,	31	23	24
„ breadth,	31	22	23
Cheek, length,	11	7	—
„ breadth,	12	8	6
„ spine, length,	—	11	17
Glabella spine, length of fragment,	—	—	11
„ „ „ probably,	—	—	30

The glabella is globular, but dips little towards the cervical fold, so that when the animal is placed in its natural position, the median portion corresponding to the basal lobe is nearly horizontal, and the fixed cheeks are in line with the anterior inferior margin of the head.

The sides of the glabella are nearly parallel, and its surface divided by three equidistant furrows, of which the anterior is shallowest (sometimes almost invisible), shortest, and most transverse. The middle one—that bounding the ocular lobe in front—is better marked, directed slightly backwards, and occupying on either side about one-third of the transverse breadth of the glabella; the posterior pair of grooves, marking off the basal lobes, leave one-fourth of the glabella as a median ridge. They are deep, and after passing directly inwards, curve abruptly backwards, parallel to the axis, towards the cervical fold, from which they are separated by a narrow neck. The deep cervical fold lies in front of the cervical ridge, whose breadth is one seventh of the length of the head.

The fixed cheek is equal in antero-posterior dimensions to the basal and cervical lobes; its anterior margin is in line with the posterior of the three furrows, and its gently arched surface is well marked off by a slight longitudinal depression from the prominent glabella. The outer margin is not straight, but bends slightly inwards posteriorly; the greatest width is, therefore, where it joins with the free cheek. The posterior angle is produced into a spine, which rapidly tapers in its proximal fourth, and thence continues of nearly the same width. The posterior margin of the cheek slopes obliquely outwards and backwards to the angle; it is raised, having in front of it a groove continuous with the cervical groove. The spine itself is directed outwards, so as to form an acute angle with the axis of the body, and is curved, so that its convexity is dorsal, and the tip does not descend below the level of the under edge of the head when the animal is placed in its natural position.

The most remarkable feature is the production of the cervical fold into a median spine, as strong, and probably as long, as the angular spines, and curved in the same fashion.

The whole surface of the glabella, cheeks, and spines, is covered with tubercles, very coarse, and elongated, on the central ridge posteriorly; equally coarse, but rounded on the basal lobe; smaller on the remaining portion of the glabella, and still smaller on the cheeks and spines. On the largest specimens fine tubercles are scattered among the coarser on the lateral and anterior parts of the glabella.

The form just described clearly belongs to the *Cheiruridae*, sharing with them the characters—first, a trilobed glabella, the basal lobe nearly circumscribed; second, the facial suture ending in the outer

margin. The distinctive feature of our specimen, namely, the cervical spine, is not found in any member of that family. Similar spines are present in *Trinuclæus concentricus*, Eaton; and *Triarthrus spinosus*, Billings—both American species; the latter, also an American genus, possessed, moreover, the additional peculiarity of a spine projecting from one of the dorsal axial body rings. In *Cyphospis* only the latter spine is present.

In the absence of the eyes, body, and tail—or rather, while it is impossible to identify any of the still undetermined bodies with this head, it is safest to leave it as a species of *Cheirurus*. It may hereafter be found to form the type of a separate genus, but the analogy of the *Trinuclæus* above-mentioned, forbids the separation, on account of the cervical spine.

I propose to name it *Cheirurus trispinosus*. Locality—Silurian, Penkill, Ayrshire.

The small specimen, Plate I., Figs. 7*a*, 7*b*, presents, at first sight, all the characters of a bivalve shell of the Solenoid group; but Mr Young detected at the posterior part of the hinge line the peculiar ornament which is comparable only to that found in Crustaceans, and is never found in Lamellibranchs.

The test is oblong quadrilateral, one quarter of an inch in length, and one fourteenth in breadth. The anterior extremity is truncated vertically, the posterior is gently rounded. The outer surface, on which an eye spot is visible, is divided into two nearly equal parts, of which the lower is slightly the smaller, by a shallow furrow which, starting from the anterior superior angle, cuts the lower margin in front of the lower posterior angle. The area anterior and inferior to this furrow is traversed by nine or ten longitudinal ridges, of which the lowest is more elevated than the others, and forms a thickened rim to the test. The posterior and upper triangular area is divided by a triangular ridge, which, narrow at its anterior superior end, gradually widens backwards, and covers more than the lower half of the posterior extremity of the test. Above this ridge is a gently convex surface, bounded superiorly by the slightly thickened dorsal margin. This area is traversed by faint concentric striae, the continuation of some of the coarser anterior ridges. It is on this area that the ornament above mentioned is seen. It consists of very close-set, minute tubercles, arranged in linear series opposite each other.

The contours of the surface are in several planes. The anterior

vertical margin is everted; the remainder of the antero-inferior area is in one plane. The middle of the postero-superior area projects considerably, in consequence of the prominence of the elevated ridge, the upper surface being flattened slightly towards the hinge line; but posteriorly the surface is flattened very markedly towards the posterior rounded margin, so that the two valves would be approximated pretty closely.

Its resemblance to a gaping bivalve is thus considerable, but on closer comparison the difference will appear well marked. No Lamellibranch has the anterior greater than the posterior gape; when the relation is not one of equality, the posterior is the larger. *Orthonotus*, the nearest in form, is not one of the gapers, nor is its hinge line linear with parallel bounding areas; its oblique, lateral ridges, moreover, cut the inferior margin, not the posterior outline, as in the specimen before us.

The ornament, again, is not that of Lamellibranchs; its granular surface has a corresponding obverse surface seen when the shell has been removed, and exactly similar to that in the internal casts of *Dilhyrocaris*. The lateral position of the beak removes the Brachiopoda at once from consideration, though, in some respects, the outer and inner surfaces present appearances not unlike those of *Productus*.

No other conclusion is open except that this form is a crustacean, and, so far as I am aware, of an undescribed type. Those which are known from the Silurian rocks are *Hymenocaris*, *Peltocaris*, *Discinocaris*, and *Ceratiocaris*. In all these the extended carapace forms a shield, with rounded outlines. Our specimen would give a quadrilateral shield. The character of the ornament is wholly peculiar; no less so is the want of the definite emargination seen in the crustacea above-mentioned.

The absence of distortion in any of the other fossils from the same locality, and the presence of the eversion of the anterior margin in all the specimens, forbids the supposition that this character is accidental.

The beds from which the specimens were obtained are in the Silurian series in Penwhapple Glen, near Girvan. The determination of their position is still under consideration by the officers of the Geological Survey—the difficulties in the way of a decision being partly stratigraphical, partly due to the remarkable mixture of fossils, which in England belong to distinct stages. The burden of

the evidence, however, goes to support the belief that the Penwhapple rocks belong to the lower Llandovery series.

This interesting form has been named by Mr Young and myself *Solenocaris solenoides*, on account of its remarkable resemblance to the bivalve *Solen*.

EXPLANATIONS OF PLATE I., FIGS. 4-7.

- Figure 4.—*Chcirurus trispinosus*. Glabella and right fixed cheek from above, natural size.
 Figure 5.— ——— ——— Glabella and left fixed cheek, lateral view.
 Figures 6a, 6b.— ——— ——— Diagrammatic restorations, superior and lateral aspects.
 Figure 7a.—*Solenocaris solenoides*. Left valve. $\times 3\frac{1}{2}$.
 Figure 7b.— ——— ——— Horizontal section of 7a, through the middle of its height.

II.—*On the Birds of Stirlingshire.*

By Mr JOHN A. HARVIE BROWN, Dunipace, Corresponding Member.

This paper contained a series of very interesting notes on the habits and nidification of the various species enumerated, some of which were rare birds in Scotland. The communication, which was distinguished for its careful preparation, gave an account of 171 species, nearly all of which had been observed by the author himself.

APRIL 30TH, 1867.

Hugh Colquhoun, M.D., in the chair. Messrs J. Gilmour, and James Macalester, were elected resident; and Messrs R. Scott-Skirving, Camptown, Drem, Haddingtonshire, and Thomas Anderson, Girvan, corresponding members.

Dr Hugh Colquhoun, Grosvenor Terrace, was, by the unanimous desire of the members, elected an honorary member of the society.

SPECIMENS EXHIBITED.

Professor Young showed a female specimen of the nimble lizard *Zootoca vivipara*, caught near Loch Skene, at about 2000 feet above the sea level. The colouring in the specimen differed slightly from the description given by Bell in his History of British Reptiles. He also exhibited a drawing of the head of a pike caught in Loch Lomond, by Mr Macniven, of Luss. The facial bones were so

shortened, and the vertical depth of the head so much increased, that the profile resembled that of a gurnard. The lower jaw, however, projected nearly an inch beyond the snout.

Mr W. Newton MacCartney drew attention to some bones of a raptorial bird, found at a depth of fourteen feet in the Blairdardie clay. These bones, from the collection of Dr Robertson, Renfrew, consist of the humerus, radius, and ulna of a bird about the size of a buzzard. The occurrence of bird remains in our clays, he remarked, was rare, this being the third known instance—the first being in Aberdeenshire, and the second at Bridge of Johnstone, near Paisley. A larger number of bones, of the same specimen, might have been gathered at Blairdardie if any one interested in such remains had been present; only the large ones, however, were retained by the workmen, who cast the others away as useless.

PAPERS READ.

I.—*On the so-called Labyrinthodont, Parabatrachus.* (Owen.)

By Professor J. YOUNG, M.D., F.G.S.

PLATE I., FIGS. 1, 2, and 3.

The specimen described by Professor Owen in 1853 as *Parabatrachus*, a new genus of carboniferous *Batrachia*, was believed to have been obtained from Carluke, in the Lanarkshire coalfield—a belief which the character of the matrix amply confirms; moreover, similar bones of various sizes are frequently found in that neighbourhood. Having examined several of these bones, as well as the original specimen above mentioned (which is now deposited in the British Museum), I have come to the conclusion that it is not *batrachian* at all, but the maxillary of a *Megalichthys*, or other ganoid closely related to that genus. Inspection of the fossil shows that it has been much fractured; that, in fact, the bone is incomplete posteriorly; and that it terminates anteriorly, not by a smooth face as in the original figure, *Geol. Journal*, IX., Pl. II., or in the copy reproduced in Plate I., Fig. 1, of this volume, but by a rough surface as in Plate I., Fig. 3, suturally united with the pre-maxillary. The small equal teeth are, further, small only because large part of their length is still embedded in the fine shaly matrix. Finally, the scale which is seen on the same slab is not *Holoptychius*, but *Megalichthys*. The value of this last fact lies in the frequency of this coincidence, and in the frequent enamelling of the bone in question. Thus, Fig. 2, Plate I., shows a jaw on which a patch of

ganoin still remains, while a scale of *Megalichthys* is impacted in the anterior angle. Fig. 3 is a view of the inner surface of a jaw, of which the hinder part is lost as in Fig. 1; but of the missing portion the cast is still perfect, and shows a glossy surface, the counterpart of the smooth ganoin of *Megalichthys*. The conical teeth are not so small in proportion to the size of the jaw as would appear from Fig. 1. The specimen, Fig. 3, shows them to be of ordinary megalichthyc type.

So far there is no reason for believing that the bone in question is other than the jaw of *Megalichthys*. But Prof. Owen puts forward certain positive characters as indicating labyrinthodont nature. Thus he considers the maxillary to be of "greatest height about one fourth from maxilla-premaxillary-suture; thence it diminishes in height, at first rapidly, afterwards gradually, terminating in a point far behind the orbit, as in the *Labyrinthodon*." Making abstraction of these two bones, *mx* and *pmx*, there remains an area made up of "the portions of the bones that seem best to answer to the lachrymal and malar in *Archeosaurus* and *Labyrinthodon*," and "the portions of the bones which best correspond with the post-frontals and squamosals in the above-mentioned reptiles." Of the six bones here mentioned, I can recognise only one—the maxillary; and I unhesitatingly assert that it alone makes up the whole of the fossil, and that it is, after all, incomplete in the fossil so circumstantially described. There is no good reason for inferring the fusion of so many parts, since the Leeds specimen of *Megalichthys* furnishes evidence of a similar single maxilla, and in the Hunterian Museum there is a specimen in which this bone is seen in place; while, on another slab, we have the isolated bones scattered amidst a great mass of scales belonging to that genus. In the former, as well as in the Leeds specimen, it appears that the orbit lay entirely anterior to the position of Owen's lachrymal; that it was bounded inferiorly and posteriorly by more than one plate, forming a suborbital chain, and that to the margin, named by Owen malar, was applied a supra-temporal bone (or bones) as in *Polypterus*. The ascending process,* near the anterior extremity, passed upwards and inwards, to be attached to the pre-frontal,

* Is this process the "left maxillary," said by Owen to lie across the specimen? My notes written before reading the paper cited, do not suggest the presence of two specimens.

which lay in front of the orbit, and not at its antero-superior angle. The inner inferior margin of the maxilla is grooved, as shown in Fig. 1 and 3; the groove dies out at the posterior limit of the teeth. If the batrachian character of the fossil is denied, this groove ceases to correspond to an air passage; but, on the other hand, it appears, from specimens in Jermyn Street, and in the British Museum, that the roof of the mouth was closed in by dentigerous palatines, which fitted to the inner margin of the maxilla, as in *Polypterus* and the *Cobacanth*s. Importance seems to be attached, by implication, to the fact that the outer surface of the jaw in the British Museum had a reticulate ornament; but it has since been shown that the enamel may be deficient to a slight extent (as in Fig. 2), or largely, or may even be wholly wanting over the cranial plates, the scales of the trunk retaining abundant enamel.

For these reasons, then, I submit that the genus *Parabatrachus* ought to be expunged from our lists of British fossils, being a synonym of *Megalichthys*, or of some allied genus, and especially because it suggests an erroneous interpretation of the systematic position of the animal to which the jaw belonged.

EXPLANATIONS OF PLATE I., FIGS. 1, 2, 3.

Fig. 1.—*Parabatrachus Colci*, Owen. One fourth natural size. Copied from *Quarterly Journal Geological Society*, Vol. IX., Pl. II.

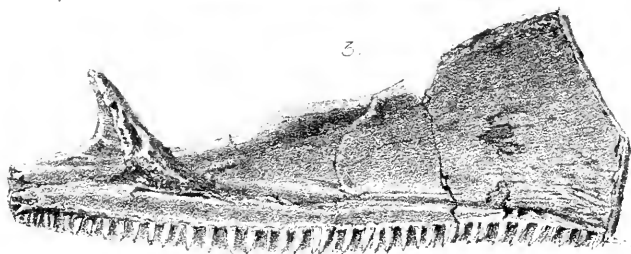
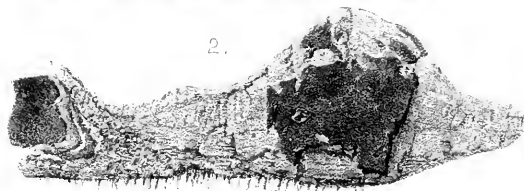
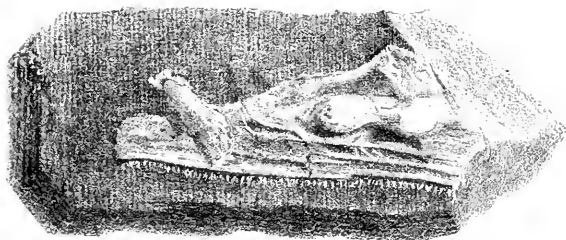
Fig. 2.—*Megalichthys*. Maxillary bone, outer surface, natural size; imperfect posteriorly, surface much worn. Patches of enamel showing deficiencies, partly due to abrasion, partly to originally imperfect development. A characteristic scale is impacted between the maxilla and its pre-frontal process.—Hunterian Museum, Glasgow.

Fig. 3.—*Megalichthys*. Maxillary bone, inner surface, showing outline of bone completed by area of cast surrounded by solid line, and restoration of top with dotted lines.—Cabinet of Dr Rankine, Carlisle.

II.—*On the History and Habits of the Roedeer (Cervus capreolus)*.

By Mr EDWARD R. ALSTON.

After remarking on the incorrectness of the accounts of this species (*Cervus capreolus*) given by most authors, Mr Alston observed that the history of its gestation and breeding had long been a puzzle to German naturalists; for, though the buck was known to seek his mate in July and August, no *facti* were ever found before January, and then of very small size. At last, in 1854, Professor Bischoff of Giessen, an anatomist of European





reputation, cleared up the mystery in a work entitled, "Entwicklungs-geschichte des Rehes." He clearly proved that the rutting time, or breeding season, is in July; but instead of the ovum or germ rapidly developing, as in other animals, it remains dormant, and of very minute size, until the middle of December, when it suddenly quickens, and is developed with the usual rapidity, the whole period of gestation being forty weeks. The Roedeer is not so strictly monogamous as is usually described, more than one buck often disputing for the favours of the doe.

Either one or two fawns are born in May, and, if undisturbed, they remain with their parents until autumn, or even until next spring. The first indication of horns are two rounded knobs, which are succeeded by straight, single points. Next spring these give place to forked antlers, which in turn are succeeded by others bearing three points each; but these changes are not always regularly gone through. Six tines are the usual maximum, but there are roe heads, in some of the German collections, with ten and even twelve branches. Often the horns are strangely deformed (of which a fine example from Dr Dewar's collection was exhibited, as well as drawings of many others). These abnormalities may, perhaps, be divided into four classes—1st, stunted growths, caused by insufficient food, and also found in old and decrepit bucks; 2d, those caused by an injury to the horn while in a soft state; 3d, the effects of injuries or diseases of the generative organs; and, 4th, genuine deformities, perhaps owing to "breeding in-and-in," or to a constitutional defect in the animal.

The roe usually conceals itself by day, feeding in the morning and evening on various kinds of herbage. Mr Alston has found quantities of *fungi* of various kinds in their stomachs. Its speed is not very great, but its leaps are often wonderful and beautiful. It is also a bold swimmer, and in Loch Lomond passes freely from isle to isle. Its voice is a short, harsh bleat, almost resembling a bark. In a state of nature, it never attacks man, even when wounded, but tame ones are dangerous pets.

The roe is generally distributed throughout central Europe, and is very common in the forests of France and Germany; in Switzerland, however, it is almost extinct, as also in most parts of Scandinavia. In this country it was confined to the Scotch Highlands when Pennant wrote, but now, owing doubtless to strict preservation, and the increase of plantations, it is not

uncommon in most wooded parts of Scotland and the north of England.

MAY 28TH, 1867.

Professor John Young in the chair. The following gentlemen were elected corresponding members:—M. Auvert, Interne à l'Hospice, Havre; Godfrey Howitt, M.D., Melbourne; and the Rev. Patrick Gordon, Duncansburgh Manse, Fort-William.

SPECIMENS EXHIBITED.

Mr John Young exhibited a slab of shale, containing two specimens of *Archæocidaris Urei*, in which the test or shell had been preserved, with the long muricated spines attached in nearly their natural position. These interesting and unique specimens of one of our oldest Echinoderms were found recently by Mr Fraser Christie, one of the members of the Glasgow Geological Society, at Sculliongaur limestone quarries, on the north hill of Campsie, and were presented by him to the Hunterian Museum. One of the specimens showed thirty-seven of the long primary spines arranged round the test in a radiating form, besides numerous smaller secondary spines which were arranged upon the outer row of tubercles that border the larger plates, and which were only recently known to have been borne by this particular species. Mr Young also exhibited other specimens of *Archæocidaris* from different localities to show the condition in which their remains are generally found scattered throughout our limestone strata.

The Secretary exhibited a specimen of the Pomarine skua (*Lestris pomarinus*), which had been caught alive, in a disabled state, near Larkhall, Lanarkshire. He remarked that many of the specimens mentioned by Yarrell and other writers as having occurred in the British Islands, had been captured in a similar way. Mr Gray, however, observed that although the pomarine skua was stated to be a rare species, it was not so in many localities, especially the shores of the eastern counties of Scotland, where it was frequently recognised in autumn and winter chasing the smaller gulls. On the west coast it had likewise been seen by Mr David Robertson, at Cumbrae.

PAPERS READ.

I.—*On Division of Scientific Labour.* By Professor YOUNG.

II.—*On Marine Dredging.* By Mr DAVID ROBERTSON.

PLATE II.

The following remarks are intended only to point out a few conditions necessary to successful dredging, in the hope that they will, in some measure, aid the student who has included the dredge in the programme of his approaching holiday excursions, and show how he may avoid some of the common sources of disappointment. The remarks apply only to the use of the dredge in a small boat, rowed by one or two men. The dredge to many may not appear the most pleasant instrument of research. With its fittings it is cumbersome, and it is wet and toilsome to work; but still, to the marine zoologist, it is indispensable and full of interest. None but those who have experienced the glowing excitement caused by the turning out of a well filled dredge, can know anything of the pleasurable suspense till the next haul is drawn up. It would be difficult to lay down rules for dredging operations, however simple, that would not be subject to modification; our success at all times depending less or more on our aptitude to meet varying circumstances as they arise.

First of all choose a good day, as little or no progress can be made with the dredge in a small boat when the sea is rough.

The Boat.—The size of the boat should be from fourteen to sixteen feet keel, but not less than thirteen feet. The objection to a small boat does not wholly apply to its capacity, for it may be large enough for one person when he chooses to go by himself, but there is great difference of power on the dredge in the large compared with the small boat. A small boat will be stopped short when the way is on it by an obstacle that would be readily overcome by a larger boat.

Although it is desirable at all times to have strong arms at the oars, when the dredge is tugging doggedly behind, still I have had many successful dredgings by myself. It is surprising what can be done by a single person in a boat, pulling at his ease, taking what advantage he can of both wind and tide, with nothing to control him, sitting, leisurely and carefully examining the contents of each haul. The way on the boat is, meanwhile, making some progress with the dredge, which has been again cast overboard, and is at the same time preventing the boat from drifting off the proper ground till the oars are applied. In regard to the build of the boat, if you have a choice, prefer one with a

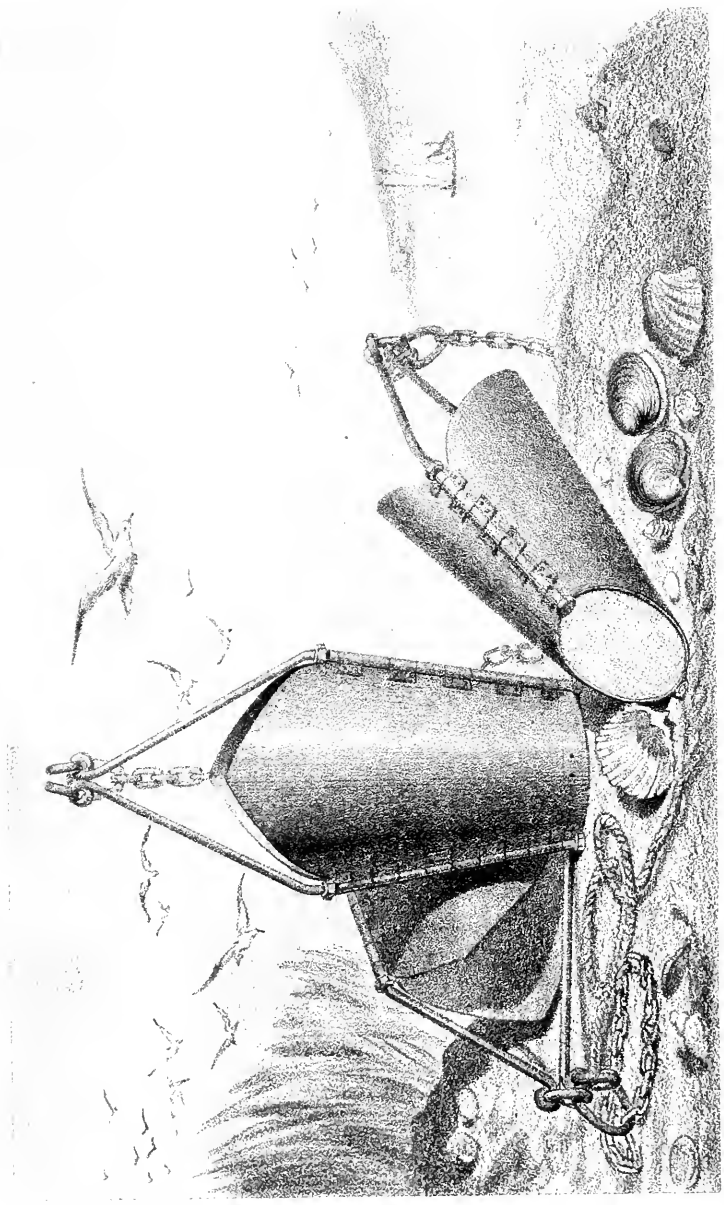
good broad beam; it gives freedom and security in dredging operations. A pulley on the stern for the rope lightens the labour of pulling up the dredge.

Dredges.—These are of various sizes and forms, according to the uses that they are applied to. A prevailing opinion is, that all that can be acquired by the dredge may be met with on the surface of the sea bottom, and dredges are generally constructed in accordance with this view. The dredge in common use by naturalists is one of this kind, with a scraper on both sides, so as to prevent it from falling with the wrong side down, and is very efficient for general work.

Believing that many valuable objects might be obtained if a dredge could be made to dip deeper into the soil than the one in common use, I had one constructed of galvanized iron, which penetrated five or six inches into the subsoil, and reached the class of animals found burrowing beneath the surface, at the same time securing much in common with the flat-rimmed dredge. As an auxiliary to the common dredge, this form of construction is particularly useful in mud and sand, being compact with solid sides, holding no more than can be conveniently examined in a small boat, besides being clean and expeditious to work with. It sinks and takes the ground readily, and soon fills; its small size offers little resistance to the currents, and is easily pulled up. In favourable weather it can be wrought in ten or twelve fathoms by one man with ease, and in thirty or forty by two men without difficulty. It has been objected to, on the ground that it dips suddenly into the soil and is filled at once, without raking over a sufficient portion of the sea-bottom, thus lessening the chance of a good haul. This so far is true, when surface animals are only taken into account; but the special province of this dredge is not the surface, but beneath it, which will be found by no means thinly tenanted. No one who has examined mud, sand, or gravel, dug from near low water, can have failed to find them abounding with multitudes of living creatures; and we may infer that the same holds good in deeper water. The result of experience with this dredge, is to prove that the subsoil round our shores is the habitat, ambush, or retreat of myriads of the invertebrate fauna, summer and winter. The subsoil qualities of this dredge, instead of being objectionable, afford in reality an important advantage to the naturalist— for by pulling it at once on the spot where it descends, he is able

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ROBERTSON'S DREDGE



to establish the habitat of the animals there found, thus obviating all doubt on that point that might be caused by the dredge being dragged over many hundred yards.

The body of the dredge is in two pieces, which are held together by the arms passing down through the dovetailing at the sides, and each fixed at the bottom by a screw. The bottom is made of coarse canvas, stretched over a hoop, which fits into the dredge. By these arrangements the whole can be readily taken asunder and packed into very small space.

Dimensions:

Length of body,	-	-	-	18 inches.
Diameter at point of lips,	-	-	-	10 "
Depth of lips,	-	-	-	4 $\frac{1}{2}$ "
Longer diameter at lower angle of lips,				11 "
Shorter, do., do.,				8 $\frac{1}{2}$ "
Longer diameter at bottom,	-	-	-	7 $\frac{3}{4}$ "
Shorter do., do.,	-	-	-	6 $\frac{1}{4}$ "
Circumference of arm rods,	-	-	-	1 $\frac{5}{8}$ "
Weight of dredge,	-	-	-	12 lbs.

The rope is connected to the dredge by ten feet of small chain, which tends greatly to keep down the machine, by counteracting the buoyancy of the rope. The next thing to be taken into consideration is the weight of the dredge. The ordinary weight used for a small boat is about 15 lbs.; but whatever the weight may be, it must be sufficient to take with ease the rope required for its use to the bottom, and to keep its place there against the ordinary speed of the boat, which has a tendency to raise the rope, and with it the mouth of the dredge. When the sea is found a little too rough, or the currents a little too strong, preventing the dredge from taking the ground, a few stones put into it will generally succeed in keeping it down, or a small bag, with a stone, fastened to the rope a fathom or two forward from the dredge, will answer the same purpose, and not interfere with its contents.

The Rope.—This, of itself, seems to be a trifling matter—yet in a small boat the character of the rope may be of much importance. The first quality is its strength; and as the way on a row-boat need scarcely be taken into account, a rope to resist the strain that could be put upon it by three or four men, may be considered sufficiently strong. A too thick rope adds unnecessarily to the

bulk and weight, making it much less portable, and that of itself is often no small inconvenience. In working the dredge, the more important objection to a thick rope is the greater action the currents have upon it. On the other hand, the rope must not be too small, independent of its strength, as it is difficult to get a firm grasp of a small rope. One an inch and a half in circumference answers very well, and is strong enough for any strain likely to be put upon it, and is not over half the weight of ropes usually employed for dredging purposes.

When the dredge is thrown overboard, allow it to sink to the bottom before commencing to pull; pull with the tide; or, if to suit circumstances, pull across it, but never against it, if such can be avoided, particularly in deep water. When working with both wind and tide in your favour, much labour is saved. When the dredge is found not to grip, more rope may be used with advantage, but when too much is given, it becomes difficult to pull the dredge, which may become fast altogether, and have to be relieved by shortening the rope; or instead of more rope, the same purpose may be gained by pulling less strongly, or by ceasing altogether for a few minutes till the dredge settles down. If it is wished to alter the course of the boat while the dredge is down, do not try to do so with a tight rope; pull the boat back over the dredge, and the slack of the rope thus made will allow it to be done with ease.

The Board.—I may now allude to the board that is generally used for examining the contents of the dredge, and which is indispensable for comfortable dredging. It should be as long as to extend a few inches over both sides of the boat near the stern. A board measuring four feet long by one and a-half broad, having a slip of wood about an inch high along each side, will, in most cases, be found suitable. The board is further serviceable for packing dredge, ropes, and other traps upon for transmission. Another useful auxiliary to the dredge is a pair of sieves—a coarse and a fine—the former to put within the latter, with which the obscuring mud can be washed away, and the coarse material separated from the fine; thus clean and assorted examination is rendered comparatively easy.

When the more minute objects are wanted, a successful plan with dredged material, laminaria roots, shell debris, etc., is to take them home in a pail of water, and transfer them to a white

basin, and in a short time many of the small animals will be seen making their way towards the sides of the vessel, and others to the surface, from which they may be easily picked up. The material may be occasionally stirred up, which will cause a new series to appear. This process may be repeated with success for a day or two. When the water has even become offensive, and many of the animals have died, a few may still be found on the surface, which do not appear at an earlier time.

Collecting Vessels.—These need not be noticed particularly here, as their form, size, and number will always depend on what objects are chiefly intended to be secured. A pail, three or four glass pickle bottles, a few phials and glass tubes for small things, a white saucer to examine them in, and a hair pencil to pick up minute objects, will go far to meet all wants in ordinary cases.

SESSION 1867-68.

THE SIXTEENTH ANNUAL GENERAL MEETING, ANDERSON'S UNIVERSITY BUILDINGS, SEPTEMBER 24TH, 1867.

Mr William Euing in the chair. The following gentlemen were elected office-bearers for the ensuing session:—Hugh Colquhoun, M.D., President; William Euing, Professor John Young, Vice-Presidents; Robert Gray, Secretary; Thomas S. Hutcheson, Treasurer; James A. Mahony, Librarian. John Scouler, M.D., LL.D., F.L.S.; James Stirton, M.D.; Alexander M'Kinlay, Walter Galt; W. Newton MacCartney; Donald Dewar, M.D.; E. A. Wünsch; and David M'Kinlay, Members of Council.

Messrs James Hamilton and David Hamilton were elected resident members.

OCTOBER 29TH, 1867.

Hugh Colquhoun, M.D., President, in the chair. The following gentlemen were elected members:—Mr John Dougall, resident; Messrs Alex. Innes Grant, Beaumont Station, Dunedin, Otago; and John Buchanan, of the Government Geological Survey, Wellington, N.Z., corresponding.

The Librarian announced, as a donation to the library, a copy of "The Birds of East Lothian," by Mr W. P. Turnbull, Philadelphia, one of the society's corresponding members.

SPECIMENS EXHIBITED.

The Secretary drew the attention of the meeting to a very fine specimen of the rough-legged buzzard (*Buteo lagopus*), which had been shot near Bishopbriggs during the present month; also a specimen of the ruff (*Machetes pugnax*), from the banks of the Clyde, near Erskine. The latter species, although tolerably common on the eastern shores of Scotland, is very rarely met with on the west. Mr Gray remarked that the rough-legged buzzard was also a much commoner bird on the east coast than

in other parts of Scotland. Both birds had been obligingly lent to the society, for the purpose of exhibition, by Mr McCulloch, taxidermist, Sauchiehall Street.

PAPERS READ.

I.—*Observations on the Habits of certain New Zealand Birds.*

By Mr JOHN BUCHANAN, of the Government Geological Survey, Wellington, New Zealand.

A very graphic account was given of the every-day life of many very interesting species, which were exhibited in illustration of this paper. In speaking of the parroquets, the writer remarked that two species, the *Platycecus Pacificus* and *Platycecus auriceps*, are found flying in immense flocks, sometimes appearing in cultivated districts like an Egyptian plague, and devastating the lands of the farmer. On these occasions they have been known to destroy whole crops in spite of every means that were used to drive them off. Regardless of danger, they could be shot in hundreds, the flock rising but for a moment when fired at, and alighting again among their dead comrades. Among the birds frequenting gardens, Mr Buchanan described the habits of the little wax-eye or blight bird, which is both an enemy and friend to the horticulturist. Having a *penchant* for cherries, a flock will alight on a tree and destroy the whole of the fruit by eating the softer parts, leaving the stalks and stones, thus converting the cherry tree into a horticultural curiosity. As an offset to this destructive propensity, however, the wax-eye destroys the *aphis*, which causes the American blight in apple trees and cabbages—a service which is perhaps cheaply purchased by a crop of cherries.

II.—*On the occurrence of shells showing colour markings, from the carboniferous limestone strata of the West of Scotland.* By Mr JOHN YOUNG.

This paper was illustrated by specimens from Mr Young's collection belonging to the genera *Orthoceras*, *Naticopsis*, *Aviculopecten*, *Myalina*, *Mastra*, *Terebratulula*, *Lingula*, etc., which showed, in different degrees of preservation, bands as well as zig-zag and wavy lines of colour, which once adorned the living shells. The author stated that although it was an interesting fact to geologists that shells, from so old a formation as the carboniferous limestone, should be found retaining traces of their original colour—

affording thereby a sort of clue to the probable depth of the seas in which these mollusca lived—yet the absence of coloured shells in any group of strata was not always to be taken as a safe test, for much depended on the nature of the sediment in which they became entombed, and the mineralogical and chemical changes which the shells have undergone during fossilisation.

III.—*Chemical Notes on the "Fucacee."* By Mr J. A. MAHONY.

The author referred to the composition of these sea-weeds, and described the varying readiness with which the different salts became separated from the organic matter by dialysis.

NOVEMBER 26TH, 1867.

Hugh Colquhoun, M.D., President, in the chair. Mr George Thomson was elected a resident member.

SPECIMENS EXHIBITED.

A specimen of the Little Bittern (*Ardea minuta*), shot at Luffness, in East Lothian, in June last, and forwarded by Lord Binning, corresponding member.

Mr Robert Gray exhibited a specimen of the Eared Grebe (*Podiceps auritus*), in spring plumage, shot in Loch Sunart, and made some remarks on the geographical distribution of the species.

A series of zoophytes from Peterhead, beautifully mounted, and forwarded by the Rev. James Yuill, corresponding member. The series embraced about thirty species, including specimens of *Thuria articulata*, *Plumularia frutescens*, *Sertularia tumarisea*, *Sertularia fusca*, *Flustra carbacea*, *Flustra Murrayana*, *Cellularia ternata*, and a beautiful variety of *Sertularia polyzonias*.

Another collection of zoophytes, from Girvan, which had been forwarded by Mr Thomas Anderson, corresponding member, and several specimens of a *Teletta*, which is probably new to British seas. These had been found on the south beach of Girvan, in considerable numbers, on the second week of September last.

Professor Young exhibited several fishes recently added to the Hunterian Museum. 1st, A sturgeon from the coast of Labrador, presented by Mr R. Grieve, St John's, through the Provost of Greenock. This fish was not known to the fishermen. It

belongs to the sub-genus *Autaceus*, but Dr Young mentioned that its characters did not correspond with those of any described species. Its nearest ally and representative is *A. medirostris* from San Francisco. The northern limit assigned to sturgeons is 54 degrees north latitude. This specimen must therefore have been found beyond the customary range of the group. 2d, *Amia canina*, a ganoid fish from New Orleans, presented by Mr Taylor Denegre, Edinburgh. Two specimens of this fish were sent, which are intended for dissection and description. Professor Young commented on the affinity said by Agassiz to exist between this genus and the *Cealacanthus*—extinct ganoids which range from the lower carboniferous to the chalk—and pointed out the important differences which separate the two genera. 3d, *Callionymus lyra*, the gemmeous dragonet, a specimen caught at Tigh-na-bruaich, and presented by Principal Barclay. 4th, The Hebridean smelt (*Osmerus Hebrideus*), determined by the late Mr Yarrell, from a specimen sent him by Mr William Euing, to whom it had been brought as an unknown fish. The present specimen was caught at Kilcreggan. The species seems very rare still, as it was sent as a curiosity to Mr M'Kenzie, of the *Greenock Advertiser*, by whom it was presented to the museum.

The Secretary exhibited beautiful casts of the leg bones of the *Dinornis*, an extinct New Zealand bird, and jaw bone of a *Diprotodon*, which had been forwarded from Melbourne by R. Brough Smyth, Esq., Secretary of Mines for the colony of Victoria.

Mr T. S. Hutcheson then laid before the meeting a quantity of writing paper showing defective spots in its manufacture, about the origin of which little appears to have been known until recently. Professor Walker Arnott, one of the society's members, had examined the paper with a view to ascertain whether the marks were of vegetable origin, but being unable to refer them to this source, he had submitted specimens of the paper to a distinguished chemist in the city, who reported as follows:—"I have often noticed the little spots on paper, and I think have seen it stated that they are vegetable, and have never had reason to doubt this. On examining them, however, I find they are mineral, and apparently consist of copper, but in what form of combination I cannot say, as the quantity is too small to admit of anything like minute examination. I presume the copper comes from the apparatus used by the paper maker, in which there is

a good deal of brass wire gauze. I imagine that small spots of oxide may be produced on this which may adhere to the paper, but how it should take on the dendritic form is not so easy to see. I found a quantity of printing paper with such spots, and it was only by cutting out a great many of them that I got enough to test. Copper has been found in paper by Berzilius, but, as I understand, it was uniformly distributed through it. It is mentioned in books as a proof of his skill with the blow-pipe that he could detect with it copper in the ash of a single sheet of paper."

PAPER READ.

On the Land and Fresh-Water Mollusca found within Ten Miles around Glasgow. By Mr JOHN DOUGALL.

I have divided the subject into four parts, the 1st being a synopsis of what I have accomplished in the way of collecting; the remaining three are more practical in their bearing, and embody the details of my experience as a collector. They are—2d, When to collect; 3d, Where to collect; 4th, How to collect. The 2d implies that there are certain seasons to collect in; the 3d, that there are certain localities to collect in; and the 4th, that there are certain ways of collecting, in order that it may be done economically and successfully.

With reference, then, to the 1st, I find from memoranda, that I made altogether fifty-four excursions, beginning early in March, and ending about the middle of July, visiting, in the interval, besides several localities in the suburbs, Cadzow Castle and forest, Barncluth Gardens, Blantyre, Blantyre Priory, Bothwell Castle, Calderwood Glen, East Kilbride, Cathkin, Carmunnock, Busby, Gorbals Gravitation Reservoirs, Barrhead, Crookston Castle, Gleniffer Braes, Canal at Paisley, Auchentorlie Glen and Bell's monument, Bowling, Old Kilpatrick, Dalnair, Spout of Ballagan, St Germain's Loch, Possil Marsh, Kelvin, Bardowie Loch, Monkland Canal from Blackhill Locks to Baillieston, Forth and Clyde Canal at intervals from Bowling to Hungryside Bridge, Craigenglen, Campsie Glen, Skilengow old limestone quarries North Hill Campsie, Hogganfield, Frankfield, with Bishop and Johnstone Lochs, Gartcosh. Most of these localities have been visited more than once, many of them several times, yielding in all twenty-one genera and forty-seven distinct species,* besides numerous varieties

* The collection has been placed in the Hunterian Museum.

and a few aberrant forms. Every two excursions have furnished nearly a genus, and forty-seven of the excursions a species each; the results of seven being *nil*. The localities may be condensed into twenty-three districts, and in this view each district has yielded about one genus and two species.

Of the land shells *Helix rotundata*, *Zonites cellaria*, and *Z. alliaria* are most plentiful, and seem equal in number; then *H. hispida*; then *Pupa umbilicata*, *Clausilia rugosa*, and *Succinea patris*; then *Corychium minimum*; then *H. nemoralis* and its variety *hortensis*; then *H. arbustorum*, *Z. fulvus*, *radiatula*, and *Vitriina pellucida*; then *Z. crystallinus*, and *Cochlicopa lubrica*. The following also are in the order of their apparent quantities, viz.: *H. aspersa*, *H. lamellata*, *H. aculeata*, *Butimus obscurus*, *H. caperata*, *pulchella*, and *rufescens*; and last of all *H. fusca* and *Balia perversa*—a single individual of each of these two species being all I could procure.

Of the fresh-water molluscs there can be no doubt that *Limnaea peregra* is the most widely and plentifully distributed, as it exists in great quantities in almost every canal, ditch, pool, pond, or river; and, what seems inexplicable, varying exceedingly in dimensions in different localities, while to all appearance the conditions of its habitat are identical. There is a great paucity of individuals and smallness of size of those *Peregra* found in lochs where there are pike, and this seems partly to explain the matter, there being none of these fish either in the Campsie Pond or the Gorbals' Reservoir, where I obtained the largest specimens, those from the latter place being very large. In extent of distribution, number of individuals, and variety of form, the *Pisidia* probably equal the *Peregra*. *Physa fontinalis* is found also in the same habitat as *L. peregra*, and although equalling it in distribution, it is less in the number of individuals. *Ancylus fluviatilis* seems to equal *Physa fontinalis* in number, but has an entirely different habitat. *Bythynia tentaculata* ranks next, and although it be somewhat sparingly distributed, yet it is very plentiful where it occurs; the Paisley Canal teems with it, and at Coats' Works, where the temperature of the water is heightened by the condensed steam from their engine, it could be taken by the bushel. In the Forth and Clyde Canal also it seems very plentiful. *Cycas cornea*, *Planorbis contortus*, *albus* and *spirorbis*, also *Limnaea palustris*, and *truncatula*, seem pretty equal in number and distribution. Next we have *Cycas lacustris*, *Anodon cygneus*, *Unio margaritifera*, *Dreissena polymorpha*,

and *Valvata piscinalis*; then *Valvata cristata*, *Planorbis nitidus*, and *Limnaea glabra*, and last of all *Limnaea auricularia*.

It appears, so far as I have investigated the ten mile area, that its existing aquatic mollusca consists of 11 genera and 22 species, viz.,—5 genera and 8 species of *Lamellibranchs*, 2 genera and 3 species *Pectinibranchs*, and 4 genera and 12 species *Pulmonobranchs*, while the terrestrial (not including the *Limacida*) consists of 8 genera and 24 species, all of which are *Pulmonobranchs*. Thus, while the aquatic molluscs exceed the terrestrial by three genera, the terrestrial exceed the aquatic by two species; showing thereby in the aquatic a greater *generic* diversity of structure than in the terrestrial; and in the terrestrial, a greater *specific* diversity of structure than in the aquatic. However, in comparison to the number of genera and species, I think these differences are small, and it seems to me remarkable that the two kinds should approximate so closely in number, more especially when we consider that all classification is necessarily more or less arbitrary; and probably this is a proof of the correctness of the investigation of those naturalists who arranged these mollusca into genera and species, as it appears more in harmony with the laws of nature, that these two great classes should nearly balance other with regard to numbers, than that the one should greatly surpass the other in the same respect.

I now come to the second part, viz., *When to collect*.—As both land and fresh water mollusca hibernate, it would be comparatively a waste of time to attempt collecting either early in spring or late in autumn. I have tried it at both periods, and have no hesitation in saying that I could find as many species in a week, about the end of June, as could be found from the beginning of September till the end of April; besides, supposing that during March and April there are some fine days, the specimens which you may then find are mostly young, and the shell therefore only partly formed; or should you secure adults they are often empty, or, if alive, much weatherworn, the epidermis being either entirely rubbed off, or so defaced as to spoil their appearance. I would therefore say that the most profitable as well as pleasant time for collecting is from the beginning of June till the middle of August; but even during this interval, should the weather be dry and hot, you will make little progress with the land shells except in the early morning or late in the evening, at which periods the vegetation is

usually more or less wet with dew, when they can be easily secured, as they then come out of their hiding places to feed. But the best time for procuring land shells, during midsummer, is after a shower that has been preceded by a drought; specimens will then be found easily, which in ordinary circumstances would require a deal of perseverance and minute searching to obtain.

On the other hand, the best time for securing aquatic kinds is during dry weather, for two reasons. First, if the weather has been wet for a time, the extra accumulation of water is likely to pass considerably over the bounds of their habitat, and thus prevent you from finding them. Second, should it be simply a shower, the disturbance to the surface of the water which the rain-drops occasion is an obstacle to your seeing the bottom, however shallow, where many of the gasteropods are easily found. What seems to me the best method, therefore, and the one which experience taught me to adopt, is to search for the aquatic sorts during *dry* weather, and the terrestrial during *wet*.

Let me now advert to the third part, viz., *Where to collect*, which implies a description of habitat; and probably I cannot do better than run over the various species in the collection, stating the localities where, and the circumstances under which they were found.

Unio margaritifera, is from a deep pool in the Clyde at the Chemical Works, Cambuslang, which seems literally filled with it. I may remark that those specimens which are broad at the beaks, and shorter than usual in their long diameter, are almost always pearl-bearers. This shell is generally found on the banks of pools in clear rivers, such as the Tay, Clyde, Doon, and Teith.

Anodon cygneus is from Paisley Canal. I found also a pair of dead valves in Bardowie Loch; and the banks of the Cart at Cardonald Mills are strewed with broken valves. All my attempts to procure this shell alive were futile, and these specimens I found in a heap of mud recently dredged from the canal.

Cycas cornea and *lucustris* are generally found in company. They are plentiful along the southern boundary of Possil Marsh, and in the canals. I have not found *lucustris* in the Paisley Canal. They are taken principally at the roots of aquatic plants. Jeffreys says he has not observed *C. lucustris* in Scotland, nor seen any notice of its having been found there.

The *Pisidia* need not engage our attention much, except it be to reflect how every little bit of marsh and stagnant pool becomes so rapidly and so numerous filled with them. The specimens in the collection are from the vicinity of Torrance, and were found in a small hollow which had every appearance of being caused by the subsidence of the old workings of a coal pit, which had got filled with rain water. By pulling up the grass they will be found adhering to its roots.

Dreissena polymorpha, from Lambhill Bridge eastward, on the towing side of the Forth and Clyde Canal, adhering to the stones, about a foot below the surface of the water, very plentiful and easily procured.

Bythynia tentaculata.—Anywhere on the Forth and Clyde or Paisley Canals, on stones and aquatic plants.

Valvata piscinalis.—Inshot on Paisley Canal, a short distance east of second bridge. I also found it in an old lade at Dalmuir, where the glacial shell bed crops out, forming, along with *Cyclus cornea*, the larval case of the May fly. *Valvata cristata*.—"The Splash," on Forth and Clyde Canal, and at Springbank, on roots of plants.

Planorbis nitidus.—Same as last. *Planorbis albus*.—Very plentiful in the drain running from Frankfield to Hogganfield Loch; and in Bishop and Johnstone Lochs, Gartcosh, on plants. *Planorbis spirorbis*.—Small marsh on Rutherglen Road; very plentiful in Bishop Loch, on plants. *Planorbis contortus*.—Numerous in Frankfield Loch, on plants.

Physa fontinalis.—Very common anywhere in the canals or stagnant water, on plants and stones.

Limnea peregrina.—Same as *Physa*, but more often found on stones and on the bottom at the margin of the water. The large specimens in the collection I found in a deep and sheltered pond in which there is a slow current, and which is the principal feeder of the upper reservoir of the Gorbals Gravitation Water Works, all of them were adhering to stones quite near the side. *L. auricularia*.—Northern bank of the Monkland Canal, on the ground in shallow water close to the side, at the western extremity of the first plot of sedges going east between the third and fourth bridge, counting the bridge crossed by the Cumberland Road the first. *L. truncatula*.—Very plentiful on the mud at the margin of Clyde, Dalmuir, and in such situations; this

species seems amphibious. *L. palustris*.—Bardowie and Frankfield Lochs; extremely numerous in a ditch at the north-western angle of the latter, on plants. *L. glabra*.—Frankfield Loch, mingled with *L. palustris* and as numerous. Jeffreys says, “this shell is sparingly distributed in this country,” and gives no Scottish locality.

Ancylus fluviatilis.—Common in rivulets and clear streams, adhering to stones *in the currents only*; very large in Clyde in the rapid opposite Dalbeth. *A. lacustris*.—I had very great difficulty in procuring this shell, and latterly found a single specimen in Bishop Loch. Since then I have gathered them in quantities in the Forth and Clyde Canal at Old Kilpatrick. They are said to be found principally on the under side of the leaves of the water lily, but they seem to prefer the blades of the iris, and are found at their lower part.

Limax maximus.—The largest of the slugs has its shell internal, which requires to be dissected from beneath the mantle. The best situations for this species are beneath blocks of decaying wood in damp places, where they will often be found five or six inches in length.

Succinea putris.—This species is found adhering to the dry parts of stones in stagnant water, and is very generally distributed. Old lade, Dalmuir; upper part of Gorbals Gravitation Water Works, etc.

Vitrina pellucida.—Corrieburn, Campsie Glen, and such places, beneath stones and among decaying leaves. I have never found the live specimens of this shell nearly so large nor so numerous as the dead ones.

Zonites cellaria, *Z. altivaria*.—It would be difficult to mention a place where there is vegetation in which some one or both of these species are not found. They seem gross feeders, and capable of living under very adverse conditions, even amongst the smoke and dust of the city, there being specimens in the collection from the College Green. They are found under stones, on old walls, and pieces of decaying wood. *Z. radiatulus*.—Calderwood Glen; very plentiful in small glen in Cadzow Forest; roots of moss and decaying leaves. *Z. crystallinus*.—North Hill, Campsie; East Kilbride, Bothwell Castle, Auchentorlie Glen, etc. Amongst dead leaves, roots of grass, and under stones. *Z. fulvus*.—Old limestone quarries, East Kilbride; Barncluith Gardens, Hamilton; Auchentorlie Glen. Under decaying wood, leaves, stones, etc.

Helix lamellata.—Extremely numerous on the western slope of Calderwood Glen amongst dead leaves. I found it also in Auchentorlie Glen under stones. *H. rotundata*.—Abundant everywhere. *H. aculeata*.—Same localities and situations as *lamellata*. *H. aspersa*.—Rocks round Henry Bell's monument, wall facing the Clyde at Old Kilpatrick, Cathcart Castle. In crevices. *H. nemoralis* and *hortensis*.—The former very plentiful and variegated, on a bank that slopes into what appears to be an old lade running parallel with the Clyde between Carmyle and Kenmuir; on young nettles. *H. hortensis* is more common at the root of a hedge leading to Cathcart Castle than at the former place. *H. arborum*.—Hungryside Bridge on Forth and Clyde Canal, Carmyle, etc. This species is generally found in company with *H. nemoralis*. *H. rufescens*.—Under tufts of grass on the rocks at the eastern side of Henry Bell's monument, Bowling. Not mentioned by Jeffreys as occurring in Scotland. *H. hispida*.—Lime quarries, East Kilbride, Busby, etc. Very common under stones, logs of wood, etc. *H. fusca*.—Very rare; Auchentorlie Glen is the only locality, and though I visited it three times, it only yielded a single specimen. I cannot say in what situation it was found. *H. caperata*.—Old lime quarries, East Kilbride, under stones. *H. pulchella*.—Old lime quarries, North Hill, Campsie, at the roots of grass in moist places.

Butimus obscurus.—Bothwell old castle, adhering to the lower part of the walls, where they are covered with grass. I found an adult and young specimen in Auchentorlie Glen, beneath a piece of trappean ash.

Pupa umbilicata.—Campsie Glen, Bothwell Castle, Calderwood Glen, Auchentorlie Glen. Pretty common, in shady parts, on walls, rocks, and stones.

Bulia perversa or *fragilis*.—Auchentorlie Glen; on the perpendicular surface of a projecting trap rock, along with *Clausilia rugosa*.

Clausilia rugosa.—Very common and numerous. Cambuslang Glen, and all such places, on old walls, rocks, trunks of trees, and beneath stones.

Cochlicopa lubrica.—Corrieburn, Crookston Castle, East Kilbride, etc., under stones and in damp places.

Carychium minimum.—This exquisite little form, the smallest of the land shells, is to be found in all our glens, under stones, dead leaves, and also at the roots of grass.

Arriving now at the fourth part, viz., *How to collect*, I will first refer to the method of procuring the aquatic kinds generally.

In order to obtain the greatest number of these in the shortest possible time, it is necessary that one should be provided with a wire sieve, to which can be joined a common walking-stick when required. Then, when collecting, with the stick joined to the sieve, you reach the latter as close to the roots of the plants as possible, and sweep it along quickly for a yard or two, keeping it well down, when any shells hanging by the plants are either jerked or swept into the sieve. In cases where the water is very deep it is not necessary that the sieve should be kept more than twelve or eighteen inches down.

Another way is by uprooting the plants and then examining them closely. The *Pisidium*s, *Planorbis nitidus*, *Cyclus cornea*, and *lacustris*, are found principally at the roots, the others on the stems. Several species are also found on stones and mud; *Ancylus fluviatilis* is always on the former in shallow and broken currents of clear water while *Limnæa peregra* is found in stagnant water on both.

In collecting land shells the following requisites should be carried—viz., a botanical lens for viewing the smaller specimens, a glass cap box for holding them, and a small wide-mouthed bottle for containing the larger sorts. Stones and pieces of decaying wood should be turned over and carefully examined, also the parts of old walls uncovered by moss, young nettles also, as these seem favourite food with many of the *Helices*. But the most economical and productive method of obtaining the minute shells is by taking home a quantity of leaves, say in a large vasculum, and after drying them on a tray, carefully searching the debris which will be found beneath. By this plan you concentrate any specimens present, while at the same time you are, as it were, collecting at home, and can begin and leave off as it suits your convenience.

It is recommended in Jeffrey's work to examine moss for shells, but so far as I have observed very few are to be found in moss. I have taken home several times great quantities of it from various localities and different situations, and seldom found more than a specimen or two of *Zonites allivivus*, or *Helix rotundata*. It is otherwise with damp leaves, as if there be shells

in the place at all where these are obtained, you will be sure to find them ensconced between their layers.

I have frequently remarked that the land shells generally prefer a smooth, clean, and hard surface, to one overgrown with lichens and moss, and have no hesitation in saying, that in the former situation fifty specimens could be found for one in the latter. Instinct seems to impress the terrestrial *Pulmonobranchs* with the necessity of economizing their slime, and also to teach them that the best way to do so is by avoiding porous and uneven surfaces, and frequenting those that are solid, smooth, and damp, the latter implying shady places.

Before concluding, I cannot avoid directing your attention *specially* to what you must have observed from the general remarks already made—viz., to the great number and rarity of many of the species found in Auchentorlie Glen, and all at its lower part. These are *Zonites alliaria*, *cellaria*, *radiatula*, *crystallinus*, and *fulvus*; *Helix nemoralis*, *fusca*, *aculeata*, and *lamellata*; *Carychium minimum*, *Clausilia rugosa*, *Pupa umbilicata*, *Bulinus obscurus*, and *Balia perversa* or *fragilis*;* while, in the immediate locality of the glen—viz., at Henry Bell's monument, we have *Helix aspersa* and *rufescens*, in all, sixteen species. Yet, while it is so rich in species, there is a wonderful paucity of individuals, as, for example, in three excursions, I only found three specimens of *H. aculeata*, two of *B. obscurus*, one of *H. fusca*, and one of *Balia fragilis*.

I may also remark that there are four species in the collection which Jeffreys does not mention as occurring in Scotland—viz., *Cyclas lacustris*, *Limnæa auricularia*, *Limnæa glabra*, and *Helix rufescens*.

* Since writing this paper I have found on more minute examination that the specimen of *Balia fragilis* referred to, is a somewhat doubtful one, and appears either to be an abnormal form of *Balia* (there being only a single indigenous species of that genus), or an abnormal form of *Clausilia rugosa*, or a variety of *C. rugosa*, probably *dubia*; or a species differing from *Clausilia rugosa*, probably "*Rolphi*." It would be easy to determine whether it was a *Balia* or *Clausilia* by breaking the shell and observing whether it had a clausilium, which is absent in *Balia*, but unfortunately there is only a single specimen, so that we must either decide from external appearances or destroy the shell. But however this may be, one characteristic specimen of *Balia* has recently been found in Auchentorlie Glen, thus maintaining the number of species which I stated is to be obtained there, and were the features of this undetermined individual properly studied, it is possible that it might add another to the number.

JANUARY 7TH, 1868.

Hugh Colquhoun, M.D., President, in the chair.

SPECIMENS EXHIBITED.

Curlew-billed Sandpiper (*Tringa subarquata*) and Storm Petrel (*Thalassidroma pelagica*), both from the Firth of Forth, forwarded by Mr John A. Harvie Brown, corresponding member. Mr Brown also sent for exhibition a specimen of the Common Dunlin (*Tringa variabilis*), which had been procured in the island of North Uist by Mr Gray. It was in full breeding plumage, and had been shot from the nest. The bird, when contrasted with others of the same species from different localities, appeared to be little more than half the size. Mr Gray explained that from personal observation he was disposed to think that the dunlins of the Outer Hebrides belonged to a northern race of that species, and were of much smaller dimensions, resembling very much in size and general features the Little Stint (*Tringa minuta*).

Dr James Stirton exhibited specimens of the following mosses:—*Brachythecium Hunti* and *Hypnum Breadalbanese*, both new to science; and *Leskea nervosa*, new to Britain—all from Ben Lawers.

Mr J. Gilmour exhibited a specimen of the common rabbit, showing a curious malformation of the teeth.

Mr Gavin Miller exhibited a complete specimen of *Productus scabriculus* (Martin), which was obtained from a bed of boulder clay, at a depth of ten feet from the surface, in digging the foundation for a building near Windsor Terrace.

The Secretary exhibited a rare *Cystidean* (*Ischadites Kanigii*), which he had collected from the silurian rocks of the Girvan district in Ayrshire.

Mr John Young made some remarks on these fossils, and stated that the *Productus* shell in the boulder sill must have been originally derived from some of the beds of *fossiliferous* limestone shale belonging to the *carboniferous* period, which exist to the north and west of Glasgow, flanking the trap hills of the Campsie and Kilpatrick range. He had often met with boulders of the *fossiliferous* limestones and ironstones of this period in the glacial drift, but he had never seen so perfect an example of a shell as the specimen exhibited. The geological relation of the *Cystidean*

discovered by Mr Gray was next pointed out. He stated that these fossils, which are exclusively characteristic of the silurian period, are supposed by palæontologists to have held an intermediate position between the *Crinoids* and *Echinoderms*, and that this was the first notice of their occurrence in the silurian strata of the Girvan district.

PAPER READ.

The Birds of Iona and Mull. By MR HENRY D. GRAHAM,
Corresponding Member, read by the Secretary.

Before the close of the meeting the librarian announced several additions to the library through the donations of members, among which was a valuable quarto volume on lichens, "*Lichenographia Universalis*," Acharius, 1810, the gift of Dr Colquhoun, the President.

JANUARY 28TH, 1868.

Hugh Colquhoun, M.D., President, in the chair. The following gentlemen were elected members:—Messrs John Turnbull, Mungo C. Duff, resident; and W. C. Angus, Aberdeen, corresponding.

SPECIMENS EXHIBITED.

Mr Edward R. Alston exhibited a specimen of the pine marten (*Martes abietum*, Ray) from Inverness-shire; also, a beautiful pied variety of the fieldfare (*Turdus pilaris*, L.) from Lanarkshire—on both of which he made a few remarks.

Mr William Lorrain exhibited a specimen of the white-fronted goose (*Anser albifrons*), which was shot lately in the Vale of Leven, near Balloch. Mr Gray stated, with regard to this species, that although it had been long looked upon as one of the rarer British wild geese, it was now found to be tolerably numerous in some of the western islands, especially Islay and neighbouring isles.

Dr Stirton exhibited specimens of *Zygodon Stirtoni* (Schimper), from Ben Lomond in August, 1865—a moss which, it would appear, is comparatively common on rocks near the sea, as Mr Wilson has reported it from the coast of Wales as well as Mr Howie from near Elie, in Fifeshire. Its nearest ally is *Zygodon viridissimus*, from which, however, it is sufficiently distinguished

by its erect, not recurved, leaves, strong excurrent nerve, elliptical capsule, etc.

Dr Stirton also exhibited specimens of *Bryum Mühlenbeckii*, from Ben Nevis in August, 1866. Although the size and colour of the plant are somewhat at variance with genuine continental specimens, yet the texture of the leaves and relative length of nerve (which possesses the characteristic tint) sufficiently warrant the close association if not identity of the two plants. This opinion is borne out by Mr Wilson, author of the *Bryologia Britannica*. Dr Stirton described at same time the situation of localities on Ben Lawers, Ben Lomond, and Ben Nevis, most prolific in rare cryptogams, and showed how they possessed many features in common, as general direction, geological formation, and degree of humidity. He likewise appealed to geologists to account for the prevalence in such spots of plants in this country which, as a rule, are only to be found at a much higher level on the continent; besides, the plants characteristic of such spots are either very rare or are confined exclusively to them.

Mr James Ramsay exhibited specimens of *Bryum roseum* in fruit, from Cumbrae, forwarded by Mr Levaek, corresponding member; and read some notes on the species by Mr David Robertson.

Mr Chapman drew the attention of the meeting to a large collection of Australian insects, the property of Mr Kirsop, of Glasgow, which that gentleman had sent for exhibition.

PAPERS READ.

I.—*On the Occurrence of Seaweeds in the Paisley Clay Beds.*

By Mr J. A. MAHONY.

The only records of the occurrence of seaweed in the glacial clays, that I am aware of, consist of a reference to their presence in some strata penetrated while digging a well at Johnstone, and Messrs Crosskey & Robertson, in the recently published Transactions of the Geological Society of Glasgow, announce the discovery of *Melobesia polymorpha* in the Dalmuir deposit. In the former instance, described by the late Mr Smith of Jordanhill, it is not stated whether the seaweed found was of the calcareous type, or soft-fronded, like the great majority of *Alyæ*. The calcareous seaweeds secrete so much carbonate of lime in their structure, that the fact of their remaining intact during the long interval of time which has elapsed since the glacial epoch is not at all extraordinary.

The Dalmuir plant *Melobesia* is of this character, and is in equally good preservation with the shells among which it is found. A closely allied plant, *Melobesia calcarea*, is found at Paisley, Houston, and some other localities.

The Westmarch Plants.—The seaweeds to which I would now refer are of soft membranaceous texture, with one exception, which is tough and coriaceous. This latter had attracted the notice of Mr Bennie, who directed my attention to it, and with him I visited the locality a few months ago. The stratum where they occur could only be recognised distinctly at Westmarch clay field, near the Race Course, the most westerly of the brick works, I believe. The section there consists of about one foot of soil, then two feet of yellow clay, with descending roots in it; next four feet of sandy clay, in which the seaweeds occur; then about ten feet of clay with the usual glacial shells of the district. Below this is an unknown depth of mud and boulder clay. The former reaches a depth of ninety-five feet in a bore made for Messrs Merry & Cunningham, at the adjoining Race Course. In the four feet stratum the vegetable matter is very abundant, but most so in the upper part, where it exists in a comminuted state, rendering the colour of the clay quite dark. Animal remains are also abundant, being represented by *Foraminifera* and *Entomostraca* and the decayed fragments of *Mytilus edulis* in great plenty. The shells of this mollusc seemed to be deficient in the carbonate and phosphate of lime necessary to give stability to the structure, and were correspondingly rich in animal matter, which had become diffused through the stratum, dyeing it of a distinct purplish hue. A portion of this sandy clay had been thrown up on the bank, and on the rain-washed surface, numerous samples of an irregularly branched plant stood out clearly defined. That it was a seaweed was the immediate and natural suggestion, and this view has been confirmed on microscopical examination. It bears a dense layer of cells on the surface of the frond, while the inner substance presents a granular appearance. Any attempt to identify the species of this plant would be premature, but I may meanwhile say that it seems to approach the *Dictyotaceæ* most closely. Mr Bennie subjected a portion of the clay to the washing process which has of late been so productive of information with regard to the minuter forms in these deposits. The vegetable *debris* so obtained was most abundant, forming a thick cake in the sieve;

and, on being dried, the *Foraminifera* could be seen in great numbers along with fragments of mussel-shell. It was only when examined microscopically that the true interest of this deposit was evolved.

Portions of unmistakable sea-weed in a very fragmentary state, leaves of mosses, scraps of the tissue of vascular plants, and little bits of the epidermis of mussel-shell, were then revealed as the organic constituents of this peaty mass. From the examination of a large quantity of it, I have hitherto found that there are altogether at least eleven species of marine *Algae*, three of which seem to be *Melanosperms*, six *Rhodospems*, and two *Chlorospems*. In the absence of fruit, or indeed of any tangible character, it would be unsafe to attempt a reference of these plants to their species. I will therefore just indicate their possible affinities.

A bit of black seaweed, on being subjected to gentle pressure, emitted bodies which I recognised as the sporangia, or parent cells of the germ cells of a *Fucus*, likely *F. vesiculosus*. One small fragment shows remains of an air-vessel; it may be a *Cystoseiria*, or possibly *Hatidryx siliquosa*.

Among the red weeds, *Callophyllis laciniata* seems to be represented by a fragment with granular cell structure. The portions titled *Polysiphonia* may belong either to that genus or *Ceramium*, for the siphons are not well defined. The long purple weed, with opposite articulated ramuli, is most probably a *Cryptonemaceous* plant, but I cannot find that it agrees with any of the species in that order.

One specimen is likely a *Callithamnion*.

In the *Chlorospems*, that named *Porphyra vulgaris* is probably correct, and the inflated plant resembles *Enteromorpha intestinalis*, although the characteristic colour is absent.

Besides these seaweeds there were also remains of terrestrial plants. Two distinct species of mosses occurred, and also one leaf of a *Jungermannia*; fragments of the tissues of *Phanerozams* were abundant, and consisted of the pith of stems, with surrounding cellular tissue, parenchyma, and spiral vessels.

The facts thus evolved are very suggestive of the conditions under which these strata were deposited. The intense cold of the period represented by the lower stratum had gradually given way to a more genial temperature, involving the extinction of

most of the boreal shells. In their place we find the mussel—a mollusc which luxuriates in estuaries or bays, where the influx of river or stream modifies the marine conditions. The leaves of mosses must have been carried down by such a stream, and deposited on this ancient shore along with the fragmentary seaweeds drifted in by the tide. That tissues so delicate and apparently evanescent should have been preserved during the undoubtedly long period which has elapsed since the deposition of these clay beds is, I think, an interesting and noteworthy circumstance.

II.—*On the Birds of Iona and Mull.*

By Mr HENRY D. GRAHAM, Corresponding Member.

FEBRUARY 25TH, 1868.

Hugh Colquhoun, M.D., President, in the chair. The following gentlemen were elected members:—Messrs John M^cKay, James W. Allan, and James Watson, Burntrigg, Cardross.

SPECIMENS EXHIBITED.

The Secretary drew the attention of the meeting to a pair of beautiful snowy owls (*Surnia nyctea*), which had been forwarded for exhibition by Mr John Harvie Brown, corresponding member. One of these was a Canadian specimen; the other had been taken alive on board a Danish craft about fifteen miles out at sea, and nearly opposite to Montrose, on the 16th December last.

Dr Stirton exhibited specimens of *Sphagnum teres*, from Ben Ledi, a species recently discovered on the continent, and one likely to be met with pretty commonly in similar localities throughout Scotland; also *Grimmia subsquarrosa*, in fruit, from Dumbuck, near Bowling, the first recorded instance of the moss having been found in a perfect state. Its nearest ally is *Grimmia pulvinata*; but the peculiar squarrose leaves and dioicous inflorescence render it quite distinct. On the same rocks were found *Grimmia leucophava*, *G. Hartmani*, *G. Schultzii*, and *G. trichophylla*. The first of these was first discovered on Arthur's Seat in the beginning of the present century; many years afterwards on the southern coast of Fife; and later still on Abbey Craig, near Stirling; the present station completes the

chain. It is somewhat remarkable that this interesting and distinct moss should be confined to this narrow belt of rocks of trap formation, stretching across the country, at intervals, beginning with Arthur's Seat and ending with Dunbarton Castle; the same is true of one or two others of the *Grimmiae* enumerated.

Dr Young exhibited specimens from a large collection recently presented to the Hunterian Museum. This collection, formed by Dr Dugés, illustrates the fauna of the vicinity of Guaguanato, in Mexico, and was presented by him to the museum through Mr L. McGowan, British Consul in Mexico. The specimens include several hundred insects; above thirty species of amphibia and reptiles; skins exquisitely prepared and ready for stuffing, of thirty-three species of birds and mammals. This magnificent gift will necessarily take some time to arrange; but Dr Young exhibited two species of tree frogs and a toad, remarking on their geographical distribution, and the mode in which they represent nearly allied species in the old world. Two species of horned lizard are now in the museum, one (*Phrynosoma orbiculare*) from Dugés' collection; of the other (*P. Harleuii*), two specimens were kept alive for some months by Mr Young, but persistently refused food. Two out of the five species of *Tropidolepis*, a lizard closely related to *Phrynosoma*, were also shown. Dr Young promised to exhibit the rest of the collection as they were arranged and mounted.

Mr Edward R. Alston exhibited a specimen of Daubenton's Bat (*Vespertilio Daubentonii*), which was taken on Glasgow Green in 1864; and made some remarks on other Scottish species of a like interest.

Mr John Young exhibited a finely-preserved specimen of a fossil fruit, obtained from the marine limestone shales at Newfield Quarry, High Blantyre. This fruit somewhat resembles in size and form the *Trigonocarpon*s, a genus of coniferous fruits found in the coal measures, of which he exhibited some illustrative specimens from the Ayrshire coal-field, but differs from them in possessing at the top of the fruit eight sharp ribs, which extend about one-third along the length of the shell, the rest of the surface being smooth, and having the calyx well marked at the base.

Mr Young also made some remarks upon the very rare occurrence of fossil fruits of this class in the marine limestone shales of Scotland, and stated that the specimen exhibited, which had

been presented to him by the Rev. Dr Gloag of Blantyre, probably belonged to a new and undescribed genus.

PAPER READ.

On the Nudibranchiate Mollusca of the Shores of the Cumbraes.

By Mr DAVID ROBERTSON, illustrated by specimens.

In bringing forward a list of the Nudibranchs of the Cumbraes, I have to remark that it must not be understood it has any pretensions to an exhaustive list of the species which may be obtained on the shores of these islands, but merely as a beginning, undertaken in the hope of enlisting more workers for the better investigation of this much neglected but most interesting family.

One great drawback to progress arises in many cases from the necessity of identifying them while they are in life, many not surviving long when removed from their natural condition.

Like many other animals, they make their appearance on our shores in greater or lesser numbers at particular seasons of the year. I find them most abundant in February, March, and April, months favourable for collecting on account of the spring tides.

Unfortunately, from the coldness and uncertainty of the weather of these months, few naturalists choose them for their holidays at the coast, and from this cause doubtless many of the best opportunities of capturing these animals are lost.

The importance of low ebbs for collecting Nudibranchs will be seen by glancing over the accompanying list, when it will be found that more than four species have been obtained on the shore, for one obtained exclusively by the dredge. That circumstance becomes the more prominent by the fact, that I have occupied much more time with the dredge than with shore work.

For working out a local list in any branch of the marine invertebrate fauna, I know no place so favourably situated as the rich shores of the Cumbraes; nor is there any place known to me where such a length and variety of shore can be reached with so much convenience and so little toil. There is not less than twenty miles of shore line to hunt upon; and making full allowance for rough ground, twenty square miles of sea to dredge in, which, at any point, scarcely exceeds six miles from the village of Millport.

In the valuable monograph of British Nudibranchiate Mollusca, by Alder & Hancock, ninety-one species are recorded; of these twenty-nine are from Scottish habitats, and twenty-two of that

number are from the Firth of Clyde, the chief localities being Ardrossan, Saltcoats, Arran, and Rothesay Bay; one species, however, was obtained from Portencross, and another from Cumbræ.

The subjoined list from the Cumbræes includes ten genera and thirty-seven species. Five of these are new to the West of Scotland, viz.:—*Hermæa bifida*, *Eolis Peachii*, *E. concinna*, *E. amæna*, and *E. cingulata*. Regarding this last species, Mr Alder writes (August, 1866)—“*Eolis cingulata*, I am particularly pleased you have met with, as the two specimens I got on our coast, about twenty years ago, are all that I ever heard of till now.”

Hero formosa is another of interest, as it is the second specimen procured in Britain (1864). The first, a single specimen, had been dredged the year before off Holy Island, Durham coast.

I have been indebted to the late Mr Joshua Alder and to Dr Collingwood for their kind assistance in determining all doubtful species. A few specimens not in the list died during their transmission to these gentlemen; one of these I believe to be *Thecacera pennigera*, a rare species.

CATALOGUE OF SPECIES, WITH THEIR HABITATS.

Doris, (Linn).

— tuberculata, (Cuvier). Common between tide mark, on stones.

— Johnstoni, (Alder & Hancock). Moderately common, on stones between tide mark.

— repanda, (A. & H.) Once at low water.

— planata, (A. & H.)—*D. testudinaria* (Risso). Two at extreme low water.

— aspera, (A. & H.) Common, dredged on *Laminaria saccharina* and between tide mark.

— bilamellata, (Linn). Moderately common, on stones at low water.

— pilosa, (Müll). Moderately common, on stones at low water.

Goniodoris, (Forbes).

— nodosa, (Mont.) Common, dredged, and at low water.

Triopa, (Johnston).

——— *claviger*, (Müll). Common, dredged, and between tide-mark.

Ægirus, (Lovén).

——— *punctilucens*, (D'Orb.) Moderately common, under muddy stones at extreme low water.

Polycera, (Cuvier).

——— *quadrilineata*, (Müll). Common, dredged on *Laminaria*.

——— *ocellata*, (A. & H.) Moderately common, under stones at low water.

Ancula, (Lovén).

——— *cristata*, (Alder). Moderately common, on stones at low water.

Tritonia, (Cuvier).

——— *Homborgii*, (Cuv.) Dredged, and at low water.

——— *plebeia*, (Johnston). Common, on stones at low water.

Dendronotus, (A. & H.)

——— *arborescens*, (Müll). Locally common on stones at low water.

Doto, (Owen).

——— *fragilis*, (Forbes). Moderately rare, dredged on zoophytes.

——— *coronata*, (Müll). Dredged.

Eolis, (Cuvier).

——— *papillosa*, (Linn). Moderately common between tide mark.

——— *Peachii*, (A. & H.) One dredged.

——— *coronata*, (Müll). Moderately common, dredged.

——— *Drummondi*, (Thomp.) Common, dredged, and between tide mark.

——— *lineata*, (Lov.) Rare, dredged on stones twenty-five fms.

——— *gracilis*, (A. & H.) Moderately rare, at low water, under stones.

——— *alba*, (A. & H.) Low water and dredged, common.

——— *concinna*, (A. & H.) Once under stones at extreme low water.

——— *nana*, (A. & H.) Once dredged on a shell occupied by *Pagurus Bernhardus*. Dr John Grieve tells me that the same species was obtained by him in Gourock Bay on a shell occupied by the same crab.

- Eolis olivacea*, (A. & H.) Once under stones at low water.
 — *aurantiaca*, (A. & H.) Moderately rare, dredged, twenty-five fms.
 — *cingulata*, (A. & H.) Once under stone at extreme low water.
 — *Glottensis*, (A. & H.) Once dredged on gravelly bottom, in ten fms., on zoophytes.
 — *amæna*, (A. & H.) Moderately rare, in ten fms., gravelly bottom, on *Sertularia polyzonius*.
 — *viridis*, (Forbes). Moderately common, on muddy stones at extreme low water.
 — *picta*, (A. & H.) Rare, dredged, gravelly bottom, on *Tubularia indivisa*.
 — *exigua*, (A. & H.) Moderately rare, at extreme low water, and dredged on *Laminaria saccharina*.

Hermæa, (Lovén).

- *bifida*, (Mont.) Moderately common, dredged on *Griffithsia corallina*. This species has a strong but not unpleasant odour.

Hero, (Lovén).

- *formosa*, (Lovén). Once dredged among *Melobesia*, adhering to the valve of a dead pecten.

MARCH 31ST, 1868.

Mr James A. Mahony in the chair. The following gentlemen were elected members of the society:—Messrs Thomas D. Moffat, resident; L. M'Gown, British Consul in Mexico; Dr Dugés, Mexico; and Rev. Dr Gloag, Blantyre, Lanarkshire, corresponding.

SPECIMENS EXHIBITED.

The Secretary exhibited a specimen of *Buarremon schistaceus* (Boiss), which had been shot in Aberdeenshire, in 1863, by Mr George Mearns, and forwarded by Mr W. C. Angus, corresponding member.

Mr John Young exhibited, from the collection in the Hunterian Museum, a new brachiopod shell, *Triglesia Grayiana* (Davidson), recently discovered in the silurian strata of the Girvan valley, by Mrs Robert Gray.

Mr Alexander M'Kinlay exhibited specimens of the following mosses, recently found in Scotland, but not described in British works:—*Sphagnum Girgensohni* (Rossow); *S. teres* (Sch.), *Angst*; *S. Lindbergii* (Sch.); *S. curvifolium* (Wils. MSS.); *S. Kinlayanum* (Wils. MSS.); *S. auriculatum* (Sch.); *S. Muelleri* (Sch.); *S. rigidum*, *var crassifolium*; with remarks on their structure and affinities. Mr M'Kinlay also exhibited *Plagiothecium Müllerianum* (Sch.) from Ben Wyvis, a species new to Britain.

Professor Young exhibited some *mammals* from Mexico, with remarks on their geographical range and affinities. Dr Young also exhibited a specimen of Diard's pheasant (*Phasianus versicolor*), which had been lately shot at Skipmess in Argyleshire, and sent for exhibition by Professor G. Ramsay of Glasgow University.

Mr John Dougall exhibited a living specimen of *Testula marginata* from Algoa Bay, Southern Africa, and read a few remarks on the organs of sense, food, and habits of that species.

Mr Walter Galt exhibited *Glyphomitrium Durieii*, from Craiggallion, Stirlingshire, a new locality discovered by Mr George Thomson and himself, in March, 1868. He further observed that during the last few years the stations for this moss had increased considerably, and it was not so rare as formerly supposed. We have now in Scotland the following habitats:—

Bowling, May, 1863, Messrs Galt and MacCartney.

Whangie, New Kilpatrick, May, 1863, Messrs Shaw and M'Kinlay.

Ardtun, Mull, May, 1864, Mr Donald Black of Iona, who examined this locality at the request of Messrs MacCartney and Galt.

Killin, Perthshire, Rev. Mr M'Millan and Mr M'Kinlay.

Skye, Mr G. E. Hunt of Manchester, about 1864, and again in 1866, by Mr John Shaw.

Blairlogie, Stirlingshire, by Mr George Thomson, in June, 1865.

Craiggallion, March, 1868, by Messrs Thomson and Galt.

Crags betwixt Strathblane and Dungoyne, Campsie Hills, March, 1868, Messrs George Thomson and Walter Galt.

This interesting moss has thus been found in the counties of Dumbarton, Argyle, Inverness, Perth, and Stirling.

PAPERS READ.

I.—*Notice of the occurrence of the White-throated Sparrow (Zonotrichia albicollis) in Aberdeenshire.*

By Mr W. C. ANGUS, Aberdeen, Corresponding Member.

PLATE III.

I have much pleasure in adding this interesting North American species to the fauna of Europe. The bird which I send for exhibition, along with this notice, was shot by Mr Mitchell on the 17th August, 1867, near the Broad Hill, on the Links of Aberdeen. It was put into my hands immediately after being procured, and I made a careful examination of the specimen before it was skinned.

The following description and measurements of the bird were then taken:—Length, six inches and a half; length of tail, about three inches; wing, from carpus, nearly three inches; wings, when closed, reaching to the extremity of the tail coverts; irides hazel. Bill robust; mandibles compressed at the tips, the upper, which is longest, being hooked at the tip and darker in colour. From the nostril to the back of the head there is a distinct line, which is of a rich yellow in front of the eye and a dull white behind it. Feathers on the crown of the head reddish brown at the base, and rich brownish black at the tips, divided by a medial whitish line; feathers on the shoulders, rich bay at the base and tipped with reddish brown, those on the back having brighter tints and a longitudinal spot of black on the tips. Rump olive brown; chin white; breast dusky; under parts dirty white; feathers on the sides somewhat darker along their shafts. Quills dusky; outer webs margined with white. First quill short; third, fourth, and fifth, about equal, and longest in the wing. First and sixth about equal in length; second, third, fourth, and fifth quills abruptly cut away on the outer webs. Secondaries emarginate, edged with ferruginous on the outer webs. A double bar on the wings is formed by the white tips of the greater and lesser wing coverts, the line on the smaller coverts being more conspicuous; the first feather being yellow, like the lower surface of the wing shoulder. Tail dusky, straight, consisting of twelve feathers, the outer webs being broad at the base, while the inner webs are broad at the points. Tarsus seven-eighths of an inch long; legs and toes robust; claws convex and sharp.

Sex, female. The stomach contained grass, sand, seeds, and insects.

Variation.—On comparing the specimen described above with a male from New Brunswick, forwarded to me by the society's secretary, and with other specimens obligingly lent to me by Professor Nicol of Marischal College, I find a slight difference in the bills—the sinus of the upper mandible being more or less distinct. The colours of the male in the New Brunswick specimen are not nearly so bright as those of the specimens belonging to the College Museum here,* the latter being, moreover, distinguished by having the whole throat mapped off by distinct straight lines. The tail feathers in all the specimens are more or less worn, the central feathers, which are wiry to the base, having, in some instances, merely the shafts remaining.

According to Wilson, this is the largest and handsomest of the American sparrows, and is common from Connecticut to Savannah, particularly in the neighbourhood of the Roanoke river, and in the rice plantations. In summer they retire inland and further north to breed. They remain in flocks during winter, preferring the borders of swampy thickets, creeks, and mill-ponds, skirted with alder bushes and rank weeds, the seeds of which form their principal food. Early in spring they have a few remarkably sweet and clear notes, which they utter a little after sunrise. "About the 20th of April," adds Wilson, "they disappear, and we see no more of them till the beginning or second week of October."

Pennant gives Pennsylvania, New York, and Newfoundland as its habitat.

I am much indebted to Mr Mitchell for kindly presenting me with this specimen, which has now been added to my collection. From its general resemblance to some of the female buntings, the bird might have, in less enthusiastic hands, altogether escaped observation. When shot it was perched on the top of a whin bush, and attracted Mr Mitchell's attention by its note, and the manner of flirting its tail. I have only to add that the bird bore no traces of having been in confinement, the wings, tail, and all the lower plumage, being quite clean.

* These specimens were presented to the Museum by Audubon, and are labelled in the handwriting of the late Professor Macgillivray.



WHITE-THROATED SPARROW (*Zonotrichia Albigollis*)



The Plate accompanying this notice is from the pencil of Mr William Sinclair; the upper figure is that of the bird exhibited, the lower one represents a male from the cabinet of Mr E. R. Alston of Glasgow.

II.—*Notes on Cocconeis, Nitzschia, and some of the allied genera of Diatomaceæ.* By Professor G. A. WALKER-ARNOTT.

I.—COCCONEIS.

In Smith's synopsis of British *Diatomaceæ*, the only systematic work on the subject of any value, this genus would appear only to differ from *Navicula* by the frustules being adherent, or attached by the surface of the lower valve to larger *algæ*. Smith adds, that "the markings of the lower are less intense than those of the upper surface, but in other respects the valves are symmetrical, and Mr West informs me that he has found the absence of a central nodule in the *lower* valve, as noticed by some writers, by no means a constant character." This observation is correct as to the marking of the lower valve, but there is a double error in regard to its nodule.

No author known to me mentions that the central nodule of the *lower* valve is absent; and it is therefore probable that West meant to speak of its absence from the *upper* valve. Kützing, in his *Bacillarien*, p. 70, places *Cocconeis* among his *Monostomaticæ* "ostiole medio in latere secundario inferiori, in superiori nullo," or, to use Smith's terms (now generally adopted, for there is no opening), "a central nodule in the lower valve, none in the upper." The same structure is indicated in his *Species Algarum*, at p. 50, and there seems to be no exception to this character in well-known species: when such occur, the species exhibiting it will probably be found to be generically distinct. The upper valve has usually no markings at the place where the nodule and median line might be expected, and when the two valves are united to form the entire frustule, we see the nodule and median line of the lower valve through the upper one, leading one to suppose that what was before us was the upper valve with a median line and central nodule. As neither Smith nor any other author has given figures of both valves of the several species, our information regarding the species is as yet very imperfect. No figures can afford good illustrations unless the specimens be obtained from the weed on which the species grows, and then at least three are required: one

ought to be given of the two valves combined, another of the upper valve only after it has been separated by the action of boiling nitric acid from the lower, and a third of the lower valve. Smith says that the markings on the lower valve are less intense, but this is not all the difference: the situation is frequently, if not always, so different, that one might easily suppose the two valves to belong to very distinct species. A familiar instance of this may be seen in *C. dirupta* of Gregory. Gregory has only figured and described the upper valve; he says, "the median line is irregular, like a slit or tear down the middle of the external surface:" this is not the median line, but the part of the valve unoccupied by striæ, and through which the median line of the lower valve would have been seen had the two been combined. Gregory says that "the *C. diaphana* occurs along with it, but concludes that the two are not the same thing, since *C. dirupta* is by no means diaphanous, while its striæ are conspicuous and its colour brown, the striæ of *C. diaphana* being very obscure, and the valve colourless." Now, what Gregory calls *C. diaphana*, is not the true *C. diaphana* of Smith, but is the lower valve of *C. dirupta*. The true *C. diaphana* has not yet been found in Scotland, nor even on the shore of England, properly so called. Smith's only specimen was from Pontac in Jersey, and preserved on mica; it is now in the British Museum; what he describes and figures as the var. β , from Sidmouth, is, however, the lower valve of *C. dirupta*. My first acquaintance with *C. dirupta* was from a gathering made at Plymouth by Mr Boswarva in 1853. On sending part of this to Mr Smith, he at first, looking only at the upper valve, pronounced it a new species; but, afterwards, on observing the other one, exactly of the same size and shape, declared all to be *C. diaphana*. Soon after that Mr R. Henedy, of Glasgow, found it in a growing state, on *Sphaecularia cirrhosa*, on the shore of Cumbrae, and a slide from that sample, supplied by me, is now the representative of *C. diaphana*, among Smith's slides in the British Museum. The true *C. diaphana* is perfectly different, both valves being diaphanous, and the upper one more convex than in *C. pediculus*. I may here mention that the true *C. diaphana* was parasitic on the antheridia of a species of *Polysiphonia* (apparently *P. nigrescens*); it had been previously found by M. de Brebisson on the coast of Normandy, at Granville, on the antheridia of *Gloiosiphonia Griffithsiana*, and called by him *Frustulia nidulans*; but

finding that it belonged to the genus *Cocconeis*, of Kützing's Bacillarien, he proposed to change the name to *C. amygdalina*, from its resemblance in miniature to the kernel of an almond: he published neither names. Kützing, however, had got specimens from him under the name of *Frust. nidulans*, and published it in his *Systema Algarum* as *Cocc. nidulans*; this was done in 1849, three years before Smith found his specimens at Jersey; so that the name *C. diaphana* must, perhaps, be laid aside. Mr Ralphs, in Pritchard's *Infusoria*, tells us that it is got "nidulating in mucous;" this is a mere inference from the name; it is really not so. I may add that M. de Brebisson has since obtained better specimens from La Croisie, or the antheridia of *Laurencia tenuissima*. In the same way Gregory's *C. distans* figured in the *Clyde Diatoms*, f. 23, is merely the upper valve; the lower valve is probably very dissimilar. *C. nitida*, f. 26, of the same work, is also an upper valve, the lower being unknown, or, if described, it is under another name. Another circumstance with regard to *Cocconeis* ought to be noticed. Not only are the two valves usually very different in appearance, but in several species, perhaps in all, each valve consists of two layers or plates, which may be separated by much boiling in acid, or being long in water after the alga has decayed, as found in dredgings and deposits. As the two layers are differently marked, we are liable to make several new species on that account; the inner layer of the upper valve is generally very pellucid, and also the lower one of the lower valve; but some species have the lower valve considerably larger than the upper one, the portion or margin beyond the upper one being strongly marked, although the central part (covered by the upper) be colourless. This extension or border appears to me in all cases to belong to the lower layer of the lower valve; so that the upper layer has a nodule and median line, and is only the size of the upper valve, while the lower layer has the strongly marked border or margin, although the middle part be diaphanous with no, or only obscure striae, and no nodule or median line. *C. ornata* of Gregory is an example of a valve with this border; it is difficult to say whether it represents the two valves conjoined, or only the lower.

Gregory's fig. 27, *C. pseudomarginata*, represents a small species with both valves. His fig. 28, called by him *C. major*, is a larger specimen of probably the same species, but exhibits the lower

valve only. For those who are interested about the productions of the Clyde, I may add that *C. splendida*, of Gregory (f. 29), is not different from *C. punctatissima*, Greville, from the West Indies, nor is either a really distinct species from *C. mousii*, Sm., and perhaps all of them belong to *C. punctata*, of Lobarzewsky. So far as my observations go—but I have obtained no specimens from the weed—the upper valve has no true median line or central nodule; and, on the other hand, *C. crebrestriata*, of Greville, appears to me to be the lower valve of his *C. punctatissima*. In *C. mousii* there are 10–12 striæ in $\cdot 001$, the dots forming the striæ being 15 in $\cdot 001$. In the same from West Australia, the striæ are 12–13 in $\cdot 001$, and the dots also 15 in $\cdot 001$. In *C. punctatissima* the striæ are 15 in $\cdot 001$, but the dots are likewise 15 in $\cdot 001$; so that although the striæ do vary a little in number, even in the same sample, the dots comprising them are isometrical.

Some species referred to *Cocconeis* may be here noticed. One is *C. Grevillei*; Smith's figures and description are apt to mislead. He says (Syn. i., p. 22), that his figure, tab. iii., f. 35 *a* is the lower valve, f. 35 *a** the upper valve, and f. 35 *á* the upper valve from within: this is not the case; f. 35 *a* is probably the upper valve; but if so, the nodule and median line are a pictorial embellishment only, the upper valve possessing neither; f. 35 *a** exhibits both valves combined, and, if the artist was not deceived, f. 35 *a* is the same again; f. 35 *á* is the lower valve, but not quite correct, in so far as the horizontal costæ or ribs are represented as interrupted in the middle by a longitudinal rugged band, which I have never seen, and must have been accidental. This lower valve consists of two layers; when both are united, the median line and nodule of the lowest plate are very obscurely seen; this has the striæ fine and very unlike those on the upper valve: sometimes the upper layer separates; on this are the costa attached to the margin, and no striæ, but these costæ leave a few granules on the lower plate, marking where they adhered to it. If there be two layers to the upper valve, I have seen nothing which I would consider the inner one. The lower layer of the lower valve has the striation, median line, and nodule of *C. major* of Gregory, but I have never seen it quite destitute of the granules I have noticed above: if such specimens are found, it would render it difficult to say whether *C. major* ought to be referred to *C. Grevillei*; or, as I have done, to *C. pseudomarginata*.

Another species placed by all in *Cocconeis*, is *C. binotata* of Grunow: that this is identical with *C. scutellum* of Roper, is by all acknowledged, but it is not so well known that it is the same with *C. Britannica* of Naegeli, described, in 1849, in Kützing's Species Algarum, p. 890. This I consider a very doubtful species of the genus. I have examined it on the weed, and detached from it by calcining it, and with the valves separated by acid, and can see no difference between the two valves. In one instance I found the two valves so slightly separated that part of the one covered part of the other; both had the same striation, the same marginal plates at the middle of each margin, the same nodule, and median line. The presence of the small marginal plates at first sight indicates *Mastogloia* as its genus; but now this affinity is not without difficulty. I saw one instance, where what appeared to be the zone (which connects the valves of diatoms) had separated, carrying with it the plates to which I allude; they are without striæ, and only appear striated when attached to the valve, the striæ of the valve being seen through them. In *Mastogloia*, the marginal plates also occasionally separate from the valve, and, according to Smith, are projections from the zone; but in all the recognised species they are marked by costæ, while in *C. binotata* there are none. This, however, and its being attached to weeds by the back of the lower valve, not free and immersed in gelatine, leave doubts as to *Mastogloia* being its proper genus. *C. fimbriata*, Ehrenberg and Brightwell, is probably a species of *Mastogloia*; but as yet it is only known by stray valves, which are not sufficient to indicate the genus.

As I have noticed *Mastogloia*, I may here mention that four of the species mentioned by Smith—*M. Dunsei*, *M. lanceolata*, *M. Smithii*, and *M. apiculata*, according to the careful measurements of my friend, Mr T. Glazebrook Ryland, of Warrington—have all the same striation and the same number of loculi in $\cdot 001$; in all, the striæ are 41 in $\cdot 001$, and the loculi 20·5 in $\cdot 001$, so that there are two striæ to each loculus—perhaps all these are therefore the same species. In *M. Gravellei* there is a difference. Here the loculi are about 19, the striæ 24·5 in $\cdot 001$, and there are seven loculi to nine striæ. In a species I lately observed very sparingly (I have only as yet seen three valves), the striæ were so obscure that I could not see them with any of my lenses, while the loculi, of which there were only about three to a plate, were 10 in $\cdot 001$.

This occurred in a sample I received from the late Dr Gregory. It is from Elgin, and distributed by him as E. 15; of this I have given slides to many friends as my number 156, so that those who possess such may perhaps find more; but a very careful search is requisite. The valve is oval, not unlike that of *Nav. apiculata* (*Nav. placentula* of Lewis, but not of Ehrenberg), but has not the apiculi at the ends.

Cocconeis Thwaitesii, Sm., is now by most referred to *Achnanthisidium* (*A. flexillum*, Breb.), but the general aspect is very unlike any other of that genus. In this species the upper valve has a median line, but no true nodule; in place of this last, there is a hazy expansion apparently within the substance of the siliceous wall. This is sometimes small, but often assumes a nearly circular or square appearance, extending almost half-way to the margin. When this is seen, we have the *Navicula macula* of Gregory, described by him from the Glenshira sand; indeed, Gregory says, of that supposed species, that it is not unlike the larger specimens of *Coc. Thwaitesii*. It is best seen in deposits (as from Watten Lake, Caithness); but in all recent samples which I have examined I have found traces of it. When the two valves are still united, both the hazy expansion and the stauros may be seen by slightly altering the focus. Another variety of *C. Thwaitesii* (or *Achn. flexillum*) is linear oblong, with nearly parallel sides. This was described by Professor Smith in his paper on Pyrenean Diatoms, under the name of *Navicula dissimilis*. It has been found on Ben Lawers, near Loch Tummell, banks of Loch Leven, near Kinross, and about Hull, but is usually scarce in each locality. In it, also, I have observed the hazy expansion on the upper valve.

II.—NITZSCHIA.

This genus was proposed by Mr Hassall for what he calls *N. elongata*, now known by the name of *N. sigmoidea*,* but the definition he gives is of no value. It was adopted by Mr Smith, but not sufficiently limited. The valves, according to him, are keeled (the keel frequently eccentric) with one or more longitudinal lines

* *N. sigmoidea* B of Smith, is quite distinct from that species, and agrees with *Synedra spectabilis* Ehr., which, however, is a true species of *Nitzschia* (*N. spectabilis*, Ralfs in Pritch. Inf., p. 782, but not *N. spectabilis* of Smith). *Sigmatella Brebissonii* Kütz. is not *N. Brebissonii* Sm., as he supposed, but a slight variety, *N. sigmoidea* having the same difficult striation.

of puncta. This is apt to mislead, and many have in consequence rested almost solely on the presence of puncta, and introduced species into the genus which ought to have been placed elsewhere. The great character of *Nitzschia* is that each valve has one conspicuous keel or angle, sometimes near the middle, but often near the margin; but there is always a portion of the valve beyond the keel. The puncta are confined to the keel. The keel is best seen when the valve rests on its two margins, the keel being then elevated; when the angle or keel forms nearly a right angle, and the valve lies on the broader half of the valve, the other half appears to coalesce with the keel. Smith's figures 115 *A.* and *C.*, in Tab. XIV., will illustrate these positions. It results from this striation that the zone which connects the two valves is not parallel to either half of the valves, but is more or less oblique. Smith has shown this in his ideal sections on Plate XIV., fig. 115 and 118, although the two figures he there gives are scarcely correct, exhibiting very convex sides to the valve on each side of the keel—in general, the portions on each side of the keel are nearly flat. Several species of *Tryblionella* have also got puncta at one side of the valve, but these are strictly marginal; there is no keel or angle there, so that the zone is quite parallel to the valves. This may be seen obscurely in *T. acuminata*, and more distinctly in *T. apiculata* of Gregory, a species which, from not attending to this character, Smith referred to his *Nitz. dubia B.* *N. thermalis*, Grun. (or *Swirella thermalis*, K \ddot{u} g.), if I may rely on specimens from M. de Brébisson, is a species of *Tryblionella*. I have seen but sparingly what I consider the same, from the Victoria Tank at Kew, collected in Feb., 1856. This Smith considered a strongly striated variety of *Nit. linearis*. In *Nitzschia* the part of the valve on each side of the keel has neither a keel nor depression; in *Tryblionella* the valve has almost always one or other. The same character will distinguish *Nitzschia* from *Denticula*, one species of which—now pretty well known, although not published, as *D. decipiens* Arn. and Ryl.—was considered by Smith, when I first met with it at Kew (in the sample already noticed), as a variety of *Nitzschia minutissima*, with conspicuous striæ. *N. curvula* of Smith (whether this be the *Nav. curvula* Ehr., I have not yet been able to ascertain, but it appears to be so, although Kützing's figures from French specimens seem different), or *N. sigmatella* of Gregory, has two keels or angles, one near each margin of the valve. It is, there-

fore, neither a species of *Nitzschia* nor of *Tryblionella*, but has been correctly removed by Dr Lewis to *Survirella*, and called by him *S. intermedia*, and chiefly differing from his *S. anceps* by the latter having conspicuous striæ. Smith's section of a frustule in the centre of Plate X. is intended to illustrate *Tryblionella*, but it is a section of *Survirella*.

Several species of *Nitzschia* have the zones marked by numerous lines. These seem to arise from the inability of the frustule to self-divide at the proper time (this may be from want of silex in the water, or other causes), and these abortive attempts may go on, the zone receiving its increments and widening, until at last the new valves are formed. These lines, and the breadth of a zone, especially when marked by such lines, are therefore accidental, and cannot be admitted as marks to distinguish species. *N. lunceolata* of Smith is a beautiful illustration of this kind of zone. When boiled in acid, it separates at these lines; but when examined before the valves be disjoined, the true structure may be easily seen. By some oversight, West, in making the figures of that species for Smith's synopsis, has represented the lines as if on the valves themselves (in place of being merely seen through the valves), and the same error takes place in the specific character. The lines mentioned there are not on the valve, but on the zone, where they vary from 8 to 35 in '001. *N. incrustans* of Grunow seems to be a small, somewhat distorted form of this species, less silicious than even the typical form is, and more common. These complex zones, as Gregory called them, are not uncommon in other genera, as in *Amphiprora* and *Amphora*, where Gregory considered them so important that he divided that genus into sections from their presence or absence—an unfortunate mistake, which will prevent many of his species being recognised, unless chance presents other specimens in a similar state. The same sort of zone occurs in *Schizonema Grevillei* (and perhaps in other species), especially when, from some cause, the usual enveloping tube is not formed. *Navicula libellus* of Gregory is *Schizonema Grevillei* in this state. His *N. rhombica* is a smaller form of the same. The allied genus *Amphipleura* is in an anomalous condition; its name alludes to supposed longitudinal ridges on the valves. This is entirely a deception; there are no ridges or keels on the valves, except in *A. sigmoidea*, and that is a genuine species of *Nitzschia*, and is a new variety of *N. sigma*,

with the striæ very faint, but when made out by an excellent microscope, these are only 47 in '001, precisely as in *N. sigma*. The supposed ridges are merely the angles formed at the union of the valves with the zone; and in *A. sigmaidea* the nitzschoid keel on each valve raises the supposed number of ridges to six.

I have mentioned that *N. curvata* of Smith has been now removed to *Surirella*: to this it may be objected that *Surirella* is characterised by the presence of transverse canaliculi in (or on) the valve. If by canaliculi superficial furrows are merely meant, this is nearly correct; but elsewhere Smith appears to indicate by that expression, tubes within the substance of the valve—as under *Epithemia*; “the transverse costæ, I regard as minute canals, which convey the nutrimental fluid to the surface of the internal membrane.” In *Surirella* there are no such internal tubes, but the valve is much undulated, particularly near where the angle or keel is seen; the portion beyond the keel is also undulated close to the keel, the union of the two series of undulations at the keel causing the singular appearance, well represented by Smith, in *S. biseriata*, *S. nobilis*, *S. splendida*,* and several others. This also

* Allied to *S. splendida*, and confused with it by Smith, is a species which is now well known to collectors of slides as *S. elegans*, of which a broken valve was figured by Ehrenberg in his tab. amer. His *S. flexuosa* in that work appears to be the same species. At least I have seen narrow broken valves present the slightly twisted appearance he represents. Both were obtained from the same sample from Real del monte. Kützing, in his Sp. alg., places them in a section of *Surirella*, corresponding to *Campylodiscus* of others, and Rabenhorst places both in *Campylodiscus*, referring the last to *C. spiralis*; and probably what Kützing obtained from Hildesheim in Germany, and considered *S. elegans*, was *C. costatus*. Mr Rylands and I, when we gave it the name of *S. splendida*, had seen no authentic specimens, but if the Mexican species be also this *Campylodiscus*, the name *S. elegans* may be retained. It is found in the deposit from Lough Mourne (Co. Antrim), and therefore is probably intended to be figured by Ehrenberg, in his Mikrogeologie, tab. xv., under the name of *S. oblonga*, which has been altered by Mr Carruthers, in Gray's Handbook of British Water Weeds, p. 87, to *S. bellis*. I presume that Ehrenberg's sample is from Lough Mourne, from its containing *Epithemia Hyndmanni* (under the name of *E. luna*), and some other species found in that deposit (although he seems not to have observed *Staur. punctata*, characteristic of it); Ehrenberg says, that it was from the Mourne mountains, in the County of Down, and that he got it from the Countess of Caledon. His second sample, or “probe,” was no doubt from the Mourne mountains, and is that known as “Lord Roden's plate powder,” but I have seen no deposit, from the County of Down, at all similar to Ehrenberg's “erste probe,” or first sample; and have no doubt he was deceived by the name of Mourne being applied both to the mountains of County

appears to be the structure in *Campylodiscus*, and the two genera might almost be united, as proposed by Dr Gregory, did not we find the two extremities and axis of the upper valve in *Surirella*, placed directly over those of the lower valve, while in *Campylodiscus*, the axis of the one valve is at right angles to that of the other. *C. bicruciatius* of Gregory (Micr. Journ., V., Trans. tab. 5, f. 42) exhibits both valves combined, the poles of the one at right angles to those of the other, while his *C. simulans* (fig. 43) is a single valve of the same species, which does not differ essentially from *C. parvulus* Sm.

From *Surirella* must certainly be removed *S. craticula*, although it is not easy to point out what its real affinities are. In the Micr. Journal, VIII., Trans., p. 138, Dr G. C. Wallich considers it a monstrosity, and that it was more allied to *Pinnularia* than to *Surirella*. He had occasionally seen the striation of *Navicula* on it, as well as the "canaliculate structure of *Surirella*." This I have also seen: whenever the *naviculoid* striation occurs, there is a central nodule. In one sample from a peat deposit at Marton (near Skirlaugh, a few miles from Hull), the form with costæ only was not scarce, and was accompanied by a few valves provided with both costæ and the horizontal striation; in the same were *Navicula birostrata* of Gregory, *N. cuspidata*, and *N. ambigua*. All the three, and likewise *S. craticula*, have precisely the same peculiar kind of nodule, which is considerably different from what we usually see in *Navicula*. *N. cuspidata* and *N. ambigua* only differ slightly from each other by the form of the valves, and are certainly the same species. They have parallel striæ; but in *N. birostrata* the valves are slightly more narrow, and the striation is radiating and coarser at the middle. The *S. craticula* agrees in size and shape with many valves of *N. birostrata*; but the striæ are scarcely so radiating, at least in the few valves I have seen with them. Mr G. Norman, of Hull, in his account of the diatoms found near Hull, assigns to it radiating striæ, and, as he

Down, and to the lake in County Antrim. It is probable that the Countess had obtained both when in Belfast. The true Lough Mourne deposit has of late been called by some in London, who prepare slides for sale, the Bellahill deposit, while that again is called by them the Carrickfergus deposit. A deposit is also got at Lough Mourne, in the County of Donegal, remarkable for containing *Nac. Trochus* Ehr. (perhaps a variety of *N. scrians*), sparingly—a diatom also found at Loch Oich, a part of the Caledonian Canal.

collected the sample, he had better opportunities of examining it. My friend Mr Rylands was (at least at one time) of opinion that *N. birostrata* was a mere variety of *N. cuspidata*, and that *S. craticula* was a diseased state of the same. I am not quite disposed to adopt these views; but, from the frequency of *N. birostrata*, where *S. craticula* is also got rather copiously, not only in the Marton deposit, but in a slide I possess from Mr G. Norman, from the ruins of Persepolis, I am inclined to think that *N. birostrata* and *S. craticula* are the two valves of the same species—the former being probably the upper valve. At one time I considered that *N. birostrata* was the lower layer of the valve of *S. craticula*; while the portion with ribs formed the upper layer, as I have mentioned already when alluding to *Cocconeis Grevillei*; and the frequency of valves with costæ and no striæ confirm this view—the chief objection being the usually much more radiating striæ of the one than of the other. It is to be hoped that ere long *S. craticula* may be got in abundance, in a living state, in its breeding ground; for by obtaining entire frustules the mystery at present attending it can only be solved.

I have already alluded to *Denticula*, as allied in some points to *Nitzschia*, and in others to *Tryblionella*, with which it is more closely connected. In the autumn of 1864 Mr Rylands, of Warrington, and I endeavoured to clear up the British species; and I will conclude this paper with a synopsis of them which we then made out. But first let me state that Mr Smith in his observations on *D. obtusa* and *D. tenuis* has rested the specific distinction on what is of no value (the shape of the frustule and valve), and omitted that from the costæ on the valve. In his figure, indeed, he has represented the side view of the frustule, not the valves, and probably this led him to misunderstand the structure.

In some species the costæ are much dilated at the base, and these dilations form ocelli, when the front view (F. V.) of the frustule is examined, similar to those seen in *Epithemia argus*, *E. ocellata*, and a few others. The costæ are attached to one margin only of each valve, and this margin, in the entire frustule, may, in the lower valve, lie either directly under the similar margin of the upper valve or under the opposite margin; in other words, the costæ, in the one case, are attached to the adjacent angles of the same frustule, in the other, to the alternate angles. By striæ or costæ pervious, is meant that they extend from the one margin of

the valve to the other. The only species in which the striæ are not pervious is *D. ocellata*.

A. Frustules not ocellate on F. V. costæ attached to the alternate angles of the same frustule.

1. *D. decipiens* A. & R.—costæ reduced to mere points on the margin; striæ very conspicuous—pervious.

In this species the alternate striæ appear, under a high power, to be coarser or stronger than the others. From the costæ being reduced to mere puncta, this might be referred to *Nitzschia*, but the puncta are on the margin, not an intramarginal angle or keel, and the zone is therefore parallel to the valve. It is more allied to some species of *Tryblionella*, but there is no ridge (or depression) along the middle.

2. *D. obtusa*—costæ (strengthened striæ) tapering from a stout base to a fine point, and extending to the other margin; striæ conspicuous—pervious. This is *D. obtusa*, Sm., but the figure is imperfect. It is not Kützing's species, which is now understood to be *Diatoma vulgare*. Grunow has given good figures of it, under the new name of *Dent. Kützingii*, in the Wien. Verh. for 1862, tab. xii., f. 15 and 27. The frustule varies much in size and form.

3. *D. sinuata*—costæ equally strong, reaching to about the middle of the valve; striæ fine, but conspicuous—pervious.

This species is extremely variable in size and form, occasionally losing entirely the sinuate margin of the valve, which gave rise to the specific name. It is a true *Denticula*, and not a species of *Dineregramma*, as proposed by M. Ralfs. *D. tabellaria* of Grunow appears to be one of the many variations. Rabenhorst has most unnecessarily formed for the two a new genus called *Grunowia*.

B. Frustules ocellate on F. V.; ocelli and costæ attached to the adjacent angles of the same frustule.

4. *D. tenuis*—ocelli conspicuous; costæ pervious, strong, and equally so throughout; striæ conspicuous—pervious.

5. *D. inflata*—same as in the last, but striæ very faint.

These two ought probably to be united. Both present the same variations in the size and form of the frustule and valve. The latter is sometimes extremely narrow, even more so than is represented in Smith's figure, and sometimes almost oval, although usually with acute extremities. Without seeing authentic specimens, it is almost impossible to say to which Kützing's species

belong, or, perhaps, some of his samples belong to the one, some to the other, and his *D. tenuis* is probably that of Smith; his *D. frigida* is referred to the same by Grunow, and as Grunow describes the striæ, he must be correct; but specimens which I have seen named by Kützing belong to *D. inflata*, that is, have very faint striæ, not visible under a good $\frac{1}{4}$ th lens, but when seen with higher powers, are not more close than in *D. tenuis*. *D. thermalia* of Kützing is also involved in doubt. Some specimens named by Kützing, which I have seen, have the striæ conspicuous, and belong to *D. tenuis*, Sm.; others from Puy de Dôme have them extremely faint, and are to be referred to *D. inflata*. Grunow takes no notice of the striæ in his short description, but seems to represent them in his figures. *D. elegans*, Kütz., as far as I can make out by Grunow's description of the costæ and striæ, is the same as *D. tenuis*; it is certainly not *D. ocellata* of Smith, as supposed by Grunow and Rabenhorst. *D. subtilis* of Grunow, according to his figure and description, appears to me to be also a mere state of *D. tenuis*, enfeebled by growing in brackish water. The shape of the valve, and number of costæ in $\cdot 001$, afford no good characters. The latter vary from 8 to 20 in $\cdot 001$; the striæ are more constant, being about 40 in $\cdot 001$.

6. *D. ocellata*—ocelli conspicuous; costæ strong, uniting before reaching the middle (about one-third across the valve), and forming false ocelli, or apparent perforations, then expanding and forming a plate over the rest of the valve; striæ fine, reaching about two-thirds across the valve. The peculiarity of this species is in the costæ, after leaving the margin a little way, expanding and forming a plate, but leaving a nearly circular space, bounded by the two costæ on each side, between the margin from which they originated, and the place from where they expand. The name was taken, not so much from the ocelli on the F. V., which *D. tenuis* and *D. inflata* also exhibit, but from the apparent perforations (or ocelli) near the one margin of the valve. Such have been seen in no other species. I have seen no specimens, except from the locality mentioned by Smith.

APRIL 28TH, 1868.

Hugh Colquhoun, M.D., President, in the chair. Mr James Young was elected a resident member.

SPECIMENS EXHIBITED.

Two specimens of the ringed or bridled Guillemot (*Uria lombyana*), in winter plumage, were exhibited by Mr J. Gilmour, who shot them, in the beginning of April, in Kilbrannan Sound.

Mr Gray, the secretary, remarked that after having carefully examined thirty or forty specimens of this bird, he could perceive no distinction in any one specimen entitling it to rank as a separate species, some of the common guillemots having the rich brown colour on the head and neck which is said to distinguish the ringed birds, while the latter possess, in many instances, a stout bill, besides other characters belonging to the common species, thus reversing or interchanging the supposed distinctive features. Mr Gray further remarked that this ringed variety occurs now in considerable numbers on the western shores of Scotland, especially as we recede towards the outer Hebrides. On Ailsa Craig it is found every year; and during the time the tacksman and his assistants are snaring the sea fowl, they get on an average three specimens in a week. On Handa, an island off the west coast of Sutherlandshire, it also occurs in tolerable abundance, being found mixing with the other species in the proportion of one to a hundred. But in the outer Hebrides it is even more plentiful. At Barra Head, for example, where there is a series of magnificent cliffs, rivalling Ailsa Craig in grandeur and extent, the proportion is one in fifty. On the east coast of Scotland generally the variety is very rare, and is now but seldom, if ever, observed on the Bass Rock, although it was found there on one or two occasions many years ago. Nor does it appear to frequent St Abb's Head, one of the principal nurseries for sea fowl on that side of the country. Looking, then, at the fact of the ringed guillemot being confined, at least in numbers, to the west coast, and seeing that as we make our observations towards Sutherlandshire, and recede from Scotland by way of the Long Island or outer Hebrides, it becomes still more numerous, we are led first to infer that even a variety may become established in a particular locality, and then to conclude

that the head-quarters of this variety is somewhere to the north-west of Great Britain.

Dr Stirton exhibited specimens of *Grimmia elongata* (new to Britain) from the neighbourhood of Glasgow, and *Trichostomum littorale* (Mitten) from Tigh-na-bruaich.

PAPER READ.

On Certain Aspects of the Grouse Disease.

By Professor JOHN YOUNG.

Dr Young recorded the result of several observations he had lately made while dissecting grouse, with a view to ascertain the cause of death. He exhibited a portion of the small intestine, completely plugged by a dense mass of tapeworms. He also described the appearance presented by three other specimens of grouse, which had died of the so-called grouse disease on a moor in Argyleshire. In all there was extensive inflammation of the peritonæum; in three, more or less adhesion of the intestines to each other and to the abdominal walls; in two, perforations had taken place through the adherent surfaces, the length of the tract from gizzard to anus being thus reduced. In these last two (red grouse) tapeworms were abundant; of the other two (black grouse) one contained only a single tapeworm, the other was wholly free of them. The two species were further contrasted, in that the intestines of the red grouse presented their normal calibre, their muscular substance being softened (this being probably a pathological condition, though possibly increased by post-mortem change), whereas those of the black grouse were very much dilated and translucent. Moreover, of these two the younger presented the earlier stages of peritonitis, granules of lymph occurring in patches over the surface. Dr Young considered these appearances as supporting the view that the disease in no way depended on the presence of the entozoa, but that the peritonæal inflammation was the true cause of death. Having had opportunity of examining fatal cases in different parts of the country, he had come to the conclusion that the mortality is not dependent on local conditions, but that the disease is the result of some general cause operating equally on birds placed under very various conditions. The mortality is, in fact, due to mal-nutrition, to a cachectic state transmitted from parent to offspring, and predisposing the young

to suffer from influences such as severity of seasons or temporary scarcity of food, which under other circumstances they would have resisted successfully. Concerning the cause of that cachexia, Dr Young had not formed an opinion—had only observed its relation to the amount of shooting over certain moors. An explanation had been given by Mr Gray, which seemed to meet all the difficulties of the case, being founded on the history of the species in time, and on the peculiar circumstances in which the birds are placed in this country. Dr Young concluded by asking for further specimens from those who might have the opportunity to send them, with a view to the preservation of a suite of specimens, illustrating the stages of the disease.

Mr Gray, the Secretary, observed that, in reviewing the widespread ravages of this disease, it was necessary, before forming a judgment, to consider the changes which over-protection had brought upon the life of the red grouse. The almost total annihilation of its natural enemies had, to a certainty, induced a greater number of sickly birds, and ultimately a weaker race had sprung up in districts where formerly only strong birds prevailed. Buzzards and hawks, etc., if allowed to live, would have captured both the sick and wounded, and thus have prevented the perpetuation of a degenerate breed; and if sportsmen would only content themselves with a moderate bag, and allow part of the feathered stock on their moors to become the prey of animals ordained by Nature to play an important part in their own particular sphere, we should have fewer instances of disease to chronicle. Nature, in her arrangements (continued Mr Gray), is very nicely balanced, but when, by man's interference, that balance is deranged, it is impossible to calculate the evils that may follow. The red grouse, therefore, wholly confined as it is in its geographical distribution to the limited range afforded by the mountain tracts of the British Islands, is in a somewhat perilous position as a species. Rigorously protected for two-thirds of the year, it is suddenly subjected to a destruction which has almost no parallel; and, looking to these periodical outbreaks of disease, combined with this annual slaughter through which the bird passes, it does not seem inconsistent with common sense to predict its extinction altogether. In the struggle for life, certain species have been known before now to be restricted to narrow limits before their final disappearance; and, bearing this fact in mind, it would be well for the holders of moors to consider

the propriety of trying some other plan for prolonging the life of this fine bird than the very questionable one now in force.

MAY 26TH, 1868.

Hugh Colquhoun, M.D., President, in the chair. The following gentlemen were elected resident members:—Messrs James S. Dixon, Frank Bott, Alexander Murdoch, and Gavin A. Gilchrist.

SPECIMENS EXHIBITED.

Mr David Robertson exhibited a large quantity of marine *Entomostraca*, which he had procured off Millport in somewhat peculiar circumstances, and communicated the following notice of their occurrence in that locality, as observed by himself:—"During the whole of last week, shoals of herrings were noticed on the surface of the water in the Bay of Millport. Being out in the bay, I happened to find myself in the middle of one of these shoals, which appeared to be about twenty or thirty feet in diameter. The splashing of fish on the surface caused a commotion in the water like the boiling of a pot, and at times the shoal spread itself over a circular space, without seeming to move in any particular direction, disappearing after a short time, and rising again at some distance. At other times the entire shoal moved on the same course, sometimes for a short distance in a straight line, then it would curve to one side, or turn round altogether, occasionally varying its movements by breaking up into two companies, and again disappearing. On rowing into the midst of a shoal, I observed the water to be swarming with minute, reddish-coloured bodies, and by drawing a hand-net, which I happened to have at hand, along the surface for a few feet only, was surprised to find it crowded with small entomostracans, which, in all my experience, I have never found so profuse in quantity. On using the net, however, at some distance from the shoal of fish, these minute crustacea, although present, were not in any quantity, showing that the herrings congregated over the spot where the entomostraca were most abundant, and that they were following and devouring them as a favourite prey." Mr Robertson also drew attention to the fact of this food of the herring being found in immense abundance on many of the

West Country lochs, and pointed out that the quality of the herrings of Western Scotland, when compared with those of the East coasts, was perhaps owing to this rich kind of feeding—the *Entomostracans* which he exhibited showing a considerable proportion of oily substance in their composition. He then instanced other fishes, from the stomachs of which he had repeatedly taken large numbers of certain species of *Entomostraca* and *Echinoderms*, remarking that he had found them, as a rule, feeding on the recurrent products of the season with apparent regularity, which would account in a great measure for the fickleness exhibited by certain kinds of fish known in the experience of the trained and practised angler.

Mr Gray, the secretary, exhibited a specimen of the Fork-tailed Petrel (*Thalassidroma Leachii*), which was found on the beach at Roseneath in the early part of this month, and obligingly forwarded by Mr Alex. Martin. This species, which was originally discovered about fifty years ago by Mr Bullock, on the island of St Kilda, has since been found breeding there in a colony under the loose rocks; but it has only recently been traced to the island of Rum, where it is now known to breed in similar situations. Mr Gray remarked that of the numbers of petrels blown on shore on the western mainland, this bird was even more frequent than the common storm petrel (*Thalassidroma pelagica*). It had been found on Benbecula, one of the outer Hebrides, on the Isle of Skye, and repeatedly on the Island of Rum. It had also been obtained at Dunoon, and would no doubt be found in most of the localities frequented by the more familiar species. It is somewhat curious that none have as yet turned up on the east coast of Scotland. A stray example appears to have been obtained in Caithness, upwards of thirty years ago, by Dr Sinclair, of Wick, in whose possession it was seen by the late James Wilson, of Woodville. It appears, therefore, to be strictly a western species; and possibly the colonies of St Kilda, and the less remote Island of Rum, are American settlers gradually extending their habitats, and likely to spread themselves to other suitable rocks nearer the mainland as the outermost ones become over-populated.

SESSION 1868-69.

THE SEVENTEENTH ANNUAL GENERAL MEETING,
ANDERSON'S UNIVERSITY BUILDINGS, SEPT. 29TH, 1868.

Professor John Young in the chair. The following gentlemen were elected office-bearers for the ensuing session:—Hugh Colquhoun, M.D., President; Professor John Young, David Robertson, Vice-Presidents; Robert Gray, Secretary; Thomas S. Hutcheson, Treasurer; James A. Mahony, Librarian. James Stirton, M.D.; John Grieve, M.D.; Thomas Chapman, Edward R. Alston, William Euing, Walter Galt, George Thomson, W. N. MacCartney, Members of Council.

PAPER READ.

On the Present Character of Zoological Research.

By Professor JOHN YOUNG, M.D.

In this address, Dr Young explained the doctrine of Evolution as at present understood, and the mode in which development and genealogical succession are treated as synonymous.

OCTOBER 27TH, 1868.

Professor John Young, Vice-President, in the chair. Professor Alexander Dickson, Glasgow University, and Mr Henry Dunbar, were elected resident members.

SPECIMENS EXHIBITED.

The Secretary exhibited a specimen of *Leptæna Youngiana*, of Davidson—a new Silurian brachiopod shell from the Girvan district. Three examples of this undescribed species had been collected during the past summer by Mrs Robert Gray, and submitted to Mr Davidson, of Brighton, who named it after Mr John Young, in consideration of the valuable aid received from him during his researches among the *Palæozoic Brachiopoda*. *Leptæna Youngiana* is distinguished from others of the same genus

by the transverse rugose ridges on the ventral valve, which is regularly convex, with an incurved beak. The dorsal valve is deeply concave, following closely the curvature of the opposite valve, giving the shell very much the appearance of a productus.

Mr Gray likewise exhibited a slab of Silurian shale, containing numerous specimens of *Entomostraca*, belonging to the genus *Leperditia*, and remarked that, so far as he was aware, it was the first example of *Entomostraca* having been found in the Girvan district—none, at least, having occurred during the last seven or eight years of constant observation in that particular field. The slab was taken from the mass at Aldons Quarry, about seven miles south of Girvan. The species of *Leperditia* had not yet been determined.

Professor Young exhibited some specimens of Moa bones recently presented, by Mr Wilkie Morris, to the Hunterian Museum, on which he offered a few remarks.

Mr J. Gilmour exhibited a very unusual specimen of the black grouse (*Tetrao tetrix*), which he described as a female (the grey hen) assuming the plumage of the male. The head and neck were exactly those of a grey hen, the rest of the plumage resembling that of a young male, the lateral tail feathers showing a tendency to curve outwards. Mr Gilmour mentioned that the bird was proved to be a female on dissection.

Mr William Lorrain exhibited a specimen of the rose-coloured pastor (*Pastor roseus*)—a male of the second year—which was shot on the farm of Hundred Acres, near Glasgow, on the 7th of August last. It had been seen previously associating with a troop of common starlings. Mr Lorrain also exhibited a specimen of the Great Spotted Woodpecker (*Picus major*) which had been shot at Ardgowan, near Inverkip, about the 17th of the present month. The species but rarely occurs in the west of Scotland; but in the eastern counties it appears to have become a regular winter visitant for some years past, making its appearance occasionally in very large flocks. Many hundreds had this year been seen in Orkney and Shetland, and larger flights than usual appear to have visited various districts of the north of Scotland.

Mr J. A. Mahony exhibited an undescribed variety of *Laminaria digitata* from county Galway. It presented no apparent structural difference from the true *Laminaria digitata*, but had the peculiarity of producing mannite on the surface of the frond after being

exposed for a few days, while the normal form bears an efflorescence of saline compounds, chiefly salts of potash and soda. Besides, while the frond only of the latter is annual, and cast off every spring, this variety becomes detached a short way down the stem, and thus the whole frond, with part of the stem attached, is thrown on shore in May when the plant is ripe. Mr Mahony also exhibited illustrative specimens of *L. digitata* and the variety *stenophylla*.

PAPERS READ.

I.—*Notes on a Botanical Tour, with Mr W. Galt, to Ben Lawers.*

By Dr JAMES STIRTON.

In the course of his remarks, Dr Stirton exhibited a collection of rare mosses, chiefly of the genus *Hypnum*, ten of which had hitherto been found in this country only on Ben Lawers. Among these were two species new to Britain—*Brachythecium Starkii* and *Hypnum Bambergi*—the latter having been found in 1867, in the same locality, by Dr Fraser, Wolverhampton, and one new to science—*Plagiothecium annotinum*. Besides these, *Hypnum imponens*, new to Scotland, was also found.

II.—*Notes on Dytiscus Lapponicus (Gyllenhal) collected in Ireland during the present Autumn.* By Mr JAMES E. SOMERVILLE, B.D.

All who, with naturalist's eye, have stooped and peered into marsh or quarry hole, ditch or pool, must be familiar with the large water beetle *Dytiscus marginalis*; for though in Scotland he is less abundant than in the southern portion of the island, yet he is plentiful enough to have found a place, for a time at least, in all our fresh water aquaria. And surely none can there have observed the graceful lines of his build, the wonderful structure of his patent floats, with their regular and simultaneous action, the curious arrangement of the windsail or ventilating apparatus, the strange anchoring appliances on the fore limbs of the males, without being forced to admire the wisdom and skill of the Architect and Builder of this little living ship, and its remarkable adaptation to the element it is intended to navigate. But in spite of all these points of attraction, *D. marginalis* is generally soon expelled the aquarium. The newts succumb to his voracity, and even the minnows find his powerful jaws the plague of their lives.

D. marginalis may be taken as a good type of the genus, of which

Europe possesses nine species, six of which are found in Britain. In nearly all the species the females may be distinguished from the males, by the elytra of the former being deeply sulcated, while those of the males are smooth. Another distinction which characterises the males of *Dytiscus*, and the three allied genera, *Cybister*, *Hydaticus*, and *Acilius*, is the curious patellated form of the anterior tarsi, the three upper joints being expanded into a circular disc, on which are placed a number of suckers by which the creatures are enabled to attach themselves to smooth surfaces.

In Scotland there occurs in our ditches, besides *marginalis*, another species, *punctulatus*, easily recognisable by its deep black hue both above and below, by the three distinct rows of punctures on the elytra, and by the rounded form of the hinder coxae. Scotland possesses yet another species, *Dytiscus Lapponicus*. It was first discovered in 1854 by the Rev. H. Clark, who obtained, with much difficulty, four specimens from a loch in the island of Mull. The species may easily be distinguished from *marginalis*, and indeed from all others, by its diminutive size, by its slender and elongated form, by its yellow scutellum, by the very acute form of the hinder coxae, but chiefly by the great number of faint yellow lines on the elytra, each elytron bearing from eighteen to twenty of these. These lines are not so apparent in the dried specimens, but they are quite remarkable when observed while the creature is under water. They appear as if shining through from the under side of the somewhat transparent wing cases. Mr Hislop of Polmont, one of our honorary members, was the second to take the insect. He obtained a few specimens also in Mull.

In 1859, while on a tour through the south of the same island, my brother and I took fifteen specimens in a very small tarn, after a long and unsuccessful hunt in many mountain lakes.

Again, in 1866, happening to be at Tobermory, in the north of Mull, I made a careful search of *all* the lakes in the neighbourhood, and that is saying not a little, but was quite unsuccessful. The last night of my stay in the island, I recollected having seen from a considerable distance what appeared to be a small tarn, and which I had not yet searched. Unwilling to give up while any hope remained, I started off, and on reaching the place found a lake different from any I had yet visited. It was situated on the top of a curiously shaped hill, standing somewhat alone. The

lake was sunk down deep into the centre of the hill, so that it was possible to see the open country from only one spot. The place reminded me of the Devil's Punch Bowl, or of the crater of Vesuvius, and, indeed, it looked uncommonly like the crater of an extinct volcano. I noticed that no stream seemed to issue from the lake, and further, that there seemed to be no trout in it. In all the other lochs trout abound, which explained the absence of *Hydrulephaga*, as trout and *Dytisci* cannot compete. *Dytiscus* must go to the wall, or more correctly to the stomach.

I observed several newts swimming about fearlessly, and very soon a Devil's Coach, as the larva of *Dytiscus* is well named, appeared; and after searching round the edge for a few minutes, I was rewarded with the sight of the insect sought. I immediately made the capture, and commenced a regular hunt, which was stopped only by darkness coming on. I came away with all my collecting bottles full.

This summer (1868) during the month of August, I happened to be in the north of Ireland, in the county Donegal, and in passing through that wild and bleak district, cast occasional glances into some of the innumerable lakes and tarns with which its hill-sides and moors are studded, but with little success. Happening one day to pass a small tarn, pretty high up on the hill-side above the sea, and observing that no stream appeared to issue from it, and that there was no indication of its containing trout, I gave a somewhat careless glance into it. I was not a little astonished to observe, almost on the instant, a *Dytiscus* slowly paddling along. It was immediately recognised as *Lapponicus*; and I have now much pleasure in recording the first capture of the insect in Ireland. Unable to spend much time looking for more specimens that day, I returned the following one. A fearful day of wind and storm it was. There was something rather eerie, I confess, in standing alone on a bleak hill-side in torrents of rain, up to the knees in the loch, the wind hissing along the surface of hill and lake, lifting the water in spray, while the Atlantic roared and thundered on the cliffs below. In spite of the difficulties of the day, I managed, however, to secure a goodly series of specimens.

Let me say a few words now about the habits of the insect. *Dytiscus Lapponicus*, as its name imports, is a truly hyperborean species. It occurs in the lakes of Norway and Sweden, and also

in northern Germany. Its occurrence in the north of Scotland was therefore a thing not so improbable; but it is interesting to find this boreal species appearing so far south as the S.W. of Donegal.

D. Lapponicus differs somewhat in its habits from *marginalis* and its congeners. *D. marginalis* seems to prefer marshes and ditches, where there are plenty of water plants; *Lapponicus* chooses rather an open lake or tarn; at least the three times I have met with it, the pieces of water have been almost devoid of vegetation. But while *Lapponicus* dislikes botany, it makes selection as to geology. A soft and muddy bottom does not suit it; it always chooses a lake where there are plenty of stones, and it is the observance of this fact which has enabled me to take it pretty freely. Instead of sweeping along the banks of the tarn, or scouring the bottoms of pools with the net, my plan is this:—Going to the shallow and stony end of the lake, and putting myself into the condition of a heron, I carefully turn over the stones, causing as little disturbance as possible, and there beneath the stones, or clinging to them, the insect is found. I have taken as many as four beneath one stone. They seem capable of taking very long breaths, or else of collecting oxygen from the diminutive vegetation which clothes the stones, as I have very seldom observed them coming to the surface to breathe.

I would infer from this habit of lurking beneath stones that *D. Lapponicus* may probably be nocturnal in its habits, as is known to be the case with another water-beetle, *Oreochilus villosus*, an insect allied to the *Gyrini*.

D. Lapponicus seems to be very local, and, it might almost be added, gregarious; for while it occurred freely in one tarn, I searched several others in the neighbourhood without success. It is also remarkable that in the loch where it was obtained, there were very few, I might say almost no other insects, although in the neighbouring peat-holes *Hydropori*, *Gyrini*, etc., were plentiful.

Another fact which struck me was, that in the lake only *D. Lapponicus* occurred, while a few yards farther up the hill, on putting the net down into a mass of floating water plants, the first haul brought up four or five *Dytiscus marginalis*, which looked quite gigantic beside their lake cousins. There was no *marginalis* in the lake, only *Lapponicus*, and no *Lapponicus* in the peat-hole, only *marginalis*.

I must not omit to notice the remarkable numerical disproportion between the males and females of this species. In regard to *marginalis* and *punctulatus*, so far as my experience goes, the two sexes are about equally numerous. Not so with *Lapponicus*. On the three occasions when I have met with it, the females have been conspicuous by their paucity—the proportion being rather more than five males to every female. I am at a loss to account for this remarkable disproportion.

One theory I would suggest is this:—The males of the genus, as I have observed, are smooth, while the females have the elytra sulcated, each with ten furrows. In *D. Lapponicus*, as noticed, the elytra are beautifully streaked with yellow lines, and when the creature has but recently emerged from the pupa, these markings are particularly distinct. I was much struck, while observing some of the males clinging to the bottom, by the very remarkable resemblance they presented to the leaf of *Potamogeton natans* when dead and half withered. The streaks of the elytra corresponded almost exactly with the veins of the leaf. May not this strange resemblance to the leaf of *Potamogeton*, which was the only plant which attracted my notice in the tarn in Ireland, be the means of preserving the males from the attacks of herons, gulls, and other enemies, while the female, not having the resemblance so strikingly, is without this shield, and so falls a prey more easily?

Should this explanation prove to be correct, *Dytiscus Lapponicus* may be looked upon as an interesting exception to the ordinary course of nature. The general rule is that when there is “imitation” or “mimicry,” it is the female more particularly which gets the benefit of the shelter. But in the present case it is the male which obtains the advantage; the other sex being left in the condition of unprotected females.

NOVEMBER 24TH, 1868.

Mr Thomas Chapman in the chair. Messrs William Haddin and James D. Dougall, jun., were elected resident members.

SPECIMENS EXHIBITED.

The Secretary exhibited the following birds which had been obligingly forwarded by William Boyd, Esq., Greenock:—

1. A specimen of the Hawk Owl (*Surnia funerea*), which was taken in the flesh to a Greenock bird-stuffer about ten days ago for preservation, and is supposed to have been captured at no great distance from that town. This is the fourth specimen that has occurred in the mainland of Britain, and the sixth Hawk Owl that has been captured as British, taking into account two specimens recorded by Dr Saxby, of Baltasound, as having been procured in the Shetland Islands.

2. A specimen of the Great Snipe (*Scolopax major*), shot by Mr Boyd on the 15th September last, in the parish of Stewarton, Ayrshire.

3. An unusually dark-coloured specimen of Richardson's Skua (*Lestris Richardsonii*), shot last winter in the Hebrides. This specimen was exactly in the uniform shade of plumage figured in Swainson's "*Fauna Boreali-Americana*," pl. 73.

Dr Dewar exhibited a handsome variety of the Pheasant, apparently a cross between *Phasianus versicolor* and *P. Colchicus*, obtained this month at Skipness, Argyleshire, and stated to the meeting that he had another specimen of this variety in his collection from Culzean grounds, Ayrshire.

Mr J. Coutts exhibited specimens of the common Silk-Worm and its products, from a second brood reared in Glasgow during the present year, on which he made a few remarks.

Mr J. Young exhibited from his own collection ten species of *Goniatites*, and made some observations on this interesting group of extinct, chambered, fossil shells, pointing out their relationship to the extinct family of Ammonites, their distribution in time, the manner of their occurrence, and the various species found in the carboniferous limestone of Scotland.

Mr William Lorrain exhibited a specimen of the Great Grey Shrike, or Butcher Bird (*Lanius excubitor*), from near Lochwinnoch, where it was shot a few days ago when in company with another bird of the same species. In the course of his remarks on this bird, Mr Lorrain stated that it occurs but rarely in the West of Scotland, but was now becoming well known in the eastern counties as a winter visitant, the specimens met with being generally females and young males. Mr Gray had informed him that out of a dozen specimens obtained by himself, only one could be said to be a male in a perfect state of plumage. Mr Lorrain expressed his obligations to Mr M'Culloch, bird preserver,

Sauchiehall Street, for the opportunity of submitting the specimen to the meeting.

Mr William Sinclair exhibited a specimen of the Green Sandpiper (*Totanus ochropus*), shot on the 10th November on the banks of the river Cart, near Pollok House, by Mr William Cox, keeper on the estate. The Secretary, in his remarks on this specimen, stated that, so far as he was aware, it was the first instance of the species having occurred on any part of the western mainland or its island dependencies. It had, however, been found in Aberdeenshire by Mr W. C. Angus, one of the society's corresponding members, and was supposed to have bred in that county; also in East Lothian, by Dr W. P. Turnbull; in Caithness shire, by Dr Sinclair, of Wick; and in Dumfriesshire, by Sir William Jardine and the late Mr Selby. Very little appears to have been recorded of its habits as a British species; and it is only within the last year or two that anything reliable or definite has been ascertained regarding the nidification of the species.

Mr Arthur Sutherland exhibited a variety of the Alder (*Alnus glutinosa*) from Evanton, Ross-shire; also, an aberrant form of *Geum rivale*.

PAPERS READ.

I.—*Short Notes on the Habits of the Parson Bird (Prosthemadera Novæ Seelandiæ), and the Great-Headed Titmouse (Petroica macrocephala).* By Mr ALEX. J. GRANT, Otago, N.Z., Corresponding Member.

II.—*Notes on some Land and Fresh-Water Shells from Egypt and Palestine*—with illustrative specimens.

By Mr JAMES E. SOMERVILLE, B.D.

III.—*Notices of the Recent Occurrence of Rare Birds in Aberdeenshire.*

By Mr W. C. ANGUS, Corresponding Member.

The principal facts alluded to in this paper were the breeding of the jacksnipe in that county; the occurrence of the honey buzzard (*Pernis apivorus*); little bittern (*Ardea minuta*); and great spotted woodpecker (*Picus major*)—the last named having apparently been seen and obtained in unusual numbers this year.

DECEMBER 29TH, 1868.

Mr Walter Galt in the chair. Messrs James Stewart and William Knox Gilchrist, were elected resident members.

SPECIMENS EXHIBITED.

1. A specimen of *Astrophytum scutatatum* from lat. 73 5 N., long. 75 40 W., at depth of 250 fathoms; also a series of varieties of *Valvata multiformis* from Mayence basin, by the Rev. H. W. Crosskey.

2. A specimen of the Cream-coloured Courser (*Cursorius Europæus*), which was shot in a grass field near Lanark by Charles Walker, Esq., of Braxfield House, on the 7th of October last. This is the first record of its occurrence in Scotland. The species is extremely rare in the British Islands, and is but seldom met with in any part of Europe.

3. A specimen of the Osprey (*Pandion haliaëtus*), shot near Larbert in October last, and forwarded by J. A. Harvie Brown, Esq., corresponding member.

4. A series of specimens of *Bryum cirrhatum* from Ben Lawers, a species new to Britain, by Dr James Stirton, who made some remarks on the variations of inflorescence on this and allied species.

JANUARY 26TH, 1869.

Professor John Young in the chair.

SPECIMENS EXHIBITED.

The Secretary exhibited a series of post-tertiary shells from a clay bed in Inch Lonaig, Loch Lomond, forwarded by Alexander Macniven, Esq., corresponding member. The series included specimens of *Astarte sulcata*, *Balanus porcatus*, *Cyprina Islandica*, *Natica affinis*, *Pecten Islandica*, etc., besides spines of *Echini*, flints, etc.

Mr David Robertson exhibited a number of specimens of the gemmeous dragonet (*Callionymus lyra*), from the shores of Cumbrae, and remarked that about three years ago a friend of his had taken nearly two dozen specimens of this uncommon fish in one day. Mr Robertson also exhibited a specimen of the black-mouthed dog-fish (*Squalus melustoma*), a rare species, taken by one of the Cumbrae fishermen on their usual fishing ground in the Firth of Clyde. In adverting to the various uncommon and important objects that have already been recorded from the Firth of Clyde,

Mr Robertson advocated, as a means of increasing our knowledge of marine animals, the formation of branch societies in seaport towns, where the labours of seafaring persons could be made advantageous to science. By giving fishermen and others a personal interest in their discoveries through membership, the results, he argued, would tend to stimulate them to industry, and have a more elevating effect than the mere reward of an occasional shilling, besides securing for scientific purposes many valuable objects that are too often thrown back into the sea as worthless.

Professor Young exhibited an unusual dental malformation of the common hare, on which he made some remarks.

Mr Gray, the Secretary, exhibited a specimen of the Velvet Scoter (*Oidemia fusca*), which had recently been shot on the Gareloch, and made some remarks on the distribution of the species in Scotland. Although a common bird on the eastern shores, it is comparatively rare in the west. Its food consisted solely of shell-fish, and for the most part these were bivalves. In the specimens he had dissected he had found large quantities of a species of *Donax* with a very thick shell, which, however, was generally broken into small pieces. Mr Gray also drew the attention of the meeting to a pair of handsome Goosanders (*Mergus merganser*) which had been sent for exhibition along with the Scoter by Mr M'Culloch, taxidermist, Sauchiehall Street. These were both from Argyleshire. Although the fact of the Goosander breeding in Scotland has lately been called in question, sufficient evidence was laid before the meeting to show that in the Outer Hebrides at least it had been taken during the nesting season on several occasions.

Mr John Young made some remarks upon a specimen of *Poterioceras*—a large chambered cephalopod shell belonging to the *Orthoceras* group. This gigantic shell, which appears to be one of the largest examples of the genus yet recorded, was found in the carboniferous limestone at Dunswood, Cumbernauld, and presented to the Hunterian Museum by Thomas Clement Waddell, Esq. The specimen, imperfect at both ends, measures 21 inches in length by 11 in breadth, but when perfect would measure 3 feet. It possesses a large-beaded siphuncle, which measures $2\frac{3}{4}$ inches in diameter, and is composed of radiating plates. From the broadly curved wave of the septa, and their distance from one another, it is concluded that this large shell belongs to an undescribed species.

Mr Young also exhibited specimens of a beautiful and rare land shell—*Azeca tridens*—found among moss in the woods at Bridge of Allan last autumn by Mr Foulis, student of Glasgow University. The occurrence of this shell in Scotland has been doubted, although the late Dr Fleming, of Edinburgh, states that it was found a great many years ago by Captain Laskey, at Carline Park, near Leith. Mr Young stated that so far as he was aware no further notice of its occurrence in Scotland had been recorded until Mr Foulis' discovery of this new locality, where it appears to be not uncommon.*

Dr James Stirton exhibited a series of mosses collected by Dr Alexander M'Hattie (lately of this city), illustrative of the close affinities of the lower forms of vegetation on both sides of the Northern Atlantic, between the parallels of latitude 50° — 60° .

PAPERS READ.

I.—*Notes on the Herring.* By Mr DAVID ROBERTSON.

The capricious movements and behaviour of the herring have long been a puzzle both to fishermen and philosophers, and may so remain for a long time to come. The most common of these freaks are the occasional appearance of the herring at, and desertion of, particular shores. These, however, do not bear directly on the few remarks that I am going to make, and I may therefore refer only to one or two cases, which embody the chief characteristics of a long list of peculiarities. There is so much told by the fishermen of the marvellous habits of the herring, that in the absence of well authenticated facts, it is difficult to know what to believe or what to doubt.

The following is a quotation from Mr Mitchell's well-known work on the herring:—

“From 1690 to 1709 a very extensive fishery was carried on at Cromarty, whither the herrings annually resorted in considerable abundance. Shortly after the Union, 1707, an immense shoal was thrown, or rather ran themselves, ashore in a little bay to the east of the town. The beach was covered with them to the

* Mr Foulis has this summer revisited the station, and found the shell in such abundance, that in a patch of moss, not more than three or four feet in length, he succeeded in obtaining upwards of 300 examples, which fact confirms former statements as to its gregarious and comparatively local distribution.

depth of several feet, and salt and casks failed the packers. The residue was carried away for manure by the farmers in the neighbourhood. Strange to say, however, they again left the frith in a single night, and no shoals again made their appearance for more than half a century."

Again, at "Loch Boag, a considerable arm of the sea in Lewis Island; before the middle of the eighteenth century, this loch was well known for its herring, they being considered of good quality. About 1750 the herring left it, and seem not to have returned till about 1790, when for a series of years thereafter there was a very regular fishing during the months of November, December, and January. In 1797 the herrings discontinued their visits; but after the lapse of thirty-two years they returned in the autumn of 1829 in considerable quantities, and in late years the fishing has been frequently abundant." (*Stat. Account of Scotland*, vol. xix., p. 252; *Phil. Journal*, No. 15, 1830.)

This season, on the evening of the 26th of June, I went out with a party to fish herring with a line in the bay of Crinan. Our boat might only be about fifteen or sixteen feet keel; one of the party rowed the boat, while four fished with one line each. The tackle is constructed by having a thick wire, about two feet long, with a piece of lead at the lower end to sink it in the water, and an eye on the upper end to attach the line to, with two wires or pieces of whalebone a foot or so long, fastened by the middle across each other to the upright wire, from which they stand out in four rays at right angles, and other two tiers are repeated in the same way, one above the other about eight inches apart. From each end of the cross wires or rays, a short line with a hook is attached, which comes a little short of the tier next to it, but on the hooks neither bait nor fly is placed—it is more a kind of grappling apparatus than line-fishing gear. This is let down over the side of the boat where herring are expected to be, and, at various depths, is jerked up and down, and if it gets among a shoal of herring, they appear to be readily caught on the hooks, sometimes by one part and sometimes by another. Occasionally the hooks come up nearly or wholly filled; at other times with one, two, three, or four, and so on; always when there is most on, they are soonest on, and then the sport becomes "fast and furious." In the hurry to get off the fish the hooks are often roughly handled, and not unfrequently broken, and sometimes the tackle

is again heaved overboard before it is entirely cleared of the fish that are upon it, while some of the lines are bare of hooks altogether before time is spared to replace them. This arises from the uncertainty of the movements of the herring. They may be got for a few minutes as fast as they can be taken, and immediately afterwards not one is felt; hence the eagerness to "make hay while the sun shines."

This mode of fishing is advantageous when a few boats are out at the same time. They are less liable to lose the shoal, because when one boat is seen taking fish plentifully, other boats not having the same fortune gather near to it, and by this means they are enabled to track and keep longer on the shoal. The take was expected to last only during twilight. We were on the station from half-past eight till near eleven. The fish were met with plentifully from nine till a little past ten, and at various depths, from near the surface to seven or eight fathoms. Our take was within three or four of three hundred. But the part that bears most on our subject is the result of two boats trawling in the bay at the same time. Although all the boats that were fishing with the lines were successful, and there might be about a dozen, the trawlers had but a few over three hundred between them. The fishermen ruefully expressed their inability to understand it, as the herring were round them in great abundance.

Captain Kerr, who had been long connected with the herring fishery, related to me the following singular trait in the habits of that fish, which seems to bear in some degree on the above case:—On one occasion, when the net was hanging perpendicularly down, a large shoal of herring came within a few inches of it, but not one *struck*—that is, in the fisherman's phrase, not one came in contact with the net, all remaining for a time stationary a few inches from it; and so straight and regular was the wall of herring noses, as far as could be seen down, that it could have been fancied that each was kept in its place by some unseen agency.

That different shoals of herring frequent the same ground at different seasons, we may, I think, reasonably infer from the following statement by Mr Mitchell. In criticising some remarks of Professor Valenciennes of Paris, he says:—"It is true that the herring fished in winter or the end or beginning of the year on the coast of Norway are very large in size, and that some are $13\frac{1}{2}$ inches in length, but in summer large shoals of another description

of herring, not young herring, but with milt and roe, approach the Norwegian coasts, and are fished in considerable quantities." Again, quoting Billing's expedition to the northern regions, he says:—"The herring appear in great shoals in the bay of Avatska towards the latter end of April, and remain till the beginning of June. They seem to come in shoals in both spring and autumn, there being a considerable difference in size, the spring herring being much the largest."

That different shoals of herring, in different conditions, frequent the same ground about the same time, appears most likely.

I am told that herring are generally fattest on a particular coast, at a particular season of the year, but that does not hold good with all the herring met with on that coast; some may be taken at one time moderately poor, and in a few days afterwards a batch may be met with loaded with fat. These facts are so far borne out by the following observations made by myself this season. On the 5th of November I had thirty herrings examined, and found them all in similar condition, moderately fat; again, on the 8th of the same month 60 more were examined from another take in the same district, and all were found exceedingly fat. We cannot well suppose that this difference of condition took place in the few days interval between the dates on which the fish were caught; the difference may be accounted for with greater probability by ascribing it to a separate shoal of herring. From this and the following reasons we may further infer, as a somewhat likely thing, that herrings endeavour to preserve their clanship.

As regards herring caught in the same draught, if *any* of them contain food, in general they *all* contain it, and that very frequently of the same kind, whether it be large or small, a mess of entomostacans, shrimps or fish, thus indicating that they have been coursing over the same hunting-ground together. So far as I can learn, or have personally observed, herring of the same take in most cases are nearly in the same condition; from which we may suppose that they have been sojourning for some considerable time together, under similar or identical circumstances.

As to spawning, the prevailing opinion appears to be, that the herring of the same coast all go to spawn at the same time, and as soon as that office is performed they proceed to deeper water. That this is true to some extent is most likely, but that it is

subject to considerable modification, I think must be admitted by every one who has given the subject any attention.

In the months of November and December, herring with milt and roe are met with in many different stages of development; these herring must therefore necessarily deposit their spawn at times different from each other. Under these circumstances, it is not unlikely that male and female herring draught off to spawn as they arrive at the proper period. What may have given rise to the belief that the herring leave for deep water immediately after spawning is, that they often all disappear in a single night; but fishermen with whom I have conversed on that subject affirm, that spent and full herring are taken frequently together, which shows that they do not always leave when they spawn, and suggests the probability that many may wait for some time after, to collect before finally leaving *en masse*.

Near the close of last session (May 26th) I made some remarks on the movements of a shoal of herring in Millport Bay; at the time, I had only seen the herring at the surface where entomostraca (*Cetochilus septentrionalis*) were in patches in excessive abundance, and although the herring were to all appearance in the act of pursuing and devouring the small animals, I had no direct proof on that occasion that they were doing so.

A week or so afterwards, I had a note from Mr James Macalester, one of our members, saying that he had examined the contents of the stomach of some herring, and found them all greatly distended with entomostraca of the same appearance as those which I had exhibited. A little later in the season I had some opportunities of extending my observations on the same subject.

At Tarbert, about the middle of June, I found the stomachs of the herring generally packed with entomostraca, and nothing else. The herring in this condition are called "*gut-poke*" herring. It is said that these herring do not cure well, and are wanting in flavour, and that they often begin to decompose in a few hours after they are taken. It has been stated that those caught early in the evening are sometimes nearly useless when they are taken on shore in the morning, owing to the belly of the fish becoming soft, and falling open. This appears to arise from the rapid decomposition of the small entomostracans contained in the stomach. The process begun speedily extends to the adjacent integuments.

I saw hundreds of herring left on the pier, or thrown into the sea at Tarbert, that had been taken the night before, but from softening and rupturing they had become so mutilated in appearance that they were considered unfit to be sent to market, not on account of the bad condition of these rejected fish themselves, but for the unsound appearance they gave to the cargo.

Some of the fishermen and curers are strongly inclined to believe that the "gut poke" herring is a distinct variety, which continually feed on such fare, and to prove this they say that these herring sometimes leave suddenly, and are succeeded by herring of a better quality. Be that as it may, they seem all to agree that the herring generally are in this state throughout that district, from about the beginning of March till about the beginning of July, and from that time, as the season advanced, the stomach of the herring got less and less full, and the fish more and more fat till about August and September, when it was rare to find a herring with food of any kind in its stomach, that organ, in most cases, having become contracted into a very small gut-like sac. Yet in August and September I have met with herring at times having their stomachs greatly distended with food; but in these months the food consists generally of larger animals, such as small fish, or members of the shrimp family. All that I found so crammed with food neither contained roe nor milt.

In August, 1867, I had a few herrings opened which were taken off the Cumbraes, and I found their stomachs all exclusively packed with the rare stomapod (*Thysanopoda Couchii*). It is the specimen No. 1 now exhibited.

Again this season, in August, on one occasion I met with others similarly distended—specimen No. 2—with the black eyes of the captives shining through the thin integuments of the stomach; but what these are I cannot say, as they are too much decomposed to determine. This season from time to time I have examined the stomachs of a great many herrings; but from the beginning of September till now I have not found one containing food, but generally a little transparent mucus, and sometimes a little air, and however anomalous this may appear, the stomach was generally covered with fat, unless where the roe and milt were becoming large. In such cases, when these increased the fat appeared to become less. These facts are all the more curious that in the months of August and September entomostraca and

small larval forms are met with in great abundance, and if we judge of their multitudes by the luminosity of the sea, which in a great measure is ascribed to the presence of these minute animals, we will find the last-named month the most luminous in the year, and yet in these months, particularly September, it appears to be rare to find on this coast food of any kind in the stomach of a herring. Whatever the cause may be, it cannot be ascribed to the want of abundance of food at their command.

As to the questions whether herrings take food indifferently all the year round, or whether they take more at one season than another, or whether they abstain from it for a time altogether, none of the fishermen whom I have consulted seem to have taken these phases of herring life much into consideration. They were all aware that at some particular seasons the stomachs of the herring were generally distended with food, and at other times generally with much less; but whether for a time they abstain entirely or not, none seemed to know, and most were disinclined to believe in their voluntary abstinence from food. The natural answer in most cases seemed to suggest itself, that there was no doubt the herring required *something* to live upon.

Perhaps no fish in the sea has been the subject of so many learned and valuable treatises as the herring; but as the chief points of interest have always been its value as food to man, and how that value could be increased or protected, none of these treatises which I have had an opportunity of consulting refers to any seasons of abstinence. That they do abstain at particular seasons there can be no doubt, so far as empty stomachs go for proof, a circumstance that may excite less surprise when we take the abstinence of many other animals into consideration.

Mr Haughton, in the September number of the *Intellectual Observer*, 1867, when speaking of the abstinence of the salmon, says:—"With respect to the physiological paradox how an animal can live without food, it must be borne in mind, in the first place, that notwithstanding the voracity of the carnivorous fishes, and their extraordinary digestive capabilities, they are able to exist for long periods of time without food. Gold and silver fishes may be kept for months without perceptible food."

I may adduce another instance of a similar kind in the small marine fish the *Amphioxus lanceolatus*, which I kept for twenty

months in a jar containing less than two gills of water, without visible food, or apparent deterioration in the condition of the animal.

Mr Houghton, quoting Dr John Davy, says:—"That the migratory species of fishes, such as the salmon and sea-trout, which attain their growth and become in a high condition in the sea—there abundantly feeding and accumulating adipose matter, though not always abstaining in fresh water, which they enter chiefly for the purpose of breeding—are at least capable of long abstinence there without materially suffering."

That they do suffer, however, to a considerable extent is evident, both in the case of the salmon and herring, by the spent state they are in at the time of spawning.

It is not unlikely that the greater part of the food taken by the herring may assimilate and go to improve the condition of the fish. Entomostraca, apparently their chief food, are exceedingly rich in fatty matter. Quantities of oil may be seen floating on the surface of the water that a number of them have been newly confined in, and must afford a highly nutritious and concentrated meal. But that they should abstain less or more as the breeding season advances, when their demand for food is apparently greatest, is a problem that may be hard to solve.

II.—On the Distribution of the *Helicide* in Bute and in the Vicinity of Largs. By WILLIAM HADDIN.

The following remarks on the distribution of the *Helicide* in Bute and at Largs are the result of observations made during the two last summers in these localities. Although including by far the greater number of species likely to be found there, the list cannot be considered exhaustive. An enumeration of the species *seriatim*, describing their habitat, is perhaps the best manner in which to treat the subject.

Vitrina pellucida, the sole representative of the genus in Britain, occurs almost everywhere, but in greater profusion on the coast line. In the spring and summer it is scarce, but towards the end of autumn and during winter it may be taken in numbers.

Of the species of *Zonites*, some are difficult to determine from their resemblance to each other. They are all found in Bute,

however, although I have not been able satisfactorily to distinguish between *Z. purus* and *Z. crystallinus*. The species of most frequent occurrence are *Z. alliarius*, *Z. cellarius*, and *Z. crystallinus*. *Zonites fulvus* seems to be widely distributed, though two specimens seldom occur together. It is to be found under stones in grassy pastures—Chapelton, and meadows—Bute. *Z. radiatulus* I have found but seldom among leaves in wooden glens—Chapelton, Bute, and Brisbane Glen, Largs. Beneath stones on the banks of Loch Ascog and Greenan Loch, Bute, *Z. nitidus* may be found. It does not appear to inhabit the Glasgow district. *Z. nitidulus*, though not mentioned in Mr Dougal's list of specimens found within ten miles of Glasgow, I have taken in Calderwood Glen, as well as at Woodend, Bute. *Z. excavatus* is the rarest species of the genus, and appears to be peculiar to Britain. In the autumn of 1867, I took a single specimen amongst leaves at Chapelton, Bute. Though I sought often there, I was not successful in finding another till last summer, when my search was rewarded by the discovery of numbers in an uncultivated field above Ardbeg Point. This is the most northern locality for this shell, so far as I know.*

Of the numerous species of *Helices* found in Britain, more than half the number are found in Bute. *Helix aspersa* may be taken in countless numbers on the coast line. I remember a wall on the shore at Mount Stuart which was literally covered with this mollusk. In the gardens there it is the most destructive snail. It is remarkable that around Glasgow it should be almost unknown. *H. nemoralis* is a common shell, both inland and on the coast. From Mount Stuart to Kilehattan Bay it may be found in quantities, where the one and the five banded varieties appear to prevail to the exclusion of all others. *H. hortensis* I have never found in Bute, even after repeated searchings. Its great scarceness, compared with the abundance of *nemoralis*, is a fact worthy of note. *H. arbustorum* in Bute occurs but sparingly, and that in the woods behind Kamesburgh, while in Gogo Glen, Largs, it is by no means scarce. *H. caperata* is found on the coast generally distributed. It occurs also on the banks of Greenan Loch. At St Ninian's Bay, Bute, *H. ericetorum* lives in company with the beautiful little *H. pulchella* on the sandy shore. This appears to

* This species I have lately taken on Ben Nevis, Argyleshire, 1869.

be the only locality for *H. ericetorum* in Bute, but I have received specimens also from Machrihanish Bay, Campbelton. The occurrence of *H. rufescens* at Bowling has already been brought before this Society. At Broomfields, Largs, in a grassy lane, I discovered a colony this summer. Most of the specimens were albinos. A single specimen was taken at Etterick Bay, Bute. *H. hispida* and *H. rotundata* are common everywhere. *H. aculeata* and *H. lamellata* are found in company in wooded glens, Woodend, and Mount Stuart, Bute. On the broad leaves of *Petasites vulgaris* in Brisbane Glen, Largs, two species may be taken—*H. sericea* and *H. fusca*. The latter I have also found at Mount Stuart and at Ardbeg, Bute.

Not a single representative of the genus *Bulimus* occurs in Bute, but at Machrihanish Bay, Campbelton, *B. acutus* has been discovered by Mr Dougal. *Zua lubrica* is a common shell everywhere.

Of the Genus *pupa*, three species inhabit the district which we have in consideration. The most common, *P. umbilicata*, is to be found plentifully under stones and among moss in almost every situation. No shell occurs in such numbers along the coast as this. Along the east shore of the island especially, thousands may be gathered in a short time, every stone, on its under side, being literally covered with them. *P. muscorum* seems to be a much scarcer shell. In Bute I have not been able to find a single specimen, but on the other side of the Clyde, at Fairlie, it dwells in company with *P. umbilicata* on the shore. The remaining species, *P. anglica*, I have taken in Mount Stuart woods on the fallen leaves of the laurel, and in Brisbane Glen, Largs, amongst the debris of a ruin, along with *Helix sericea*.

The genus next in order, *Vertigo*, is unrepresented in the Glasgow district. In Bute two species occur, *V. edentula* and *V. antivertigo*. The former may readily be found on examining the under side of the fronds of *Lastrea filix-mas*—Skeoch Wood and Chapelton—and also under stones on the banks of Loch Greenan. The latter occurs on the banks of Loch Ascog and Loch Greenan. *V. pygmaea*, although said to be the most widely distributed of the genus, is the scarcest in this district. Often have I sought for it on elevated situations, such as it is said to inhabit, but without success, till this autumn, when wandering along the sea shore at Largs, at Broomeraigs, I came upon the

long-looked-for prize, amongst stones just above the high water mark—a situation most unusual for it, so far as I can learn.*

In Mr Dougal's paper already referred to, *Balea perversa* is mentioned as an apparently rare inhabitant of Auchentorlie Glen, Bowling. On the rocks at Bell's Monument I took a number of specimens of this shell lately. At St Ninian's Bay, Bute, it is to be found in colonies, adhering to stones in a loosely built wall on the shore. Under the loose bark of trees, chiefly ash, in many parts of the island, and on high elevations on the hills behind Largs, I have likewise taken it.

Clausilia rugosa is common on the trunks of trees, especially beech, and on mossy walls. Beautiful specimens occur on an old wall at Mount Stuart House.

Succinea putris is not rare on the banks of the lochs throughout the island. In brackish pools, near St Ninian's Bay, it seems to thrive well.

It will be observed, from the preceding remarks, that I have not been able to record a single species from the banks of Loch Fad, while on the shores of Loch Ascog and Loch Greenan are found *Zonites nitidus*, *Helix caperata*, *Vertigo antivertigo*, *V. edentula*, and *Succinea putris*. The reason of this I would not venture to affirm, but it is a fact worthy of note, that the banks of the former are formed of shale, while those of the two latter are of sand. The uncultivated districts, such as Chapelton, the old woods of Mount Stuart, and the coast line, are found to yield many more species than the cultivated parts.

Three species occur at Largs, which do not seem to have found their way over to Bute, viz., *Helix sericea*, *Pupa muscorum*, and *Vertigo pygmæa*.

In comparing the Glasgow District with the one under consideration, it is observed that two species occur in the former which are absent in the latter—*Helix hortensis* and *Bulimus obscurus*; while peculiar to the latter we have *Zonites nitidus*, *Z. excavatus*, *Helix ericetorum*, *H. sericea*, *Pupa muscorum*, *P. anglica*, *Vertigo antivertigo*, *V. edentula*, and *V. pygmæa*. I would call attention to the fact that at Bowling the distribution of many of the species occurring on the coast seems to stop short, viz., *Helix aspersa*, *H. rufescens*, *H. fusca*, and *Balea perversa*.

* *Vertigo pygmæa* I have since found on the banks of Loch Ascog, Bute, thus reducing the species found at Largs only, and not in Bute, to two.

I would take this opportunity of recording the following:—*Pisidium cinereum*, from a pond near Bishopbriggs, and *P. amnicum* from the banks of the Clyde above Rutherglen Bridge—not before mentioned from the Glasgow district.

A sinistral specimen of *Limneus pereger*, from a small stream on the banks of the Clyde above Dalmarnock Bridge. (In the following summer, 1868, another specimen was taken there again.)

Planorbis marginatus, hitherto unknown in Scotland, from Lochend, near Edinburgh.

FEBRUARY 23D, 1869.

Mr David Robertson, Vice-President, in the chair. The following gentlemen were elected members of the Society:—Wm. S. Paterson, resident; and George Stabler, Milnethorpe, Westmoreland, corresponding.

The following donations to the library were then announced:—Proceedings of the Berwickshire Naturalists' Club; Proceedings of the Dumfriesshire and Galloway Natural History and Antiquarian Society; Proceedings of the Belfast Naturalists' Field Club—all from the respective societies. Also, "Memoire pour la Connaissance de Crinoides Vivants, par M. Sars;" and "Meteorologische Jagtagelser," from the Christiania University.

SPECIMENS EXHIBITED.

Mr Henry Dunbar exhibited a series of American land and fresh water shells, belonging to the genera *Helix Helicina*, *Bulinus*, *Conovulus*, and *Succinea*, and made some remarks as to their geographical range and distribution in the States.

The Secretary exhibited a beautifully mottled specimen of the Wood Pigeon, which had recently been obtained near Glasgow, and forwarded by Mr Martin, Exchange Square. The whole of the plumage was spotted with white, giving the bird a very curious appearance. Such varieties very rarely occur in the Ring Dove.

Mr Gray also exhibited a female Sparrow-Hawk which had been captured in the town of Dingwall, under somewhat peculiar circumstances. The bird had apparently been perched on a tree opposite the house of Mr Grigor there, and seeing a canary in a cage suspended at one of the windows, had dashed through a pane

of glass, broken the cage, and killed the occupant. It had been trapped a considerable time before, and had entirely lost one of its legs, so that the mischievous act showed an extraordinary amount of daring in a bird with only one foot to deal the blow.

PAPER READ.

The Life of the Boulder Clay Period, as represented in Strata near Crofthead. By Mr JAMES A. MAHONY.

In the course of his remarks he described the geological features of the deposit, and referred to the species of the organic remains found in it, and wound up by stating some conclusions deducible from the subject. The strata, which have partly been laid bare in the cutting of the Kilmarnock and Crofthead Extension Railway, consist of about thirty feet of stratified clay, mud, and sand, resting on boulder clay, and also overlaid by it. The reasons for regarding them as intercalated with the Till, and therefore as being of glacial age, were stated at some length, Mr Mahony's views agreeing with those expressed by Mr James Geikie, by whom the deposit was first described in the *Geological Magazine*.* The animal and plant remains were found in two layers of vegetable *debris*, seven feet apart, which occurred in the stratified beds. One remarkable feature about these remains was the exceeding abundance of diatoms, which were found to constitute a considerable portion of the upper leaf bed (twelve inches thick), and to represent ten genera and thirty species. There were also described three species of desmids (one in the sporangial state), eleven mosses, seven flowering plants; and, as representatives of the animal kingdom, one sponge (*Spongilla fluvialis*), three infusoria, several species of entomostraca (some in the larval state), one of the jaws of a leech, and many fragments of beetles, indicating the presence of at least three species.

In his concluding remarks, Mr Mahony showed that the data pointed to the former existence of a lake, and suggested that we had here confirmatory evidence of the occurrence of an interval of ameliorated temperature during the ice epoch.

In the discussion which followed the reading of this paper, which was illustrated by numerous specimens and drawings, Mr John Young referred to the very great care with which Mr Mahony had worked out and determined the various minute

* Geol. Mag., vol. v., p. 393.

organisms found in the mud bed. He further stated that the antiquity of these organisms, and of the sand and mud beds of the Crofthead section, depended entirely upon the correct identification of a so-called bed of boulder till which was stated to have overlain the mud bed at one point of the section. If this could be shown to have been produced by a land slip of the older boulder till from the hill side over part of the old lake bottom, then the underlying beds, with their organisms, might be of comparatively modern date. Mr Young stated that he had not seen the disputed beds, but that he was very sceptical as to the upper bed of boulder till having been laid down by a second sheet of glacier ice passing along the valley. The thickness of the mud, sand, and gravel beds showed that a long period of time must have elapsed during their formation, and he therefore thought that the whole of the phenomena might yet be explained without bringing in such a great physical revolution as a second ice period. Mr Young also stated some of his objections to the boulder till of the low lying districts of Scotland being viewed as a formation resulting from the melting of a great sheet of land ice lying above sea level, when there is every reason to believe that not only those districts where the boulder till lies thickest, but the whole country was depressed many hundred feet below the present sea level during the great ice period.

The Rev. H. W. Crosskey explained the great difficulties connected with the section, and asked for judgment to be reserved until some fresh cuttings had been exposed. Mr Robertson and himself had found in the clay several species of fresh-water *Entomostraca* which were common in the Paisley Canal at the present day. The boulder clay hangs in patches along the sides of the valley, and has evidently been subjected to great denudation. A mass hanging by the side of the old lake might have been undermined and brought down gradually by the water. On the north east, before approaching the boss of trap, a peaty bed, with nuts and branches of various trees, occurs, evidently of comparatively modern origin. The question is whether the bed in which *Bos primegenius* was found does not correspond with this. There is great difficulty in conceiving how the passage of a second glacier could have left the clays and sands and gravels preserved in their present condition and position. The whole

section, however, constitute an excellent debating ground, and for the present Mr Crosskey wished to reserve his opinion.

MARCH 30TH, 1869.*

Mr David Robertson, Vice-President, in the chair.

The following gentlemen were elected members of the Society:— Alexander Drew, jun., resident; and the Rev. John Fergusson, Glenprosen, Forfarshire; Rev. James Keith, Forres; and Rev. George Gordon, Birnie, by Elgin, corresponding.

The Society voted a sum of ten guineas as a subscription to the fund now being raised by the University for the purchase of the late Professor Walker Arnot's Herbarium and Library.

The Librarian announced the following donations to the library: "Stainton's Natural History of the Tineina," 10 vols. 8vo, coloured plates, by Dr Hugh Colquhoun; "Quatrefage's Rambles of a Naturalist," 2 vols. 8vo, and "Seaside Book," by Dr Harvey, by Mr A. C. Millar; "Transactions Geological Society of Glasgow," "Transactions Archæological Society of Glasgow," "Proceedings Berwickshire Naturalists' Club," — all from the respective societies.

SPECIMENS EXHIBITED.

Mr James D. Dougall, jun., exhibited a specimen of the Grey Phalarope (*Phalaropus lobatus*), which had been shot in November last on the banks of Lochfyne.

The Secretary exhibited a very fine specimen of the Greenland Falcon (*Falco canalicans Gmel*), from Elgin, in Morayshire. The bird had been captured near that town about three years ago, and now belonged to Mr Gray's private collection. Although in bad condition when obtained, it had since been skilfully remounted by Mr McCulloch, sen., Sauchiehall Street, and is considered to be one of the most perfect examples of this rare species that has ever been taken in Britain. Mr Gray likewise exhibited two rare birds from New Zealand, namely, a specimen of *Apteryx Owenii*, and one of the Owl Parrot (*Strigops habroptilus*), both having been recently obtained in that country by Mr Thomas Yuill, Taxidermist, Sauchiehall Street. Owen's Apteryx is distinguished

from the common ki-wi by its somewhat larger size, lighter colour, freckled markings, and general puffiness of plumage. The principal localities it frequents are dense gullies, where it remains concealed during the daytime, and from which it almost never issues until the approach of night, when it ventures out in quest of food. From this habit it is but seldom seen except by the natives, who watch its appearance, and never miss an opportunity of capturing it. They often watch it with great patience in the recesses of the forest for the sake of its fat, which they make use of as a cure for skin diseases. They also use the feathers for dressing fish hooks. The Maories, therefore, tempted by the virtues of ki-wi grease, and the utility of the bird's wiry feathers, seldom think of preserving it for scientific purposes. Hence even the rewards offered to these savages are generally fruitless as regards the acquisition of specimens. The nest of this highly curious wingless bird is found in hollow logs, and is formed of dried ferns and grasses. There is but one egg, which, however, is of great size, weighing about 13 ounces, being almost a sixth of the entire weight of the bird itself. For some of these particulars Mr Gray expressed himself indebted to Mr Yuill, who had lived many years in New Zealand.

The Owl Parrot (*Strigops habroptilus*) was described as another of the weird-looking examples of an ancient avi-fauna not yet extinct. Like the Apteryx, it is strictly nocturnal in its habits, concealing itself in holes and under tree stumps, coming abroad only after sunset. From native reports it would appear that these birds at one time collected together in great numbers in winter, and associated in one congregation in large caves, making a deafening noise when they at first assembled, and again when they dispersed. This singular-looking species possesses but feeble powers of flight, only proceeding a short distance when put up. It is seldom seen in trees, but inhabits the ground, on which its food is chiefly gathered. It appears to make use of its bill in digging up certain roots, leaves, and twigs, on which it constantly subsists. The nest is placed in hollow logs of decayed wood lying upon the ground, and is generally found to contain two eggs. The bird makes a sort of pathway leading to it, and this track is so conspicuous (being about a foot in width) that it often misleads the traveller, who imagines he has found the track of human footsteps.

It has lately been doubted if any of these birds survive in New Zealand, which country, so far as is known, is or was its only habitat. The present example was obtained in the south island in March, 1868, within seventeen miles of the town of Nelson; and the specimen of Owen's Apteryx was killed at the same time and place.

The Secretary exhibited a specimen of the Spotted Sandpiper (*Totanus macularius*), which had been forwarded by Mr W. C. Angus, Aberdeen, corresponding member. The bird was one of a pair obtained near that city in August, 1867. Mr Gray said that although the Spotted Sandpiper had been introduced as a British species by the late Mr Yarrell many years ago, in his work on British birds, none of the numerous records of that writer regarding that bird could well stand scrutiny.

PAPER READ.

Remarks and Notes of Correspondence on the identity, of Heterophyllia Lyelli and H. mirabilis of Duncan. By Mr JOHN YOUNG.

PLATE IV.

The following paper and subsequent correspondence, upon the identity of two recently-described species of carboniferous corals from Scotland, appeared lately in the *Geological Magazine*, and as the errors in the description of these corals which I attempted to point out, have been denied by Dr Duncan of London—the author of the species in question—I have thought fit to place my remarks, and the specimens upon which they are founded, before the Society, with the correspondence for and against their identity, so that members may have an opportunity of judging for themselves whether there are really two species of this coral, and whether its spines were articulated upon tubercles as asserted by Dr Duncan.

My criticisms were not written in any hostile spirit, or with a wish to find fault with what Dr Duncan had done. My object was to point out several mistakes into which I believe he had fallen, from not having seen all the examples of the best preserved specimens of the coral that had been obtained.

My remarks in the *Geological Magazine* are as follows:—

In a paper published in the *Phil. Trans.* of the Royal Society of

London,* Dr Duncan has figured and described six new species of carboniferous corals, belonging to the genus *Heterophyllia* of McCoy, from specimens found in Scottish carboniferous limestone strata. Of these species two, *H. Lyelli* and *H. mirabilis*, seem to be founded on portions, which the careful examination of better preserved specimens would have shown to belong to only one good species.

I would not have ventured to make the following remarks upon these corals, had not the localities from whence they are obtained been long and familiarly known to me; and I am satisfied, after a careful examination of more than fifty specimens, large and small, and in all states of preservation, that they all belong to one species, in which the external characters and internal structure vary to a certain extent.

In order to show the close connection that exists between these two so-called species, I will quote Dr Duncan's description of the corals, side by side, with the parts numbered, so that the points of specific distinction may be more easily perceived, and will then make my remarks in support of what I consider their identity.

Heterophyllia Lyelli, sp. nov., Duncan.

1st. The corallum is very long, very slender, and is slightly bent.

2nd. The costæ are large, smooth, and rounded; they project, and are marked with occasional tubercles, pits, and grooves.

3rd. The intercostal spaces are wide and shallow, and equal; they are slightly concave, and are marked with festoon-shaped ridges or lines.

Heterophyllia mirabilis, sp. nov.,
Duncan.

1st. The corallum is tall, very slender, and nearly straight.

2nd. The costæ are narrow, rounded, smooth, and slightly projecting; they have tubercles at regular and frequent intervals. These tubercles are rounded and oblique, and project slightly. To each of them is articulated a curved hook-shaped process, which stands out from the costæ and the tubercles, its concavity being directed inwards and downwards.

3rd. The intercostal spaces are shallow, wide, and usually convex, but occasionally concave; they are marked with three longitudinal delicate shallow grooves, with very slightly rounded longitudinal eminences between them. A groove is central.

* On the Genera *Heterophyllia*, *Battersbyia*, *Palæocyclus*, and *Asterosmilia*; the Anatomy of their Species, and their position in the Classification of the *Sclerodermic Zootharia*. By P. Martin Duncan, M.B. Lond., F.G.S., Secretary to the Geological Society.—Read May 2, 1867.

4th. The horizontal section of the corallum is hexagonal in outline; the wall is stout and thick, and only very slightly concave between the costæ.

5th. The surface of the corallum is smooth and plain.

6th. There are six septa, which are united by a linear septal columella.

7th. The endotheca is tolerably abundant.

8th. The diameter of the corallum is 1-10th inch or less.

9th. In the carboniferous limestone of Craigenglen, Stirling, and Brockley, Lesmahagow, Lanarkshire.

4th. The horizontal section of the corallum is nearly circular; there are projections which correspond with the costæ; and the wall is moderately thick.

5th. The surface of the corallum is smooth.

6th. There are six septa, which are united by a linear septal columella.

7th. The endotheca is scanty, and the dissepiments are wide apart.

8th. The diameter of the corallum is rather more than 1-20th inch.

9th. From the carboniferous limestone of Craigenglen and Brockley.

From the above descriptions it will be seen that the two species, as described by Dr Duncan, have many characters in common, and I am satisfied that, had he examined a larger number of specimens, he would have found every variety connecting them.

In the first place, this coral has never, so far as I am aware, been found with its extremities perfect, fragments occur from three to four inches in length, but generally it is found in shorter pieces; these are of every diameter between $\frac{1}{10}$ and $\frac{1}{4}$ inch or less. One specimen $3\frac{1}{4}$ inches in length, tapers in that distance from $\frac{1}{12}$ to $\frac{1}{20}$ inch in diameter, showing that measurements from fragments of various sizes are of no specific value.

All the larger specimens are more or less flexuous, some of them being much curved, and occasionally bent at right angles; this is the case with both stout and slender specimens of the corallum.

The curved hook-shaped processes which are described as one of the principal specific characters of *H. mirabilis*, I consider as of no value in distinguishing that species, for we possess specimens of every diameter as formerly quoted, showing these little hooklets. On nearly every specimen which is found embedded in the shale, they may be exposed with careful manipulation. Indeed, it seems to have been the perfect condition of the corallum, large or small. In weathered specimens of the stems, found lying upon the shale-banks, the hooklets are always broken off, but their bases may still be traced upon the costæ, or in the grooves to which they were fixed.

Dr Duncan states that *H. Lyelli* is only occasionally tuberculated, but the specimen of this species which he figures in pl. xxxi., fig.

4, c., is as regularly tuberculated as that shown in his figures of *H. mirabilis*. Except in very much worn specimens, the tubercles are always present upon both large and small diameters of the corallum, and as they are sometimes seen to vary slightly in number and regularity, even upon parts of the same stem, mere irregularity of occurrence is not, therefore, to be considered of any specific value.

The costæ and intercostal spaces are also characters that vary considerably in this coral, and cannot, I think, be depended upon as points of specific distinction, as some specimens of the largest diameter have costæ less developed than those seen upon more moderately sized stems. The intercostal spaces are wide, shallow, or deep, according to the diameter of the specimen, and the prominence of the costæ.

In *H. Lyelli*, the horizontal section of the corallum is stated to be hexagonal, in *H. mirabilis*, mostly circular; this is a point that appears to me of no value in the diagnosis of the species, as the section varies with the prominence of the costæ and the convexity or concavity of the intercostal spaces, and this variation may sometimes be seen upon the same specimen. In general, the greatest number of specimens of all the various diameters met with, approach the hexagonal form; one specimen, however, in my collection shows, in a cross section, a stellate or six-sided angular form, and another well marked fragment is quadrangular in section, having four small tuberculated costæ. Internally this specimen has only four septa corresponding with the costæ, instead of six, the normal number. Other specimens occur which show a nearly circular section, and on some of these, instead of costæ, we have only longitudinal grooves to the floor of which the hooklets were fixed. These differences in the external form of the stem of the corallum I consider to be mere exceptional variations of one species.

The endotheca and dissepiments are also characters that vary. In many specimens the endotheca has either never been well developed or has been destroyed by the crystallization of the internal structure of the corallum. The dissepiments are stated to be wide apart, but one longitudinal section shows 30 in the length of one inch, being less than one half line apart.

It will be seen from the above remarks that this coral varies, to a certain extent, both in its external form and internal structure, many of its parts depending upon the state of preservation in

which we find the specimens. It seems to me that Dr Duncan has taken the specific characters of *H. Lyelli* from the lower portion of a stem with the hooklets broken off and slightly worn, and his *H. mirabilis* from the upper or more slender part of a stem, as seen lying in the shale, with the hooklets in position.

There is one important mistake which Dr Duncan has committed in his description of *H. mirabilis*, to which I wish shortly to refer. He states that the curved hook-shaped spines or processes, which stand out from the costæ, were articulated to the tubercles upon the costæ, and he gives several figures to illustrate what he supposes was their mode of attachment. This view is not warranted by an examination of several fine specimens in my own collection and in that of Mr James Armstrong, which are embedded in shale, and show the hooklets in position.

These were not hooklets articulated upon tubercles, but small, curved, spinous processes immoveably attached to the stem, either upon the costæ or in grooves. At their base these processes seem to have been tubular, and when broken off and a little worn, as seen in weathered specimens, they then present a deceptive appearance as of a small rounded tubercle, with a pit in the centre, which is caused by the hollow base of the spine.

In nearly every specimen in which these delicate little hooklets are preserved in position, they are seen to be fractured close to their attachment with the stem. This has been produced by the pressure to which the corallum was subjected while lying in the soft shale. It is easily seen, from the irregular way in which they are fractured, that they were broken off by pressure, and not by any process of disarticulation. On some specimens there is still to be seen, at rare intervals, a single spine attached by its solid base to the stem, while on numerous other examples, where the hooklets have not been fractured quite close to the stems, their bases are seen projecting a short distance from the costæ. In one specimen the hooklet has been broken off near the stem, but the matrix retains a cast of the detached spine; the contour of which, from base to apex, is perfectly even and unbroken, an appearance incompatible with the alleged mode of attachment. The above facts clearly show that there was no articulation of their bases upon rounded tubercles, which would, it appears to me, be quite an anomaly in the structure of a zoophyte.

A specimen of what seems to have been a fragment of this coral was figured by David Ure in his Natural History of Rutherglen and East Kilbride, in the year 1793, pl. xix., fig. 11. Ure does not describe the specimen further than by stating that it was beautiful on account of its denticulation, and that it was rare. He placed it among his *Coralloides*.

Prof. M'Coy's *Serpula hexicarinata* evidently belongs to this coral, or to a closely allied species of *Heterophyllia*. His specimen seems to have shown no internal structure, nor any of the external spinous processes: this led him to conclude that it was some anomalous species of *Serpula*. The absence of structure and external markings may have been due to the specimen having been preserved in a crystalline limestone. M'Coy thus defines the organism in his carboniferous fossils of Ireland. "*Serpula hexicarinata*, pl. xxiii., fig. 28, sp. ch. Elongate, slightly flexuous, hexagonal; sides nearly equal, smooth, flat; rounded, prominent keel on each of the angles. This species is easily distinguished from any other of the Palæozoic *Serpulae*, by the hexagonal form of the tube, and the six narrow rounded keels on the angles. Length usually about two inches, width half a length."

So closely does the above description answer to small, worn specimens of *H. mirabilis*, that my specimens were long identified with M'Coy's fossil, and as such appeared with his name in my lists with a (?), as I was satisfied that it could not belong to the genus *Serpula*, but was a zoophyte closely allied to other forms I had found at Brockley near Lesmahagow, which Dr Duncan has now placed, no doubt correctly, among Professor M'Coy's *Heterophyllia*.*

Craigenglen, Campsie, has yielded the finest preserved specimens of the coral under discussion, and as these specimens seem to prove the identity of the two so-called species, one of the specific names adopted by Dr Duncan must be allowed to drop. I would, therefore, suggest that that of *H. mirabilis* be the one retained, as it is

* In the Catalogue of the collection of fossils in the Museum of Practical Geology, page 129, *Serpula hexagona* is mentioned from the Glasgow district. Unfortunately, as the authorities for the species are not given in that work, I am unable to state whether that species be the same as M'Coy's *S. hexicarinata*. But I suspect that it is, and if so, then it must be referred to the genus of corals in question, for I know of no hexagonal form of *Serpula* from the carboniferous strata of Scotland, especially from the Glasgow district, with the fossils of which I am well acquainted.

given to the specimen which represents the most perfect condition of the coral.

The foregoing remarks called forth some correspondence in the November number of the *Geological Magazine*—from Mr De Wilde, the artist who drew the figures of the corals for Dr Duncan's paper; from Mr Fielding, another artist, to whom Mr Woodward, the editor of the Magazine, had submitted the series of specimens I had forwarded for examination, illustrating all the various states of preservation in which the coral is found; and we had also a few remarks from Mr Woodward himself.

In the following remarks upon the correspondence which ensued, I will only very briefly refer to those points bearing upon the subject under discussion:—Mr De Wilde states that the specimens which he figured presented a “bulb with a pit in its centre, and the slight concavity at the base of the hooklet.” He further states, “Supposing the articulation to be a mistake, these fragile appendages would hardly break invariably at that point where they are stoutest and strongest.” Mr Fielding states, “That it is easy to select specimens from those sent by Mr Young, which present rows of tubercles the exact counterpart of those figured by Mr De Wilde. On the other hand, however, there are amongst Mr Young's specimens some which present characters differing greatly from those figured in Dr Duncan's plate, and in which the hooklets are broken off at various distances from the costæ—in some cases even close up to the body of the coral, leaving a concave cicatrix instead of a tubercle.” Mr Woodward, amongst other remarks, states, “Mr Young, in his paper, says, if a coral had spines articulated at their bases upon rounded tubercles, such a structure would be quite an anomaly in a zoophyte. We must beg Mr Young not to reject a discovery because it is anomalous. Palæozoic life-structures present many strange features.”

In the December number of the Magazine there was some further correspondence from the pen of Dr John Young, Dr Duncan, and myself. It may here be proper to state, that before writing the remarks upon the identity of the two species of this coral, that Dr Young minutely examined, along with myself, all the best preserved specimens of the coral that I could find, and we came to the conclusion that they ought to be considered as belonging to one species; and further, that the so-called articu-

lation of the hooklets upon tubercles could not be held as tenable, and he agreed with Mr Armstrong and myself in viewing them as solid processes that had become fractured from the stem by pressure.

Dr Young, in his note to the editor of the Magazine, says, "Mr De Wilde's letter is quite satisfactory. Had the appearances referred to by Mr Young been present in Dr Duncan's specimens, neither he nor Mr De Wilde would have failed to notice them. It is therefore to be regretted that you did not submit Mr Young's specimens to that artist, who has an interest in the matter, rather than to Mr Fielding, who has none. The testimony which that gentleman volunteers is, however, of value, as confirming the only inference possible from the statements and figures, that the specimens of *Heterophyllia* are variously preserved, and that Mr De Wilde has not seen all the varieties."

Dr Young, in reply to Mr Woodward's remarks, says, "I am unaware, of course, of your reasons for adopting a somewhat unusual style of comment on Mr Young's paper. He does not, however, as you say, 'object to a discovery because it is an anomaly.' He thinks the appearances may be otherwise interpreted, and that so unexpected a phenomenon as articulated spines on a coral requires more evidence in its support than has been adduced. Anomalies, in other groups of animals, furnish no argument in support of this particular one. Mr Young thinks his specimens justify him in taking exception to Dr Duncan's paper on two grounds: 1st. That *H. Lyelli* and *H. mirabilis* are not distinct species; 2d. That neither possessed articulated spines. The criticism of published species is neither an unusual nor a hurtful proceeding, and I should have been unwilling to interfere in the matter, which rests entirely between Dr Duncan and Mr Young, but having seen the specimens, I am satisfied that the difference of opinion, at least on the second of Mr Young's criticisms, is due to difference in the state of preservation of the fossils."

In my reply to the statements of Messrs De Wilde and Fielding, I mentioned, amongst other points, that "the mere rounding of the base of the spines, so as to resemble tubercles, seen upon some specimens, stands for nothing in the face of the important fact which numerous others go to prove, viz., that these tubercles

are not rounded in the better preserved specimens, and that they are, in fact, only the fractured bases of the spines or hooklets." To Mr De Wilde's statement, where he says, "supposing the articulation to be a mistake, these fragile appendages would hardly break invariably at that point where they are stoutest and strongest," I replied, that "he must remember that although this be their thickest part, yet it is their weakest point in their relation to the stem," stating, as points in illustration, "that twigs torn from the stem of a plant naturally break close to their attachment to the stem, yet this is also their thickest point; and that the spines of the *Productæ* found in our soft shales are seen in most cases to be fractured close to their attachment to the shell, owing to the pressure they have sustained;" and further stated, "that this fracturing of the spines by pressure was not always regular in its distance from the organism, either in the *Productæ* or the coral in question, as some of my specimens in the hands of Mr Woodward clearly showed."

Dr Duncan, in his reply to some of my remarks, says, that "really the slightest possible examination of the specimens proves that the appearance of irregular fracture of the spines is the exception, and that which I have described is the rule. The irregular fracture has been produced by pressure, which has acted more upon the base of the tubercles than upon the junction of the hooklets with the tubercles. Probably some anchylosis had occurred, and the joint had been destroyed."

Dr Duncan, in his further remarks, does not advance a single fact beyond what I have already quoted, either for considering the above corals as two distinct species, or in support of the so-called articulation of the hooklets. He says, "I am content to abide by the decision I came to whilst the *Heterophyllia* in the Hunterian Museum of Glasgow were still called *Serpulæ*, and to consider *H. Lyelli* and *H. mirabilis* very interestingly separate species." The rest of his note consists of a personal attack upon myself for venturing to criticise his (Dr Duncan's) work. To his personal remarks I thought it unworthy to reply in my concluding note in the Magazine, except in stating, "that my object was to try and settle the determination of the coral in question, not the qualifications of paleontologists." To his assertion, that irregular fracture of the spines is the exception and not the rule, and the

assumption of ankylosis of the joint, I stated, "that it entirely begged the question, and that after what I had written I thought I was justified in disputing assertions, however authoritatively stated."

I may here remark that Dr Duncan's admission, that probably the bases of the spines had become ankylosed upon the tubercles, and that the joint had been destroyed, is to me one of the weakest points in his whole argument; and I think that it must be apparent to nearly every one that it would have been better, and perhaps more honest, if he had frankly admitted that he had been mistaken as to the articulation of the hooklets, and acknowledged them at once as having been solid appendages, instead of making a half admission that they are really so, by his assumption of ankylosis of the joint.

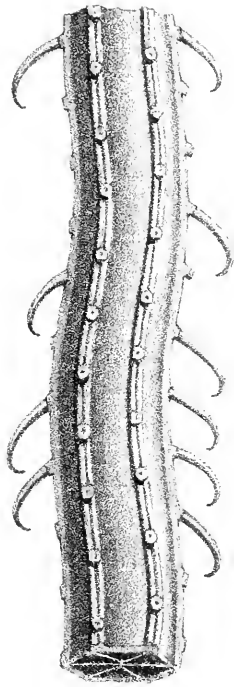
With regard to his statement, that this coral was allowed to lie in the Hunterian Museum, under the name of *Serpulæ*, it shows that he must have been misinformed upon the subject. The museum, as yet, has never possessed any examples of this organism. My remarks are founded upon specimens in my own collection and that of Mr Armstrong. In the list of fossils in my paper on the "Geology of the Campsie District," page 57, I there state that "finely preserved specimens of this organism are found in the shales of Craigenglen; that they agree externally with M'Coy's figure of *Serpulæ* (?) *hexicarinata*, but are probably zoophytes, as they are divided internally with septa and tabulæ, and have numerous slender hook-like spines on each of the keels."

To show still further that I was not entirely ignorant of the structure of this organism, I have here a transparent vertical section of the coral which I exhibited, along with my collection, at the British Association Meeting in Glasgow in 1855. I also, while in London in 1861, submitted some of my specimens to Mr Salter, then in the Jermyn Street Museum, and to the late Dr Samuel Woodward, of the British Museum. They both agreed with me as to its close identity with M'Coy's figure of *Serpulæ hexicarinata* (a point which Dr Duncan in his description has overlooked); but they were satisfied, from both the external and internal structure, that it was not any species of *Serpulæ*, but a peculiar and undescribed zoophyte. The idea, however, of its

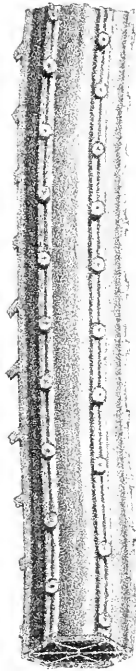
having had articulated spines never entered into the minds of any one to whom I ever submitted this coral, nor have I ever seen a single specimen which, on close examination, represents such an appearance, or that would warrant the conclusions of Dr Duncan.

There are two other points to which I wish to call your attention, beyond what has been already stated in the remarks and correspondence. The first is one which appears to me to go hard against the supposition that the hooklets were ever articulated upon tubercles by any ligamentary process. The fact stands thus: all the specimens of this coral are found in marine limestone shales, associated with a great many genera and species of organic remains, consisting of corals, crinoids, echini, mollusca, etc. These all bear evidence of having lain for some time upon the sea-bottom after the death of the organisms, during which the ligaments that held them together had in most cases gone to decay, and allowed their parts to be scattered about by the waves and currents, before becoming embedded in the mud in which we now find them. If this has been the case with large organisms bound together with strong ligaments, we would hardly expect that those which are said to have attached these delicate hooklets to the stem of the coral would have remained uninjured. Indeed, if they had ever been articulated, I would have considered it one of the rarest things to have found a specimen of the coral with the hooklets attached, as rare as what it is to find in the same strata, any of the remains of the crinoids, echini, or chitons, with their parts preserved in their relative positions. But if the hooklets are viewed as solid processes upon the stem of the corallum, we can then easily perceive how they may have been preserved in most instances after the death of the organism, their present fractured state being the result of the pressure they have sustained while lying embedded in the shale.

The second point to which I wish to make reference before closing this paper, is that Dr Duncan in his description of *H. Lyelli* makes no mention whatever of that species having borne hooklets upon the costae. He only states that it was marked with occasional tubercles, but makes no inference as to what could have been their use. I think that every one who examines the specimens upon the table will admit that the largest diameters of the corallum as well as the smallest, bore these hooklets; also, that the so-called



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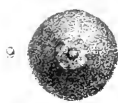
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CARBONIFEROUS FOSSILS

HETEROPHYLLIA MIRABILIS & TRIGONOCARPUM?



tubercles are nothing but their broken bases. It was unfortunate that Dr Duncan's specimens did not show these hooklets, and that he should have attempted to found specific distinctions upon fragments, which every one who has had any opportunity of examining this coral, will consider to have been imperfect examples of the organism in question.

NOTE.—I am glad to be able to state that since the date on which this paper was read, Mr David Robertson has carefully examined, under the microscope, all the specimens of this coral in the collection of Mr James Thomson, upon which Dr Duncan's figures and descriptions were founded, and that, with a knowledge of all the disputed points before him, Mr Robertson has failed to see any evidence in these specimens of articulated hooklets. Dr Young, who has also examined Mr Thomson's specimens, confirms Mr Robertson's opinion, and says, that they present the same irregular fracture of the hooklets at their base as seen in our specimens—an appearance not represented by any of the figures drawn by Mr De Wilde.

EXPLANATION OF THE FIGURES OF PLATE IV.

- Fig. 1.—*Heterophyllia mirabilis*.—Portion of a finely-preserved specimen of the coral, embedded in shale, showing several of the hooklets in position, and the irregular way in which they have been fractured at various distances from the stem of the coral by pressure. From the collection of Mr James Armstrong.
- Fig. 2.—Another specimen out of the matrix, showing the projecting bases of several hooklets, and the very irregular manner in which they are seen to be broken on many specimens of the coral.
- Fig. 3.—Vertical section of a portion of one of the largest diameters of the coral, in which the dissepiments are only one half line apart, or about thirty in the length of one inch.
- Fig. 4.—Vertical section of another specimen, in which the dissepiments are more wide apart.
- Fig. 5.—Horizontal section, showing the normal form of the coral, and the septæ and endotheca, when well preserved.
- Fig. 6.—Horizontal section of a stellate, or six-sided angular variety.
- Fig. 7.—Horizontal section of a nearly circular variety, in which the hooklets are planted in grooves on the stem instead of upon costæ.
- Fig. 8.—Horizontal section of a four-sided or quadrangular variety, having only four septa corresponding to the number of costæ.
- Figs. 9, 10.—*Trigonocarpum* (?).—A fossil fruit (natural size) from the carboniferous limestone shales, Calderside, High Blantyre. Referred to in Part I., page 203, of this Society's "Proceedings." 9, View of calyx; 10, Side view of shell.

Note.—All the figures of the corals are enlarged from four to six times.

Figs. 2 to 8, are from specimens in Mr J. Young's collection.

APRIL 27TH, 1869.

Mr David Robertson, Vice-President, in the chair.

Mr John Bell, Mossvale, Paisley, was admitted a resident member, and Captain H. W. Feilden, 18th Hussars, Junior United Service Club, London, a corresponding member of the Society.

The Librarian announced, as a donation to the Library, from the Royal Physical Society of Edinburgh, a complete set of their published Proceedings.

SPECIMENS EXHIBITED.

The Chairman exhibited a living specimen of a rare sea anemone—*Peachia triphylla*—from Cumbræ, in the Firth of Clyde. Mr Gosse, in his work on this class of Zoophytes, gives the Channel Islands as the habitat of the species. He had never seen it himself, both descriptions and drawings having been supplied to him by Dr Wallich. Mr Robertson described the habits of the creature in captivity, regarding which nothing appears to have previously been noticed.

Mr Robertson also exhibited two *Nudibranchs*, new to Scotland, namely, *Doris prorima* and *Eolis glauca*, both from Cumbræ—the former having hitherto been considered peculiar to the Mersey, and the latter to the Devonshire coast. He likewise described the habits of both in confinement, and their distinguishing characteristics, and explained the means by which he had been enabled to keep them alive so as to observe their movements.

Dr W. L. Stewart, of Bothwell, exhibited a collection of reptiles, insects, and *Arachnida* from Western Africa. Among these were conspicuous a scorpion, remarkable for its great size, and a double-headed snake; the whole of the objects being in a beautiful state of preservation.

The Secretary drew the attention of the meeting to a very interesting series of British birds' nests and eggs, which had been sent for exhibition by Mr James Thomson, late of Dummore. The collection, prepared by Mr Thomson himself, was distinguished for great neatness and accuracy in its arrangement.

Mr James Dairon exhibited a series of *Graptolites* from the Silurian shales of the Moffat district, belonging to the genera *Graptolites*, *Diplograpsus*, *Didymograpsus*, *Dichograpsus*, and *Rastrites*. In the course of his remarks, Mr Dairon pointed out some of the physical features of the Moffat district and the nature of the strata

in which the *Graptolites* are found. He next referred to the characters of the several species which he exhibited, and how the different genera were distinguished from one another; and also pointed out and referred to other districts in the south of Scotland, and several other parts of the world, in which this interesting class of organisms had been found. In no other place in this country do they seem to occur in such great abundance, or of so many genera and species, as in the dark semi-aluminous shales of Hartfell, Garpel, Bell Craig, and Dobs Linn, all in the vicinity of Moffat. Mr Dairon concluded his remarks by referring to the various countries from which *Graptolites* have been recorded, stating that they characterise the Silurian system, and especially its lower divisions. He believed that although a considerable amount of work had been done in the investigation of the Moffat shales, much still remains to reward the labours of future investigators, as is evidenced by the number of new species of *Graptolites* and *Phyllopod crustaceans* which have been discovered within the last few years.

Mr George J. Combe exhibited a large and beautifully prepared collection of British and Exotic Ferns. Among the former there were specimens of *Asplenium fontanum*, *A. Germanicum*, and *A. septentrionale*, *Polypodium alpestre*, *Athyrium Filix fem.*, var. *Victorie*, *Lastrea remota*, *L. Barnesii*; also *Trichomanes radicans*, and *Lastrea cristata*, both from the only known Scottish habitats. Mr Combe also exhibited *Elatine hexandra*, *Linnaea borealis*, *Eriocaulon septangulare*, and the very rare *Menziesia corulea*, from the only known habitat in Britain; also part of the stem of a vine, seventy-five years old, cut down in January last in the gardens, Buchanan House. It measured about five inches in diameter.

PAPERS READ.

I.—*On the Birds of Ayrshire and Wigtownshire.*

By Mr ROBERT GRAY, Secretary, and Mr THOMAS ANDERSON,
Corresponding Member.

INTRODUCTORY REMARKS.

The counties of Ayr and Wigtown present many interesting features, which appear to be intimately associated with a profusion of bird life. A glance at the position and configuration of the districts of Kyle, Carrick, and Galloway, will show that the entire

coast outline indicates a variety of locality sufficient to attract, and in many instances retain, species of a wandering habit elsewhere.* Luce Bay, and the Bay of Wigtown, with their far-stretching sands, and Loch Ryan, with its sheltered nooks and shores, draw large numbers of waders and waterfowl. Burrow Head and the Mull of Galloway furnish haunts for cliff-building birds, and for the peregrine and lively chough; while the many caves which intersect the precipitous rocks from Ballantrae to the entrance to Glen App, afford shelter to the rock-dove and cormorant. In inland quarters, on the other hand, the numerous lochs scattered over both counties draw flocks of fresh water species, and not a few rarities, as the black tern, garganey, osprey, and wild swan; the high rocky cliffs harbour the raven and eagle; the moors the merlin and hen harrier, dipper and ring ouzel; while the glens and valleys, from their extremely inviting aspect, give encouragement to a number of soft-billed birds, among which may be noticed the grasshopper warbler and lesser whitethroat.

In addition to its many other attractions, this district possesses two isolated breeding places for gulls and guillemots—viz., Ailsa Craig in the Firth of Clyde, and the Scaur Rocks in the Bay of Luce. The former, being one of the most extensive nurseries for sea-fowl in Great Britain, is in some respects peculiarly interesting—the Iceland gull and little auk having been seen there in summer; while among land birds it can still rank as occasional visitants both the golden and white-tailed eagles, the deserted eyries of which are yet shown to the inquiring visitor. The Great and Little Scaur, a small group of rocks situated near the entrance to Luce Bay, and about midway between the Mull of Galloway and Burrow Head (the former headland itself being an extensive breeding place), are frequented by numbers of guillemots, razor-bills, and puffins, etc., which incubate there as at Ailsa. These two breeding places, with many of the inland lochs, which are occupied by the black-headed and lesser black-backed gulls, enable us to include a number of resident birds which other districts do not possess; and as a fair proportion of the rarer stragglers have appeared from time to time within our limits, the

* We may here recommend to the notice of ornithologists, in consulting this or any future catalogues that may be published, "Philips' Travelling Map of Scotland," in which the various headlands, lochs, and islets are very correctly named and indicated.

catalogue may be regarded as somewhat fuller than can be expected from a more central district, or even seaboard counties further north.

The Solway Firth appears to lead some of the characteristic birds of the south towards the east, and thus forms a kind of barrier to their wanderings into Scotland by the shorter route of crossing the water; thus even species swift of wing, such as the black tern (*Sterna nigra*) and shoveller duck (*Anas platyrhynchos*), travel eastwards, tempted by the inviting shores of the Solway, until they are gradually led through Roxburghshire into Berwickshire, whence they speed northwards. We therefore find these birds appearing much more frequently in East Lothian and Fife, especially in the vicinity of the rivers Tyne and Eden—these estuaries being sufficient to arrest them for a time in the course of their journey. The Ruff (*Macetes pugnax*) is another example of the influence of the Solway in arresting, or rather diverting the direction of the flight of English birds. It is seldom or never found in Wigtonshire or Ayrshire, while it is tolerably common in the estuaries just named. We draw this inference advisedly, seeing that two of the species at least which we have mentioned are at times abundant in Lancashire. On the banks of the Ribble the ruff is plentiful, while in most of the *meres*, as the patches of fresh water there are called, the shoveller is equally numerous, as many as a dozen or fifteen specimens having been sent to the Preston bird stuffers in one day.

As a post of observation for the migratory movements of birds from the remoter districts of western Scotland, the Mull of Galloway is, perhaps, not to be excelled. At the Lighthouse numerous species appear at the time of setting out from our shores, and are sometimes driven back by adverse winds. Even the Waders, such as the knot and sandpiper, are caught on the lantern, upwards of 300 feet above the sea level; and the ring ouzel and gold-crest are likewise captured—the latter in great numbers. In many of the woods near Newton-Stewart, and extending from that westwards to the Rhims of Galloway, very great flocks of migratory species collect in the end of autumn, and appear to wait a favourable opportunity of effecting a start. We have also noticed that, in the south of Wigtonshire, early migrants, such as the swift, sensibly increase in numbers as the time for their migration approaches. Large flocks from the north may even be

seen passing southwards on the west side of the Rhinns, and steering at a considerable height in the air, with a strong and steady flight, and with apparently no intention of halting until their journey is accomplished.

Looking to the fact that there are so many safe places of refuge westward of our district, where the birds of the Hebrides assemble during winter, we naturally do not look for many marine species whose boundary line, so to speak, may be said to be north of the Solway. The Scoters, for example, are almost wholly absent, and we listen in vain for the wildly-musical call note of the long-tailed duck—a species of constant occurrence within the circle of the inner islands. On the other hand, such birds as the quail, which evidently come to us from the Irish coast, where they are taken in some numbers, are familiar in almost every parish—their soft and gentle note on dewy evenings being a well-known and pleasing sound in the summer months.

In conclusion, we may remark that, contrasted with a county like Aberdeenshire, which may almost be called the opposite extreme of our district, there are many differences at once apparent. Several North American land birds and Waders, which would seem to travel to this country *via* Greenland, Iceland, and the Faroe Islands, and thence by Orkney and Shetland to the outlying shoulder of Scotland represented in the shires of Banff and Aberdeen, are never seen with us; while, as an offset to this deficiency, we have large and interesting migratory flocks from the central and western portion of our island lingering at the fall of the leaf in our famed glens and valleys, and beside our brown moors, ruined castles, and the banks of our brawling rivers, as if telling us, in their changed notes of autumn, that they are reluctantly preparing to quit our shores.

It only remains to be added, that considerable care has been bestowed in authenticating the information contained in this catalogue. We have traversed a large extent of both counties in quest of species, and have, for the last fifteen years, been almost daily adding to our observations from which the short notes on each of the birds have been selected. These pleasant rambles and excursions, undertaken of late years for the twofold object of investigating the ornithology and paleontology of the glens and hills of Ayrshire, have enabled us to give a somewhat accurate idea of the species to be found within their boundaries. A con-

siderable number of the birds enumerated have been procured by ourselves, and preserved as cabinet specimens, and we have seldom introduced a species that has not come under our own personal notice. For some of the specimens obtained, we have been indebted to Dr William Anderson, now of Brigus, Newfoundland, whose observations have likewise been of service to us.

One or two remarks on certain birds injurious to farmers have been inserted on the authority of Mr Anderson, who has for some years directed his attention closely to their habits, and who has now matured these at a time when a full knowledge of the subject is of some importance both to the bird student and agriculturist.

CATALOGUE OF SPECIES.

RAPTORES.

FALCONIDÆ.

THE GOLDEN EAGLE (*Aquila chrysaetos*).

This splendid bird of prey, formerly so well known in many parts of Scotland, is now extremely rare. A stray visitant is seen at uncertain intervals on Ailsa Craig, especially in spring, when the rabbits are being trapped and disembowelled on the rock. It still breeds in Kirkeudbrightshire. In a work entitled, "General View of the Agriculture of the County of Ayr," etc., published by William Aiton, writer, Strathavon, in 1811, the following passage occurs:—"Eagles formerly abounded so much about Loch Doon, in the higher parts of Carrick, as to prove formidable enemies to the helpless sheep for many miles round their haunts. They have been much reduced in their numbers by the shepherds, but they are by no means extirpated. They still hatch in the most inaccessible rocks, and occasionally carry off, in their powerful talons, a lamb to feed themselves and their young."

THE WHITE-TAILED SEA EAGLE (*Haliaëtus albicilla*).

Within the last thirty years this eagle has been gradually becoming scarcer, and can now only be regarded as a very rare straggler. Wandering examples of the bird are still met with in the Firth of Clyde, resting occasionally on Ailsa Craig, where the species formerly had an eyrie. These probably come from Islay, which is yet frequented by two or three pairs, although it is doubtful if they now breed there. A specimen was obtained early in May at Dunoon a few years ago; and so long as the species maintains

its hold of the numerous romantic headlands in Western Scotland, we may expect to meet with stray specimens at that season of the year when eagles are most inclined to wander from their ordinary haunts.

THE OSPREY (*Pandion haliaëtus*).

About fifteen years ago the osprey frequented Loch Doon with some regularity. One bird at least might have been seen fishing in the loch, and perching at times on the boulders near its banks. This was thought to be a male in quest of prey to carry to his mate incubating on an islet in a small loch in Wigtownshire, where we have good reason for saying a frequented eyrie still exists.

THE PEREGRINE FALCON (*Falco peregrinus*).

This handsome falcon, although much reduced in numbers of late years, is found in both counties, frequenting places where it has been known for many generations. There are still two eyries at the Heads of Ayr, and one on Ailsa Craig. Mr Gray has also seen one at Burrow Head. In the wilder parts of some of the inland districts it is also familiar to game preservers as a destructive enemy to grouse and black game. The peregrine is yet comparatively common in Kirkeudbrightshire.

Mr Ewen, of Ewenfield, Ayr, some months ago communicated to the *Sporting Gazette* a somewhat interesting incident which occurred within his own observation when out hunting with his hawks. His falconer had let off a two-year old tiercel at some partridges, when a wild peregrine made its appearance, intending, no doubt, to secure one of the birds. As soon as the tiercel had struck his prey to the ground, the wild bird singled out another of the partridges, clutching it in the air, and was carrying it off triumphantly, when Mr Ewen's bird caught sight of the stranger, and at once gave chase, causing it to drop the partridge; the tiercel then pounced upon the falling bird, and caught it before it reached the ground.

THE MERLIN (*Falco aesalon*).

Found in both counties, but is less common in Wigtownshire. Even in Ayrshire it appears to be in a measure restricted to the moors facing the sea. Its favourite prey is the snipe; it also kills dunlins, dotterel, and other shore birds. In the cultivated parts

of our district, and also those of Kirkcubrightshire, it is only a winter visitant.

A very beautiful adult male, measuring not more than nine inches in length, was shot on the farm of Drummuck, near Girvan, in the summer of 1869.

OBS.—The Hobby (*Falco subbuteo*) has occurred several times in the south of Scotland, viz., in Dumfriesshire, Roxburghshire, and Kirkcubrightshire. In the last named county, Mr Tottenham Lee procured two specimens, and saw a third.

THE KESTREL (*Falco tinnunculus*).

Common. A favourite resort for this species is the line of cliffs between Lendalfoot and Ballantrae, where we have seen many nests comparatively easy of access. Several pairs breed on the cliffs at the Mull of Galloway. The kestrel is quite harmless as a bird of prey to the game preserver, feeding on moths, beetles, and even worms. We have seen it in small groups on the public road near the edge of the cliffs referred to, apparently on the look-out for *Geotrupes stercorarius* burrowing in its favourite mounds. The kestrel appears to live on good terms with the starling and jackdaw, both of which are its daily associates during the breeding season.

THE SPARROW-HAWK (*Accipiter nisus*).

Of frequent occurrence, and much persecuted on account of its destructive ravages among game and poultry, keepers and farmers alike waging war against it. Its partiality for barn-door chickens and partridges has given the bird a bad name, and, indeed, its thefts are offences not easily overlooked. It breeds on the cliffs at the Mull of Galloway, but is perhaps better known as a native of old plantations, where it frequently makes use of the deserted nests of other birds.

OBS.—The Goshawk (*Astur palumbarius*) has been observed repeatedly in Kirkcubrightshire by Mr Tottenham Lee, who found its nest in at least two instances. See *Naturalist* for 1853, vol. iii., p. 45; also Mr A. G. More's paper in the *Ibis* for 1865.

THE KITE (*Milvus vulgaris*).

Formerly bred in Glen App, a beautiful district in the south of Ayrshire, but it is now doubtful if even a stray bird is at any

time visible. This fine species appears to be more sensitive to persecution than other birds of prey, judging from the very rapid diminution of its numbers throughout Scotland during the last twenty years.

Mr Gray lately examined a beautiful specimen shot near Beith many years ago. It is now never seen there.

THE COMMON BUZZARD (*Buteo vulgaris*).

Very uncommon, having doubtless yielded to the wide-spread persecution which has been practised since the excessive protection of game became common. In the upland ranges of both counties the nest is sometimes found. Specimens of both young and old birds are occasionally taken to Newton-Stewart from the neighbourhood of Loch Trool—a charming bit of scenery about sixteen miles north-east of that town. Mr Gray lately examined a specimen of this buzzard shot near New Cumnock.

THE HONEY BUZZARD (*Pernis apivorus*).

A young male bird of this species was shot on 21st September, 1864, at Wellwood, near Muirkirk, Ayrshire. It had been seen in the neighbourhood previously, and the keeper who shot it states that he trapped a bird of the same species in September, 1863, but that it broke away on his approach, leaving part of one of its legs in the trap.

Obs.—The Rough-legged Buzzard (*Buteo lagopus*) has occurred in Lanarkshire on the confines of our district, but not, so far as we are aware, within the limits we have prescribed for ourselves.

THE HEN HARRIER (*Circus cyaneus*).

Even of greater rarity than the preceding. A solitary pair may yet be seen frequenting some of the wilder moors of Wigtownshire, but so soon as their whereabouts is discovered, means are used for their destruction. The conspicuous appearance of the male bird against the brown heath, especially during flight, has no doubt tended to the discovery of the nest, and consequent capture of both birds. Keepers, on finding a nest, usually wait until the eggs are hatched, and are in the habit of killing all the young birds except one, which they fasten by the leg to a stake, and thus oblige to remain there, even after being fully fledged until

an opportunity occurs for shooting the old birds. This is sometimes but too easily accomplished, as they continue bringing prey to the tethered captive long after it should have been hunting the moors on its own account. From a published list of "vermin" destroyed by Lord Ailsa's keepers, within a limited area, between 25th June, 1850, and 25th November, 1854, we find that 310 "ash-coloured hawks" were killed in that interval.*

MONTAGU'S HARRIER (*Circus Montagu*).

Our only authority for recording this species is a notice by the late Mr Thompson in his "Birds of Ireland," vol. i., p. 83, where it is stated that a specimen—a male bird—was shot on a moor near Ballantrae in 1836.

STRIGIDÆ.

THE LONG-EARED OWL (*Otus vulgaris*).

Sparingly distributed in Ayrshire, and some parts of Wigtownshire, frequenting fir woods, especially where the trees are of some age. As a rule, this species is characteristic of the eastern side of Scotland.

THE SHORT-EARED OWL (*Otus brachyotus*).

Well known in the higher grounds, where it probably breeds, although we have not heard of any authentic discovery of its nest of late years. It formerly bred on the moors above Portpatrick. This bird occasionally takes voluntary flights by day, and appears to hunt over turnip and potato fields in quest of field mice, thus proving itself a useful friend to the farmer.

THE WHITE OR BARN OWL (*Strix flammea*).

This beautiful owl is not uncommon, taking up its abode in ruined castles, which are numerous scattered throughout Ayrshire. Some of these ruins are situated in very romantic places

* To show the ignorant and indiscriminate nature of the slaughter referred to, we may state that the list likewise includes thirty-three "Fern Owls," catalogued as offenders, with Brown Owls, Horned Owls, and Barn Owls—all innocent of the destructive propensities ascribed to them. Making the usual allowance for the proverbial diligence of keepers in general, we cannot but regard the destruction of the poor Nightjar as the result of a melancholy, but fortunately unusual, ignorance of the bird's habits.

on the borders of desolate moors, and the banks of fertile glens, where the bird is alike at home, trusting to the nearest clachan or homestead for a sufficient supply of its favourite prey.

THE TAWNY OWL (*Syrnium stridula*).

Frequently obtained. It seems to prefer woods where the trees are of some height, but its nest is seldom more than a few feet from the ground. It is merely a handful of withered leaves laid in a cavity where the larger branches diverge from the main trunk. The tawny owl is often procured by parties practising shooting at rooks. We have long noticed the partiality of this owl for rookeries.

THE SNOWY OWL (*Surnia nyctea*).

A splendid male bird of this species was shot near Kilmarnock in February, 1863, and exhibited by Dr Colquhoun at a meeting of the Natural History Society of Glasgow. It may not be out of place to state that two other examples of the snowy owl occurred in the Firth of Clyde about the same time. One of these, captured near Greenock, is now in the collection of Mr W. C. Angus, Aberdeen.

OBS.—The Hawk Owl (*Surnia funerea*), having twice occurred near the Clyde estuary, is likely to be met with accidentally in our district. Examples of this bird, no doubt, find their way to the shores of Scotland by means of Clyde ships, on which they alight when at a considerable distance from land, and remain until nearing the coast.

INSESSORES.

DENTIROSTRES

LANIADÆ.

GREAT GREY SHRIKE (*Lanius excubitor*).

It is only of late years that the grey shrike has appeared in our district, or indeed in any part of the West of Scotland. Mr Oliver Eaton, bird preserver, Kilmarnock, has informed us that he preserved a specimen which was shot on the Kilkerran estate on 10th December, 1868, by George Blacklaw, gamekeeper there, and Mr Gray has examined two which were obtained near Kilbirnie in 1863. It has likewise been shot in Renfrewshire on one or two occasions. This species is now a regular winter visitant to the eastern counties of Scotland.

*MUSCICAPIDÆ.*THE SPOTTED FLYCATCHER (*Muscicapa grisola*).

A quiet and unobtrusive species, generally distributed. It builds in gardens, sometimes close to dwelling-houses; at other times in rocky niches, and on the main stems of trees at a distance from such habitations. It feeds upon various insects, including moths and butterflies, and is fond of a conspicuous perch from which it can easily detect its passing prey.

*MERULIDÆ.*THE COMMON DIPPER (*Cinclus aquaticus*).

Very common on most of the rivers and streams of both counties, on the banks of which it breeds in various situations. We have seen its nest on inaccessible walls of rock, underneath bridges, in abrupt banks, on moss-covered rocky boulders, and in holes of trees. In severe winters the families of the previous summer appear to re-assemble, and forage together at open pools. We have noticed as many as five perched on the ice, and diving into holes broken by ourselves to admit of their access to the water. One of these birds frequented for some months the beams of a wooden bridge thrown across the water of Girvan at Enoch farm. It roosted every night in the same spot, and its first act in the morning was to take a "header" into the stream, and re-appear at a little distance from the bridge, after which it flew off to its ordinary haunts.

THE MISSEL THRUSH (*Turdus viscivorus*).

Now tolerably common, although a somewhat rare bird thirty years ago. Flocks of ten or twelve assemble in autumn, and frequent the fields about the time the crops are gathered. They seem partial to potato lands. It is now a very common species in the neighbourhood of Girvan. We observed about twenty feeding daily on Knock-a-vallie, near the shore, in June, 1869.

THE FIELDFARE (*Turdus pilaris*).

A familiar winter visitant, resorting to the coast line in hard weather, where it turns over the rejectamenta left by the tides in search of larvæ, etc.

THE SONG THRUSH (*Turdus musicus*).

Generally distributed. Near Girvan it resorts, during the autumn months, to the sea-shore, frequenting pasture lands in the immediate vicinity, and feeding on a small species of *helix* conspicuously plentiful at that season. It breeds upon Ailsa Craig, where its song may be heard strangely in contrast to the other sounds of various quality to be heard on that lonely rock.

THE REDWING (*Turdus iliacus*).

A winter visitant, appearing about the same time as the Fieldfare, and associating with it in its shore haunts.

THE BLACKBIRD (*Turdus merula*).

Abundant. Between Girvan and Ballantrae numbers of these birds may be seen, after the breeding time is past, frequenting the beach, and seeking refuge on hot days below the rocky boulders. We have ejected as many as fifteen and eighteen blackbirds from underneath one rock. This species is found on Ailsa Craig, where it breeds. Dr Anderson found a nest with five eggs built in one of the turret holes of the old castle a few years ago.

THE RING OUZEL (*Turdus torquatus*).

A very common species on many of the wildest moorland tracts of Ayrshire, but much less common in Wigtownshire, as far as our own observations enable us to judge. Mr Anderson has observed it frequenting his garden at Girvan late in autumn. This species migrates southward as winter approaches. Mr McDonald, one of the keepers at the Mull of Galloway lighthouse, captures an occasional specimen on the lantern about the time the flocks are quitting Scotland.

SYLVIDÆ.

THE HEDGE ACCENTOR (*Accentor modularis*).

The confiding Shufflingwing is everywhere known. It lives upon Ailsa Craig, among the kittiwakes and guillemots, and jerks about among the rugged stones as contentedly as if in the near neighbourhood of a stack yard.

THE REDBREAST (*Erythaca rubecula*).

Abundant. A fine specimen with a pure white head was shot

by Mr Anderson at Girvan, about three years ago, and is now in Mr Gray's collection.

THE REDSTART (*Phoenicurus ruticilla*).

Not common. It is, indeed, even rare in some parts of Ayrshire. Mr Oliver Eaton, during a long experience as a bird preserver at Kilmarnock, mentions that he has only had one specimen through his hands; it was shot by himself, at a coal pit at the Grange, in the end of October, and had been seen there two weeks previously. It frequents sheep farm steadings in retired upland districts, and is often found at an elevation of 1,500 feet above the sea level.

THE STONECHAT (*Saxicola rubicola*).

This lively bird is very abundant on the coast line extending from Ayr to Burrow Head, with the exception of spots here and there where the cliffs are of great height. In sheltered recesses, however, where a breach in the cliffs occurs and vegetation gets a hold, the Stonechat is sure to be there, perching on weeds and bramble stems, and uttering his monotonous "chuck-chuck" as he turns round to look at the intruder.

THE WHINCHAT (*Saxicola rubetra*).

Not nearly so common as the preceding species, but nevertheless occurring in considerable numbers. It is seen mostly in pairs, and often draws attention to its movements by its habit of fluttering over a particular spot, and snapping at insects while at rest on grassy stems, etc.

THE WHEATEAR (*Saxicola oenanthe*).

Very common. On Ailsa Craig it is also numerous, frequenting the summit of the island, where it breeds in crevices and rabbit holes. It sometimes lingers till October, both on the shore and on the upland sheep pastures.

THE GRASSHOPPER WARBLER (*Salicaria locustella*).

This warbler is very common in the neighbourhood of Kilmarnock. Mr Gray having recently observed this species in the collection of Mr Eaton, bird preserver there, made inquiries as to the localities frequented by the bird, and was informed by that

diligent collector that he had been familiar with it for the last nineteen years. "Almost all the young plantations," writes Mr Eaton, "are frequented by a pair; they arrive with our other summer visitors." We are also satisfied of the species being a native of Wigtownshire. It is stated in a communication by the late Rev. Thomas B. Bell, published in the Proceedings of the Royal Physical Society of Edinburgh, that it breeds in the parish of Leswalt in that county. We took notice of this interesting species near Girvan in the beginning of July, 1869.

THE SEDGE WARBLER (*Salicaria phragmitis*).

One of the commonest warblers in Ayrshire, and, so far as we can judge, a common species also in Wigtownshire. It is a very conspicuous bird on the banks of the Water of Girvan, where its unceasing mirth is sure to attract the most careless observer. It breeds in some numbers on the farm of Enoch, near Girvan, and is also very common near the curling pond. We have often observed this bird singing while on wing mounting into the air, and descending again with jerks to the hedge or growing grain from which it rose.

THE BLACKCAP WARBLER (*Curruca atricapilla*).

Wherever a soft, sylvan spot occurs throughout our district, the blackcap is a well-known element in the bird life of the locality. Being, in appearance at least, a firmly-built and hard-billed warbler, it might be expected to combat the rigours of a blustering autumn or early winter; hence we find that even when the woods are fast losing their tints, and all other warblers are gone, the blackcap lingers in young plantations and orchards, garden plots and sheltered nooks, feeding upon small fruits and insect prey, in searching for which it exhibits great restlessness. It may at these times be heard uttering a hard but clear note, reminding the observer of the habits of some of the larger Tits.

THE GARDEN WARBLER (*Curruca hortensis*).

Found sparingly in cultivated districts, chiefly frequenting orchards and cottage gardens, and taking up its perch regularly on some old apple tree, from the top branches of which it may be seen, morning and evening, pouring out its rich notes, to the delight of the listener. The song of this warbler, indeed, is only

surpassed by that of the nightingale. It is, however, of comparatively short duration, as the bird becomes silent when the first brood is hatched, and is only heard for a little while should a second nest be built.

THE COMMON WHITETHROAT (*Curruca cinerea*).

Very commonly distributed, arriving early in May, and enlivening almost every hedge-row in the two counties. It sometimes rears two broods, the nest being placed in tufts of coarse grass, bramble or briar thickets, or among rank plants near the base of a hedge. These birds arrive in full plumage, and are for a time very diverting from their liveliness and loquacity. As the season advances, however, the feathers become faded and worn, and the birds quit our coasts in a costume so ragged as to cause one to wonder how the little fellows, imperfectly clad as they are, can undertake the fatiguing journey they have in prospect. We have seen this warbler continually haunting the grassy patches occurring on the coast line between Girvan and Lendalfoot, where one would little expect to find a bird of sylvan habits.

THE LESSER WHITETHROAT (*Curruca sylvicola*).

Springily met with, and much less obtrusive in its habits than the preceding species. This warbler was well known as an Ayrshire bird thirty years ago. We are not, however, certain of its being a native of Wigtownshire.

THE WOOD WARBLER (*Sylvia sylvicola*).

A well-known, though not abundant, summer visitant to both counties. Being much quieter in its habits than the next species, it is not so often observed, although of brighter tints. It is also later in making its appearance, and in consequence not so easily perceived among the dense foliage of the trees which it frequents.

THE WILLOW WARBLER (*Sylvia trochilus*).

This welcome little summer bird is very common, arriving some seasons about the middle of April. It visits the glens in both counties extending to some height above the sea level, and remains there during the season, building its nest in heathery tufts, and lining it with game bird feathers. We have heard this species singing blythely in the middle of July.

THE CHIFF CHAFF (*Sylvia rufa*).

Of much rarer occurrence with us than the preceding species. We have identified it near Girvan, both on its arrival and previous to its departure. It prolongs its stay until the beginning of October, and may be then observed flitting anxiously among the birch and alder trees in some of the glens, uttering a cheeping note, and sallying out after passing insects.

THE GOLDEN-CRESTED WREN (*Regulus cristatus*).

Common. Great numbers are seen late in autumn frequenting fir woods in the south of Wigtonshire. They are apparently congregations assembling before migrating southwards. Mr McDonald, light-keeper at the Mull of Galloway, informs us that he captures quantities of these little creatures in the lantern about that season, and also again in spring when they return.

. PARIDÆ.

THE GREAT TIT (*Parus major*).

Tolerably common, and extremely restless in its habits, seldom remaining above a few minutes in one place. It often breeds in holes of walls, and sometimes in straw stacks. Old birds and young broods appear in gardens in July.

THE BLUE TIT (*Parus cæruleus*).

Very common; travelling in lively companies from place to place in the autumn and winter months. The nest is frequently found in gardens, placed generally in any suitable crevice in an old wall or hollow tree. It is a vigorous little bird in defence of its young.

THE COLE TIT (*Parus ater*).

Common in woods and belts of plantations. In the winter season it takes up its quarters in private policies, where the woods are old, and finds plenty of sustenance on the old trees infested with insects. We have often seen it hopping among the withered leaves on the ground, which it diligently turns over in search of prey.

OBS.—The Marsh Tit (*Parus palustris*), although known to occur in Renfrewshire and Lanarkshire, has not yet come under our

notice in our own district. It will, no doubt, however, be found in both counties.

THE LONG-TAILED TIT (*Parus caudatus*).

Common, frequenting woods and hedge-rows. Very conspicuous in autumn and the beginning of winter, when they assemble in troops and travel long distances in company.

AMPELIDÆ.

THE BOHEMIAN WAXWING.

Has occurred in Wigtownshire. A specimen seen and examined by Mr Gray was taken alive at Portpatrick in the winter of 1866. As a rule, this species is but seldom met with in the western counties of Scotland.

MOTACILLIDÆ.

THE PIED WAGTAIL (*Motacilla Yarellii*).

Very generally distributed. Large flocks gather in some of the shore districts of both counties, preparatory to a general migration. Great numbers of these birds roost in alder bushes growing upon the banks of the Girvan Water throughout the month of September. They come in at nightfall from all parts, and assemble in clusters, taking up their perches five or six on a branch. As many as thirty or forty may on these occasions be dislodged from one bush. After rain, they sally forth in companies in the morning to the nearest grass park, where they diligently devour the smaller larvæ and insects that may have been disturbed by the shower.

THE GREY WAGTAIL (*Motacilla boarula*).

Permanently resident. It is found on the high lands as well as the low grounds, and is very partial to clear, running water, frequenting alike the margins of drains, brooks, rivers, and ditches. The situation of the nest varies according to circumstances. It is found under bridges, in holes of walls and tree roots, sometimes within reach of a flood, and there are two broods in the year. We have seen as many as seven or eight of these beautiful wagtails in Girvan Harbour at low tide, and in August,

1869, we took notice of an equal number together at once in the stony bed of the Stinchar, near Daljerrock.

RAY'S WAGTAIL (*Motacilla Rayi*).

A common summer visitant, and found distributed in pairs throughout our district. We have seen it frequenting the pebbly bed of the Girvan at mid-day throughout the summer months. In the month of July, but more especially in autumn, we have repeatedly observed it on the sea-shore, generally at the mouth of a small rivulet. The plumage of the bird has then lost its lustre, and the bright yellow of the spring dress has entirely disappeared.

ANTHIDÆ.

THE TREE PIPIT (*Anthus arboreus*).

Found breeding near Girvan. Several pairs may be seen throughout the summer frequenting the outskirts of Killoop Wood. It is also met with at Braehill, and other localities in the district.

THE MEADOW PIPIT (*Anthus pratensis*).

There appears to be a partial migration of this species southwards in autumn, many flocks at that season descending from the higher grounds to the fields skirting the shore. These congregations disappear, and come back in the following spring. The meadow pipit, like some of the buntings and warblers, looks much altered about the close of autumn when the plumage becomes faded.

THE ROCK PIPIT (*Anthus petrosus*).

Strictly confined to the sea-shore, where it appears to be uniformly distributed from Ayr to the Mull of Galloway. In some places where the shore is flat it constructs its nest among the rough stones beyond high water mark, and at the line where tufts of grass appear in summer time. In rocky situations it is placed in crevices, sometimes at a considerable height in the front of the precipice. We have taken it in exceedingly picturesque spots on the line of rocks near Carleton Fishery—the nest being often placed under a tuft of wild roses or other flowers, and completely screened from observation.

ALAUDIDÆ.

THE SKY-LARK (*Alauda arvensis*).

The familiar laverock is abundantly distributed. Some winters ago immense flocks of larks appeared during hard weather in some fields close to the town of Girvan. On rising from the ground, the cloud of birds appeared so dense as to obscure objects in the line of their flight. Large numbers were killed on the telegraph wires, and after the flocks passed it was found that many birds had been mutilated, their wings being torn off by the wires.

THE WOOD-LARK (*Alauda arborea*).

The late Rev. Dr Landsborough informed Mr Gray that he had found this species at Stevenston. It has never come directly under our own observation. Various records of its existence as a familiar Scottish species have from time to time been published, but many of these, it is to be feared, refer to some other bird. The wood-lark, however, has certainly been found in many parts of Scotland, satisfactory instances of which are given in Mr Gray's "Birds of the West of Scotland,"* etc.

EMBERIZIDÆ.

THE SNOW BUNTING (*Plectrophanes nivalis*).

A winter visitant only, occurring at times in solitary specimens along the coast. As a rule, it is much commoner on the shores of the east of Scotland. In April and May the birds assume the breeding plumage, which in the male contrasts strikingly with the sober tints of the hill sides, where small flocks are seen flitting in advance of any intruder on their haunts.

THE COMMON BUNTING (*Emberiza miliaria*).

Very abundant in both counties, especially near the coast between Girvan and the borders of Kirkeudbrightshire. Mr Gray has observed it to be particularly common in the southern districts of Wigtownshire, where the pasture lands are irregularly broken with protruding masses of rock.

THE BLACK-HEADED BUNTING (*Emberiza schoeniculus*).

Common, and generally distributed. It breeds in some num-

* In the press, and will shortly be published.

bers in the neighbourhood of Girvan. In a nest taken by Mr Anderson one of the eggs was not much larger than a pea. It is permanently resident, and, so far as we can learn, there are no winter flocks in our district from other quarters.

THE YELLOW BUNTING, or YELLOW HAMMER (*Emberiza citrinella*).

This bunting is very common in all the lower grounds under cultivation. During the warm season of 1868 it appeared to be unusually abundant in Wigtownshire, and attracted notice by its assembling on the public roads during the excessive heat. They seemed to be the only birds visible, and harmonised curiously with the golden tints pervading all surrounding objects.

FRINGILLIDÆ.

THE CHAFFINCH (*Fringilla cœlebs*).

Very common everywhere, and a familiar visitant to farm-steadings even when situated in moorland localities. Mr Anderson found a nest of this species built on the top of a wall at Enoch Farm, beside a bit of turf. Two other nests were situated in a tree only a few feet from the spot. A tame Chaffinch at Penkill Castle lived in confinement upwards of seventeen years; it was taken from the nest, and carefully supplied with insect food, which doubtlessly accounts for its prolonged life in captivity.

THE MOUNTAIN FINCH, or BRAMBLING (*Fringilla montifringilla*).

A regular winter visitant, but only in small numbers, except in unusually severe weather. It then appears at farm-steadings, mixing with sparrows, chaffinches, yellow hammers, and green linnets; and is often caught by country boys, who cage their captives in triumph, as the *Cock o' the North*.

THE HOUSE SPARROW (*Passer domesticus*).

Extremely common. A colony of these birds have taken possession of a number of holes in a broken embankment above a deep pool in the Water of Girvan on Enoch Farm. Dr Anderson turned out many of their nests containing eggs; these had been placed on beds of material laid there by a colony of sand martins, the original owners of the holes. Frequent battles were fought by the martins and sparrows for possession, and these were in one

or two cases settled by the two species sharing a hole between them—the martins' nests being placed at the very extremity of the hole, and the sparrows' about midway from the entrance.

Mr Gray has examined two cream-coloured varieties of this species in the possession of Mr John Jamieson, Ardrossan.

THE GREENFINCH (*Coccothraustes chloris*).

Permanently resident, and generally distributed. During the autumn months very large flocks of these birds congregate in fields adjoining the sea-coast, and feed upon the seeds of various plants, also upon left grain. Swarms of them are seen on the mounds of chaff visible here and there along the shore, the record of visits of itinerant threshing machines. Sparrow-hawks and other birds of prey often stoop into the midst of these multitudes, and carry a bird to the nearest rock, where it is plucked and devoured. During this process the linnets re-assemble on the chaff, and are again pounced upon, the hawk, in this second instance, flying off to a distance with his victim.

Mr Eaton has in his possession a specimen of the green linnet of a pure bright yellow, with the quill feathers entirely white.

THE GOLDFINCH (*Carduelis elegans*).

There can be no doubt that the great improvements effected in the agriculture of the two counties have materially lessened the number of goldfinches throughout the country. Its favourite food is the seed of plants now carefully destroyed by the husbandman, so that the bird's haunts are, for the most part, now confined to glens penetrating some distance into the uplands, where these plants are yet tolerated, or where their growth is not a hindrance to profitable farming.

THE SISKIN (*Carduelis spinus*).

Although we have not yet taken the nest of this bird in either of the counties, we are inclined to think it may yet be found. It breeds in the adjoining county of Kirkcudbright. Siskins are captured by the country bird catchers in small numbers, chiefly during the autumn season. As a rule, these birds are much commoner in the eastern counties.

THE COMMON LINNET (*Linota cannabina*).

Common throughout the district. "In some parts of Ayrshire linnets are gregarious to some extent, even in the breeding season, both on the sea-shore and in the pebbly beds of rivers and smaller streams, which they frequent at certain hours, coming and going together in flocks with apparent regularity." See "Birds of the West of Scotland."

THE MEALY REDPOLE (*Linota canescens*).

This species, occurring, as it does, frequently in Kirkcudbrightshire, may also occur in our district in some numbers. At present, however, we can only record with certainty a single example: it was shot at Caperton, near Kilmarnock, in April, 1864, and is now in the possession of Mr Eaton, bird preserver. We may state that, in the same year, many specimens were taken in the south of Scotland.

THE LESSER REDPOLE (*Linota linaria*).

This interesting and familiar bird is sparingly distributed in localities suited to its habits. It breeds in both counties, and in Renfrewshire and Dumfriesshire. The habits of the lesser redpole may be easily studied, as it is exceedingly tame, and heedless of observation.

THE MOUNTAIN LINNET, or TWITE (*Linota montium*).

This, the "heather lintie" of most rural districts, is generally distributed, frequenting chiefly the higher grounds beyond the limits of high cultivation. It is a much more plentiful species in the western counties than those of the east of Scotland. Mr Gray has given an account of its habits, as observed by himself in the Outer Hebrides, where it is extremely numerous. See "Birds of the West of Scotland."

THE BULLFINCH (*Pyrrhula vulgaris*).

Is found in considerable numbers throughout Ayrshire. It is nowhere more plentiful than in some of the glens within a few miles of Girvan, where groups of five or six may be heard piping from the alder thickets after the young are fledged. We have observed it to be particularly common on the farm of Drummuck,

in the parish of Dailly; indeed, the whole of the valley of Girvan seems peculiarly attractive to the species.

THE COMMON CROSSBILL (*Loxia curvirostra*).

A yearly visitant, and probably a permanent resident in some places. It breeds in the woods on Drummuck farm, the nest having been found there as late as May—probably a second brood. We have seen specimens of the bird that were killed there at that season. In the adjoining county of Kirkcudbrightshire the crossbill is equally well known; and a record dated as far back as 1792 states that it then was known to breed in the parish of Buittle. Mr Gray has been informed by a gentleman well acquainted with birds, that he has every reason to believe that it breeds there still.

THE PARROT CROSSBILL (*Loxia pityopsittacus*).

This rare species has been obtained on the confines of Ayrshire, a specimen having been killed at Wemyss Bay in the spring of 1862, as recorded in “Birds of the West of Scotland.”

STURNIDÆ.

THE COMMON STARLING (*Sturnus vulgaris*).

Has become very common of late years, chiefly owing to the protection afforded it. It appears to have spread itself in all quarters, although thirty years ago it was comparatively rare. This bird seems partial to the sea-shore during the winter season.

CORVIDÆ.

THE CHOUGH (*Fregilus graculus*).

Inhabits the cliffs near Ballantrae, also the Mull of Galloway and Burrow Head. Its numbers of late years, however, have become greatly reduced. Mr Gray has visited its haunts repeatedly for the express object of seeing the birds, but has almost invariably been disappointed. One was shot near Burrow Head in the beginning of November, 1868. Along the shores of the southern part of Kirkcudbrightshire it occurs in small flocks; and Mr Gray has been informed by Mr Watson, Stranraer, that he has seen it frequently, during the last few years, in the parish of Kirkmaiden. Mr M'Donald, of the Mull of Galloway lighthouse, states his

opinion, that in his neighbourhood the chough was much oftener seen some years ago than it is now; indeed, he believes that at present there are only one or two pairs. The Rev. Thomas B. Bell of Leswalt, Wigtownshire, in a communication made some years ago to the Royal Physical Society of Edinburgh, says that the chough “annoys the farmers by digging up the sprouting wheat and tearing off the roofs of their stacks.”

THE RAVEN (*Corvus corax*).

Now greatly thinned, being greatly and justly disliked by the sheep farmer, on whose lands it commits its worst depredations. Notwithstanding the rigorous persecution to which it is subjected, the raven seems even yet in less danger of total extirpation than many other birds whose lives are in constant danger. The best time to shoot the vagabond is at dusk, when he and his mate are returning from a day's foray to their favourite roosting place. The following lines are taken from an address to the bird, probably written by some half-poetical and watchful keeper, in the prospect of a revengeful shot:—

“ Say, weary bird, whose level flight,
Thus, at the dusky hour of night,
Wends through the midway air—
Why yet beyond the verge of day
Is lengthened out thy dark delay,
Adding another to the hours of care?”

THE CARRION CROW (*Corvus corone*).

Not common, but seen occasionally in autumn frequenting the sea-shore, sometimes in company with the Hooded Crow. *Hoody Crow* is the name given to this bird in most parts of Scotland.

THE HOODED CROW (*Corvus cornix*).

About equal in numbers with the preceding bird, but both are well kept down by the game preservers. As the two birds are perfectly identical in form, size, habits, and general mode of living, and are *known to breed freely together* in the middle districts of Scotland, it is difficult to believe in any specific distinction between them. The grey-backed bird is believed by Mr Gray to belong to a northern race of the carrion crow, and it has been ascertained that the boundary line where the two unite stretches from Argyleshire through Perthshire and Forfarshire. In the Outer Hebrides

the grey markings become permanent. See "Birds of the West of Scotland," where the question of unity is more fully dwelt upon.

THE ROOK (*Corvus frugilegus*).

Abundant. Recent discussions in agricultural quarters have placed this bird in a somewhat doubtful position. That rooks commit mischief cannot, we think, be called in question; but that they also do great service, in devouring noxious larvæ and other farm insect-pests, is equally true. The question is, on which side does their daily habit preponderate? The following fact, communicated to an Edinburgh newspaper during a late controversy on this point, seems to show that their appearance on newly-sown fields is not necessarily associated with bird damages:—"I put a boy," says the writer, "to keep them off a field of six acres sown with wheat in October. The season was wet and cold, so the boy got under a tree in the corner, made his little fire, and enjoyed himself. So did the rooks on every part of the field except that within stone-throw of the corner. In this portion of the field the wheat was wretched; but wherever the rooks had eaten up the slug or the wire-worm, the crop was plentiful."

THE JACKDAW (*Corvus monedula*).

Very abundant in both counties, frequenting old castles, rookeries, and rocky headlands, such as the Mull of Galloway and Burrow Head. In both the last-named localities it is feared that it has been the means of nearly exterminating the chough. Dr Anderson shot a specimen which had its mandibles crossed like those of a *loria*. The bird is now in the University Museum, Glasgow.

THE MAGPIE (*Pica caulata*).

This beautiful bird has of late years been very much shot down in game-preserving quarters. We were lately interested in observing as many as twelve or fourteen magpies, on the farm of Littleton, near Girvan, where no keeper had been employed for some years. These birds kept strictly within the limits of their asylum. We have been informed, however, that a few weeks ago the keeper on the surrounding estate (Culzean), invaded their sanctuary, and shot several birds after having destroyed the nests.

THE JAY (*Garrulus glandarius*).

Even less numerous than the magpie, although rivalling it in beauty of plumage. Its thievish habits form the universal apology for its destruction; but no sensible ornithologist, we think, would object to a few jays being left to enliven and beautify our woods.

INSESSORES.

SCANSORES.

PICIDÆ.

GREAT SPOTTED WOODPECKER (*Picus major*).

This Woodpecker, which of late years has become rather a common winter visitant to the eastern districts of Scotland, has been obtained several times in Ayrshire, and once on the outskirts of the county. One was shot at Cumnock; another at Fullarton, near Troon, on 2d November, 1868; and a third, about five weeks later, near Ayr. For these notices we are indebted to Mr Oliver Eaton, bird preserver, Kilmarnock. A specimen was shot at Inverkip, Renfrewshire, in October of the same year. This locality is very close to the boundary of our district.

CERTHIADÆ.

THE COMMON CREEPER (*Certhia familiaris*).

Well known in both counties, and permanently resident in woods and patches of plantation attractive to a bird of its habits.

THE WREN (*Troglodytes vulgaris*).

Common everywhere. It frequents Ailsa Craig, where it apparently remains all the year. Great numbers of winter nests are found underneath the abrupt banks of the water of Girvan. These structures are of small size, and without any lining.

There is a cream-coloured variety of this bird in the collection of Mr Eaton, Kilmarnock. It was shot near that town.

THE HOOPOE (*Upupa epops*).

Mr Yarrell states, in his "British Birds," that a specimen of the hoopoe was killed in Ayrshire, without, however, specifying any particular locality. This record probably refers to a specimen shot near Coylton, in Ayrshire, on 16th October, 1836—an occurrence which is noted in the "Magazine of Geology and Botany," Vol. I., page 491, on the authority of Mr P. W. MacLagan.

Mr Gray was lately informed by Mr Stewart of Tonderghie,

Wigtownshire, that one of these birds frequented his policies in 1862 for about ten days, and was frequently seen near the house. It has once occurred in Renfrewshire—a specimen having been shot near Port-Glasgow in October, 1863.

CUCULIDÆ.

THE COMMON CUCKOO (*Cuculus canorus*).

Very common throughout the whole district. In passing northward it halts for a time on Ailsa Craig, and enlivens that isolated spot with its familiar salutation. These visits, however, are brief and uncertain. Mr Anderson has observed that all the specimens yearly killed by him immediately after their arrival appear to be in the moult.

INSESSORES.

FISSIROSTRES.

MEROPIDÆ.

THE ROLLER (*Coracias garrula*).

The late Dr Landsborough informed Mr Gray many years ago that a specimen of this rare bird was shot near Stevenston, in Ayrshire, about the year 1833. It has occurred in some of the neighbouring counties, but not elsewhere in our district.

THE BEE EATER (*Merops apiaster*).

In the summer of 1832 a bee eater was shot at Logan Garden, in the parish of Kirkmaiden, Wigtownshire. The species has occurred frequently in the eastern counties of Scotland, but is decidedly rare in the west.

HALCYONIDÆ.

THE KINGFISHER (*Alcedo ispida*).

The brilliant kingfisher is not uncommon on all our streams, preferring, however, those whose banks are clothed with birch and alder trees, or other overhanging bushes, in which it can perch and look out for prey. It breeds on the banks of the Stinchar and Girvan Water, and other picturesque streams, and delights the rambler in its romantic haunts as it whirrs past him when changing its pools. We have seen it fishing in company with the dipper in severe weather, when both were glad to avail themselves of an opening in the ice. On one occasion four or five dippers—probably a brood of the previous summer—had assembled at such an opening, and were perched in a half-circle, when

a kingfisher, which had been sitting on a twig overhead, an unobserved "companion of the bath," flashed like an emerald into the water, and almost immediately reappeared with a minnow, which it battered on a little ice block, and then devoured. In this group of tiny plungers a beautiful grey wagtail sat in disconsolate silence, the whole of the birds forming a somewhat interesting winter assembly.

HIRUNDINIDÆ.

THE SWALLOW (*Hirundo rustica*).

Very common everywhere, extending to lonely and unfrequented shielings on the hill sides, and breeding in the rafters, or under bridges spanning moorland burns. Mr Anderson took a nest of this bird in an outhouse at Penkill farm, which was built on a tree branch hanging from the roof. This nest is now in Mr Gray's possession. It is composed of the usual materials, but is circular in shape, and profusely decorated with peacock's feathers. After the nest had been removed, the birds constructed another in a similar situation, and bedecked it in the same ornamental manner. A somewhat unusual site was selected by a pair of these birds this year at the Killochan Station, on the Maybole and Girvan Railway. The nest was built on the top ledge of a frame of an advertising placard, about eight or ten feet from the ground.

THE MARTIN (*Hirundo urtica*).

This familiar species is, as may be supposed, common over both counties, frequenting towns, villages, and farm-steadings. On some country mansions we have counted as many as eighteen and twenty nests built under the projecting eaves, and clustered, in some cases, closely together. A large colony frequents a part of the rocky cliffs near the port of Currarie, a few miles south of Ballantrae. Their nests are placed in fissures of the rock above the mouth of a large cave frequented by cormorants and rock-doves. In wild weather these nests are sometimes in danger of destruction by the masses of spray dashed over their surface.

THE SAND MARTIN (*Hirundo riparia*).

The haunts of this early summer visitant are met with in our district from the vicinity of the sea-shore to an elevation of ten

or twelve hundred feet on the hills surrounding the moorlands of Ayrshire. It lives in colonies sometimes numbering twenty or thirty pairs, but is often found in single pairs in small quarries and abrupt river banks in retired places. We have seen their occupied burrows on the summit of Mulloch Hill and elsewhere, in the face of the little cuttings made by the road makers, and have watched them during our intervals of rest while exploring these places for Silurian fossils. In these upland haunts we have never found more than one pair inhabiting a quarry.

On the banks of the Water of Girvan, near Drumrannie, a numerous colony existed some years ago. Dr Anderson carefully examined upwards of a dozen of their burrows, most of which he found occupied by two pairs of birds, each passage branching into two about a foot from the outside. This particular bend of the river was frequented by the martins regularly for years, although every winter large masses of the banks were carried away by the floods. A few pairs still remain, and may be seen disputing the occupancy of the holes with a colony of impudent sparrows who lately took possession of them before the martins arrived.

Mr Gray has seen an albino of this species in the possession of Mr John Jamieson, Ardrossan.

THE COMMON SWIFT (*Cypselus apus*).

Extremely abundant. Towards the close of summer very large numbers congregate in the south of Wigtownshire, before finally quitting our shores.

The numerous old castles whose ruined towers are so conspicuous throughout Ayrshire, are all frequented by numbers of swifts, and occupied as nurseries during their brief summer stay. From these ancient ruins the birds take long excursions, especially in dull weather, returning to their cold and *erie* quarters at night-fall. The eggs of this species are very difficult to procure, the nest being almost invariably placed in holes and crevices with an extremely small entrance. We have found a long tobacco pipe useful for extracting them from these cracks and fissures, but even with such an instrument there is always a risk of breakage, unless the eggs can be seen.

CAPRIMULGIDÆ.

THE NIGHTJAR (*Caprimulgus Europæus*).

Sparingly distributed, but nowhere numerous. It is, however,



familiar enough to most collectors, and is a native of both counties. The nightjar is, perhaps, oftener recognised in its moorland quarters, from which it descends at the gloaming to the lower grounds in quest of moths and beetles, which we have seen it dexterously snapping from the surface of a grass field.

RASORES.

COLUMBIDÆ.

THE RING DOVE, OR WOOD PIGEON (*Columba palumbus*).

Of late years this bird has become very numerous, and is now looked upon as a feathered nuisance throughout the agricultural counties of Scotland. In Ayrshire it has been for some years past a destructive farm pest, devouring the ripening wheat and other cereals in great quantities. In Wigtownshire, where turnips are cultivated to a large extent, it is equally mischievous, by eating up the tender blades, and destroying the growth of the bulb. It even picks up the sprouting seed of the turnip shortly after it has been sown; and as it feeds voraciously from early dawn to sunset, its depredations are not easily checked. Some years ago Mr Anderson found it a good plan to visit the turnip drills about sunrise, when the pigeons were found even at that hour dozing half asleep, after an early breakfast, and, by taking them in a line, give them a good charge of No. 6 at fifteen yards. The ravages committed by wood pigeons in East Lothian have been met by a most extraordinary but unavailing slaughter of the birds on the part of the farmers of that district. This district is fully considered in the "Birds of the West of Scotland."

THE ROCK DOVE (*Columba livia*).

Plentiful along the coast between Ballantrae and the entrance to Loch Ryan, and also along the range of cliffs forming the Mull of Galloway. In these localities there is the usual admixture of the domestic breed, judging from the number of parti-coloured specimens noticeable in the flocks frequenting the line of caves on both Ayrshire and Galloway coasts. Last year we found a single pair breeding in the roof of a cave under the ruins of Turnberry Castle. A number of pairs frequent the caverns of Ailsa Craig.

Like the wood pigeon, this bird is occasionally destructive on farms in the vicinity of its haunts.

THE TURTLE DOVE (*Columba turtur*).

Has occurred several times in Wigtownshire. The late Dr Landsborough mentioned to Mr Gray that a specimen was shot at Stevenston, Ayrshire, in 1834.

PHASIANIDÆ.

THE COMMON PHEASANT (*Phasianus colchicus*).

Abundant in all the preserves of both counties, and nowhere more numerous than in some parts of Ayrshire, where the protection of all kinds of game is encouraged to an injurious extent. In the preserves at Culzean Castle, and also on the estate of Kilkerran, there is a handsome breed frequenting the woods, viz., a cross between this species and Diard's pheasant (*P. versicolor*).

TETRAONIDÆ.

THE BLACK GROUSE (*Tetrao tetrix*).

This handsome species is very common on all the moors, especially those of the higher grounds of Ayrshire. In Wigtownshire it extends to the Mull of Galloway, and has been seen near the Lighthouse. It has also been found on the moors above Portpatrick, within sight of the Irish coast. Various attempts have been made to naturalise the species in Ireland, but without success.

A fresh egg of this bird was found about two years ago near the summit of Ailsa Craig, but it had probably been carried thither by some vagrant gull.

Mr Anderson has remarked, that in the neighbourhood of Girvan (Cuddlystone Glen), he has seen young broods near cultivated fields, and at a long distance from the usual haunts of the old birds. In June, 1869, we sprung a grey hen in this locality, attended by a brood of seven healthy chicks.

OBS.—The Capercaillie (*Tetrao urogallus*) has, in one instance, been met with near Auchengray, in Lanarkshire, which is sufficiently close to our boundaries to merit remark. The specimen—a fine male bird in beautiful plumage—was shot by Henry Lees, Esq., in December, 1868.

THE RED GROUSE (*Lagopus Scoticus*).

Abundant on all the numerous shootings in both counties.

Very handsome birds are bred on some of the Ayrshire moors. The disease to which this fine bird, for the last twenty years, has been more or less subject, appears to be intimately associated with the destruction of birds of prey frequenting its haunts. (See "Proceedings," page 226).

THE COMMON PARTRIDGE (*Perdix cinerea*).

Also very common, and well distributed, extending in Wigtownshire to the verge of the cliffs at the Mull of Galloway Lighthouse, where we saw a covey last year in a small patch of oats in the enclosed piece of cultivated ground belonging to the Commissioners.

In ordinary seasons this bird is useful to farmers as a destroyer of *aphides* and other larger insects, which adhere to and injure the leaves of the turnip. Mr Anderson has seen a covey leisurely traversing the turnip drills, and picking the insects from the under side of the leaves; and we are gratified to learn from Mr J. A. Harvie Brown—an excellent observer, resident in Stirlingshire—that he has made similar observations on this habit of the partridge, during the present summer. "The *Green Fly*," writes Mr Brown, "is abundant on turnip leaves in some places this year, and the partridges seem to feed largely on it. I observed a covey, the other day, feeding along the edge of a turnip field, underneath the leaves; and Mr Drummond observed the same thing this year. I don't remember having actually seen them doing this before." A beautiful albino of this species was shot in Wigtownshire some years ago, by H. Stewart, Esq., of Tonderghie.

THE COMMON QUAIL (*Coturnix vulgaris*).

Well known both in Ayrshire and Wigtownshire. It is not uncommon near Girvan, frequenting grass fields, where, on summer nights, it is often detected by its soft and liquid note. Among rural people it is known by the name of *wcet-my-feet*, these words being well expressed in the sounds emitted by the bird. Mr Gray has in his collection a specimen in summer plumage, shot near Kilharnock, in May, 1868, by Mr Eaton, who states that it must breed somewhere in that neighbourhood. The nest has been frequently found in other parts of Ayrshire. Mr Gray has in his collection two very prettily marked eggs, taken along with other nine in a nest near Ardrossan, by Mr John Jamieson.

The nest was found by a party of mowers while at work in a rye-grass field. Quails were abundant in some districts of Wigtownshire about seventy or eighty years ago.

OBS.—It may here be remarked, that in the Statistical Account of the parish of Maybole, published in 1836, the Great Bustard (*Otis tarda*) is mentioned in a list of the birds of that district prepared by Dr M'Tyer. We have no means, however, of now proving the authenticity of this record.

GRALLATORES.

CHARADRIDÆ.

THE GOLDEN PLOVER (*Charadrius pluvialis*).

Very abundant, and resident all the year, frequenting the moors in summer during the breeding season, and the sea-shore at low tide in winter. When the tide is full they repair to fallow grounds in the interior, sometimes travelling inland to a considerable distance. They seem to know instinctively at what hour to leave, so as to reach the coast when the rocks and sands are being exposed as the water recedes. On these occasions the flocks are immense, covering many acres of the shore, and sometimes packing so closely as to form a vast ornithological causeway. In the months of February and March, about the time when plovers partly assume their breeding plumage, Mr Anderson has seen flocks alighting in grass fields on Enoch Farm, and literally covering about eight or ten acres of ground. A noted haunt for this species in Ayrshire is the farm of Turnberry Warren, about five miles north of Girvan, where many thousands congregate in the pasture lands near the sea about the middle of July.

THE RINGED PLOVER (*Charadrius hiaticula*).

One of the commonest shore birds from Ayr Heads to the Mull of Galloway wherever a stretch of sand occurs. Large migratory flocks appear to congregate on the shores of the Mull of Galloway in autumn. These flocks break up and disappear as winter approaches.

THE SANDERLING (*Culidris arenaria*).

About the beginning of August this species is found in considerable numbers on the shore near Girvan, but does not remain there longer than two or three weeks. We have repeatedly, and in some seasons invariably, found it in pairs, resting on the wet sand at low tide.

THE GREY PLOVER (*Squaterola cinerea*).

Very sparingly met with on the coasts. It appears to be much commoner in the eastern counties than with us.

THE LAPWING, OR PEEWIT (*Vanellus cristatus*).

Extremely common in the autumn months, congregating in pasture lands and the sea shore alternately. It disappears to a great extent in November, and returns in April, when the breeding haunts are occupied. They breed in communities of twenty or thirty pairs. In the last week of July, 1869, we observed a number of pairs of lapwings on the farm of Turnberry Warren, near Girvan, and being attracted by the behaviour of the birds as they plunged in the air while we drove past, we made a search in the field, and were surprised to find concealed among the rushes eight or ten broods in the down. These young birds were not more than ten days old. We have often observed this bird on moonlight evenings travelling in companies at a late hour, and at a considerable height in the air. Rural people in Ayrshire speak of the peesweep as a restless and "ill-conditioned brute." A properly seasoned dish of lapwings, however, about the close of autumn, when their flesh is really palatable, might help to dissipate this prejudice.

THE TURNSTONE (*Streptilas interpres*).

Although the Turnstone cannot be called a common species in Ayrshire, it is never altogether absent. It is generally seen flying in flocks of five or six birds, and is somewhat restless in its habits, owing, probably, to the beach being unsuitable for a prolonged stay. Very fine specimens, nearly in the full breeding plumage, have been obtained by Mr Eaton at Ardrossan, where it appears to linger every year until May. In its winter dress it is common in some parts of Wigtownshire, such as the Bay of Wigtown, Galloway Harbour, and the shores of Loch Ryan, etc.

THE OYSTER-CATCHER (*Haematopus ostralegus*).

Very common. On Fairlie Sands as many as fifty or sixty may be seen at a time, ranged along the oozy shores at low water. Southward on the Ayrshire coast, however, it becomes less numerous, and from Ayr to Ballantrae it occurs mostly in pairs, the small sandy bays offering but little temptation to a greater num-

ber to remain. In Loch Ryan, Wigtown Bay, and Garliestown, it again appears in abundance. We have seen flocks of twenty to thirty, flying at a great height, passing Girvan on their way to another feeding ground; and have counted, in the month of July, as many as sixty resting together on the sandy beach near Turnberry Castle.

ARDEIDÆ.

THE COMMON HERON (*Ardea cinerea*).

Common everywhere, from the sea-coast to the source of the moorland burn, many miles inland, and more than a thousand feet above the sea level. There are one or two heronries in Ayrshire. Towards nightfall, in the month of August, we have seen as many as six herons flying in company, and following the windings of the Water of Girvan, looking out for an attractive pool. They are at times very destructive to fish.

THE COMMON BITTERN (*Botaurus stellaris*).

Formerly bred in Bruntwood Loch, near Mancline. This species is now, however, of very rare and uncertain occurrence in both counties. We have not, indeed, seen a recently killed specimen for some years.

THE NIGHT HERON (*Nycticorax Gardeni*).

Mr Eaton has informed us that a specimen of this heron was shot, many years ago, within a mile of Kilmarnock. We know of no other instance of its occurrence in any part of our district.

SCOLOPACIDÆ.

THE COMMON CURLEW (*Numenius arquata*).

The well-known whaup is very abundant, breeding on all the moors of both counties, and frequenting the entire coast line, at low water, from Fairlie banks to the shores of Kirkmaiden. When the young are fledged, and begin to congregate in autumn, they frequent pasture lands, and are then easily obtained, not having acquired the characteristic wariness of the old birds. We have seen them in July traversing the line of high water mark, and feeding upon sand hoppers, which at that season are exceedingly abundant; and in the same month immense flocks collect in

the pasture lands of Turnberry Warren farm, from which they make daily visits to the beach. On 24th July, 1869, we noticed a flock in which there could not have been fewer than 500 birds.

THE WHIMBREL (*Numenius arquata*).

Almost never seen with us but in May, during its migratory flight northwards. A few are tempted to travel along the shore as far as the Clyde estuary, where they linger about two weeks. The principal flocks appear to take a more direct line to their breeding quarters, by steering for Islay, Jura, and Mull, and thence to the outer Hebrides, where they make a longer stay.

THE COMMON REDSHANK (*Totanus calidris*).

Breeds in both counties, and is nowhere more common than in the Bay of Luce, from Port-William to the Drumore coast. Its summer haunts are numerous throughout the district, and present a variety of scenery, from the low lying marshes of the south of Wigtown to the chain of moorland lochs lying embosomed among some of the finest mountain ranges in our district. We have observed it in small flocks on the coast as early as the beginning of July.

OBS.—The Green Sandpiper (*Totanus ochropus*), and the Wood Sandpiper (*T. glareolus*), have both occurred in districts bordering upon our limits, but not exactly within the prescribed boundaries.

THE COMMON SANDPIPER (*Totanus hypoleucos*).

This lively species is very common from April to September, frequenting every stream, and many of our moorland lochs, on the banks of which they breed in considerable numbers. On the Girvan Water, which is subject to frequent floods, these birds instinctively avoid places for nesting inside the embankment, and invariably betake themselves to the adjoining turnip and potato fields, where the nest is often found under shelter of the leaves of the growing plants. The young, on being hatched, are led by both parents to the water's edge, where they remain almost continually until able to shift for themselves. We have also found the broods in drains and ditches communicating with the river. In the autumn the families assemble, and follow the stream to the sea, where they remain a week or ten days before finally leaving the coasts.

THE GREENSHANK (*Totanus glottis*).

Sparingly distributed along all the shores in autumn and winter. In the months of August and September we have seen it ascending the courses of our larger streams, and coming to a distance from the sea-coast. Two very fine specimens now before us were shot by Dr Anderson in the pebbly bed of Girvan Water, on Enoch Farm, some years ago.

THE BAR-TAILED GODWIT (*Limosa rufa*).

In the Bay of Luce and also in Wigtown Bay this bird finds an agreeable resting-place in its flight southwards at the close of summer. On the coast of Ayrshire, however, it is much seldomer observed, probably from the fact of the western migratory flocks coming down from the Hebrides, and taking the southern point of Scotland as their guide to the Solway Firth, where considerable numbers remain during the whole of the winter months.

OBS.—The Black-tailed Godwit (*Limosa melanura*) has occurred on two occasions on the confines of our district. One was shot on the Renfrewshire side of the Clyde estuary on 25th November, 1867; another was killed on the Castle Semple Estate, near Lochwinnoch, in the last week of August, 1869.

THE RUFF (*Machetes pugnax*).

So far as we can judge, this species is rare in any part of our district. The Solway Firth appears to check its progress northward in autumn, or rather to divert the line of its flight eastward through the southern portion of the counties of Roxburgh and Berwick to the shores of Haddington and Fife. The Ruff has occurred in Renfrewshire, and we lately heard of a specimen having been shot near Kilbirnie, in Ayrshire—an inland situation. The female is apt to be overlooked by ordinary sportsmen, owing to its small size.

THE WOODCOCK (*Scolopax rusticola*).

A common winter visitant. It arrives generally in September, and leaves in April. Many of these birds are taken in lighthouses about the time they pass northward. We have not yet heard of the nest having been taken in any part of our district.

THE GREAT SNIPE (*Scolopax major*).

A specimen of this bird was shot by Mr W. Boyd of Greenock, in September, 1868, on the lands of Corsehouse, in the parish of Stewarton, as narrated in Gray's "Birds of the West of Scotland." The species has likewise been shot in Renfrewshire, on the borders of our district.

THE COMMON SNIPE (*Scolopax gallinago*).

Abundant in suitable localities over the district. The great amount of drainage, however, which has been effected during the last twenty years, has been the means of banishing the snipe from former waste lands now under cultivation. Numbers are yet observed in the larger drains and ditches bounding the grain and grass fields of the low country.

THE JACK SNIPE (*Scolopax gallinula*).

Strictly a winter visitant, and found in some numbers in small marshes and moist meadows.

THE CURLEW SANDPIPER (*Tringa sub-arquata*).

Not commonly met with, although it is probably seldom absent, during the winter months, from Loch Ryan, Luce Bay, Garliestown shore, and the Bay of Wigtown. It can only be regarded as a straggler on other parts of the coast of either county, and is, for the most part, seen there on its arrival in the beginning of autumn.

THE KNOT (*Tringa canutus*).

So far as our observations extend, this species is rather rare in our district. It never appears on our shores in flocks of more than three or four birds. One was taken on the lantern at the Mull of Galloway Lighthouse, in September, 1866; but Mr Gray, who happened to be there at the time, was informed by the keeper that he had never seen one in the district before.

THE DUNLIN (*Tringa variabilis*).

This extremely variable species, as regards size, colouring, and length of bill, is found in great numbers on the sea-coast, in sandy bays, and muddy estuaries, and is also met with, sparingly, during summer, breeding on the margins of little fresh water

lochs and pools among the hills. Mr Gray is inclined to regard the dunlin of the Outer Hebrides as belonging to a northern race, being darker in colour and much smaller in size than that found on the south-western mainland.

THE PURPLE SANDPIPER (*Tringa maritima*).

Occurs in irregular flocks on the rocky parts of the Ayrshire coast, and has also been found in Wigtownshire. Dr Anderson killed five of these birds at a shot, near Girvan, a few years ago. We have also seen specimens killed near Ardrossan.

THE GREY PHALAROPE (*Phalaropus lobatus*).

Of very rare occurrence in any part of our district. Single examples have been obtained on the northern shores of Ayrshire. It has also occurred in Renfrewshire. The Red-necked Phalarope (*Phalaropus hyperboreus*) has never, to our knowledge, been met with in Ayrshire or Wigtownshire.

RALLIDÆ.

THE LANDRAIL, OR CORN CRAKE (*Crex pratensis*).

Abundant everywhere. With us it calls throughout the whole of the night, from the time of its arrival till the end of July. In warm seasons numbers of corn crakes frequent the Water of Girvan about mid day, and appear to delight in bathing in the little pools among the pebbles of the stream. During excessive heat, we have seen these birds anxiously traversing the dusty roads in quest of water.

THE SPOTTED CRAKE (*Crex porzana*).

In both counties this bird has several times been captured, and it has been taken in Renfrewshire. Mr M'Omish, bird-stuffer, Stranraer, showed Mr Gray a specimen killed near that town in 1867. From its quiet and unobtrusive habits, the spotted crane is but seldom observed anywhere.

THE WATER RAIL (*Rallus aquaticus*).

Occurs sparingly in suitable localities. It seems to prefer marshy spots of inconsiderable extent, where, if unmolested, it remains a long time, seeking occasional refuge in covered drains

and thick tufts of herbage. From such places of concealment it is very difficult to dislodge the bird. There is a great difference in size between the sexes.

Mr Thomas Anderson, jun., informed us some time ago that he captured a water rail, which flew on board one of the Cunard steamers in December, 1867, when about 450 miles from land. The ship was on an outward voyage from Liverpool.

THE MOOR HEN (*Gallinula chloropus*).

The familiar water hen is very common in all the streams, lochs, and pools of our district, frequenting also mill-dams, ditches, and other water courses, especially such as are fringed with a profusion of water plants, where the birds can hide themselves from observation. The eggs of this species are, in some districts, subject to considerable variation in size, markings, and general appearance.

LOBIPEDIDÆ.

THE COMMON COOT (*Fulica atra*).

Found with the preceding species in the larger lochs, but not, so far as we have observed, in water courses or drains.

NATATORES.

ANATIDÆ.

THE GREY-LAG GOOSE (*Anser ferus*).

Stray birds of this species are occasionally found during the winter months on the larger inland lochs and marshes. Their appearance, however, is uncertain. The attractions of the western islands as a feeding ground are sufficient to prevent these birds wandering to any great extent. A portion of both counties is visited by small flocks in passing southward in the beginning of winter, and again in March and April as they return. On these occasions they often alight on Ailsa Craig, and pitch upon a marsh there.

THE BEAN GOOSE (*Anser segetum*).

Of occasional occurrence in moist ground in retired moorlands, and sometimes seen in flocks on the sands at the Bay of Wigtown and near Glenuce. The following note is taken from Thomson's "Birds of Ireland":—"A sporting friend, residing in the south of

Ayrshire, has occasionally met with Bean Geese in the bogs there, and sprung them from among beds of wild roses, on the fruit of which (a small mountain species) they must have been busied feeding, as proved on dissection of those killed."

THE PINK-FOOTED GOOSE (*Anser brachyrhynens*).

Of rare and uncertain occurrence only; one or two specimens, at most, being all that are identified during the course of a season.

THE WHITE-FRONTED GOOSE (*Anser albifrons*).

Occurs in small flocks on the low-lying grassy shores of Wigtownshire, and is sometimes taken, with other wild fowl, by keepers and others who practise loch-shooting for the market.

THE BERNICLE GOOSE (*Anser leucopsis*).

Numbers of this species frequent the Firth of Clyde in winter, and are also observed on the sands at Luce Bay. The passing flocks going northwards assemble at a pool of the estuary near Dumbarton Castle, where they seem to have attracted the notice of the curious nearly three hundred years ago.

THE BRENT GOOSE (*Anser torquatus*).

Much less common than the preceding species, occurring, perhaps, in the proportion of one to fifty. It is better known in the eastern counties. Small numbers are every winter sent, along with other wild fowl, from Ayrshire shootings to the Glasgow market.

THE CANADA GOOSE (*Anser Canadensis*).

Has been once or twice observed on some of the larger lochs of both counties. A specimen shot on Tarbolton Loch, 11th March, 1865, is now in the collection of our friend Mr William Sinclair of Glasgow.

THE HOOPER, OR WHISTLING SWAN (*Cygnus ferus*).

At the close of last century, flocks of this species appeared every winter on Loch Inch, and other similar sheets of water in Wigtownshire. These lochs are still visited by passing flocks, but not regularly. Considerable numbers annually visit Lochwinnoch in Renfrewshire, which is on the borders of our district.

In this beautiful loch there are about fifty tame swans, and it is a sight of no ordinary interest to see the fleet of noble birds sailing together on the blue waters. Persons resident in the neighbourhood inform us that the winter visitants are much smaller in size, darker in colour, and much more active on the wing than the usual residents. Many of these are, of course, referable to the next species.

BEWICK'S SWAN (*Cygnus Bewickii*).

This species is sometimes recognised in lochs and ponds in severe winters, many of the birds being in the plumage of the first year.

THE COMMON SHELLDRAKE (*Tadorna vulpanser*).

This showy and handsome bird is not uncommon in rabbit warrens on the coasts of both counties. It appears, however, to be more plentiful in Wigtownshire. We have obtained the eggs from near Garliestown. It also breeds in Kirkeudbrightshire. A number of pairs used to breed on the Horse Island, off Ardrossan, but of late years these have become reduced, on account of the frequent visits made to the locality by boating parties from the harbour, and this year (1869) only one pair has been observed.

THE SHOVELER (*Anas clypeata*).

Has occurred but in three instances in our district. A pair—male and female—were shot on the Cree, near Newton-Stewart, in the spring of 1865, by James Hamilton, keeper. Another was shot in the month of May, 1860, in a small burn on the farm of Drummuck, near Girvan, by a son of Mr Davidson, farmer there.

THE GADWALL (*Anas strepera*).

With the exception of a single specimen—a male—shot on the loch of Tarbolton a few years ago, we cannot trace the occurrence of this species anywhere in our district. It is, notwithstanding, a bird of tolerably wide distribution in western Scotland.

THE PINTAIL DUCK (*Anas acuta*).

Of occasional and uncertain appearance only; appearing singly, in most cases, on the larger streams and inland lochs.

THE WILD DUCK (*Anas boschas*).

Abundant everywhere. We have seen very large flocks coming up from the coast at twilight to the potato pits on some Ayrshire farms, where they committed much mischief. On the private ponds they take up their quarters throughout the winter months, and, if unmolested, often remain to breed in the vicinity.

THE GARGANEY (*Anas querquedula*).

We have been informed by the Rev. George Wilson of Glencuce, that a specimen of this beautiful duck, which he had an opportunity of examining, was shot in the Bay of Luce in 1867.

THE TEAL (*Anas crecca*).

Also common. In hard winters it ascends the course of the frozen rivers, and is often taken in the neighbourhood of mill-ponds where the water is kept running. Dr Anderson procured several beautiful males, by making an opening in the ice, a few winters ago, and keeping a look-out for the birds as they halted in their flight before alighting at the spot.

THE WIGEON (*Anas penelope*).

A very common winter visitant, appearing in September or October, and leaving in March or April. This species sometimes pairs early, and in these particular seasons they disappear sooner.

THE EIDER DUCK (*Somateria mollissima*).

This large and conspicuous bird is very seldom procured. It may occur much oftener than we suppose, but being strictly of marine habits, few persons have an opportunity of shooting it. So far as we can learn, it does not breed anywhere in our district.

THE VELVET SCOTER (*Oidemia fusca*).

Very rarely observed on the coast, and very few specimens are ever obtained. It is better known as a winter visitant to the eastern shores of Scotland.

THE COMMON SCOTER (*Oidemia nigra*).

Equally scarce with the preceding, and almost never procured, although readily enough distinguished when seen.

THE POCHARD, OR DUN BIRD (*Fuligula rufina*).

A well-known winter visitant to our estuaries at twilight. During the day-time it frequents fresh-water lochs at some distance inland, and is sometimes procured in quantities by poachers, who watch their opportunity for a raking shot.

THE SCAUP DUCK (*Fuligula marila*).

Frequents the open sea chiefly during the day-time, coming shorewards in the evening. It appears to be somewhat irregular in numbers—some winters the flocks are tolerably numerous; at other times a pair or two only are seen.

THE TUFTED DUCK (*Fuligula cristata*).

Strictly a winter visitant; frequenting the open sea in fine weather, and coming up the larger rivers during storms. It is also found on our lochs and ponds, especially those not far from the coast.

OBS.—Although the Long-tailed Duck (*F. glacialis*) is found in considerable numbers in the Hebrides, we have never had an opportunity of seeing it in our district.

THE GOLDEN EYE (*Fuligula clangula*).

This fine species is rather common with us at times. It is, perhaps, more frequently met with in Wigtownshire than in Ayrshire, but cannot be called rare in the latter county. Most of the specimens we have seen were young birds and females.

THE SMEW.

So far as we know, this beautiful bird has occurred but once in Wigtownshire, a male having been shot, in March, 1855, on Castle Kennedy Loch, near Stranraer. For this record we are indebted to the Rev. George Wilson of Glenluce.

THE RED BREASTED MERGANSER (*Mergus serrator*).

Breeds sparingly in both counties. In the winter season it is often shot on the sea-coast.

THE GOOSANDER (*Mergus merganser*).

In spring time very handsome specimens of this fine bird are obtained on our lochs and rivers.

COLYMBIDÆ.

THE GREAT CRESTED GREBE (*Podiceps cristatus*).

Very rarely met with in either of the counties. Being resident all the year in Ireland, it is somewhat singular that few, if any, of the young birds hatched in the loughs there find their way to the western shores of Wigtown.

THE RED-NECKED GREBE (*Podiceps rubricollis*).

Equally rare with the preceding; very few specimens being obtained. It is occasionally seen in the estuaries, and at some distance up the rivers, but not later than the month of April. One of these birds in the breeding plumage was shot, a few years ago, at Caldwell in Ayrshire, and is now in the collection of Mr Orr, Kilbirnie.

THE SCLAVONIAN GREBE (*Podiceps cornutus*).

Uncommon, and generally seen at sea when it does occur. It turns up occasionally on fresh water lakes in spring and autumn, but is entirely absent during the summer months.

THE LITTLE GREBE, OR DABCHICK (*Podiceps minor*).

Even this species, which is so numerous in almost all other parts of Scotland, is not common. Mr Gray saw one lately in the possession of H. Stewart, Esq. of Tonderghie, near Burrow Head, and was surprised to learn from that gentleman that it was extremely rare in his neighbourhood. In Ayrshire, however, it is more frequently obtained.

THE GREAT NORTHERN DIVER (*Colymbus glacialis*).

Very common in both counties. It is, indeed, found in great numbers off the coast of Wigtownshire in autumn and winter. We have seen it also in summer near Girvan, in pairs, about a mile off shore on warm days during a dead calm, when their hoarse conversation was distinctly heard. When in pursuit of prey, they are at this season occasionally taken in the salmon nets near the town. Mr Anderson saw two very fine specimens in the last week of May, 1869. One of these—a brilliant bird in full summer dress—is now in the possession of Mr Murray, banker, Girvan. In August, old birds still partly clad in this

plumage have been seen near Ballantrae, each attended by a young one about the size of a wild duck. Mr Watson of Stranraer informs us that he repeatedly sees three or four at a time off the Galloway coast near Kirkmaiden.

THE BLACK-THROATED DIVER (*Colymbus arcticus*).

Occurs off the coasts, chiefly in spring and beginning of summer, about the time of moving towards the breeding localities to the north-west. We have seen pairs of this beautiful bird also off Girvan. Mr Anderson had a splendid specimen, in the breeding plumage, presented to him by Mr Murray. It was taken alive in the salmon nets, and has lately been transferred to Mr Gray's private collection in Glasgow.

THE RED-THROATED DIVER (*Colymbus septentrionalis*).

So far as we can learn, this species is only a winter visitant; it is frequently taken in fresh-water lakes, deep pools in rivers, and still oftener on the sea-coast, close to the shore, where it finds its favourite food in suitable quantity. It is very rarely met with in the breeding plumage in our district.

ALCADÆ.

THE COMMON GUILLEMOT (*Uria troile*).

A very common species off the coasts of both counties. Its breeding haunts are at Ailsa Craig, in Ayrshire, and the Scaur rocks, at the entrance to the Bay of Luce, in Wigtownshire—at both of which places it is found in great abundance. Vast numbers were at one time killed yearly on Ailsa Craig, during the breeding season; but since the passing of the "Sea Birds Preservation Bill" the practice is believed to have been discontinued. At the Scaur Rocks the birds were seldom if ever molested.

Towards the close of summer, large companies of these birds occasionally congregate near the shore, and remain there for days in calm weather, over the sand banks where their food is obtained.

THE RINGED GUILLEMOT, OR BRIDLED GUILLEMOT (*Uria lomvia*).

Occurs at Ailsa Craig and also at the Scaur Rocks, in the proportion of one to five hundred of the commoner species. We have

proved this at various times on the Craig, by counting the slaughtered birds taken in the tacksman's nets. In 1867 we counted over 1500 of *Uria troile*, in which we found two specimens of this bird; but one of the men stated that he had obtained a third, which he had taken out of the net alive, and tethered to a stone. On returning, however, to the place, he could not hit on the exact spot, and so lost the bird.

THE BLACK GUILLEMOT (*Uria grylle*).

We have seen this bird in summer, near the entrance to Loch Ryan, and also in the Bay of Luce, but have not been able to find it incubating either on Ailsa Craig or the Scaur Rocks. From the frequency of its occurrence at this season, however, it is probably a native of both places. During the winter months it is found in small numbers in the Firth of Clyde, from Ayrshire to Port-Glasgow, and small numbers have been observed, in the full breeding plumage, off Ardrossan. Mr Gray examined a very fine one which had been shot by Mr Steedman near the Horse Island. We have reason to believe that one or two pairs breed in the rocky fissures near Kildonan, in Arran.

THE LITTLE AUK (*Mergulus melanoleucos*).

The late Mr Thompson, in his work on the "Birds of Ireland," states that, on 19th May, 1849, "Mr Darragh, of the Belfast Museum, saw four little auks on Ailsa Craig;" but during a long experience in the estuary of the Clyde, and numerous visits to the Craig, it has never come under our observation. In one or two instances examples of its occurrence in winter have been made known to us. In the season of 1867-68, a number of little auks were driven inland at various places. One of these was picked up at Kilmarnock, and given to Mr Eaton there, in whose hands Mr Gray saw it.

As a rule, this bird is found much more plentifully on the eastern coasts of Scotland.

THE PUFFIN (*Fratercula arctica*).

Occurs in immense numbers on Ailsa Craig during the breeding season, and is found plentifully on all parts of the coast between Ayr Heads and the Mull of Galloway from February to October. On Ailsa Craig its burrows are found under the broken rocks

piled at the base of the island, and also on a part of the grassy slopes about half way towards its summit. The young are fed, for the most part, on sand eels, quantities of which are brought by the old birds to the burrows—each having from six to eleven of these fishes at a time. These are often procured at a considerable distance from the rock, as any one accustomed to make repeated visits to that celebrated breeding place may easily testify by observing the puffins, many miles away from it, rise from the water and steer straight homewards, with their bills quite full. The male of this bird is said to have a larger bill than the female; and with the view of ascertaining whether the former took part in the duties of incubation, we turned over upwards of 500 dead ones during the occasion of our last visit, but found not more than half-a-dozen large billed specimens in that number. These puffins had been taken out of the nets in the course of three days' fowling, and in many of the burrows we found eggs and newly-hatched young birds—the former in many instances being addled, and the latter dead. Mr Gray has elsewhere dwelt on the habits of the puffin in this locality.*

THE RAZORBILL (*Alca torda*).

A very common species on Ailsa Craig in the breeding time, and also a native of the Searc Rocks in Luce Bay. In September, 1859, a very extraordinary mortality occurred among the sea fowl of the Craig, which was largely shared in by this species. A number of razorbills are taken annually by the Girvan fishermen when drawing their nets, which are sometimes floated within a mile or two of the rocks.

PELECANIDÆ.

THE COMMON CORMORANT (*Phalacrocorax carbo*).

The gaunt figure of this well-known bird is seldom wanting on our sea beacons and isolated rocks within a short distance of the shore. At any season the cormorant is nowhere more abundant than along the shores of Wigtownshire, especially that part of the coast between Glencuce and Port-William, where fifty or sixty are constantly seen, either fishing, in the winter months, or, in summer, drying their wings preparatory to their inland flight. Their

* See "Birds of the West of Scotland."

nursery is, or was until recently, situated on the banks of the Castle Loch, about seven miles inland.* Another very important breeding station is at Loch Moan, in Ayrshire, and is frequented by several hundred pairs, which lay their eggs on a small island in the middle of the lake. The nesting haunts of this species, however, are not confined to inland districts. A pretty extensive colony may be seen hatching on a part of the cliffs between Ballantrae and the entrance to Glen App, and a few pairs are also found breeding on Ailsa Craig.

THE SHAG, OR GREEN CORMORANT (*Phalacrocorax graculus*).

The green cormorant occurs much less frequently than the preceding species; it is, however, a common bird of the coasts. Its breeding haunts with us are strictly confined to Ailsa Craig and the numerous caves which exist southwards of Ballantrae, and again at the Mull of Galloway and Burrow Head.

THE GANNET, OR SOLAND GOOSE (*Sula alba*).

Off the Ayrshire coast the gannet is a daily object of attention as it sweeps its pure white figure against the blue sky or the dark cloud. Occasionally it comes very near the beach; we have observed it in shallow bays diving after whittings, in a depth of water not exceeding three or four feet. On such occasions the plunge was made at an acute angle, the gannet appearing almost immediately, and before its body had time to be fully submerged. Its mode of fishing was very skilful and guarded. The gannet appears off our coasts early in February, and generally leaves about the close of September; its movements, however, are considerably influenced by the abundance or scarcity of the various fish upon which it is known to feed.

LARIDÆ.

THE SANDWICH TERN (*Sterna Boysi*).

We have recognised this fine species in flight off the coast near Girvan, and have seen an occasional specimen shot in our district. We have not, however, been able to discover it breeding on any of the rocks frequented by the other species.

* This loch, one of a group, is situated in the parish of Mochrum, and throughout the district these birds are known by the name of "Mochrum Elders."

THE COMMON TERN (*Sterna hirundo*).

A comparatively common species in the Firth of Clyde, but a very few pairs only breed with us.

THE ARCTIC TERN (*Sterna arctica*).

More common than the preceding species. At low water occasional specimens are seen along the shore near Girvan, picking up the slender fishes on which they feed. Mr Anderson came upon a small flock of these birds some years ago in very peculiar circumstances. He was driving his dog-cart within a mile of Girvan one winter afternoon, during a thick fall of snow, when the terns suddenly made their appearance, flapping around the horse's ears. Using his whip vigorously, he struck down three of the birds, and captured them.

THE LESSER TERN (*Sterna minuta*).

So far as we can ascertain, this beautiful species is of somewhat rare and uncertain occurrence in either county. It is probably found every year in limited flocks when travelling southwards from their breeding stations, but these are nowhere numerous on the west coast. Mr Eaton, of Kilmarnock, has in his collection a specimen in the first month's plumage, which was shot on the Water of Irvine a few years ago.

THE BLACK TERN (*Sterna fessipes*).

Of very rare occurrence. It has been observed on one or two occasions, and in one instance at least a specimen has been obtained. The bird referred to was shot on 29th August, 1868, at Broadstone, near Stranraer, and preserved by Mr M'Omish, bird stuffer there.

THE LITTLE GULL (*Larus minutus*).

In the Transactions of the Wernerian Society of Edinburgh it is recorded by Mr Selby that a specimen of this bird was procured in Wigtonshire.

No other example of the species has come under our observation.

THE BLACK-HEADED GULL (*Larus ridibundus*).

A very abundant species throughout both counties. There are many breeding stations in our district—such as Loch Doon in

Ayrshire—which are frequented by thousands of birds; and as the eggs are not farmed out as in England, these nurseries are seldom invaded, except by mischievous boys in quest of adventure, or some prowling fox desirous of giving her cubs a change of diet.

In the heat of the summer months we have often observed a pair or two of this gull hunting over the potato fields near Girvan with great regularity, and picking up worms and snails, thus proving themselves useful friends of the farmer. One of these birds is at present living as a familiar pet in a house at Girvan, where it has been confined for the last thirteen years. It assumes the black cap regularly, like a wild bird, in spring, and becomes white in winter.

THE KITTIWAKE GULL (*Larus tridactylus*).

This beautiful gull is very common along the shores of Ayrshire during the spring months. In May the flocks assemble on Ailsa Craig, their chief breeding place, and become dispersed after the duties of incubation are past. The greater number migrate to other countries in the month of October, but many remain throughout the entire winter. Perhaps it would be more correct to say that these winter birds are visitants from more northern latitudes. In the Firth of Clyde they are seen in flocks near the beach and in harbours, where they appear to subsist principally upon the remains of fish, and other substances thrown out by the fishermen.

THE IVORY GULL (*Larus eburneus*).

Although the ivory gull has never, to our knowledge, been actually obtained in our district, there can be little doubt of its having occurred off the coasts. Various examples have been met with in surrounding localities, namely, Islay, Argyleshire, Arran, and Renfrewshire. In June, 1854, Mr William Sinclair saw an ivory gull on Ailsa Craig, and was near enough to recognise it.

THE COMMON GULL (*Larus canus*).

Also a very common species, breeding on Ailsa Craig, the Scaur Rocks, and the Mull of Galloway. They also nest by the side of some of the inland lochs in Wigtownshire. It is a well known frequenter of the beach near Girvan from September to April.

THE ICELAND GULL, OR LESSER WHITE-WINGED GULL (*Larus Icelandicus*).

Has been repeatedly observed on Ailsa Craig. The late Mr Thompson procured two specimens from Ballantrae, and the species has been observed by Mr Gray in other parts of Ayrshire. It appears to be an indolent bird during the day time, admitting of a near approach, and consequently, where it does occur, it is not difficult to obtain.

THE LESSER BLACK-BACKED GULL (*Larus fuscus*).

Extremely common throughout our district, breeding upon Ailsa Craig in great numbers, and also on the borders of the Castle Loch, and other similar patches of water in Wigtownshire. In the harvest months great numbers betake themselves to grass fields at some distance inland about nightfall, and remain there until daybreak, when they again get on wing, and repair to the sea shore. In wild weather, however, they linger in the field until the day is well advanced, and come back in the afternoon much earlier, taking up their old position, as if reluctant to expose themselves to the storm. This bird, like the black-headed gull, is often seen at Girvan beating over the potato fields daily in the middle of summer, and alighting every minute or so to pick up the snails, worms, and caterpillars for which it so diligently searches.

THE HERRING GULL (*Larus argentatus*).

The herring gull is a very common species throughout the year, but appears to be strictly confined to the sea coast. In the breeding season it haunts the cliffs at the Mull of Galloway, the Scaur Rocks, and Ailsa Craig. This bird is a notorious egg-lifter, and will even devour young grouse, and other game, when it gets an opportunity. On Ailsa Craig it rivals in this respect, if it does not exceed in rapacity, its congener, the lesser black-back, and pounces upon the unprotected eggs of the guillemot or razor-bill with unfailing success. The curlew, and its kindred, are equally molested during the breeding time. In the winter season they subsist entirely on what the sea shore affords them.

THE GREAT BLACK-BACKED GULL (*Larus marinus*).

This bird has even a worse reputation than the preceding

species. It is hardly so common with us, but is still sufficiently numerous to form an important item in the bird life of our district. At Girvan we have observed several pairs coming apparently from Ailsa Craig, and proceeding with strong-winged beats, high in the air, in the direction of some of the largest sheep farms on the hills, and have watched their raven-like flight until they disappeared beyond the top of the Saugh Hill. Their prey, we doubt not, was variously suggestive.

THE POMERINE SKUA (*Lestris pomarinus*).

This species, easily recognised by its superior bulk from Richardson's skua, has been observed in various parts of Ayrshire. It has, according to the late Mr Thompson, occurred at Ballantrae, and Mr Gray has observed it off the coast on more than one occasion. It has likewise been obtained in Wigtownshire.

RICHARDSON'S SKUA (*Lestris Richardsonii*).

Occasionally observed along shore chasing the sea gulls. It visits Ailsa Craig early in the season—probably before retiring to its breeding quarters—and delights in molesting the kittiwakes, among whom he is a most unwelcome intruder. About this time also it scours the coast line as far as the Mull of Galloway in the same pursuit, but is seldom or never observed in June, July, or August, when the birds are hatching.

BUFFON'S SKUA (*Lestris Buffonii*).

Can only be ranked with us as a rare straggler. The last and most recent specimen coming under our observation was one shot on the Cree, near Newton-Stewart, in the spring of 1863.

THE MANX SHEARWATER (*Puffinus anglorum*).

As this bird seldom approaches the coast nearer than a mile's distance, it is not often observed, except by those who go in quest of birds, or are interested in their movements. It may, however, be seen regularly passing and repassing even as late as the end of June. There are probably no breeding stations of this species nearer us than the islands of Mull, Staffa, or Iona; yet it is possible that they may extend their daily excursions to the Ayrshire coast, as their flight is extremely easy and buoyant.

THE FORK-TAILED PETREL (*Thalassidroma Leachii*).

Occasionally cast on shore in rough weather. A specimen was taken at Stranraer in the winter of 1863. In the west of Scotland generally this species is found to be about as numerous as the storm petrel.

THE STORM PETREL (*Thalassidroma pelagica*).

During the severest winter storms, this diminutive bird of the ocean occasionally loses its reckoning, and is blown on shore. We have seen specimens taken at Kilbirnie and Kilmarnock, and other towns at some distance inland. It breeds in limited numbers on Ailsa Craig; and we have seen it flying in small groups about midway between that rock and the mainland.

CONCLUDING REMARKS.

In closing this catalogue of the Birds of Ayrshire and Wigtownshire, we cannot withhold the expression of a belief, in which we trust that most persons interested in ornithological pursuits will readily join, that the time has now arrived when the protection of various classes of birds has become a paramount duty. We have only to consider the vast diminution of species that has taken place during the last thirty years in order to learn the mischief that has resulted from one cause alone—viz., the over-zealous destruction of creatures that are supposed to be enemies to game. In the exercise of their daily avocations, gamekeepers throughout the whole of these districts have, in fact, done more to thin our bird population than any other class of men. Birds of prey especially have suffered to an almost inconceivable extent—eagles, falcons, buzzards, hawks, and owls having been subjected to such continual persecution as to be now in some places on the verge of extinction as native species. Making due allowance for the ravages committed by some of the Raptorial and Corvine species, we believe that many of the birds which fall victims to the game preserver's vengeance are totally innocent of the charges laid against them. Owls, for example, are for the most part guiltless—their principal prey consisting of rats, mice, and other vermin that require to be kept in check. Nightjars and dippers are also harmless; and even the Kestrel falcon, which shares the fate of the hooded crow or the polecat, is not only harmless but useful as a devourer of mice and beetles, thus proving itself a friend instead of an enemy.

But apart from these considerations, it must be admitted that the destruction of certain groups of birds tends to derange that nicely-balanced harmony which is everywhere apparent in the dominion of Nature. Ample proof of this has been experienced in our own country, where the banishment of owls has been known to result in an inordinate increase of the various species of field mice, which constitute the ordinary food of these useful birds, and also in other countries, where the disappearance of insectivorous species has been followed by insect plagues—these examples, and many others which could be cited, tending to shew that Nature's plans are, at least, incapable of amelioration through man's interference.

To advocate the protection of eagles and falcons, therefore, for a time at least, would appear to us to be but a reasonable duty; and to influence our landed proprietors, with whom the power chiefly lies, in their favour, we would regard as only a just compensation for injuries already inflicted. It is certainly a matter of regret that some of our Scottish proprietors should actually have lent their influence against the protection of bird life. From these nothing can be expected but an unwilling obedience to laws already enacted for the preservation of certain maritime species that throw themselves entirely on the mercy of man during the breeding season; and naturalists may indeed congratulate themselves that the recent opposition brought to bear against the passing of the "Act for the Preservation of Sea Birds"—a humane and salutary law—was signally defeated.

We still cling to the hope that similar enactments may yet be framed for the protection of land birds, from the soaring eagle to the timid thrush; and until this takes place, proprietors would earn the gratitude of all true naturalists by resolving to discontinue the deadly practice of exterminating what their keepers have branded as vermin, and let our woods, fields, and mountain sides regain what has now for many years been wanting to give a charm to some of the finest, and, at the same time, the wildest scenery in the British Islands.

In a volume of 220 pages now before us, relating to the "Game Laws of the principal States of the United States and Canada," we find that Section VI. of the laws of the State of New York provides for the protection of a large number of land birds, including the eagle, fish hawk, night hawk, whip-poor-will, swallow, oriole, woodpecker, bobolink, *or any other harmless bird*. The penalty for

violating the provisions of this Act is stated at fifty dollars for each offence, and it may be presumed that the exemption in favour of naturalists desirous of studying their habits or history and having them preserved as cabinet specimens, will commend itself to the most fastidious collector. Such an Act, if applied to our own country, would operate favourably in many ways, and lead to a restoration of bird life that would prove welcome not only to students of nature but to those very persons who, under a mistaken prejudice, are at this moment its worst enemies.

Waiving this digression, however, we think that, in common fairness, to adduce no stronger argument, birds of all kinds should have a "close time" during the season of incubation. It is not right that any class of creatures should be killed when brooding on their eggs, or exposing themselves to danger in the protection of their defenceless young. In the case of birds especially, many species wholly throw aside their usual wariness at such a season; and as regards isolated places like Ailsa Craig, exposed as they are to the plundering visits of heartless pleasure seekers, no one, we think, will ever call in question the wisdom or humanity of providing for their future protection.

II.—*On some Lepidopterous Insects from Congo.*

By Mr THOMAS CHAPMAN.

PLATES V, VI, and VII.

A large series of specimens in very fine order, lately received from Congo, were exhibited. Mr Chapman remarked upon the great unexplored field in tropical Africa waiting to be visited by the naturalist, exemplified by these Congo insects. About seventy-five per centum of the moths in this small collection are new to science; and among the butterflies the genus *Harma* is represented by five new species, indicating that the head-quarters of this very beautiful genus had been reached. Of the moths, twenty-six new genera and seventy-six new species, are described below by Francis Walker, Esq., F.L.S.

LEPIDOPTERA HETEROCERA.

- | | |
|--|--|
| TRIBE. <i>SPHINGITES</i> . | Genus. <i>Aletis</i> , <i>Hubn.</i> |
| Family. <i>SMERINTHIDÆ</i> . | <i>A. postica</i> . |
| Genus. <i>Smerinthus</i> , <i>Latr.</i> | Genus. <i>Phægorista</i> , <i>Boisd.</i> |
| <i>S. subjectus</i> . | <i>P. similis</i> . |
| Genus. <i>Ambulyx</i> , <i>Boisd.</i> | Family. <i>HYPSIDÆ</i> . |
| <i>A. constringilis</i> . | Genus. <i>Surina</i> , <i>n.</i> |
| Genus. <i>Basiana</i> , <i>Walk.</i> | <i>S. hypsoides</i> . |
| <i>B. suffusa</i> . | Genus. <i>Hypsa</i> , <i>Hubn.</i> |
| | <i>H. dissociata</i> . |
| TRIBE. <i>BOMBYCITES</i> . | Genus. <i>Zaracha</i> , <i>n.</i> |
| Family. <i>AGARISTIDÆ</i> . | <i>Z. extranea</i> . |
| Genus. <i>Eusemia</i> , <i>Dalm.</i> | Family. <i>LITHOSIDÆ</i> . |
| <i>E. pardalina</i> . | Genus. <i>Soloe</i> , <i>Walk.</i> |
| Family. <i>NYCTEMERIDÆ</i> . | <i>S. quadriguttata</i> . |
| Genus. <i>Nyctemera</i> , <i>Hubn.</i> | Genus. <i>Barsine</i> , <i>Walk.</i> |
| <i>N. simplex</i> . | <i>B. indecisa</i> . |
| <i>N. decisa</i> . | Family. <i>ARCTIDÆ</i> . |
| Family. <i>ZYGËNIDÆ</i> . | Genus. <i>Spilosoma</i> , <i>Steph.</i> |
| Genus. <i>Balacra</i> , <i>Walk.</i> | <i>S. ramivitta</i> . |
| <i>B. ochracea</i> . | Genus. <i>Sciatta</i> , <i>n.</i> |
| Family. <i>MELAMERIDÆ</i> . | <i>S. inconcisa</i> . |
| Genus. <i>Leucopsumis</i> , <i>Hubn.</i> | Family. <i>LIPARIDÆ</i> . |
| <i>L. cryptochroma</i> . | Genus. <i>Artaxa</i> , <i>Walk.</i> |
| Family. <i>PERICOPIDÆ</i> . | <i>A. squamiplaga</i> . |

- Genus. Zarfa, n.
 Z. lunifera.
 Genus. Sizalisca, n.
 S. graminosa.
 Genus. Viana, n.
 V. velutina.
 Family. SICULODIDÆ.
 Genus. Vaena, n.
 V. eacleoides.
 Family. BOMBYCIDÆ.
 Genus. Pœcilocampa, *Steph*
 P. sublineata.
 Family. LIMACODIDÆ.
 Genus. Nyssia, *Herr-Sch.*
 N. rudis.
 Genus. Zinara, n.
 Z. nervosa.
 Family. SATURNIDÆ.
 Genus. Antheræa, *Hüb.*
 A. rhodophila.
 A. intermiscens.
- TRIBE. NOCTUITES.
 Family. BRYOPHILIDÆ.
 Genus. Tachosa, n.
 T. acronyctoides.
 T. metaphæaria.
 Family. GLOTTULIDÆ.
 Genus. Tuerta, n.
 T. chrysochlora.
 Genus. Petrinia, n.
 P. lignosa.
 Family. NOCTUIDÆ.
 Genus. Agrotis, *Ochs.*
 A. hemileuca.
 A. catenifera.
 Family. ACONTIDÆ.
 Genus. Tavila, n.
 T. indeterminata.
- Family. ERASTRIDÆ.
 Genus. Erastria, *Ochs.*
 E. decora.
 Family. ANTHOPHILIDÆ.
 Genus. Hydrelia, *Guén.*
 H. terminata.
 Genus. Micra, *Guén.*
 M. convergens.
 M. intricata.
 Family. EURHIPIDÆ.
 Genus. Eutelia, *Hüb.*
 E. quadriliterata.
 Family. HEMICERIDÆ.
 Genus. Nedroma, n.
 N. ferruginea.
 Family. HYPOGRAMMIDÆ.
 Genus. Stridova, n.
 S. albigutta.
 Genus. Briarda, *Walk.*
 B. conturbata.
 Family. EREBIDÆ.
 Genus. Tolna, n.
 T. versicolor.
 Family. OPHIDERIDÆ.
 Genus. Ophideres, *Boisd.*
 O. divitiosa.
 Family. OPHIUSIDÆ.
 Genus. Achæa, *Hüb.*
 A. ophismoides.
 A. partita.
 Genus. Hypætra, *Guén.*
 H. atriplaga.
 H. biangulata.
 H. (?) nana.
 Genus. Athyrma, *Hüb.*
 A. albicincta.
 Genus. Ophiusa, *Ochs.*
 O. subænescens.
 Genus. Grammodes, *Guén.*
 G. curvilinea.

- Genus. *Obba*, n.
O. prompta.
 Family. POAPHILIDÆ.
 Genus. *Zirona*, n.
Z. marginata.
 Family. AMPHIGONIDÆ.
 Genus. *Amphigonia*, *Guén.*
A. fumosa.
 Family. THERMESIDÆ.
 Genus. *Thermesia*, *Hüb.*
T. (?) sejuncta.
 Genus. *Capnodes*, *Guén.*
C. trinitata.
 Genus. *Riela*, n.
R. expandens.
 Genus. *Raclia*, n.
R. cervina.

TRIBE. DELTOIDITES.

- Family. HERMINIDÆ.
 Genus. *Orixa*, n.
O. filifera.

 TRIBE. PYRALITES.
 Family. PYRALIDÆ.
 Genus. *Pyrallis*, *Lin.*
P. (?) crassalis.
 Family. ASOPIDÆ.
 Genus. *Samea*, *Guén.*
S. figuralis.
 Family. BOTYDÆ.
 Genus. *Vatica*, n.
V. rutilalis.
 Genus. *Botys*, *Latr.*
B. interfixalis.

- Genus. *Xacca*, n.
X. trigonalis.
 Genus. *Opula*, n.
O. impletalis.

TRIBE. GEOMETRITES.

- Family. GEOMETRIDÆ.
 Genus. *Geometra*, *Treit.*
G. congrua.
 Family. PALYADÆ.
 Genus. *Traina*, n.
T. stramineata.
 Genus. *Timana*, n.
T. costalis.
 Family. BOARMIDÆ.
 Genus. *Boarmia*, *Treit.*
B. abruptaria.
 Genus. *Tephrosia*, *Boisd.*
T. diffusa.
 Family. ACIDALIDÆ.
 Genus. *Acidalia*, *Treit.*
A. latifera.
 Genus. *Nebessa*, n.
N. chalybeata.
 Family. FIDONIDÆ.
 Genus. *Scodiona*, *Boisd.*
S. cephalotes.
 Family. MICRONIDÆ.
 Genus. *Micronia*, *Guén.*
M. tenella.

 TRIBE. PHYCITES.
 Family. PHYCIDÆ.
 Genus. *Subrita*, *Walk.*
S. luctuosa.

1. *SMERINTHUS SUBJECTUS*. *Mas.* Cinereorufus; palpis porrectis crassis obtusis pilosissimis caput paullo superantibus; antennis subpectinatis; abdomine alas posticas longe superante; alis anticis latiusculis acutis purpurascente subtinctis, fasciis tribus obliquis viriditestaceis, 1^a, antemedial angulosa marginata; 2^a, postmedia fusco intus marginata; 3^a, submarginali interrupta informi, reniformi viriditestaceo marginata longiuscula, linea obscura transversa subarcuata punctisque duobus nigris basim versus, puncto nigro antemedio subcostali, margine exteriori integro vix arcuato; alis posticis rufocinereis, lineis duabus ferrugineis undulatis.

Male. Cinereous red. Palpi porrect, thick, obtuse, very pilose, extending a little beyond the head. Antennæ slightly pectinated; branches densely setose. Abdomen extending much beyond the hind wings. Legs stout; femora and tibiæ pilose; hind tibiæ with four long spurs. Wings rather broad. Fore wings acute, with a slight purplish bloom; three oblique testaceous bands; 1st band antemedial, zig-zag, bordered by two darker lines, a transverse slightly curved darker line nearer the base, two black points still nearer the base, and a black subcostal antemedial point; 2nd band postmedial, concisely bordered on the inner side by a straight brown line; 3rd band submarginal, interrupted, very irregular; reniform mark greenish testaceous with a darker border, rather long and narrow; exterior border moderately oblique, hardly curved; under side with one line corresponding to the straight line before mentioned. Hind wings reddish cinereous, with two undulating ferruginous lines; these lines are more conspicuous on the under side, where the second one is dentate; exterior border entire, rounded. Length of the body 11 lines; of the fore wings 26 lines.

2. *AMBULYX CONSTRIGILIS*. *Mas.* Ochraceoviridis; subtus pallide ochracea; antennis serratis; abdomine pallide ochraceo; alis fusco transverse conspersis; alis anticis acutis subfalcatis, lineis quatuor fuscis transversis indeterminatis postice approximatis, plagis duabus lunulaque exteriori costalibus albidis, margine exteriori subexcavato; alis posticis plaga basili nigricante, lineis tribus discoidalibus rufescentibus obliquis arcuatis.

Male. Ochraceous green, pale dull ochraceous beneath. Proboscis very short. Palpi stout, obliquely ascending, closely applied to the head, not rising higher than the vertex; 3rd joint very

short. Antennæ serrated. Abdomen pale ochraceous, lanceolate, extending for more than half its length beyond the hind wings; apical tuft very small. Wings long, narrow, transversely speckled with brown. Fore wings acute, subfalcate, with four transverse irregular brown lines, which converge towards the interior border, two whitish costal patches, and an exterior whitish costal lunule, the 2nd patch much smaller than the 1st; exterior border slightly excavated. Hind wings ochraceous, with a blackish patch at the base, and with three oblique curved reddish lines in the disk; middle line much shorter than the others; speckles about the lines reddish. Wings beneath with nearly similar markings. Length of the body 20 lines; of the wings 48 lines.

3. *BASIANA SUFFUSA*. *Fem.* Cervina; antennis serratis; pedibus nigro spinulosis; alis lineis duabus fuscis postmediis obliquis angulosis indeterminatis; alis anticis falcatis cinereo suffusis, annulo discoidali fusco indeterminato.

Fem. de. Fawn colour. Proboscis very short. Palpi very broad and short, obliquely ascending, 3rd joint very minute. Antennæ serrated. Abdomen extending much beyond the hind wings. Legs beset with minute black spines; fore tibiæ slightly dilated, excavated beneath; hind tibiæ with four slender spines. Wings with two brown postmedial oblique indistinct zig-zag lines. Fore wings falcate, partly suffused with cinereous; an indistinct brown ringlet at the end of the areolet. Length of the body 12 lines; of the wings 33 lines.

Nearly allied to *B. submarginalis*.

4. *EUSEMIA PARDALINA*. *Mas.* Nigra; capite palpis thorace pedibusque albo punctatis, abdominis segmentis tarsisque luteo fasciatis; alis anticis luteo pallido sexmaculatis atomis chalybœis acervatim conspersis, fimbria apicali alba; alis posticis luteis nigro late marginatis, fimbria apicali pallide lutea.

Male. Black. Head, palpi, and thorax with some white points. Abdomen with a luteous band on the hind border of each segment, and with a luteous apical tuft. Femora, tibiæ and joints of the tarsi with white tips; tarsi with a broad luteous band. Fore wings with six large pale luteous spots, of which the sixth is transverse and nearer the tip, and much longer than the others; a few small clusters of chalybeous speckles between the spots; fringe white

about the tip; under side with the 1st spot connected with the 2nd, and the 3rd with the 4th. Hind wings luteous, with a broad black border, which is undulating on its inner side; fringe pale luteous at the tip, white at the tip on the under side, where there is a little luteous streak in the hind part of the black border. Length of the body 8 lines; of the fore wings 25 lines. See Plate V, Fig. 1.

5. NYCTEMERA SIMPLEX. *Fem.* Alba, gracilis, capite nigro albo-univittato; palpis nigricantibus porrectis articulo 3^o lineari; antennis nigris setulosis; thorace margine antico luteo plagis quatuor vittaque postica nigris; abdomine guttis dorsalibus nigris, apice luteo; alis semihyalinis fusco marginatis; alis anticis margine fusco lato antice valde dilutato; alis posticis margine fusco sat angusto antice latiore postice intus latiore.

Female. White, slender. Head black, with a white stripe. Proboscis tawny. Palpi blackish, porrect, slender, extending somewhat beyond the head; 3rd joint linear, a little shorter than the 2nd. Antennæ black, slender, minutely setulose. Thorax with a luteous fore border; discs of the four tegulæ black; a black stripe on the hind part. Abdomen not extending beyond the hind wings, with a dorsal row of black dots; tip luteous. Legs smooth, very slender; spurs very short. Wings semihyaline, bordered with brown along the exterior border. Fore wings with the brown hue occupying more than one-third of the surface, much dilated in front. Hind wings with the brown hue much narrower, broadest in front, undulating along the inner side of its hind part. Length of the body 6 lines; of the wings 18 lines.

6. NYCTEMERA DECISA. *Mas.* Nigra; capite plaga antica alba; palpis porrectis subtus ochraceis articulo, 3^o parvo acuto; antennis pectinatis apice serratis; thorace et abdomine nigricante cinereis, illius margine antico ochraceo; pectore ochraceo bivittato; ventre vittis duabus macularibus albis; alis anticis striga longitudinali latissima strigaeque exteriore lata obliqua albis; alis posticis albis margine lato strigaeque lanceolata apud angulum interiorum nigris, limbria apice alba.

Male. Black. Head with a white patch on the front. Proboscis piceous. Palpi porrect, ochraceous beneath, extending a little beyond the head; 3d joint acute, minute. Antennæ moderately

pectinated, serrated at the tips. Thorax and abdomen blackish cinereous, the former bordered with ochraceous in front. Pectus with two ochraceous stripes. Abdomen a little shorter than the interior border of the hind wings; under side with two macular white stripes. Femora striped with white. Wings elongate, hardly broad. Fore wings with a very broad white streak, which occupies nearly half the length from the base, and from two-thirds to four-fifths of the breadth from the interior border; a broad exterior oblique white streak in the disc. Hind wings white, bordered with black along the costa, and much more broadly so about the tips and along the exterior border; the white hue excavated, and receiving a black lanceolate streak near the interior angle; fringe white at the tip; under side with an elongated white apical spot. Length of the body $7\frac{1}{2}$ lines; of the wings 24 lines. See Plate V, Fig. 2.

7. BALACRA OCHRACEA. *Mus.* Ochracea; capite pedibusque rufis; antennis nigris subserratis; abdomine alas posticæ longissime superante; pedibus breviusculis, tibiis ecalcaratis, tarsis nigricantibus; alis anticis basi rufo bistrigatis; alis posticis brevissimis apice oblique truncatis.

Male. Ochraceous. Head and legs bright red. Antennæ black, stout, very minutely serrated. Abdomen extending for much more than half its length beyond the hind wings. Legs stout, rather short; tibiæ without spurs; tarsi blackish. Fore wings long, slightly rounded at the tips, with two bright red streaks which proceed from the base, and diverge from each other; exterior border rounded, extremely oblique. Hind wings obliquely truncated, not more than one-third of the length of the fore wings. Length of the body 9 lines; of the fore wings 24 lines.

The genus *Balacra* has been previously included in the *Arctiidae*, but it rather belongs to the *Zygænidæ*. These two families are nearly allied, and their close affinity has been remarked by Dr Herrich-Schæffer.

8. LEUCOPSUMIS CRYPTOCHROMA. *Mus.* Nigra; capite subtus pectore ventreque luteis, vertice argenteoalbo; palpis oblique ascendētib; verticem non superantibus, articulo 3^o lineari 2^o dimidio breviorē; antennis pectinatis apice setulosis; pedibus subtus argenteis; alis anticis striga postmedia lata obliqua alba

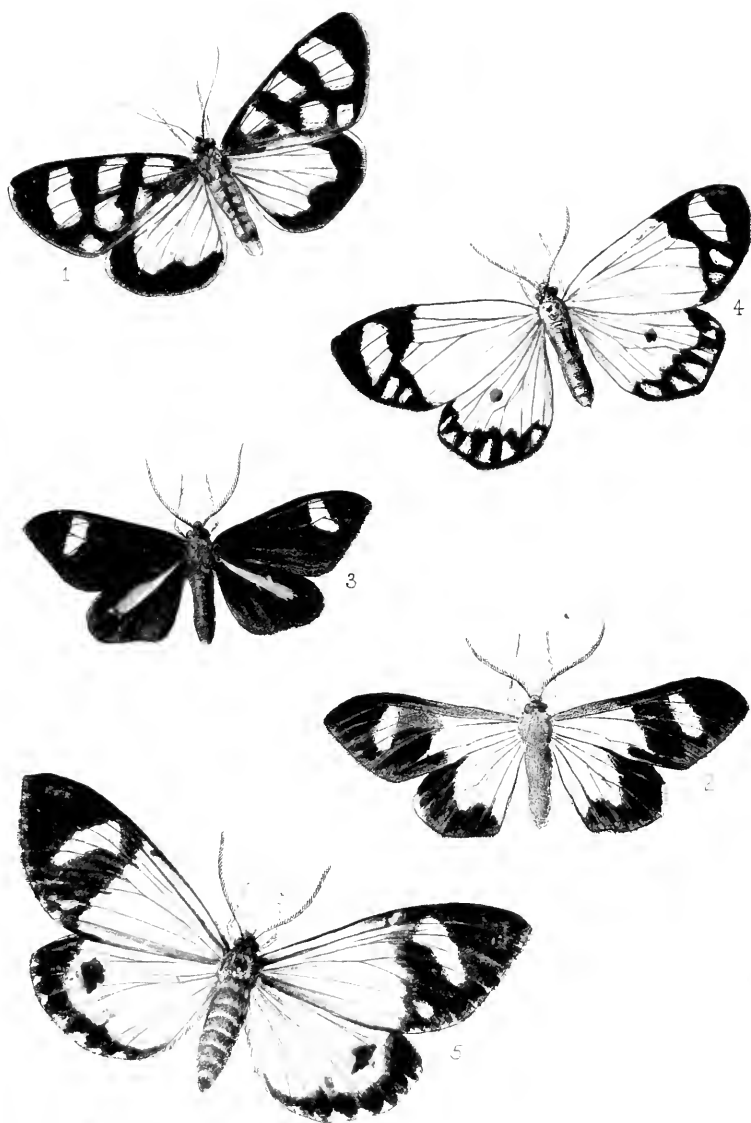
diaphana; alis posticis vitta discoidali cyanea, subtus luteis nigro marginatis.

Male. Black, rather stout. Head luteous beneath; vertex silvery white. Palpi obliquely ascending, not rising higher than the vertex, 3rd joint linear, much more slender than the 2nd, and less than half its length. Antennæ moderately pectinated, setulose towards the tips. Pectus luteous. Abdomen extending rather beyond the hind wings; under side luteous, with incomplete black spots on each side; apical tuft very small, very pale testaceous beneath. Legs silvery beneath. Fore wings with a broad white hyaline oblique streak in the exterior part of the disk. Hind wings with an abbreviated metallic blue stripe in the disk; under side luteous, black about the tips, and along the exterior border. Length of the body 8 lines; of the fore wings 21 lines. See Plate V, Fig. 3.

9. *ALETIS POSTICA.* *Mus.* Ochracea; corpore nigro; capite palpis pectoreque albis, vertice nigro albo-bivittato; thorace albo maculato et bifasciato ochraceo-unifasciato; abdomine vittis tribus macularibus ventre pedibusque albis; alis anticis dimidio exteriore nigro plagam magnam transversam maculasque duas posteriores albas includente; alis posticis macula discoidali fasciaque lata marginali strigas sex albas lanceolatas includente nigris.

Male. Ochraceous. Body Black. Head white; vertex black, with two white stripes. Proboscis pale testaceous. Palpi white. Antennæ pectinated, white above; branches short. Thorax with some white spots in front, with two white bands behind, and with a broad intermediate ochraceous band. Abdomen with three rows of white spots; under side, pectus, and legs white. Fore wings with somewhat less than half of the exterior surface black, including a large transverse white patch, and two posterior white spots. Hind wings with a black spot in the disk, and with a broad marginal black band, which includes six lanceolate white streaks. Length of the body 8 lines; of the fore wings 2 lines. See Plate V, Fig. 4.

10. *PILEGORISTA SIMILIS.* *Mus.* Ochracea; capite thoraceque atris albo notatis; capite subtus palpisque ochraceis, his apice albis; abdomine fusco basi ochraceo segmentis albo fasciatis; pedibus fuscis albo vittatis; alis anticis costa linea subcostali dimi-



1 EUSEMIA PARDALINA. 3 LEUCOPSUMIS CRYPTOCHROMA.
2 NYCTEMERA DECISA. 4 ALETIS POSTICA.
5. PHÆGONISTA SIMILIS.

dioque exteriore strigam latam guttam posticam guttasque marginales albas includente nigris; alis posticis margine lato nigro albo-guttato.

Male. Ochraceous. Head, proboscis, antennæ, and thorax deep black. Head white along the eyes beneath, with a white dot on each side of the front, and with an anterior white band; under side ochraceous. Palpi ochraceous, rising higher than the vertex. 3d joint deep black, linear, as long as the 2d. Antennæ moderately pectinated. Thorax with four white dots, and with six posterior white stripes. Abdomen brown, ochraceous at the base; a white band on the hind border of each segment; apical tuft very small. Legs brown, striped with white. Fore wings with a black costa and a black subcostal line; almost half the exterior surface black, including a broad oblique white streak in the disk, a white dot near the interior angle, and white marginal dots. Hind wings with a broad black border, and with marginal dots like those of the fore wings. Length of the body $9\frac{1}{2}$ lines; of the fore wings 32 lines. See Plate V, Fig. 5.

Gen. SURINA.

Fam. Corpus robustum, læve. Proboscis brevis. Palpi graciles, longissimi, verticem valde superantes; articulus 3^{us} subclavatus, 2^o longior. Antennæ validæ, subtilissime pubescentes. Thorax squamosus. Abdomen alas posticas paullo superans. Pedes robusti, læves; calcaria validæ. Alæ anticae longæ, angustæ, subfusiformes, costa perparum rotundata, margine exteriore perobliquo.

Female. Body stout, smooth. Proboscis short. Palpi smooth, slender, very long, rising very high above the vertex; 3d joint subclavate, longer than the 2d. Antennæ stout, extremely minutely pubescent. Thorax squamous. Abdomen extending a little beyond the hind wings. Legs stout, smooth; hind tibiæ with four stout spurs, one in each pair much longer than the other. Wings long. Fore wings narrow, subfusiform, rounded at the tips; costa very slightly rounded; exterior border rounded, extremely oblique.

The greater length of the 3d joint of the palpi, and the rounded basal part of the costa of the fore wing, distinguish this genus from *Hypsa*.

11. SURINA HYSPOIDES. *Fam.* Pallide cinerea, subtus lutea;

capite nigro-biguttato, palpis antennisque nigricantibus; thorace nigro quadri-guttato; alis anticis basi nigro guttatis, linea flavo-alba basi dilatata apicem versus dentata et arcuata, vitta posteriore argenteo alba, spatio costali fusca, linea transversa post-media e guttis nigris; alis posticis luteis, triente apicali fusca plagam apicalem albam includente.

Female. Pale cinereous, luteous beneath. Head with two black dots between the antennæ. Proboscis testaceous. Palpi and antennæ blackish. Thorax with two black dots on each of the fore tegulæ, and with two on each of the hind tegulæ. Abdomen luteous, with three rows of black dots. Legs luteous. Fore wings with some black dots near the base, a yellowish white line extending from the base of the costa, where it is dilated, slightly dentate and curved in its exterior part, and ending near the tip of the wing; space between the line and the costa brown; a silvery white stripe bordering the antemedial hind side of the above line; a black guttular postmedial line extending from the end of the stripe to the interior border; under side with the exterior half, brown. Hind wings luteous; apical third part brown, including an apical white patch. Length of the body 12 lines; of the fore wings 35 lines.

12. *HYPSA DISSOCIATA.* *Fem.* Fusca; capite albo nigro-quadri-maculato; thorace fasciis tribus macularibus maculisque quatuor posterioribus nigris, abdomine ochraceo, vitta interrupta nigra; alis anticis atomis plaga costali lineaque exteriori transversa angulosa albis, lineis tribus transversis e guttis nigris; alis posticis ochraceis fascia lata marginali cinereofusca.

Female. Brown. Head and thorax white. Head with four black spots, one on each side of the vertex, and one on each side of the front; frontal tuft black beneath. Rostrum testaceous. Antennæ black, smooth. Thorax with three black bands, and with four posterior black spots, two of the latter on each side; 1st band interrupted in the middle; 2nd composed of two transverse streaks, and of two intermediate spots; 3rd of four black spots. Pectus cinereous. Abdomen ochraceous, extending rather beyond the hind wings, with a black stripe, which is interrupted on the hind border of each segment, and is dilated at the tip. Legs blackish; femora and tibiæ fringed; tarsi with white dots. Wings long, narrow, fringed with whitish marks. Fore wings

rounded at the tips, with white speckles, with a white costal patch at a little beyond the middle, and with a slight transverse zig-zag white line near the exterior border; some black dots on the veins forming three irregular transverse lines—1st very near the base; 2nd antemedial; 3rd oblique, postmedial; under side cinereous-brown, with a broad ochraceous streak along the basal part of the interior border; exterior border slightly rounded, very oblique. Hind wings ochraceous, with a broad marginal cinereous-brown band, which extends along the exterior border, and is broadest at the tip. Length of the body 9 lines; of the wings 28 lines.

Gen. ZARACHA.

Mas. Corpus robustum. Proboscis nulla. Palpi robusti, porrecti; caput vix superantes; articulus 3^{us} minimus. Antennæ subserratae, triente basali subincrassatae et late pectinatae. Abdomen alas posticas longe superans, piles longissimis vestitum; fasciculus apicalis minimus. Pedes sat validi; femora et tibiae subfimbriata; calcaria brevia. Alæ longæ, angustæ; anticae apice rotundatae, margine exteriore convexo perobliquo.

Male. Body stout. Proboscis obsolete. Palpi stout, porrect hardly extending beyond the head; 3rd joint extremely minute. Antennæ minutely serrated, slightly incrusted, and broadly pectinated for one-third of the length from the base. Abdomen clothed with long hairs, extending much beyond the hind wings; apical tuft very small. Legs rather stout; femora and tibiae slightly fringed; spurs short. Wings long, narrow. Fore wings rounded at the tips; exterior border rounded, extremely oblique; anal vein united with the subanal vein at a short distance from the base.

13. ZARACHA EXTRANEA. *Mas.* Fusca, capite fronte albo, vertice palpis antennis que nigris; thorace margine antico ochraceo, tegulis anticis albis nigro unimaculatis; pectore abdomineque ochraceis, hoc vitta dorsali fusca interrupta; pedibus nigris, femoribus ochraceo pilosis; alis anticis venis basalibus fasciaque obliqua abbreviata albis; alis posticis ochraceis gutta discoidali nigra, fascia marginali lata fusca.

Male. Brown. Head white above; vertex, palpi, and antennae black. Thorax bordered with ochraceous in front; fore tegulae white, each including a black spot. Pectus and abdomen ochra-

ceous, the latter with an interrupted brown dorsal stripe. Legs black; femora with ochraceous hairs. Fore wings with the veins white at the base; an abbreviated oblique white band at three-fourths of the length, dilated in front. Hind wings ochraceous, with a black dot in the disk, and with a broad brown marginal band. Length of the body 8 lines; of the wings 21 lines.

14. SOLOE QUADRIGUTTATA. *Mus.* Ochracea, gracilis; palpis latissimis erectis verticem paullo superantibus articulo 3^o minimo; abdomine alas posticas longe superante, basi cervino, fasciculo apiculi longo nigricante; tibiis tarsisque anticis nigricantibus; alis macula discoidali nigra; alis anticis cervinis; alis posticis albidis, plaga apicali fusca.

Male. Ochraceous, slender. Proboscis moderately long. Palpi very broad, erect, rising a little higher than the vertex; 3rd joint extremely small. Abdomen fawn colour towards the base, extending much beyond the hind wings; apical tuft blackish, elongated. Legs long, smooth, slender; spurs long, slender; fore tibiae and fore tarsi blackish. Wings with a black discoidal spot. Fore wings fawn colour, slightly acute; exterior border rounded, very oblique. Hind wings whitish, with a brown apical patch; discoidal spot smaller than that of the fore wings. Length of the body 7 lines; of the wings 16 lines.

15. BARSINE INDECISA. *Mus.* Ochracea, subtus pallide lutea; palpis porrectis brevissimis gracillimis; antennis serratis; abdomine alas posticas non superante, sexualibus longis; alis anticis apice rotundatis, fasciis quatuor aut quinque obliquis macularibus purpureo rufis, disco subtus purpurascente; alis posticis flavis.

Male. Ochraceous; under side and abdomen pale luteous. Proboscis slender. Palpi porrect, very short and slender, not extending to the front of the head. Antennae serrated, setulose. Abdomen not extending beyond the hind wings; apical appendages long. Legs smooth, rather stout; hind tibiae with four short slender spurs. Fore wings rounded at the tips, with four or five oblique indistinct macular purplish red bands; exterior border rounded, very oblique; under side with a purplish disk. Hind wings yellow. Length of the body 3 lines; of the wings 9½ lines.

16. SPILOSOMA RAMIVITTA. *Mus.* Alba; palpis nigris basi albis;

antennis nigris sat late pectinatis; thorace nigro-sexmaculato; abdomine dorso ochraceo vittis tribus guttularibus nigris, segmento 1° albotrinotato, lineis duabus ventralibus punctularibus nigris; pedibus luteo nigroque variis; alis anticis vitta media fusca ramos emittente albo maculata et guttata; alis posticis macula subcostali maculisque tribus submarginalibus fuscis.

Male. White. Palpi porrect, black except at the base, extending somewhat beyond the head; 3rd joint conical, less than one-fourth of the length of the 2nd. Antennæ black, rather broadly pectinated. Thorax with six black spots, one in the fore part, and one in the hind part of the disk, and one on each of the four tegulæ. Abdomen extending rather beyond the hind wings, ochraceous above, with three stripes of black dots; 1st segment white on each side, and with a white longitudinal middle streak; under side with two lines of black points. Legs partly tinged with luteous; tarsi and four anterior tibiæ black; hind tibiæ with a black subapical streak. Wings elongate. Fore wings rounded at the tips, with a brown middle stripe, which emits branches to the costa and to the interior border, and is dilated along its exterior part, and there contains some white spots and dots, and emits streaks to the exterior border. Hind wings with a brown subcostal spot, and with three brown spots near the exterior border. Length of the body 8 lines; of the wings 20 lines.

Gen. SCIATTA.

Mts. Corpus sat robustum. Caput subproductum, antice rotundatum. Proboscis subobsoleta. Palpi porrecti, sat graciles, caput non superantes; articulus 3^{us} parvus, acutus. Antennæ breves, validæ, serratæ. Abdomen alas posticas sat superans, sexualibus magnis. Pedes breves, tibiis breviter calcaratis. Alæ longæ, angustæ; anticæ apice rotundatæ margine exteriore subconvexo perobliquo.

Male. Body rather stout. Head prominent and rounded in front. Proboscis rudimentary. Palpi porrect, rather slender, not extending beyond the head; 3rd joint acute, not more than one-fourth of the length of the 2nd. Antennæ short, stout, serrated. Abdomen extending somewhat beyond the hind wings; a hooked appendage above, and two lateral valves at the tip. Legs short, moderately stout, spurs short. Wings long, narrow. Fore wings rounded at the tips; exterior border slightly rounded, very

oblique; 2nd inferior vein a little nearer to the 1st than to the 3rd.

17. *SCIATTA INCONCISA*. *Mos.* Alba; thorace antice ochraceo-fasciato; abdomine ochraceo vittis tribus macularibus nigris; alis anticis macula basali fascia antemedia plagisque exterioribus ochraceis; alis posticis fascia marginali ochracea informi valde interrupta.

Male. White. Thorax with a narrow ochraceous band on the fore tegulae. Abdomen ochraceous, with three stripes of black spots. Tarsi with black bands. Fore wings with an ochraceous spot at the base, with an ochraceous antemedial band, which is much dilated towards the interior border, and with some ochraceous exterior patches, of which the largest is costal. Hind wings with an irregular and much interrupted ochraceous marginal band. Length of the body 6 lines; of the wings $17\frac{1}{2}$ lines.

18. *ARTAXA SQUAMIPLAGA*. *Mos.* Pallide ochracea; palpis porrectis caput longe superantibus; antennis sat late pectinatis; thorace pilis longis vestito; alis anticis lineis duabus transversis obliquis undulatis saturate ochraceis, plaga diffusa e squamis atris.

Male. Pale ochraceous. Palpi slender, porrect, extending much beyond the head; 3rd joint conical, not more than one sixth of the length of the 2nd. Antennae short, rather broadly pectinated. Thorax clothed with long hairs. Abdomen a little shorter than the interior border of the hind wings; apical tuft rather large. Fore wings with two deep ochraceous transverse oblique undulating lines, a diffuse patch of deep black speckles between the lines, and a few speckles of the same hue beyond the 2nd line. Length of the body 5 lines; of the wings 15 lines.

Gen. ZARFA.

Mos. Corpus robustum. Caput bifasciculatum. Palpi graciles, porrecti, caput paullo superantes; articulus 3^{us} lancolatus. Antennae late pectinatae, thorace breviores. Abdomen basi fasciculatum, alas posticas non superans; fasciculus apicalis brevis. Pedes breves, fimbriati. Alae anticae longiuseculae, sat angustae, apice valde rotundatae, margine exteriori convexo perobliquo.

Male. Body stout. Head with a tuft on each side at the base

of the antennæ. Palpi slender, porrect, extending a little beyond the head; 3rd joint lanceolate, more slender than the 2nd, and not more than one-fourth of its length. Antennæ broadly pectinated, shorter than the thorax. Abdomen tufted above at the base, not extending beyond the hind wings; apical tuft short. Legs short; femora and tibiæ fringed. Fore wings rather long and narrow, much rounded at the tips; exterior border rounded, very oblique.

19. ZARFA LUNIFERA. *Mus.* Albo, capite apud oculos ochraceo; antennarum ramis fulvis thorace abdominis que crista pallide lutescentibus; tarsis nigro fasciatis; alis anticis testaceo albis, margine lunula que fusco marginata nigro biguttata pallide luteis, punctis discoidalibus nigris, linea marginali interrupta argenteo alba.

Male. White. Head ochraceous along the eye on the outer side. Antennæ with tawny branches. Thorax, except in front and crest of the abdomen, with a pale luteous tinge. Tarsi with black bands. Fore wings testaceous white, bordered with pale luteous; a pale luteous brown bordered lunule across the tip of the areolet, with a black dot at each end; some black points on the median vein; an interrupted silvery white line along the exterior border. Length of the body 8 lines; of the wings 23 lines.

Gen. SIZALISCA.

Mus. Corpus crassum. Proboscis nulla. Palpi porrecti, dense pilosi, caput vix superantes; articulus 3^{us} brevissimus. Antennæ breves, late pectinatæ, apice serratæ. Abdomen alas posticas sat superans; fasciculus apicalis longus. Pedes breves, fimbriati; tibiæ posticæ calcaribus duobus parvis apicalibus. Alæ anticæ longæ, apice rotundatæ, margine exteriori convexo perobliquo.

Male. Body thick. Proboscis obsolete. Palpi porrect, densely clothed with short hairs, hardly extending beyond the head; 3rd joint extremely short. Antennæ short, broadly pectinated to four fifths of the length, minutely serrated from thence to the tips. Abdomen extending somewhat beyond the hind wings; apical tuft elongate. Legs short; femora and tibiæ fringed; hind tibiæ with two short apical spurs. Wings elongate. Fore wings rounded at the tips; exterior border rounded, very oblique.

20. *SIZALISCA GRAMINOSA*. *Mus.* Herbida, subtus cinereo fulva; palpis nigris apice pallide cinereis; antennis cinereis ferrugineo ramosis; abdomine cinereo cervino vitta lata fasciculo que apicali viridibus; alis anticis nigro conspersis, lineis quatuor transversis angulosis liturisque marginalibus nigris, plaga discoidali fusca; alis posticis cinereo-cervinis.

Male. Grass green, cinereous fawn colour beneath. Palpi black, pale cinereous towards the tips. Antennæ cinereous, with ferruginous branches. Abdomen cinereous fawn colour, with a broad green stripe; apical tuft wholly green. Femora and tibiæ thickly clothed with green hairs. Fore wings thickly and minutely black speckled; two antemedial and two postmedial zig-zag transverse black lines; an intermediate brown patch in the disk; a row of irregular black marginal marks; fringe cinereous, with black spots. Hind wings cinereous fawn colour. Length of the body $10\frac{1}{2}$ lines; of the wings 27 lines.

Gen. VIANA.

Mus. Corpus sat gracile. Caput sat magnum, thorace arcte insertum. Proboscis nulla. Palpi validi, porrecti, subpilosi, caput paullo superantes; articulus 3^{us} acutus, brevissimus. Antennæ breviusculæ, late pectinatae. Abdomen breve; fasciculus apicalis longus, subcompressus. Pedes breves, graciles, femoribus tibiis que subfimbriatis, tibiis posticis apice bicalcaratis. Alæ anticae latae, apice subrotundatae, margine exteriori convexo subobliquo, areola discoidali brevi. Alæ posticae abdomen longæ superantes, margine exteriori subangulato.

Male. Body rather slender. Head rather large, deeply inserted in the thorax. Proboscis obsolete. Palpi stout, porrect, clothed with short hairs, extending a little beyond the head; 3rd joint acute, very short. Antennæ rather short, broadly pectinated; joints very short. Abdomen much shorter than the interior border of the hind wings; apical tuft elongate, slightly compressed. Legs short, slender; femora and tibiæ thinly fringed; hind tibiæ with two long slender apical spurs. Wings broad. Fore wings more thickly clothed at the base, slightly rounded at the tips; exterior border rounded, slightly oblique; discoidal areolet near the costa, extending to somewhat beyond one-third of the length; 2nd median nervule very slightly more remote from the 3rd than

from the 1st. Hind wings most thickly clothed along the interior border; exterior border slightly angular in the middle.

21. VIANA VELUTINA. *Mus.* Cervina; corpore subtus palpis subtus pedibusque albido testaceis; alis anticis linea postmedia nigricante obliqua fere recta intus concisa extus diffusa; alis posticis ochraceis, linea transversa arcuata fuscescente extus diffusa, spatio exteriori margineque interiori cervinis.

Male. Fawn colour. Body, palpi beneath, and legs whitish testaceous. Fore wings with a blackish oblique nearly straight postmedial line, which is concise on the inner side, and diffuse on the outer side. Hind wings ochraceous, except along the interior border, for full two-thirds of the length from the base, this line bounded by a curved brownish line, which is diffuse on the outer side. Length of the body $6\frac{1}{2}$ lines, of the fore wings 21 lines.

Gen. VAENA.

Fem. Corpus sat robustum. Caput parvum, thorace arcte insertum; frons plana. Proboscis brevissima, gracillima. Palpi porrecti, brevissimi, gracillimi, caput non superantes; articulus 3^{us} minimus. Antennæ glabræ. Abdomen alas posticas paullo superans. Pedes læves, breves, graciles; femora sulcata; calcaria parva. Alæ, antiçæ longæ, acutæ, costa perparum convexa, margine exteriori angulato autice recto subobliquo postice excavato perobliquo. Alæ posticæ apice fere rectangulatæ.

Female. Body rather stout. Head small, deeply inserted in the thorax; front flat. Proboscis very short and slender. Palpi porrect, very short and slender, not extending beyond the head; 3rd joint extremely minute. Antennæ smooth. Abdomen extending a little beyond the hind wings. Legs smooth, short, slender; femora grooved; hind tibiæ with four short spurs. Wings moderately broad. Fore wings long, acute; costa very slightly rounded; exterior border angular in the middle, its fore half straight and slightly oblique, its hind half concave and very oblique. Hind wings nearly rectangular at the tips; interior border receding from the abdomen.

22. VAENA EACLEOIDES. *Fem.* Latea; thorace purpureo-rufo; alis gutta discoidali nigra, atomis fasciisque tribus obliquis inde-

terminatis purpureo rufis; alis anticis fasciis 1^a et 2^a confusis; alis posticis fascia 3^a marginali valde interrupta.

Female. Luteous. Eyes black. Thorax purplish red. Wings with a black discoidal dot, with purplish red speckles, and with two oblique, very irregular purplish red bands, which are confused together in the fore wings; a third exterior and more oblique purplish red band, which is marginal and much interrupted in its hind wings. Fore wings with the 3rd band apparent on the underside. Hind wings with the 2nd band visible beneath. Length of the body 5 lines; of the fore wings 15 lines.

23. PÆCILOCAMPA SUBLINEATA. *Fem.* Ferrugineo rufa, subtus cinereo rufa; capite antice fasciculato; palpis porrectis brevissimis; antennis serratis; abdomine alas posticas paullo superante; pedibus brevibus, gracilibus, femoribus tibiis que pilosis; alis fascia obliqua nigricante; alis anticis apice rotundatis, gutta discoidali antemedia alba, fascia media obliqua nigricante.

Female. Ferruginous red, cinereous red beneath. Body densely pilose. Head deeply inserted in the thorax, tufted in front. Palpi porrect, hardly extending beyond the hairs; 3rd joint lanceolate. Antennæ serrated. Abdomen extending a little beyond the hind wings. Legs short, slender; femora and tibiæ pilose; spurs slender. Wings with an oblique blackish band which extends from near the tips of the fore wings to the outer part of the interior border of the hind wings. Fore wings rounded at the tips, with an oblique blackish middle band, and with an antemedial discoidal white dot; 3rd inferior vein, or median nervule, very remote from the 2nd; exterior border rounded, slightly oblique. Length of the body 6 lines; of the wings 18 lines.

24. NYSSIA RUDIS. *Mas et Fem.* Ochracea, crassa, capite supra thorace abdomineque basi viridibus; alis anticis nigro-conspersis, fascia viridi informi obliqua antice dilatata. *Mas.* Antennis subserratis basi pectinatis.

Male and Female. Ochraceous, very stout. Head above, thorax and base of the abdomen grass green. Antennæ of the male slightly serrated, moderately pectinated from the base to one-third of the length. Abdomen of the male extending somewhat

beyond the hind wings. Legs very hairy. Fore wings with black speckles, and with an irregular oblique grass green band, which is dilated on its anterior half, and extends from one-third of the length of the interior border to somewhat beyond the middle of the costa; exterior border slightly rounded, very oblique. Length of the body 9-11 lines; of the wings 27-30 lines.

Gen. ZINARA.

Mus. Corpus robustum. Proboscis nulla. Palpi validi, vix ascendentes, caput paullo superantes; articulus 3^{us} lanceolatus. Antennæ breves, late pectinatae, apice versus simplices. Thorax squamosus. Abdomen alas posticas perpaullo superans; fasciculus apicalis spissus, vix productus. Pedes validi; calcaria longa. Alæ anticæ apice rotundatæ, margine exteriore convexo perobliquo.

Male. Body stout. Proboscis obsolete. Palpi stout, hardly ascending, extending a little beyond the head; 3rd joint lanceolate, not more than one-fourth of the length of the 2nd. Antennæ short, broadly pectinated to beyond half the length. Thorax squamous. Abdomen extending very little beyond the hind wings; apical tuft compact, slightly elongate. Legs stout; spurs long. Wings moderately broad. Fore wings rounded at the tips; exterior border rounded, very oblique.

25. ZINARA NERVOSA. *Mus.* Ferruginea, subtus cinerea; alis anticis atomis striga basili transversa arcuata plagaque antemedia cinereo submarginata nigris, linea postmedia transversa venisque exterioribus cinereis; alis posticis cinereis.

Male. Ferruginous, cinereous beneath. Thorax mostly blackish. Fore wings irregularly black-speckled, with a curved transverse black streak near the base; an antemedial black patch near the interior border, broadly and irregularly bordered with pale cinereous on the outer side; a postmedial transverse pale cinereous line which does not extend to the costa; exterior veins pale cinereous; under side mostly blackish in front. Hind wings cinereous; under side with some black speckles in front. Length of the body 3½ lines; of the wings 10 lines.

26. ANTHEREA RHODOPHILA. *Fem.* Ferrugineo fusca; corpore subroseo, capite thoracisque tegulis anticis roseis; antennis nigris subserratis; alis basi roseis, lineis duabus obliquis albidis, 2^a

fusco marginata, alis anticis subfalcatis linea 1^o angulosa purpurascente suffusa, striga costali lata albida, macula discoidali angulata vitrea, alis posticis oculo magno ochraceo nigro roseo alboque marginato guttam vitream angulatam includente, margine exteriori subangulato.

Female. Ferruginous brown. Body dull rose colour. Head and fore tegulae of the thorax brown, the latter bordered in front and behind with rose colour. Antennae black, minutely serrated. Abdomen somewhat more than half the length of the interior border of the hind wings. Tibiae and tarsi black. Wings with a rosy tinge at the base, with an antemedial oblique whitish line, and with a postmedial more oblique whitish line, which is bordered with brown on the outer side; these markings are indistinct on the under side. Fore wings rounded at the tips, hardly falcate, with a broad whitish streak which extends along the costa from the inner side of the postmedial line; antemedial line zig-zag, with a purplish tinge; an angular moderately large vitreous spot in the disk. Hind wings with a large ochraceous ocellus in the disk; this ocellus includes an angular vitreous dot, and is bordered with black, then with rose colour, and lastly with white; exterior border slightly angular in the middle. Length of the body 11 lines; of the wings 54 lines.

27. ANTHEREA INTERMISCENS. *Fem.* Lutescente viridis; thoracis tegulis albido marginatis; abdomine cinereo; alis lineis duabus obliquis nigricantibus fasciis que duabus latis indeterminatus purpureo albidis, linea 2^o albido marginata; alis anticis viae falcatis macula discoidali vitrea angulata, alis posticis oculo saturate ochraceo guttam vitream includente atro viridescente et purpureo albo-marginato, margine exteriori subconvexo.

Female. Dull luteous green. Tegulae of the thorax with whitish borders. Abdomen with cinereous hairs, much shorter than the interior border of the hind wings. Wings with two oblique blackish lines, each having along its outer side a broad irregular purplish whitish band; 2nd line narrowly bordered with whitish on its inner side; under side very broadly cinereous towards the base, and with an exterior dentate oblique cinereous band, which is macular in the fore wings. Fore wings very slightly acute, hardly falcate, with an angular vitreous spot between the lines, which are nearly straight. Hind wings with the lines undulating,

the outer one contiguous to a large intermediate deep ochraceous ocellus, which includes a vitreous dot, and is bordered with deep black, and with pale dull green, and lastly with purplish white; exterior border slightly rounded. Length of the body $16\frac{1}{2}$ lines; of the wings 62 lines. See Plate VI, Fig. 6.

Gen. TACHOSA.

Mas et *Fem.* Corpus robustum. Caput fasciculo frontali brevissimo. Proboscis valida. Palpi robusti, erecti, verticem perpaullo superantes; articulus 3^{us} linearis, graciles, 2ⁱ dimidio brevior. Pedes vix robusti; femora subfimbriata; calcaria longa, gracilia. Alæ anticæ sat angustæ, apice subrotundatæ, margine exteriore convexo subobliquo. *Mas.* Antennæ setosæ, apices versus glabræ. Abdomen alas posticas longe superans; fasciculus apicalis longus, compressus. *Fem.* Antennæ glabræ. Abdomen non elongatum.

Male and *Female.* Body stout. Head with a very short frontal tuft. Eyes large, prominent. Proboscis robust, moderately long. Palpi stout, erect, rising very little higher than the vertex; 3rd joint linear, rounded at the tip, much more slender than the 2nd, and about one-third of its length. Antennæ slender, setose for two-thirds of the length in the male, smooth in the female. Abdomen tapering, extending very much beyond the hind wings in the male, shorter in the female; apical tuft of the male long, compressed. Legs hardly stout; femora slightly fringed; spurs long, slender. Wings rather narrow. Fore wings slightly rounded at the tips; exterior border rounded, slightly oblique; 1st, 2nd, and 3rd inferior veins approximate at the base; 4th remote.

28. TACHOSA ACRONYCTOIDES. *Mas* et *Fem.* Cana capite fusco-fasciato; palpis fusco fasciatis; thorace fascia antica fusca; abdomine cinereo pilis basalibus longis; alis anticis nigro conspersis, fusco nebulosis, lineis tribus nigris angulosis, 1^a abbreviata, 2^a ramum emittente, 3^a albo submarginata, punctis marginalibus nigris, alis posticis fuscis, basi cinereis et subhyalinis.

Male and *Female.* Hoary, cinereous beneath. Head with a narrow brown band on the vertex. 2nd and 3rd joints of the palpi brown, hoary at the base and at the tip. Thorax with a brown band on the fore tegulæ. Abdomen cinereous, with long

hairs at the base. Fore wings black speckled, clouded with brown; three irregular zig-zag black lines; 1st line very near the base, not extending to the interior border; 2nd antemedial, emitting an oblique branch to the 3rd, which is postmedial, and partly white bordered; marginal points black. Hind wings brown, cinereous and slightly hyaline towards the base. Length of the body 8-9 lines; of the wings 18 lines.

29. TACHOSA METAPHLEARIA. *Fem* Cinerea, subtus cervina; palpis nigris oblique ascendentibus verticem non superantibus, articulo 3^o lineari basi apice que albo, thorace fusco-quadrinaculato tegulis anticis nigricante marginatis, abdomine alisque posticis cervinis, alis anticis striga transversa basali annulo interrupta linea antemedialia transversa undulata maculis tribus lineaque exteriori transversa angulosa fuscis, linea postmedia angulosa palide fusca, guttis apud lineam exterioriorem guttisque marginalibus nigris, spatiae marginali pallide fusco lineam albidam transversam angulosam includente.

Female. Cinereous, fawn colour beneath. Palpi black, smooth, moderately stout, obliquely ascending, not rising higher than the vertex; 2nd joint white at the tip; 3rd linear, white at the base and at the tip, less than half the length of the 2nd. Antennae slender. Fore tegulae of the thorax narrowly bordered with blackish in front; two brown spots on each of the hind tegulae. Abdomen and hind wings fawn colour, the former hardly extending beyond the latter. Legs cinereous, stout; femora and tibiae fringed; tips of the latter and of the joints of the tarsi whitish; spurs long, slender. Fore wings slightly rounded at the tips; a dark brown transverse streak near the base, joining an incomplete dark brown ringlet in the disk; an antemedial transverse undulating brown line accompanied by two dark brown spots, one costal, the other discoidal; a zig-zag pale brown slightly post-medial transverse line, with a dark brown discoidal spot on its inner side; an exterior transverse zig-zag brown line accompanied by black dots; space from thence to the exterior border pale brown, including a zig-zag transverse white line; marginal dots black. Length of the body 6 lines; of the wings 17½ lines.

Gen. TUERTA.

Mas. Corpus cylindricum, sat validem. Caput et thorax dense

squamoso-pilosa. Proboscis medioeris. Palpi robusti, squamoso hirti, suberecti, verticem non superantes; articulus 3^{us} conicus. Antennæ robustæ, glabræ. Abdomen alas posticas paullo superans; dorsum cristatum; fasciculus apicalis spissus, elongatus. Pedes fimbriati, sat graciles; calcaria gracilia. Alæ anticæ longæ, apice subrotundatæ, margine exteriore rotundo sat obliquo.

Male. Body cylindrical, moderately stout. Head and thorax thickly clothed with squamous hairs. Proboscis moderately long. Palpi stout, thickly clothed with squamous hairs, nearly erect, applied to the head, not rising higher than the vertex; 3rd joint conical, not more than one-sixth of the length of the 2nd. Antennæ stout, smooth. Abdomen extending a little beyond the hind wings, with dorsal crests, and with a large elongate apical tuft. Legs rather slender; femora and tibiæ fringed; spurs slender, moderately long. Wings elongate. Fore wings slightly rounded at the tips; exterior border rounded, rather oblique; 4th inferior vein remote from the other three, which are approximate to each other.

30. TUERTA CHRYSOCHLORA. *Mus.* Obscure ferrugineo fusca, subtus ochracea; antennis nigris; abdomine ochraceo nigro-cristato; alis anticis cinereo conspersis plaga maxima pallide viridi; alis posticis ochraceis fusco late marginatis fimbria pallide cinerea.

Male. Dark ferruginous brown, ochraceous beneath. Antennæ black. Abdomen ochraceous, with small black crests. Fore wings cinereous-speckled, with a very large pale green patch, which extends along the costa from the base to three-fourths of the length, and is widest beyond its middle, where it occupies three-fourths of the breadth of the wing. Hind wings ochraceous, with a broad brown border; fringe pale cinereous. Length of the body 8 lines; of the wings 20 lines. See Plate VI, Fig. 7.

Gen. PETRINIA.

Fœm. Corpus robustum. Proboscis medioeris. Palpi sat graciles, oblique ascendentes, verticem non superantes; articulus 3^{us} lanceolatus 2ⁱ dimidio brevior. Antennæ graciles. Abdomen alas posticas paullo superans. Pedes sat validi; calcaria longa, gracilia. Alæ anticæ apice rotundatæ, margine exteriore convexo perobliquo.

Female. Body stout. Proboscis moderately long. Palpi rather

slender, obliquely ascending, not rising higher than the vertex; 3rd joint lanceolate, less than half the length of the 2nd. Antennæ slender. Abdomen extending a little beyond the hind wings. Legs rather stout; spurs long, slender. Wings moderately broad. Fore wings rounded at the tips; exterior border rounded, its hind part very oblique; 1st, 2nd, and 3rd inferior veins approximate at the base; 4th remote.

31. *PETRINIA LIGNOSA*. *Fœm.* Cervina, subtus cinerea, thorace fusco-trifasciato, alis anticis margine costali fasciis duabus angulosis lineaque submarginali fracta atro marginata pallide testaceis, fascia 1^o informi apud medium dilatata, 2^o lineam angulatam emittente, atomis non nullis subcostalibus guttaque discoidali atris; alis posticis cinereo-fuscis.

Female. Fawn colour, cinereous beneath. Thorax with three dark brown bands. Fore wings pale testaceous along the costa at the base, and with two pale testaceous zig-zag bands; 1st band antemedial, very irregular, dilated in the middle; 2nd postmedial, emitting from its inner side an angular line which proceeds towards the costa; a submarginal dislocated pale testaceous line irregularly bordered with deep black; a testaceous marginal festoon; some deep black subcostal speckles, and a deep black discoidal dot. Hind wings cinereous brown; fringe pale cinereous. Length of the body 6 lines; of the wings 16 lines.

32. *AGROTIS HEMILEUCA*. *Mas.* Fusca, subtus sordide alba; palpis robustis perparum ascendentibus caput superantibus, articulo 2^o extus nigricante, 3^o conico; antennis sat late pectinatis apice simplicibus; thorace nigro unifasciato; abdomine sordide albo alas posticas sat superante fasciulo apicali fulvo; alis anticis lineis tribus nigris transversis angulosis, fascia diffusa striga longitudinali interrupta guttisque marginalibus nigricantibus, orbiculari et reniformi nigro marginatis; alis posticis niveis.

Male. Ferruginous brown, dingy white beneath. Palpi stout, very slightly ascending, extending somewhat beyond the head; 2nd joint blackish on the outer side; 3rd conical, not more than one-fourth of the length of the 2nd. Antennæ rather broadly pectinated, except near the tips. Thorax with a black band on the fore tegulæ. Abdomen dingy white, extending rather beyond the hind wings; apical tuft tawny. Legs brown; tips of the

tarsal joints white. Fore wings with three zig-zag transverse black lines, and with a diffuse blackish band between the 2nd and 3rd lines; a blackish longitudinal streak between the 2nd and 3rd lines, interrupted by the black-bordered orbicular and reniform marks which have the usual form; three whitish costal points near the tip; marginal dots blackish. Hind wings pure white. Length of the body 7 lines; of the wings 16 lines.

33. *AGROTIS CATENIFERA*. *Fem.* Fusca, subtus cinerea; palpis oblique ascendentibus verticem non superantibus, articulo 3^o conico, abdomine cinereo alas posticas sat superante; alis anticis linea basali dimidio exteriore dilatata punctis que submarginalibus et marginalibus nigris, striga discoidali interrupta nigricante, orbiculari et reniformi magnis nigro marginatis hujus disco nigricante cinereo; alis posticis cinereis basi albidis.

Female. Brown, cinereous beneath. Palpi obliquely ascending, not rising higher than the vertex; 3rd joint conical, about one-sixth of the length of the 2nd. Abdomen cinereous, extending rather beyond the hind wings. Fore wings with a black line which extends from the base, and is dilated along its outer half, and terminates behind the orbicular mark; a blackish streak in the disk interrupted by the orbicular and reniform marks, which are large and black bordered, and of the usual form; disk of the reniform blackish cinereous; a transverse line of black points nearer to the exterior border than to the reniform; marginal points black. Hind wings cinereous, whitish towards the base. Length of the body 9 lines; of the wings 19 lines.

Gen. TAVILA.

Mas. Corpus breve, sat robustum. Proboscis mediocris. Palpi graciles, erecti, verticem paullo superantes; articulus 3^{us} lanceolatus, 2^o duplo brevior. Antennæ setulosæ. Thoraceis tegulæ anticæ breves. Abdomen alas posticas sat superans; fasciculus apicalis parvus, subcompressus. Pedes breves, graciles; calcaria longa, gracilia. Alæ anticæ latæ, apice subrotundatæ, plaga subtus basali squamosa glabra, costa apud medium subdilatata.

Male. Body smooth, moderately stout. Proboscis of the usual length. Palpi slender, erect, rising a little higher than the vertex; 3rd joint lanceolate, about half the length of the 2nd. Antennæ minutely setulose. Fore tegulæ of the thorax short.

Abdomen extending somewhat beyond the hind wings; apical tuft small, slightly compressed. Legs smooth, slender; spurs long, slender. Wings broad. Fore wings slightly rounded at the tips; costa slightly dilated in the middle; exterior border slightly rounded and oblique; under side with a smooth squamous patch in the disk near the base; 2nd inferior vein equally remote from the 1st and from the 3rd; 3rd thrice further from the 4th than from the 2nd.

34. TAVILA INDETERMINATA. *Mus.* Pallide straminea, palporum articulo 2° nigro-vittato, antennis fulvis, thoraceis tegulis anticis ochraceis, alis anticis postice pallidissime cervinis, lineis duabus transversis connexis pallide fuscis, 1° angulosa, 2° valde flexa.

Male. Pale straw colour. Second joint of the palpi with a black stripe along the outer side. Antennæ tawny. Fore tegulæ of the thorax ochraceous. Fore wings with two pale brown transverse lines; 1st line antemedial, zig-zag, connected on the costa with the 2nd, which is much bent outward; hind half very pale fawn colour. Length of the body 5 lines; of the wings 11 lines.

35. ERASTRIA DECORA. *Mus.* Cinerea; corpore subtus, palpis subtus pedibusque argenteo albis; palpis oblique ascendentibus, articulo 2° squamoso fimbriato, 3° lanceolato; thorace pallide roseo, tegulis anticis cinereis, alis anticis lineis transversis nigris undulatis albo marginatis, macula basali fasciaque media antice inordinatim dilatata maculamque nigram costalem includente, linea postmedia transversa alba angulosa, maculisque tribus exterioribus pallide roseis, strigis exterioribus nigris; alis posticis apud marginem interiorem lituratis.

Male. Cinereous. Body beneath, palpi beneath, and legs silvery white. Palpi obliquely ascending; 2nd joint with a short squamous fringe; 3rd lanceolate, more than half the length of the 2nd. Antennæ smooth, stout. Thorax pale rose colour; fore tegulæ cinereous. Fore wings with a few black undulating transverse white-bordered lines; a pale rose-coloured spot near the base, and a pale rosy middle band, which is excessively dilated in front, and includes a black costal spot; an exterior zig-zag white line, which is accompanied by three pale rosy spots, and by some more exterior black streaks. Hind wings with markings near the

interior border, like those of the fore wings. Length of the body $3\frac{1}{2}$ lines; of the fore wings 10 lines.

36. *HYDRELIA TERMINATA*. *Fem.* Cinerea; palpis squamoso fimbriatis oblique ascendentibus verticem non superantibus, articulo 3^o lanceolato; abdomine alas posticas paullo superante; alis anticis purpurascente chalybæo et viridescente subinctis apice subrotundatis, fascia marginali fusca intus valide rotundata; alis posticis pallide fuscis.

Female. Cinereous, rather stout. Proboscis long, stout. Palpi slender, obliquely ascending, not rising higher than the vertex, with a squamous fringe; 3rd joint lanceolate, more than half the length of the 2nd. Antennæ slender. Abdomen extending a little beyond the hind wings. Fore wings slightly rounded at the tips, with an indistinct purplish and chalybeous and pale greenish tinge; a brown marginal band, which is much dilated and rounded on the inner side; exterior border slightly rounded, hardly oblique. Hind wings pale brown above. Wings beneath with a brown discoidal dot, and a brown marginal festoon. Length of the body $4\frac{1}{2}$ lines; of the fore wings 11 lines.

37. *MICRA CONVERGENS*. *Mas.* Pallidissime testaceæ subtus albidæ; palpis porrectis caput longe superantibus, articulo 3^o lanceolato; alis anticis acutis, apud marginem exteriorem fusco pallido nebulosis, lineis quatuor obliquis fuscis, 3^o et 4^o versus marginem exteriorem testaceo pallido marginatis; alis posticis albidis.

Male. Very pale testaceous, whitish beneath. Palpi slender, porrect, extending much beyond the head; 3rd joint lanceolate, nearly half the length of the 2nd. Fore wings acute, clouded towards the exterior border with pale brown, adorned with four oblique tawny lines; 1st line extending from near the base to the costa at half the length; 2nd, 3rd, and 4th converging slightly towards the costa, on approaching which they are retracted; 3rd and 4th mostly in the brownish part, where they are bordered with pale testaceous on the outer side; a submarginal pale testaceous festoon, bordered with dark brown on the outer side. Hind wings whitish. Length of the body $2\frac{3}{4}$ lines; of the wings 8 lines.

28. *MICRA INTRICATA*. *Fem.* Albida, palpis porrectis caput sat superantibus articulo 3^o lanceolatae; alis anticis cervinis linea antemedial alba arcuata antice furcata plagamque fuscam includente, plaga fusca majore subapicali albo interlineata et marginata.

Female. Whitish, slender. Palpi porrect, smooth, slender, extending somewhat beyond the head; 3rd joint lanceolate, about half the length of the 2nd. Abdomen lanceolate, not extending beyond the hind wings. Fore wings fawn colour, acute, moderately broad; an antemedial curved white line, which is forked in front, and there includes a costal brown patch; a larger costal brown patch near the tip, interlined with white, and bordered by two white lines which are partly connected; exterior border slightly rounded, moderately oblique. Length of the body 3 lines; of the wings 8 lines.

39. *EUTELIA QUADRILITURATA*. *Fem.* Fusca, crassa; palpis validis erectis verticem sat superantibus, articulo 3^o lineari 2^o paullo brevioribus; thorace antice cinereo-biguttato; alis anticis strigis duabus albis, 1^a furcata maculaque exteriore cinerea connexis, lineis duabus exterioribus albis transversis angulosis nigro marginatis 2^a submarginali ex parte duplicata, lunulis marginalibus nigris albido marginatis; alis posticis macula apud angulum interiorem alba.

Female. Brown, very stout, cinereous-brown beneath. Palpi stout, erect, rising somewhat higher than the vertex; 3rd joint linear, rounded at the tip, a little shorter than the 2nd. Antennae stout. Thorax with a cinereous dot on each side in front. Abdomen paler brown, extending rather beyond the hind wings. Legs stout; femora fringed; spurs whitish; tarsi with whitish bands. Fore wings rounded at the tips, with two white streaks; 1st streak forked, proceeding from a little before the middle of the costa to the disk, adjoining a cinereous spot on its outer side; 2nd proceeding obliquely from a little beyond the middle of the interior border to the disk; two exterior transverse zig-zag black-bordered white lines, the 1st incomplete, the 2nd submarginal, and partly double; marginal lunules black, whitish-bordered; fringe with whitish dots. Hind wings with a white spot near the interior angle, and with a cinereous marginal festoon. Wings beneath with some dark brown zig-zag transverse lines, which are most

numerous on the hind wings. Length of the body 5 lines; of the wings 12 lines.

Gen. NEDROMA.

Mas. Corpus robustum. Caput fasciculo frontali munitum. Proboscis elongata. Palpi validi, breves, oblique ascendentes, verticem superantes; articulus 3^{us} gracilis, linearis, 2^o brevior. Thorace antice carinatus. Abdomen alas posticas paullo superans; fasciculus apicalis subcompressus. Pedes fimbriati, sat robusti; calcaria longa, gracilia. Alæ anticæ latæ, vix acutæ, costa basi subrotundata, margine interiore excavato.

Male. Body stout. Head with a frontal tuft, which forms a ridge above, and extends somewhat beyond the face. Proboscis long. Palpi stout, smooth, obliquely ascending, rising higher than the vertex; 3rd joint linear, rounded at the tip, rather shorter and much more slender than the 2nd. Fore tegulæ of the thorax forming a ridge. Abdomen extending a little beyond the hind wings; apical tuft moderately large; slightly compressed. Legs rather stout; femora and fore tibiæ fringed; spurs long, slender. Wings broad. Fore wings hardly acute; costa slightly rounded near the base; exterior border rounded, not oblique; interior border excavated beyond the middle; 1st, 2nd, and 3rd inferior veins approximate at the base; 4th remote.

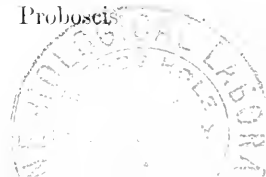
40. NEDROMA FERRUGINEA. *Mas.* Ferruginea, subtus ferrugineo cinerea; alis anticis transverse nigro-conspersis; alis posticis ferrugineo fascis subtus transverse fusco subconsersis.

Male. Ferruginous, ferruginous-cinereous beneath. Fore wings above transversely black-speckled. Hind wings ferruginous-brown; under side transversely and slightly brown speckled. Length of the body 7½ lines; of the wings 18 lines.

Gen. STRIDONA.

Fam. Corpus læve, robustum. Caput latiusculum. Proboscis brevis. Palpi oblique ascendentes, verticem superantes; articulus 2^{us} brevi fimbriatus; 3^{us} linearis, 2^o paullo brevior. Antennæ glabræ, graciles. Thorax squamosus. Abdomen alas posticas vix superans. Pedes breves, robusti vix pilosi. Alæ anticæ breves, latæ, apice rectangulatæ, margine exteriori subconvexo vix obliquo.

Female. Body smooth, stout. Head rather broad. Proboscis



short. Palpi obliquely ascending, rising higher than the vertex; 2nd joint with a short fringe; 3rd linear, a little shorter than the 2nd. Antennæ smooth, slender. Thorax squamous. Abdomen hardly extending beyond the hind wings. Legs short, stout, hardly pilose; hind tibiæ with four long spines, one in each pair longer than the other. Wings broad, short. Fore wings rectangular at the tips; exterior border slightly rounded, hardly oblique; 4th inferior vein, or median nervule, not very remote from the other three which are contiguous at the base.

The short wings and the structure of the veins chiefly distinguish this genus from the other *Hypogrammidæ*.

41. STRIDOVA ALBIGUTTA. *Fœm.* Murina, subtus argenteo cinerea; capite albo-fasciato; alis anticis atomis lineis duabus transversis undulatis indeterminatis macula discoidali punctis paucis costalibus punctisque marginalibus nigricante notatis albis; alis posticis subtus cinereis puncto discoidali atomisque fuscis.

Female. Mouse colour; under side silvery cinereous. Head with a white band between the eyes. Wings with a cinereous fringe, which is interlined with brown. Fore wings with a few white speckles; two indeterminate undulating transverse white lines; a few costal white points, and a row of marginal white blackish-marked points; a white discoidal spot. Hind wings beneath cinereous, thickly speckled with brown; a brown point in the disk. Length of the body 4 lines; of the wings 10 lines.

42. BRIARDA CONTURBATA. *Fœm.* Fusca; palpis oblique ascendentibus verticem sat superantibus articulo 3^o lineari, 2^o duplo brevioribus; abdomine nigroecante-bicristato, alas posticas paullo superante; alis anticis cinereo-fuscis, plaga magna postica antemedialia pallide cinerea striga basali fascia infornis lineis tribus exterioribus transversis angulosis cinereo marginatis striga transversa postmedia strigaque subapicali obscure fuscis; alis posticis fuscis, striga basali plagaque discoidali cinereis semihyalinis.

Female. Brown. Palpi rather slender, obliquely ascending, rising somewhat higher than the vertex; 3rd joint linear, rounded at the tip, about half the length of the 2nd. Pectus cinereous, thickly clothed with long hairs. Abdomen extending a little beyond the hind wings, with two blackish crests, one on the 1st segment, the other on the 3rd segment; under side pale pearly

cinereous. Fore wings cinereous-brown, slightly rounded at the tips; a large pale cinereous antemedial patch near the interior border, contiguous to a dark brown streak, which proceeds from the base, and is bounded on the outer side by an irregular dark brown band, which is broadest towards the costa; three exterior transverse indistinct zig-zag dark brown cinereous-bordered lines; a broad transverse dark brown streak between the 2nd and 3rd lines, and a little longitudinal subcostal subapical dark brown streak; exterior border rounded, rather oblique. Hind wings brown, with a cinereous semi-hyaline streak proceeding from the base, and with a patch of the same hue in the disk. Length of the body 7 lines, of the wings 17 lines.

Gen. TOLNA.

Mus. Corpus robustum, squamosum. Caput magnum; frons lata. Palpi validi, fere erecti, verticem paullo superantes; articulus 2^{us} latus; 3^{us} lanceolatus, 2ⁱ dimidio brevior. Antennæ subtilissime setulosæ. Abdomen alas posticas non superans; fasciculus apicalis longiusculus, subcompressus. Pedes validi, femoribus tibiisque dense pilosis. Alæ anticæ latæ, acutæ, margine exteriori vix convexo. Alæ posticæ margine exteriori subangulatæ valde rotundato.

Male. Body stout, squamous. Head large, front broad. Proboscis moderately long. Palpi stout, nearly erect, rising a little higher than the vertex; 2nd joint broad; 3rd lanceolate, less than half the length of the 2nd. Antennæ nearly imperceptibly setulose. Abdomen tapering from the base to the tip, not extending beyond the hind wings; apical tuft elongated, slightly compressed. Legs stout; femora and tibiæ densely clothed; spurs long, slender. Wings broad, not long. Fore wings acute; interior border hardly curved, moderately oblique; 4th inferior vein very remote from the other three. Hind wings, with the exterior border much rounded, indistinctly angular in the middle.

It may be distinguished from the genus *Tuvia* by the much shorter third joint of the palpi.

43. TOLNA VERSICOLOR. *Mus.* Fusca; capite thoraceque cinereo conspersis; alis anticis viridi cæruleo purpureoque conspersis, lineis sex transversis angulosis non conspersis, fascia alba obliqua postmedia, reniformi angusta e atomis viridibus, plaga

costali subapicali magna ferruginea albo marginata, punctis marginalibus albis; alis posticis striga apicali alba.

Male. Brown. Head and thorax minutely speckled with cinereous. Palpi testaceous on the inner side. Abdomen pale cinereous beneath at the tip. Joints of the tarsi and spurs with pale cinereous tips. Fore wings flecked with green, with pale blue, and with pale purple scales; six zig-zag transverse lines of the ground hue, but without speckles, these lines are distinguished by the clustering speckles with which they are irregularly bordered; the 4th, 5th, and 6th lines are partly included in an oblique white band, which extends from beyond the middle of the costa to the hinder part of the exterior border; reniform mark narrow, formed by green speckles; a large ferruginous costal patch between the band and the tip, bordered with white on the hind side, and including three white costal points; marginal festoon black, including white points, bordered with testaceous on the outer side; fringe with elongated cinereous dots; under side with a white band, with exterior pale testaceous costal points, and with black white-marked points along the exterior border. Hind wings with a white apical streak, and with a black line along the exterior border; this line is bordered with pale testaceous on the outer side, and includes four white points; under side thinly speckled with white, with marginal points like those of the fore wings, with a transverse streak in the disk, and with two exterior bands, which are unspeckled, and a little darker than the ground hue. Length of the body 12 lines; of the fore wings 30 lines. See Plate VII, Fig. 10.

44. OPHIDERES DIVITIOSA. *Fem.* Ferruginea subtus fusca; abdomine ochraceo fusco-vittato; alis anticis purpureo suffusis, fasciis duabus antemediis lineis que duabus obliquis, linea exteriori perobliqua subundulata, strigis duabus transversis adhuc exterioribus lineaque intermedia transversa fuscis, plaga basali fasciaque postmedia viridibus, reniformi sordide viridi fusco marginata; alis posticis luteis, basi fuscis, margine lato purpureo fusco, maculis marginalibus albidis.

Female. Ferruginous, brown beneath. Abdomen ochraceous, with a brown stripe which occupies the whole of the tip, and is attenuated and abbreviated towards the base above, but is broad and entire beneath. Fore wings acute, purple-tinged, with

two oblique antemedial brown bands, and with two oblique brown lines; 1st line between the base and the 1st band; 2nd between the bands; an exterior very oblique slightly undulating brown line, which approaches the costa at four-fifths of its length, and is very near the 2nd band on the interior border, and is irregularly bordered by a grass-green band on the outer side; a slight grass-green patch near the base; reniform mark dark dull green, brown bordered, transverse, irregularly oval; an exterior transverse brown streak, and a more exterior angular brown line, which borders the fore part of the outer side of the green band; a sub-marginal transverse brown streak; underside with an irregular transverse luteous streak in the disk. Hind wings luteous, brown at the base, with a broad purplish brown border, and with whitish marginal spots. Length of the body $13\frac{1}{2}$ lines, of the wings 41 lines. See Plate VII, Fig. 11.

45. *ACHLEA OPHISMOIDES*. *Fœm.* Ferruginea; palpis erectis verticem sat superantibus, articulo 3^o lineari 2^o triplo brevioribus; alis anticis fascia media glauco-alba nigro marginata antice dilatata extus angulosa, striga apicali obliqua nigricante, punctis submarginalibus nigris; alis posticis fuscis, fascia nigricante postmedia diffusa latissima, maculis duabus magnis albis 1^a apicali 2^a marginali.

Female. Ferruginous. Body cinereous beneath. Palpi erect, rising somewhat higher than the vertex; 3rd joint linear, much more slender than the 2nd, and about one-third of its length. Abdomen not extending beyond the hind wings; apical tuft slightly compressed. Tarsi spinulose. Fore wings broad, slightly rounded at the tips, with a broad glaucous white middle band, which is narrowly black bordered on each side, and is dilated towards the costa, and is oblique and zig-zag on its outer side, and contains three black points, one indicating the orbicular mark, and two the reniform; a blackish streak extending obliquely from the tip to the disk; a row of submarginal black points; fringe blackish, bordered with cinereous; under side with a white band, which is not dilated in front, and does not extend to the costa. Hind wings brown, with a diffuse postmedial very broad blackish band; two large white spots, the 1st apical, the 2nd on the exterior border, and near the 1st; under side pale cinereous brown, with an antemedial brown lunule, and two

exterior transverse brown lines. Length of the body 11 lines; of the wings 28 lines.

46. ACILEA PARTITA. *Fem.* Fusca; palpis fere erectis verticem superantibus, articulo 3^o sublanceolato 2ⁱ dimidio brevior; alis anticis nigrofuscis fascia media lata cervina fusco nebulosa nigro bipunctata antice dilatata, linea exteriori nigra angulosa, linea adhuc exteriori nigricante obliqua vix undulata cervino submarginata, fascia postmedia strigaeque exteriori subtus albis; alis posticis plagis duabus marginalibus liturisque nonnullis apud angulum interiorem albis.

Female. Brown. Body cinereous beneath. Head and thorax rather darker than the abdomen. Palpi smooth, nearly erect, rising higher than the vertex; 3rd joint nearly lanceolate, more slender than the 2nd, and about one-third of its length. Fore wings blackish brown, with a broad fawn-coloured middle band, which is much dilated in front, is concise and hardly oblique on the inner side, and is mostly limited on the outer side by a zig-zag black line; it is partly and slightly clouded with brown, and includes two black points, which represent the reniform mark; an oblique hardly undulating blackish line beyond the zig-zag line, partly bordered with fawn colour on its outer side; submarginal points black; under side with a white postmedial band, and with a white streak along the fore part of the exterior border. Hind wings with two white patches, one at the tip of the costa, the other on the fore part of the exterior border; some small white marks near the interior angle; under side whitish from the base to beyond the middle, including two brown bands; an exterior slender dentate white band. Length of the body 9 lines; of the wings 22 lines. See Plate VI, Fig. 8.

47. HYP.ETRA ATRIPLAGA. *Mus.* Ferruginea; capitis vertice thoraceque antico atris; palpis oblique ascendentibus verticem non superantibus, articulo 2^o nigricante notato, 3^o lineari brevi; alis anticis nigro conspersis, plagis duabus magnis guttaque intermedia atris cinereo marginatis, plaga 1^a basali postice attenuata lineam subarcuatam emittente, 2^a discoidali lineam arcuatam lineamque rectam emittente, linea exteriori cinerea transversa brevi undulata nigricante-marginata, puncto basili punctisque marginalibus nigris; alis posticis nigricantibus, basi cinereis, fimbria pallide testacea.

Male. Ferruginous, cinereous beneath. Vertex of the head and forepart of the thorax deep black. Palpi stout, obliquely ascending, not rising higher than the vertex; 2nd joint blackish in the middle on the outer side; 3rd, linear, rounded at the tip, not more than one-fourth of the length of the 2nd. Antennæ slender, minutely setose. Abdomen not extending beyond the hind wings; apical tuft very small. Legs blackish, stout; tibiæ slightly fringed; tarsi with cinereous bands. Fore wings moderately broad, minutely black speckled, rounded at the tips; two large patches and an intermediate dot, deep black, cinereous-bordered; 1st patch near the base, attenuated hindward, and extending to the interior border, and emitting a slightly curved line to the costa; 2nd patch in the disk, in a longitudinal line with the dot, emitting a curved line to the interior border, and a straight line to the hind end of an exterior short transverse undulating cinereous blackish-bordered line; a basal point and marginal points black; a blackish line along the exterior part of the costa, including three testaceous points. Hind wings blackish, cinereous towards the base; fringe pale testaceous. Wings beneath with a blackish discoidal spot (which is lunate in the fore wings), with an exterior incomplete undulating blackish line, and with a very broad marginal blackish band. Length of the body $6\frac{1}{2}$ lines; of the wings 18 lines.

48. HYPÆTRA BIANGULATA. *Mas.* Cervina, capite postice nigricante; palpis oblique ascendentes verticem non superantibus, articulo 3^o conico; thorax antice nigricante; alis anticis subfalcatis, fascia obliqua nigricante postice biangulata et pallide marginata, spatio exteriore fusco-nebuloso, striga costali antemedia fusca brevissima; alis posticis pallide fuscis apud costam cinereis.

Male. Fawn colour, paler beneath. Head blackish along the hind border. Palpi stout, obliquely rounding, not rising higher than the vertex; 3rd joint conical, not more than one-eighth of the length of the 2nd. Antennæ minutely serrated. Fore tegulæ of the thorax blackish. Abdomen a little shorter than the interior border of the hind wings; apical tuft very small. Fore wings broad acute, subfalcate, with a blackish straight band, which extends from near the base of the interior border to near the tips of the costa, and forms on its hind side two large angles, which have pale borders, the space beyond being mostly clouded with brown; marginal festoon blackish, very slender; a dark brown

oblique very short costal antemedial streak. Hind wings pale brown, cinereous along the costa. Length of the body 7 lines; of the wings 20 lines.

49. HYPÆTRA(?) NANA. *Fœm.* Ferruginea; palpis cinereis oblique ascendentibus verticem paullo superantibus, articulo 2^o extus fusco, 3^o lanceolate; alis anticis lineis duabis transversis fuscis 1^a abbreviata obliqua 2^a valde arenata, linea submarginali fusciscente unguulosa vix conspicua, striga antica transversa lata utra, reniformi fusco marginata; alis posticis fuscis.

Female. Ferruginous, cinereous beneath. Palpi cinereous, rather slender, obliquely ascending, rising a little higher than the vertex; 2nd joint mostly dark brown on the outer side; 3rd, lanceolate, much shorter than the 2nd. Abdomen extending a little beyond the hind wings. Legs smooth, moderately stout. Fore wings with two transverse brown lines; 1st line antemedial, oblique, extending from the disk to the interior border; 2nd, postmedial, much curved outward; a brownish, zig-zag, very indistinct submarginal line; a broad, deep black streak extending from the costa to the disk, notched on the outer side, hiding part of the reniform mark; the latter large, brown bordered, of the usual form; underside without markings. Hind wings brown. Length of the body 4½ lines; of the wings 11 lines.

50. ATHYRMA ALBICINCTA. *Fœm.* Ferruginea; capite fascia guttisque duabus anterioribus albis; palpis fere erectis, verticem multo superantibus articulo 3^o lineari longo; thorace albo bifasciato; abdomine fusciscente cinereo, macula basali ferruginea; alis anticis purpurascente ferrugineis, plaga postica maxima nigricante albomarginata, lineis duabus anticis transversis fuscis angulosis; alis posticis fuscis antice cinereis.

Female. Ferruginous, smooth, testaceous-cinereous beneath. Head with a slender white band on the vertex, and with a white dot on each side of the front. Palpi nearly erect, rising very much higher than the vertex; 3rd joint linear, slightly acute, rather shorter than the 2nd. Thorax with two slender white bands bordering the tegulae. Abdomen brownish cinereous, not extending beyond the hind wings, with a ferruginous spot at the base. Fore wings purplish ferruginous, acute; a very large blackish patch resting on the interior border and bordered with white in

front; two brown zig-zag lines extending from the costa to the patch; fringe cinereous, interlined with blackish. Hind wings brown, cinereous in front. Length of the body $6\frac{1}{2}$ lines; of the wings 17 lines.

51. *OPHIUSA SUBÆNESEENS*. *Mus*. Cinereo fusca; palpis fere erectis verticem paullo superantibus, articulo 3^o longi conico; alis anticis nigro conspersis, fasciis duabus atris fusco extus late marginatis, 1^a apud marginem interiorem producta, 2^a antice dilatata flexa et fere interrupta, fascia marginali abbreviata obscure fusca, lineis quatuor fuscis transversis undulatis, reniformi fusco aut nigro marginata; alis posticis lineis tribus fuscis transversis subangulosis.

Male. Cinereous brown, rather slender, cinereous beneath. Palpi stout, nearly erect, rising a little higher than the vertex; 3rd joint elongate, conical, not more than one-fourth of the length of the 2nd. Antennæ slender, minutely setulose. Abdomen hardly extending beyond the hind wings; apical tuft very small. Legs slender; femora and tibiæ fringed. Fore wings acute, minutely black-speckled, with two deep black bands; a brown space along the outer side of each band; 1st band prolonged outward along the interior border; 2nd widened in front, where it is bent outward, and nearly interrupted; a dark brown marginal band, which is abbreviated at each end; two transverse undulating brown lines near the base, and two more between the bands, the latter lines between the interior border and the reniform mark, which is bordered with brown or with black; under side with a broad abbreviated dark brown submarginal band. Hind wings with three brown transverse postmedial slightly zig-zag lines. Length of the body 9 lines; of the wings 22 lines. See Plate VI, Fig. 9.

52. *GRAMMODES CURVILINEA*. *Fœm*. Fusca; corpore alisque subtus facieque albidis; palpis oblique ascendentibus subtus fimbriatis; alis fascia antemedia alba recta; alis anticis fascia postmedia tenui alba angulata biarcuata extus corvino marginata, fasciis subtus duabus fuscis 1^a furcata; alis posticis maculo submarginali albâ, fasciis subtus tribus fuscis 3^a latissima maculas albas includente.

Female. Brown. Face, palpi beneath and body beneath whitish.

Palpi obliquely ascending, fringed beneath; 3rd joint linear, about half the length of the 2nd. Abdomen cinereous brown. Legs mostly white. Wings with a white straight antemedial band. Fore wings with a postmedial slender white band, which has two curves, and is bordered with fawn colour on the outer side, and forms an acute inward angle in the middle; under side whitish, with two brown bands; 1st band in the middle, forked in front, much broader than the 2nd, which is nearer the exterior border, and is dilated near the costa. Hind wings with a white spot near the exterior border; under side white, with three brown bands; 1st and 2nd bands slender, dentate; 3rd very broad, including some white spots. Length of the body 6 lines; of the fore wings 16 lines.

Gen. OBBA.

Mus. Corpus robustum. Caput planum; fasciculus frontalis brevis. Proboscis mediocris. Palpi validi, fere erecti, verticem sat superantes; articulus 3^{us} lanceolatus, 2^o duplo brevior. Antennæ setosæ. Abdomen alas posticas non superans; fasciculus apicalis mediocris, subcompressus. Pedes sat graciles, late fimbriati; calcaria longa, gracilia. Alæ anticæ latæ, subacutæ, basi lanuginosæ, costæ dimidio basali late fimbriato, margine exteriore rotundato.

Male. Body stout. Head flat above, with a short frontal tuft. Proboscis moderately long. Palpi stout, nearly erect, rising somewhat higher than the vertex; 3rd joint lanceolate, about half the length of the 2nd. Antennæ setose; the bristles slightly decreasing in length from the base to the tips. Abdomen tapering, not extending beyond the hind wings; apical tuft moderately long, slightly compressed. Legs rather slender; femora and tibiæ broadly fringed; spurs long, slender. Wings broad. Fore wings slightly acute; woolly at the base; costa straight, with a broad flat smooth softened fringe along half the length from the base; exterior border rounded, moderately oblique.

53. OBBA PROMPTA. *Mus.* Fulva; alis nigro conspersis, linea obliqua nigra recta, linea exteriore nigricante angulosa, punctis submarginalibus nigris; alis anticis linea 1^a rufescente marginata.

Male. Tawny, a little paler beneath. Wings thinly and minutely black speckled, with a straight black line, which extends

from the tips of the fore wings to a little beyond the middle of the interior border of the hind wings, and is reddish-bordered on the outer side in the fore wings; an exterior zig-zag blackish line, and a row of submarginal black points; fringe blackish beneath. Length of the body $5\frac{1}{2}$ lines; of the wings 21 lines.

Gen. ZIRONA.

Fœm. Corpus vix robustum. Proboscis breviuscula. Palpi porrecti, squamosi, sat graciles; vix ascendentes, caput longe superantes; articulus 3^{us} lanceolatus, 2^o brevior. Antennæ graciles, glabræ. Abdomen breviusculum. Pedes graciles, læves; calcaria longa, gracilia. Alæ anticæ latæ, acutæ, margine exteriore rotundato subobliquo.

Female. Body hardly stout. Proboscis rather short. Palpi porrect, squamous, hardly ascending, rather slender, extending much beyond the head; 3rd joint lanceolate, much more than half the length of the 2nd. Antennæ slender, smooth. Abdomen rather shorter than the interior border of the hind wings. Legs slender, smooth; spurs long, slender. Wings broad. Fore wings acute; exterior border rounded, slightly oblique; 1st, 2nd, and 3rd inferior veins approximate at the base; 4th moderately remote.

The structure of the palpi distinguishes this genus from the other *Poophildæ*.

54. ZIRONA MARGINATA. *Fœm.* Cinereo fusca; alis fascia marginali pallidiore cinereo undulatim marginata, linea media transversa indistincta undulata obscure fusca; alis anticis linea antemedia fusca undulata valde indistincta, gutta discoidali cinerea.

Female. Cinereous brown. Wings with a paler marginal band, which is divided from the darker hue by a cinereous undulating line; a dark brown indistinct undulating middle line; fringe brown, cinereous at the base; under side without markings. Fore wings with a line like the one before mentioned, but more indistinct, and nearer the base; a cinereous dot in the disk between the lines. Length of the body 6 lines; of the wings 18 lines.

55. AMPHIGONIA FUMOSA. *Mus.* Ferrugineo cinerea; fasciculo frontali porrecto, palpis oblique ascendentibus articulo 2^o late fimbriatis; antennis setosis; abdomine alas posticas vix superante fasciculo apicali parvo; pedibus fimbriatis; alis obscure cinereis,

fasciis tribus diffusis ferrugineis, lineis duabis transversis angulosis obscure fuscis; alis anticis lunula interrupta punctoque costali albis, margine exteriori subangulato; alis posticis margine exteriori subangulato.

Male. Ferruginous cinereous, paler beneath. Frontal tuft porrect, acute. Palpi obliquely ascending; 2nd joint thickly fringed in front. Antennæ minutely setose. Abdomen hardly extending beyond the hind wings; apical tuft small. Legs slender; femora and tibiæ fringed; tarsi with white dots above. Wings elongate, dark cinereous, with three diffuse ferruginous bands, and with two zig-zag dark brown lines; 1st line between the 1st and 2nd bands; 2nd, between the 2nd and 3rd bands; markings less distinct beneath. Fore wings acute, with an interrupted white lunule in the 2nd band, and with an elongated white costal point in front of the 3rd band; exterior border slightly angular. Hind wings with the exterior border more angular. Length of the body 7 lines; of the wings 19 lines.

56. *THERMESIA* (?) *SEJUNCTA*. *Fæm.* Fusca, robusta; vertice, thoracis margine antio plagisque duabus rufis; palpis oblique ascendentibus verticem longe superantibus, articulo 2^o fimbriato, 3^o subclavato apice albedo; alis latis, fasciis tribus flavis rufo conspersis valde indeterminatis et interruptis, linea submarginali undulata nigricante, puncto discoidali punctisque marginalibus nigris; alis anticis acutis, margine exteriori convexo subobliquo.

Female. Brown, stout, cinereous-testaceous beneath. Vertex of the head, fore border of the thorax, and a patch on each of the hind tegulæ bright red. Palpi obliquely ascending, rising much higher than the vertex; 2nd joint fringed above; 3rd subclavate, whitish at the tip, much more slender than the 2nd, and a little more than half its length. Abdomen brownish-cinereous, not extending beyond the hind wings. Legs smooth, rather slender. Wings broad, with three very irregular and much interrupted yellow bands, which are speckled with bright red; an undulating irregular blackish line near the exterior border; a discoidal point, and marginal points and marginal festoon blackish; under side without markings. Fore wings acute; bands brighter and more distinct than those of the hind wings; exterior border rounded, slightly oblique. Length of the body 7½ lines; of the wings 20 lines.

57. CAPNODES(?) TRINOTATA. *Form.* Ferrugineo rufa, robusta; abdomine cinereo-rufa; pedibus fimbriatis; alis latis, nigro subconspersis, linea postmedia transversa e punctis albis, punctis marginalibus nigris; alis anticis acutis, strigis tribus costalibus niveis, margine exteriore subconvexo subobliquo.

Female. Ferruginous red, stout, paler and with a cinereous tinge beneath. Antennæ slender. Abdomen cinereous red, shorter than the interior border of the hind wings. Legs stout; femora and tibiæ fringed; spurs slender, very long. Wings broad, thinly and minutely black-speckled, with a postmedial transverse line of white points, and with marginal black points. Fore wings acute, with three pure white irregular streaks extending from the costa to the disk; 1st streak near the base; 3rd on the inner side of the row of white points; four exterior whitish elongated costal points; exterior border slightly rounded and oblique. Length of the body $7\frac{1}{2}$ lines; of the wings 20 lines.

The palpi are destroyed in the specimen described. It may be distinguished from *C. semimaculata* by having no transverse blackish lines on the fore wings.

Gen. RICLA.

Form. Corpus sat robustum. Caput fasciulo frontali longo peracuto. Palpi graciles, læves, oblique ascendentes, verticem valde superantes; articulus 3^{us} linearis, apicem versus subdilatus, 2^o multo brevior. Abdomen alas posticas non superans. Pedes graciles fimbriati; calcaria longa, gracilia. Alæ anticæ longæ, apice rectangulatæ, costa vix convexa, margine exteriore angulato.

Female. Body moderately stout. Frontal tuft elongate, very acute. Palpi slender, smooth, obliquely ascending, rising very much higher than the vertex; 3rd joint much shorter than the 2nd, linear, slightly dilated towards the tip, which is truncated. Abdomen not extending beyond the hind wings. Legs slender; femora and tibiæ fringed; spurs long, slender. Wings elongate. Fore wings rectangular at the tips; costa hardly rounded; exterior border forming an obtuse angle in the middle; 2nd inferior vein as near to the 3rd as to the 1st; 4th very remote.

58. RICLA EXPANDENS. *Form.* Ferruginea, fasciulo frontali albo-marginato, palporum articulo 3^o cano nigro-consperso; alis anticis linea media transversa alba arcuata nigro marginata. fascia

exteriore indeterminata albido flava, spatio adhuc exteriore pallide purpurascete ferrugineo guttas quatuor fuscas cinereo marginatas includente, linea postica cinerea arcuata fusco marginata apud marginem exteriorem dilatata, linea basali fusca angulosa, gutta discoidali nigra; alis posticis cinereo fuscis.

Female. Ferruginous, cinereous beneath. Frontal tuft bordered with white. Third joint of the palpi hoary, black-speckled, wholly black towards the tip, which is hoary. Abdomen cinereous. Fore wings with a white transverse middle inward-curved line, which is black-bordered on its inner side, and is accompanied on the outer side by a whitish-yellow incomplete irregular band; exterior space pale purplish ferruginous, with four brown partly cinereous-bordered dots, which form a transverse undulating line in front of a cinereous curved line; the latter is brown-bordered on both sides, and extends from the apical part of the interior border towards the hind part of the exterior border, where it terminates in a brown patch; a zig-zag transverse brown line near the base, and an antemedial black dot in the disk. Hind wings cinereous brown; fringe cinereous. Length of the body $6\frac{1}{2}$ lines; of the wings 18 lines.

Gen. RACLIA.

Fem. Corpus læve, sat validum. Caput fasciculo frontali porrecto longissimo acuto. Proboscis breviuscula. Palpi graciles, læves, oblique ascendentes, verticem longe superantes; articulus 3^{us} linearis, 2^o paullo longior. Antennæ sat robustæ. Abdomen alas posticas sat superans. Pedes læves, graciles, tibiis anticis fasciculatis, calcaribus longissimis gracillimis. Alæ anticæ acutæ, vix falcatæ, costa perparum convexa margine exteriore postico rotundato obliquo.

Female. Body smooth, moderately stout. Frontal tuft porrect, acute, extending much beyond the head. Proboscis rather short. Palpi slender, smooth, obliquely ascending, rising much higher than the vertex; 3rd joint linear, rounded at the tip, a little longer than the 2nd. Antennæ rather stout. Abdomen extending somewhat beyond the hind wings. Legs smooth, slender; fore legs short, their tibiæ tufted; spurs very long and slender. Wings moderately broad. Fore wings acute, hardly falcate; costa very slightly rounded; hind part of the exterior border rounded and oblique; 2nd inferior vein much nearer to the 3rd than to the 1st; 4th remote.

59. *RACLIA CERVINA*. *Fœm.* Pallide cervina, subtus pallide testacea; alis anticis fusco pallido transverse strigatis, lineis tribus transversis pallide cinereis fusco pallido marginatis, 1^a et 2^a antice approximatis, 2^a et 3^a subangulosis, puncto discoidali guttis duabus submarginalibus punctisque marginalibus fuscis; alis posticis fuscis, apud costam albidis.

Female. Pale fawn colour, pale testaceous beneath. Fore wings transversely and indistinctly streaked with pale brown; three transverse pale cinereous lines, which are slightly bordered with pale brown; 1st and 2nd converging much from the interior border to the costa; 2nd and 3rd slightly zig-zag; 3rd diverging hindward from the 2nd; a brown point in the disk between the 1st and 2nd lines; two small brown dots beyond the 3rd line and brown marginal points; under side reddish fawn colour in the disk, speckled with brown along the costa, whitish along the interior border. Hind wings above brown, whitish along the costa. Length of the body 6 lines; of the wings 15 lines.

Gen. ORIXA.

Mas. Corpus gracile. Caput fasciculo frontali brevi. Palpi graciles, arcuati, utrinque fimbriati, verticem valde superantes; articulus 3^{us} acutus, 2^o paullo brevior. Antennæ graciles, setulosæ. Abdomen alas posticas paullo superans; fasciculus apicalis parvus. Pedes graciles, breves; tibiæ posticæ fimbriatæ; calcaria longa, gracilia. Alæ anticæ latæ, apice subrectangulatæ, costa perparum convexa, margine exteriore rotundato vix obliquo.

Male. Body slender. Frontal tuft short. Palpi slender, curved, fringed on both sides, longer than the breadth of the head, rising very much higher than the vertex; 3rd joint acute, a little shorter than the 2nd. Antennæ slender, minutely setulose. Abdomen extending a little beyond the hind wings; apical tuft small. Legs slender, smooth; hind tibiæ with a short thick fringe; spurs long, slender. Wings broad. Fore wings hardly acute, nearly rectangular at the tips; costa very slightly rounded; exterior border rounded, hardly oblique; veins with the usual structure.

60. *ORIXA FILIFERA*. *Mas.* Saturate ferrugineo fusca; capite fascia alba angulata; alis anticis lineis duabus transversis puncto que discoidali intermedio chalybæis nigro marginatis.

Male. Dark ferruginous brown. Head with a white angular band on the front. Pectus cinereous. Abdomen dark brown; under side whitish, except at the tip. Legs beneath and tarsi wholly pale cinereous. Fore wings with two transverse slightly black-bordered chalybeous blue lines, and with an intermediate discoidal point of the same hue; 1st line near the base, more oblique than the 2nd. Hind wings dark brown. Length of the body 7 lines; of the wings 17 lines.

61. PYRALIS (?) CRASSALIS. *Fem.* Argenteo cinerea, robusta; capite subtus pectore pedibusque argenteo albis; fasciculo frontali acuto; palpis porrectis late fimbriatis caput sat superantibus, articulo 3^o minimo; abdomine alas posticas paullo superante; alis atomis nonnullis fasciisque duabus undulatis indeterminatis nigricantibus, punctis marginalibus nigris; alis anticis fascia 1^a apud costam attenuata 2^a flavescente marginata; alis posticis fascia 2^a flavescente intus late marginata.

Female. Silvery cinereous, stout. Head beneath, pectus and legs silvery white. Head rather large; frontal tuft acute. Palpi perfect, broadly fringed beneath, extending somewhat beyond the head; 3rd joint very minute. Antennæ smooth, slender. Abdomen extending a little beyond the hind wings. Legs smooth, slender; hind tibiæ with four long slender spurs. Wings with some blackish speckles, and with two irregular undulating blackish bands; marginal points black; under side with a black discoidal dot, and with two incomplete blackish bands. Fore wings acute; 1st band attenuated towards the costa; 2nd bordered on the inner side by a yellowish line; exterior border rounded, slightly oblique. Hind wings with the 2nd band bordered on the inner side by a yellowish band, which is dilated in the middle. Length of the body 4½ lines; of the fore wings 10½ lines.

62. SAMEA FIGURALIS. *Fem.* Cervina, subtus alba; abdomine fusco segmentis albo marginatis; alis fasciis duabus obliquis albis diaphanis nigro marginatis; alis anticis fascia 2^a furcata lineam nigram undulatum includente.

Female. Fawn colour, white beneath. Abdomen brown; hind borders of the segments white. Legs white, long, smooth, slender. Wings with two pellucid iridescent oblique white black-bordered bands, which are irregular in the fore wings; 1st band antemedial,

extending to the base in the hind wings; 2d, postmedial, forked in the fore wings, including a black undulating line; marginal fessoon black; fringe white; under side with the pellucid bands broadly and irregularly blackish-bordered. Length of the body $3\frac{1}{2}$ lines; of the fore wings 10 lines.

Gen. VATICA.

Fœm. Corpus gracile. Oculi magni, prominuli. Proboscis valida; palpi ascendentes; articulus 2^{us} late fimbriatus; 3^{us} brevissimus. Thoracis tegulae nostericae longae. Abdomen alas posticas longe superans. Pedes laeves, graciles; femora postica fimbriata; tibiae posticae brevissimae. Alae anticae amplae, subacutae, margine exteriori convexo. Alae posticae fasciculo longo apud marginem interiorem.

Female. Body slender. Eyes large, prominent. Proboscis stout. Palpi ascending, applied to the head; 2nd joint broadly fringed; 3rd very short. Hind tegulae of the thorax long. Abdomen extending much beyond the hind wings. Legs smooth, slender; hind femora fringed; fore tibiae very short; hind tibiae with one spur in each pair extremely long. Wings ample. Fore wings slightly acute; exterior border rounded, moderately oblique. Hind wings with an elongate tuft in the disk near the interior border, which is broadly fringed.

The tuft on the hind wings distinguishes this genus from *Botys*, to which it is closely allied.

63. VATICA RUTILALIS. *Fœm.* Ochracea; corpore subtus pedibusque argenteo albis; femoribus anticis extus nigricantibus, tibiis anticis apice nigris; alis anticis vittis diffusis spatiumque exteriori rufis, linea transversa postmedia arcuata costa fimbriaque nigris; alis posticis nigro late marginatis.

Female. Ochraceous. Body beneath and legs silvery white. Proboscis testaceous. Fore femora blackish on the inner side; fore tibiae with black tips. Fore wings with diffuse red stripes, which extend to a black curved transverse postmedial line, beyond which the wings are red; costa and fringe black; under side with the apical part corresponding to the red part above blackish. Hind wings with a broad black border. Length of the body 6 lines; of the fore wings 14 lines.

64. *BOTYS INTERFIXALIS*. *Fœm.* Pallide flava, subtus albida, abdomine alas posticas longe superante, alis lineis duabus fuscis transversis obliquis, fascia marginali lata pallide ænea; alis anticis punctis costalibus nigricantibus, linea 1^a apud costam retracta, 2^a interrupta et abbreviata, linea exteriorè fusca fasciam marginalim attingente.

Female. Pale yellow, slender, iridescent, whitish beneath. Abdomen extending much beyond the hind wings. Wings with two transverse oblique brown lines, and with a broad pale æneous marginal band. Fore wings acute, with several blackish costal points; 1st line retracted near the costa; 2nd interrupted in the disk, abbreviated near the costa; a 3rd exterior brown line, which joins the hind part of the marginal band. Length of the body 3 lines; of the wings 7 lines.

Nearly allied to *B. villinsolis* and to *B. Neoclisulis*.

Gen. XACCA.

Fœm. Corpus robustum, breve, squamosum. Caput inter antennis cornibus duobus porrectis lanceolatis. Proboscis mediocris. Palpi graciles, læves, oblique ascendentes, verticem sat superantes; articulus 3^{us} linearis, 2ⁱ dimidio brevior. Antennæ validæ, breviusculæ. Abdomen lanceolatum, alas posticas longe superans; latera fasciculata. Pedes sat validi; coxæ anticæ longæ, clavatæ, apice fasciculatæ; calcaria longa, gracilia. Alæ anticæ acutæ, margine exteriorè subconvexo.

Female. Body stout, smooth, squamous. Head in front with two porrect lanceolate appendages between the antennæ. Proboscis moderately long. Palpi slender, smooth, obliquely ascending, rising somewhat higher than the vertex; 3rd joint linear, rounded at the tip, less than half the length of the 2nd. Antennæ stout, rather short. Abdomen lanceolate, with small tufts along each side, extending much beyond the hind wings. Legs rather stout; fore coxæ long, clavate, densely tufted towards the tips; spurs long, slender. Wings moderately broad. Fore wings acute; exterior border slightly rounded, moderately oblique; 2nd inferior vein more than twice further from the 3rd than from the 1st; 4th emitted near the base of the wing.

65. *XACCA TRIGONALIS*. *Fœm.* Cupreo purpureo, capite palpis thoraceque antico ochraceis; coxis anticis luteis purpureo fasci-

culatis, tibiis quatuor posterioribus luteis purpureo bifasciatis; alis anticis striga basali maculaque magna trigona costali ochraceis.

Female. Cupreous purple. Head, palpi, and fore part of the thorax ochraceous. Proboscis tawny. Pectus pearly white. Abdomen beneath pale testaceous, except towards the tip. Fore coxæ luteous, with purple tufts; four posterior tibiæ luteous, purple at the base and at the tips; tarsi luteous. Fore wings with a transverse ochraceous streak at the base, and with a large ochraceous costal triangular spot at a little before half the length. Length of the body $5\frac{1}{2}$ lines; of the wings 11 lines.

Gen. OPULA.

Fœm. Corpus crassum. Proboscis brevis. Palpi graciles, arcuati, oblique ascendentes, verticem non superantes; articulus 3^{us} linearis, vix acutus, 2^o duplo brevior. Antennæ robustæ, glabræ. Abdomen alas posticas sat superans. Pedes validi, læves; calcaria longa, gracilia. Alæ antiçæ longissimæ, acutæ, margine exteriore convexo perobliquo.

Female. Body thick. Proboscis short. Palpi slender, curved, obliquely ascending, not rising higher than the vertex; 3rd joint linear, hardly acute, about half the length of the 2nd. Antennæ stout, smooth. Abdomen extending somewhat beyond the hind wings. Legs stout, smooth; spurs long, slender. Wings very long, moderately broad. Fore wings acute; exterior border rounded, very oblique; 4th inferior vein very remote from the 3rd.

66. OPULA IMPLETALIS. *Fœm.* Cervina, alis fasciis quatuor obliquis macularibus indeterminatis pallide flavescentibus cervino sublineatis.

Female. Fawn-colour. Wings with four oblique macular and very irregular pale yellowish bands, which are slightly and irregularly interlined with the ground hue; under side like the upper surface. Length of the body 7 lines; of the wings 18 lines.

67. GEOMETRA CONGRUA. *Mas.* Viridis; capite palpis antennis pectore abdomine pedibusque albis; palpis porrectis caput sat superantibus, articulo 2^o parvo acuto; antennis sat late pectinatis; alis latis albo conspersis, puncto discoidali nigro, fimbria pallidis-

sime viridi; alis anticis subacutis margine exteriore fere recto; alis posticis margine exteriore subangulato.

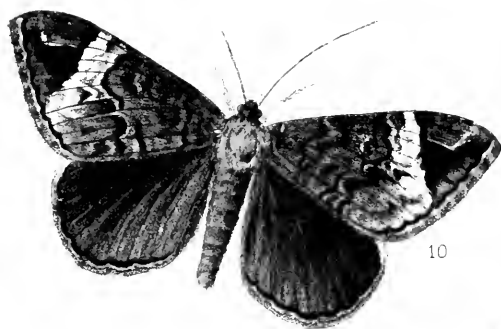
Male. Grass green. Head, palpi, antennæ, pectus, abdomen, and legs white. Palpi smooth, slender, porrect, extending rather beyond the head; 3rd joint acute, less than one-fourth of the length of the 2nd. Antennæ rather broadly pectinated. Abdomen much shorter than the interior border of the hind wings. Legs smooth, slender; hind tibiæ with four rather short spurs. Wings broad, with a black point in the disk, with many shining white speckles, and with a very pale green fringe. Fore wings slightly acute; exterior border almost straight. Hind wings with the exterior border slightly angular in the middle. Length of the body 5 lines; of the fore wings 15 lines.

Gen. TRAINA.

Fem. Corpus gracile. Proboscis longiuscula, sat valida. Palpi porrecti, graciles, subtus fimbriati, caput paullo superantes; articulo 3^o conicus. Antennæ gracillimæ, subsetulosæ. Abdomen breviusculum. Pedes longi, gracillimi; calcaria longa, gracilia; tibiæ anticæ incisæ, calcaribus apicalibus fimbriatis. Alæ latissimæ; anticæ acutæ, margine exteriore subconvexo; posticæ costa apice truncata, margine exteriore vix inciso.

Female. Body slender. Proboscis rather long and stout. Palpi porrect, slender, fringed beneath, extending a little beyond the head; 3rd joint conical, less than one-fourth of the length of the 2nd. Antennæ very slender, very minutely setose. Abdomen much shorter than the interior border of the hind wings. Legs long, very slender; fore tibiæ notched beneath at somewhat beyond the middle, with fringed apical spurs; hind tibiæ with four slender spurs. Wings very broad. Fore wings acute; exterior border slightly rounded, moderately oblique. Hind wings with the apical part of the costa obliquely truncated; exterior border very slightly festooned.

68. TRAINA STRAMINEATA. *Fem.* Pallidissime straminea; capite ferrugineo-bifasciato; thoracæ anticæ ferrugineo; alis anticis ferrugineo conspersis, linea recta obliqua linea exteriore angulosa lineaque marginali ferrugineis; alis anticis costa lineaque 4^a transversa ferrugineis, gutta subcostali producta nigra; alis posticis puncto discoïdali nigro.



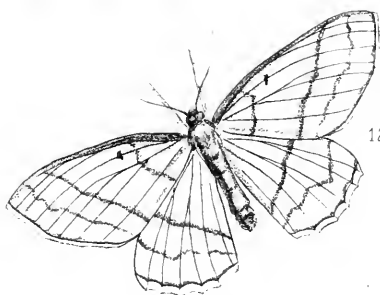
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Frank E. St. Luth

10. *TOLNA VERSICOLOR*. 12 *TRAIMA STRAMINATA*.
11. *OPHIDERES DIVITIOSA*. 13 *TIMANA COSTALIS*.
14. *SCODIONA CEPHALOTES*.



Female. Very pale straw colour. Head with two ferruginous bands. Thorax ferruginous in front. Wings minutely speckled with ferruginous; a straight ferruginous line extending from a little beyond three-fourths of the length of the costa of the fore wings to a little beyond three-fourths of the length of the interior border of the hind wings; an exterior zig-zag ferruginous line, and a marginal ferruginous line. Fore wings with a ferruginous costa, and with a ferruginous transverse line near the inner side of a transversely elongated black discoidal dot. Hind wings with a black point on the disk. Length of the body 8 lines; of the wings 24 lines. See Plate VII, Fig. 12.

Gen. TIMANA.

Fœm. Corpus gracile. Caput porrigens. Proboscis brevis. Palpi validi, oblique ascendentes; articulus 3^{us} minimus. Antennæ glabræ, graciles. Abdomen subcompressum. Pedes breves, longi, gracillimi; tibiæ posticæ subincrassatæ, quadricarcatæ. Alæ anticæ latæ, acutæ, margine exteriori subrotundato subobliquo. Alæ posticæ abdomen superantes.

Female. Body slender. Head rather prominent. Proboscis short. Palpi stout, obliquely ascending, not rising so high as the vertex; 3rd joint extremely small. Antennæ smooth, slender. Abdomen slightly compressed, rather shorter than the interior border of the hind wings. Legs long, smooth, very slender; hind tibiæ very slightly incrassated, with four spurs, the 1st pair much longer than the apical pair. Wings broad. Fore wings acute; exterior border slightly rounded and oblique; areolet much less than half the length of the wing.

69. TIMANA COSTALIS. *Fœm.* Lutea; vertice cinereo; fronte ferrugineo conspersa et unifasciata antice alba; pectore ventre que albis; pedibus posticis albidis; alis ferrugineo, conspersis et bifasciatis, fascia 1^a postmedia angulata intus diffusa, 2^a submarginali interrupta informi, guttis submarginalibus argenteis nigro marginatis; alis anticis fascia ferruginea antemedia recta angusta, vitta costali cinerea, gutta discoidali argentea nigro-marginata; alis posticis puncto discoidali argenteo nigro-marginato.

Female. Luteous. Vertex of the head cinereous; front with

ferruginous speckles, and a ferruginous band, its fore part white. Pectus and under side of the abdomen white. Hind legs whitish. Wings with transverse ferruginous speckles, and with two ferruginous bands; 1st band postmedial, forming an acute outward angle in each wing, diffuse on the inner side; 2nd band submarginal, interrupted, and very irregular, accompanied by silvery partly black-bordered dots of various size and shape; under side pale, with the markings much less complete. Fore wings with an antemedial slender straight ferruginous band; a cinereous costal stripe, which is contiguous to a silvery black bordered dot in the disk. Hind wings with a silvery black-bordered discoidal point. Length of the body $7\frac{1}{2}$ lines; of the wings 19 lines. See Plate VII, Fig. 13.

70. BOARMIA ABRUPTARIA. *Mus.* Alba, robusta; capite antico palpisque fuscis, vertice luteo-bifasciato; thoracæ maculis duabus anticis nigris luteo marginatis duabusque posticis luteis; abdominis segmentis luteo fasciatis; alis fusco conspersis, lineis duabus duplicatis interruptis angulosis guttisque marginalibus fuscis; alis anticis maculis tribus costalibus fuscis; alis posticis margine exteriore subundulato vix angulato.

Male. White, stout. Head in front and palpi dark brown; vertex with two luteous bands. Antennæ black, white at the base, broadly pectinated to two-thirds of the length. Thorax with a black broadly luteous bordered spot on each of the fore tegulæ, and with a luteous spot on each side near the hind border. Abdomen not extending beyond the hind wings, with a luteous band on the hind border of each segment, and with a few black speckles; apical tuft small. Legs stout, mostly blackish. Wings dimly brown-speckled, with two very incomplete double zig-zag brown lines; 1st line antemedial, apparent near the interior border of the hind wings; 2nd postmedial, apparent near the interior border of the fore wings and of the hind wings; some submarginal clusters of speckles, and a row of marginal brown dots. Fore wings acute, with three brown costal spots; exterior border slightly rounded, very oblique. Hind wings with the exterior border slightly festooned, hardly angular. Length of the body 9 lines; of the wings 22 lines.

71. TEPHIROSIA DIFFUSA. *Fam.* Cinereo-viridis, gracilis; palpis

oblique ascendentibus verticem vix superantibus, articulo 3^o conico; alis amplis fusco subconspersis, lineis duabus obliquis angulosis fuscis, guttis marginalibus nigricantibus, macula discoidali fasciaque submarginali lata atomaria subtus fuscis; alis anticis apice subrotundatis; alis posticis margine exteriore inciso.

Female. Cinereous green, slender, pale cinereous beneath. Palpi obliquely ascending, hardly rising higher than the vertex; 3rd joint conical, not more than one sixth of the length of the 2nd. Abdomen shorter than the interior border of the hind wings. Wings ample, indistinctly brown-speckled, with two brown zig-zag oblique lines, one antemedial, the other postmedial; marginal dots blackish; under side with a brown discoidal spot (which is largest in the fore wings), and with a broad submarginal band composed of brown speckles. Fore wings slightly rounded at the tips; exterior border rounded very oblique. Hind wings with the exterior border scalloped. Length of the body 6 lines; of the wings 19 lines.

72. ACIDALIA LATIFERA. *Fem.* Alba; capite palpis thoracisque tegulis anticis cinereis; palpis oblique ascendentibus verticem non superantibus, articulo 3^o lineari 2ⁱ dimidio brevioribus; abdomine rufescente cinereo basi et segmentorum marginibus posticis albis; alis vitta rufescente cinerea antice abbreviata lineam albam undulatam includente, vitta submarginali minus determinata lineam albam angulosam includente, punctis marginalibus nigris.

Female. White, stout. Head, palpi, and fore tegulæ of the thorax cinereous. Palpi obliquely ascending, not rising higher than the vertex; 3rd joint linear, less than half the length of the 2nd. Abdomen reddish cinereous; base and hind borders of the segments white. Legs smooth, slender. Wings with a reddish cinereous stripe, which extends from the middle of the interior border of the hind wings, and is abbreviated near the fore exterior border of the fore wings, and includes on its hind side a white undulating line; a submarginal stripe of the same hue, but less determinate, including a white zig-zag line; marginal points black; under side pale cinereous. Length of the body 3 lines; of the fore wings 9 lines.

Gen. NEBESSA.

Mas. Corpus sat robustum. Proboscis brevis. Palpi erecti,

sat validi, verticem non superantes; articulus 3^{us} conicus. Antennæ crebre setosæ. Abdomen alas posticas non superans; sexualia magna. Pedes graciles, longiusculi; tibiæ posticæ dilatatæ; tarsi postici brevissimi. Alæ anticæ latæ, acutæ, margine exterioriore vix convexo.

Male. Body rather stout. Proboscis short. Palpi erect, rather stout, not rising higher than the vertex; 3rd joint conical, not more than one-sixth of the length of the 2nd. Antennæ thickly setose. Abdomen not extending beyond the hind wings; tip with lateral valves, and with a large tuft. Legs slender, rather long; hind tibiæ dilated; hind tarsi very short. Wings broad. Fore wings acute; exterior border very slightly rounded, moderately oblique.

73. *NEBESSA CHALYBÆATA.* *Mus.* Pallidissime cervina; capite, palpis, antennis thoraceque antico nigricantibus; thorace albo; alis fascia antemedia lata obliqua lineisque duabus exterioribus angulosis albido marginatis linea, submarginali pallidiore diffusa indistincta, puncto discoidali nigro; alis anticis fascia apud medium dilatata chalybæo suffusa, linea 1^a exterioriore postice nigra.

Male. Very pale fawn colour, testaceous whitish beneath. Head, palpi, antennæ, and fore border of the thorax blackish. Thorax white. Wings with a broad antemedial oblique fawn coloured band, which has darker borders; two exterior zig-zag fawn coloured lines, each of which is bordered with whitish on the outer side; a paler indistinct diffuse submarginal line; marginal festoon brown; a black point in the disk. Fore wings with the band much dilated in the middle on the outer side, partly overspread with chalybeous; hind part of the 1st exterior line black. Length of the body $7\frac{1}{2}$ lines; of the wings 19 lines.

74. *SCODIONA CEPHALOTES.* *Mus.* Cana, fusco conspersa; palpis porrectis subrostriformibus caput sat superantibus, articulo 3^o acuto minimo; thorace margine antico testaceo; tibiis posticis sublatis; alis fasciis duabus fasciis undulatis, fasciis duabus exterioribus pallidioribus angulosis, fimbria alba, subtus flavis nigrofusco bifasciatis; alis anticis fascia intermedia fusca undulata, fasciis subtus duabus intermediis nigris.

Male. Hoary, speckled with brown. Body whitish beneath. Palpi porrect, subrostriform, extending somewhat beyond the head; 3rd joint acute, very minute. Antennæ minutely setulose. Thorax with a testaceous fore border. Abdomen rather shorter than the interior border of the hind wings; apical tuft small. Legs smooth, slender; hind tibiæ slightly dilated. Wings with two undulating brown bands, and with two exterior paler brown zig-zag bands; fringe white; under side yellow, with an antemedial band and a broad marginal band, both blackish brown. Fore wings with an intermediate undulating brown band; under side with two black bands between the antemedial band and the marginal band, with which latter they are connected at the hind end. Length of the body 6 lines; of the fore wings 16 lines. See Plate VII, Fig. 14.

75. MICRONIA TENELLA. *Mus.* Alba; capite anticio nigricante; antennis fulvis robustis; alis testaceo pallido transverse strigatis; alis posticis margine exteriore rectangulato.

Male. White, slender. Front of the head blackish. Antennæ tawny, stout, smooth. Abdomen shorter than the interior border of the hind wings. Legs short, smooth, rather stout. Wings transversely and indistinctly streaked with pale testaceous. Fore wings acute; costa and exterior border slightly rounded, the latter slightly oblique. Hind wings with the exterior border rectangular in the middle. Length of the body 4 lines; of the wings 14 lines.

76. SUBRITA LUCTUOSA. *Mus.* Obscure cinerea, subtus albida; palpis erectis verticem longe superantibus articulo 3^o lanceolato; abdomine alas posticas longe superante; alis anticis albo subconspersis apice rotundatis, lineis quatuor nigricantibus transversis undulatis 3^a valde arcuata albo marginata 4^a subangulosa, punctis marginalibus nigris.

Male. Dark cinereous. Body whitish beneath. Palpi erect, rather slender, rising much higher than the vertex; 3rd joint lanceolate, a little shorter than the 2nd. Antennæ smooth, rather stout. Abdomen cinereous, extending much beyond the hind wings; apical tuft small. Legs whitish, smooth. Fore wings rounded at the tips, with some white speckles, and with four

blackish undulating transverse lines; 1st line very near the base; 2nd antemedial, accompanied by a white line; 3rd postmedial, much curved outward, slightly bordered with white on the outer side; 4th slightly zig-zag; marginal points black; exterior border rounded, not oblique; under side whitish along the interior border. Hind wings whitish along the costa. Length of the body 3 lines; of the wings 8 lines.

MAY 25TH, 1869.

Professor John Young, M.D., Vice-President, in the chair.

SPECIMENS EXHIBITED.

Dr Young exhibited specimens of *Eurypterus Scouleri* (Hibbert), obtained from the lower carboniferous strata near Dunse, and presented to the Hunterian Museum by Mr William Stevenson of that town. This is the second specimen exhibited in Glasgow, the first—the type specimen—being deposited in the Andersonian Museum. After pointing out the specific character, Dr Young said he would defer more detailed observations on the fossil, as Mr Young had informed him that further examples were to be sent. Dr Young also exhibited a very fine example of the Australian spiny lizard (*Moloch horridus*, Gray), presented to the Hunterian Museum by Mr Kirsop, Argyle Street.

Mr Gray exhibited three specimens of the Great-Spotted Woodpecker (*Picus major*), male, female, and young bird of the first year, from Forfarshire and Banffshire. For two of the specimens he expressed himself indebted to Mr James Murison, station master, Tillynaught Junction, by whom they had been shot in that neighbourhood a few weeks previously. Mr Gray also exhibited a specimen of Leach's Petrel (*Thalassidroma Leachii*), which had been captured near the Loch of Forfar a few months ago.

The Secretary exhibited a small collection of zoophytes and shells from Banffshire and Ayrshire, forwarded by Messrs John Macdonald, Buckie, and Thomas Anderson, Girvan, corresponding members. Two of the characteristic shells of the Buckie coast were *Pinna ingens* and *Fusus corneus*; and among the zoophytes from Girvan there were several large specimens of *Pennatulula*

phosphorea, regarding which Mr Gray remarked that they were of extreme size when compared with specimens taken off the Dunbar coast, and were besides much lighter in colour. Examples of this zoophyte from the east of Scotland were, as a rule, much smaller, and of a deeper red, than those of the west coast, and it might be of importance to ascertain if they were not two species. He had examined in one day as many as seven or eight hundred of the smaller kind, brought on shore by the Dunbar fishermen.

Mr John Young exhibited a specimen of *Calamites nodosus* from the Springhill pits, Baillicton, showing the nodes to which the lateral fronds were attached; also a fine lateral frond of the same plant from Craigneuk pit, near Motherwell, presented to the Hunterian Museum by Mr David Wingate. Mr Young remarked that this was the first frond of this plant which he had yet seen from the Scottish coalfield. He pointed out its relation to the stem, and wherein it differed from other species of the genus *Calamites*.

Mr Young also exhibited a mounted series of small fossil organisms, which he had obtained from a travelled boulder of limestone embedded in the boulder clay at Gilmorehill. This limestone, he stated, agreed in mineral composition, and in the character of its fossils, with the bed of limestone which underlies the coal of the Campsie district, locally known as the "white limestone." The outer surface of the boulder had become partially rotted from lying so long in the till, and so abundant were the organisms in the stone, that from a small quantity of the rotted material, scraped from the face of the boulder, he had obtained several thousand specimens of *Eutomostruca*, and a small spiral annelide, all in a good state of preservation. The *Eutomostruca* were all of species that had recently been determined by Professor Rupert Jones and Mr J. W. Kirby as new to science, and were named as follows:—*Cythere fabulina*, a large variety, *C. pungens*, *C. secans*, and *C. subula*. The annelide, *Spirorbis carbonarius*, is a well known species, but seldom found in such good preservation as in the present instance. Mr Young stated that the foregoing organisms, along with one or two other species of *Cythere*, characterise, in a measure, all the so-called fresh water or estuarine strata of the Lanarkshire coalfield, several of the species being found to range from the bottom to the top of the system; and although the beds in which they occur often alternate with

marine strata, he had never found these species mixed up with the organisms of the marine beds, hence he inferred that they had lived under different conditions.

Mr James E. Somerville exhibited specimens of *Euplectella aspergillum*, Owen, popularly known as Venus' Flower Basket. These beautiful organisms, of which Mr Somerville had no fewer than seven on the table for the inspection of the members, attracted great attention. This remarkable sponge was discovered upwards of thirty years ago, and was then so rare that a pair of them sold for as much as £200. Even two or three years ago, a single specimen brought thirty guineas. Mr Somerville called attention to the wonderful regularity in the disposition of the fibres composing the structure. The fibres, which are nothing more than very elongated sponge spicules, are bound together in fascicles. These, varying in number from thirty to sixty, arise from the base or narrower portion of the cylinder, and, diverging very gently, proceed to the upper or free extremity. The longitudinal fascicles are crossed by two series of less regular oblique fibres, which, both above and below, embrace the longitudinal ones, and proceed in a spiral manner in opposite directions to the top. Strength is further given to the skeleton by a succession of hoops or rings, placed at regular intervals, on the inner side of the structure, and at right angles to the longitudinal fibres. The result of the whole is a beautiful cornucopia of glass, presenting a lace-like surface, with spaces alternately open and closed. In addition to all this, from the two sides of each bundle of oblique fibres, two plates of short upright fibres arise, which meet, and are held together by others which interlace, and thus sharp ridges are formed, which, with their elegant wavy spirals, decorate the exterior of the cylinder. The remote extremity is closed by a lid or net work of strong fibres, with upright projections at the intersections. This lid is separated from the cylinder by a broad frill or circular ridge. The absence of the wavy crests and circular frill, among other things, serves to distinguish the only other known *Euplectella*, viz., *cucumer*, a species obtained among the Seychelle Islands. The structure of the organism (which is simply the skeleton, the whole being covered in the living state by sarcode) may be seen by tracing the fascicles to the base, where they resolve themselves into their composing fibres. These, along with other free fibres, form a mass of loose, felt-like material, in which are embedded

portions of shells, corals, and stones. The last two or three inches of each fibre, when examined closely, are found to be armed with a large number of teeth, or thorny projections, while the extremity is equipped with four or five small hooks, arranged in the form of a grapnel. By this means the sponge anchors itself to the place of its attachment. Mr Somerville adverted to the fact of nearly every specimen of *Euptectella* containing one or more small crabs, frequently of different species. These had been foolishly supposed by some to have caused, by their running up and down the tube, the curvature at the base which all the specimens of *Euptectella* possess more or less. The crabs probably entered before the enclosing lid was added, for that seems the latest part to be formed; or else, by entering as fry through the openings in the walls of the cylinder, and living on the food brought in by the circulating currents, they attained their mature state.

Two of the specimens on the table exhibited remarkable malformations. The one departed considerably from the ordinary symmetrical form, being bulged out in several parts. The other had been fractured while alive, and had been mended by the animal itself. In it the ordinary gentle curve of the *Euptectella* was broken, and the repair marked by an angle. Mr Somerville stated that he was indebted to a lady in Glasgow for the opportunity of exhibiting the specimens. They had been collected in deep water off the island of Zebu in the Philippine group, and sent to this country by James Fyfe, Esq. of Ilo Ilo.

Dr James Stirton exhibited specimens of *Dicranum arcticum* from Ben Lawers, and made a few remarks on the species.

At the close of the proceedings, the Secretary (Mr Gray) handed over to Professor Young, as keeper of the Hunterian Museum, several rare birds and other objects not previously in the collection, remarking that it afforded him much gratification to observe the very great care with which all donations to that institution are preserved. Dr Young accepted the donation, and stated that he had been directed by the Senate of the University to convey to Mr Gray their thanks for the interest he had taken in the Museum, and for the important additions he had made in various departments.

After a few remarks from Professor Young on the satisfactory progress made by the Society during the past year, the Session was declared to be closed.

ADDENDUM.

The following abstract of Mr Somerville's remarks on Terrestrial and Fluviatile Mollusca from Egypt and Palestine refers to specimens exhibited by that gentleman at the meeting held on November 24th, 1868, page 237:—

Mr Somerville exhibited a small collection of land and fresh-water shells, made by himself during a recent tour in Egypt and Palestine. He remarked that the soft, muddy banks of the Nile were eminently suitable for *Unionida*, but by no means so for *Gasteropoda*. The former, however, seemed to be held in check by the rise and fall of the river. Specimens of *Unio pictorum*, *Unio Nilotica*, and *Unio Egyptiaca* (Caill), from the Nile in Upper Egypt were shown. Near Esneh a number of *Cyrena fluvialilis* (Müll.) were obtained, exhibiting some interesting varieties. At the First Cataracts, on the confines of Egypt and Nubia, *Paludina bulimoides* (Lam.) was very abundant, along with a small species of *Melania*. The Berber children are accustomed to string these into necklaces for sale to travellers. The rocky sides and bed of the river at that part, consisting, as they do, of red syenite (whence were quarried materials for the obelisks, statues, and temples of the ancient Egyptians), afford a firm and clean surface for such *Gasteropods*.

In the neighbourhood of the pyramids specimens of *Paludina Nilotica* were met with, a species closely resembling a *Cyclostoma*. They had probably been transported from the dried-up pools to the desert by the wind.

Throughout the valley of the Nile *Helicidae* are very scarce. The annual submergence of the country, and the universality of cultivation wherever the soil is moistened, may account for their paucity. *Bulimus decollatus* was the only one observed. But in going out to the desert, one is amazed at the exuberance of snail life. The scanty vegetation there met with is attacked by hosts of *Helices*. At one of the stations on the railway between Cairo and Suez, a few hundred yards from the station house, where there seemed at first to be nothing but dry, rounded flints, *Helix muculosa* (Born.) occurred in profusion. Specimens of *H. Arabica* were also shown, collected by Rev. A. N. Somerville in the desert near Sinai (1849).

On reaching Palestine, the traveller finds himself in a country

differing in almost every respect from Egypt. There the soil, climate, and vegetation, luxuriant and varied, are eminently suited for the development of terrestrial mollusca.

In the southern portion of the country, about Jerusalem and Hebron, the elegant *Helix spiriplana* (Olivier) is abundant, along with *H. melanostoma*, *H. caudilissima*, *H. virgata*, and *H. caesareana* (Pam.) At the pools of Solomon, between Bethlehem and Hebron, *Zonites Jebusitica* (Roth.), *Chondrus ocularis* (Lam.), *Bulinus Sidoniensis* (Charp.) occurred beneath stones. On the dry hill-sides of Judæa, *Helix Arabica* (Roth.) is common, while the scraggy and usually aromatic vegetation of these districts is absolutely covered with *Helix Syriacus* (Ehr.), and with its near ally *H. Olivieri* (Fer).

The district around the base of Hermon (Jebel es Sheikh) is well watered, and has abundance of natural wood, mollusca are consequently plentiful. The large *Bulinus lubrosus* (Olivier) was very common, and in crannies where it had hibernated, might be gathered in dozens. Along with it were *Bulinus carneus* (Pfr.), *B. Syriacus* (Pfr.), *B. Sidoniensis* (Charp.). Large specimens of *Helix pomatia* (Lin.) were also common, as well as the pyramidal *Helix elegans* (Drap.), and the curious flattened *Helix cariosa* (Olivier), with its eroded surface and large umbilicus.

The streams and fountains of Palestine abound with mollusca. In nearly all the springs, whether of sweet or brackish, cold or warm water, *Melampus praerosus* and *Neritina Michonii* (both of which have a black, smooth, and glossy epidermis) are to be met with in profusion. Their development, however, was noticeably affected by the character of the water. Thus, in the very cold waters at the source of the Abana or Barada, near Damascus, they were quite diminutive. At the sources of the Jordan, both at Dan, Tel el Kady, and at Caesarea Philippi, Baniyas, they were somewhat larger. In the sweet but tepid waters (72°) of the fountain of Elisha (Ain es Sultan), at Jericho, they were considerably more bulky; while in the hot and saline waters of the streams at Ain et Tabigha, supposed to be Bethsaida, they attained their largest development. Both species seem liable to erosion of the spire, and that apparently whether in sweet or brackish water.

The two mollusca just mentioned seem confined to running water. When the still waters of the lakes of Merom and Tiberias

are visited, their places are found to be taken by two other species, *Melanopsis costata*, a shell with numerous varices, and banded with purple and white; and *Neritina Jordani* (Buttl.), a little dumpy, but beautifully variegated shell, with streaks of black, white, and rose. These two species appear to be confined to the upper waters of the Jordan Valley, where they occur in such profusion as to form a considerable portion of the beach of the Sea of Galilee. In the same waters occurred sparingly *Cyrena Cor* (Lam.) (Rev. A. N. Somerville, 1849).

At the fountain of Jezreel (Ain Jalud) (1 Sam. xxix. 1), which bursts out from a grotto overhung with *Adiantum capillus Veneris*, at the base of Mount Gilboa, another species of *Melanopsis*, viz., *Sauleyi* (Bourg.) occurs, intermediate between the two above mentioned, the apical portion exhibiting varices similar to those in *M. costata*, while the basal portion is smooth as in *M. praeerosa*. This species was also met with at Ain es Sultan (Jericho), where *Melania tuberculata* was likewise collected.

At Nahr el Kelb, near Beirut, one of the streams from Lebanon, where are seen the remarkable tablets cut on the face of the rocks by the ancient Assyrian and Egyptian monarchs, and later by Marcus Aurelius, several species were obtained. On the surface of the tablets were hundreds of the fine *Clausilia Boissieri* (Charp.), which hung with their apices pointing downwards in a singular manner. Along with it occurred *Cyclostoma elegans* and *Helix nummus* (Ehr.) The latter resembles, and seems to take the place of our own *Helix lapicida*.

At Rhodes, on the ruins of the castle of the Knights of St John, were found *Bulimus faax-nigrum*, and on the castle of Smyrna *Clausilia corrugata* (Fer.) The ruined theatre of ancient Ephesus (see Acts xix. 29) yielded *Bulimus decollatus*. And during a few minutes on shore at Larnaca, Cyprus, *Helix pisana* and *H. vermicularis* were collected.

Mr Somerville expressed his obligation to T. Gray, Esq., and the Rev. Dr Tristram, for assistance in identifying the species.

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